GUJARAT ENERGY

Request for Proposal for Selection of Implementation Agency for Establishing SCADA, AMI and CMP for Gujarat Energy Limited

Volume II

Invited by:

Gujarat Energy Limited,

Tower 2, Infocity, Gandhinagar, Gujarat

DISCLAIMER

The information contained in this Request for Proposal document ("**RFP**") whether subsequently provided to the Bidders, ("**Bidder/s**") verbally or in documentary form by Gujarat Energy Limited (henceforth referred to as "**GEL**" in this document) or any of its employees or advisors, is provided to Bidders on the terms and conditions set out in this RFP document and any other terms and conditions subject to which such information is provided.

This RFP document is not an agreement and is not an offer or invitation to any party. The purpose of this RFP is to provide the Bidders or any other person with information to assist the formulation of their financial offers ("**Bid**"). This RFP includes statements, which reflect various assumptions and assessments arrived at by Gujarat Energy Limited in relation to this scope. This Tender document does not purport to contain all the information each Bidder may require. This Tender document may not be appropriate for all person/s and it is not possible for the Managing Director, Gujarat Energy Limited and their employees or advisors to consider the objectives, technical expertise and particular needs of each Bidder. The assumptions, assessments, statements and information contained in the Bid documents, may not be complete, accurate, adequate or correct. Each Bidder must therefore conduct its own analysis of the information contained in this RFP and to seek its own professional advice from appropriate sources.

Information provided in this Tender document to the Bidder is on a wide range of matters, some of which may depend upon interpretation of law. The information given is not intended to be an exhaustive account of statutory requirements and should not be regarded as a complete or authoritative statement of law. GEL accepts no responsibility for the accuracy or otherwise for any interpretation of opinion on law expressed herein.

GEL and their employees and advisors make no representation or warranty and shall incur no liability to any person, including the Bidder under law, statute, rules or regulations or tort, the principles of restitution or unjust enrichment or otherwise for any loss, cost, expense or damage which may arise from or be incurred or suffered on account of anything contained in this RFP or otherwise, including the accuracy, reliability or completeness of the RFP and any assessment, assumption, statement or information contained therein or deemed to form part of this RFP or arising in any way in this Selection Process.

GEL also accepts no liability of any nature whether resulting from negligence or otherwise howsoever caused arising from reliance of any Bidder upon the statements contained in this RFP. Gujarat Energy Limited may in its absolute discretion, but without being under any obligation to do so, can amend or supplement the information in this RFP.

The issue of this RFP document does not imply that GEL is bound to select a Bidder or to appoint the Selected Bidder (as defined hereinafter), for implementation and GEL reserves the right to reject all or any of the Bidders or Bids without assigning any reason whatsoever.

The Bidder shall bear all its costs associated with or relating to the preparation and submission of its Bid including but not limited to preparation, copying, postage, delivery fees, expenses associated with any demonstrations or presentations which may be required by GEL or any other costs incurred in connection with or relating to its Bid. All such costs and expenses will remain with

the Bidder and GEL shall not be liable in any manner whatsoever for the same or for any other costs or other expenses incurred by a Bidder in preparation for submission of the Bid, regardless of the conduct or outcome of the selection process.

- Any conditional bid or major deviations from the RFP requirements may at GEL's discretion be rejected and will not be considered for further evaluation process.
- GEL reserves the right to check/validate the authenticity of the information provided in the Pre-qualification and Technical evaluation criteria.
- GEL may invite each Bidder to make a presentation on their proposal. Further, GEL may request written clarifications from the Bidders to clarify ambiguities and uncertainties arising out of the evaluation of the Bid documents.
- The Bidder is required to submit a notarized copy of all the documentary evidence, as per the clauses/requirements mentioned therein.
- Errors & Rectification: Arithmetical errors will be rectified on the following basis:
    - If there is a discrepancy between the unit price and the total price that is obtained by multiplying the unit price and quantity, the unit price shall prevail and the total price shall be corrected.
    - If there is a discrepancy between words and figures, the amount in words will prevail.
    - If the Bidder does not accept the error correction, its Bid will be rejected and EMD may be forfeited.
- The executed/estimated quantities provided in the RFP would be used for evaluation purposes; however, the payment would be made on the actual quantity commissioned against each of the line item.

Table of Contents

1. Acronyms and Definitions 10

1.1. Acronyms 10

1.2. Gas Industry Station Types 16

1.3. Project-Specific Definitions 17

2. Introduction and Overview 22

2.1. About Gujarat Energy Limited (GEL) 22

2.2. Background and Purpose 22

2.2.1. Overview and Scope of Work 23

2.2.2. Commercial and Ownership Model 28

2.2.3. Project Objectives 29

2.2.4. Project Beneficiaries 29

3. Scope of Work 31

3.1. Brief Scope of the work for SCADA 31

3.2. Brief Scope of work for AMI 37

3.2.1. EVC OEM Driver Development 42

3.2.2. New EVC and PD Meter Onboarding During the O&M Period 43

3.3. Brief Scope of work for CMP 43

3.4. Station-Wise SCADA Scope 46

3.4.1. City Gate Station (CGS) - 14 locations 46

3.4.2. Odorizer Units – 85 Units 49

3.4.3. CNG Station - 850 locations 50

3.4.4. District Regulating Station (DRS/CPRS) - 375 locations 57

3.4.5. Underground DRS – 195 locations 59

3.4.6. Decompression Skids - 20 locations 60

3.4.7. Cathodic Protection System (TR Units) - 110 locations 63

3.4.8. LCNG Station - 8 locations 66

3.4.9. Compressed Biogas (CBG) Plant - 7 locations 71

3.4.10. Check Metering Stations - 100 locations 73

3.4.11. LNG Dispensing Stations 74

3.4.12. Gas Exploration Site (E&P) - 16 locations 79

3.4.13. Comprehensive Miscellaneous Activities for All Station Types 80

3.4.14. Indicative Scope of SCADA 115

Station wise AMI Hardware Scope 124

3.4.15. Metering Sites with EVC (IMS) 124

3.4.16. Positive Displacement Meters 126

3.4.17. Indicative Scope of AMI 129
3.5. General AMI Platform Scope of Work 131
3.5.1. AMI Platform Overview and General Requirements 131
3.5.2. Interoperability and Open Standards 133
3.5.3. Multi-OEM EVC and PD Meter Integration 133
3.5.4. Layer 1 — Head-End System (HES) Functionality 134
3.5.5. Layer 2 — Meter Data Management System (MDMS) 137
3.5.6. Miscellaneous Activities for All Locations 140
3.6. Centralized Monitoring Platform (CMP) 149
3.6.1. Detailed Scope of Work - CMP 149
3.7. Common and Cross-Cutting Systems and Requirements 162
3.7.1. Data Responsibility — Lapses, Loss and Theft 162
3.7.2. Network Management System (NMS) 163
3.7.3. Enterprise Management System (EMS) 165
3.7.4. Integrated Portal Visibility of NMS and EMS 165
3.7.5. Insurance 166
3.7.6. Quality Assurance, Testing and Acceptance Criteria 168
3.7.7. Survey, Site Assessment and Requirement Gathering 178
3.7.8. Cloud Hosting, Data Centre, Disaster Recovery, MeitY Empanelment and Data Residency 179
3.7.9. Cybersecurity and Data Protection 180
3.7.10. Enterprise and Cross-System Integration 182
3.7.11. Identity and Access Management (RBAC, SSO and Audit Logging) 183
3.7.12. Documentation, As-Built and SOPs 184
3.7.13. Technology Currency, Updates and Version Management 185
3.7.14. General 186
3.7.15. Time Synchronisation 186
3.7.16. SIM and Connectivity Management (SCADA and AMI) 187
3.7.17. EVC Driver Library (SCADA and AMI) 188
3.7.18. Field Installation and Hazardous-Area Safety (SCADA and AMI) 189
3.7.19. Power Design and Power Calculation 190
4. Comprehensive Operations and Maintenance 192
4.1. Overview 192
4.1.1. O&M Philosophy and Maintenance Manual 192
4.2. General O&M Requirements 193
4.2.1. Support Team 195
4.2.2. Preventive Maintenance 196
4.2.3. Corrective Maintenance and Field Incident Resolution 197
4.2.4. Platform and Software Operations 197

4.2.5. SIM Management and Connectivity Operations 199
4.2.6. Maintenance Spares 199
4.2.7. Vendor and Stakeholder Management 200
4.2.8. Field Support, HSE and Transport 200
4.2.9. System Enhancement and Modification 201
4.2.10. CMP-Specific Operations and Maintenance 202
4.2.11. Insurance 203
4.2.12. Handover at End of Contractual Period 203
4.2.13. General Instructions 204
5. Payment and Project Milestones 206
5.1. Overview and Principles 206
5.2. Implementation Milestones and Payment Schedule 207
5.3. Definitions — Installation & Commissioning, Go-Live and Handover 210
5.4. Installation and Go-Live Schedule 211
5.4.1. AMI I&C Go-Live Schedule 211
5.4.2. SCADA Go-Live Schedule 212
5.4.3. CMP Phase Schedule 213
5.5. Phased Go-Live, Per-Lot/Zone Stabilisation and Pro-Rata Billing 213
5.6. Detailed Implementation Milestones 213
5.6.1. Milestone 1 — Survey and Requirement Gathering 213
5.6.1. Milestone 2 — Material Factory Acceptance Test (FAT) 216
5.6.2. Milestone 3 — Installation & Commissioning, AMI 218
5.6.3. Milestone 4 — Go-Live of CMP Phase 1 220
5.6.4. Milestone 5 — Go-Live, AMI 221
5.6.5. Milestone 6 — Go-Live of CMP Phase 2 223
5.6.6. Milestone 7 — Installation & Commissioning, SCADA 225
5.6.7. Milestone 8 — Go-Live, SCADA 227
5.6.8. Milestone 9 — Go-Live of CMP Phase 3, and Final Go-Live of all three components 229
5.6.9. Milestone 10 — Handover of SCADA, AMI and CMP 231
5.7. Post Go-Live Operation & Maintenance Payment Milestones 234
5.7.1. Overview 234
5.7.2. O&M Milestones 234
5.7.3. Pro-Rata Billing Mechanism 235
5.7.4. Deliverables during the O&M Phase 236
5.7.5. Payment Release Conditions 238
5.7.6. New Onboarding During the O&M Period 239
5.7.7. Schedule C — One-Time Costs 240
6. Service Level Agreement (SLA) and Penalty Framework 241

6.1. Framework and Principles 241
6.1.1. Measurement authority 241
6.1.2. Scheduled maintenance 241
6.1.3. SLA stabilisation period 242
6.1.4. Basis of "Quarterly Payment" 242
6.1.5. Penalty caps 242
6.1.6. Contract termination 242
6.2. Definitions 243
6.3. Penalty for Delay in Implementation Milestones 244
6.3.1. AMI I&C and Go-Live Schedule 244
6.3.2. SCADA Go-Live Schedule 245
6.4. Manpower SLAs 246
6.5. Common SLAs (SCADA, AMI and CMP) 247
6.6. O&M SLAs — SCADA, AMI and CMP 251
6.7. Penalty Deduction Process 256
6.8. SLA Exclusions 256
7. Training and Capacity Building 257
7.1. Training Strategy 257
7.2. Indicative Training Courses 257
7.3. Training Materials 257
7.4. Knowledge Transfer 258
7.5. Training Evaluation 258
7.6. Standard Operating Procedures 258
7.6.1. SOP Development Framework 258
7.7. Go-Live Support, Shadowing and Knowledge Transfer Transition 260
7.7.1. Support Model 260
7.7.2. Knowledge Transfer Completion Assessment 261
7.7.3. Knowledge Transfer Completion Certificate 262
7.7.4. Stage 3 — Support Team Model for the Full Contract Duration 262
8. Schedule of Rates 263
8.1. Schedule A – Hardware Costs 263
8.2. Schedule B – Recuring Costs and ARC 263
8.2.1. Schedule B1 – Recuring Costs 264
8.2.1. Schedule B2 – Annual Rate Contract Costs 265
8.3. Schedule C – One Time Costs 266
8.4. Important Notes to Bidders 267
9. Manpower Requirement 270
9.1. Implementation-Phase Key Personnel 270

9.2. O&M-Phase Support Team 271
10. Technical Bid Submission Documents 274
10.1. Mandatory Technical Submission Documents 274
10.1.1. Deviation Form 274
10.1.2. Equipment Specifications and Technical Datasheets 275
10.1.3. Software Specifications and Licensing Documentation 276
10.1.4. System Architecture and Design Documentation 279
10.1.5. Bill of Materials (BoM) and Procurement Documentation 279
10.1.6. Power and Load Calculations 280
10.1.7. Communication and Network Design 281
10.1.8. Integration and Interface Documentation 282
10.1.9. Project Implementation and Execution Plans 283
10.1.10. Training and Support Documentation 283
11. Annexures 284
11.1. Functional Requirement 284
11.1.1. SCADA Functional Specification 284
11.1.2. AMI Platform Functional Requirements 345
11.1.3. CMP Functional Specification 372
11.1.4. Cross Cutting Common Functionality 387
11.2. Technical Specifications for Hardware Components 410
11.2.1. General Technical Requirements 410
11.2.1.1. General Site Information: 410
11.3. Type 2 - Industrial Cellular Modem 456
11.4. Modem Antenna 458
11.5. Explosion-Proof Junction Box 459
11.6. Solar Power System (Optional for DRS) 460
11.7. Managed ethernet switches (For CNG Station/LCNG Station) 462
11.8. Pressure Transmitter 463
11.9. Temperature Transmitter 464
Isolation Barrier Modules 466
11.10. Surge Protection Devices 468
11.11. Cabling Infrastructure 476
11.12. Technical Specifications for RTU and Modem Cabinets 483
1.1.2 Cabinet Specifications for RTUs and Modems 483
11.13. AMI Modem and MIU —Technical Specifications 490
1.1.3 General Hardware Principles 490
12. Indicative SCADA Architecture 507
12.1. City Gate Station 508

12.2. Check Metering Stations 509
12.3. Mother/Online CNG Stations 510
12.4. Daughter Booster CNG Station 511
12.5. Daughter CNG Station 512
12.6. LCNG Station 513
12.7. Industrial/Commercial Metering Skids with EVC 514
12.8. Industrial/Commercial Metering Skids with Diaphragm Meters 515
12.9. District Regulation Skids 516
12.10. Compressed Biogas Plants 517
12.11. Decompression Skids 518
12.12. Odorizer Units 519
12.13. Cathodic Protection Unit 520
12.14. Gas Exploration Sites 521
13. Indicative Reports for Stations 522
14. Tentative Monitoring and Control Parameters 525
15. Indicative Station Wise I/O Details 533
16. Annexure A - Indicative List of Existing EVCs and PD Meters 535
17. Annexure B - Indicative List of Existing EVCs 537
18. Annexure C: Indicative List of integration requirements for existing GGL applications, 538
19. Annexure D: Indicative List of Use Cases for running AI/ML module driven Advanced Analytics Dashboard 539

1. Acronyms and Definitions

For the purpose of this Request for Proposal (RFP) document, the following definitions, acronyms and station-type descriptions shall apply.

Primary Definitions: Refer to Volume I of this RFP. In the event of any conflict between a definition in Volume I and a Project-Specific Definition below, the order of precedence at Clause 1.4 shall apply.

1.1. Acronyms

Acronym	Full Form
AC	Alternating Current
AD	Active Directory
AES	Advanced Encryption Standard
AGA	American Gas Association
AI/ML	Artificial Intelligence / Machine Learning
AMI	Advanced Metering Infrastructure
AMQP	Advanced Message Queuing Protocol
AMR	Automated Meter Reading
ANSI	American National Standards Institute
APN	Access Point Name
API	Application Programming Interface / American Petroleum Institute
ARC	Annual Rate Contract
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATEX	Atmosphères Explosibles (European Explosive Atmosphere Directive)
AWG	American Wire Gauge
BGV	Background Verification
BIS	Bureau of Indian Standards
BMS	Backup Master Station
BoM	Bill of Materials
BoQ	Bill of Quantities
BTU	British Thermal Unit
CA	Chartered Accountant
CAMC	Comprehensive Annual Maintenance Contract
CAPEX	Capital Expenditure
CBG	Compressed Bio-Gas
CCTV	Closed-Circuit Television
CEO	Chief Executive Officer
CERT-In	Computer Emergency Response Team – India
CFO	Chief Financial Officer

Acronym	Full Form
CGD	City Gas Distribution
CGS	City Gate Station
CIM	Common Information Model (IEC 61968-9)
CMP	Centralized Monitoring Platform
CNG	Compressed Natural Gas
COO	Chief Operating Officer
COTS	Commercial Off-The-Shelf
CP	Cathodic Protection
CP-TR	Cathodic Protection – Transformer Rectifier
CPRS	City Pressure Regulating Station
CPU	Central Processing Unit
CRC	Cyclic Redundancy Check
CRM / CIS	Customer Relationship Management / Customer Information System
CRV	Creep Relief Valve
CSV	Comma-Separated Values
DBFOOT	Design, Build, Finance, Own, Operate and Transfer
DC	Direct Current
DCU	Data Concentrator Unit
DCS	Distributed Control System
DHCP	Dynamic Host Configuration Protocol
DLMS/COSEM	Device Language Message Specification / Companion Specification for Energy Metering
DMZ	Demilitarized Zone
DNS	Domain Name System
DNP3	Distributed Network Protocol 3
DOQ	Daily Order Quantity
DRS	District Regulating Station
EMC	Electromagnetic Compatibility
EMD	Earnest Money Deposit
EMI	Electromagnetic Interference
EMS	Enterprise Management System
EPMC	Engineering Project Management Consultant
ERP	Enterprise Resource Planning
ESB	Enterprise Service Bus
ESD	Emergency Shutdown
EVC	Electronic Volume Corrector
Ex d/e/ia/ib	Explosion Protection Types (Flameproof / Increased Safety / Intrinsically Safe)
F&G	Fire and Gas
FAT	Factory Acceptance Testing
FD	Fire Detection
FIPS	Federal Information Processing Standards
FRLS	Fire Retardant Low Smoke

Acronym	Full Form
FRPVC	Fire Retardant PVC
FY	Financial Year
GA	Geographical Area
GD	Gas Detection
GEL	Gujarat Energy Limited
GI	Galvanized Iron
GIGL	GSPL India Gasnet Ltd.
GIS	Geographic Information System
Go-Live	Final system acceptance and operational start (see Clause 1.3)
GPRS	General Packet Radio Service
GPS	Global Positioning System
GST	Goods and Services Tax
HART	Highway Addressable Remote Transducer
HES	Head End System (functional capability of the AMI Platform)
HMI	Human-Machine Interface
HMR	Hour Meter Reading
HSE	Health, Safety and Environment
HTML	HyperText Markup Language
HTTP/HTTPS	HyperText Transfer Protocol (Secure)
HVAC	Heating, Ventilation and Air Conditioning
I/O	Input/Output
ICCC	Integrated Command and Control Centre
IEC	International Electrotechnical Commission
IECEx	International Electrotechnical Commission Explosive
IED	Intelligent Electronic Device
IEEE	Institute of Electrical and Electronics Engineers
IMS	Industrial Metering Skid
INR	Indian Rupees
IoT	Internet of Things
IP	Internet Protocol / Ingress Protection
IPsec	Internet Protocol Security
IPRS	Industrial Pressure Regulating Station
IS	Indian Standard
ISO	International Organization for Standardization
IST	Indian Standard Time (UTC+5:30)
IT	Information Technology
ITIL	Information Technology Infrastructure Library
ITSM	IT Service Management
IV&V	Independent Verification and Validation
JDBC	Java Database Connectivity
JSON	JavaScript Object Notation

Acronym	Full Form
KOD	Knock-Out Drum
KPI	Key Performance Indicator
LCNG	Liquefied to Compressed Natural Gas
LCV	Light Commercial Vehicle
LED	Light-Emitting Diode
LNG	Liquefied Natural Gas
LOA	Letter of Authorization
LT	Low Tension
LTE	Long Term Evolution
MAC	Media Access Control
MAF	Manufacturer Authorization Form
MCC	Motor Control Center
MCB	Miniature Circuit Breaker
MCCB	Moulded Case Circuit Breaker
MCV	Medium Commercial Vehicle
MDMS	Meter Data Management System (functional capability of the AMI Platform)
MeITY	Ministry of Electronics and Information Technology
MFA	Multi-Factor Authentication
MFM	Mass Flow Meter
MIMO	Multiple Input Multiple Output
MIU	Meter Interface Unit
MMS	Main Master Station
MOE&F	Ministry of Environment & Forest
MoU	Memorandum of Understanding
MPLS	Multiprotocol Label Switching
MQTT	Message Queuing Telemetry Transport
MRS	Metering Regulating Station
MTBF	Mean Time Between Failures
MTTR	Mean Time to Repair
NAT	Network Address Translation
NB-IoT	Narrowband Internet of Things
NCIIPC	National Critical Information Infrastructure Protection Centre
NDA	Non-Disclosure Agreement
NEMA	National Electrical Manufacturers Association
NERC CIP	North American Electric Reliability Corporation Critical Infrastructure Protection
NFPA	National Fire Protection Association
NIST	National Institute of Standards and Technology
NIT	Notice Inviting Tender
NMS	Network Management System
NTL	Non-Technical Loss
NTP	Network Time Protocol

Acronym	Full Form
O&M	Operation and Maintenance
OAuth	Open Authorization
ODBC	Open Database Connectivity
OData	Open Data Protocol
OEM	Original Equipment Manufacturer
OISD	Oil Industry Safety Directorate
OPEX	Operational Expenditure
OPC UA	OPC Unified Architecture
OS	Operating System
OSI	Open System Interconnect
OT	Operational Technology
OTA	Over-the-Air
PBG	Performance Bank Guarantee
PCB	Printed Circuit Board
PD	Positive Displacement (Diaphragm) Meter
PDF	Portable Document Format
PDT	Portable Diagnostic Terminal
PE	Polyethylene
PESO	Petroleum and Explosives Safety Organisation
PLC	Programmable Logic Controller
PMBOK	Project Management Body of Knowledge
PMO	Project Management Office
PNG	Piped Natural Gas
PNGRB	Petroleum & Natural Gas Regulatory Board
POC	Proof of Concept
PQ	Pre-Qualification
PSP	Pipe-to-Soil Potential
PSU	Public Sector Undertaking
PTP	Precision Time Protocol
PTW	Permit to Work
PTZ	Pressure-Temperature-Compressibility correction
PVC	Polyvinyl Chloride
PWMC	Post-Warranty Maintenance Contract
QAP	Quality Assurance Plan
QCBS	Quality and Cost Based Selection
QHSE	Quality, Health, Safety and Environment
QoS	Quality of Service
QR	Quick Response
RACI	Responsible, Accountable, Consulted, Informed
RAM	Random Access Memory
RBAC	Role-Based Access Control
RDBMS	Relational Database Management System
REST	Representational State Transfer

Acronym	Full Form
RFI	Radio Frequency Interference
RFP	Request for Proposal
RFID	Radio Frequency Identification
RH	Relative Humidity
RMON	Remote Monitoring
ROM	Read-Only Memory
RPD	Rotary Positive Displacement
RPO	Recovery Point Objective
RS-232/485	Recommended Standard 232/485
RSSI	Received Signal Strength Indicator
RTOS	Real-Time Operating System
RTO	Recovery Time Objective
RTU	Remote Terminal / Telemetry Unit
SaaS	Software as a Service
SAP	Systems, Applications and Products (GEL's ERP and Billing platform)
SAT	Site Acceptance Testing
SAv5	Secure Authentication version 5 (DNP3)
SCADA	Supervisory Control and Data Acquisition
SCM	Standard Cubic Metre
SCR	Stand-by Control Room
SG	Specific Gravity
SI	System Integrator
SIEM	Security Information and Event Management
SIM	Subscriber Identity Module
SINR	Signal to Interference and Noise Ratio
SLA	Service Level Agreement
SLP	Secondary Level Point
SMA	SubMiniature version A
SMF VRLA	Sealed Maintenance Free Valve Regulated Lead Acid
SMPS	Switched Mode Power Supply
SNMP	Simple Network Management Protocol
SOA	Service-Oriented Architecture
SOC	Service Organization Control
SOP	Standard Operating Procedure
SOR	Schedule of Rates
SoW	Scope of Work
SPOC	Single Point of Contact
SQL	Structured Query Language
SR	Service Regulator
SSH	Secure Shell
SSL	Secure Sockets Layer
SSO	Single Sign-On

Acronym	Full Form
SSV	Slam Shut Valve
TCP/IP	Transmission Control Protocol / Internet Protocol
TIA	Telecommunications Industry Association
TLP	Test Lead Point
TLS	Transport Layer Security
TPM	Trusted Platform Module
TQ	Technical Qualification
TR	Transformer Rectifier
UAT	User Acceptance Testing
UDP	User Datagram Protocol
UFG	Unaccounted for Gas
UOM	Unit of Measure
UPS	Uninterruptible Power Supply
URL	Uniform Resource Locator
USB	Universal Serial Bus
USM	Ultrasonic Meter
VAPT	Vulnerability Assessment and Penetration Testing
VEE	Validation, Estimation and Editing
VPN	Virtual Private Network
VRRP	Virtual Router Redundancy Protocol
VSWR	Voltage Standing Wave Ratio
VTS	Vehicle Tracking System
WAF	Web Application Firewall
WAN	Wide Area Network
WBS	Work Breakdown Structure
WCAG	Web Content Accessibility Guidelines
WORM	Write Once, Read Many
XLPE	Cross-Linked Polyethylene
XML	eXtensible Markup Language
XLSX	Excel Open XML Spreadsheet

1.2. Gas Industry Station Types

Station Type	Description
CBG Station	Compressed Bio-Gas facility
CGS	City Gate Station
Check Metering Station	Gas measurement verification facility
CNG Station	Compressed Natural Gas refuelling station
Decompression Skid	Pressure reduction facility
DRS	District Regulating Station — pressure regulation facility

Station Type	Description
Domestic Metering Locations	Domestic metering locations equipped with G1.6 PD meters
IMS	Industrial Metering Skid — Industrial/Commercial metering point equipped with an EVC
Industrial/Commercial Metering Locations	Industrial/Commercial metering point equipped with a PD Meter
LCNG Station	Liquefied-to-Compressed Natural Gas facility
Odorizer Unit	Gas odorization facility
CP TR	Cathodic Protection Unit (Transformer Rectifier)

1.3. Project-Specific Definitions

The following terms carry the meanings set out below wherever they appear in this RFP.

Term	Definition
AMI	Advanced Metering Infrastructure — a system that facilitates automated, two-way collection of gas metering data from Industrial and Commercial customers through various meter types (EVCs and Positive Displacement meters fitted with MIUs) and transmits consumption-related data to GEL's SAP Billing/ERP systems and to the CMP for centralized monitoring.
AMI Platform	The centralised, cloud-hosted software platform forming the core of the AMI System, delivering the full functional scope of data acquisition, data management, VEE, alarm management, asset management, reporting, billing integration and staff mobile application. The Bidder may deliver these functions through a unified product or a combination of integrated components, provided all specified functional requirements are fully met. The AMI Platform shall be a COTS product; custom-developed or bespoke platforms are not acceptable.
Bidder	The entity submitting a bid in response to this RFP and, upon award of the work order, the entity executing the Project under contract with GEL. The Bidder assumes full end-to-end responsibility for the design, build, finance, supply, installation, integration, testing, commissioning, operation, maintenance and eventual transfer of the integrated SCADA, AMI and CMP System. The terms "Successful Bidder", "Winning Bidder", "System Integrator (SI)", "Implementation Agency", "Contractor" and "Vendor" used anywhere in this RFP shall all mean the Bidder.

Term	Definition
BMS	Backup Master Station — the secondary control instance configured to provide redundancy and automatic failover in case of MMS failure.
CMP	Centralized Monitoring Platform — a Command & Control solution providing integrated dashboards, real-time monitoring, AI/ML-driven analytics, incident management and emergency control across GEL's operational systems, including SCADA, AMI and other infrastructure monitoring applications.
COTS	Commercial Off-The-Shelf — a pre-developed, commercially available software product with an established user base and proven deployments in utility environments. Software platforms proposed under this RFP shall be COTS products unless expressly stated otherwise; custom-developed or bespoke platforms are not acceptable.
Driver	A software component within the AMI Platform (or SCADA system, as applicable) that enables two-way communication with a specific OEM's proprietary protocol or interface. Each OEM make or model not natively supported requires a dedicated driver developed by the Bidder.
EVC	Electronic Volume Corrector — a device fitted to a gas meter that automatically corrects measured gas volume at line conditions to standard reference conditions by applying real-time pressure, temperature and compressibility (PTZ) correction.
GA	Geographical Area — GEL's operational planning unit. GEL currently operates across 29 GAs spanning 6 states and 1 union territory. References to operational teams, reporting and monitoring in this document are structured at the GA level.
GA Teams	GEL's operational field teams and GA-level management personnel who operate, monitor and manage the gas distribution network within each Geographical Area. GA Teams are among the primary users of the AMI, SCADA and CMP systems.

Term	Definition
Go-Live	The formal acceptance by GEL of the delivered solution following successful completion of all specified testing — including FAT, SAT, integration testing, CERT-In empanelled VAPT closure and User Acceptance Testing (UAT). Two levels of Go-Live apply under this RFP: **(a) System Go-Live** — acceptance of the complete SCADA, AMI and CMP scope across all in-scope locations, from which the full O&M Period, SLA measurement and OPEX payment obligations commence; and **(b) Zone-wise Go-Live** — acceptance of all in-scope SCADA, AMI and CMP deliverables within a defined operational Zone/GA, entitling the Bidder to pro-rata OPEX for that Zone and from which SLA measurement for that Zone commences. No Go-Live, at either level, shall be deemed achieved on the basis of any one system (SCADA, AMI or CMP) alone.
HES Functionality	The set of functional capabilities relating to automated two-way communication with all field devices (EVCs via Modems, PD Meters via MIUs), scheduled and on-demand data acquisition, alarm and event processing, OTA firmware management and device health monitoring. This is a functional requirement of the AMI Platform; the Bidder may deliver it through a dedicated Head End System, a unified combined platform, or any other compliant COTS architecture.
IMS	Industrial Metering Skid — a field installation comprising gas metering equipment at the inlet to an Industrial or Commercial consumer's premises, typically equipped with an EVC for automated volume correction and data logging.
IP – Intellectual Property Rights	Any patent, copyright, trademark, trade name, service mark, brand, proprietary information or software, whether arising before or after execution of this Contract, together with the right to ownership and registration of such rights.
Maintenance	Maintaining, repairing and replacing, if necessary, the devices, equipment, software and supporting utilities implemented under this project by the Bidder within the scope of this RFP. Scheduled inspections are included within Maintenance.
MAF	Manufacturer Authorization Form — a document from an OEM/vendor confirming authorization for the Bidder to supply, install and support that OEM's products.

Term	Definition
MDMS Functionality	The set of functional capabilities relating to meter data Validation, Estimation and Editing (VEE), billing-determinant preparation, data archival, asset management, exception management and integration with GEL's enterprise systems. This is a functional requirement of the AMI Platform; the Bidder may deliver it through a dedicated Meter Data Management System, a unified combined platform, or any other compliant COTS architecture.
MIU	Meter Interface Unit — a field device supplied and installed by the Bidder on a Positive Displacement (Diaphragm) gas meter that captures the meter's pulse output and transmits metering data to the AMI Platform via a wireless communication network. Each MIU shall incorporate a built-in communication modem or be paired with a dedicated external modem, enabling direct connectivity to the AMI Platform without any intermediary infrastructure.
MMS	Main Master Station — the primary control instance for the SCADA system, hosted on the cloud infrastructure defined in this RFP.
Modem	A wireless communication device supplied and installed by the Bidder and connected to an EVC (or other field device), enabling that device to transmit metering/telemetry data to the AMI Platform or SCADA system over a wireless WAN. All Modems supplied under this RFP shall be newly procured — no reuse of existing field devices is in scope. Each Modem shall support single-SIM/dual-SIM operation with multi-network capability using multi-IMSI technology and shall be PESO/ATEX/IECEx certified for the hazardous-area classification applicable at the installation location.
O&M Period	Operations and Maintenance Period — the five (5) year period commencing from System Go-Live (or, for a given Zone, from that Zone's Zone-wise Go-Live), during which the Bidder is responsible for the full operation, maintenance and performance of the integrated System against the SLAs specified in this RFP.
OPEX	Operational Expenditure — the recurring quarterly payments made by GEL to the Bidder during the O&M Period for operation, maintenance and SaaS services, payable subject to SLA compliance.
OTA	Over-the-Air — the remote delivery of firmware updates, security patches or configuration changes to field devices (Modems, MIUs, RTUs) without requiring physical site access. OTA capability is a mandatory functional requirement.

Term	Definition
PD Meter	Positive Displacement (Diaphragm) Gas Meter — a volumetric gas meter characterised by a mechanical pulse output interface. Under this RFP, PD Meters at Industrial metering locations is within current scope for MIU installation; PD Meters at Commercial/Domestic customer locations are designated for integration as specified in the Scope of Work.
RTU	Remote Terminal / Telemetry Unit — a field device that interfaces with field instruments and equipment to collect data and provide control capability for remote SCADA operations.
SaaS	Software as a Service — the cloud-based delivery model under which the software platforms (including all functional modules, hosting infrastructure and licences) are provided to GEL on a subscription basis by the Bidder throughout the contractual period.
SCADA	Supervisory Control and Data Acquisition — the industrial control system used for monitoring and controlling the gas distribution network infrastructure.
SIM	Subscriber Identity Module — the cellular connectivity module within a Modem, MIU or RTU that enables wireless WAN communication. All SIMs supplied under this RFP shall be registered in GEL's name; the Bidder shall determine SIM operator selection to meet the applicable SLA.
UAT	User Acceptance Testing — structured testing conducted by GEL's designated GA Teams and functional teams to validate that the implemented System meets all specified functional, integration and performance requirements prior to Go-Live acceptance.
VEE	Validation, Estimation and Editing — the automated data-quality process within the AMI Platform for validating meter reads, estimating missing/invalid reads and controlling authorised edits, with a full audit trail.
Zone	A defined operational grouping (one or more GAs, or a sub-division thereof) used for phased implementation, Zone-wise Go-Live and pro-rata OPEX release as specified.

2. Introduction and Overview

2.1. About Gujarat Energy Limited (GEL)

Gujarat Energy Limited (GEL) is one of India's leading natural gas distribution companies and a part of the GSPC Group. GEL is India's largest City Gas Distribution (CGD) company by geographic spread, with operations across 29 Geographical Areas (GAs) spanning 6 states (Gujarat, Rajasthan, Maharashtra, Madhya Pradesh, Haryana and Punjab) and one union territory.

GEL is engaged in the distribution of natural gas, including Piped Natural Gas (PNG) to domestic, commercial and industrial customers and Compressed Natural Gas (CNG) to the transport sector, supported by an extensive pipeline network and field infrastructure. Following the integration of GSPC's exploration and production (E&P) operations into GEL, associated gas E&P sites also fall within GEL's operational footprint and within the scope of this initiative.

GEL's operational footprint includes:

- 29 Geographical Areas across 6 states;
- 44 districts across these states, with Gujarat being the largest contributor;
- the Union Territory of Dadra & Nagar Haveli.

The company's operations span urban, semi-urban and rural areas, with a focus on expanding its reach to provide clean and economical fuel to a larger customer base and it continues to expand its infrastructure to meet growing demand for natural gas across its operational areas.

GEL is advancing its digital transformation journey by centralizing and simplifying data collection across its 29 GAs onto a single, unified digital platform. This initiative deploys three integrated systems — a Supervisory Control and Data Acquisition (SCADA) system, an Advanced Metering Infrastructure (AMI) and a Centralized Monitoring Platform (CMP) — on a common private cloud, to consolidate operational and metering data from across GEL's network, enable real-time visibility and advanced analytics and support strategic decision-making. Real-time data accessibility will enable GEL to anticipate demand fluctuations more accurately, optimize supply logistics, reduce wastage and improve service delivery.

The key objectives of this initiative are to collect, monitor and manage data from GEL's gas distribution network and metering base, enabling advanced analytics and informed decision-making. The three systems shall interoperate — SCADA and AMI feeding the CMP and all three integrating with GEL's ERP and other enterprise systems — to deliver centralized control, real-time monitoring and robust analytics, while reducing manual intervention, optimizing resource allocation and improving response times to system alerts, thereby minimizing disruptions and improving operational efficiency.

2.2. Background and Purpose

Gujarat Energy Limited (GEL) operates one of the largest and most geographically dispersed City Gas Distribution networks in India, spanning 29 Geographical Areas across 6 states and the Union Territory of Dadra & Nagar Haveli and exploration and production (E&P) operations — a portfolio of upstream assets as well. The network continues to expand into new urban, semi-urban and rural areas and with that expansion the volume, variety and operational significance of the data generated across GEL's field infrastructure and metering base grow correspondingly. As the network scales, the ability to observe, control and act upon this data from a single, enterprise-wide vantage point becomes decisive for operational safety, supply reliability, regulatory compliance and commercial performance.

The purpose of this project is to establish a single, integrated digital platform that consolidates operational and metering data from across GEL's City Gas Distribution network and its integrated E&P assets and that delivers unified real-time visibility, centralised supervisory monitoring and control, automated metering, advanced analytics and emergency and incident management, on a common, secure and scalable cloud foundation.

To achieve this, GEL is deploying three interoperable systems on a common India based MeitY-empanelled private cloud:

- a **Supervisory Control and Data Acquisition (SCADA)** system, providing cloud-hosted, real-time supervisory monitoring and control of GEL's gas distribution field infrastructure across all in-scope station types;
- an **Advanced Metering Infrastructure (AMI)**, automating the two-way collection of gas metering data from field devices and delivering validated, billing-grade determinants to GEL's SAP Billing system, thereby eliminating manual meter reading; and
- a **Centralized Monitoring Platform (CMP)**, serving as GEL's command-and-control, analytics and emergency-management hub, integrating existing and future operational systems, applications and third-party solutions into a single source of truth.

The three systems shall interoperate — SCADA and AMI feeding the CMP and all three integrating with GEL's ERP and other enterprise systems — to provide centralised control, real-time monitoring and robust analytics; to reduce manual intervention; to optimise resource allocation; and to improve response times to system alerts, thereby minimising disruptions and improving operational efficiency across the network. The initiative is intended to give GEL an enduring, future-ready digital foundation that can scale with the network, adapt to evolving technology and support data-driven decision-making at every level of the organisation.

2.2.1. Overview and Scope of Work

The successful Bidder shall implement all three systems on a single private cloud infrastructure hosted on MeITY-empanelled cloud, with comprehensive cybersecurity implementation, data management systems and scalable, redundant architecture ensuring high availability and reliability. The Cloud Service Provider shall be and shall remain, an empanelled member of MeITY-empanelled CSPs for the entire duration of this project, including any extension.

- The Bidder shall deploy all three applications on a MeITY-empanelled private cloud with all data centres within India. The Cloud Service Provider shall maintain active MeITY empanelment for the full contractual period including any extensions; loss of empanelment shall require immediate migration to a compliant provider at the Bidder's cost with no disruption to GEL operations.

- All Platforms shall be hosted in a primary cloud data centre with a geographically separate Disaster Recovery (DR) site. The DR site shall be in a different geographic region from the primary. Automatic failover to the DR site shall be configured and tested with a Recovery Time Objective (RTO) of four hours or less and a Recovery Point Objective (RPO) of one hour or less.

- All GEL data under this contract shall reside and remain within the territorial boundaries of India at all times, throughout the contract period and extension, if any. "GEL data" means all field metering data, processed and billing data, customer data, alarms and events, logs, telemetry, backups, archives, configuration and any derivative data held or generated by the AMI Platform or any connected component. No GEL data shall be stored, replicated, backed up, cached, processed or transmitted to any location, data centre, service or person outside India, whether by the Bidder, the Cloud Service Provider, any OEM, or any sub-processor.

The scope of work comprises the following, including but not limited to:

2.2.1.1. Supervisory Control and Data Acquisition System (SCADA)

The SCADA system shall provide GEL with real-time, cloud-hosted supervisory monitoring and control of its gas distribution network across all in-scope field locations spanning 29 GAs. The system shall acquire data from field devices via Remote Telemetry Units (RTUs) and industrial cellular modems over a secured cellular network, present it through a cloud-hosted master station environment and enable operational control, alarm management, trending, historical archival, analytics and reporting.

All master-station functions — Main Master Station (MMS), Backup Master Station (BMS) and GA-level control — shall be cloud-hosted on MeITY-empanelled private cloud, configured in dual hot-standby with automatic failover. No physical control-centre infrastructure (video walls, UPS, security appliances) is in scope. Field communication shall use the DNP3 protocol with TLS encryption over 4G/LTE with 2G fallback, with store-and-forward buffering for communication outages.

The scope of the SCADA System comprises, including but not limited to:

- **End-to-end delivery.** Design, supply, install, test, commission, operate and maintain a complete cloud-based SCADA system covering 830+ CNG Stations, 14 CGS, 70+ CMS, 350+ DRS, 90+ CP TR units, 14 Decompression skids, 4 CBG, 4 LCNG, 4 LNG terminals, 80+ odorizers, etc. across 29 GAs, in the quantities set out in the Schedule of Rates (SOR) and station-wise scope.

- **Cloud based master station and DR.** Deploy MMS, BMS and GA-level control functions on a single MeITY-empanelled private cloud, in dual hot-standby with automatic failover and a geographically separated Disaster Recovery site.

- **RTU supply and integration.** Supply and install IEC 62443 certified Type-1 and Type-2 RTUs with redundant power supplies and dual-SIM/Single-Sim with multi network support, industrial cellular modems at all other station types and migrate all existing I/O points.

- **Field instrumentation and integration.** Supply and integrate pressure/temperature transmitters, PLC/EVC/flow-computer/mass-flow-meter interfaces, cathodic-protection interfaces and hazardous-area barrier/surge protection as applicable per station type.

- **Functional capability.** Provide real-time data acquisition and control, alarm management, trending, historical archival, dashboards, GIS integration, role-based access and audit logging.

- **Wireless communication network.** Provide end-to-end WAN connectivity for all field devices. The Bidder shall select the communication service providers (4G LTE with 2G fallback) per location, based on the feasibility survey of network availability as conducted by the bidder across all GEL's field device locations, to meet the SLAs. All SIM cards shall be registered in the GEL name; SIM management and operator coordination shall be Bidder's responsibility.

- **Analytics and reporting.** Provide standard analytics — line-pack, LUAG/UFG, consumption monitoring, automated logbooks, remote CNG price change, compressor line-loss and power-consumption monitoring — and standard/custom reporting, at no additional licence cost.

- **Mobile application.** Provide iOS and Android applications with secure authentication, real-time data access and field-operations support.

- **Cyber-secure delivery.** Design and operate the SCADA system as a cyber-secure system (TLS, IPsec/AES-256 VPN tunnelling, certificate-based RTU authentication, IEC 62443 / ISO 27001 alignment, CERT-In empanelled VAPT before Go-Live and periodically thereafter).

- **Operations, maintenance and handover.** Operate and maintain the complete SCADA system for the O&M Period, meeting all SLAs and complete a structured handover at contract completion.

2.2.1.2. Advanced Metering Infrastructure (AMI)

The AMI System is an integrated, end-to-end infrastructure comprising field communication devices (Modems connected to EVCs and Meter Interface Units on Positive Displacement meters), a wireless wide area communication network and a centralised, cloud-hosted AMI Platform delivering data acquisition, data management, VEE processing, billing integration, alarm and asset management, reporting and a staff mobile application. It enables automated, two-way exchange of gas metering data between field devices and GEL's enterprise systems, eliminating manual meter reading.

The complete scope of this RFP is summarised in the following points. Each is elaborated in the Sections referenced.

- **End-to-end delivery.** Design, supply, install, test, commission, operate and maintain a complete AMI System covering all in-scope field metering locations across GEL's 29 GAs, in the quantities set out in the Schedule of Rates (SOR).

- **AMI Platform.** Provide a cloud-hosted COTS AMI Platform delivering Head-End System (HES), Meter Data Management System (MDMS), Network Management System (NMS), Enterprise Management System (EMS), reporting, dashboards and a GEL staff mobile application. Platform architecture (unified or modular) is at the Bidder's discretion provided all functional requirements are met and the platform shall be scalable to the metering-point count specified in the SOR.

- **Software on SaaS.** All software proposed under this RFP shall be provided on a Software-as-a-Service (SaaS) basis. The Bidder shall own and licence the AMI Platform software for the contractual period and shall provide GEL active licences and full transition support at contract completion.

- **Cloud and Disaster Recovery.** Host the AMI Platform on a single private cloud on MeITY-empanelled cloud infrastructure with SOC 2 type II certification, with high availability and a geographically separated Disaster Recovery site. The Cloud Service Provider shall remain a MeITY-empanelled CSP with SOC 2 type II certification for the entire contract duration including any extension.

- **EVC communication Modems.** Supply and install new dual-SIM / single-SIM industrial wireless Modems (multi-network, multi-IMSI) at all EVC-equipped Industrial and Commercial metering locations. No reuse of existing devices.
- **Multi-OEM EVC integration — Annexure A.** Integrate all EVC makes and models listed in **Annexure A** (GEL's existing installed base). Working communication drivers for every Annexure A EVC make and model shall be developed, tested and available **before contract award**, at no additional cost to GEL, so that integration capability is proven and not a post-award risk.
- **New EVC makes — Annexure B.** For any EVC make or model listed in **Annexure B** (makes not already integrated), the Bidder shall submit, as part of its commercial bid, a per-make driver development cost. Following price discovery, GEL shall decide at its sole discretion whether to proceed with driver development for each Annexure B make, or to replace those EVCs. No Annexure B driver development shall commence without GEL's written instruction.
- **Meter Interface Units (MIUs).** Supply and install MIUs with built-in or dedicated external modems for in-scope Positive Displacement (Diaphragm) meters at Industrial and Commercial sites, including pulse interface cabling, plus a provision for 100 MIUs on domestic G1.6 meters.
- **Wireless communication network.** Provide end-to-end WAN connectivity for all field devices. The Bidder shall select the communication service providers (4G LTE with 2G fallback) per site, based on the feasibility survey of network availability as conducted by the bidder across all GEL's field device locations, to meet the SLAs. All SIM cards shall be registered in the GEL name; SIM management and operator coordination shall be Bidder's responsibility.
- **Data acquisition, VEE and billing.** Collect metering data at fixed intervals and on demand, apply Validation, Estimation and Editing (VEE) with a complete immutable audit trail and deliver validated billing determinants to GEL's SAP Billing system through mandatory automated integration, supporting GEL's (minimum of 7-day, 10-day and 15-day) billing cycles without disruption.
- **Enterprise integration.** Integrate the AMI Platform with GEL's SCADA, CMP, CRM and other enterprise systems as required during the contractual period, through open, standard APIs.
- **Hardware ownership with GEL.** All field hardware — Modems, MIUs, antennas, enclosures, cables and associated accessories — shall be owned by GEL. Ownership of each item passes to GEL on release of the milestone payment covering it. The Bidder shall supply, install, operate and maintain this hardware throughout the contractual period, but does not own it.
- **Cyber-secure system.** Design, implement and operate the AMI System as a cyber-secure system throughout the contractual period — TLS 1.2 or higher for all field-to-platform communication, AES-128 / 256 at rest, IEC 62443 and NCIIPC compliance, STQC certification, CERT-In empanelled VAPT before Go-Live, before each version release and at least annually thereafter.
- **Parallel operations and transition.** Demonstrate the new AMI System through the mandatory parallel operations period, obtain GEL batch-wise acceptance on comparative

data reconciliation and transition off the existing system with no billing disruption and no data loss.

- **Operations, maintenance and handover.** Operate and maintain the complete AMI System — hardware and software — for the five-year O&M Period post the achievement of Go live, meeting all SLAs and complete a structured handover to GEL or its nominated successor at contract completion.

Explicitly outside the scope of this RFP:

- Supply of any EVCs, PD Meters or any gas meter of any type. EVCs and PD meters are already installed or shall be supplied by GEL where required.

2.2.1.3. Centralized Monitoring Platform (CMP)

The CMP is a Commercial-off-the-shelf (COTS) Command & Control platform that shall serve as GEL's central hub for accessing essential and critical information by integrating GEL's operational systems, existing and future applications and third-party vendor solutions. It shall enable comprehensive monitoring of operational assets and insights into real-time and historical data through advanced AI/ML-driven analytics and shall facilitate incident management and emergency control through a unified interface with alerts and predictive insights. All data formats shall adhere to GEL's data philosophy, formats and standards. The CMP shall be accessible through web and mobile (Android and iOS) interfaces with role-based access and SSO and all intellectual property in code developed for GEL under this project shall rest solely with GEL.

The CMP shall be implemented in three phases:

- **Phase 1 — CMP setup and integration of existing applications.** Supply, deploy, configure and customise the CMP software and MeITY-compliant cloud environment; integrate existing operational systems, applications and third-party vendor solutions (SAP, existing multi-OEM SCADA platforms, multiple legacy AMR applications, spreadsheet feeds and other applications per Annexure 1) into a centralised Data Lake; develop reporting dashboards; and develop/customise the mobile application with required dashboards. It should also Include E&P dashboards with manual data-entry forms. Additionally, integration with the proposed AMI platform.

- **Phase 2 — Integration with new SCADA and basic analytics:** Integrate the new SCADA and AMI systems delivered under this RFP, develop basic analytics and cascading reporting dashboards; migrate E&P data entry to middleware integration. Outgoing legacy SCADA/AMR applications shall remain integrated until their assets are migrated to the new systems (mandatory coexistence).

- **Phase 3 — AI/ML advanced analytics and emergency control.** Develop and deploy AI/ML-driven advanced analytics module/engine along with the finalized use cases; Integrate new/middleware applications as they have been deployed; implement alert management and emergency-control system; integrate future applications, as and when it is made available for the integration.

2.2.2. Commercial and Ownership Model

2.2.2.1. Business Model

The AMI System shall be delivered under a **design, build, operate and maintain model in which GEL owns all hardware and the Bidder owns and provides the software as a service.** The Bidder designs, supplies, installs, commissions, operates and maintains the complete AMI System for the contractual period; GEL owns the field hardware; and the Bidder retains ownership of the AMI Platform software, licensed to GEL on a SaaS basis for the contractual period.

The model separates ownership of the two layers deliberately:

- **Hardware — owned by GEL.** All field hardware (RTU, Pressure and Temperature transmitters, Modems, MIUs, antennas, enclosures, cables and associated accessories) shall be owned by GEL. Ownership of each item passes to GEL, free of all encumbrances, on release of the milestone payment covering that item. The Bidder does not own the hardware at any point after payment and shall not create any lien, charge, or encumbrance over any hardware for which GEL has paid.
- **Software — owned by the Bidder, provided on SaaS.** All software proposed under this RFP is owned or licensed by the Bidder and provided to GEL on a Software-as-a-Service basis for the contractual period. At contract completion the Bidder shall provide GEL with active licences in GEL's name and full transition support.

2.2.2.2. Design Responsibility

Because the Bidder is responsible for meeting the functional and SLA requirements of this RFP, GEL does not prescribe exact implementation values for hardware design parameters — power supply arrangement, enclosure design, barrier and surge protection, communication technology selection and cable sizing. The Bidder is responsible for all such design decisions and the technical specifications in annexure are a minimum requirement that do not relieve the Bidder of responsibility for delivering a System that meets every SLA. The Bidder's ownership of the hardware during the term does not transfer design responsibility to GEL.

GEL prescribes 4G LTE (with 2G fallback) for cellular communication either with Dual-SIM/Single-SIM multi-network support modems or single sim modems with multi network support. Communication hardware for any new SCADA field location, EVC or PD meter added during the O&M Period shall be supplied, installed, operated and maintained by the Bidder at the rate applicable for that year in the SOR. All SIM cards shall be registered in the GEL name, with SIM management and operator coordination being the Bidder's responsibility.

2.2.2.3. Product and Software Lifecycle Requirements

The Bidder shall ensure that no hardware product, software product, operating system, database, middleware, or any other component proposed under the Integrated System is at, approaching, or beyond its End-of-Life (EOL) or End-of-Support (EOS) date at the time of deployment. Specifically, the following requirements shall be complied with:

- All proposed hardware products shall have a minimum remaining manufacturer support life of 5 years from the planned Go-Live date.

- All proposed software products, operating systems, databases and middleware shall have active vendor support and security-patch availability for the entire contractual period (implementation + O&M).
- The Bidder shall submit, as part of the technical proposal, a Product Lifecycle Declaration listing every hardware and software component in the proposed System along with the current manufacturer support status and confirmed EOL/EOS date for each component.
- In the event any component reaches EOL/EOS during the O&M Period, the Bidder shall proactively plan and execute an upgrade or migration to a supported version at no additional cost to GEL, with prior intimation and GEL's written approval.
- GEL reserves the right to reject any proposal that includes EOL or EOS products at the time of bid evaluation.

2.2.3. Project Objectives

The Digital Infrastructure Transformation project will strengthen five key operational areas of Gujarat Energy Limited (GEL):

- **Operational Excellence Enhancement:** Establish centralised monitoring and control capabilities, eliminating manual processes and enabling real-time operational visibility across the entire distribution network.
- **Safety and Compliance Improvement:** Implement comprehensive safety monitoring, automated alarm management and regulatory compliance reporting through integrated digital systems.
- **Customer Service Optimisation:** Modernise metering infrastructure for accurate billing, eliminate manual meter reading and provide real-time consumption data for enhanced customer service delivery.
- **Data-Driven Decision Making:** Deploy advanced analytics and business-intelligence capabilities enabling strategic planning, operational optimisation and predictive maintenance across all business functions.
- **Future-Ready Infrastructure:** Establish a scalable, secure digital foundation supporting long-term growth, technology evolution and integration with emerging smart-infrastructure solutions.

2.2.4. Project Beneficiaries

The beneficiaries of the project include:

Primary Beneficiaries

- **Gujarat Energy Limited (GEL)** — enhanced operational efficiency, reduced costs, improved safety compliance and competitive advantage through digital transformation.
- **GEL Customers** — improved service reliability, accurate billing, faster issue resolution and an enhanced customer experience.
- **GEL Employees** — modern tools and systems, improved working conditions, enhanced safety and professional development opportunities.

Secondary Beneficiaries

- **Regulatory Bodies** — enhanced compliance reporting, improved safety standards and transparent operational data.
- **Local Communities** — improved gas supply reliability, enhanced safety measures and economic benefits from infrastructure modernisation.
- **Technology Partners** — long-term partnership opportunities and a platform for innovation in the natural gas distribution sector.

3. Scope of Work

This section defines the comprehensive scope of work to be performed by the BIDDER for the design, supply, installation, testing, commissioning and post-implementation support of the SCADA, AMI and CMP system for Gujarat Energy Limited. The scope is divided into three main parts:

- **Brief Scope of the Bidder:** A brief scope of the proposed system.
- **Station-Wise Scope**: Specific monitoring and control requirements for each type of facility in the gas distribution network.
- **General Scope**: Requirements for central SCADA system, AMI and CMP functionality, including software, infrastructure, analytics, reporting and integration.

3.1. Brief Scope of the work for SCADA

- The bidder shall design, supply, install, test and commission a comprehensive cloud-based SCADA system for Gujarat Energy Limited to monitor and control approximately 1400+ field locations across the distribution network.
- The bidder shall ensure the SCADA system can effectively monitor and / or control all infrastructure types including 14 City Gate Stations, 71 Check Metering Stations, 833 CNG Stations, 360 Above Ground DRS/CPRS, 195 Underground DRS, 4 Compressed Biogas Plants, 4 LCNG Stations, 14 Decompression Stations, 73 Odorizer Units and 97 Cathodic Protection systems,14Gas Exploration Sites etc. The above numbers may vary based on the actual field survey.
- The bidder shall establish a Main Master Station (MMS) and a Backup Master Station (BMS) both on cloud setup with full redundancy capabilities to ensure continuous operation even during site failures.
- The bidder shall implement server infrastructure on cloud including, but not limited to Cellular Communication Servers, SCADA Servers, DMZ Servers, Web Servers, OPC UA Servers, Dashboard and Workstation Servers, Mobile Gateway Servers, Historian Servers, Alarm Management Servers and Reporting Server. Bidder shall also consider all the other cost associated with the cloud based Data Centre and Disaster Recovery centre.
- The bidder shall implement a subset of these servers at the BMS focused on core operational capability during failover situations, including SCADA Server, Web Server, OPC UA Server, Dashboard and Workstation Server and Mobile Gateway Server etc.
- The Bidder shall provide OS, Database, Anti-Virus, End point security solution, Firewall etc. licenses on cloud setup along with the compliance to the cyber security norms, as suggested by CERT-In.

- The bidder shall supply and install appropriate workstations including 6 SCADA Operator Workstations, 3 Engineering Workstations, 2 Report Development Workstations at the MMS, as well as 3 SCADA Operator Workstations, 1 Engineering Workstation at the BMS.

- The bidder shall supply and install a Workstations (1 per GA) for Geographic Area control centers.

- The bidder shall supply and install junction boxes with surge protection devices for all field connections at hazardous area locations in accordance with IEC 60079 for Zone 1, Gr IIA/B with mandatory PESO/ATEX/ICEX certification for all equipment installed in hazardous areas.

- The Bidder shall estimate and recommend minimum bandwidth requirement for the internet / intranet each of the GA locations and Head office / other office locations of GEL to access cloud-based SCADA, Historian, etc. solutions.

- The bidder shall provide and install new FRLS (Fire Retardant Low Smoke) armoured and screened cables for all field connections throughout the entire system including at CGS, CNG stations, Decompression Stations and LCNG stations.

- The bidder shall provide and install new FRLS (Fire Retardant Low Smoke) armoured and screened cables for all field connections throughout the entire system, with suitable cable glands and cable adapters for both ends complying with applicable hazardous area certifications.

- The bidder shall supply and install isolation barrier modules (1 per 2 dispensers) for Modbus cabling to RTUs at CNG and LCNG stations, as well as appropriate isolation barrier modules for all hazardous area connections throughout the system to ensure intrinsically safe operations in accordance with Ex ia, Ex ib, Ex d, or Ex e protection types as defined in ATEX Directive 95/IEC 60079.

- Bidder shall interface with existing compressor PLC systems by converting all the existing protocols (Profibus, Profinet, Modbus, etc.) by necessary converters or programming to be able to connect to the RTU by existing managed ethernet switches or new managed ethernet switches .

- The bidder shall implement new cable trenching from dispensers to panel rooms at CNG stations and provide RS-485 cables to dispensers (5V DC FRLS armoured and screened cable through metal conduit).

- The bidder shall supply and install new managed ethernet switches es at locations where no spare ports are available in existing equipment to facilitate integration with PLCs and control systems.

- The bidder shall configure the SCADA system to handle over 150,000 tags (expandable to 300,000+) and provide real-time monitoring, control, data acquisition, alarm management, reporting and historical data archiving for 8 years.

- The bidder shall develop and implement a secure mobile application that provides access to live process data, alarms and KPIs for authorized personnel.
- The bidder shall ensure the mobile application supports both iOS and Android platforms with role-based access control and secure authentication.
- The bidder shall configure the Mobile Gateway Server to manage mobile authentication, optimize data for efficient mobile transmission, handle push notifications for alarms and events and manage offline synchronization for mobile devices.
- All liaison with different OEMs required to complete the scope of work for SCADA, resolve protocol ambiguities, obtain technical documentation and fulfil any other obligation under this RFP shall be the sole responsibility of the Bidder; GEL shall not be required to intervene or facilitate communication with any OEM on the Bidder's behalf.
- The bidder shall provide at least 60 concurrent web and mobile user licenses each (expandable with user creation limit of 150) for secured access to the SCADA system.
- The bidder shall ensure that at minimum, all the current I/O points from existing RTUs at CGS locations are integrated and displayed in the new SCADA system.
- The bidder shall integrate all I/O points available through all the stations to be visible and accessible through the new SCADA system.
- The bidder shall ensure all points currently available through the existing Cathodic Protection system are made fully available and visible in the new SCADA system.
- The bidder shall replace the CGS RTUs with appropriate Type-1 RTUs as specified for each station type, equipped with redundant SMPS diode-based power supplies and required calculation capabilities.
- The bidder shall deploy comprehensive cyber security across enterprise IT and OT networks for a unified end-to-end security architecture with separate firewalls for OT Networks and redundant firewalls for internet and intranet with automatic failover capability.
- The bidder shall be responsible for all activities related to software including firmware upgradation, patch management and software updates throughout the warranty and post-warranty maintenance period.
- The bidder shall deploy multiple teams in each GA / zone location to complete all installation works within the defined time schedule, with at least one safety engineer in each zone location while work is being carried out to ensure compliance with safety protocols.
- The bidder shall lay all underground cables in trenches prepared by the bidder according to applicable standards and all above-ground cables shall be laid on perforated GI cable trays / pipe with tubular lugs used for all cable terminations. These installations must be undertaken at an adequate depth from the surface.

- The bidder shall provide surge protection devices extensively for AC/DC at input and output, as well as at earth circuits and field communication links to ensure system robustness against electrical transients.

- The bidder shall ensure all equipment is capable of operating in the specified environmental conditions and designed for 24x7 operation, with all RTUs and modems being of rugged design as air-conditioned rooms are unavailable at proposed list of locations.

- The bidder shall coordinate with mechanical, civil, electrical, instrumentation and other contractors for all works related to SCADA, conduct site visits to gather any required input or data and shall take work permits from GEL for each station for each day of working at any station.

- The bidder shall design the SCADA system with flexibility for future technological upgrades and deliver a system architecture that supports addition of new stations, new parameters and modifications to existing configurations without requiring major system changes.

- The bidder shall carry out any number of changes, modifications, additions, or deletions to Graphics, Logics, Reports, etc. as required by GEL for any number of times at any stage of the project (including during warranty and post-warranty periods) without any additional cost to GEL.

- The bidder shall handle the scope for increase of quantity of any item involving all the works including design, engineering, transport, insurance, loading, unloading, supply, erection, cabling, glanding, termination, testing and commissioning of the respective item, complete in all respects. Bidder shall be paid on an actual basis for the additional work undertaken by their team.

- The bidder shall implement VPN tunnelling architecture with IPsec protocol and AES-256 encryption for all communications between field devices and the cloud-based SCADA infrastructure.

- The bidder shall ensure communications protocols include Modbus RTU/TCP, HART and DNP3 authentication with MeITY encryption for security.

- The bidder shall provide Dual-SIM/Single-SIM multi-network support industrial cellular modems along with SIM cards for field devices with automatic failover between service providers and store-and-forward capability during communication outages.

- The bidder shall interface SCADA with new RTU over the network using different open protocols (DNP 3.0, Modbus TCP/IP, IEC, MQTT, etc.) and ensure the platform supports OPC UA/OData API to allow future interfacing and integration of 3rd party systems including but not limited to: CMP, ESB, GIS, CCTV, RFID LCV Journey Application, SAP, etc.

- The bidder shall configure I/O and Application servers with provision to run on cloud as well as on MMS and BMS and provide all software (SCADA, RTU and any other applications) in hard disk with license key or paper license.

- The bidder shall perform logic modification in RTUs as needed and provide free SCADA software updates and upgrades and RTU firmware for the installed version during the contractual period.
- It shall be the responsibility of the SCADA vendor for coordination with mechanical, civil, electrical, instrumentation and other contractors for all the works related to SCADA.
- All equipment shall be capable of operating for the specified environmental conditions. All equipment unless otherwise specified, shall be electronic type.
- Dual pole MCB shall be provided for all power isolation at any location. Power to any device at any location shall be through dual pole MCB.
- Laying & routing of cables through conduits, glanding, termination of cables, dressing and ferruling for all the cables.
- Providing earthing to SCADA equipments at all locations by extending the earth conductor of suitable dimension from earth pit or earthing grid. Vendor may check earth connectivity before connection to the equipment rack. Bidder shall use 1 C x 6 sq mm FRLS armoured cable for earthing at each location and cost of the same shall be included in installation cost of respective equipment.
- SCADA vendor must coordinate with Instrumentation / Telecommunication / Electrical / CP system contractor / vendor during installation & commissioning for proper integration.
- The electrical works associated with the installation and commissioning of the equipments, earthing of equipments at all sites, powering of equipments at all sites, termination of cables as required shall be the responsibility of the bidder. Supply and laying of Power Cables from Electrical panel to respective RTU Panel, Server Panel, RWS etc cables as required shall be the responsibility of the bidder.
- Supply and laying of cables & connectors from each IED to RTU is in bidder's scope.
- Supply and laying of cables & connectors from Local IEDs to RTU and MODEM & interconnection between SCADA equipment is in bidder's scope.
- Glanding, ferruling, cable tagging at both ends of each cable, termination of cabling at RTU end, workstation end and respective end at PLC, Electrical Panel, IEDs or any other interfacing device shall be bidder's responsibility.
- The bidder shall connect ultra sonic meters (USM) through appropriate port wherever available with Dual-SIM/Single-SIM multi-network support industrial modem along with the EVC/flow computer.
- The design and installation shall be generally in accordance with international recommended practices and other applicable standards like ASI, IBR etc. All standards, code of practice shall be of the latest edition.

- The Bidder shall provide complete grid power connection for all Electronic Volume Correctors (EVCs) at GEL sites including all hardware, materials and installation activities as specified below:
- All materials and equipment shall be of the highest quality, conforming to international standards and safety requirements. The Bidder shall provide all necessary installation accessories, supports and ancillary items required for complete and safe grid power connection to the EVC, whether specifically mentioned or not.
- The bidder shall provide one private cloud for all the three solutions in this RFP.
- The bidder shall give necessary user, access and configuration to GEL for all the applications in this RFP.
- The bidder shall provide and configure the firewall for all applications, and it should be Nextgen and / or WAF
- All hardware and components supplied under this contract shall be brand new, unused and latest generation available from the manufacturer.
- No refurbished, reconditioned, or second-hand equipment shall be supplied under any circumstances.
- All hardware and components shall come with manufacturer's comprehensive warranty as specified in the contract terms.
- The Bidder shall provide manufacturer's warranty certificates for all supplied hardware and components.
- Any hardware or component found to be non-compliant with the "new" requirement shall be immediately replaced at the Bidder's cost without any time extension.
- The Bidder shall assume complete responsibility for any incident, failure, or disruption occurring in the deployed systems during the contract period.
- Incident management shall include:
    - Immediate response to any system failure or disruption
    - Root cause analysis and corrective action implementation
    - Preventive measures to avoid recurrence
    - Complete documentation of incident and resolution steps
- The Bidder shall be liable for:
    - Any business disruption caused by system failures
    - Data loss or corruption incidents

- Security breaches or cyber incidents
- Performance degradation below SLA requirements

- The Bidder shall maintain comprehensive incident management system with real-time tracking and reporting capabilities.
- GEL shall be immediately notified of any incident along with preliminary assessment and resolution timeline.
- The Bidder shall be responsible for performing and completing all work, activities, services and deliverables necessary for the successful completion of the project, whether specifically mentioned in the scope of work or not. This includes but is not limited to any ancillary work, supporting activities, complementary services, regulatory compliance requirements, testing, commissioning, documentation, training and any other tasks that are reasonably necessary or incidental to achieve the project objectives and deliverables as envisioned. The Bidder cannot claim additional compensation or refuse to perform any work on the grounds that such work was not explicitly mentioned in the scope of work, provided such work is reasonably necessary for project completion. The Bidder is expected to use their professional expertise and industry knowledge to identify and execute all necessary work components to deliver a complete, functional and ready-to-operate solution.
- The bidder shall ensure all work is performed in line with GEL health and safety guidelines
- This is a NO DEVIATION TENDER. All bidders must complete the attached Deviation Form. Any deviations noted outside of this prescribed form will render the offer non-responsive and liable for rejection, as per the form's instruction.

3.2. Brief Scope of work for AMI

- The Bidder shall design, supply, install, test, commission, operate and maintain a complete Advanced Metering Infrastructure (AMI) System for Gujarat Energy Limited to replace GEL's existing AMI system and automate meter data collection from field metering locations (Qty. as specified in the SOR) across GEL's 29 Geographical Areas.
- In the event of any discrepancy between the quantities of metering nodes listed in SOW, quantities identified during the survey and quantities stated in the SOR (Schedule of Rates), the quantities in the SOR shall prevail for commercial purposes. The Bidder shall flag any such discrepancy in writing to GEL during the site survey stage / milestone; GEL shall issue a written clarification before installation commences. In the absence of a written clarification, the SOR quantities shall be treated as final.
- The battery limit for the bidder starts from, in case of the EVC at the serial port and in the case of PD meters at the index cover. The bidder is not required to supply either the EVCs or PD meters under the scope of this RFP.
- Bidder shall ensure that all components supplied under this project are STQC certified throughout the contractual duration of the project.
- The Bidder shall supply and install new dual-SIM/single-SIM with multi-network capability using multi-IMSI technology wireless Modems at all EVC-equipped metering locations (IMS).

- Integrate all EVC makes and models listed in Annexure A (GEL's existing installed base). Working communication drivers for every Annexure A EVC make and model shall be developed, tested and available before contract award, at no additional cost to GEL.
- For any EVC make or model listed in Annexure B (makes not already integrated), the Bidder shall submit, as part of its commercial bid, a per-make driver development cost (under Schedule C). Following price discovery, GEL shall decide at its sole discretion whether to proceed with driver development for each Annexure B make, or to replace those EVCs. No Annexure B driver development shall commence without GEL's written instruction.
- The Bidder shall supply and install Meter Interface Units (MIUs) with built-in or dedicated external modems with dual-SIM/single-SIM with multi-network capability using multi-IMSI technology functionality, along with all required pulse interface cabling, at all in-scope Positive Displacement (Diaphragm) meter locations at Industrial customer sites.
- The Bidder shall deploy, configure and maintain a cloud-hosted COTS AMI Platform on a MeITY empanelled cloud infrastructure with a geographically separate Disaster Recovery site. The AMI Platform shall deliver HES functionality, MDMS functionality, a GEL staff mobile application and all specifications as specified in this document.
- The Bidder shall configure mandatory integration between the AMI Platform and GEL's SAP Billing system, supporting different types of billing cycles such as 7-day, 10-day and 15-day intervals (or any other billing cycle as per GEL requirement). The Bidder shall configure integrations with GEL's SCADA, CMP, CRM and other enterprise systems as and when required during the contractual period.
- The Bidder shall plan and execute a mandatory parallel operations period batch-by-batch, providing comparative data reconciliation reports for GEL's acceptance at each batch.
- The Bidder shall select the wireless communication technology — cellular (4G LTE) or NB-IoT — appropriate for site conditions at each location. GEL has specified the required SLA outcomes for the engagement whereas the Bidder is free to select the right technology and / or tool to meet them.
- The Bidder shall procure and manage all SIM cards throughout the contractual period. All SIMs shall be registered in GEL name. Bidder shall make all the payment associated with SIM cards for success operation of all the devices.
- The Bidder shall procure, operate and maintain all hardware throughout the contractual period and handover all assets to GEL in fully functional condition at contract completion.
- The Bidder shall operate and maintain the complete AMI System during the five-year O&M Period, meeting all SLAs specified.
- The Bidder shall make sure all hardware and software products proposed under this RFP are not End-of-Life (EOL) or End-of-Support (EOS) at the time of deployment and carry a minimum remaining manufacturer support life of five years from the planned Go-Live date. Bidder to submit the Manufacturer Authorization Form (MAF), as mentioned in the BQC document along with the Bid.
- The Bidder shall ensure all field-to-platform communication is encrypted using TLS 1.2 or higher. The complete AMI System and its data shall comply with IEC 62443, NCIIPC and DPDP guidelines for cybersecurity throughout the contractual period.

- The Bidder shall conduct an independent penetration test by a CERT-In empanelled security auditor prior to Go-Live and remediate all critical and high severity findings before seeking GEL's acceptance. Additionally, Bidder shall also undertake the VAPT testing through CERT-IN empanelled agency every year and shall submit report in this regard. Bidder shall ensure that any recommendations suggested by the CERN-IN empanelled agency is addressed within V1–V4 15/30/60/90 model upon receipt of the report.
- The Bidder shall carry out any modifications, additions, or configuration changes to the AMI Platform as required by GEL at any stage of the project, including during the O&M period, without additional cost to GEL. However, the same shall be limited to four major changes in an O&M year. Bidder shall not raise any concerns for any minor changes which includes modifications / creation of a particular report, change / updation of field name, dashboard re-alignment, setup of periodic report sharing etc.
- The Bidder shall handle any increase in the quantity of field devices, including all associated works — survey, supply, installation, commissioning and AMI Platform registration — as per the unit rate applicable for particular year as priced in the SOR. Similarly, the OPEX cost shall be provided to the Bidder upon successful acceptance of additional sites.
- The AMI platform architecture shall support canonical data model-based normalization to enable standardized interoperability across multi-OEM devices and enterprise applications.
- The bidder shall supply and install junction boxes with surge protection devices for all field connections at hazardous area locations in accordance with IEC 60079 for Zone-1/Zone-2, Gr IIA/B with mandatory ATEX/PESO certification for all supplied equipment.
- The Bidder shall estimate and recommend minimum bandwidth requirement for the internet / intranet each of the GA locations and Head office / other office locations of GEL to access cloud-based AMI solution.
- The bidder shall ensure the mobile application supports both iOS and Android platforms with role-based access control and secure authentication.
- The bidder shall configure the Mobile Gateway Server to manage mobile authentication, optimize data for efficient mobile transmission, handle push notifications for alarms and events and manage offline synchronization for mobile devices.
- The bidder shall deploy comprehensive cyber security across enterprise IT and OT networks for a unified end-to-end security architecture with separate firewalls for OT Networks and redundant firewalls for internet and intranet with automatic failover capability.
- The bidder shall be responsible for all activities related to software including firmware upgradation, patch management and software updates throughout the warranty and post-warranty maintenance period.
- The bidder shall deploy multiple teams in each GA location to complete all installation works within the defined time schedule, with at least one safety engineer in each GA location while work is being carried out to ensure compliance with safety protocols.
- The bidder shall provide surge protection devices extensively for AC/DC at input and output, as well as at earth circuits and field communication links to ensure system robustness against electrical transients.

- The bidder shall ensure all equipment is capable of operating in the specified environmental conditions and designed for 24x7 operation, with all modems and MIUs being of rugged design (industrial grade), as air-conditioned rooms are not available at GA locations.
- The bidder shall coordinate with mechanical, civil, electrical, instrumentation and other contractors for all works related to AMI, conduct site visits to gather any required input or data and shall take work permits from GEL for each station for each day of working at any station.
- The bidder shall design the AMI system with flexibility for future technological upgrades and deliver a system architecture that supports addition of new EVCs, new parameters and modifications to existing configurations without requiring major system changes.
- The bidder shall carry out any number of changes, modifications, additions, or deletions to Graphics, Logics, Reports, etc. as required by GEL for any number of times at any stage of the project (including during warranty and post-warranty periods) without any additional cost to GEL.
- The bidder shall handle the scope for increase of quantity of any item involving all the works including design, engineering, transport, insurance, loading, unloading, supply, erection, cabling, glanding, termination, testing and commissioning of the respective item, complete in all respects.
- The bidder shall implement VPN tunnelling architecture with IPsec protocol and AES-128 / 256 encryption for all communications between field devices and the cloud-based AMI infrastructure.
- All APIs, protocol adapters, communication interfaces and integration interfaces shall be openly documented and made available to GEL without additional licensing dependency.
- All equipment shall be capable of operating for the specified environmental conditions. All equipment unless otherwise specified, shall be electronic type.
- Dual pole MCB shall be provided for all power isolation at any location. Power to any device at any location shall be through dual pole MCB.
- Laying & routing of cables through conduits, glanding, termination of cables, dressing and ferruling for all the cables.
- Providing earthing to new AMI equipment at all locations by extending the earth conductor of suitable dimension from earth pit or earthing grid. Vendor may check earth connectivity before connection to the equipment rack. Bidder shall use 1 C x 6 sq mm FRLS armoured cable for earthing at each location and cost of the same shall be included in installation cost of respective equipment.
- Vendor shall coordinate with Instrumentation / Telecommunication / Electrical / CP system contractor / vendor during installation & commissioning for proper integration as required.
- The electrical works associated with the installation and commissioning of the equipments, earthing of equipment at all sites, powering of equipment at all sites, termination of cables as required shall be the responsibility of the bidder. Supply and laying of Power Cables from Electrical panel to respective equipment cables as required shall be the responsibility of the bidder.

- Glanding, ferruling, cable tagging at both ends of each cable, termination of cabling at field devices end, workstation end and respective end at EVC, Electrical Panel, IEDs or any other interfacing device shall be bidder's responsibility.
- The design and installation shall be generally in accordance with international recommended practices and other applicable standards like ASI, IBR etc. All standards, code of practice shall be of the latest edition.
- The Bidder shall provide power solution for all modems at GEL sites including all hardware, materials and installation activities as specified below:
- All materials and equipment shall be of the highest quality, conforming to international standards and safety requirements. The Bidder shall provide all necessary installation accessories, supports and ancillary items required for complete and safe grid power connection to the EVC, whether specifically mentioned or not.
- The bidder shall give necessary user, access and configuration to GEL for all the applications in this RFP.
- The bidder shall provide and configure the firewall for all applications, and it should be Nextgen or WAF
- All hardware and components supplied under this contract shall be brand new, unused and latest generation available from the manufacturer.
- No refurbished, reconditioned, or second-hand equipment shall be supplied under any circumstances.
- All hardware and components shall carry the manufacturer's comprehensive warranty and a comprehensive onsite warranty for the full contractual period. The Bidder is responsible for all onsite warranty service.
- The Bidder shall provide manufacturer's warranty certificates for all supplied hardware and software components.
- Any hardware or component found to be non-compliant with the requirement shall be immediately replaced at the Bidder's cost without any time extension.
- The Bidder shall assume complete responsibility for any incident, failure, or disruption occurring in the deployed systems during the contract period.
- Incident management shall include:
    - Immediate response to any system failure or disruption
    - Root cause analysis and corrective action implementation
    - Preventive measures to avoid recurrence
    - Complete documentation of incident and resolution steps
- The Bidder shall be liable for:
    - Any business disruption caused by system failures

- Data loss or corruption incidents
- Security breaches or cyber incidents
- Performance degradation below SLA requirements

- The Bidder shall maintain comprehensive incident management system with real-time tracking and reporting capabilities.

- GEL shall be immediately notified of any incident along with preliminary assessment and resolution timeline.

- The Bidder shall be responsible for performing and completing all work, activities, services and deliverables necessary for the successful completion of the project, whether specifically mentioned in the scope of work or not. This includes but is not limited to any ancillary work, supporting activities, complementary services, regulatory compliance requirements, testing, commissioning, documentation, training and any other tasks that are reasonably necessary or incidental to achieve the project objectives and deliverables as envisioned. The Bidder cannot claim additional compensation or refuse to perform any work on the grounds that such work was not explicitly mentioned in the scope of work, provided such work is reasonably necessary for project completion. The Bidder is expected to use their professional expertise and industry knowledge to identify and execute all necessary work components to deliver a complete, functional and ready-to-operate solution.

- The bidder shall ensure all work is performed in line with GEL health and safety guidelines

- This is a NO DEVIATION TENDER. All bidders shall complete the attached Deviation Form. Any deviations noted outside of this prescribed form will render the offer non-responsive and liable for rejection, as per the form's instructions

- In case of any dispute between Bidder and OEM, it shall be the responsibilities of Bidder to resolve this concern. In any case, there should not be any impact on GEL arising out of this dispute. Bidder should ensure this to be addressed.

3.2.1. EVC OEM Driver Development

- The Bidder shall develop communication drivers for all EVC OEM makes listed in Annexure A and models in GEL's network if that are not natively supported by the proposed AMI Platform. This work is within the Bidder's scope and shall be completed before contract award.
- Integrate all EVC makes and models listed in Annexure A (GEL's existing installed base). Working communication drivers for every Annexure A EVC make and model shall be developed, tested and available before contract award, at no additional cost to GEL
- For any EVC make or model listed in Annexure B (makes not already integrated), the Bidder shall submit, as part of its commercial bid, a per-make driver development cost. Following price discovery, GEL shall decide at its sole discretion whether to proceed with driver development for each Annexure B make, or to replace those EVCs. No Annexure B driver development shall commence without GEL's written instruction.
- For new EVC OEMs introduced into GEL's network after contract award, where the AMI Platform does not natively support that OEM's protocol, the Bidder shall develop the required

driver. The one-time cost of driver development per new EVC OEM shall be separately quoted by the Bidder and agreed with GEL before development commences. This is a separate line item in the SOR.

- The Bidder shall maintain a driver version register, updated whenever a driver is developed, modified, or upgraded.

3.2.2. New EVC and PD Meter Onboarding During the O&M Period

- During the five-year O&M Period, GEL will install new EVC and PD meters at new or existing metering locations. The Bidder shall onboard all such new meters into the AMI System.
- New EVC / PD meter onboarding during the O&M Period shall be priced on the **annual unit rate applicable for the year in which onboarding occurs**, as quoted in the SOR. The SOR shall contain a separate unit rate for each year of the O&M Period (Year 1 through Year 5).
- GEL shall pay per device onboarded at that year's rate. There is no blanket or free onboarding of new meters during the O&M Period.
- The Bidder's scope for each new device is identical to the initial deployment scope: physical survey, supply and installation of hardware, WAN connectivity, device commissioning in the AMI Platform and confirmation of data collection.
- Where a new EVC OEM not previously present in GEL's network is introduced during the O&M Period, driver development costs shall apply as per SOR.

3.3. Brief Scope of work for CMP

- The bidder shall design, deploy, configure, customize, operate and maintain a fully operational Centralized Monitoring Platform (CMP) for Gujarat Energy Limited (GEL), serving as the central hub for accessing essential and critical information by integrating various applications of GEL and its third-party vendors and enabling comprehensive monitoring of operational assets with real-time and historical insights through advanced AI/ML-driven analytics.
- The bidder shall supply and deploy the CMP software along with all necessary licenses in the name of Gujarat Energy Limited (GEL). Bidder shall submit documentation of licenses for GEL's records.
- The bidder shall set up a MeitY-compliant cloud environment with scalability, redundancy and high availability, including adequate storage for data storage and processing, applying security protocols for data protection during processing and storage.
- The bidder shall set up all servers required for deployment of the CMP platform, including but not limited to application server, database server, historian server and data analytics server.
- The bidder shall develop and submit Functional and Software Requirements Specification (FRS and SRS) documents — including the proposed GUI layout and dashboard designs — encompassing all three phases of CMP implementation, for GEL's review and approval.
- The bidder shall implement the CMP in three phases: **Phase 1** - CMP software set-up and integration of existing applications; **Phase 2** integration of proposed AMI and SCADA

application and development of basic analytics and cascading reporting dashboards; and **Phase 3** deployment and development of an AI/ML-driven advanced analytics, emergency control module/engine and new middleware / other future applications of GEL.

- The bidder shall, in Phase 1, integrate all operational systems, existing applications and third-party vendor solutions of GEL — including SAP, existing multiple third-party SCADA platforms, GEL's in-house SCADA, multiple AMR applications and data shared over spreadsheets (list at Annexure 1) — into the CMP, with all data replicated to a centralized Data Lake/alternative storage solution.
- The bidder shall ensure that outgoing/legacy applications (multiple SCADA and AMR platforms) remain integrated with the CMP alongside the new SCADA and AMI platforms of this RFP until all corresponding meters/EVCs/stations are migrated to the new platforms and shall not raise any concern in this regard.
- Bidder shall ensure that they provide the provision of taking a data input through spreadsheets (MS excel, Google sheets, etc.) and / or manual entry through periodic data capturing from shared folder. Bidder shall also make a dashboard out of the shared dataset
- In Phase 2, The bidder shall integrate the SCADA and AMI applications delivered under this RFP with the CMP, Bidder shall ensure that the CMP software and architecture are compatible with standard ESB solutions available in the market.
- The bidder shall develop reporting dashboards in Phase 1 and, following integration of the new applications, deploy cascading reporting dashboards with data analytics in Phase 2, providing role-based and customizable dashboards with multiple drill-down levels and the capability to download reports in PDF/Excel/other formats.
- The bidder shall develop and customize a mobile application platform on both Android and iOS that mirrors the CMP layout and functionality, with role-based access control, secure login supporting SSO, offline capability with automatic synchronization, push notifications, geo-tagged and time-stamped photograph upload and field task/issue assignment and closure.
- The bidder shall develop comprehensive dashboards for GEL's Exploration and Production (E&P) operations, with customized manual data-entry forms in Phase 1 and automated middleware integration in Phase 3, developed in consultation with GEL's E&P team.
- The bidder shall, in Phase 3, deploy and develop an AI/ML-driven advanced data analytics engine/module — integrated with or tightly coupled to the CMP — with predictive, prescriptive and descriptive analytics capabilities and deploy AI/ML-driven advanced analytics dashboards. Bidder may propose a product with an in-built capability of AI / ML driven data analytics engine. In addition to this, it is desirable to have a conversational AI as a top layer to the entire dataset integrated with CMP and the data stored in data lake. It shall be able to generate customized data, report, chart, etc. as per the manual query by the user. Please note that this functionality is desirable to have a not mandatory to be supplied by the Bidder.
- The bidder shall implement an alert management and emergency control system integrated with operator interfaces, process control systems and the CMP, supporting multiple communication channels (SMS, WhatsApp, email, voice notifications), automatic linkage to digital SOPs, geospatial rendering (GML/KML), role-based access with SSO, severity-based escalation workflows and a dispatch console for coordinated emergency response.
- The bidder shall integrate digital SOPs into the CMP to ensure consistent operations, streamlined workflows and real-time procedural access.

- The bidder shall set up an archival database in the Data Lake/alternative storage solution to retain all KPI values for at least 5 years (or as per GEL's data retention policy) and shall plan and execute migration of the previous 5 years of data into the CMP.
- The bidder shall ensure the CMP can normalize data formats and adapt to GEL's evolving data philosophy, formats and standards and shall create and maintain comprehensive documentation of KPIs, data sources, schemas, calculation methodology and connectors.
- The bidder shall ensure all data transfers are encrypted using TLS 1.2 or higher with token-based authentication and maintain audit trails compliant with industry standards.
- The bidder shall integrate any additional future applications into the CMP as and when required throughout the contract duration, quoting the additional amount in the commercial bid and being paid on actuals upon successful completion of such integration.
- The bidder shall provide user guides, training materials and documentation in English, Hindi and Gujarati and train GEL staff on CMP and mobile application usage, along with Standard Operating Procedures (SOPs).
- The bidder shall not lay any claim to Intellectual Property Rights or patents for any code developed for GEL under this project; all such rights shall lie solely with GEL.

3.4. Station-Wise SCADA Scope

3.4.1. City Gate Station (CGS) - 14 locations

3.4.1.1. Existing Setup

- Each CGS station is currently equipped with RTUs that monitor various process parameters including pressure, temperature, flow, valve positions, emergency shutdown system status, fire and gas detection signals and gas composition.
- The existing field instrumentation includes pressure transmitters, RTD temperature sensors, flow meters, limit switches for valve position monitoring, emergency systems, fire and gas detection systems and gas chromatographs.
- Current control capabilities include pressure setpoint adjustment through LC 21 controller, flow rate limitation through FCV, valve operation and emergency shutoff valve activation.
- The existing RTUs interface with odorizer units, flow computers, slow meters and other ancillary systems to provide complete monitoring of the CGS operations.

3.4.1.2. New Hardware Requirements

- Bidder shall supply Type-1 RTUs with redundant SMPS diode-based power supplies, mounted in fully wired free-standing panels, with built-in AGA calculations.
- Bidder shall supply Dual-SIM/Single-SIM multi-network support industrial cellular modems with 4G/LTE capability and 2G fallback for redundant communication paths to ensure reliable connectivity.
- Bidder shall supply junction boxes with surge protection for all field connections to ensure safe operation in hazardous areas.
- Bidder shall supply new FRLS armored and screened cables for all field connections, as existing wiring will not be used.
- Bidder shall supply new wired connections with limit switches for valve position monitoring for SSV and new wired connections for Emergency Shutoff Valve (ESV) monitoring.
- Bidder shall supply new FRLS cables for FCV, ROV and PCV connections where available, along with control signal wiring for ESV activation.
- Bidder shall supply proper cable glands for all field connections to ensure appropriate environmental sealing and mechanical protection according to applicable IP rating requirements.
- Bidder shall supply surge arrestors for all I/O points to protect against electrical transients and ensure system reliability.

- Bidder shall supply isolation barrier modules for all hazardous area connections to ensure intrinsic safety requirements are met according to applicable standards.
- Bidder shall install an antenna along with each industrial modem

3.4.1.3. Work Associated with Implementation

- Before carrying out any work at any CGS station, bidder shall inform GEL at least 7 days in advance and seek permission from GEL to carry out the RTU works at CGS station. Bidder shall commence the work only after getting the required permission and work permit from GEL.
- Bidder shall study the existing I/O configuration, signal types, field instruments and control requirements to understand the complete system before commencing work and submit their report to GEL for approval as per the Milestone S5 of this tender.
- Bidder shall provide the duration of the blackout period of the CGS before powering off the existing RTU following the power-off procedure as per the guidance of GEL to ensure safe working conditions.
- At CGS locations with existing RTUs, the bidder shall disconnect existing cables, remove the old RTU and install the new Type-1 RTU. The bidder shall supply and install completely new FRLS armored and screened cables for all field connections, as existing wiring will not be used. All new cabling, terminations and configurations shall be performed by the bidder. The bidder shall ensure mapping of all existing I/O points to the new RTU without exception. The complete replacement of all field communication wiring is a mandatory requirement for CGS locations to ensure system reliability and integrity.
- AGA flow calculations shall either be performed by interfacing with the existing flow computer or be configured directly on the RTU as determined during the detailed engineering phase. If AGA calculations are configured on the RTU, the bidder shall ensure full compliance with the relevant AGA standards.
- Bidder shall remove the existing RTU panel from the base channel/base frame and install the bidder-supplied RTU Panel at the same place. In case spare space is available after installing the new RTU Panel, bidder shall provide the MS chuker plate of required size to cover the spare open space.
- Bidder shall terminate all new cables to their respective terminals in the RTU panel according to the GEL approved termination diagrams.
- After installation of all new hardware, bidder shall complete the testing of each type of hardware as per the bidder submitted and GEL approved testing.
- Bidder shall configure the RTU for all I/O points & existing RTU configuration, ensuring that all current I/O points monitored and existing configuration by existing RTUs are migrated to and displayed in the new SCADA system without exception.

- Bidder shall configure the RTU with the required communication protocols (Modbus RTU/TCP, HART) including TLS encryption and DNP3 authentication.
- Bidder shall implement and test store-and-forward functionality, scheduled and event-driven data transmission and on-demand data retrieval capabilities.
- All the works shall be done in presence of GEL and shall be done following all the precautions and safety measures as advised by GEL.
- Bidder shall be responsible for proper documentation of all new wiring, I/O list, termination details and configuration parameters for future reference.

3.4.1.4. Connectivity

- The CGS facilities shall be connected to the SCADA system through Type-1 RTUs installed at each location. The RTU shall interface with various equipment and instruments at the CGS including pressure regulators, flow meters, gas chromatographs and emergency shutdown systems.
- Flow computers at CGS locations shall be connected to the RTU through dedicated serial ports using appropriate interfaces. At locations where the flow computer supports Modbus protocol, direct connection shall be established through RS-485/RS-232 ports. At locations where flow computers support proprietary protocols, protocol converters shall be provided by the bidder. All protocol converters, interface devices and associated cables are included in the bidder's scope. The choice between interfacing with existing flow computer or implementing calculations on the RTU shall be decided during detailed engineering phase.
- Gas chromatographs shall be connected to the RTU through serial ports (RS-485/RS-232) using the protocol supported by the device (typically Modbus). At locations where the gas chromatograph uses proprietary protocols, suitable protocol converters shall be provided by the bidder.
- Emergency Shutdown Valve (ESV) limit switches shall be hardwired to the RTU digital input modules. Each ESV shall have open and close position signals connected to the RTU. The bidder shall install new limit switches where existing ones are not functional or not available.
- Slam Shut Valve (SSV) limit switches shall be hardwired to the RTU digital input modules. Each SSV shall have open and close position signals connected to the RTU. The bidder shall install new limit switches where existing ones are not functional or not available.
- Pressure control valve parameters shall be connected to the RTU through appropriate interface based on the controller type (typically Modbus RS-485 or 4-20mA analog signals). For remote setpoint adjustment capability, the bidder shall provide analog output signals from the RTU to the valve controller.
- For interface with flow computers, gas chromatographs and other serialized devices at each CGS location, the RTU shall provide a minimum of four (6) serial ports. Each serial port shall

be isolated and capable of being configured independently for different communication parameters (baud rate, parity, data bits, stop bits).

- At locations where Ethernet-based instruments or control systems exist, the bidder shall provide suitable Managed ethernet switches es to establish connectivity between these devices and the RTU. All Managed ethernet switches es shall have a minimum of 25% spare ports.
- The bidder shall establish dual-redundant communication paths from each CGS location to the central SCADA system using Dual-SIM/Single-SIM multi-network support industrial cellular modems with automatic failover capability. All communication shall be secured using TLS encryption and DNP3 authentication.
- For all control functions, the bidder shall implement secure control mechanisms with validation checks, confirmation requirements and audit logging.

3.4.2. Odorizer Units – 85 Units

3.4.2.1. Existing Setup

- The current odorizer units are equipped with local control systems that manage the odorization process.
- These systems monitor odorization level, injection rate and tank levels, providing critical information for the safe operation of the gas distribution network.
- The existing systems communicate via Modbus RTU protocol but may not be efficiently integrated into the centralized SCADA system.

3.4.2.2. New Hardware Requirements

- Bidder shall supply and install Dual-SIM/Single-SIM multi-network support industrial cellular modems with 4G/LTE capability and 2G fallback with 3-day battery backup where grid power is available and a minimum of 5-year battery backup where grid power is not available or interface the odorizer unit with new RTU installed at CGS and CMS stations
- Bidder shall supply and install proper cable glands for all field connections to ensure appropriate environmental sealing and mechanical protection.
- Bidder shall supply and install surge arrestors for all communication lines to protect against electrical transients.
- Bidder shall install an antenna along with each industrial modem
- Bidder shall supply and install isolation barrier modules for hazardous area connections to ensure intrinsic safety requirements are met.

3.4.2.3. Work Associated with Implementation

- Bidder shall interface with existing odorizer units through Modbus RTU protocol, configuring the communication parameters to ensure reliable data exchange.
- After installation of all new hardware, bidder shall complete the testing of each type of hardware as per the bidder submitted and GEL approved testing procedures in the Milestone S5 of this tender.
- Bidder shall configure direct cellular to cloud communications with appropriate protocol as per the existing system.
- Bidder shall implement scheduled transmission of odorization data to ensure regular updates in the SCADA system.
- Bidder shall develop and implement on-demand retrieval of odorizer parameters for operational flexibility.
- Bidder shall implement monitoring capabilities to track odorization compliance and system availability KPIs.
- Bidder shall ensure proper documentation of all communication parameters, alarm thresholds and reporting configurations.
- Bidder shall test the complete odorizer monitoring system after installation to verify correct operation.
- Bidder shall coordinate with GEL operations team to minimize disruption during implementation.

3.4.3. CNG Station - 850 locations

3.4.3.1. Existing Setup

- The CNG stations (except for daughter stations) are currently equipped with compressor PLC systems which are already interfaced with existing pressure sensors, dispenser systems, safety systems, power monitoring systems and Mass Flow Meters.
- These systems monitor and control various parameters including compressor status, pressures, temperatures, gas flow and dispenser operations.
- The existing systems may use different protocols and communication methods, requiring standardization and integration into the centralized SCADA system.
- Some compressors may not have flow meters at inlet locations.

- In the future GEL may add LNG dispensers at some CNG locations. The bidder has to connect the LNG dispenser to the SCADA system with the same level of control and monitoring applied for CNG dispensers.

3.4.3.2. New Hardware Requirements

- Bidder shall supply and install Type-2 RTUs with redundant SMPS diode-based power supplies at all CNG station locations, mounted in fully wired wall mounted panels.
- Bidder shall supply and install Dual-SIM/Single-SIM multi-network support industrial cellular modems with 4G/LTE capability and 2G fallback with 3-day battery backup where grid power is available and a minimum of 5-year battery backup where grid power is not available.
- Bidder shall supply and install ethernet connections for newer compressor PLCs and serial interface cables for older PLCs to ensure compatibility across various equipment generations.
- Bidder shall supply, install and commission new pressure transmitters with displays with all the necessary ancillaries before PRV for compressors at station inlets.
- Bidder shall make provisions in the SCADA system to integrate mass flow meters for compressors at locations where currently flow meters at inlet are not present but will be available in the future as identified during site survey.
- Bidder shall supply and install RS-485 cables to dispensers using 5V DC FRLS armored and screened cable through metal conduit for reliable communication in hazardous areas.
- Bidder shall supply and install Isolation Barrier Modules, with one module serving a maximum of 2 dispensers for Modbus cabling to RTU, ensuring intrinsic safety requirements are met.
- Bidder shall supply and install isolation barrier modules for all hazardous area connections throughout the station.
- Bidder shall supply and install new managed ethernet switches es at locations where less than 2 spare ethernet ports are available in existing equipment.
- Bidder shall supply and install Dual-SIM/Single-SIM multi-network support industrial cellular modems for redundant communication paths.
- Bidder shall supply and install proper cable glands for all field connections to ensure appropriate environmental sealing and mechanical protection.
- Bidder shall install an antenna along with each industrial modem
- Bidder shall supply and install surge arrestors for all I/O and communication lines to protect against electrical transients.

- The Bidder shall implement individual dispenser electrical supply isolation capability with the following requirements:

Hardware Installation:

  - The Bidder shall supply and install one MCB (Miniature Circuit Breaker) with auxiliary contact block (1 NO + 1 NC) in the electrical supply line of each dispenser
  - The Bidder shall supply and install one motor-rated contactor with auxiliary contacts (1 NO + 1 NC) in series with the MCB for remote control capability
  - The Bidder shall provide 24V DC control supply for contactor coil operation through RTU Digital Output

- RTU Integration:
  - The Bidder shall connect MCB auxiliary contacts to RTU Digital Input for MCB position feedback
  - The Bidder shall connect contactor auxiliary contacts to RTU Digital Input for power supply status confirmation
  - The Bidder shall connect RTU Digital Output to contactor coil for remote isolation control
  - The Bidder shall implement dual-status confirmation requiring both MCB and contactor feedback before confirming isolation status

- Safety Compliance:
  - All control and feedback circuits shall comply with hazardous area requirements using appropriate Isolation Barrier Modules
  - The Bidder shall implement proper cable routing using FRLS armored screened cable through metal conduit
  - Emergency manual override capability shall be maintained at each dispenser location through MCB operation

- Control Logic:
  - Remote isolation command shall de-energize contactor coil, opening power supply to dispenser
  - Manual isolation capability shall remain available through MCB operation independent of SCADA system
  - Status feedback shall confirm both MCB position and actual power supply status before updating dispenser isolation status in SCADA

- Isolation command shall include safety interlocks preventing isolation during active dispensing operations

- The Bidder shall implement individual dispenser isolation control with the following specifications:
  - Remote Dispenser Isolation Capability: Each dispenser shall be individually controllable from SCADA system with ON/OFF isolation functionality
  - Select-Check-Execute Sequence: All dispenser isolation commands shall follow the select-check-execute sequence with operator confirmation before execution
  - Safety Interlocks: Comprehensive safety interlocks ensuring dispenser isolation is only executed after:
    - Dispenser status verification (not in active filling mode)
    - Communication link integrity confirmation
    - Operator authorization validation
    - Emergency conditions assessment
      - Multi-level Confirmation: Isolation commands require acknowledgment from both central SCADA system and individual dispenser units before execution
      - Automatic Rollback: Automatic command cancellation in case of communication failures during execution
      - Configurable Timeout: Isolation command timeout feature (configurable 2 seconds to 60 minutes) with automatic abort if confirmation not received
      - Status Feedback: Real-time status reporting of isolation command execution with success/failure confirmation
      - Emergency Override: Manual override capability at dispenser location for emergency situations.

3.4.3.3. Work Associated with Implementation

- Bidder shall interface with existing compressor PLC systems by connecting to spare port on PLC or existing ethernet switch.

- After installation of all new hardware, bidder shall complete the testing of each type of hardware as per the bidder submitted and GEL approved testing procedures.

- Bidder shall perform new cable trenching from dispensers to panel rooms as required based on site conditions.

- Bidder shall ensure a maximum of 2 dispensers are connected to one RTU Modbus port to maintain communication reliability.
- Bidder shall engineer and implement remote price update capability on dispensers through Modbus write register.
- Bidder shall engineer and implement remote ESD activation for compressors only.
- Bidder shall perform programming for conversion of non-Modbus protocols to Modbus wherever required.
- Bidder shall engineer and implement dispenser data read interface to monitor dispenser system through Modbus register.
- Bidder shall configure communications using Modbus RTU/TCP and Ethernet protocols with direct cellular to cloud connectivity.
- Bidder shall implement and test store-and-forward functionality, scheduled and event-driven data transmission and on-demand data retrieval capabilities.
- Bidder shall implement TLS encryption, DNP3 and additional security measures for control functions.
- Bidder shall develop and implement but not limited to compressor line loss calculation, LUAG calculation for station, automated logbook data and station sales reconciliation through SCADA.
- Bidder shall ensure proper grounding and surge protection implementation according to applicable standards.
- Bidder shall ensure all work is performed in line with GEL health and safety guidelines.

3.4.3.3.1. Pressure Transmitters

a) Pressure Transmitters (PT) shall be provided by the bidder along with all applicable accessories such as SS Tubes, SS Valves, SS Manifolds, SS ferrules, SS connectors etc. as required for connection of Pressure transmitter. PT shall be installed on a post near the pipeline. All the works for installation, testing and commissioning of each Pressure Transmitter provided by the bidder, including tubing, cable laying from PT to RTU, glanding, termination etc. is included in scope of the bidder. The height of the PT post shall be 1.6 meters. FRP canopy shall be provided with each PT.

3.4.3.4. Connectivity

3.4.3.4.1. CNG Dispensers

- The dispensers shall be connected to the RTU through RS-485 MODBUS port. For all stations, a maximum of 2 dispensers shall be connected to one RTU Modbus port. RS-485 cables shall be laid from each dispenser to the RTU using 5V DC FRLS (Fire Retardant Low Smoke) armored and screened cable through metal conduit for reliable communication in hazardous areas. The Modbus port on the dispenser motherboard side (RS-485/232 port) shall be connected to the RTU serial port using appropriate interface cables. Isolation barrier modules shall be installed, with one module serving a maximum of 3 dispensers for Modbus cabling to RTU, ensuring intrinsic safety requirements are met in hazardous areas.

- At locations where a dispenser is connected to the compressor PLC, if another spare RS-485 port and spare cable entry is available in the dispenser, then the dispenser shall be connected to the RTU. If either spare RS-485 port or spare cable entry is not available in the dispenser, then the dispenser shall be disconnected from the PLC. Separate cable shall be laid by the bidder from each dispenser to RTU and existing cable at both the dispenser end and compressor PLC end shall be disconnected by the bidder and removed from the respective junction box at both locations and handed over to GEL. New cable trenching shall be performed from dispensers to panel rooms as required based on site conditions.

- Configuration of all the arms per dispenser shall be done to enable both reading and writing of data via Modbus. This includes programming for dispenser data read interface to monitor dispenser systems and enabling remote price update capability through Modbus write register. The configuration shall ensure proper communication with each dispenser arm to allow time-stamped reporting of batch filling operations.

3.4.3.4.2. CNG Compressor PLC Connectivity Scope

Scenario 1: PLC with Direct Port (No External Ethernet Switch)

The compressor PLC shall be connected through the available direct port to a new 4-port industrial Ethernet switch. At locations where direct port is available in compressor PLC, but no Ethernet switch is present, the port of the compressor PLC shall be connected to a new 4-port industrial Ethernet switch. The Ethernet switch shall be installed in the panel room. A CAT-6 FRLS cable shall be laid from the PLC port to the new Ethernet switch with proper cabling glanding and protection. The Type-2 RTU shall also be installed in the panel room and connected to the new Ethernet switch. Necessary configuration shall be carried out by the bidder. At such locations, Ethernet switch with minimum 4 ports shall be provided by the bidder. The switch shall be connected to the Type-2 RTU using CAT-6 patch cable. Necessary configuration of PLC, Ethernet switch and Type-2 RTU shall be carried out by the bidder. All the supplied switches shall have minimum 25% spare port capacity.

Scenario 2: PLC with Existing Ethernet Switch (with Spare Port)

The compressor PLC shall be connected through the spare port in the existing Ethernet switch of the PLC. At locations where spare port is available in existing Ethernet switch of compressor PLC, the spare port of the existing Ethernet switch shall be connected to the Type-2 RTU. The Type-2 RTU shall be installed in the panel room. A CAT-6 FRLS cable shall be laid from the spare port on the existing switch to the Type-2 RTU with proper cabling glanding and protection. Necessary configuration of Ethernet switch and Type-2 RTU shall be carried out by the bidder. The bidder shall ensure that proper IP addressing is configured for the Type-2 RTU to communicate with the PLC. The bidder shall verify network connectivity between all components and ensure data acquisition for all configured points.

Scenario 3: PLC with Existing Ethernet Switch (with Less Than 2 Spare Ports)

The compressor PLC shall be connected through the existing Ethernet switch with limited spare ports to a new Ethernet switch. At locations where existing Ethernet switch has less than 2 spare ports, one spare port from the existing Ethernet switch shall be connected to a new 4-port industrial Ethernet switch. The new Ethernet switch shall be installed in the panel room. A CAT-6 FRLS cable shall be laid from the spare port on the existing switch to the new Ethernet switch with proper cabling glanding and protection. The Type-2 RTU shall also be installed in the panel room and connected to the new Ethernet switch. The bidder shall install the Type-2 RTU in the panel room and connect it to the new Ethernet switch using CAT-6 patch cable. Necessary configuration of existing Ethernet switch, new Ethernet switch and Type-2 RTU shall be carried out by the bidder. All the supplied switches shall have minimum 25% spare port capacity.

Scenario 4: PLC without Ethernet Port but with Serial Port

At locations where Ethernet port is not available in existing compressor PLC but Serial communication port (RS-485/RS-232) is available, the PLC shall be connected directly to the Type-2 RTU through the available serial port. The Type-2 RTU shall be installed in the panel room. A suitable RS-485/RS-232 communication cable shall be laid from the PLC MODBUS port to the Type-2 RTU with proper cabling glanding and protection. Necessary RS-232 to RS-485 converter shall be provided by the bidder if required. The bidder shall configure the Type-2 RTU for MODBUS protocol communication and verify data acquisition from the PLC.

Scenario 5: PLC without Ethernet or Serial Port

At locations where neither Ethernet nor serial port is available in certain PLCs. A suitable protocol converter shall be provided by the bidder. The converter shall be installed in the panel room. The proprietary connection shall be made from the PLC to the converter and then the converter shall be connected to the Type-2 RTU using CAT-6 cable. The Type-2 RTU shall be installed in the panel room. Necessary configuration of the converter and Type-2 RTU shall be carried out by the bidder to ensure proper data communication.

Scenario 6: PLC without Ethernet or MODBUS Port

At locations where neither Ethernet nor MODBUS communication port is available in PLCs of Type B, a suitable managed Ethernet switch (minimum 4 port) shall be provided by the bidder. The Ethernet switch shall be installed in the panel room if space is available, otherwise in a suitable location. A compatible connection shall be established between the PLC and the Ethernet switch based on available communication options. The Ethernet switch shall then be connected to the Type-2 RTU installed in the panel room using CAT-6 cable. Necessary configuration shall be carried out by the bidder to ensure proper data communication.

Scenario 7: Limited Cable Entry Points

At locations where spare cable entry is not available in the compressor PLC, an explosion proof junction box shall be provided by the bidder and installed near the compressor JB. Minimum 2 cables (as per the instructions of GEL) from the compressor JB shall be disconnected from compressor JB and connected to ex-proof JB supplied by bidder and 1 multi-pair cable shall be connected from ex-proof JB supplied by bidder to the compressor JB and terminated in the compressor JB. All the works for removing existing cable, removing the existing cable gland, glanding and termination of removed cable in ex-proof JB, glanding and termination of multi-pair cable in compressor JB etc. as per the direction of GEL is included in scope of the bidder.

3.4.4. District Regulating Station (DRS/CPRS) - 375 locations

3.4.4.1. Existing Setup

- Some DRS/CPRS locations are currently equipped with EVC/data logger that measure outlet parameters only.
- Manual logbooks are maintained for operational data and consumption analysis.
- The current monitoring capability may be limited without automated data collection.

3.4.4.2. New Hardware Requirements

- Bidder shall supply and install Dual-SIM/Single-SIM multi-network support industrial cellular modems with 4G/LTE capability and 2G fallback with 3-day battery backup where grid power is available and a minimum of 5-year battery backup where grid power is not available.
- Bidder shall supply and install a minimum solar panel option to ensure DRS locations remain online 24x7 as required.
- Bidder shall install an antenna along with each industrial modem
- Bidder shall supply and install cable glands for all field connections.
- Bidder shall supply and install surge arrestors for all communication lines.

3.4.4.3. Work Associated with Implementation

- Bidder shall engineer and implement interface with EVC via Modbus RS-485/232,
- Bidder shall also configure the system to accommodate EVCs where input from both inlet and outlet lines, whereas the current EVC only takes parameters from the outlet line.
- Bidder shall configure communications using Modbus RTU protocol with direct cellular to cloud connectivity.
- Bidder shall implement TLS encryption, firewall protection and Dual-SIM/Single-SIM multi-network support redundancy.
- Bidder shall develop and implement store-and-forward functionality based on EVC memory.
- Bidder shall develop automated logbook data functionality, domestic/commercial consumption analysis software and threshold setting for flow maximum and minimum.
- Bidder shall implement proper grounding and surge protection according to applicable standards.
- Bidder shall ensure all work is performed in line with GEL health and safety guidelines.

3.4.4.4. Connectivity

a. The DRS locations where Flow meter with EVC and Power Supply is available, such DRS shall be connected to the SCADA. At locations where power supply is not present, a provision for optional solar power supply system shall be considered. At such locations, junction box and MODEM shall be provided. The MODEM shall be installed inside the Junction box. The EVC shall be connected with the MODEM through serial RS-485 connection over MODBUS RTU protocol. At locations where RS-232 port is available in EVC, at such locations either MODEM with RS-232 port shall be provided or suitable RS-232 to RS-485 converter shall be provided by the bidder. At DRS locations, MODEM with minimum 1 Ethernet port and 2 serial ports shall be provided by the bidder.

b. If solar power supply system is required (as an optional item), it shall consist of the following:

- Solar PV Panel – The Size of the Solar PV panel shall be based on the power consumption of the MODEM and battery charging requirement to completely charge a total discharged battery in 5 days.
- SMF VRLA battery – The SMF VRLA battery shall be provided with back-up of 3 days for the power consumption requirement of MODEM provided by the bidder.
- Battery charge controller with dual charging – Charge controller shall be provided to charge battery from either of following source: • Solar PV Module • 230V AC external power supply
- Serial port shall be provided in solar charge controller which shall connect with MODEM over RS-485 port for serial data communication of battery voltage, charging current.

- Junction Box – Junction boxes shall be provided for installation of battery, MODEM and solar charge controller. The battery shall be installed in one explosion proof junction box and MODEM; Solar charge controller shall be installed in separate junction box.

3.4.5. Underground DRS – 195 locations

3.4.5.1. Overview

- Approximately **195 underground District Regulating Stations (DRS)** are present in GEL's network. These locations **currently have limited/no digital monitoring equipment** of any kind; monitoring today is carried out through periodic manual inspection with logbook-based recording.
- The underground DRS are situated in subsurface chambers with limited accessibility and challenging environmental conditions — moisture and water ingress, temperature variation, limited ventilation, space constraints and the potential accumulation of hazardous gas — and, being below ground, the feasibility of reliable cellular communication from within the chamber is uncertain.
- Because there is no existing digital infrastructure to build upon and the technical feasibility of deploying such infrastructure varies location to location, the underground DRS are treated as a **distinct category**, subject to survey, a proposed solution and a proof of concept, and to GEL's sole discretion as set out below.
- **GEL gives no commitment to include the underground DRS locations in the deployed scope.**

3.4.5.2. Survey

The Bidder shall conduct a survey of the underground DRS location (agreed with GEL) to establish, whether digital monitoring can feasibly be deployed and, if so, how. As there is no existing digital instrumentation to integrate, the survey shall assess the site as a fresh installation and shall cover, at minimum: the underground chamber's dimensions, accessibility and structural condition; the environmental conditions, including moisture and the risk of water ingress or flooding, ventilation and the temperature range; the presence and level of any hazardous-gas accumulation and the applicable hazardous-area classification; the availability or absence of any power supply and grounding; the cellular signal strength and the feasibility of reliable communication from within and around the subsurface chamber; and the space available for new equipment. The Bidder shall record its findings and share with GEL.

3.4.5.3. Proposed Solution

- On the basis of the survey, the Bidder shall propose an appropriate technical solution for fresh digital monitoring, or an alternative monitoring approach where direct installation is not feasible.
- A complete monitoring solution would typically comprise: field instrumentation appropriate to a regulating station — upstream and downstream pressure, temperature, together with **water/liquid-level detection** (given the flooding risk inherent to underground chambers) and gas detection for hazardous-gas accumulation; a remote terminal / telemetry unit with local **store-and-forward** so that data and time-stamped alarms are retained and transmitted on restoration during any loss of communication; a power solution suited to a location that may have no mains supply — a battery of adequate operating life, or mains with backup, sized for the underground duty and the transmission profile; a communication solution that overcomes subsurface signal attenuation, for example a surface-mounted or externally-extended

antenna; and hazardous-area-rated, moisture-protected, intrinsically-safe equipment and enclosures suitable for the chamber.

- Where direct installation within the chamber is not feasible, the Bidder shall instead propose a viable alternative — for example a surface-level or adjacent above-ground installation, or another approach that achieves the required monitoring — together with the infrastructure upgrades, safety measures and access procedures required. The proposed solution for each location or category shall be submitted to GEL for consideration.

3.4.5.4. Proof of Concept

- GEL shall not accept any proposed solution on the basis of documentation alone. GEL may ask the Bidder shall to implement a **proof of concept** at representative underground DRS location, selected in consultation with GEL, and shall demonstrate, under the actual underground conditions, that the proposed solution reliably acquires the required parameters and communicates them to the platform — including sustained communication from within the subsurface chamber, adequate power endurance and safe operation in the hazardous, moisture-prone environment — **to GEL's satisfaction**.
- The proof of concept shall establish either that the solution is feasible for that category of underground DRS, or that a particular approach is not feasible. The Bidder shall bear the full cost of the survey and the proof of concept as part of its base scope.
- GEL may ask the bidder to submit the technical and commercial proposal for underground DRS locations, quantities shall be finalised by GEL based on bidder’s technical and commercial proposal.

3.4.5.5. GEL's Discretion

- GEL gives no commitment to the underground DRS locations. Based on the survey findings, the proposed solution and the outcome of the proof of concept, GEL shall decide, at its **sole discretion**, whether to include **all, some or none** of the underground DRS locations in the deployed scope; GEL's decision shall be final and binding, and GEL is under no obligation to accept any proposed solution or to proceed with any underground DRS location.
- The underground DRS locations are **excluded from the committed scope and from the quantities on which the milestone and payment obligations are based** and shall remain excluded until GEL issues written instruction to proceed for specific locations; no underground DRS location shall be counted toward any milestone completion, Go-Live quantity or payment tranche unless and until GEL has instructed the Bidder to proceed with it.
- The survey, the proposed solution and the proof of concept for the underground DRS are within the Bidder's base scope at no additional cost, and the Bidder shall make no claim for any payment, milestone extension or additional charge on account of any underground DRS location that GEL elects not to proceed with.

3.4.6. Decompression Skids - 20 locations

3.4.6.1. Existing Setup

- The decompression skids currently have limit switches for temperature range values and relay-based control systems.

- Manual logbooks are maintained for operational data.

- Existing relay-based control system operates independently of SCADA monitoring.

3.4.6.2. New Hardware Requirements

- Bidder shall supply and install Type-2 RTUs with redundant SMPS diode-based power supplies at all decompression station locations, mounted in fully wired wall mounted panels.
- Bidder shall supply and install Dual-SIM/Single-SIM multi-network support industrial cellular modems with 4G/LTE capability and 2G fallback with 3-day battery backup where grid power is available and a minimum of 5-year battery backup where grid power is not available.
- Bidder shall supply and install Dual-SIM/Single-SIM multi-network support industrial cellular modem.
- Bidder shall supply, install and commission new pressure transmitters with displays, temperature transmitters for outlet with all the necessary ancillaries.
- Bidder shall supply and install new FRLS armored and screened cable.
- Bidder shall supply and install cable glands for all field connections.
- Bidder shall supply and install surge arrestors for all I/O points.
- Bidder shall supply and install isolation barrier modules for hazardous area connections.

3.4.6.2.1. Pressure Transmitters

Pressure Transmitters (PT) shall be provided by the bidder along with all applicable accessories such as SS Tubes, SS Valves, SS Manifolds, SS ferrules, SS connectors etc. as required for connection of Pressure transmitter. PT shall be installed on a post near the pipeline. All the works for installation, testing and commissioning of each Pressure Transmitter provided by the bidder, including tubing, cable laying from PT to RTU, glanding, termination etc. is included in scope of the bidder. The height of the PT post shall be 1.6 meters. FRP canopy shall be provided with each PT.

3.4.6.2.1. Temperature Transmitters

Temperature transmitters shall be provided by the Bidder along with all applicable accessories — including a stainless-steel thermowell of suitable insertion length, bore and material for natural-gas service, the RTD (Pt100) sensing element, and all mounting hardware, connectors and cable glands required for connection of the temperature transmitter. The thermowell shall be installed into the pipeline at the outlet of the decompression skid, and the transmitter shall be head-mounted on the thermowell or, where required, remote-mounted nearby on a post of 1.6 metres height with an FRP canopy. All works for the installation, testing and commissioning of each temperature transmitter provided by the Bidder — including thermowell installation, cable laying from the TT to the RTU, glanding and termination — are included in the Bidder's scope.

3.4.6.3. Work Associated with Implementation

- Bidder shall interface with existing limit switch for temperature range values and selected DI inputs from the existing relay-based control system.

- Bidder shall configure communications using Modbus RTU and digital I/O from relay with direct cellular to cloud connectivity.
- Bidder shall implement TLS encryption and DNP3.
- Bidder shall develop automated logbook data functionality to replace manual processes.
- Bidder shall implement proper grounding and surge protection implementation according to applicable standards.
- Bidder shall ensure all work is performed in line with GEL health and safety guidelines.

3.4.6.4. Connectivity

a. At decompression skid locations, the bidder shall connect the agreed relay signals to the RTU digital input modules. These relay signals shall include temperature range values and selected discrete inputs from the existing relay-based control system.

b. The bidder shall install new pressure transmitters at the inlet and outlet of the decompression skid. These transmitters shall be installed with all required accessories.

c. The bidder shall install new temperature transmitters at the outlet of the decompression skid. These transmitters shall be installed with all required accessories including thermowells suitable for natural gas service.

d. All transmitters shall be connected to the RTU through appropriate barriers and surge protection devices. The installation, testing and commissioning of all field instruments, including tubing, cable laying, glanding and termination, is included in the bidder's scope.

e. The bidder shall maintain the independent operation of the existing relay-based control system while implementing monitoring capabilities through the SCADA system.

3.4.7. Cathodic Protection System (TR Units) - 110 locations

3.4.7.1. Existing Setup

a. The current Cathodic Protection system consists of remote monitoring units that track pipe-to-soil potential, output voltage/current and other protection parameters.

b. The existing system uses established communication methods to transmit CP data.

c. The CP system is critical for maintaining pipeline integrity by preventing corrosion.

3.4.7.2. New Solution Architecture

CP-TR OEM RTU Integration:

- Bidder shall integrate the SCADA system with CP-TR OEM RTUs through direct MQTT communication protocol
- No additional RTU hardware supply required from the bidder for CP monitoring locations
- Communication architecture based on MQTT messaging protocol for real-time data exchange.

Bidder Integration Requirements

MQTT Communication Interface:

- Bidder shall develop and implement MQTT client functionality within the SCADA system to communicate directly with CP-TR OEM RTUs
- Bidder shall configure MQTT broker connectivity and subscription management for all 97 CP locations
- Bidder shall implement MQTT message parsing, data validation and error handling mechanisms
- Bidder shall ensure secure MQTT communication with authentication, encryption and access control

3.4.7.3. Data Integration Specifications:

- Bidder shall configure data mapping from CP-TR OEM RTU MQTT messages to SCADA database
- Bidder shall develop CP data interface for protocol conversion, parameter mapping and data collection configuration
- Bidder shall ensure all data points available from the CP-TR OEM RTUs are fully integrated into the SCADA system without exception

- Bidder shall implement real-time alarm integration for all CP system parameters received via MQTT

3.4.7.4. Work Associated with Implementation

SCADA System Configuration:

- Bidder shall configure MQTT communication drivers and protocol handlers within SCADA software
- Bidder shall develop automated logbook data functionality to replace manual processes using MQTT data streams
- Bidder shall implement data validation, quality checks and exception handling for MQTT communications
- Bidder shall develop API integration capabilities if required for additional CP system interfaces.

3.4.7.5. System Integration Activities:

- Bidder shall coordinate with CP-TR OEM to establish MQTT communication parameters, topic structures and message formats
- Bidder shall participate in integration testing with CP-TR OEM RTUs to validate data flow and communication reliability
- Bidder shall implement backup communication mechanisms and failover procedures for MQTT connectivity
- Bidder shall develop comprehensive monitoring and diagnostic capabilities for MQTT communication health

3.4.7.6. Connectivity and Communication

MQTT Protocol Implementation:

- The Cathodic Protection (CP) systems shall be integrated with the SCADA system through direct MQTT communication with CP-TR OEM installed RTUs
- Bidder shall establish secure MQTT broker connectivity with appropriate quality of service (QoS) levels for reliable data transmission
- The bidder shall coordinate with the CP-TR OEM to establish the required MQTT topic structure for monitoring Transformer-Rectifier (TR) unit parameters, pipe-to-soil potentials, AC input voltages and other CP system parameters
- The bidder shall ensure that all data points available from the CP-TR OEM RTUs are fully integrated into the new SCADA system through MQTT messaging without exception

Communication Security and Reliability:

- The integration shall include MQTT authentication, data validation and secure communication mechanisms approved by the CP-TR OEM and GEL
- Bidder shall implement TLS encryption for all MQTT communications and secure certificate management
- Bidder shall develop automated logbook functionality for CP systems using MQTT data streams to replace manual process documentation
- Bidder shall implement comprehensive monitoring of MQTT communication quality, message delivery confirmation and connection health diagnostics

3.4.7.7. Performance and Monitoring Requirements

MQTT Communication SLAs:

- MQTT message delivery success rate: minimum 99.5%
- MQTT communication latency: maximum 5 seconds for normal conditions
- MQTT broker availability: 99.9% uptime requirement
- Real-time alarm notification through MQTT: maximum 10 seconds from event to SCADA alarm

Integration Validation:

- Bidder shall validate 100% data point integration from all CP-TR OEM RTUs
- End-to-end communication testing with CP-TR OEM during commissioning phase
- MQTT communication stress testing under various network conditions
- Failover and recovery testing for MQTT broker connectivity issues

3.4.8. LCNG Station - 8 locations

3.4.8.1. Existing Setup

- The LCNG stations are equipped with PLC systems controlling tanks, pumps, vaporizers and dispensers.
- These systems monitor tank levels, pressures, temperatures and flow parameters, as well as controlling the conversion process from LNG to CNG.
- Safety systems include fire and gas detection with emergency shutdown capabilities.
- The existing equipment may use various communication protocols requiring integration.

3.4.8.2. New Hardware Requirements

- Bidder shall supply and install Type-2 RTU with redundant SMPS diode-based power supply.
- Bidder shall supply and install Dual-SIM/Single-SIM multi-network support industrial cellular modems with 4G/LTE capability and 2G fallback with 3-day battery backup where grid power is available and a minimum of 5-year battery backup where grid power is not available.
- Bidder shall supply and install junction boxes with surge protection.
- Bidder shall supply and install FRLS armored screened cables for all field connections.
- Bidder shall supply and install isolation barrier modules for Modbus Cable (1 per 3 Dispensers).
- Bidder shall supply and install isolation barrier modules for all hazardous area connections.

- Bidder shall supply and install Dual-SIM/Single-SIM multi-network support industrial cellular modem.
- Bidder shall supply and install new ethernet switch if no spare ports are available.
- Bidder shall supply and install cable glands for all field connections.
- Bidder shall supply and install surge arrestors for all I/O and communication lines.
- The Bidder shall implement individual dispenser electrical supply isolation capability with the following requirements:
- Hardware Installation:
    - The Bidder shall supply and install one MCB (Miniature Circuit Breaker) with auxiliary contact block (1 NO + 1 NC) in the electrical supply line of each dispenser
    - The Bidder shall supply and install one motor-rated contactor with auxiliary contacts (1 NO + 1 NC) in series with the MCB for remote control capability
    - The Bidder shall provide 24V DC control supply for contactor coil operation through RTU Digital Output
- RTU Integration:
    - The Bidder shall connect MCB auxiliary contacts to RTU Digital Input for MCB position feedback
    - The Bidder shall connect contactor auxiliary contacts to RTU Digital Input for power supply status confirmation
    - The Bidder shall connect RTU Digital Output to contactor coil for remote isolation control
    - The Bidder shall implement dual-status confirmation requiring both MCB and contactor feedback before confirming isolation status
- Safety Compliance:
    - All control and feedback circuits shall comply with hazardous area requirements using appropriate Isolation Barrier Modules
    - The Bidder shall implement proper cable routing using FRLS armored screened cable through metal conduit
    - Emergency manual override capability shall be maintained at each dispenser location through MCB operation
- Control Logic:

- Remote isolation command shall de-energize contactor coil, opening power supply to dispenser
- Manual isolation capability shall remain available through MCB operation independent of SCADA system
- Status feedback shall confirm both MCB position and actual power supply status before updating dispenser isolation status in SCADA
- Isolation command shall include safety interlocks preventing isolation during active dispensing operations

- The Bidder shall implement individual dispenser isolation control with the following specifications:
  - Remote Dispenser Isolation Capability: Each dispenser shall be individually controllable from SCADA system with ON/OFF isolation functionality
  - Select-Check-Execute Sequence: All dispenser isolation commands shall follow the select-check-execute sequence with operator confirmation before execution
  - Safety Interlocks: Comprehensive safety interlocks ensuring dispenser isolation is only executed after:
    - Dispenser status verification (not in active filling mode)
    - Communication link integrity confirmation
    - Operator authorization validation
    - Emergency conditions assessment
  - Multi-level Confirmation: Isolation commands require acknowledgment from both central SCADA system and individual dispenser units before execution
  - Automatic Rollback: Automatic command cancellation in case of communication failures during execution
  - Configurable Timeout: Isolation command timeout feature (configurable 2 seconds to 60 minutes) with automatic abort if confirmation not received
  - Status Feedback: Real-time status reporting of isolation command execution with success/failure confirmation
  - Emergency Override: Manual override capability at dispenser location for emergency situations.

3.4.8.3. Work Associated with Implementation

- Bidder shall interface with existing PLC, pump, dispenser, safety and isolation systems.
- Bidder shall connect to spare port on PLC or existing ethernet switch.
- Bidder shall engineer and implement interface with PLC via ethernet port for all parameters of compressor, tanks and vapouriser.
- Bidder shall engineer and implement interface with mass flow meters via Modbus RS-485.
- Bidder shall engineer and implement interface with fire and gas system through PLC.
- Bidder shall engineer and implement remote price update capability in CNG dispensers.
- Bidder shall engineer and implement dispenser data read interface to monitor dispenser system through Modbus register.
- Bidder shall ensure a maximum of 2 dispensers are connected to one RTU Modbus port.
- Bidder shall perform PLC programming for protocol conversion to Modbus where needed.
- Bidder shall ensure all I/O points available from LCNG PLCs are fully integrated into the SCADA system, including any additional parameters that are currently available in the PLC but not specifically listed in the monitoring requirements.
- Bidder shall develop automated logbook data functionality and LNG to CNG conversion efficiency analysis.
- Bidder shall configure communications using Modbus RTU/TCP with direct cellular to cloud connectivity.
- Bidder shall implement proper grounding and surge protection implementation according to applicable standards.
- Bidder shall ensure all work is performed in line with GEL health and safety guidelines.

3.4.8.3.1. Pressure Transmitters

a) Pressure Transmitters (PT) shall be provided by the bidder along with all applicable accessories such as SS Tubes, SS Valves, SS Manifolds, SS ferrules, SS connectors etc. as required for connection of Pressure transmitter. PT shall be installed on a post near the pipeline. All the works for installation, testing and commissioning of each Pressure Transmitter provided by the bidder, including tubing, cable laying from PT to RTU, glanding, termination etc. is included in scope of the bidder. The height of the PT post shall be 1.6 meters. FRP canopy shall be provided with each PT.

3.4.8.4. Connectivity

Note for LCNG Station Connectivity

The connectivity approach for LCNG stations shall be similar to CNG stations for PLCs and dispensers as described for CNG stations, with the following differences:

- Additional integration with LNG storage tank monitoring systems
- Interface with vaporization equipment controllers
- Connection to specialized LNG-specific safety systems
- Integration with pumps and specialized cryogenic equipment
- More complex process monitoring requirements due to the cryogenic nature of LNG

3.4.9. Compressed Biogas (CBG) Plant - 7 locations

3.4.9.1. Existing Setup

- The CBG plants produce biogas which is purified and compressed for injection into the GEL pipeline network.
- The plants monitor production rate, biogas quality and injection parameters.
- The existing systems have limited integration with the central SCADA system.

3.4.9.2. New Hardware Requirements

- Bidder shall supply and install Type-2 RTUs with redundant SMPS diode-based power supplies at all CBG station locations, mounted in fully wired wall mounted panels.
- Bidder shall supply and install Dual-SIM/Single-SIM multi-network support industrial cellular modems with 4G/LTE capability and 2G fallback with 3-day battery backup where grid power is available and a minimum of 5-year battery backup where grid power is not available.
- Bidder shall supply and install managed ethernet switch if required to connect to CBG OEMs PLCs and serial interface cables for older PLCs to ensure compatibility across various equipment generations.
- Bidder shall supply and install isolation barrier modules for all hazardous area connections throughout the station.
- Bidder shall supply and install new managed ethernet switches at locations where less than 2 spare ethernet ports are available in existing equipment.
- Bidder shall supply and install Dual-SIM/Single-SIM multi-network support industrial cellular modems for redundant communication paths.
- Bidder shall supply and install proper cable glands for all field connections to ensure appropriate environmental sealing and mechanical protection.
- Bidder shall install an antenna along with each industrial modem
- Bidder shall supply and install surge arrestors for all I/O and communication lines to protect against electrical transients.
- Bidder shall supply and install surge arrestors for communication lines.

3.4.9.3. Work Associated with Implementation

1. Bidder shall interface with existing systems at the CBG plant.
2. Bidder shall develop and implement API integration for selected parameters from CBG producer app wherever available.

3. Bidder shall interface with existing GEL pipeline EVC.
4. Bidder shall engineer and implement connection to flow meter and EVC on GEL pipeline through Modbus RS-485/232.
5. Bidder shall configure communications using Modbus RTU and API integration with direct cellular to cloud connectivity.
6. Bidder shall implement TLS encryption and firewall protection.
7. Bidder shall develop and implement store and forward functionality based on EVC memory.
8. Bidder shall develop automated logbook data functionality to replace manual processes.
9. Bidder shall implement proper grounding and surge protection implementation according to applicable standards.
10. Bidder shall ensure all work is performed in line with GEL health and safety guidelines.

3.4.9.4. Connectivity

a. The CBG plants shall be connected to the SCADA system for monitoring of raw biogas production rate, production system status, production parameters, biogas quality and composition, purification efficiency, compressed gas pressure and gas injection parameters into the GEL grid.

b. The bidder shall interface with existing systems at the CBG plant and develop API integration for selected parameters from CBG producer app as required.

c. The bidder shall interface with existing GEL pipeline EVC at the CBG plant through Modbus RS-485/232 connection. At locations where RS-232 port is available, suitable RS-232 to RS-485 converter shall be provided by the bidder.

d. Type-2 RTU with dual-SIM/Single-SIM multi-network support industrial cellular modem with 4G/LTE failover to 2G shall be provided at each CBG plant location to enable communication with the SCADA system.

e. The communication configuration shall use Modbus RTU and API integration with direct cellular to cloud connectivity, implementing TLS encryption and firewall protection for secure data transmission.

f. The bidder shall develop and implement store and forward functionality based on EVC memory to prevent data loss during communication outages.

g. The bidder shall develop automated logbook data functionality to replace manual processes related to CBG plant operations.

3.4.10.Check Metering Stations - 100 locations

3.4.10.1. Existing Setup

- The check metering stations verify flow measurement for custody transfer and billing validation.
- Current systems include flow meters and EVCs for volume correction.
- Limited remote monitoring capability exists at many locations.

3.4.10.2. New Hardware Requirements

- Bidder shall supply and install Dual-SIM/Single-SIM multi-network support industrial cellular modems with 4G/LTE capability and 2G fallback with 3-day battery backup where grid power is available and a minimum of 5-year battery backup where grid power is not available with RS-485/232 capability.
- Bidder shall supply and install cable glands for all field connections.
- Bidder shall supply and install surge arrestors for communication lines.

3.4.10.3. Work Associated with Implementation

- Bidder shall interface with existing flow meters.
- Bidder shall engineer and implement Modbus interface with existing EVC and flow meter.
- Bidder shall configure communications using Modbus RTU/TCP with direct cellular to cloud connectivity.
- Bidder shall implement TLS encryption and DNP3.
- Bidder shall develop and implement scheduled data transmission and on-demand data retrieval capability.
- Bidder shall develop check meter validation functionality, volume totalization calculations and meter health monitoring.
- Bidder shall develop automated logbook data functionality to replace manual processes.
- Bidder shall implement proper grounding and surge protection implementation according to applicable standards.
- Bidder shall ensure all work is performed in line with GEL health and safety guidelines.

3.4.11.LNG Dispensing Stations

3.4.11.1. Existing Setup

- The LNG dispensing stations (future scope) will be equipped with dispenser control systems and LNG-specific equipment including storage systems, pumps and safety systems.
- These systems will monitor and control various parameters including LNG storage tank levels, pressures, temperatures, dispensing operations and cryogenic safety systems.
- The future systems will use standard communication protocols requiring integration into the centralized SCADA system.
- LNG dispensing stations will incorporate cryogenic-specific safety and monitoring requirements beyond standard CNG operations.

3.4.11.2. New Hardware Requirements

- Bidder shall supply and install Type-2 RTUs with redundant SMPS diode-based power supplies at all LNG dispensing station locations, mounted in fully wired wall mounted panels.
- Bidder shall supply and install Dual-SIM/Single-SIM multi-network support industrial cellular modems with 4G/LTE capability and 2G fallback with 3-day battery backup where grid power is available and a minimum of 5-year battery backup where grid power is not available.
- Bidder shall supply and install ethernet connections for newer dispenser control systems and serial interface cables for legacy equipment to ensure compatibility across various equipment generations.
- Bidder shall supply, install and commission new pressure transmitters with displays and temperature transmitters with all the necessary ancillaries for LNG storage monitoring.
- Bidder shall supply and install RS-485 cables to dispensers using 5V DC FRLS armored and screened cable through metal conduit for reliable communication in hazardous areas.
- Bidder shall supply and install Isolation Barrier Modules, with one module serving a maximum of 3 dispensers for Modbus cabling to RTU, ensuring intrinsic safety requirements are met.
- Bidder shall supply and install isolation barrier modules for all hazardous area connections specific to applications.
- Bidder shall supply and install Dual-SIM/Single-SIM multi-network support industrial cellular modem with RS-485/232 capability.
- Bidder shall supply and install new managed ethernet switches if no spare ports are available.

- Bidder shall supply and install cable glands for all field connections rated for cryogenic applications.
- Bidder shall supply and install surge arrestors for all I/O and communication lines.
- Bidder shall supply and install junction boxes with surge protection rated for LNG applications.
- Bidder shall supply and install FRLS armored screened cables for all field connections.
- The Bidder shall implement individual dispenser electrical supply isolation capability with the following requirements:

Hardware Installation:

- The Bidder shall supply and install one MCB (Miniature Circuit Breaker) with auxiliary contact block (1 NO + 1 NC) in the electrical supply line of each LNG dispenser
- The Bidder shall supply and install one motor-rated contactor with auxiliary contacts (1 NO + 1 NC) in series with the MCB for remote control capability
- The Bidder shall provide 24V DC control supply for contactor coil operation through RTU Digital Output.

RTU Integration:

- The Bidder shall connect MCB auxiliary contacts to RTU Digital Input for MCB position feedback
- The Bidder shall connect contactor auxiliary contacts to RTU Digital Input for power supply status confirmation
- The Bidder shall connect RTU Digital Output to contactor coil for remote isolation control
- The Bidder shall implement dual-status confirmation requiring both MCB and contactor feedback before confirming isolation status

Safety Compliance:

- All control and feedback circuits shall comply with hazardous area requirements using appropriate Isolation Barrier Modules
- The Bidder shall implement proper cable routing using FRLS armored screened cable through metal conduit
- Emergency manual override capability shall be maintained at each dispenser location through MCB operation
- Additional safety measures specific to cryogenic LNG handling shall be implemented.

Control Logic:

- Remote isolation command shall de-energize contactor coil, opening power supply to dispenser
- Manual isolation capability shall remain available through MCB operation independent of SCADA system
- Status feedback shall confirm both MCB position and actual power supply status before updating dispenser isolation status in SCADA
- Isolation command shall include safety interlocks preventing isolation during active LNG dispensing operations

The Bidder shall implement individual LNG dispenser isolation control with the following specifications:

- Remote Dispenser Isolation Capability: Each LNG dispenser shall be individually controllable from SCADA system with ON/OFF isolation functionality
- Select-Check-Execute Sequence: All dispenser isolation commands shall follow the select-check-execute sequence with operator confirmation before execution

Safety Interlocks: Comprehensive safety interlocks ensuring dispenser isolation is only executed after:

- LNG dispenser status verification (not in active filling mode)
- Communication link integrity confirmation
- Cryogenic safety system status verification
- LNG storage system status confirmation

3.4.11.3. Work Associated with Implementation

- Bidder shall interface with LNG dispenser control systems and integrate all I/O points into the RTU system.
- Bidder shall interface with LNG storage monitoring systems
- Bidder shall interface with cryogenic pump systems and associated safety equipment.
- Bidder shall configure communications using Modbus RTU/TCP and digital I/O with direct cellular to cloud connectivity.
- Bidder shall implement TLS encryption and DNP3.
- Bidder shall develop automated logbook data functionality and LNG dispensing efficiency analysis.
- Bidder shall implement station sales reconciliation software adapted for LNG operations.
- Bidder shall implement remote price change interface for LNG dispensers where applicable.
- Bidder shall implement dispenser data read interface for sales and operational data.
- Bidder shall implement remote emergency shutdown activation for LNG systems.
- Bidder shall configure store-and-forward functionality during communication outages.
- Bidder shall implement proper grounding and surge protection implementation according to applicable standards and cryogenic safety requirements.
- Bidder shall ensure all work is performed in line with GEL health and safety guidelines and LNG-specific safety protocols.
- After installation of all new hardware, bidder shall complete the testing of each type of hardware as per the bidder submitted and GEL approved testing procedures.
- The Bidder shall ensure LNG dispensing station monitoring includes all capabilities present in mother CNG stations plus LNG-specific requirements

- LNG storage system monitoring with real-time tank level, pressure and temperature data
- Cryogenic equipment performance monitoring and predictive maintenance capabilities
- LNG dispensing efficiency analysis and loss calculations
- Integration with central alarm management system with LNG-specific alarm prioritization
- Store-and-forward functionality utilizing equipment memory during communication outages
- Data validation and quality checking specific to LNG measurement and custody transfer requirements
- The bidder shall ensure that all data points from LNG dispensing systems are fully integrated into the new SCADA system without exception
- The integration shall include authentication, data validation and secure communication mechanisms approved by GEL
- The bidder shall develop automated logbook functionality for LNG dispensing systems to replace manual process documentation

3.4.11.4. Connectivity

Note for LNG Dispensing Station Connectivity The connectivity approach for LNG dispensing stations shall be similar to CNG stations, with the following additional requirements:

- Additional integration with LNG storage tank monitoring systems via Modbus RTU/TCP
- Interface with cryogenic pump controllers and vaporization equipment (where applicable)
- Connection to specialized LNG safety systems including fire and gas detection specific to cryogenic applications
- Integration with boil-off gas management systems • Enhanced temperature monitoring for cryogenic operations
- More complex process monitoring requirements due to the cryogenic nature of LNG
- Protocol conversion capabilities for LNG-specific equipment manufacturers
- Integration with custody transfer systems for LNG sales measurement
    - At LNG dispensing station locations, the bidder shall connect the LNG dispenser control systems to the RTU using appropriate communication protocols (Modbus RTU/TCP, Ethernet/IP as applicable).
    - The bidder shall install interfaces with LNG storage systems to monitor tank levels, pressures, temperatures and safety parameters.

- The bidder shall connect cryogenic safety systems including emergency shutdown valves, fire and gas detection systems and boil-off gas management systems.
- The bidder shall implement communication interfaces with LNG pumping systems and associated control equipment.
- The bidder shall configure data collection for LNG dispensing operations including volume dispensed, mass calculations, temperature compensation and sales reconciliation.
- The bidder shall implement remote control capabilities for authorized LNG dispensing operations within defined safety parameters.
- All connections shall comply with cryogenic safety standards and hazardous area classifications specific to LNG operations.

3.4.12. Gas Exploration Site (E&P) - 16 locations

3.4.12.1. Existing Setup

- GEL operates multiple Gas Exploration and Production (E&P) across multiple oil and gas fields.
- These sites currently have Smart Water Meters installed for monitoring water usage associated with exploration and production operations.
- Future installations will include Mass Flow Meters for precise measurement of gas and fluid flows at these exploration sites.

3.4.12.2. New Hardware Requirements

- Bidder shall supply Type-2 RTUs with redundant SMPS diode-based power supplies, mounted in wall-mounted industrial grade cabinets
- Bidder shall supply Dual-SIM/Single-SIM multi-network support industrial cellular modems with 4G/LTE capability and 2G fallback, ensuring reliable connectivity at remote exploration sites.
- Bidder shall provide all necessary interface cables, junction boxes, surge arrestors and cable glands for field connections.
- Bidder shall ensure the RTU configuration allows for future expansion to accommodate Mass Flow Meter integration without hardware replacement.

3.4.12.3. Work Associated with Implementation

- Bidder shall install Type-2 RTU at each Gas Exploration Site in accordance with GEL-approved installation procedures.
- Bidder shall interface the RTU with existing Smart Water Meters using appropriate communication protocols (Modbus RTU/TCP or as supported by the meter).
- Bidder shall configure the RTU with provision for future Mass Flow Meter integration. When GEL installs Mass Flow Meters at these sites, the bidder shall integrate them with the existing RTU infrastructure at no additional hardware cost (integration services shall be part of O&M scope).

- Bidder shall configure the Dual-SIM/Single-SIM multi-network support industrial cellular modem with appropriate communication parameters and establish connectivity with the central SCADA system.
- Bidder shall implement store-and-forward functionality to buffer data during communication outages, with automatic backfill of historical data after communication restoration.
- All communication shall use DNP3 protocol with TLS encryption (128-bit minimum) as specified.

3.4.12.4. Connectivity

- The Gas Exploration Sites shall be connected to the SCADA system through Type-2 RTUs installed at each location.
- Smart Water Meters shall be connected to the RTU through serial ports (RS-485/RS-232) using Modbus protocol or as supported by the meter manufacturer.
- Future Mass Flow Meters shall be connected to the RTU through available serial ports or Ethernet ports as applicable. The bidder shall ensure adequate spare capacity (minimum 30% as per cabinet specifications) for future expansion.
- The bidder shall establish dual-redundant communication paths from each Gas Exploration Site to the central SCADA system using Dual-SIM/Single-SIM multi-network support industrial cellular modems with automatic failover capability.

3.4.13. Comprehensive Miscellaneous Activities for All Station Types

The Bidder shall execute the following miscellaneous activities across all station types as applicable. These activities are structured into three sequential phases and are applicable as relevant to each station type based on the specific scope requirements identified during site surveys and detailed engineering.

The Bidder shall inform Gujarat Energy Limited at least seven (7) calendar days in advance before commencing any work at any station / location and shall obtain written permission and work permits from GEL. Work shall commence only after receiving the required approvals and shall be conducted in accordance with GEL's health, safety and environmental guidelines.

3.4.13.1. Installation Activities

3.4.13.1.1. Pre-Installation Activities and Site Preparation

Permissions and Regulatory Compliance

- The Bidder shall obtain work permits from GEL for each station for each day of working at the location, ensuring continuous authorization throughout the installation period

- The Bidder shall submit detailed work plans and schedules for approval before commencing work at each location, coordinating with GEL operations to minimize disruption
- The Bidder shall secure all necessary regulatory clearances and permits as required by local authorities, including PESO certifications for hazardous area work
- The Bidder shall coordinate with respective GEL department heads for station access and scheduling to ensure operational continuity
- The Bidder shall obtain HSE permit to work (PTW) before/during work completion as per prevailing/amended terms of GEL.

Site Assessment and Documentation

- The Bidder shall study existing I/O configuration, signal types, field instruments and control requirements to understand the complete system architecture before commencing physical work
- The Bidder shall submit comprehensive site survey reports and engineering drawings to GEL for approval as per milestone requirements
- The Bidder shall provide detailed documentation of anticipated blackout periods for existing systems before implementing power-off procedures
- The Bidder shall identify and document any deviations from original design specifications and propose corrective measures for GEL approval
- The Bidder shall conduct signal strength assessment at all locations to determine antenna requirements and optimal placement.

Safety Implementation and Compliance

- The Bidder shall deploy at least one qualified safety engineer in each Geographic Area (GA) location while work is being carried out to ensure compliance with safety protocols.
- The Bidder shall conduct mandatory safety briefings before commencing work at each location with all personnel involved in the installation
- The Bidder shall perform job safety analysis (JSA) for all installation activities and obtain GEL approval before work commencement
- The Bidder shall implement appropriate safety measures including personal protective equipment (PPE) suitable for hazardous area work environments
- The Bidder shall ensure all work is performed in line with GEL health and safety guidelines and applicable international standards.

- **Existing Equipment Removal and Documentation**

RTU Replacement Procedures (Applicable to CGS Locations)

- The Bidder shall systematically power off existing RTU systems following established safety procedures and GEL operational requirements upon receiving authorization
- The Bidder shall carefully remove field termination cables from terminal blocks and document the identity, function and signal type of each cable core with comprehensive labelling and record-keeping
- The Bidder shall properly note the name and type of signal for each cable core while removing field termination, maintaining detailed records with cable core identification
- The Bidder shall label cables as per signal type and bidder convenience for future identification, providing durable labels at both panel and field ends
- The Bidder shall remove existing RTU panels from mounting infrastructure and provide closure plates to cover unused spaces

Existing Instrumentation Removal and Assessment

- The Bidder shall remove existing pressure gauges at CNG stations where new pressure transmitters are to be installed, ensuring proper isolation and safety procedures
- The Bidder shall assess existing instrumentation at decompression skids and remove equipment as required for new transmitter installation
- The Bidder shall document existing instrument configurations and preserve mounting infrastructure where reusable
- The Bidder shall implement protection measures for exposed process connections during equipment replacement periods

- **Material Delivery and Warehouse Storage Accountability**

The Bidder shall ensure complete accountability for material procurement, storage and delivery to execution sites through the following mandatory requirements:

a. **Bidder's Warehouse Storage:** The Bidder shall procure and store 100% of project materials at their own warehouses/facilities across appropriate Zones/Geographic Areas (GAs) with proper environmental controls, security measures and inventory management systems.
b. **Just-in-Time Delivery:** The Bidder shall deliver materials from their warehouses to execution sites as required for implementation activities without affecting project timelines. Delivery schedules shall be coordinated with site execution plans to ensure seamless project flow.
c. **Storage Management Requirements:** The Bidder's warehouse facilities shall maintain:
    - Appropriate environmental conditions for all equipment types
    - Adequate security and access controls

- Proper handling and storage procedures per manufacturer specifications
- Insurance coverage for stored materials against theft, damage and natural calamities

d. **Reconciliation Requirements:** The Bidder shall maintain complete reconciliation records showing:
   - Purchase order quantities vs. received quantities at Bidder's warehouse
   - Warehouse inventory status with real-time tracking
   - Site delivery confirmations with timestamps
   - Material condition reports upon delivery to sites
   - Any discrepancies with immediate notification to GEL

e. **Timeline Accountability:** The Bidder shall be fully responsible for ensuring material availability does not cause any delays in project implementation. Any delays due to material unavailability shall attract penalties as per contract terms.

f. **Contractual Accountability:** The Bidder shall be contractually liable for any missing, damaged, or undelivered materials from procurement until final installation and commissioning at respective sites.

g. **Third-Party Verification:** All delivery and storage reconciliation clauses shall be verified and approved by GEL procurement and legal teams before contract execution.

- **RTU and Control System Hardware Installation**

RTU Installation Based on Station Type

- The Bidder shall supply and install Type-1 RTUs with redundant power supplies housed in fully wired free-standing panels at all CGS locations with built-in AGA calculations.
- The Bidder shall supply and install Type-2 RTUs with redundant power supplies in fully wired wall-mounted panels at CNG, LCNG, Decompression Skids and Cathodic Protection locations as applicable
- The Bidder shall ensure all RTU installations include appropriate I/O modules, communication cards and diagnostic capabilities as specified for each station type
- The Bidder shall configure RTUs with dedicated communication ports for serial communication with field devices and ethernet communication as required

Communication Equipment Installation

- The Bidder shall install Dual-SIM/Single-SIM multi-network support industrial cellular modems with primary cellular capability and fallback options at all required locations requiring redundant communication paths

- The Bidder shall install appropriate antennas with each industrial modem to ensure optimal signal reception to meet the system availability SLAs

Panel and Enclosure Installation

- The Bidder shall install junction boxes with appropriate IP ratings and PESO certification for all hazardous area applications
- The Bidder shall provide breathers with junction boxes to maintain proper environmental control
- The Bidder shall install weatherproof enclosures with proper ventilation and environmental sealing suitable for local conditions
- The Bidder shall install mounting infrastructure with proper foundations for outdoor equipment installations where building-mounted options are not feasible

Solar Power System Installation (Where Applicable)

- The Bidder shall install Solar PV panels sized appropriately for equipment power consumption and battery charging requirements
- The Bidder shall install battery systems providing adequate backup duration for operational continuity
- The Bidder shall install charge controllers with dual charging capability from renewable and conventional power sources
- The Bidder shall configure monitoring systems for solar power generation and battery status reporting
- The Bidder shall install appropriate enclosures for battery and control equipment installations

- **Comprehensive Power Source Monitoring and Status Integration**

- The Bidder shall implement comprehensive power source monitoring capabilities at all station locations where Diesel Generator (DG) sets and Uninterruptible Power Supply (UPS) systems are installed, providing real-time visibility into power system status and automatic downtime tracking.
- The Bidder shall configure RTUs and communication systems to continuously monitor and report the operational status of primary grid power, UPS systems and DG sets, including automatic detection of power source transitions and equipment operational states.
- The Bidder shall implement power source status monitoring through dedicated digital inputs connected to auxiliary contacts or status relays from DG sets and UPS systems, ensuring reliable detection of equipment operational states without interference to existing power system operations.

- The Bidder shall configure automatic downtime calculation algorithms that track and record the duration of grid power outages, UPS operation periods and DG set runtime, providing comprehensive power availability statistics and downtime analysis for each station location.
- The Bidder shall implement power quality monitoring where applicable, including voltage levels, frequency variations and power factor measurements from available instrumentation, enabling assessment of power system performance and identification of potential issues.

- **Power System Integration and Data Collection**

- The Bidder shall establish hardwired connections from DG set control panels and UPS system status outputs to RTU digital input modules, ensuring reliable monitoring of equipment status including running/stopped conditions, fault alarms, fuel levels and maintenance requirements.
- The Bidder shall configure SCADA displays to show real-time power source status for each station, indicating active power source (Grid/UPS/DG), equipment operational status, alarm conditions and historical power availability statistics.
- The Bidder shall implement automated reporting capabilities for power system performance, including downtime summaries, power source utilization statistics and equipment reliability metrics, enabling proactive maintenance planning and operational optimization.
- The Bidder shall configure alarm management for power system events including grid power failures, UPS low battery conditions, DG set start/stop events and equipment fault conditions, ensuring immediate notification of power system issues to operations personnel.
- The Bidder shall ensure all power monitoring implementations maintain electrical isolation and do not interfere with existing power system protection, control, or safety functions, utilizing appropriate signal conditioning and isolation devices as required.

- **Electronic Volume Corrector (EVC) Data Management and Communication Requirements**

- **EVC Modbus Data Mapping and Communication Requirements**

The Bidder shall provide comprehensive Modbus data mapping and communication capabilities for all Electronic Volume Correctors (EVCs) as specified below:

Complete Register Mapping and Documentation

The Bidder shall:

- Register Mapping: Provide complete Modbus register mapping for all EVC parameters
- Documentation: Deliver comprehensive documentation detailing all register addresses, data types, scaling factors and parameter descriptions for each EVC make and model
- Universal Compatibility: Ensure register mapping covers all leading EVC makes and models currently deployed in the CGD industry

Multi-Type Communication Implementation

The Bidder shall implement:

- Standard Communication: Real-time Modbus RTU/TCP communication for routine monitoring and data collection

- On-Demand Data Retrieval: Capability to retrieve specific data ranges, parameter sets, or historical records upon operator request through SCADA interface, mobile applications, or API calls
- Scheduled Polling: Configurable scheduled data acquisition with different frequencies based on operational requirements
- Push Communication: Unsolicited data reporting capabilities for critical events and alarms

Data Backfilling Capabilities

The Bidder shall provide:

- Automatic Backfilling: Comprehensive data backfilling functionality to recover historical measurement data following power outages, communication failures, or maintenance activities
- Gap Detection: Automatic detection of data gaps in historical records and initiation of backfilling procedures
- Priority-Based Recovery: Intelligent backfilling algorithms prioritizing critical measurement data including accumulated volumes, flow rates, pressure/temperature readings and alarm events
- Store-and-Forward: Implementation utilizing EVC internal memory capacity to buffer measurement data during communication outages
- Conflict Resolution: Data conflict resolution mechanisms for handling overlapping data periods, duplicate records and timestamp synchronization issues

Advanced Communication Features

The Bidder shall implement:

- Data Compression: Data compression and optimization techniques to minimize bandwidth usage while maintaining data completeness
- Retry Mechanisms: Configurable retry mechanisms, timeout settings and error handling procedures for reliable data transmission
- Communication Logging: Comprehensive logging and audit trails for all EVC data operations including scheduled polls, on-demand requests, backfilling activities and communication errors
- Quality Validation: Data validation and quality checking mechanisms with appropriate status indicators for data quality and communication reliability

- **Modem Driver Compatibility Requirements**

The Bidder shall ensure universal modem driver compatibility for all EVC makes and models currently deployed with GEL as specified below:

Universal Driver Compatibility

The Bidder shall:

- Multi-Make Support: Provide modem drivers compatible with all leading EVC makes and models currently in GEL's network including but not limited to existing manufacturers' devices across the distribution network
- Legacy Support: Ensure backward compatibility with older EVC models and their communication protocols
- Protocol Support: Support multiple communication protocols including Modbus RTU, Modbus TCP and proprietary protocols as required by different EVC manufacturers
- Interface Compatibility: Ensure driver compatibility with various communication interfaces including RS-232, RS-485 and Ethernet connections.

Standard and Data Backfilling Communication Types

The Bidder shall provide modem drivers supporting:

- Standard Communication: Real-time communication drivers for routine data collection, parameter monitoring and device status verification
- Data Backfilling Communication: Specialized drivers supporting historical data retrieval, gap filling and recovery operations from EVC internal memory
- Hybrid Operations: Seamless switching between standard and backfilling communication modes based on operational requirements and communication status
- Memory Management: Drivers capable of accessing and managing EVC internal data storage for backfilling operations

Communication Reliability Features

The Bidder shall ensure:

- Network Flexibility: Driver support for 4G/LTE with 2G fallback capability across all EVC makes and models
- Error Handling: Robust error handling and recovery mechanisms specific to each EVC manufacturer's communication characteristics
- Diagnostics: Comprehensive diagnostic capabilities for troubleshooting communication issues with different EVC types

- Performance Optimization: Optimized communication protocols tailored to each EVC manufacturer's specifications and capabilities

Testing and Validation Requirements

The Bidder shall:

- Compatibility Testing: Conduct comprehensive testing with all EVC makes and models currently deployed in GEL's network
- Communication Validation: Verify both standard and data backfilling communication types for each EVC manufacturer
- Performance Verification: Demonstrate successful data retrieval, backfilling operations and real-time communication across all supported EVC types
- Documentation: Provide detailed compatibility matrices and performance specifications for each EVC make/model combination

Future Compatibility Assurance

The Bidder shall:

- Upgrade Path: Ensure modem drivers can be updated to support new EVC models or firmware versions without hardware replacement
- Scalability: Design driver architecture to accommodate future EVC manufacturers or communication protocol updates
- Maintenance Support: Provide ongoing driver maintenance and updates throughout the contract period to ensure continued compatibility

- **On-Demand Data Retrieval and Communication Flexibility**

- The Bidder shall implement comprehensive on-demand data retrieval capabilities for all Electronic Volume Correctors (EVCs) across the distribution network, enabling real-time access to current measurement data, historical records and configuration parameters upon operator request or system requirement.
- The Bidder shall configure EVC communication systems to support both scheduled polling and on-demand query modes, providing operational flexibility for routine monitoring and immediate data access during operational events, maintenance activities, or billing verification procedures.
- The Bidder shall implement intelligent data request mechanisms that allow operators to retrieve specific data ranges, parameter sets, or historical records from EVCs through the SCADA interface, mobile applications, or API calls, ensuring efficient data access without overwhelming communication networks.

- The Bidder shall configure on-demand data retrieval to include real-time measurement values, accumulated volumes, correction factors, alarm logs, event records and device status information, providing comprehensive visibility into EVC performance and measurement accuracy.
- The Bidder shall implement data validation and quality checking mechanisms for on-demand requests, ensuring retrieved data integrity and providing appropriate status indicators for data quality, communication reliability and measurement validity.

- **Data Backfilling and Outage Recovery Capabilities**

- The Bidder shall implement comprehensive data backfilling capabilities for all EVC locations to automatically recover and synchronize historical measurement data following power outages, communication failures, or system maintenance activities, ensuring complete data continuity for billing and operational analysis.
- The Bidder shall configure EVC communication systems to automatically detect data gaps in historical records and initiate backfilling procedures to retrieve missing data from EVC internal memory storage, maintaining chronological data integrity and completeness.
- The Bidder shall implement intelligent backfilling algorithms that prioritize critical measurement data including accumulated volumes, flow rates, pressure and temperature readings and alarm events, ensuring essential information is recovered first during restoration procedures.
- The Bidder shall configure data backfilling to operate automatically upon communication restoration and manually upon operator request, providing flexible recovery options for different operational scenarios and data requirements.
- The Bidder shall implement data conflict resolution mechanisms for backfilling operations, ensuring proper handling of overlapping data periods, duplicate records and timestamp synchronization issues that may occur during outage recovery procedures.

- **Advanced EVC Communication and Data Integrity**

- The Bidder shall configure store-and-forward functionality in all EVC communication systems, utilizing EVC internal memory capacity to buffer measurement data during communication outages and automatically transmit stored data upon communication restoration.
- The Bidder shall implement data compression and optimization techniques for EVC communications to minimize bandwidth usage while maintaining data completeness, particularly important for locations with limited cellular coverage or high communication costs.
- The Bidder shall configure EVC communication systems with configurable retry mechanisms, timeout settings and error handling procedures to ensure reliable data transmission under varying network conditions and communication quality scenarios.

- The Bidder shall implement comprehensive logging and audit trails for all EVC data operations including scheduled polls, on-demand requests, backfilling activities and communication errors, enabling troubleshooting and performance optimization.
- The Bidder shall ensure EVC data management systems maintain full compatibility with existing billing systems, regulatory reporting requirements and custody transfer validation procedures, preserving data accuracy and traceability throughout the measurement chain.

- **RTU Communication Protocol and Data Management Requirements**

3.4.13.1.1..1. DNP3 Protocol Implementation for Push and Pull Communications

- The Bidder shall implement comprehensive DNP3 Level 4 protocol capabilities across all RTU locations, supporting both unsolicited data reporting (push) and polled data requests (pull) to provide flexible communication options optimized for different operational requirements and network conditions.
- The Bidder shall configure DNP3 protocol stack with Secure Authentication Version 5 (SAv5) for all RTU communications, ensuring encrypted data transmission, message authentication and protection against cybersecurity threats while maintaining protocol efficiency and reliability.
- The Bidder shall implement intelligent data reporting mechanisms using DNP3 report-by-exception capabilities, automatically transmitting critical parameter changes, alarm conditions and significant operational events while maintaining scheduled polling for routine monitoring parameters.
- The Bidder shall configure DNP3 communication with flexible polling groups and priority levels, enabling different update rates for critical safety parameters, operational control points and statistical monitoring data based on operational importance and communication efficiency requirements.
- The Bidder shall implement DNP3 time synchronization capabilities to ensure accurate timestamping of all data points, events and alarm conditions across the distributed RTU network, maintaining chronological integrity for operational analysis and regulatory compliance.

3.4.13.1.1..2. Advanced Data Push Capabilities and Event Reporting

- The Bidder shall configure RTUs to automatically transmit critical data changes and alarm conditions using DNP3 unsolicited response capabilities, ensuring immediate notification of safety-critical events, equipment failures and operational anomalies without waiting for scheduled polling cycles.
- The Bidder shall implement configurable data change thresholds and deadband settings for analog parameters, optimizing communication efficiency by transmitting only significant value changes while maintaining adequate monitoring resolution for operational control.

- The Bidder shall configure RTUs to generate and transmit DNP3 event objects for digital state changes, analog value variations and system status modifications, providing comprehensive event logging and real-time operational awareness.
- The Bidder shall implement priority-based event transmission ensuring critical safety events, emergency conditions and high-priority alarms are transmitted immediately while lower-priority events are queued and transmitted based on communication availability and system loading.
- The Bidder shall configure RTUs with buffering capabilities for event data, ensuring critical operational events are preserved during communication outages and transmitted upon communication restoration, maintaining complete operational history and audit trails.

3.4.13.1.1..3. On-Demand Data Retrieval and Historical Access

- The Bidder shall implement comprehensive on-demand data retrieval capabilities using DNP3 read requests, enabling operators and automated systems to access current RTU data, historical logs and configuration parameters immediately upon request regardless of scheduled polling cycles.
- The Bidder shall configure RTUs to support DNP3 file transfer capabilities for large data sets, historical logs and configuration backups, enabling efficient transfer of comprehensive operational data and system documentation.
- The Bidder shall implement DNP3-based device control capabilities with appropriate security mechanisms, enabling remote configuration changes, setpoint adjustments and operational command execution through standardized protocol interfaces.
- The Bidder shall configure RTUs to respond to DNP3 integrity polls and specific data requests with current system status, ensuring operators can obtain complete system snapshots and verify operational conditions at any time.
- The Bidder shall implement DNP3 device restart and warm restart capabilities, enabling remote RTU management and recovery procedures without requiring field personnel intervention for routine maintenance and troubleshooting activities.

3.4.13.1.1..4. Data Backfilling and Communication Recovery for RTU Locations

- The Bidder shall implement comprehensive data backfilling capabilities for all RTU locations using DNP3 protocol mechanisms, automatically recovering historical data stored in RTU memory following communication outages, power failures, or system maintenance activities.
- The Bidder shall configure RTUs with sufficient internal memory and data logging capabilities to store critical operational parameters, alarm events and control actions during communication outages, ensuring no loss of operational data during system disruptions.

- The Bidder shall implement automatic synchronization procedures that detect data gaps in central historical databases and initiate DNP3-based data retrieval from RTU storage, maintaining complete operational records and regulatory compliance.
- The Bidder shall configure data backfilling with timestamp preservation and sequence numbering to ensure proper chronological ordering of recovered data and detection of any missing information during the recovery process.
- The Bidder shall implement conflict resolution and data validation mechanisms for backfilled information, ensuring data integrity and consistency when integrating recovered data with existing historical records and operational databases.

3.4.13.1.1..5. Communication Performance Optimization and Reliability

- The Bidder shall configure DNP3 communication parameters including fragment sizes, timeout values and retry mechanisms optimized for cellular communication networks, ensuring reliable data transmission while minimizing communication costs and bandwidth usage.
- The Bidder shall implement adaptive communication strategies that adjust polling frequencies and data reporting based on communication quality, RTU operational status and system loading conditions, optimizing performance under varying network conditions.
- The Bidder shall configure DNP3 link layer parameters including confirmation timeouts, retry counts and keep-alive mechanisms appropriate for cellular communication latency and reliability characteristics, ensuring stable communication links.
- The Bidder shall implement comprehensive communication monitoring and diagnostics using DNP3 protocol capabilities, tracking communication quality metrics, error rates and performance statistics for proactive maintenance and optimization.
- The Bidder shall configure RTUs with communication redundancy options where applicable, implementing automatic failover between primary and backup communication paths using DNP3 protocol mechanisms to maintain operational continuity during communication system failures.

- **Field Instrumentation Installation**

Pressure Measurement Installation

- The Bidder shall supply and install new pressure transmitters with displays along with all necessary accessories including connecting hardware, valves and fittings as required
- The Bidder shall install pressure transmitters at appropriate mounting locations near process equipment with suitable support structures
- The Bidder shall provide weather protection enclosures for outdoor pressure transmitter installations

- The Bidder shall perform complete installation including process connections, cabling and system integration.

Temperature Measurement Installation

- The Bidder shall supply, install and commission new temperature transmitters where specified, including all necessary accessories and thermowells suitable for process conditions
- The Bidder shall install temperature measurement systems at outlet locations and other specified points with appropriate process connections
- The Bidder shall ensure proper installation practices for accurate temperature measurement and long-term reliability

Flow Measurement Configuration

- The Bidder shall program and configure existing mass flow meters where required for enhanced data collection and integration
- The Bidder shall install and configure mass flow meter systems for specialized applications including cascade vehicle operations
- The Bidder shall implement flow measurement systems with appropriate communication interfaces and data collection capabilities

Valve Position Monitoring Installation

- The Bidder shall install new limit switches for valve position monitoring where existing equipment is not functional or unavailable
- The Bidder shall install proximity sensors with appropriate signal conditioning for valve position detection where suitable mounting provisions exist
- The Bidder shall provide separate sensing systems for different valve positions to ensure comprehensive monitoring coverage

- **Cable Installation and Infrastructure**

Cable Supply and Installation

- The Bidder shall supply and install new FRLS armored and screened cables for all field connections throughout the system
- The Bidder shall supply and install specialized communication cables for dispenser connections using appropriate fire-rated and screened cables through protective conduits
- The Bidder shall install ethernet cables for network connections with proper environmental protection and routing

- The Bidder shall ensure adequate spare capacity in all cable installations for future expansion requirements

Cable Routing and Protection

- The Bidder shall implement underground cable installation in properly prepared trenches according to applicable standards
- The Bidder shall install above-ground cable management systems using appropriate cable trays and protection with proper specifications
- The Bidder shall perform cable trenching and routing as required based on site-specific conditions and accessibility requirements
- The Bidder shall provide comprehensive cable protection including proper sealing and mechanical protection for all installations

Cable Connection and Termination

- The Bidder shall supply and install appropriate cable entry systems for all field connections ensuring environmental sealing and mechanical protection
- The Bidder shall terminate all cables according to approved termination procedures and documentation
- The Bidder shall implement proper cable identification and labelling systems for maintenance and troubleshooting purposes
- The Bidder shall ensure all cable installations comply with applicable electrical and safety standards

- **Communication Network Implementation**

Network Equipment Installation

- The Bidder shall install managed ethernet switches es with adequate port capacity and spare provisions at locations where existing equipment lacks sufficient connectivity
- The Bidder shall supply and install all required protocol conversion equipment to standardize communication protocols across all field devices, ensuring seamless integration of equipment using proprietary or non-standard communication methods into the unified SCADA architecture
- The Bidder shall implement comprehensive protocol conversion solutions including but not limited to Modbus RTU/TCP conversion, DNP3 protocol adaptation, HART protocol integration and proprietary PLC protocol standardization to enable uniform data acquisition and control capabilities
- The Bidder shall provide appropriate communication converters where different interface standards require interconnection

- The Bidder shall implement network infrastructure supporting required data rates and communication reliability

Specialized Communication Installation

- The Bidder shall install signal conversion equipment for Cathodic Protection systems to interface with standard RTU input formats
- The Bidder shall implement communication interfaces for flow computers and gas analysis equipment using appropriate protocols and conversion devices
- The Bidder shall install communication infrastructure for integration with existing enterprise systems and data loggers where present
- The Bidder shall provide all necessary interface devices and associated interconnection materials.

- **Safety and Protection Systems**

Intrinsic Safety Implementation

- The Bidder shall supply and install isolation barrier modules with appropriate capacity for dispenser connections and other hazardous area interfaces
- The Bidder shall install appropriate barrier isolation systems for all hazardous area connections ensuring compliance with intrinsic safety requirements
- The Bidder shall ensure all hazardous area installations comply with applicable safety standards and obtain required certifications
- The Bidder shall implement proper separation and isolation between safe area and hazardous area circuits

Surge Protection Installation

- The Bidder shall supply and install surge protection devices for all I/O points and communication interfaces
- The Bidder shall implement comprehensive surge protection for power supply circuits and communication lines
- The Bidder shall ensure proper grounding implementation for all equipment and surge protection systems
- The Bidder shall install protection systems according to applicable standards for electrical safety and equipment protection

- **Specialized Equipment Integration**

Enhanced Dispenser Integration Infrastructure with Advanced Control Systems

- The Bidder shall implement communication connections to dispensers using appropriate protocols and ensuring proper loading distribution across communication ports
- The Bidder shall establish point-to-point or daisy-chain communication configurations based on station requirements and equipment limitations
- The Bidder shall disconnect and reroute existing dispenser connections where necessary to accommodate new communication architecture
- The Bidder shall implement new cable routing and connection infrastructure for dispenser integration as required by site conditions

Advanced PLC Integration Infrastructure

- The Bidder shall implement various connectivity scenarios for compressor PLCs based on available communication interfaces and expansion requirements
- The Bidder shall install new network infrastructure where existing systems lack adequate connectivity options
- The Bidder shall implement protocol conversion and interface equipment for PLCs using proprietary communication methods
- The Bidder shall install additional connection infrastructure where cable entry limitations require alternative approaches

Enhanced EVC and Metering Integration

- The Bidder shall implement communication interfaces for Electronic Volume Correctors using appropriate serial communication standards
- The Bidder shall install communication infrastructure accommodating both existing single-parameter and new dual-parameter EVC configurations
- The Bidder shall provide communication conversion equipment where interface standards require adaptation
- The Bidder shall implement metering system integration with appropriate data collection and validation capabilities

3.4.13.2. Commissioning Activities

3.4.13.2.1. System Configuration and Setup

RTU Configuration Implementation

- The Bidder shall configure RTUs for all I/O points including migration of existing configurations ensuring complete parameter coverage without exception

- The Bidder shall implement communication protocol configuration including security features and authentication mechanisms
- The Bidder shall configure data mapping and parameter assignments ensuring compatibility with existing operational procedures
- The Bidder shall implement RTU diagnostic and monitoring capabilities for system health assessment

Communication System Configuration

- The Bidder shall configure cellular communication systems with appropriate protocols and connectivity options
- The Bidder shall implement secure communication protocols including encryption and authentication mechanisms
- The Bidder shall configure communication redundancy and failover mechanisms for critical locations
- The Bidder shall establish communication parameter optimization for reliable data transmission under varying network conditions

Data Management Configuration

- The Bidder shall implement store-and-forward functionality for communication reliability during network outages
- The Bidder shall configure scheduled and event-driven data transmission based on operational requirements
- The Bidder shall implement on-demand data retrieval capabilities for operational flexibility
- The Bidder shall configure data validation and quality assurance mechanisms

3.4.13.2.2. Field Device Integration and Commissioning

Flow Measurement Integration

- The Bidder shall commission flow computer interfaces using appropriate communication methods and protocol conversion where required
- The Bidder shall implement AGA calculation functionality through direct RTU implementation with full standards compliance
- The Bidder shall configure gas composition analysis integration ensuring accurate data collection and processing
- The Bidder shall implement flow measurement validation and calibration verification procedures

Process Control Integration

- The Bidder shall commission valve monitoring systems including position feedback and control capability where specified
- The Bidder shall implement pressure control integration with remote setpoint adjustment capabilities
- The Bidder shall configure emergency shutdown system integration with appropriate safety interlocks and response procedures
- The Bidder shall commission safety system integration ensuring proper alarm handling and emergency response

Specialized Equipment Commissioning

- The Bidder shall commission odorizer system integration including compliance monitoring and parameter optimization
- The Bidder shall implement fire and gas detection system integration with emergency response coordination
- The Bidder shall configure Cathodic Protection system integration ensuring comprehensive parameter monitoring and data collection
- The Bidder shall commission specialized process equipment integration based on station-specific requirements

3.4.13.3. Advanced System Features Implementation

Enhanced Remote Control Capabilities with Comprehensive Interlocks

- The Bidder shall implement comprehensive safety interlocks and validation mechanisms for CNG price change operations, ensuring that price updates can only be executed after successful completion of pre-defined safety checks including dispenser status verification, communication link integrity confirmation and operator authorization validation
- The Bidder shall configure multi-level confirmation and feedback systems for CNG price changes, requiring acknowledgment from both the central SCADA system and individual dispenser units before price modification takes effect, with automatic rollback capabilities in case of communication failures
- The Bidder shall implement real-time validation and status monitoring for all price change operations, providing comprehensive feedback to operators including confirmation of successful price updates, identification of failed update attempts and detailed logging of all price modification activities with timestamp and operator identification
- The Bidder shall configure remote emergency shutdown capabilities with proper safety interlocks and authorization procedures

- The Bidder shall implement dispenser data collection including transaction recording and operational status monitoring
- The Bidder shall configure control system validation with appropriate feedback and confirmation mechanisms

Advanced Mobile Cascade Vehicle Tracking and Loss Analysis System

Objective

The Bidder shall design and implement a Mobile Cascade Vehicle (MCV) and Light Commercial Vehicle (LCV) tracking and loss-analysis module within the SCADA system and its mobile application. The module shall record, through a QR-code-driven mobile workflow, the gas transferred into a vehicle at the filling (source) station and decanted from it at the destination station, compute the quantity transported, the quantity remaining in the vehicle and the transport losses, and provide intelligent analytics across the mobile cascade supply chain.

QR Code Generation and Registry

- The Bidder shall generate and provide the QR codes for **every Mass Flow Meter (MFM)** and **every MCV/LCV** in GEL's cascade operation and shall physically affix / issue them as agreed with GEL.
- The Bidder shall maintain a QR-to-asset registry in the SCADA system, mapping each QR code to its MFM (with its station and connectivity status) or to its vehicle (with vehicle particulars and cascade capacity), and shall keep the registry current as MFMs and vehicles are added, replaced or retired.

Capture Workflow — Filling at Source (Online / Mother CNG Station or LCNG Facility)

The Bidder shall implement the following workflow on the SCADA mobile application:

- **Scan the station MFM QR code.** Where the MFM is integrated with the SCADA system, the current MFM reading (mass/volume, pressure and temperature) shall be **pulled automatically** from SCADA and displayed on the app for the operator to confirm. Where the MFM is **not** integrated with SCADA, the operator shall **manually enter** the MFM reading and **capture a photograph** of the MFM display as evidence, which shall be stored against the record.
- **Scan the MCV/LCV QR code** to identify the vehicle and record the fill against that vehicle — the metered fill quantity, and, where the vehicle carries an onboard MFM/totaliser, the vehicle-side reading, together with the fill details and operational parameters.
- The app shall stamp each record with operator identity, date/time and GPS location, and shall open the cascade movement (source station, vehicle, fill quantity) for reconciliation at decant.

Capture Workflow — Decanting at Destination (Daughter Booster / Daughter Station)

The identical workflow shall apply at the destination:

- **Scan the destination station MFM QR code** — auto-pull the reading where the MFM is SCADA-integrated or manually enter the reading with a photograph where it is not.
- **Scan the MCV/LCV QR code** to identify the arriving vehicle and record the decant against the same open cascade movement — the metered decant quantity and, where available, the vehicle's onboard/remaining reading on arrival and after decanting.
- The app shall close the cascade movement on decant, linking source-fill and destination-decant records for the same vehicle.

Loss and Mass-Balance Analysis

- For each cascade movement, the system shall compute in real time: the quantity **filled** at source, the quantity **decanted** at destination, the quantity **remaining in the vehicle** (heel), and the **transport loss** (fill − decant − remaining), and shall present these on the mobile application and the CMP dashboards.
- The system shall aggregate cascade losses per vehicle, per route, per operator, per source and per destination station, and network-wide, and shall reconcile cascade movement against station consumption and sales.
- The Bidder shall configure alerts to notify GEL and the operator when a cascade loss exceeds predefined thresholds, enabling proactive investigation and corrective action.

Intelligent Features

In addition to the above, the Bidder shall implement intelligent features that add value to GEL's mobile cascade operation, including at minimum:

- **Loss benchmarking and trending** — establish a normal loss band per route/vehicle and rank chronic-loss routes, vehicles, operators and stations, so recurring inefficiencies are visible and actionable.
- **Anomaly and pilferage detection** — flag fill/decant mismatches, abnormally high losses, a decant without a matching fill (or vice versa), out-of-sequence scans, or fills/decants outside the expected geofence or time window, as potential measurement error or gas theft.
- **Predictive replenishment and dispatch optimisation** — forecast each daughter/daughter-booster station's time-to-empty from its consumption and recommend refill scheduling and vehicle-to-route allocation to minimise stockouts, deadhead running and idle time.
- **In-transit tracking and safety** — GPS-based journey tracking from source to destination with geofencing, route-deviation and excessive-idle alerts, ETA to destination, and (where vehicle telemetry is available) cascade pressure/temperature-drift alerts in transit.
- **Turnaround and utilisation analytics** — fill-to-decant cycle time, vehicle utilisation, and station queue/wait time, to improve cascade availability.

- **Digital chain-of-custody and e-logbook** — a tamper-evident, timestamped, geo-tagged QR-and-photo audit trail for every fill and decant, operator-wise accountability, an exception-approval workflow, and an automated logbook replacing the manual process, with configurable reports.
- **UFG/LUAG linkage** — attribute cascade transport losses to the network Unaccounted-for-Gas / LUAG analysis and per-station accountability.

3.4.13.4. Enterprise System Integration

Existing System Integration

- The Bidder shall implement integration with existing data logging systems using appropriate interface methods
- The Bidder shall configure API integration for specialized applications including third-party system connectivity
- The Bidder shall implement secure communication mechanisms with authentication and data validation protocols
- The Bidder shall configure enterprise system interfaces ensuring data consistency and operational continuity

Third-Party System Connectivity

- The Bidder shall implement CBG plant integration including production monitoring and quality parameter tracking
- The Bidder shall configure specialized equipment integration with OEM coordination for optimal functionality
- The Bidder shall implement communication interfaces supporting various protocols and data exchange requirements
- The Bidder shall configure system integration ensuring operational independence of existing control systems where required

3.4.13.5. Performance Optimization and Validation

Communication Performance Optimization

- The Bidder shall optimize communication parameters for reliable data transmission under various network conditions
- The Bidder shall configure communication load balancing and traffic management for optimal system performance
- The Bidder shall implement communication monitoring and diagnostic capabilities for proactive maintenance

- The Bidder shall configure automatic recovery mechanisms for communication system resilience.

System Performance Validation

- The Bidder shall validate system response times and data update frequencies against operational requirements
- The Bidder shall configure system performance monitoring and alerting mechanisms
- The Bidder shall implement system optimization procedures for continued performance improvement
- The Bidder shall validate integration interfaces ensuring proper data flow and system interoperability

3.4.13.6. Standard Operating Procedures Development and Implementation

Comprehensive SOP Development Framework

- The Bidder shall develop detailed Standard Operating Procedures (SOPs) for all critical SCADA operations including but not limited to CNG price change procedures, emergency shutdown protocols, mobile cascade tracking operations, system maintenance activities and alarm response procedures
- The Bidder shall prepare station-specific SOPs covering routine operational tasks, troubleshooting procedures and emergency response protocols, ensuring consistency across all facility types while addressing unique operational requirements of each station category
- The Bidder shall develop SOPs for mobile application usage including cascade vehicle tracking procedures, data entry protocols, alarm acknowledgment processes and field maintenance activities, with clear step-by-step instructions and safety guidelines

SOP Review and Approval Process

- The Bidder shall submit all developed SOPs to Gujarat Energy Limited for comprehensive review and approval, incorporating feedback and modifications as required by GEL operations personnel and management
- The Bidder shall establish a formal SOP approval workflow ensuring that all operational procedures are validated by appropriate GEL departments including Operations, Safety and Engineering before implementation
- The Bidder shall implement a version control system for all SOPs, maintaining records of revisions, approval dates and implementation status throughout the project lifecycle and operations phase

SOP Training and Implementation

- The Bidder shall conduct comprehensive training sessions for GEL personnel covering all approved SOPs, ensuring operators understand proper procedures for system operation, emergency response and routine maintenance activities
- The Bidder shall provide ongoing support during SOP implementation, monitoring adherence to established procedures and providing additional training or procedure refinement as required based on operational experience
- The Bidder shall establish periodic SOP review and update mechanisms, ensuring procedures remain current with system modifications, operational changes and evolving safety requirements

3.4.13.7. Testing Activities

3.4.13.7.1. Pre-Testing Preparation and Validation

Testing Procedure Development

- The Bidder shall submit comprehensive testing procedures covering all hardware and software components for GEL review and approval
- The Bidder shall prepare detailed test plans addressing system functionality, integration verification and performance validation
- The Bidder shall document testing methodologies and acceptance criteria for all system components and interfaces
- The Bidder shall coordinate testing schedules with GEL operations to minimize disruption to ongoing activities

Testing Infrastructure Preparation

- The Bidder shall prepare comprehensive testing equipment and qualified personnel for system validation activities
- The Bidder shall establish testing procedures addressing safety requirements and operational constraints
- The Bidder shall implement testing documentation and reporting procedures for comprehensive result tracking
- The Bidder shall coordinate with GEL representatives for testing oversight and validation

3.4.13.7.2. Cable and Connection Validation

Cable Integrity Testing

- The Bidder shall perform comprehensive cable testing from termination points to field connections before system energization
- The Bidder shall document any issues observed during cable testing and implement corrective measures as required
- The Bidder shall prepare comprehensive testing reports documenting cable integrity and connection validation
- The Bidder shall perform additional testing after system energization to verify operational integrity under normal conditions

Connection Verification

- The Bidder shall verify proper signal continuity and connection integrity for all installed systems
- The Bidder shall validate communication interfaces and protocol functionality across all system components
- The Bidder shall test system grounding and electrical safety implementations according to applicable standards
- The Bidder shall document all connection testing results with comprehensive analysis and corrective actions where required

3.4.13.7.3. Hardware Component Testing

RTU and I/O System Testing

- The Bidder shall complete comprehensive testing of all hardware components according to approved testing procedures
- The Bidder shall verify RTU functionality including I/O processing, communication interfaces and diagnostic capabilities
- The Bidder shall test power supply systems including backup power and automatic changeover mechanisms
- The Bidder shall validate protection system functionality including surge protection and intrinsic safety compliance.

Communication Equipment Testing

- The Bidder shall test cellular communication systems including signal quality, data transmission reliability and failover mechanisms
- The Bidder shall verify antenna performance and communication optimization under various environmental conditions
- The Bidder shall validate protocol conversion equipment and communication interface functionality
- The Bidder shall test communication redundancy and automatic recovery mechanisms.

Protection System Validation

- The Bidder shall verify surge protection effectiveness and proper installation across all system components
- The Bidder shall test intrinsic safety compliance in hazardous area installations with appropriate certification validation
- The Bidder shall validate explosion-proof enclosure integrity and environmental protection systems
- The Bidder shall test electrical safety implementations including grounding systems and isolation mechanisms

3.4.13.7.4. Field Device Integration Testing

Instrumentation System Testing

- The Bidder shall test pressure measurement systems including accuracy validation and integration verification
- The Bidder shall verify temperature measurement functionality and communication interface reliability
- The Bidder shall test flow measurement integration including data collection accuracy and protocol functionality
- The Bidder shall validate valve position monitoring systems and feedback mechanism reliability

Process Equipment Integration Testing

- The Bidder shall test dispenser integration including communication reliability and control functionality
- The Bidder shall verify PLC integration ensuring comprehensive parameter access and control capability

- The Bidder shall test EVC integration including data collection reliability and communication protocol validation
- The Bidder shall validate specialized equipment integration including safety system interfaces and emergency response mechanisms

Control System Functionality Testing

- The Bidder shall test remote control capabilities including validation mechanisms and safety interlocks
- The Bidder shall verify emergency shutdown functionality with appropriate response time validation
- The Bidder shall test alarm management systems including detection, notification and acknowledgment procedures
- The Bidder shall validate automated system responses and control logic implementation

3.4.13.7.5. System Integration and Performance Testing

End-to-End System Testing

- The Bidder shall conduct comprehensive integration testing with all field devices operational and connected
- The Bidder shall test complete data flow from field measurements through communication systems to central displays
- The Bidder shall verify database accuracy and real-time data representation across all system interfaces
- The Bidder shall test remote diagnostic capabilities and system monitoring functionality

Performance Validation Testing

- The Bidder shall test system performance under maximum loading conditions and peak operational scenarios
- The Bidder shall verify communication system reliability during various network conditions and traffic loads
- The Bidder shall validate system response times and data update frequencies against operational requirements
- The Bidder shall test system recovery mechanisms and failover procedures under simulated failure conditions.

Advanced Feature Testing

- The Bidder shall test automated data processing including calculation algorithms and analytical functions
- The Bidder shall verify mobile application functionality and remote access capabilities including cascade vehicle tracking features
- The Bidder shall test enterprise system integration including data exchange accuracy and protocol compliance
- The Bidder shall validate specialized applications including AMR functionality and billing system integration

3.4.13.7.6. Safety and Security Validation

Safety System Testing

- The Bidder shall test all safety functions ensuring compliance with operational requirements and industry standards
- The Bidder shall verify emergency response systems including automatic shutdown and alarm notification procedures
- The Bidder shall validate hazardous area compliance and intrinsic safety implementation across all applicable installations
- The Bidder shall test safety interlock systems and emergency override procedures

Security and Compliance Testing

- The Bidder shall test communication security including encryption effectiveness and authentication mechanisms
- The Bidder shall verify access control systems and user authorization procedures
- The Bidder shall validate cybersecurity implementations including intrusion detection and system protection mechanisms
- The Bidder shall test audit logging functionality and compliance reporting capabilities

3.4.13.7.7. Acceptance Testing and System Handover

Comprehensive System Validation

- The Bidder shall conduct Pre-Site Acceptance Testing with comprehensive system functionality verification
- The Bidder shall verify all monitoring capabilities and control functions operate according to specifications

- The Bidder shall test system performance against specified operational requirements and service level agreements
- The Bidder shall provide comprehensive testing documentation for GEL review and acceptance

Final Integration Validation

- The Bidder shall coordinate with other contractors for complete system integration testing and validation
- The Bidder shall verify enterprise system integration ensuring proper data flow and operational compatibility
- The Bidder shall test operational procedures ensuring existing control systems maintain independent functionality where required
- The Bidder shall validate system documentation including as-built drawings, configuration parameters and operational procedures

3.4.13.8. Protocol and Software Version Management Requirements

3.4.13.8.1. Protocol and Software Version Requirements

The Bidder shall ensure all communication protocols and software components are implemented using the latest available versions and shall provide continuous version management throughout the project duration as specified below**:**

Latest Version Implementation

The Bidder shall:

- **Current Versions**: Supply and implement all communication protocols, software components and system applications using the latest commercially available versions at the time of system deployment
- **Protocol Specifications**:
    - TLS encryption: Latest version with minimum 128-bit encryption capability
    - DNP3 authentication: Latest available version with Secure Authentication
    - Modbus RTU/TCP: Latest protocol specifications and implementations
    - MQTT, AMQP, HTTP/REST API: Latest stable versions with security enhancements
    - IEC 61850: Latest available standard implementation where applicable

- **Software Components**: All SCADA software, RTU firmware, HMI applications, database software, operating systems, security software and all other system components shall be latest available versions

Version Update Obligations - No Additional Cost

The Bidder shall provide all version updates and upgrades at no additional cost to GEL for the entire project duration including:

Protocol Updates

- **Security Updates**: Immediate implementation of critical security patches and protocol vulnerability fixes within 48 hours of availability
- **Feature Enhancements**: Implementation of protocol feature updates and performance improvements as released by standards organizations
- **Compatibility Updates**: Protocol version updates to maintain compatibility with evolving industry standards and GEL's expanding infrastructure
- **Encryption Upgrades**: Automatic upgrade to stronger encryption standards as they become available and industry-adopted

Software Version Management

- **Major Version Upgrades**: All major software version releases including SCADA platform, RTU firmware, HMI software, database systems and all applications
- **Minor Version Updates**: Regular minor updates, patches and performance improvements
- **Security Patches**: Critical security patches implemented within 48 hours of release
- **Feature Updates**: New features and functionality enhancements released by software vendors
- **Operating System Updates**: Regular OS updates, security patches and version upgrades for all system components

Firmware and Embedded Software

- **RTU Firmware**: All RTU firmware updates and feature enhancements throughout the contract period
- **Modem Firmware**: Industrial cellular modem firmware updates for performance and security improvements
- **Device Firmware**: Updates for all field devices, transmitters and communication equipment
- **Protocol Stack Updates**: Communication protocol stack updates in RTUs and communication devices

Update Management Process

The Bidder shall:

- **Change Management**: Implement structured change management process for all version updates ensuring minimal operational disruption
- **Testing Requirements**: Conduct comprehensive testing of all updates in controlled environment before production deployment
- **Rollback Capability**: Maintain rollback capability for all updates with immediate restoration procedures if issues arise
- **Documentation**: Provide complete documentation for all version changes including impact analysis and configuration updates
- **Approval Process**: Obtain GEL approval for major version changes that may impact system functionality or user interfaces
- **Scheduled Maintenance**: Coordinate version updates during scheduled maintenance windows to minimize operational impact

End-of-Life Product Management

The Bidder shall:

- **Proactive Replacement**: Monitor all software and protocol versions for end-of-life announcements and proactively plan replacements
- **No EOL Products**: Not supply any products approaching end-of-life during the initial deployment phase
- **Upgrade Obligations**: When any component reaches end-of-life during the contract period, upgrade to equivalent or higher specification replacement at no additional cost to GEL
- **Vendor Support**: Ensure continuous vendor support availability for all software components throughout the contract duration
- **Migration Services**: Provide complete migration services when platform or protocol changes are required due to end-of-life situations

Version Compatibility and Integration

The Bidder shall ensure:

- **Backward Compatibility**: All version updates maintain backward compatibility with existing system components and configurations
- **Integration Testing**: Comprehensive integration testing after each update to verify system interoperability

- **Data Integrity**: Version updates shall not compromise data integrity, historical data access, or operational continuity
- **User Experience**: Version updates shall maintain or improve user experience without requiring extensive retraining
- **Performance Maintenance**: All updates shall maintain or improve system performance benchmarks

Performance Guarantee for Version Management

The Bidder guarantees:

- **Zero Additional Cost**: All version updates, upgrades and associated services at absolutely no additional cost to GEL
- **Minimal Downtime**: Version updates shall not exceed scheduled maintenance downtime limits as specified in SLA requirements
- **Performance Maintenance**: System performance shall meet or exceed original specifications after all updates
- **Data Protection**: Complete protection of historical data and configurations during all update procedures
- **Continuous Operation**: Maintain system availability requirements during update processes using appropriate redundancy and failover mechanisms

Vendor Coordination and Licensing

The Bidder shall:

- **Vendor Relations**: Maintain direct relationships with all software and protocol vendors for timely access to updates
- **License Management**: Manage all software licenses ensuring continuous compliance and availability of updates
- **Support Agreements**: Maintain active support agreements with all vendors providing immediate access to latest versions
- **Technology Roadmap**: Provide annual technology roadmap updates showing planned version releases and upgrade schedules
- **Cost Absorption**: Absorb all licensing, support and implementation costs for version updates throughout the contract period.

12.6.9 Contractual Commitments

This version management commitment includes:

- **Binding Obligation**: Legally binding commitment to provide all updates at no additional cost for the complete 5-year operational period
- **Performance Penalties**: Standard SLA penalties apply for failure to implement critical security updates within specified timeframes
- **Documentation Requirements**: Comprehensive documentation of all version management activities and update histories
- **Audit Rights**: GEL's right to audit version compliance and update implementation procedures
- **Continuous Improvement**: Obligation to continuously improve system capabilities through regular version updates and enhancements

3.4.13.9. SIM Card Procurement and Lifecycle Management

The Bidder shall procure, supply and manage all SIM cards required for the project as specified below:

- **Complete Procurement**: The Bidder shall procure all SIM cards required for industrial cellular modems across all station types.
- **Dual-SIM Provider Diversity**: For all dual-SIM installations, the Bidder shall procure SIM cards from two different service providers to ensure communication redundancy and network failover capability.
- **Single-SIM provider Diversity:** For all Single-SIM installations, the Bidder shall procure SIM card which will support communication from two different service providers to ensure communication redundancy and network failover capability.
- **Registration Requirements**: All SIM cards shall be issued and registered in the name of Gujarat Energy Limited (GEL) with appropriate corporate/industrial service plans.
- **Service Provider Management**: The Bidder shall be solely responsible for managing all SIM card issues, service requests, technical support, billing queries and coordination with service providers throughout the contract duration, while SIM cards remain registered under GEL's name.
- **Technical Requirements**: All SIM cards shall support 4G/LTE with 2G fallback capability, static IP addressing or appropriate APN configuration and be registered for industrial/IoT applications.
- **Operational Responsibility**: The Bidder shall ensure continuous connectivity, monitor data usage, manage SIM security, coordinate with multiple service providers for dual-SIM setups

and provide communication diagnostics for all SIM cards without any additional charges to GEL.

Performance Guarantee: The Bidder guarantees uninterrupted cellular communication services and shall replace any non-performing SIM cards immediately at no cost to GEL, including coordination with respective service providers for resolution

3.4.14.Indicative Scope of SCADA

Sr. No.	Type of Station	No. of Stations	New Hardware to be installed by bidder	Services to be executed by the bidder
1	City Gate Station (CGS)	14	**Type-1 RTUs** with redundant SMPS diode-based power supplies • Explosion-proof junction boxes with surge protection • FRLS armoured and screened cables • Dual-SIM/Single-SIM multi-network support industrial cellular modem with 4G/LTE failover to 2G (with SIM Cards) with RS-485/232 capability • New wired connections with limit switches for SSV • New wired connections for ESV monitoring • New FRLS cables for FCV, ROV and PCV • Cable glands for all field connections • Surge arrestors for all I/O points • Isolation barrier modules for hazardous area connections	• Line pack calculation software implementation • Emergency supply duration prediction algorithms • LUAG analysis functionality • Migration of all I/O points from existing RTUs • Configuration of RTUs with AGA calculations • Interface with gas chromatograph • Configuration of communications with encryption and authentication • Store-and-forward functionality implementation • Proper grounding and surge protection implementation

Sr. No.	Type of Station	No. of Stations	New Hardware to be installed by bidder	Services to be executed by the bidder
2	Odorizer Units	85	• Dual-SIM/Single-SIM multi-network support industrial cellular modem with industrial cellular modem with 4G/LTE failover to 2G (with SIM Cards) with RS-485/232 capability • Cable glands for all field connections • Surge arrestors for all communication lines • Isolation barrier modules for hazardous area connections	• Interface with existing odorizer units through Modbus RTU • Configuration of cloud communications • Implementation of scheduled data transmission • On-demand parameter retrieval capability • Monitoring of odorization compliance • Proper grounding and surge protection implementation
3	CNG Station	850	• Type-2 RTUs with redundant SMPS diode-based power supplies • Ethernet connections for newer compressor PLCs • Serial interface cables for older PLCs • New pressure transmitters with displays • RS-485 cables to dispensers (FRLS armored & screened) • Isolation barrier modules (1 per 3 dispensers for Modbus) • Isolation barrier modules for all hazardous area connections	• Integration of all PLC I/O points • LUAG calculation implementation • Automated logbook data functionality • Station sales reconciliation software • MFM programming where required • Cable trenching from dispensers to panel rooms • PLC programming for protocol conversion • Remote price change interface implementation • Dispenser data read interface implementation • Remote ESD activation for compressors

Sr. No.	Type of Station	No. of Stations	New Hardware to be installed by bidder	Services to be executed by the bidder
			• New managed ethernet switches es where needed • Dual-SIM/Single-SIM multi-network support industrial cellular modem with industrial cellular modem with 4G/LTE failover to 2G (with SIM Cards) with RS-485/232 capability • Cable glands for all field connections • Surge arrestors for all I/O and communication lines	• Proper grounding and surge protection implementation
4	District Regulating Station (DRS/CPRS)	375	• Dual-SIM/Single-SIM multi-network support industrial cellular modem with industrial cellular modem with 4G/LTE failover to 2G (with SIM Cards) with RS-485/232 capability • Option for Solar panel systems for 24x7 operation • Cable glands for all field connections • Surge arrestors for all communication lines	• Interface with new EVC (GEL procured) via Modbus • Automated logbook data functionality • Domestic/commercial consumption analysis software • Threshold setting for flow max/min• Configuration of communications with encryption • Store-and-forward functionality implementation • Proper grounding and surge protection implementation
5	Decompression Skids	20	• Type-2 RTU with redundant SMPS diode-based power supply	• Interface with existing limit switch and limited DI inputs from relay switches • Automated logbook data functionality

Sr. No.	Type of Station	No. of Stations	New Hardware to be installed by bidder	Services to be executed by the bidder
			• Dual-SIM/Single-SIM multi-network support industrial cellular modem with industrial cellular modem with 4G/LTE failover to 2G (with SIM Cards) with RS-485/232 capability • New pressure transmitters with displays • New Temperature transmitters for outlet • New FRLS armored and screened cable • Cable glands for all field connections • Surge arrestors for all I/O points • Isolation barrier modules for hazardous area connections	• Configuration of communications using Modbus RTU • Implementation of TLS encryption and DNP3 authentication • Proper grounding and surge protection implementation
6	Cathodic Protection System	110	• Type-2 RTU with redundant SMPS diode-based power supply • Signal converters for each type of signal • Protocol converter to Modbus (if needed) • Dual-SIM/Single-SIM multi-network support industrial cellular modem with industrial cellular modem with	• Integration of all existing CP data points • CP data interface connection • Protocol conversion as needed • Parameter mapping from existing system • Data collection configuration • Alarm integration • Automated logbook data functionality • API integration with Itech Systems RMU software if required

Sr. No.	Type of Station	No. of Stations	New Hardware to be installed by bidder	Services to be executed by the bidder
			4G/LTE failover to 2G (with SIM Cards) with RS-485/232 capability • Cable glands for all field connections • Surge arrestors for communication lines	• Proper grounding and surge protection implementation
7	LCNG Station	8	• Type-2 RTU with redundant SMPS diode-based power supply • Junction boxes with surge protection • FRLS armored screened cables • Isolation barrier modules for Modbus Cable (1 per 3 Dispensers) • Isolation barrier modules for all hazardous area connections • Dual-SIM/Single-SIM multi-network support industrial cellular modem with industrial cellular modem with 4G/LTE failover to 2G (with SIM Cards) with RS-485/232 capability • New managed ethernet switches if needed • Cable glands for all field connections • Surge arrestors for all I/O and communication lines	• Integration of all existing PLC I/O points • Automated logbook data functionality • LNG to CNG conversion efficiency analysis • Interface with existing PLC, pump, dispenser, safety systems • Interface with PLC via ethernet port • Interface with mass flow meters via Modbus RS-485 • Interface with fire & gas system through PLC • Remote price update capability implementation • Dispenser data read interface implementation • PLC programming for protocol conversion • Maximum 2 dispensers per RTU Modbus port

Sr. No.	Type of Station	No. of Stations	New Hardware to be installed by bidder	Services to be executed by the bidder
				• Proper grounding and surge protection implementation
8	Compressed Biogas (CBG) Plant	7	• Type-2 RTU with redundant SMPS diode-based power supply • Junction boxes with surge protection • FRLS armored screened cables • Isolation barrier modules for Modbus Cable (1 per 3 Dispensers) • Isolation barrier modules for all hazardous area connections • Dual-SIM/Single-SIM multi-network support industrial cellular modem with industrial cellular modem with 4G/LTE failover to 2G (with SIM Cards) with RS-485/232 capability • New managed ethernet switches if needed • Cable glands for all field connections • Surge arrestors for all I/O and communication lines	• Automated logbook data functionality • Interface with existing systems • API integration with CBG producer app • Interface with existing GEL pipeline EVC • Connection to flow meter via Modbus • Configuration of communications with encryption • Store-and-forward functionality implementation • Proper grounding and surge protection implementation
9	Check Metering Stations	100	• Dual-SIM/Single-SIM multi-network support industrial cellular modem with industrial cellular modem with 4G/LTE failover to 2G (with SIM Cards) with RS-485/232 capability	• Check meter validation functionality • Volume totalization calculations • Meter health monitoring • Automated logbook data functionality

Sr. No.	Type of Station	No. of Stations	New Hardware to be installed by bidder	Services to be executed by the bidder
			• Cable glands for all field connections • Surge arrestors for communication lines	• Interface with existing flow meters and EVCs • Configuration of communications with encryption • Scheduled and on-demand data transmission • Proper grounding and surge protection implementation
10	LNG Dispensing Stations	TBD	• Type-2 RTUs with redundant SMPS diode-based power supplies • Ethernet connections for LNG dispenser control systems • Serial interface cables for legacy equipment • New pressure transmitters and temperature transmitters with displays for LNG storage • RS-485 cables to dispensers (FRLS armored & screened) • Isolation barrier modules (1 per 3 dispensers for Modbus) • Isolation barrier modules for all hazardous area connections • Dual-SIM/Single-SIM multi-network support industrial cellular modem	• Integration of all LNG dispenser and storage system I/O points • LNG dispensing efficiency analysis implementation • Automated logbook data functionality • Station sales reconciliation software for LNG operations • Remote price change interface implementation • LNG dispenser data read interface implementation • Remote ESD activation for LNG systems • Cryogenic safety system integration • LNG storage monitoring (level, pressure, temperature) • Boil-off gas management system interface

Sr. No.	Type of Station	No. of Stations	New Hardware to be installed by bidder	Services to be executed by the bidder
			with 4G/LTE failover to 2G (with SIM Cards) with RS-485/232 capability • New managed ethernet switches es where needed • Cable glands for all field connections (cryogenic rated) • Surge arrestors for all I/O and communication lines • Junction boxes with surge protection for LNG applications • FRLS armored screened cables for all field connections	• Protocol conversion for LNG-specific equipment • Store-and-forward functionality implementation • Proper grounding and surge protection implementation
11	Gas Exploration Site (E&P)	16	• Type-2 RTU with redundant SMPS diode-based power supply • Dual-SIM/Single-SIM multi-network support industrial cellular modem with 4G/LTE failover to 2G (with SIM Cards) with RS-485/232 capability • Cable glands for all field connections • Surge arrestors for all I/O and communication lines • Junction boxes with surge protection • Interface cables for existing Smart Water Meters	• Interface with existing Smart Water Meters via Modbus RTU/TCP • Provision for future integration with Mass Flow Meters (to be installed by GEL at a later stage) • Automated logbook data functionality • Configuration of communications with TLS encryption and DNP3 authentication • Store-and-forward functionality implementation • Scheduled and on-demand data transmission • Proper grounding and surge protection implementation

Sr. No.	Type of Station	No. of Stations	New Hardware to be installed by bidder	Services to be executed by the bidder
			• Provision for future Mass Flow Meter integration	• Water consumption monitoring and reporting • Future-ready architecture for Mass Flow Meter data acquisition

Station wise AMI Hardware Scope

3.4.15.Metering Sites with EVC (IMS)

3.4.15.1. Existing Setup

- Industrial and Commercial metering Skids are equipped with EVCs of multiple make and models for gas volume correction and billing measurement (Refer Annexure A).
- GEL's existing AMI system currently collects data from these EVCs through EVC built-in modems. The Bidder shall replace all existing modems with newly supplied Modems Reuse of any existing modem hardware is not permitted.
- EVC make and models vary across GEL's 29 GAs. Some EVCs communicate via Modbus RS-485/232; others use proprietary OEM protocols. A detailed list of EVC OEMs and models is provided in Annexure A.

3.4.15.2. New Hardware to be Supplied and Installed by Bidder

- The Bidder shall supply and install one new dual-SIM/single-SIM with multi-network capability using multi-IMSI technology industrial wireless Modem per EVC at each IMS location.
- The Bidder shall supply and install an antenna at each location, with appropriate mounting hardware and cable routing to achieve optimum signal reception.
- The Bidder shall supply and install a weatherproof enclosure for the Modem and associated accessories. The enclosure shall be positioned outside the metering skid in the safe zone, at a minimum distance of 1.5 metres from boundary for hazardous area, in line with prevailing field practice at GEL sites.
- If the modem is not ATEX/PESO certified, an appropriate ATEX/PESO certified safety barrier is to be installed by the bidder between EVC and the modem
- The Bidder shall supply and install shielded communication cable between the EVC communication port and the Modem.
- The Bidder shall supply and install surge protection devices on all communication lines.
- The Bidder shall supply and install cable glands at all field connections.
- All hardware installed in or near hazardous area classified zones shall be ATEX/PESO certified and suitable for the applicable area classification. The enclosure shall carry a minimum IP65 rating for outdoor installation in industrial environments.
- The Bidder shall determine and implement the power supply arrangement — mains, battery, or other source — required to meet the device availability SLA specified. GEL does not prescribe the power source; the Bidder is responsible for continuous device availability.
- The Bidder shall supply and install a **weatherproof industrial outdoor enclosure** for each Modem installation. The enclosure shall meet minimum IP65 ingress protection for outdoor industrial environments. The enclosure shall be installed in the safe zone, at a minimum distance of **5 feet (1.5 metres)** from the boundary of the hazardous area at the metering skid and shall not be positioned inside any hazardous classified zone. The enclosure shall be

wall-mounted or pole-mounted as dictated by site conditions. Where pole mounting is required, the Bidder shall supply and install the pole, including all civil foundation work, hardware, clamping brackets and associated accessories — pole installation is within the Bidder's scope. All ancillary items required for the weatherproof enclosure installation — cable glands, mounting plates, DIN rails, terminal blocks, breathers, hinged lockable door, anti-condensation heater where required and anti-tamper seal — shall be supplied and installed by the Bidder.

3.4.15.3. Work Associated with Implementation

- The Bidder shall conduct a physical site survey at each IMS location prior to installation, as detailed in this RFP.
- The Bidder shall engineer and implement the interface between the new Modem and the EVC via RS-232/RS-485, using shielded cable. Where the EVC requires externally supplied power at its serial/communication port to sustain the interface, the Modem shall provide it, within the EVC's intrinsic-safety limits.
- The Bidder shall configure the communication protocol between the Modem and EVC — Modbus RTU/TCP or the applicable EVC OEM proprietary protocol — using the appropriate driver in the AMI Platform.
- The Bidder shall configure each device to implement the device communication behaviour specified— daily once data push (including hourly log of all stored parameters in the last 24 hours), real-time event push, hourly pull-request check and hourly operational-data push to EMS and NMS — and shall verify all four behaviours during commissioning before the location is declared commissioned.
- Where the AMI Platform does not natively support an EVC OEM's communication protocol, the Bidder shall develop the required driver.
- The Bidder shall configure TLS 1.2 or higher encryption on all data communication between the Modem and the AMI Platform.
- The Bidder shall configure the modem to push data transmission at all required frequencies, with a minimum of daily standard read with 24 hourly interval reads pushed at least once daily, with all alarms and events clubbed with the hourly push. All parameters as present in the hourly logs of existing EVC / MIU shall be pushed to AMI System as per pre-define periodicity by the modem.
- The Bidder shall configure on-demand (pull) data read capability for each device.
- AMI Software shall be capable to push/pull data based on GEL EIC requirements
- Daily, Hourly, interval based as per the time frame mentioned in customized way in terms of Dates. All parameters' data configured in EVC's to be retrieved remotely from AMI software.
- The Bidder shall implement store-and-forward functionality based on available EVC or Modem memory to retain data during communication outages and transmit on reconnection.
- For each deployed modem the Bidder shall either configure OTA firmware update capability through the AMI Platform or firmware update through wired connection. The bidder shall be responsible for all firmware updates either via OTA or through on-ground wired connection throughout the contractual duration.

- The Bidder shall register and commission each device in the AMI Platform, verify successful data transmission and confirm that the AMI Platform is correctly receiving and processing data from the device before completing installation at that location.
- All installation activities shall be carried out in the presence of GEL's designated representative. Comprehensive installation records including photographs, signal strength readings and commissioning test results shall be maintained for each location.
- The Bidder shall restore the site to its pre-installation condition on completion of works at each location.

3.4.15.4. Connectivity

- The Bidder shall design and deploy WAN connectivity for each IMS location using the communication technology — cellular or NB-IoT— selected by the Bidder based on site signal survey results and the SLA requirements.
- Each Modem shall be fitted with dual SIM/single-SIM with multi-operator capability cards. The primary and secondary SIM slots shall be configured for automatic failover. The Bidder shall, where operationally feasible, use SIM cards from two different network operators across the two SIM slots to maximise network redundancy.
- The Bidder shall activate both SIM slots, verify data transmission on each slot independently and confirm automatic failover between slots during commissioning testing.
- All SIM cards shall be registered in GEL name under appropriate industrial/IoT service plans.

The Bidder shall configure a dedicated APN or equivalent secure network configuration for all SIM cards to prevent unauthorised access to the communication channel

3.4.16.Positive Displacement Meters

3.4.16.1. Existing Setup

- PD (Diaphragm) meters have provision to interface with MIU.
- At present, meter reading of PD meter locations is carried out manually. Under this RFP, new MIUs shall be supplied, installed, operated and maintained by the Bidder for the entire contract duration.
- PD meters at these locations vary by make and model across GEL's network. A detailed list of PD meter locations is provided in Annexure A.

3.4.16.2. New Hardware to be Supplied and Installed by Bidder

- The Bidder shall supply and install new MIU per PD meter at each in-scope location. Each MIU shall incorporate a built-in communication modem or shall be paired with a dedicated external communication modem. MIU shall be ATEX/PESO certified for installation in Zone-1/Zone-2 Hazardous area.
- If the MIU is not ATEX/PESO certified, an ATEX/PESO certified safety barrier is to be installed by the bidder between PD meter and the MIU

- The Bidder shall supply and install pulse interface cabling from the PD meter's pulse output port to the MIU input. All pulse cabling shall be shielded and routed appropriately for the installation environment.
- The Bidder shall supply and install appropriate mounting hardware and a weatherproof enclosure for the MIU, rated at minimum IP65 for outdoor industrial use.
- The Bidder shall supply and install surge protection devices on communication lines.
- The Bidder shall supply and install cable glands at all field connections.
- All hardware shall be ATEX/PESO certified for the applicable hazardous area classification at the installation site.
- Where the MIU is of snap-fit type and mounts directly on the meter index, no additional enclosure is required provided the MIU's own housing meets minimum IP65. Where the MIU is not of snap-fit type, the Bidder shall supply and install a **weatherproof junction box** with a hinged, lockable door for the MIU. The junction box shall be mounted at the most appropriate position for the site — **wall-mounted, pole-mounted, or pipe-mounted** — based on site conditions identified during the Phase 1 survey. Where pole or pipe mounting is required, the Bidder shall supply and install all associated mounting hardware, brackets and civil works. All ancillary items — cable glands, mounting hardware, DIN rails, anti-condensation provisions and anti-tamper seals — shall be supplied and installed by the Bidder. The wire-seal provision specified shall apply regardless of mounting type.
- The Bidder shall determine and implement the power supply arrangement required to meet the device availability SLA specified.

3.4.16.3. Work Associated with Implementation

- The Bidder shall conduct a physical site survey at each PD meter location prior to installation, including assessment of the pulse output interface, pulse cabling route and site conditions..
- The Bidder shall supply and install pulse interface cabling between the PD meter pulse output and the MIU. Cable routing shall protect cabling from mechanical damage and environmental exposure.
- The Bidder shall configure the pulse constant in the MIU to match the PD meter's rated pulse output per unit volume and verify pulse count accuracy against a concurrent manual meter reading before installation is complete.
- The Bidder shall configure TLS 1.2 or higher encryption on all communication between the MIU and the AMI Platform.
- The Bidder shall configure each device to implement the device communication behaviour specified — hourly interval data push, real-time event push, hourly pull-request check and hourly operational-data push to EMS and NMS — and shall verify all four behaviours during commissioning before the location is declared commissioned.
- The Bidder shall configure on-demand (pull) data read capability for each device.
- For each deployed modem the Bidder shall either configure OTA firmware update capability through the AMI Platform or firmware update through wired connection. The bidder shall be

responsible for all firmware updates either via OTA or through on-ground wired connection throughout the contractual duration.

- The Bidder shall configure OTA firmware update capability for each deployed MIU through the AMI Platform.
- The Bidder shall register and commission each MIU in the AMI Platform, verify successful data transmission and confirm that the AMI Platform is correctly receiving and processing pulse-count data from the device before completing installation at that location.
- All installation activities shall be carried out in the presence of GEL's designated representative, with comprehensive installation records including photographs, pulse count verification data, signal strength readings and commissioning test results maintained for each location.
- The Bidder shall restore the site to its pre-installation condition on completion of works at each location.
- The MIU shall capture the meter index in a manner that is numerically identical to the mechanical index displayed on the PD meter at the time of reading. The Bidder shall configure the pulse constant per device to make sure the MIU-derived cumulative volume matches the mechanical index reading at all times. Any discrepancy between the MIU-captured index and the mechanical index at the time of commissioning constitutes a commissioning failure.

3.4.16.4. Connectivity

- The Bidder shall design and deploy WAN connectivity for each PD meter location using the communication technology selected by the Bidder based on site signal survey results and SLA requirements.
- Each MIU modem (built-in or external) shall support dual-SIM/single-SIM with multi-network capability using multi-IMSI technology operation with automatic failover. The Bidder shall activate both SIM slots, verify data transmission on each and confirm failover functionality during commissioning testing.
- All SIM cards shall be registered in GEL name.
- The Bidder shall configure a dedicated APN or equivalent secure network configuration for all SIM cards.

3.4.17.Indicative Scope of AMI

Sr. No.	Location Type	No. of Locations (Indicative)	New Hardware to be Supplied and Installed by Bidder	Services to be Performed by Bidder
1	Metering Skid (IMS) — with EVC	3,158	- New dual-SIM/single-SIM with multi-network capability using multi-IMSI technology industrial wireless Modem per EVC - Antenna with mounting hardware - Weatherproof enclosure where applicable (outside skid, safe zone, min. 1.5m from the boundary of the metering skid) - Shielded cable between EVC and Modem - Surge protection devices - Cable glands and mounting accessories	- Physical survey and site assessment - Interface with EVC via RS-232/RS-485 - Configuration of communication protocol (Modbus RTU/TCP or EVC OEM protocol as applicable) - TLS-encrypted communication to AMI Platform - Push and pull data collection configuration - OTA firmware update capability - Device registration and commissioning in AMI Platform - Parallel operations data collection and reconciliation
2	Positive Displacement (Diaphragm) Meter	1,439	- New MIU with built-in or dedicated external modem per PD meter - Pulse interface cabling from PD meter pulse output to MIU - Antenna with mounting hardware - Weatherproof enclosure where applicable (outside skid, safe zone, min.	- Physical survey and site assessment, including pulse output interface evaluation - Supply and installation of pulse interface cabling - MIU configuration with correct pulse constant per meter - TLS-encrypted communication to AMI Platform - Device registration and commissioning in AMI Platform

Sr. No.	Location Type	No. of Locations (Indicative)	New Hardware to be Supplied and Installed by Bidder	Services to be Performed by Bidder
			1.5m from the boundary of the metering skid) - Surge protection devices - Cable glands and mounting accessories	- Parallel operations data collection and reconciliation
3	Commercial Metering Sites — with EVC	Part of 3,158 above	Same as Row 1	Same as Row 1
4	Domestic Meters with G1.6 PD meters	100	- New MIU with built-in or dedicated external modem per PD meter - Pulse interface cabling from PD meter pulse output to MIU - Antenna with mounting hardware - Weatherproof enclosure - Surge protection devices - Cable glands and mounting accessories	- Physical survey and site assessment, including pulse output interface evaluation - Supply and installation of pulse interface cabling - MIU configuration with correct pulse constant per meter - TLS-encrypted communication to AMI Platform - Device registration and commissioning in AMI Platform - Parallel operations data collection and reconciliation

3.5. General AMI Platform Scope of Work

This section defines the requirements for the AMI Platform and all associated software components. Detailed functional specifications for each module are provided.

The Bidder shall design, supply, install, test, commission, operate and maintain a complete Advanced Metering Infrastructure (AMI) System for Gujarat Energy Limited, covering all field metering locations made up of EVC-equipped metering and Positive Displacement metering sites — across GEL's 29 Geographical Areas. In the event of any discrepancy between quantities stated in this Scope of Work and quantities in the Schedule of Rates, the Schedule of Rates shall prevail for commercial purposes; the Bidder shall flag such discrepancies in writing to GEL during Phase 1.

The Bidder shall conduct a mandatory parallel operations period — indicatively 30 days — during which both systems shall simultaneously collect data from the same field devices. The Bidder shall provide a batch-wise comparative data reconciliation report.

The AMI Platform is the central software system through which all field metering data flows. It is structured across four functional layers — HES (Head-End System), MDMS (Meter Data Management System), NMS (Network Management System) and EMS (Enterprise Management System) — each with a dedicated scope sub-section below. Cross-cutting capabilities that span all four layers are covered in the sub-sections.

3.5.1. AMI Platform Overview and General Requirements

- The Bidder shall deploy a COTS AMI Platform on a MeITY-empanelled private cloud with all data centres within India. The Cloud Service Provider shall maintain active MeITY empanelment for the full contractual period including any extensions; loss of empanelment shall require immediate migration to a compliant provider at the Bidder's cost with no disruption to GEL operations.
- The AMI Platform shall be hosted in a primary cloud data centre with a geographically separate Disaster Recovery (DR) site. The DR site shall be in a different geographic region from the primary. Automatic failover to the DR site shall be configured and tested with a Recovery Time Objective (RTO) of four hours or less and a Recovery Point Objective (RPO) of one hour or less.
- All GEL data under this contract shall reside and remain within the territorial boundaries of India at all times, throughout the contract period and any extension. "GEL data" means all field metering data, processed and billing data, customer data, alarms and events, logs, telemetry, backups, archives, configuration and any derivative data held or generated by the AMI Platform or any connected component. No GEL data shall be stored, replicated, backed up, cached, processed or transmitted to any location, data centre, service or person outside India, whether by the Bidder, the Cloud Service Provider, any OEM, or any sub-processor.
- The AMI Platform shall support the contracted metering scope and shall be scalable to a minimum of 7,000 metering points without architectural redesign, performance degradation, or additional per-node licence cost beyond the contracted rate.
- The Bidder shall demonstrate at least two live utility references for the proposed COTS AMI Platform at the time of bid submission.
- The AMI Platform architecture — whether a single unified COTS product or separate pre-integrated components — is at the Bidder's discretion, provided all functional requirements

are met. Where HES and MDMS functionality are delivered as separate products, they shall be pre-integrated at the time of bid submission; custom integration developed at implementation is not acceptable.

3.5.1.1. Module Classification — Mandatory and Desirable

- Every functional module of the AMI Platform is classified in this RFP as either Mandatory or Desirable. The classification for each module is set out in the table below and governs the treatment of that module in bid evaluation, in the FRS/SRS, in testing and acceptance and in the SLA framework.
- Mandatory modules are required in full. No deviation, alternative, or exclusion is permitted against any Mandatory module. A bid that proposes an alternative to, or an exclusion from, any Mandatory module shall be considered non-responsive.
- Desirable modules are not conditions of bid responsiveness. The Bidder shall state Offered or Not Offered against each Desirable module in the Technical Bid. A statement of "Not Offered" shall not attract disqualification.
- Where a Desirable module is stated as Offered, it becomes a binding contractual deliverable on the same terms as a Mandatory module — included in the approved FRS/SRS, demonstrated at Field Trial/POC and UAT, sustained for the contractual period
- Where a Desirable module is stated as Not Offered, GEL may require it at any time during the contractual period through the change management process, at rates to be mutually agreed.

Layer	Module	Classification
Platform-wide	System Architecture and General Requirements	Mandatory
Platform-wide	Interoperability and Open Standards	Mandatory
Platform-wide	Driver Source Code and Licence	Mandatory
Platform-wide	Multi-OEM EVC and PD Meter Integration	Mandatory
HES	Device Communication and Data Acquisition	Mandatory
MDMS	Meter Data Storage and Collection	Mandatory
MDMS	Validation, Estimation and Editing (VEE)	Mandatory
MDMS	Billing Determinant Calculation	Mandatory
MDMS	Asset Management — incl. Cross-Replacement Continuity and Field Device Maintenance Management	Mandatory
MDMS	Device Lifecycle and Reconciliation	**Desirable**
MDMS	Alarm, Event and Exception Management	Mandatory
MDMS	Revenue Protection and Loss Analytics	Mandatory
NMS	Communication Network Monitoring and SIM Management	Mandatory
EMS	SLA Monitoring and Compliance Reporting	Mandatory

Layer	Module	Classification
Cross-cutting	Reporting and Dashboards	Mandatory
Cross-cutting	Integration with GEL Enterprise Systems	Mandatory
Cross-cutting	Security and Compliance	Mandatory
Cross-cutting	Data Responsibility — Lapses, Loss and Theft	Mandatory
Cross-cutting	GEL Staff User Interfaces (web portal and mobile application)	Mandatory
Cross-cutting	Data Migration and Parallel Operations	Mandatory
Cross-cutting	Maintenance, Updates and Version Management	Mandatory
Cross-cutting	Quality Assurance, FAT, SAT and UAT	Mandatory

3.5.2. Interoperability and Open Standards

- The AMI Platform shall be built on open, documented protocols and data standards — including Modbus RTU/TCP, DLMS/COSEM, MQTT and REST APIs — so that GEL can independently connect third-party systems, onboard new field devices and replace any platform component at contract expiry without architectural constraints. No proprietary interface that creates vendor lock-in at any layer is acceptable.
- At contract expiry, GEL or its successor shall be able to onboard Modems and MIUs from any compliant manufacturer through the platform's open API and standard protocol interfaces, without requiring any architectural change to the AMI Platform. The Bidder shall demonstrate this capability during UAT by simulating onboarding of a device from a manufacturer different from the originally deployed hardware.
- All integration interfaces between the AMI Platform and GEL enterprise systems shall conform to the IEC 61968-9 CIM data model or an equivalent industry-standard data model agreed with GEL before Go-Live.
- All hardware supplied under this RFP shall be newly manufactured, carry a remaining manufacturer support life of at least five years from the planned Go-Live date and not be at or beyond End-of-Life or End-of-Support at the time of supply.
- The proposed hardware devices procured under this contract shall support open protocols and shall be compatible with any other AMI systems which support open protocols.

3.5.3. Multi-OEM EVC and PD Meter Integration

- The AMI Platform shall communicate with all EVC makes and models in GEL's network as listed in Annexure A. No EVC location shall be excluded due to protocol limitations or proprietary interface constraints. All future EVC makes and models introduced during the contractual period shall likewise be integrated; a separate one-time SOR line item shall apply per new EVC make or model not present in Annexure A at contract award.
- The Bidder shall maintain a driver library covering all EVC OEMs in GEL's installed base and shall develop drivers for any OEM not natively supported by the proposed platform. Driver

development for all OEMs in Annexure A at contract award is within scope at no additional cost to GEL.

- The AMI System shall read data from EVCs and shall remotely update EVC alarm thresholds through the AMI Platform. This is a **Mandatory** requirement.
- Remote configuration of EVC parameters beyond alarm thresholds — the writing of configuration values to the EVC from the AMI Platform — is classified as a **Desirable** function. Where the Bidder states this function as Offered, GEL retains the sole right to activate or not activate it at any time during the contractual period.
- The AMI Platform shall communicate with all PD meter MIU types installed under this RFP; all PD meter locations, Integration is via the MIU pulse interface, are in scope without exception.
- All liaison with EVC and PD meter OEMs required to complete driver development, resolve protocol ambiguities, obtain technical documentation and fulfil any other obligation under this RFP shall be the sole responsibility of the Bidder; GEL shall not be required to intervene or facilitate communication with any OEM on the Bidder's behalf.
- Where an EVC or PD meter OEM does not cooperate or imposes conditions that delay driver development or integration, the Bidder shall resolve such impediments independently and at its own cost; delays or failures attributable to OEM non-cooperation shall not constitute grounds for milestone extension or additional charges to GEL.

3.5.4. Layer 1 — Head-End System (HES) Functionality

3.5.4.1. Device Communication and Data Acquisition

- The HES layer shall manage all two-way communication between the AMI Platform and field devices — EVC Modems and PD meter MIUs — covering device registration, protocol translation, scheduled polling, on-demand reads, alarm event push and firmware management.
- Communication shall operate in push (device-initiated) and pull (server-initiated, on-demand) modes, independently configurable per device or device group. Both modes are mandatory.
- Communication shall operate in push (device-initiated) and pull (server-initiated, on-demand) modes, independently configurable per device or device group. Both modes are mandatory. The HES shall receive and process the hourly data push, real-time event push and hourly operational-data push from every field device as specified in the RFP and shall support on-demand pull reads to any device or device group.
- The HES shall support NTP-based time synchronisation across all devices with IST as the mandatory reference; firmware OTA updates with signed firmware and rollback capability; and store-and-forward with automatic data backfilling from device internal memory following communication outages.
- Where HES and MDMS functionality are delivered as separate products, their interface shall be a pre-integrated, native data flow using IEC 61968-9 CIM or an equivalent standard agreed with GEL.
- The Bidder shall provide an independent fallback data path for EVC field data that remains available when the AMI Platform is unavailable — including where both the primary and

Disaster Recovery instances of the AMI Platform are down or the platform is otherwise unable to receive field data. The objective is that GEL is never without visibility of live EVC field data and that no EVC field data is lost during an AMI Platform outage.

- This fallback shall be provided through the individual EVC OEM Head-End System (OEM HES) for each EVC make in GEL's network. The Bidder shall implement one of the following, at the Bidder's choice but subject to GEL's acceptance: (a) host the individual EVC OEM HES for each make on the Bidder's own infrastructure, ensure EVC field data reaches this OEM HES and provide GEL access to it through a portal; or (b) ensure EVC field data reaches the EVC OEM HES (installed at all GEL offices) and provide GEL with direct access to the field data held on that OEM HES. Under either option, GEL's access shall require no separate licence cost to GEL and shall be available for the full contract period.
- The fallback EVC data path shall be live and continuously available, not a mechanism that must be built or activated only after an outage begins. During normal operation it may run in parallel with the AMI Platform; during an AMI Platform outage it shall be the means by which GEL continues to view EVC field data. GEL's access to the OEM HES shall be read access to field data, with role-based visibility consistent with the RFP.
- On restoration of the AMI Platform, all EVC field data collected during the outage shall be reconciled into the AMI Platform without loss, gap or duplication, so that the AMI Platform remains the complete system of record. This reconciliation is additional to and shall not replace, device store-and-forward backfill.
- For PD-meter MIU locations, which have no OEM Head-End System, continuity during an AMI Platform outage shall be provided by device store-and-forward and automatic backfill on restoration, as specified elsewhere in this Section.
- All EVC field data held on any OEM HES, whether hosted by the Bidder or the OEM, is GEL data. The Bidder shall ensure GEL's access to it, its security in line with the platform security framework and its return or deletion at contract end per the data-portability and exit provisions.

3.5.4.2. Device Communication Behaviour

Every EVC Modem and PD meter MIU supplied under this RFP shall implement the following communication behaviour as a minimum. This behaviour is mandatory for every device and is not configurable below these minimums, though GEL may configure more frequent operation.

- **Hourly interval data push.** Each device shall record metering data at hourly intervals (or stored logs in EVC could be fetched by the modem as required) and shall push, in push (device-initiated) mode, all twenty-four (24) hourly readings for a day to the AMI Platform at least once per day, together with current configuration of the EVC / MIU and all parameters present in the hourly logs of the EVC or MIU. No hourly reading shall be omitted and each reading shall carry the original EVC-side or MIU-side timestamp.
- **Event, alarm and configuration push.** Each device shall detect and record all alarms, events and configuration changes as they occur and shall push them to the AMI Platform on its next hourly listening-window wake. The maximum latency between an alarm occurring at the device and its arrival at the AMI Platform shall not exceed one (1) hour.
- **Hourly pull-request check (listening window).** Each device shall establish a session with the AMI Platform **at least once every hour** and check for and execute, any pending pull

request, configuration push, or queued command from the platform. The listening interval shall be configurable by authorised GEL users and shall in no case be configurable to a value longer than one hour. The listening window shall operate independently of the scheduled data push; a device shall not omit a listening window on the basis that no push was due. On each hourly wake, in the same session, the device shall (a) check for and execute any pending pull request or command, (b) push its operational/health telemetry to the EMS and NMS and, (c) push any alarms and events recorded since the previous wake. All three are performed in a single hourly session so the device radio is activated once per hour.

- **Operational data push to EMS and NMS on each wake.** On each hourly wake, in addition to the above, each device shall push its own operational and health telemetry to the EMS and the NMS, covering at minimum: device online status, last successful read timestamp, signal strength (RSSI/SINR) per active SIM slot, active SIM identity, battery level or power status, firmware version, packet-loss/communication-quality indicators and any self-diagnostic flags. This telemetry feeds the NMS communication-health monitoring (and the EMS SLA event capture without manual intervention.
- **Store-and-forward integrity.** Where any hourly push, event push, or operational-data push cannot be delivered due to a communication outage or any other issue, the device shall buffer the data in internal memory and backfill it in chronological order on restoration, with no loss and with original EVC timestamps preserved.

The Bidder shall size each device's power arrangement and, where applicable, battery, to sustain this hourly wake/push/listen duty cycle for the full contractual period without reducing any frequency. Battery depletion shall not be grounds for extending the listening interval or reducing push frequency.

- All device behaviour parameters shall be configurable by authorised GEL users through the AMI Platform, without vendor involvement and without firmware changes, within the mandatory minimums set in this RFP. Configurable parameters shall include at minimum: data logging interval, data push schedule and frequency, listening-window interval, operational-telemetry push frequency, alarm reporting behaviour and the parameter sets that constitute each stored device profile. Configuration changes shall be pushed to devices over the air on the device's next listening window and shall be versioned with effective dates and an audit trail of who changed what and when.
- The Bidder shall support multiple named behaviour profiles stored on each Modem — at minimum a Normal profile and a Power-Saving profile — each being a complete set of the configurable behaviour parameters above. GEL shall be able to define, edit and assign profiles through the AMI Platform. A device shall be able to switch profiles automatically on a defined trigger, or on GEL command.
- At mains-powered EVC Modem locations, on detection of a mains-supply failure the Modem shall automatically switch to the GEL-approved Power-Saving profile, so configured that the Modem's backup battery sustains operation for a minimum of 72 hours (3 days) during the mains outage. On restoration of mains supply the Modem shall automatically revert to the Normal profile. During the Power-Saving profile the Modem shall continue to record all metrology and event data so that no data is lost — any communication deferred to conserve battery shall be buffered and backfilled on reversion, per store-and-forward. The power-failure alarm itself shall be reported on the next listening window as for any alarm.

- The Power-Saving profile is the sole sanctioned reduction of the device duty cycle; it applies only for the duration of a mains-failure event at a mains-powered device and does not relax the duty cycle during normal operation (see the amended power-sizing bullets in this Section).
- The AMI Platform configuration interface shall display, at the point of configuration and before a change is applied, the calculated effect of the proposed device-behaviour configuration on device battery endurance — specifically, for EVC Modems, the resulting backup-battery autonomy against the 72-hour (3-day) target and for PD-meter MIUs, the resulting battery life against the 5-year target. Where a proposed configuration would cause either target to be breached, the platform shall warn the user and shall require an explicit authorised override to proceed, recording the override in the audit trail.

3.5.5. Layer 2 — Meter Data Management System (MDMS)

3.5.5.1. Meter Data Storage and Collection

- The MDMS shall maintain a centralised data repository for all meter data collected from EVCs and MIUs, retaining all collected and processed data for a minimum of 10 years with full retrieval and export capability for any historical period.
- Original raw data received from field devices shall be preserved in a non-manipulated state alongside processed data for the full retention period. No user — including system administrators — shall be able to modify or delete raw data records.
- The MDMS shall support customer grouping by customer type (Industrial/Commercial), geography, GA, billing cycle (7-day, 10-day, 15-day) and any other configurable filter required by GEL for operational and billing purposes.
- Automated data archival shall run at 180-day intervals or at such other interval specified in the approved FRS/SRS. The Bidder shall document and demonstrate the archival and restoration process before Go-Live.
- The MDMS shall automatically detect data gaps in historical records and trigger backfilling from device internal memory, with conflict resolution for overlapping periods and duplicate records handled without manual intervention.

3.5.5.2. Validation, Estimation and Editing (VEE)

- The AMI Platform shall process all collected meter data through a configurable VEE engine before any use in billing or reporting. All VEE rules shall be configurable by GEL without vendor involvement.
- Validation shall cover at minimum: consumption threshold checks, zero consumption detection, consecutive identical reading detection, negative flow (reverse flow) detection, digit overflow correction and pulse coherence verification between MIU and PD meter readings.
- Where validation identifies missing or anomalous values, the VEE engine shall automatically trigger estimation using industry-standard methods configurable per customer segment. The

estimation workflow shall be configurable: auto-application, manual review before application, or estimated value as a suggestion pending GEL approval.

- All manual edits to validated or estimated values shall require a reason code from a configurable list and an authorisation workflow. Every edit shall be logged in an immutable audit trail with editor identity, timestamp, original value and new value.
- An automated daily data quality report covering completeness, accuracy and discrepancies shall be generated and made available to GEL's GA Teams without manual intervention.

3.5.5.3. Billing Determinant Calculation

- The MDMS shall calculate all billing determinants required by GEL's SAP Billing system, including total gas consumption (SCM), energy (MMBTU or GJ), peak flow rate, time-of-day block consumption, imbalance quantity against Contract Demand or Annual Quantity and average calorific value. No PTZ correction shall be applied at the platform level; EVCs supply corrected volume (Qb) directly.
- Billing determinant calculation shall support GEL approved (a minimum of 7-day, 10-day and 15-day) billing cycles operating concurrently, with each customer assigned to one cycle. Determinant extraction shall operate independently per customer's assigned cycle without cross-cycle interference.
- ToD tariff configuration shall be available by customer category, day type (weekday, weekend, holiday) and season. The number and duration of ToD blocks shall be configurable by GEL without vendor involvement.
- Special metering situations — check metering, sub-metering, bi-directional metering and multiple meters at the same premises — shall be handled correctly in all billing and reporting calculations.
- Validated billing determinants shall be delivered automatically to GEL's SAP Billing system on or before each customer's scheduled billing date. A manual reading entry workflow shall be available as a fallback for locations where automated collection has failed before the billing date; manual entries shall be flagged in the SAP export.

3.5.5.4. Asset Management

- The AMI Platform shall maintain a master asset repository covering all installed metering assets, including meter location, customer information (name, BP number), service line number, meter ID, meter type, configuration parameters, GIS coordinates and customer hierarchy association (DRS, SLP, CGS, Distribution Main).
- GIS coordinates shall be maintained for every installed device, with map visualisation and hierarchical navigation from network level down to individual device level, filterable by status, customer category, GA and communication technology.
- Damage and deterioration events shall be loggable against any asset with cause attribution (customer, operations, environment) and a complete in-service location history per device.
- Bulk asset data import through file upload shall be supported, with validation against existing records and error reporting before the import is committed.

- Gas consumption history shall be maintained without interruption across meter, EVC and MIU replacements; consumption continuity shall be preserved at the customer level even when the underlying device is replaced, with no data loss.
- The AMI Platform shall maintain a configurable preventive maintenance schedule per device type, generate maintenance work orders on schedule and on condition trigger, maintain a per-device service history and provide a maintenance compliance dashboard segmented by GA and device type.

3.5.5.5. Device Lifecycle and Reconciliation

- The AMI Platform shall manage the full device lifecycle — registration, installation, provisioning, operations, maintenance and decommissioning — through a defined workflow with enforced status transitions and appropriate authorisation requirements per transition.
- Automated reconciliation reports shall identify meters installed but not communicating for a configurable duration, segmented by GA, communication technology and customer category, without manual generation.
- A real-time dashboard shall display pending, in-progress, installed and decommissioned device counts by GA, updating continuously.

3.5.5.6. Alarm, Event and Exception Management

- The AMI Platform shall support a configurable alarm framework covering: safety alarms (tamper, cover open, pulse cable cut, pressure exceedance, power supply failure); revenue alarms (zero consumption, consumption threshold breach, Daily Order Quantity exceedance); network alarms (communication failure, signal quality degradation, device offline, time synchronisation failure); and device health alarms (low battery, firmware fault, metrological sensor failure, pulse coherence failure, volume under alarm, spare volume conditions).
- All alarms, including tamper and other safety-related alarms, shall reach the platform within one (1) hour of the device event, being reported on the device's next hourly wake. All alarm categories, priorities and threshold values shall be configurable by authorised GEL users without vendor involvement.
- Multi-channel notifications — Email, SMS, WhatsApp and mobile application push — shall be configurable per alarm category and per recipient role. Notification delivery confirmation shall be logged for audit.
- Alarm acknowledgement, configurable escalation rules for unacknowledged alarms, resolution tracking with notes and service order auto-generation from configured alarm types shall be available. Service orders shall route to GEL's Workforce Management system through standard APIs.
- Complete alarm history and trend data shall be retained for the full contractual period, with trend reports available by alarm type, device, customer and GA.
- Exceptions shall be automatically generated for devices not delivering accurate meter data post-installation. Exception criteria shall be configurable per device type and customer category.

3.5.5.7. Revenue Protection and Loss Analytics

- The AMI Platform shall analyse meter tamper flags, zero consumption patterns and DRS/SLP-level material balance — comparing measured input against aggregate metered output — to identify Non-Technical Loss. Material balance reconciliation shall run daily, with anomalies flagged automatically.
- Pattern analysis shall compare each customer's consumption against their own historical profile and against comparable customers in the same category and geography. Configurable business rules shall drive alert generation and shall be adjustable by authorised GEL users through a user interface that does not require programming skills; rule changes shall be versioned with effective dates.
- Authorised field activity records shall suppress false-positive alerts during planned maintenance and meter replacements. A field activity calendar maintained by authorised GEL users shall drive alert suppression.
- A case management workflow shall support suspect customer investigation with multi-user collaboration, activity logging and evidence capture. Service orders for field investigation shall be auto-generated and routed to the appropriate GA Team.
- Investigation outcomes shall be logged back to the case, enabling trend analysis of revenue protection effectiveness over time.

3.5.6. Miscellaneous Activities for All Locations

3.5.6.1. General

The Bidder shall execute the miscellaneous activities described in this section across all EVC and PD meter locations as applicable, based on the specific scope identified during the Phase 1 site survey and detailed engineering. These activities support the core installation, commissioning and operation of the AMI System and are part of the Bidder's contracted scope under this RFP. The Bidder shall inform GEL at least **seven (7) calendar days** in advance before commencing any work at any location and shall obtain written permission and work permits from GEL. Work shall commence only after the Bidder receives the required approvals and shall be carried out in accordance with GEL's health, safety and environmental guidelines and applicable OISD standards. Pre-Installation Activities and Site Preparation Permissions and Regulatory Compliance

- The Bidder shall obtain a work permit from GEL for each location for each day of work, maintaining continuous authorisation throughout the installation period at that location.
- The Bidder shall submit detailed work plans and schedules for GEL's approval before commencing work at each location and shall coordinate with GEL's GA Teams to minimise disruption to ongoing operations.
- The Bidder shall secure all regulatory clearances and permits required by local authorities, including PESO clearances for work in or adjacent to hazardous classified areas.
- The Bidder shall obtain GEL's HSE Permit to Work (PTW) before commencing work, as per GEL's prevailing PTW procedure.
- The Bidder shall coordinate with the respective GEL GA Team and department heads for site access and scheduling.

3.5.6.1.1. Site Assessment and Documentation

- The Bidder shall study the existing EVC or PD meter configuration, communication port type and field conditions at each location before commencing physical work.
- The Bidder shall conduct a signal strength assessment at each location to determine antenna requirements and optimal placement for the selected communication technology.
- The Bidder shall record the data collection performance of GEL's existing AMI system at each location, as the baseline for parallel operations reconciliation.
- The Bidder shall document any deviation from the survey findings or proposed installation design and shall propose corrective measures for GEL's approval before proceeding.

3.5.6.1.2. Safety Implementation

- The Bidder shall deploy at least one qualified safety officer in each Geographical Area (GA) while installation work is being carried out in that GA.
- The Bidder shall conduct a mandatory safety briefing with all personnel before commencing work at each location.
- The Bidder shall perform a Job Safety Analysis (JSA) for all installation activities and obtain GEL's approval before work begins.
- The Bidder shall provide and enforce the use of appropriate personal protective equipment (PPE) suitable for the hazardous area classification at each work site.
- The Bidder shall carry out all work in line with GEL's health and safety guidelines and applicable OISD / other industry relevant standards.

3.5.6.1.3. Power Supply Design and Power Calculation

GEL does not prescribe whether field devices shall be mains-powered or battery-operated. The Bidder is free to select the power arrangement for each device type based on site conditions, provided the arrangement meets the device availability SLA and the battery backup requirements in this RFP. However, the Bidder shall demonstrate the adequacy of its proposed power design through formal power calculations.

- The Bidder shall submit a **power calculation and power budget** for each device type (EVC Modem and MIU) to GEL as part of the Phase 2 deliverables, before hardware installation commences.
- For EVC Modems, the Bidder may select the power arrangement (mains with backup, or battery). PD meter MIUs shall be battery-only. The Bidder shall demonstrate the adequacy of the proposed power design through formal power calculations.
- **For battery-operated devices**, the power calculation shall demonstrate that the proposed battery capacity supports a minimum operating life of **five (5) years** under the stated data transmission frequency, accounting for communication retries, signal conditions and ambient temperature variation across GEL's operating geography. The calculation shall state the battery chemistry, rated capacity, expected current draw per operating mode (sleep, active, transmit), duty cycle and the derived battery life.

- **For mains-powered devices**, the power calculation shall demonstrate the device's continuous power consumption, the rating of the proposed power supply module and the sizing of the battery backup that maintains continuous device operation for a minimum of **72 hours (3 days)** during a mains supply failure. The calculation shall state the backup battery capacity, current draw during mains failure and the derived backup autonomy. This mains-backup calculation applies to EVC Modems only where mains is proposed. This battery shall be rechargeable through the mains power on site.
- MIUs are battery-only and shall instead demonstrate a 5-year battery-life calculation as per RFP duty cycle.
- The Bidder shall update the power calculation if the device configuration, transmission frequency, or communication technology changes during the project.
- GEL reserves the right to review the power calculation and require revision where the calculation does not adequately support the device availability SLA or the battery life and backup requirements.

3.5.6.1.4. Installation Activities

- **Modem Installation at EVC Locations**

- The Bidder shall install one new dual-SIM/single-SIM with multi-network capability using multi-IMSI technology. Modem per EVC, interfaced to the EVC communication port via RS-232 or RS-485 using shielded cable.
- The Bidder shall install the Modem within a weatherproof enclosure positioned in the safe zone, at a minimum distance of 5 feet (1.5 metres) from the boundary of the metering skid, wall-mounted or pole-mounted as dictated by site conditions. Where pole mounting is required, pole supply, installation, civil foundation work and all ancillary mounting hardware are within the Bidder's scope. The Bidder shall install the antenna at the optimal position determined during the signal survey, with appropriate mounting hardware and cable routing. MIU Installation at PD Meter Locations the Bidder shall install one MIU per PD meter, snap-fit directly to the meter index where supported, or connected via pulse cable (supply of pulse cable within Bidder’s scope) and housed in a weatherproof junction box where snap-fit is not feasible.
- Where the MIU is housed in a junction box, the box shall be wall-mounted, pole-mounted, or pipe-mounted based on site conditions, with all mounting hardware and ancillaries supplied and installed by the Bidder.
- The Bidder shall configure the MIU pulse constant to match the PD meter's rated pulse output and shall verify index parity against the mechanical index at commissioning.

- **Enclosures and Ancillaries**

- The Bidder shall supply and install all weatherproof enclosures, junction boxes, cable glands, mounting plates, DIN rails, terminal blocks, breathers, hinged lockable doors, anti-condensation provisions where required and anti-tamper seals needed for a complete and weatherproof installation at each location. All enclosures shall meet minimum IP65 ingress protection.

- Cabling: The Bidder shall supply and install shielded communication cable between the EVC and the Modem. Cable routing and fixing shall protect against mechanical damage and environmental exposure. Cable shielding shall be earthed at one end only.
- The Bidder shall supply and install pulse interface cabling between the PD meter pulse output and the MIU where snap-fit mounting is not used.
- Cable sizing and routing design are the Bidder's engineering responsibility and shall be appropriate for the site conditions and the device's communication and power requirements.

3.5.6.1.5. EVC and PD Meter Data Management and Communication

- **Register Mapping and Documentation**

- The Bidder shall provide complete Modbus (or applicable protocol) register mapping for all parameters of every EVC make and model in GEL's network.
- The Bidder shall deliver comprehensive documentation detailing register addresses, data types, scaling factors and parameter descriptions for each EVC make and model, at no additional cost to GEL.
- The register mapping shall cover all leading EVC makes and models currently deployed across GEL's network, as listed in Annexure A.

- **Communication Modes**

- The modem and MIU listening mode shall be configurable as per GEL requirements but at minimum of every hour to check for any pull requests from the AMI platform
- The Bidder shall implement real-time scheduled communication for routine monitoring and daily, hourly and event-based data collection.
- The Bidder shall implement on-demand (pull) data retrieval, enabling authorised GEL users to retrieve specific data ranges, parameter sets, or historical records from any device through the AMI Platform interface, mobile application, or API.
- All events and alarms, including critical and tamper alarms, shall be reported on the device's hourly listening-window wake, clubbed with the hourly data push, with a maximum latency of one hour as per the SLA framework.
- Device listening, push and pull behaviour is specified. The Bidder shall implement scheduled, on-demand and event-driven communication in accordance with that Section.

- **Data Backfilling**

- The Bidder shall implement automatic data backfilling to recover historical measurement data following power outages, communication failures, or maintenance activities.
- The Bidder shall implement automatic gap detection in central historical records and shall initiate backfilling from the EVC or MIU internal memory.
- The Bidder shall implement priority-based recovery, prioritising critical measurement data — accumulated volumes, flow rates, pressure and temperature readings and alarm events.

- The Bidder shall implement store-and-forward functionality using device internal memory to buffer data during communication outages and transmit it on restoration, with no data loss.
- The Bidder shall implement conflict resolution for overlapping data periods, duplicate records and timestamp synchronisation during backfilling.

3.11.5.4 Communication Reliability

- The Bidder shall implement configurable retry mechanisms, timeout settings and error handling for reliable data transmission under varying network conditions.
- The Bidder shall maintain comprehensive logging and audit trails for all data operations — scheduled polls, on-demand requests, backfilling activities and communication errors.
- The Bidder shall implement data validation and quality checks at ingestion, with status indicators for data quality and communication reliability.

3.5.6.1.6. Communication Network and Protocol Integration

- The Bidder shall supply and configure all protocol drivers and conversion required to integrate every EVC make and model in GEL's network into the AMI Platform, regardless of manufacturer or communication protocol.
- The Bidder shall support multiple communication protocols including Modbus RTU, Modbus TCP, DLMS/COSEM, MQTT and proprietary EVC OEM protocols as required.
- The Bidder shall ensure driver compatibility across all communication interfaces present in GEL's network, including RS-232, RS-485 and where applicable Ethernet connections.
- The Bidder shall develop drivers for any EVC OEM in Annexure A not natively supported by the AMI Platform.
- The Bidder shall maintain backward compatibility with older EVC models and their communication protocols throughout the contractual period.

3.5.6.1.7. EVC Data Preservation During Integration

- The Bidder shall integrate every EVC in GEL's network with the AMI Platform without any loss of the historical data held in that EVC's internal memory.
- Where integration of any EVC — whether at initial deployment, on driver deployment, on modem installation, on parameter reconfiguration, on firmware update, or at any point during the contractual period — requires or may result in the deletion, clearing, overwriting, resetting, or truncation of any data held in that EVC's internal memory, including hourly logs, interval logs, daily logs, event logs, alarm logs, audit logs, configuration records and accumulated volume registers, the Bidder shall, **before performing any such operation**:
    - **Extract in full** all data held in that EVC's internal memory, covering the entire period retained by the device, with the original EVC-side date and time stamps preserved and with no substitution of server-side timestamps.
    - **Transfer and ingest** the complete extracted data set into the AMI Platform, associated with the correct metering location and customer record, stored in the MDMS as raw data in a non-manipulated, tamper-proof state and made available through the platform's standard query, reporting and export interfaces on the same terms as data collected by the AMI System.

- **Verify and reconcile** the transferred data against the EVC's on-device records, confirming record count, period coverage, timestamp integrity and the absence of gaps or duplication and produce a per-EVC data transfer and reconciliation report.
- **Obtain GEL's written approval** to proceed with the deletion. The Bidder shall submit the per-EVC data transfer and reconciliation report to GEL and shall not perform any deletion, clearing, reset, or overwrite operation on any EVC until GEL has issued written approval against that report. Verbal, telephonic, or site-level informal clearance shall not constitute approval.

- This obligation applies to **every EVC in GEL's network without exception**, irrespective of make, model, OEM, GA, location, customer category, or the volume or age of the data held. The Bidder shall not exclude any EVC on the grounds of extraction difficulty, OEM non-cooperation, tooling limitation, or commercial consideration.
- Where an EVC OEM's tooling, protocol, or documentation does not permit extraction of the full internal memory before a required reset, the Bidder shall resolve the impediment with the OEM independently and at its own cost. Such an impediment shall not constitute grounds for a milestone extension, an additional charge to GEL, an exclusion from scope, or authority to proceed with deletion.
- The Bidder shall maintain an **EVC Data Preservation Register**, updated in real time and accessible to GEL throughout the contractual period, recording for every EVC: EVC identity and metering location; whether a deletion-inducing operation was required; the date and time of extraction; the period and record count extracted; the reconciliation outcome; the GEL approval reference and date; and the date and time of the deletion operation.
- Any deletion, clearing, reset, overwrite, or truncation of EVC internal memory performed **without** prior full extraction, verified transfer to the AMI Platform and GEL's written approval shall constitute **irrecoverable data loss** and shall be treated as a Critical SLA. The Bidder shall not fabricate, estimate, back-calculate, or substitute any data to fill a gap created by such an operation.

3.5.6.1.8. Safety and Protection Systems

- **Intrinsic Safety**

- The Bidder shall ensure all hardware installed in or adjacent to hazardous classified areas carries valid PESO certification appropriate for the area classification.
- The Bidder shall implement appropriate separation and isolation between safe-area and hazardous-area circuits where applicable.
- The Bidder shall ensure all hazardous-area installations comply with applicable safety standards and obtain the required certifications.

- **Surge and Lightning Protection**

- The Bidder shall provide surge and lightning protection for communication lines and power supply circuits as required to maintain the device availability SLA. Surge protection design is the Bidder's engineering responsibility, sized to suit the site conditions.

- **Earthing and Grounding**

- The Bidder shall carry out all earthing and grounding in accordance with PNGRB guidelines and the prevailing best practices of the CGD industry. GEL does not prescribe specific resistance values. Earthing design is the Bidder's engineering responsibility, taking into account the applicable OISD standards and OEM recommendations.

3.5.6.1.9. Material Delivery and Warehouse Accountability

The Bidder shall ensure complete accountability for material procurement, storage and delivery to installation sites through the following:

- **Warehouse Storage:** The Bidder shall procure and store all project hardware at its own warehouses or facilities, zoned by GA or region, with appropriate environmental controls, security and inventory management systems.
- **Just-in-Time Delivery:** The Bidder shall deliver materials from its warehouses to installation sites as required for the implementation schedule, coordinated with the zone-wise rollout plan, without affecting project timelines.
- **Storage Management:** The Bidder's warehouse facilities shall maintain appropriate environmental conditions for all equipment types, adequate security and access controls, proper handling and storage procedures per manufacturer specifications and insurance coverage for stored materials against theft, damage and natural calamities.
- **Reconciliation:** The Bidder shall maintain complete reconciliation records — purchase order quantities versus received quantities at the warehouse, real-time warehouse inventory status, site delivery confirmations with timestamps, material condition reports on delivery and immediate notification to GEL of any discrepancy.
- **Timeline Accountability:** The Bidder shall be fully responsible for material availability and shall not allow any delay in implementation on account of material non-availability. Delays attributable to material non-availability shall attract penalties.
- **Contractual Accountability:** The Bidder shall be contractually liable for any missing, damaged, or undelivered material from procurement through to final installation and commissioning at each site.

3.5.6.1.10. Commissioning Activities

- The Bidder shall configure each device for data collection at the three required frequencies — daily, hourly and event-based push — and shall verify on-demand pull capability at commissioning.
- The Bidder shall configure store-and-forward, retry and backfilling functionality at each device during commissioning.
- The Bidder shall register and commission each device in the AMI Platform, verify successful data transmission on both SIM slots and confirm that the AMI Platform correctly receives and processes data from the device.
- The Bidder shall configure data validation and quality checks for each commissioned device.
- The Bidder shall complete the SAT for each location, with a signed SAT record obtained before the location is declared commissioned.

3.5.6.1.11. Testing Activities

- The Bidder shall submit comprehensive testing procedures covering all hardware and software components for GEL's review and approval before testing begins, as part of the QAP.
- The Bidder shall perform cable integrity and connection verification testing for every installed device — signal continuity, connection integrity and communication interface functionality.
- The Bidder shall test communication on both SIM slots independently, including automatic failover and shall record signal strength readings at commissioning.
- The Bidder shall test the end-to-end data flow from each device through the AMI Platform to the SAP billing data export, as part of the batch-level SAT.
- The Bidder shall document all testing results with comprehensive analysis and corrective actions and shall include them in the SAT documentation for each location.

3.5.6.1.12. Protocol and Software Version Management

- The Bidder shall supply and implement all communication protocols, software components and system applications using the latest commercially available versions at the time of deployment. No component shall be at or beyond its End-of-Life (EOL) or End-of-Support (EOS) date at the time of deployment.
- The Bidder shall provide all version updates and upgrades — major platform upgrades, minor updates, security patches, firmware updates and protocol stack updates — at no additional cost to GEL throughout the contractual period.
- The Bidder shall implement critical security patches within the timelines specified in the RFP.
- The Bidder shall maintain rollback capability for all updates, with immediate restoration procedures if an update causes a problem.
- The Bidder shall obtain GEL's approval before applying any major version change that may impact system functionality or user interfaces and shall provide complete documentation for all version changes including impact analysis.
- The Bidder shall conduct comprehensive testing of all updates in a controlled environment before production deployment and shall coordinate version updates during agreed maintenance windows to minimise operational impact.
- Where any component reaches EOL or EOS during the contractual period, the Bidder shall upgrade or migrate to an equivalent or higher-specification supported version at no additional cost to GEL, with GEL's advance notification and approval.

3.5.6.1.13. SIM Card Procurement and Lifecycle Management

- The Bidder shall procure, register, supply and manage all SIM cards required for the project across all device types.
- All SIM cards procured shall be M2M sims and IPV4 compatible (IPV6 preferred).
- All SIM cards shall support push and pull functionality as per this RFP.

- All SIM cards procured shall be field replaceable and it will be bidders' responsibility to replace the SIM cards if they do not meet the SLA.
- For all dual-SIM/single-SIM with multi-network capability using multi-IMSI technology installations, the Bidder shall procure SIM cards from two different service providers, where operationally feasible, to enable communication redundancy and network failover.
- All SIM cards shall be issued and registered in the name of GEL, with appropriate corporate/industrial service plans. Bidder shall determine SIM operator selection to meet the SLA requirements.
- The Bidder shall be solely responsible for managing all SIM-related matters — service requests, payment to service providers, technical support, billing queries and operator coordination — throughout the contractual period.
- All SIM cards shall support the communication technology selected by the Bidder for the site, with appropriate APN configuration and shall be registered for industrial/IoT applications.
- The Bidder shall ensure continuous connectivity, monitor data usage, manage SIM security and provide communication diagnostics for all SIMs at no additional charge to GEL.
- The bidder shall ensure that all SIM cards under this contract are bounded and tied to the application under this contract and access to any other application shall not be possible throughout the contractual duration.
- The Bidder shall replace any non-performing SIM card promptly at no cost to GEL, including all coordination with the service provider, within the timelines specified in the RFP.

3.5.6.1.14. Quality Assurance and Site Management

- The Bidder shall implement quality control throughout all installation, commissioning and testing activities in accordance with the QAP, FAT and SAT procedures in in the RFP.
- All activities at field locations shall be carried out in the presence of GEL's designated GA Team representative, following approved procedures, with complete documentation of all results, observations and corrective actions.
- The Bidder shall maintain work area cleanliness and shall restore each site to its pre-installation condition on completion of works.
- The Bidder shall ensure proper disposal of any removed packaging, waste, or materials in accordance with environmental requirements.
- The Bidder shall provide complete documentation for each location — installation details, configuration parameters, commissioning test results and SAT records — for ongoing maintenance and system operation.

3.6. Centralized Monitoring Platform (CMP)

The bidder shall be responsible for deploying a fully operational Centralized Monitoring Platform (CMP) for Gujarat Energy Limited (GEL). This platform should serve as the central hub for accessing essential and critical information by integrating various applications of GEL and its third-party vendors. It will enable comprehensive monitoring of operational assets and insights into both real-time and historical data by deploying advanced AI/ML driven data analytics capabilities. All data formats in the system should adhere to GEL data philosophy, formats and standards which will be shared at a later stage. Additionally, the CMP will facilitate efficient incident management and emergency control through a unified interface, alerts and predictive insights, providing GEL with enhanced oversight and control capabilities.

The CMP shall be implemented in three key phases which include:

- **Phase 1: CMP Software Set Up and Integration of Existing Applications**

i. Supply, deployment, configuration and customization of CMP software
ii. Integration of existing applications i.e. all operational systems, existing applications, third-party vendor solutions, including SCADA, AMR from existing third-party multiple service providers and any data shared over spreadsheets.
iii. Development of reporting dashboards
iv. Development & customization of mobile application platform

- **Phase 2: Integration of New/Middleware and Future Applications and Development of Basic Analytics and Cascading Reporting Dashboards**

i. Integration with SCADA and AMI (part of the scope of this RFP)
ii. Development of basic analytics & cascading reporting dashboards

- **Phase 3: Deployment and Development of AI/ML Driven Advanced Analytics & Emergency Control Module/Engine and dashboards**

i. Integration with new applications (based on their readiness).
ii. Deployment and Development of AI/ML driven advanced analytics module/engine
iii. Implementation of alert management and emergency control system
iv. Integration with future applications

3.6.1. Detailed Scope of Work - CMP

3.6.1.1. Phase 1: CMP Software Set Up and Integration of Existing Applications

3.6.1.1.1. Supply, deployment, configuration and customization of CMP software

- Supply and deploy the CMP software (detailed functional specifications attached to along with all necessary licenses in the name of Gujarat Energy Limited (GEL). Ensure compliance with industry regulations and GEL's specific requirements and submit documentation of licenses for GEL's records.
- Set up a MeitY-compliant cloud environment with scalability, redundancy and high availability, including adequate storage for data storage and processing needs. Apply security protocols for data protection during processing and storage, ensuring compliance with relevant regulatory requirements.
- Set up various servers required for the deployment of CMP platform including but not limited to application server, database server, historian server, data analytics server etc.
- Post discussion with concerned GEL stakeholders at multiple hierarchies, develop and submit Functional and Software Requirements Specification (FRS and SRS) documents detailing the

requirements for GEL's review and approval. The detailed list of stakeholders will be shared with the successful bidder, post their onboarding. This should also include the proposed GUI layout of the product.

- The bidder shall ensure that the Functional and Software Requirements Specification (FRS and SRS) documents encompass the three phases of CMP implementation, including considerations such as dashboard designs and integration specifics. These documents should provide a comprehensive roadmap that aligns with all the phases of implementation.
- Deploy and configure the CMP software within the cloud environment, aligning with GEL's operational requirements for optimized performance.
- Conduct comprehensive testing to ensure the CMP's functionality, performance and security meets defined standards before full deployment.

- **Integration of existing applications**

The bidder shall integrate all operational systems, existing applications and third-party vendor solutions of Gujarat Energy Limited's (GEL), including SAP, SCADA, AMR and other applications (List attached to annexure C) into the Centralized Monitoring Platform (CMP) using the in-built capabilities of the software, depending on the best fit for project needs. Additionally, the platform should also take input data from spreadsheet updated on a periodical basis and placed in a common folder. This integration will facilitate real-time and batch data exchange, centralized visibility and direct navigation between CMP dashboards and source applications. All data shall be replicated to a centralized Data Lake/alternative storage solution according to the project's overall requirements for data analysis and compliance purposes. The bidder must ensure the integration adheres to industry standards, enhancing GEL's operational efficiency and decision-making.

With reference to the integration of existing applications with CMP, it is to be noted that, GEL has multiple AMR applications, procured from time-to-time basis. Bidder must ensure that all these applications are integrated into the CMP. Once the new platform is developed, Bidder to ensure that the new platform (which is part of this RFP) shall be integrated with the CMP. Bidder should also ensure that the older / outgoing applications may also have to remain integrated till the time, all the corresponding meter / EVCs are tagged with the new AMI application. Hence, in the meantime, CMP must support an outgoing application (multiple) and new application for AMI. Bidder shall not raise any concern in this regard and shall provide swift support during the entire journey.

With reference to the SCADA applications, it is to be noted that currently, multiple OEMs have deployed their SCADA platform for their devices installed as part of the project for GEL. These are owned by respective OEMs / third party service providers. Bidder is required to ensure that all these multiple SCADA platforms along with one in-house SCADA platform of GEL must be integrated in this phase of the project. Additionally, as mentioned in case of AMI integration, as and when the new platform of SCADA (proposed as part of this project) is ready, should be integrated and other outgoing platforms must remain integrated till the time, respective stations are made live through this project and is accessible through the SCADA platform of this RFP. Such scenario of integrating an outgoing application(s) and new application may be considered for other GEL applications as well. Bidder shall not raise any concern in this regard.

The CMP shall include comprehensive dashboards for GEL's Exploration and Production (E&P) operations. The bidder shall develop data forms and templates in consultation with GEL's E&P team to capture the following KPIs and operational data:

E&P Manual Data Entry

In the initial phase, E&P teams shall manually input data into the CMP through customized data entry forms developed by the bidder. The bidder shall:

- Conduct detailed discussions with GEL's E&P team to understand data requirements, formats and reporting frequencies
- Design and develop user-friendly data entry forms/templates for E&P operations
- Implement data validation rules to ensure data quality and consistency
- Provide training to E&P teams on data entry procedures

The bidder shall carry out the implementation of this stage in the following manner:

Plan and gathering requirements

- Conduct a detailed study of all existing applications of GEL and third-party vendors to understand their functionalities and integration capabilities/avenues.
- Organize meetings with each application owner to discuss integration plan and address initial questions or requirements.
- Collaborate with solution owners to gather crucial sample data points needed for integrating in the CMP in a standardized format.

API architecture, integration and testing

- Gather API/SDK and integration documents from the respective application owner for all the applications. It must include input-output formats, authentication, sample payloads, rate limits and fallback logic.
- Perform technical assessments of the API documents, focusing on authentication methods, data formats and potential integration challenges and their mitigation strategy.
- Design a scalable and flexible integration architecture using the in-built capability in bidder's proprietary platform, specifically optimized for seamless integration into the CMP.
- Create custom connectors or adapters to ensure compatibility and seamless data exchange with target system APIs.
- Implement advanced security measures for API communication, including API keys and OAuth tokens, with regular security protocol updates. Integrate web-hooks for real-time data updates, enabling immediate notifications from external applications to enhance the responsiveness of CMP application.
- Execute trial API integrations with rigorous testing utilizing synthetic and live data, facilitated by webhooks for monitoring interactions specific to the CMP.
- As part of integrating the applications into CMP software, digital SOPs shall be incorporated to ensure consistent operations, streamline workflows and support robust decision-making with real-time procedural access.
- Implement error handling, retry and failure management protocols with webhooks for real-time alerts and resolution.
- Establish sandbox or test environments for comprehensive validation and user acceptance testing to ensure that the integration into the CMP meets all operational requirements.
- Develop data transformation and mapping processes to align outputs with the model of the CMP application.
- Set up logging & monitoring infrastructure for real-time traceability and rapid issue diagnosis.
- Undertake performance tuning to meet latency and throughput requirements with webhook-based metrics.
- Conduct exhaustive API testing and integrate data into the CMP, with comprehensive documentation.
- Ensure necessary data is integrated with the CMP application in the desired format.
- Plan and execute data migration (previous 5 years) in the proposed CMP.
- Ensure regular system updates and maintenance to sustain efficiency and reliability throughout the integration lifecycle.
- Upon successful completion of integration of any of the applications, necessary validation must be undertaken along with the preparation of integration documentation.
- Upon successful integration, validate data with concerned GEL departments to ensure that the data replication on CMP is in conjunction with data presented in the native application.
- Ensure compliance with security, data privacy and regulatory requirements, with regular protocol reviews and updates to uphold the standards of the CMP.

- Provide extensive post-deployment support, including continuous monitoring, issue resolution, performance optimization and system updates.

- **Development of reporting dashboards**

Post integrating existing applications, the bidder shall be responsible for developing reporting dashboard within the Centralized Monitoring Platform (CMP). This dashboard will focus on visualizing critical and essential data from the integrated applications, serving as a centralized hub for operational insights. It should provide a streamlined view of key performance indicators (KPIs) and essential operational metrics, tailored to different user roles (role based) to ensure that each role accesses relevant data. The dashboard should also allow for the creation of personalized dashboards, enabling users to customize their views according to specific needs. It should have a user-friendly interface and facilitate real-time monitoring and provide quick access to vital information, empowering GEL's teams with data-driven insights to boost efficiency, enhance decision-making and uphold operational excellence.

The bidder shall carry out the implementation of this stage in the following manner:

Understand user requirements

- Organize meetings with concerned GEL departments at multiple hierarchies to identify key performance indicators (KPIs) and critical information required for reporting on the dashboard. The detailed list of stakeholders will be shared with the successful bidder.
- The Bidder shall provide a standard/recommended KPI library, which will enable GEL to select relevant KPIs for different areas. Furthermore, the Bidder shall actively seek inputs from GEL to incorporate additional KPIs, allowing for customization and adaptability to evolving business needs.
- The Functional and Software Requirements Specification (FRS and SRS) documents submitted during the initial phase of the project shall be updated based on the KPIs, critical information and other relevant documents finalized by the respective stakeholder departments. These updated documents shall then be submitted to GEL for review and approval.
- Establish the format, frequency and level of detail needed for dashboard reports, ensuring that they meet the specific needs and requirements of each department.
- The KPIs that need to be monitored shall be with multiple drill down levels. If the same KPI is used in multiple dashboards with or without different visualizations (e.g., bar chart in dashboard 1 and pie chart in dashboard 2), it will be considered as one KPI only.
- Create a detailed list and documentation of all data sources, like databases and sensors, specifying formats and protocols to ensure the successful integration of the finalized KPIs and critical information into the dashboard.
- Understand the requirements pertaining to having a periodical system generated reports through CMP. Necessary reports must be created as part of the project.
- These business dashboards shall be online real-time representation of GEL’s business data and shall help senior management and field team take better business decisions based on real time insights.
- The bidder shall create a document with the exhaustive list of KPIs, data sources for the KPIs, formats of the staging tables used (schemas), type (IP, port, protocol, connection parameters), the calculation methodology, column names, column types, list of connectors used for the staging and archive database, etc. The document must be shared with GEL & updated from time to time, for future reference as well as for conducting any maintenance activities that might be required on the dashboards and database servers.
- The bidder shall not lay any claim for any Intellectual Property Rights or anything of that sort, or patent in such a manner that would cause any financial outgo for GEL, for any of such code(s) developed by the bidder for GEL for this project. All such rights shall lie solely with GEL.

Develop the reporting dashboards

- Develop a comprehensive blueprint outlining the dashboard's layout, incorporating sections for visualizing KPIs and information.
- Bidder should provide role-based dashboards, with functionality to undertake custom dashboards.
- Bidder should understand such role-based dashboard-related requirements from all the concerned stakeholders and develop the sample UI/UX in this regard and take an appropriate concurrence from stakeholders.
- Dashboards should be visually appealing. The bidder shall design a layout that presents key metrics prominently and ensures easy navigation and also arrange components logically to prioritize important information.
- Choose tools and frameworks suitable for dashboard development, considering factors like existing infrastructure, compatibility and scalability.
- Choose appropriate visualization types based on the data and insights required. Ensure visualizations are clear and convey the intended message effectively.
- Apply a consistent design language across the dashboard, including colour schemes, fonts and icons. This improves usability and readability.
- The bidder shall leverage the already deployed data lake/alternative storage solution as a unified data source to streamline the development of reporting dashboards. This approach will maximize data processing efficiency, facilitate comprehensive analytics and ensure smooth integration of diverse datasets for real-time insights.
- The bidder is expected to utilize the deployed data lake/alternative storage solution for the staging environment. This utilization is to occur after performing necessary ETL (Extract, Transform, Load) operations. Implement APIs or ETL processes to facilitate data movement from diverse sources into a centralized Data Lake within the CMP.
- The bidder shall also set up an archival database in Data Lake/alternative storage solution to ensure that all KPI values of at least 5 years (or as per GEL data retention policy) are visible and can be seamlessly retrieved whenever required for any historical comparison of any KPI on the dashboards. The bidder should ensure that the data storage space provided in the staging & archival is utilized judiciously & conservatively.
- Create dynamic visual components such as charts, graphs, tables and GIS-based views using the existing GIS application of GEL.
- Develop accurate, high-performance data models to support the required reports. Cleanse and transform data to ensure consistency and accuracy. Prepare data in a format that aligns with the dashboard's design.
- Design visualizations to be interactive, customizable and linked directly to relevant datasets (e.g., SCADA status views). It should have excellent graphical representation and offer up-to-date information, which is crucial for timely business decisions.
- Tailor dashboards for specific user roles, aligning with GEL's requirements to deliver personalized data access.
- Ensure the reporting dashboard includes the capability for users to download reports in PDF/Excel/other customized format, facilitating easy sharing and documentation of critical insights.
- Implement a secure login-password system for separate user accounts, providing personalized access and ensuring data security. It should also support SSO login.
- Ensure the dashboard is customizable, allowing users to tailor their views and components to fit individual preferences and operational requirements. The interface allows users to customize the look and feel in a simple point-and-click fashion.
- Dashboard shall be just another notebook view. Users shall be able to instantly create many different dashboards from one notebook, tailoring the presentation of the same results to different audiences.

Conduct User Acceptance Testing (UAT)

- Obtain final approval from stakeholders to confirm the dashboard meets all requirements and is ready for deployment.

- Provide administrators with an integration dashboard for real-time monitoring of connectors, system logs and diagnostics.
- Conduct rigorous testing to ensure dashboards are error-free and perform as expected, validating interactive elements.
- Engage end-users in testing to confirm dashboards meet their needs, incorporating feedback to enhance usability.
- Ensure all data transfers are encrypted using TLS 1.2+ and support token-based authentication, while maintaining audit trails compliant with industry standards.
- Deploy the dashboards in a live production environment, ensuring minimal disruption to operations and addressing issues promptly.
- Prepare user guides and training materials in both English, Hindi & Gujarati language to help users understand how to use the dashboard and interpret the visualizations.
- Train GEL staff on dashboard usage, including navigation, report interpretation and customization elements.
- Establish a support framework to address user queries and facilitate continuous improvement based on user feedback and changing needs of GEL users.

i. Development & customization of mobile application platform

- The bidder shall organize meetings with concerned GEL departments to understand their needs and expectations for replicating CMP functionalities on both Android and iOS mobile application, focusing on usability and accessibility
- Post discussion with concerned GEL stakeholders, develop and submit Functional and Software Requirements Specification (FRS and SRS) documents detailing the mobile application platform's functional and non-functional capabilities for GEL's review and approval.
- Ensure the mobile application platform complies with relevant industry standards for data representation, exchange, interoperability and security.
- Ensure provision for seamless integration with existing applications and scalability for future applications through the CMP.
- Develop an intuitive interface that mirrors the CMP layout and functionality, ensuring easy navigation and consistent user experience across the mobile application.
- Implement features that allow for seamless real-time monitoring and access to reporting dashboards, ensuring the mobile application provides the same operational visibility as the CMP.
- Implement role-based access control within the mobile application to limit data visibility and functionalities based on user roles, ensuring security and relevance in user interactions.
- Implement a secure login-password system for separate user accounts, providing personalized access and ensuring data security. It should have a functionality to integrate with SSO.
- Incorporate offline capabilities that allow users to access key features and data when network connectivity is unavailable, with automatic synchronization when the connection is restored.
- The application shall have the capability to push notifications to alert users of critical events and updates promptly, keeping them informed and responsive.
- Assignment of tasks/issues to field staff based on the category, location, department, zone
- Field staff should be able to manage and close any task/issues using the App.
- The application should also be used (maybe through a separate module within the same mobile application) as a tool to input requisite data from field / site and same should be made visible to concerned stakeholders along with the capturing required dashboard pertaining to the data entered.
- The app should have facility to upload a geo-tagged & time-stamped photograph and remarks text, from mobile device.
- The Mobile App shall a have the facility to view the various dashboard based on user access rights.

- Mobile App shall provide push notifications to field staff in parallel to SMS and email.
- Build the application to be compatible with both Android and iOS platforms, adhering to specific app store guidelines and ensuring broad accessibility.
- Create robust APIs and connectors to facilitate seamless data synchronization between CMP and the mobile application, ensuring consistency in data handling.
- Ensure that updates on either platform are reflected across the CMP and mobile application, maintaining data integrity and accuracy.
- Ensure the mobile platform adheres to data privacy and security regulations, like those governing the CMP.
- Conduct thorough testing to verify that the mobile app is as user-friendly as the CMP, with seamless replication of its functionalities.
- Test the mobile application for efficiency and reliability across various devices and network conditions, ensuring optimal performance.
- Work closely with GEL's IT team for a smooth deployment, minimizing disruptions to existing operations.
- Conduct training sessions to familiarize users with mobile applications, emphasizing key functionalities and customizations.
- Create comprehensive documentation in both English, Hindi and Gujarati language detailing the application's features, navigation and troubleshooting steps along with a Standard Operating Procedure (SOP) for the usage of the mobile application.
- Incorporate a feedback system within the application for users to report issues or suggest improvements, facilitating continuous enhancement based on real-world use cases.

3.6.1.2. Phase 2: Integration of New/Middleware and Future Applications and Development of Basic Analytics and Cascading Reporting Dashboards

3.6.1.2.1. Integration with SCADA and AMI (part of the scope of this RFP)

The bidder is required to further integrate the SCADA and AMI applications which are a part of the scope of this RFP with the Centralized Monitoring Platform (CMP). The bidder shall follow the procedure established in this RFP for integrating GEL applications with the CMP software. In Phase II, for integrating new/Middleware and future applications, the bidder shall leverage the Enterprise Service Bus (ESB) that GEL plans to deploy during this period, ensuring all further integrations with the CMP occur via ESB. This ESB deployment is part of a separate new/Middleware applications project of Gujarat Energy Limited (GEL). The bidder must ensure that the CMP software and related architecture are compatible with standard ESB solutions available in the market. It is imperative that integration shall ensure seamless interoperability and functionality across the systems. The bidder must ensure that these integrations facilitate robust data exchange, real-time monitoring and control, thereby enhancing the overall operational efficiency of GEL's infrastructure. As part of integrating the applications into CMP software, digital SOPs will be incorporated to ensure consistent operations, streamlined workflows and support robust decision-making with real-time procedural access.

Initially, in Phase I, the bidder is required to integrate the existing third-party SCADA and AMR applications (multiple applications) of Gujarat Energy Limited. In Phase II, they will integrate the SCADA and AMI systems proposed as part of this project. The bidder may also need to

temporarily integrate both the existing and new platforms, considering potential data point unavailability on either platform. The bidder shall not raise concerns about this requirement.

This scenario may also apply to a few other existing applications of GEL and the bidder shall provide the necessary support to ensure seamless integration of both outgoing and new applications. Furthermore, in both scenarios, the bidder is responsible for developing necessary dashboards, KPIs and basic analyses for both outgoing and new applications. The bidder shall not raise concerns regarding these requirements.

3.6.1.2.2. Development of analytics & cascading reporting dashboards

In this stage of Phase II implementation, the reporting dashboard deployed during Phase I shall be systematically decommissioned to enable the deployment of a cascading reporting dashboard with data analytics functionalities, following the integration of the new GEL applications. The bidder shall develop these analytics-driven cascading dashboards following the procedure established in this RFP, deploying additional analytics and cascading capabilities in line with the analytics needs of the concerned stakeholders. The data analytics shall either be an integrated capability within the bidder's proposed CMP platform or function as an additional engine/module, tightly coupled with the CMP.

By implementing these steps, the bidder should deploy core analytics and cascading dashboards that enhance the CMP's capabilities, providing Gujarat Energy Limited (GEL) with actionable insights to improve operational efficiency and decision-making. The bidder shall leverage the already deployed data lake/alternative storage solution as a unified data source to streamline the development of reporting dashboards, maximizing data processing efficiency, facilitating comprehensive analytics and ensuring smooth integration of diverse datasets for real-time insights. Expectedly, the bidder is to utilize the data lake/alternative storage solution for the staging environment following necessary ETL (Extract, Transform, Load) operations - a common practice to leverage existing infrastructure, potentially saving costs and time. The bidder shall implement APIs or ETL processes to facilitate data movement from diverse sources into a centralized Data Lake within the CMP.

The bidder shall carry out the implementation of this stage in the following manner:

Understand user requirements

- Conduct meetings with GEL departments at multiple hierarchies to identify analytical needs, key performance indicators (KPIs) and use cases for deploying analytics and cascading dashboards. The detailed list of stakeholders will be shared with the successful bidder. The bidder shall also understand requirements for periodic system-generated reports through the CMP.
- The Bidder shall provide a standard/recommended KPI and use cases library, which will enable GEL to select relevant KPIs and use cases for different areas. Furthermore, the Bidder shall actively seek inputs from GEL to incorporate additional KPIs, allowing for customization and adaptability to evolving business needs.
- The KPIs shall be monitored with multiple drill down levels. If the same KPI is used in multiple dashboards with or without different visualizations (e.g., bar chart in dashboard 1 and pie chart in dashboard 2), it will be considered as one KPI only. Some of the illustrative KPIs include, but not limited to:
    1. *Gas consumption trends:* Display trends in gas consumption across different regions and customer segments. This could be represented as time-series graphs comparing monthly or yearly usage, enabling understanding of demand patterns.

2. *Pipeline network performance:* Show metrics relating to pipeline integrity, such as pressure levels, flow rates and incident reports. Highlight areas where maintenance or upgrades might be required more frequently.
3. *Safety incident tracking:* Visualize statistics on safety incidents or emergencies within the distribution network, including types of incidents, their frequency and affected areas. This can help with proactive safety management.
4. *Customer growth metrics:* Present data on the growth of residential, industrial and commercial customer bases, potentially segmented by geographic area. Monitor changes in customer numbers over time to support expansion strategies.
5. *Billing and revenue analysis:* Offer insights into billing efficiency and revenue trends. This may include overdue accounts, average billing cycles, comparisons between projected and actual revenue, or analysis by customer type.

- The Functional and Software Requirements Specification (FRS and SRS) documents submitted during the initial phase of the project shall be updated based on the KPIs, critical information and other relevant documents finalized by the respective stakeholder departments. These updated documents shall then be submitted to GEL for review and approval.
- Create detailed documentation of data sources, specifying formats and protocols for successful integration and processing of analytics use cases. Establish real-time and batch data processing pipelines for seamless data flow.
- CMP should have the capability to normalize the data formats and adapt to the ever-evolving data philosophy of GEL.
- These dashboards shall be online real-time representation of operations data and shall help senior management take better business decisions based on real time insights.
- The bidder shall create a document with the exhaustive list of KPIs, data sources for the KPIs, formats of the staging tables used (schemas), type (IP, port, protocol, connection parameters), the calculation methodology, column names, column types, list of connectors used for the staging and archive database, etc. The document must be shared with GEL & updated from time to time, for future reference as well as for conducting any maintenance activities that might be required on the dashboards and database servers.
- The bidder shall not lay any claim for any Intellectual Property Rights or anything of that sort, or patent in such a manner that would cause any financial outgo for GEL, for any of such code(s) developed by the bidder for GEL for this project. All such rights shall lie solely with GEL.

Develop data analytics & cascading dashboards

- Choose appropriate analytics platform compatible with existing infrastructure and dashboards with layered insights and dynamic visualizations.
- Select compatible analytics platforms and tools aligned with existing infrastructure.
- Design cascading dashboards with layered insights and dynamic visualizations, like interactive charts and GIS-based views, for effective data representation.
- Introduce advanced visualization tools such as heat maps, bubble charts and timeline graphs to offer rich, interactive visual representations of complex datasets, making it easier for users to derive insights.
- Ensure dashboards are compatible with the deployed mobile application, allowing users to access key analytics and insights on-the-go, ensuring they're informed anytime, anywhere.
- Develop data models to support complex analytical queries and data exploration. Ensure standardized API communication and unified data formats for seamless interoperability.

- Incorporate features that allow users to generate their custom reports and dashboards without needing extensive technical assistance, empowering them with more flexible data exploration capabilities.
- The bidder is expected to utilize the existing Data Lake that is part of the CMP software for the staging environment. This utilization is to occur after performing necessary ETL (Extract, Transform, Load) operations. This is a common practice as it leverages existing infrastructure, potentially saving costs and time. Implement APIs or ETL processes to facilitate data movement from diverse sources into a centralized Data Lake within the CMP.
- The bidder shall also set up an archival database in Data Lake to ensure that all KPI values of at least 5 years (or as per GEL data retention policy) are visible and can be seamlessly retrieved whenever required for any historical comparison of any KPI on the dashboards. The bidder should ensure that the data storage space provided in the staging & archival is utilized judiciously & conservatively.

Conduct User Acceptance Testing (UAT)

- Conduct rigorous testing to ensure analytics modules and dashboards function correctly, validating interactive elements and performance.
- Engage end-users for feedback during user acceptance testing and make necessary adjustments to enhance usability.
- Deploy dashboards in a live production environment, ensuring smooth operations and addressing issues promptly.
- Train GEL staff on dashboard usage, including navigation, report interpretation and customization, with comprehensive materials in both English, Hindi and Gujarati.
- Provide detailed documentation and establish support channels for ongoing maintenance and tool enhancements, facilitating continuous improvement based on user feedback.
- Enable events, alarms, sensor telemetry and performance metrics to feed directly into the CMP for near real-time analytics, supporting integration with triggers for actions across subsystems.
- Ensure all data transfers are encrypted using TLS 1.2+ with token-based authentication while maintaining compliant audit trails.

3.6.1.3. Phase 3: Deployment and Development of AI/ML Driven Advanced Analytics & Emergency Control Module/Engine

3.6.1.3.1. Development of new AI/ML-driven advanced analytics

During this phase, the bidder shall deploy an AI/ML-driven data analytics engine/module specifically tailored for Gujarat Energy Limited (GEL). This engine/module must seamlessly integrate with the proposed Centralized Monitoring Platform (CMP) or operate as a standalone solution, designed to address all analytical requirements of GEL stakeholders. It must be compatible with the existing Data Lake integrated/alternative storage solution deployed within the CMP, to ensure access to the diverse datasets stored there for performing comprehensive analytics. Furthermore, it must ensure compatibility with other existing systems involved in data processing or receiving analytics output.

The bidder shall implement this platform with predictive, prescriptive and descriptive data analytics capabilities that align with the continuously evolving needs of GEL. The platform should offer a fully customizable solution, accommodating various analytical needs by allowing for the addition or removal of data analytics use cases or individual steps within a use case. The Functional and Software Requirements Specification (FRS and SRS) documents submitted at the project's outset

should be updated to reflect the KPIs, use cases, critical information and other pertinent data finalized by stakeholder departments at this stage. These revised documents shall be submitted to GEL for review and approval.

The bidder shall also deploy advanced AI/ML dashboards within the CMP software driven by the AI/ML module/engine. The analytics and cascading dashboards implemented in Phase 2 can be either enhanced or systematically decommissioned, as required, to facilitate the deployment of additional dashboards powered by the AI/ML-driven advanced analytics engine to satisfy visualization needs of GEL stakeholder. These new dashboards shall deliver automated insights and analytics, leveraging data through artificial intelligence and machine learning techniques.

The bidder shall adhere to the procedures outlined in this RFP for dashboard development, while deploying additional advanced analytics capabilities with AI/ML methods during this phase. The platform must offer robust capabilities for deploying industry standards and cutting-edge analytics, ensuring alignment with strategic objectives and best practices in data governance. It should be highly configurable and supported throughout the contract duration, empowering stakeholders to derive actionable insights from real-time and historical data for informed decision-making. The platform must be scalable to accommodate growing data volumes and expanding analytical needs. Sample use cases that these AI/ML-enabled advanced analytics dashboards should implement.

3.6.1.3.2. Integration of new middleware applications

Gujarat Energy Limited (GEL) is in the process of finalizing certain digital interventions, which are to be implemented as part of its vision for digital transformation. Once all the necessary interventions are finalized in a due course of time, it'll be followed up by an RFP document for the procurement of requisite services from competent Bidder. GEL has given the name of such applications as Middleware and high-level list of such applications is provided. As part of integrating the applications into CMP software, digital SOPs will be incorporated to ensure consistent operations, streamline workflows and support robust decision-making with real-time procedural access.

The bidder shall follow the procedure established in this RFP for integrating GEL applications with the CMP software. At this stage of Phase II, for integrating New/Middleware/Future applications, the bidder shall leverage the Enterprise Service Bus (ESB) that GEL plans to deploy during this period, ensuring all further integrations with the CMP occur via the ESB. This ESB deployment is part of a separate new/Middleware applications project of Gujarat Energy Limited (GEL). The bidder must ensure that the CMP software and related architecture are compatible with standard ESB solutions available in the market.

In addition, there will be multiple other applications, which may be developed in future by GEL/their empanelled agency. These applications are not covered in the above-mentioned. The Bidder must be ready to integrate these new future applications of GEL with the CMP software as and when required throughout the contract duration, ensuring alignment with GEL's overarching architecture and objectives. Bidder would be required to quote additional amount pertaining to this in the commercial bid and shall be paid, on actuals upon successful completion of integration of these applications. Bidder shall not raise any concerns in this regard and extend all the requisite support to GEL, third party (application owner) of GEL to achieve desired result.

3.6.1.3.3. Implementation of alert management and emergency control systems

Understand User Requirements

- Conduct meetings with GEL departments to define alert management requirements, including the types of alerts and escalation protocols, ensuring robust and clear communication throughout the organization.
- The bidder shall create a set of sample alert scenarios and requirements, allowing stakeholders at GEL to review and select the most relevant options. This will aid in tailoring the alert management system to meet specific operational needs while ensuring comprehensive coverage of potential situations.
- The Functional and Software Requirements Specification (FRS and SRS) documents submitted during the initial phase of the project shall be updated based on the KPIs, critical information and other relevant information finalized by the respective stakeholder departments at this stage of implementation. These updated documents shall then be submitted to GEL for review and approval.
- Identify and confirm communication channels (SMS, WhatsApp, email, voice notifications, etc.) for alerts to ensure comprehensive coverage across multiple platforms.
- Design the architecture for the alert management system, ensuring seamless integration with existing operator interfaces, process control systems and CMP for event monitoring and directive issuance.
- Ensure automatic linkage to standard operating procedures (SOPs) for handling critical events without human intervention, adhering to industry standards for interoperability, data representation and exchange, including Geo Spatial Standards like GML & KML.

Deploy Alert Management and Emergency Control Engine

- Integrate digital SOPs into the CMP to enable automated insights and alerts through streamlined workflows.
- Implement communication channels for alert distribution, supporting both manual and sensor-triggered reporting, to ensure timely and accurate event status updates.
- Equip the system with real-time monitoring tools, including geospatial rendering and impact plotting, to facilitate efficient resource mobilization and response actions.
- Establish a role-based security model with single sign-on for authorized access, ensuring secure directive issuance through effective authentication and role assignments.
- Develop workflows for operational alerts and automatic escalations that are triggered by the severity of monitored events, ensuring responsive management.
- Set up a dispatch console to consolidate various communication channels, providing comprehensive incident information and enabling instant messaging for coordinated emergency response teams.

Conduct User Acceptance Testing (UAT)

- Develop customizable forms for capturing detailed incident information, allowing easy update and dissemination across teams.
- Offer integrated dashboards and tools for assembling personalized views, supporting historical reports and data export in formats such as PDF or HTML.
- Facilitate data correlation and analysis, tracking the status of critical infrastructure and resources, with summaries based on user roles.
- Conduct thorough testing of alert functionalities to ensure reliability and accuracy, alongside stakeholder validation exercises to confirm system effectiveness in real-world scenarios.
- Deploy the alert management system in a live environment, ensuring minimal disruption to existing operations and confirming operational readiness of all system components.

- Train users comprehensively on system functionalities, alert management and emergency response protocols, providing necessary documentation and ongoing support for system maintenance and enhancement.
- Integrating these enhancements ensures the CMP platform accommodates digital SOPs for automated insights and workflow-based alerts, meeting GEL's strategic objectives efficiently.

3.6.1.3.4. Integration with future applications

The bidder will be responsible for seamlessly integrating any additional future applications into the CMP as required by GEL throughout the duration of this project. This integration shall adhere to the procedures established in this RFP for integrating GEL applications with the CMP software. The bidder should proactively address scalability to ensure the CMP software can accommodate new applications without issue, guaranteeing smooth expansion and enhancement of system capabilities. Furthermore, the live AI/ML dashboards should dynamically incorporate and analyze the additional data, transforming it into actionable insights from these applications.

3.7. Common and Cross-Cutting Systems and Requirements

3.7.1. Data Responsibility — Lapses, Loss and Theft

The Bidder is solely and unconditionally responsible for the integrity, availability, continuity and security of all data — operational, metering and monitoring — collected, processed, stored and transmitted by the SCADA, AMI and CMP System, from the date of commissioning of each field device (and, for the CMP, from the date each application or data source is integrated) through the full contractual period. This responsibility covers three distinct categories.

Data Lapses

- Any gap in data collection caused by SCADA, AMI or CMP downtime, communication failure, software fault, incorrect configuration, or any cause attributable to the Bidder's scope shall be the Bidder's responsibility to investigate, report and remediate.
- For every data gap at a field location, the Bidder shall attempt recovery of the missing data from the field device's internal memory through the store-and-forward mechanism (RTU/modem buffer for SCADA locations; EVC/MIU buffer for AMI locations). For the CMP, the Bidder shall re-ingest any missed data from the relevant source application or system. Where full recovery is possible, recovered data shall be ingested and processed through the normal workflow — including, for AMI, the VEE and billing workflow — clearly flagged as backfilled.
- Where data cannot be recovered — for example where the device buffer was overwritten before connection was restored, or the source system no longer holds the record — the Bidder shall document the cause, the affected device or system, the affected time period and the estimated data loss and shall submit this to GEL as part of the quarterly EMS report.
- Data lapses attributable to GEL-directed actions, customer-side obstruction, or force-majeure events shall be classified as non-Bidder-attributable per the NMS root-cause categorisation framework and shall not attract penalties, provided the Bidder has documented and submitted evidence of the cause to GEL within 5 working days of identifying the gap.

Data Loss

- The Bidder is responsible for any operational, metering or monitoring data that is collected or held by the SCADA, AMI or CMP System but subsequently lost due to storage failure, software error, accidental deletion, incorrect configuration change, failed migration, or any other cause within the Bidder's scope.
- Where data loss is identified, the Bidder shall notify GEL in writing within 24 hours of detection, identifying the scope of loss — affected devices or systems, affected time period, estimated volume of records — and the probable cause.
- The Bidder shall restore lost data from the most recent backup within the Recovery Point Objective defined in the System architecture. Where data predates the most recent backup and cannot be recovered, the Bidder shall document the irrecoverable loss in full and submit a root-cause analysis to GEL within 5 working days from the date of intimation by GEL in this regard.

- The Bidder shall not fabricate, estimate or substitute data to fill a loss gap. Raw data records that have been lost cannot be reconstructed; such gaps shall be reflected accurately in the EMS and in all billing and SLA reporting. (Legitimate VEE estimation within the AMI billing workflow, clearly flagged as estimated, is distinct from and unaffected by this prohibition.)
- Irrecoverable data loss shall be treated as a Critical SLA breach under the Service Level Agreement (SLA) and Penalty Framework and shall attract the applicable penalties. GEL's right to withhold payment for periods where data was permanently lost is unaffected by any force-majeure or other contractual exclusion.

Data Theft and Unauthorised Access

- The Bidder is responsible for preventing unauthorised access to all data within the SCADA, AMI and CMP System — whether at rest in the cloud database or Data Lake, in transit between field devices, source systems and the platforms, through APIs, or through any user interface.
- Where the Bidder identifies or has reasonable grounds to suspect unauthorised access, data exfiltration, or a security breach affecting any component of the SCADA, AMI or CMP System, the Bidder shall notify GEL in writing within 4 hours of detection. This notification shall include the nature of the incident, the data or systems affected, the probable attack vector and the immediate containment measures taken.
- Within 24 hours of detection, the Bidder shall notify CERT-In and any other regulatory authority as required under applicable Indian law and shall copy GEL on all such notifications.
- The Bidder shall conduct a root-cause analysis of any confirmed breach and shall submit a full incident report — including cause, extent of data accessed or exfiltrated, remediation actions completed and measures implemented to prevent recurrence — to GEL within 7 calendar days of the incident.
- The cost of all remediation, regulatory compliance, forensic investigation, notification obligations and any GEL reputational or commercial damage arising from a data breach caused by a failure in the Bidder's systems, processes or personnel shall be borne entirely by the Bidder. GEL shall have no financial obligation in connection with any such breach.
- GEL reserves the right to commission an independent forensic investigation of any suspected data breach at the Bidder's cost. The Bidder shall provide full access to all systems, logs and personnel required for such an investigation within the timeline specified by GEL.

3.7.2. Network Management System (NMS)

The SIM and communication-network health of the field connectivity estate shall be monitored through a Network Management System (NMS). The NMS may be provided to the Bidder by the connectivity / SIM service provider. Irrespective of whether the NMS is provided by the service provider or supplied by the Bidder, the Bidder shall be responsible for integrating the NMS with the SCADA, AMI and CMP platforms and for all NMS configuration and programming required to meet the requirements of this RFP, at no additional cost to GEL.

The NMS monitors SIM and communication-network health only. Device health and device availability are monitored by the respective platform and reported to the Enterprise Management System (EMS) and are not within the scope of the NMS.

SIM and communication-network monitoring

- The NMS shall monitor, in real time, the SIM and communication health of every field connection, tracking SIM status, network registration status, data-session status, last successful communication timestamp and consecutive communication-failure count per SIM. A field-connectivity topology view showing real-time connectivity status, segmented by GA, zone and communication technology, shall be available.
- Signal-quality metrics — RSSI, SINR or equivalent and packet-loss percentage — shall be tracked and retained per SIM for the full contractual period. Configurable quality thresholds shall trigger network-performance alerts.
- SIM-level performance shall be monitored per connection: active SIM identity / IMSI, data usage per billing cycle, per-SIM and per-network signal quality and automatic failover events between SIMs (for dual-SIM modems) or between networks / IMSIs (for single-SIM multi-network modems). Per-operator performance statistics shall be available to support GEL's SIM operator-selection decisions.
- Communication failures shall be classified by root cause — signal quality, SIM issue, network outage, planned maintenance, GEL-attributable or TSP-attributable — with this classification feeding directly into the SLA exclusion determination specified in the Service Level Agreement (SLA) and Penalty Framework.
- The NMS shall support remote SIM and network control where technically applicable — SIM switchover and communication-parameter push — and shall provide network-performance reports covering communication success rate per SIM, per zone and per GA; signal-quality distribution across the network; SIM failover frequency; and TSP-attributable outage time.
- The NMS shall feed the EMS with all SIM and communication metrics required for SLA computation and shall be surfaced to GEL through the read-only view described under *Integrated Portal Visibility of NMS and EMS*.

Integration responsibility

- The Bidder shall integrate the NMS with the SCADA, AMI and CMP platforms so that SIM and communication-network health information is available within each platform's portal, per *Integrated Portal Visibility of NMS and EMS*. Where the NMS is provided by the connectivity / SIM service provider, the integration, API development, data mapping and view embedding remain the Bidder's responsibility at no additional cost to GEL.

Modem types and SIM failover

- The field modems supplied under this RFP are either dual-SIM modems or single-SIM modems with multi-network (multi-IMSI) capability. The NMS shall monitor and report failover for both types — between the two SIMs for dual-SIM modems and between networks / IMSIs for single-SIM multi-network modems.
- Any programming, configuration or rule development required on the NMS to implement and meet the SIM failover mechanisms — including failover triggers, network-selection logic and automatic recovery — shall be performed by the Bidder at no additional cost to GEL. The detailed SIM failover mechanism is specified under *SIM and Connectivity Management (SCADA and AMI)*.

Applicability

- The NMS monitors the SIM estate of the SCADA and AMI field devices. The CMP carries no field SIMs; the NMS shall be integrated with the CMP for consolidated visibility and network-health reporting only.

3.7.3. Enterprise Management System (EMS)

The Bidder shall supply, deploy and maintain an Enterprise Management System (EMS) as an integral part of the contracted scope, at no additional cost to GEL. In this RFP, **EMS refers to the Enterprise Management System for SLA monitoring** — it is not an Element Management System or an Energy Management System.

- The EMS is the authoritative and **sole reference** for all SLA performance measurement and quarterly payment determination across SCADA, AMI and CMP, as specified in the Service Level Agreement (SLA) and Penalty Framework. All SLA events — device Go-Live dates, uptime, communication outcomes, data-collection completeness, billing-data delivery and incident resolution — shall be captured automatically, without manual entry.
- The EMS shall calculate pro-rata billable days per device and per System per quarter, generate quarterly SLA compliance reports simultaneously available to GEL and the Bidder and compute applicable penalty deductions automatically using the penalty framework in the Service Level Agreement (SLA) and Penalty Framework.
- An immutable SLA event log shall prevent modification or deletion of any recorded event. GEL shall have direct, independent, read-only access to all EMS data at all times, through a dedicated view that the Bidder cannot disable, restrict or intercept.
- Real-time trending alerts shall notify the Bidder and GEL-designated teams when any SLA metric is approaching a breach threshold. The EMS shall be fully deployed and GEL access confirmed, as a mandatory condition of Go-Live acceptance under the Quality Assurance, Testing and Acceptance Criteria section.
- The EMS shall draw its inputs from: the NMS, for all SIM and communication-network metrics; and each System platform (SCADA, AMI and CMP), for platform and device availability, data-collection completeness, VEE and billing-data delivery (AMI), control and alarm delivery (SCADA) and integration availability and alert delivery (CMP).

3.7.4. Integrated Portal Visibility of NMS and EMS

The NMS and the EMS may be delivered as dedicated applications. Irrespective of how they are deployed, the Bidder shall integrate a **read-only view** of the NMS and the EMS into **each of the SCADA, AMI and CMP portals**, so that authorised GEL users can view network-health and SLA / compliance information from within the portal they already use, according to their assigned role. The Bidder shall not deliver the NMS or the EMS only as a separate standalone application requiring a separate login, a separate user directory or a separate role model.

- **Read-only view in each portal.** Each System portal shall present NMS and EMS information — dashboards, SIM and network communication health, network status, SLA metrics, compliance status and event summaries — in view mode only. Users shall not be able to make, submit or trigger any NMS or EMS configuration change from within a System portal. The embedded view is for monitoring and information only.

- **Configuration only in the dedicated applications.** All configuration of the NMS and the EMS — thresholds, alarm rules, SLA parameters, report definitions, user and role administration of those systems and any other setup or change — shall be performed exclusively through the NMS's and EMS's own dedicated applications. No System portal shall be a configuration path for either system.
- **Role-based visibility.** Visibility of the embedded NMS and EMS views shall be governed by the common Role-Based Access Control framework and its data-level scoping (per GA, per zone, per device group, per data scope). A user shall see the NMS and EMS view content only where their assigned role grants it and only for the GAs and data scopes their role permits. For example, without limiting GEL's role design: a GA-team user sees the NMS communication-health view for their own GA only; a GEL SLA / compliance officer sees the full EMS SLA and compliance view; a GEL administrator sees both in full across all GAs. The role-to-view mapping shall be configurable by authorised GEL administrators.
- **Single sign-on to the view.** A GEL user shall reach the embedded NMS and EMS views through their existing System-portal login (Active Directory / SSO / MFA), without a separate authentication to view this content. Access to the dedicated NMS / EMS applications for configuration may retain their own authentication, which shall also align with GEL's SSO / MFA where technically supported.
- **Current, not stale, data.** The embedded views shall reflect near-real-time NMS and EMS data, refreshed at an interval agreed with GEL. The Bidder shall specify the refresh mechanism (live query, API or streaming) and latency in the FRS / SRS.
- **GEL independent EMS access preserved.** This view integration is in addition to and shall not restrict, GEL's direct, independent, always-on, read-only access to all EMS data. Where GEL's independent EMS access and the embedded portal view overlap, both shall remain available.
- **Delivery condition.** The role-based read-only NMS and EMS views in each System portal shall be demonstrated at UAT and are a condition of Go-Live acceptance under the Quality Assurance, Testing and Acceptance Criteria section.

3.7.5. Insurance

Under the commercial and ownership model for this project (Hybrid OPEX), **all field hardware is owned by GEL** and all software is provided by the Bidder on a Software-as-a-Service basis. Ownership of each hardware item passes to GEL, free of all encumbrances, on release of the milestone payment covering that item, as set out in the Commercial and Ownership Model and the Payment Terms sections. The Bidder shall supply, install, operate, maintain and insure this hardware throughout the contractual period.

This Section applies to SCADA and AMI field hardware; for the CMP, which carries no field hardware, only the whole-solution cover in this Section applies.

Hardware insurance (SCADA and AMI)

- The Bidder shall maintain valid insurance of all components for the entire duration of the contract. The insurance shall cover damage from and loss due to, theft, water damage, vandalism, power fluctuation, fire and allied perils, for every device installed at site as part of this project. The Bidder shall submit documentary evidence issued by the insurer, confirming

that such insurance has been taken, at the document-approval stage (together with QAP and datasheet approval).

- The Bidder shall bear all statutory levies (customs, insurance, freight and the like) applicable on the goods, together with all transportation, octroi and similar charges, until the goods are delivered at their respective installation sites.
- In case of theft, the Bidder shall register the complaint on behalf of GEL and carry out end-to-end follow-up on the case with the concerned department.
- The Bidder shall file, manage and pursue to conclusion all insurance claims in respect of any insured hardware, at its own cost and administrative effort, irrespective of whether title to the affected hardware rests with GEL or the Bidder at the time of the event. GEL's ownership of commissioned hardware shall not make GEL responsible for filing or managing any claim. The Bidder shall keep GEL informed of any claim affecting GEL-owned hardware, but the entire claims process — documentation, filing, follow-up, survey coordination and settlement — is the Bidder's responsibility. Service restoration under the Operations and Maintenance section shall not await claim settlement.

Loss payee

- For hardware owned by GEL (commissioned items, for which the milestone payment has been released), the policy shall name GEL as loss payee. For hardware not yet commissioned (Bidder-owned), the Bidder is the insured; where a milestone payment has been released for such hardware, GEL shall be named loss payee to the extent of that payment, as set out in the Payment Terms section. This allocation shall not relieve the Bidder of its obligation to repair or replace any lost, stolen or damaged hardware and to restore service within the timelines in the Operations and Maintenance section, irrespective of the state of any claim.

Whole-solution cover (all three Systems)

- The Bidder shall take out and maintain, on terms and conditions approved by GEL, employer's liability and workers' compensation insurance in respect of its personnel, in accordance with applicable law, together with any life, health, accident, travel or other insurance appropriate to such personnel.
- The Bidder shall maintain professional-indemnity and cyber-liability cover appropriate to the delivery and operation of the SCADA, AMI and CMP System for the contractual period.
- At GEL's request, the Bidder shall provide evidence that all insurance required under this Section has been taken out and maintained and that current premiums have been paid.

The field modems supplied under this RFP are either dual-SIM modems or single-SIM modems with multi-network (multi-IMSI) capability. The Bidder shall implement and maintain an automatic SIM and network failover mechanism that preserves field communication without manual intervention and without loss of field data.

- **Dual-SIM modems.** The modem shall maintain a primary and a secondary SIM and shall fail over automatically from the primary to the secondary SIM on loss of the primary SIM's connectivity — including loss of network registration, sustained signal degradation below a configurable threshold, or a data-session failure persisting beyond a configurable timeout —

and shall fail back to the primary SIM when it is restored, subject to a configurable hysteresis to prevent repeated switching (flapping).

- **Single-SIM multi-network modems.** The modem shall automatically select and register on the best-available permitted network / IMSI and shall switch networks on loss or sustained degradation of the current network, subject to the same configurable thresholds and hysteresis.
- **Configurability and Bidder responsibility.** All failover triggers, thresholds, timeouts, network-selection order and hysteresis parameters shall be configurable. Any programming or rule development required — on the NMS and / or the modem-management platform — to implement these failover mechanisms and to meet the field-communication and device-availability SLAs shall be performed by the Bidder at no additional cost to GEL.
- **Logging and reporting.** Every failover and fail-back event shall be logged with a timestamp, the trigger cause and the SIM / network switched from and to and shall be reported through the NMS and made available to the EMS and to the integrated portal view.
- **No data loss on transition.** The failover mechanism shall operate together with the field device's store-and-forward buffering so that no field data is lost during a failover transition. Any data buffered during the transition shall be transmitted on restoration of connectivity and processed through the normal workflow, flagged as backfilled where applicable.

3.7.6. Quality Assurance, Testing and Acceptance Criteria

This Section defines the quality-assurance framework, testing responsibilities, test procedures, acceptance criteria and documentation requirements that govern all phases of the project — from hardware procurement and platform deployment through to Go-Live acceptance — for the SCADA, AMI and CMP System. The requirements in this Section apply in addition to and do not replace, the functional requirements for QA, FAT, SAT and UAT specified in the Functional Requirements section.

Unless a clause is marked for a specific System, the requirement applies to all three Systems. Clauses concerning field hardware (Hardware Delivery Inspection, Factory Acceptance Testing and Site Acceptance Testing) apply to SCADA and AMI only; the CMP carries no field hardware and its equivalent validation gates are identified under each such clause. All formats for below activities shall be submitted by the bidder for GEL review and approval.

3.7.6.1. Quality Assurance Framework

- The Bidder has full and sole responsibility for the quality of all hardware, software, installation workmanship, integration, data migration and platform configuration delivered under this contract. GEL's inspection, witnessing or approval activities at any stage do not transfer or diminish this responsibility.
- The Bidder shall deploy a dedicated quality-management function for the project. A named Quality Manager shall be identified in the bid, shall be present at key inspection and acceptance events and shall be the single point of accountability for all quality-related correspondence with GEL.
- All testing activities shall be conducted in the same environment and architecture that will be used for production. Testing conducted in a separate or simulated environment shall not be accepted as evidence of compliance.

- The Bidder shall maintain a live test-management system throughout the project, capable of logging test cases, recording test results, tracking defect status and generating summary reports accessible to GEL on request. The system may be the Bidder's own tool; GEL does not intend to own or host the tool.
- The Bidder shall prepare and maintain as-built documentation — single-line drawings, network-topology diagrams, device-installation records and configuration records, for each System — and shall submit the complete as-built package to GEL as part of the Go-Live acceptance deliverables.
- Any delay in testing caused by factors within the Bidder's control shall render the Bidder liable to milestone-delay penalties under the Service Level Agreement (SLA) and Penalty Framework. Where a delay is caused by factors outside the Bidder's control, the Bidder shall issue formal written notice to GEL within 48 hours of the delay becoming apparent, with supporting evidence. Delay notices without supporting documentation shall not be accepted.

3.7.6.2. Quality Assurance Plan

- The Bidder shall submit a Quality Assurance Plan to GEL within seven working days of contract award and before any hardware procurement or platform-deployment activity begins. GEL's written approval of the QAP is a prerequisite for hardware procurement and platform deployment.
- The QAP shall cover, at minimum: hardware procurement quality standards and supplier-qualification criteria; FAT procedures for all hardware types (SCADA RTUs and field devices; AMI Modems and MIUs); SAT procedures for each SCADA station type and each AMI location type; platform testing procedures for each System — system testing, integration testing, performance testing and security testing; the AMI parallel-operations methodology and reconciliation procedures; the CMP per-phase and per-integration acceptance procedures; UAT procedures and acceptance criteria; data-quality check procedures at each phase; EOL/EOS compliance-verification procedures at time of procurement; defect-classification criteria (critical, high, medium and low) with associated resolution timelines; and non-conformance management procedures.
- Where GEL raises queries on the QAP during its review, the Bidder shall resolve all queries to GEL's satisfaction within two working days of receiving them. No extension to the implementation schedule shall be granted for delays in QAP approval that are attributable to the Bidder.
- Where a system change, process change, or incident finding during the project requires the QAP to be revised, the Bidder shall submit the revised QAP to GEL for approval within 10 working days of the triggering event.

3.7.6.3. Hardware Delivery Inspection (SCADA and AMI)

- Before any hardware is dispatched from the Bidder's or the manufacturer's facility, the Bidder shall prepare a detailed shipment checklist for each lot, specifying item descriptions, part numbers, quantities, serial numbers, firmware versions and certification references for each unit. GEL may audit this checklist at any time.
- On delivery of each hardware lot to the Bidder's staging facility or directly to site, the Bidder shall conduct a physical receipt inspection in the presence of GEL's designated

representative, covering: physical count against the shipment checklist (any shortfall renders the shipment incomplete); physical-condition check of each unit for transit damage, incomplete assemblies or missing accessories; serial-number and part-number verification against purchase documents; and certification-label verification (PESO/ATEX labels, IP-rating markings and manufacturer certification markings).

- Any unit found to be physically damaged, non-compliant with the specifications in the Technical Specifications for Hardware Components section, or missing required certifications, shall be rejected and returned to the Bidder's supplier at the Bidder's cost. Rejected units shall be replaced and re-inspected before being accepted into the project inventory.
- GEL reserves the right to require replacement of any hardware found, at any stage of the project, to be non-compliant with the specifications in the Technical Specifications for Hardware Components section. Where the non-compliance affects SLA performance, the Bidder shall replace the hardware at no cost to GEL and within the timeline specified in the Service Level Agreement (SLA) and Penalty Framework.
- The Bidder shall maintain an inventory-management log for all hardware received, installed, held in spare inventory and decommissioned, updated in real time and accessible to GEL throughout the contractual period.

3.7.6.4. Factory Acceptance Testing (FAT) (SCADA and AMI)

General

- FAT shall be conducted on all SCADA field hardware and all AMI Modems and MIUs before dispatch to site. No unit shall be dispatched without a GEL-accepted FAT pass record.
- FAT shall be conducted by a third-party inspection agency (TPIA) appointed and paid for by the Bidder. The TPIA shall be an accredited inspection body and/or GEL/PMC team members. The engagement, scheduling, conduct and payment of the TPIA are entirely the Bidder's responsibility. The Bidder shall bear all costs associated with the FAT for all members engaged in the activity.
- The Bidder shall notify GEL by email at least seven working days before each FAT activity, specifying the date, location, batch composition and TPIA contact. GEL reserves the right to witness any or all FAT activities at any time, with or without advance notice. GEL witnessing does not substitute for TPIA certification.
- The TPIA shall issue a FAT completion certificate for each hardware batch. GEL shall issue technical clearance within seven working days of receiving all TPIA documents. Hardware shall not be dispatched before GEL's technical clearance.
- Units that fail FAT shall be reworked by the Bidder, retested and presented for re-inspection. The TPIA shall issue a fresh certificate covering reworked units before they are dispatched. Rework and re-inspection are entirely at the Bidder's cost and time.

AMI — FAT verification (per unit, each batch)

- *Physical and mechanical:* physical condition and build quality (no damage, incomplete assembly or missing components); enclosure IP rating verified against the IP65 minimum by test or certification; ATEX/PESO certification validity for the applicable hazardous-area

classification; and dimensional and mounting compliance with the Technical Specifications for Hardware Components section.

- *Communication and protocol:* communication functionality on both SIM slots independently (data transmission, signal quality RSSI/SINR and failover); Modbus RTU and Modbus TCP protocol driver operation; all applicable EVC OEM proprietary protocol drivers loaded and functional; and dual-SIM / single-SIM multi-network (multi-IMSI) failover — primary SIM disabled, automatic failover to secondary within the configured timeout, data transmission confirmed on secondary.
- *Firmware and software:* firmware version verified and confirmed not EOL/EOS; firmware-update reception and confirmation (a test firmware package delivered to the device and applied successfully); and secure boot confirmed (device rejects unsigned firmware).
- *MIU-specific:* pulse-count accuracy against a calibrated reference (tolerance per QAP); and pulse-cable interface verified (shielding and connector integrity).

SCADA — FAT verification (per unit, each batch)

- *Physical and mechanical:* physical condition and build quality; enclosure IP rating and, where applicable, explosion-proof/hazardous-area certification (ATEX/IECEx/PESO) validity for the applicable area classification; and dimensional and mounting compliance with the Technical Specifications for Hardware Components section.
- *RTU and I/O:* RTU functionality including I/O processing across all configured input/output types, on-board diagnostics and communication interfaces; verification of redundant power-supply operation and automatic changeover; and confirmation of configured I/O point count and channel integrity.
- *Communication and protocol:* cellular communication functionality including signal quality, data-transmission reliability and failover; DNP3 (and, where applicable, Modbus RTU/TCP) protocol driver operation; protocol-conversion/interface operation for connected field devices; and communication redundancy and automatic-recovery behaviour.
- *Protection and safety:* surge-protection and barrier/isolation-device operation; intrinsic-safety compliance for hazardous-area units with certification validation; and explosion-proof enclosure integrity where applicable.
- *Firmware and software:* firmware version verified and confirmed not EOL/EOS; firmware-update reception and confirmation; and secure boot confirmed where supported.

CMP

- The CMP carries no field hardware and is not subject to FAT. The equivalent factory-stage gate for the CMP is the software deployment and configuration validation of the CMP software in the MeitY-compliant cloud environment, verified under *Platform Testing Framework* and accepted at the CMP Phase 1 Go-Live per the Project Milestones and Implementation Timeline section.

3.7.6.5. Site Acceptance Testing (SAT) (SCADA and AMI)

General

- SAT shall be conducted at every field location after installation and before that location is declared commissioned, in the presence of GEL's designated GA Team representative.

- The SAT checklist shall be reviewed and approved by GEL as part of the QAP approval. No SAT may commence before GEL approves the checklist.
- The Bidder shall prepare a SAT completion record for each location, documenting all test results, RSSI/SINR readings and any deviations. The SAT record shall be signed by both the Bidder's representative and GEL's GA Team representative before the location is declared commissioned. GEL's representative shall not be pressured to sign before all deficiencies are resolved.
- Locations where SAT identifies deficiencies shall be recorded in the Bidder's installation tracker, reworked and retested. No batch shall be declared ready for parallel operations (AMI) or for the applicable Go-Live (SCADA) until 100% of locations in that batch / zone have a signed SAT record. In case of SCADA go live of a particular zone, it shall be less than the locations having a dependency(ies).

AMI — SAT verification (per location)

- *Physical installation:* Modem or MIU positioning, enclosure fixing quality, cable routing and weatherproofing; shielded-cable integrity between EVC and Modem, or pulse cable between PD meter and MIU; safe-zone compliance (enclosure confirmed outside the metering skid at minimum 1.5 metres from the hazardous-zone boundary); and earthing and surge-protection installation.
- *Communication:* communication test on both SIM slots independently, with RSSI and SINR logged per SIM; SIM-failover test (primary SIM manually disabled, automatic failover to secondary confirmed with data transmission continuing without operator intervention); and protocol test (data read from EVC confirmed against a concurrent manual reading for the same interval).
- *Platform-side:* AMI Platform data receipt confirmed and correctly processed; end-to-end data-flow test to the SAP billing data export in the correct format; TLS encryption confirmed active on the field-to-platform path; and OTA capability test (a test firmware package pushed to the device with confirmed receipt).
- *PD meter locations (additional):* simultaneous manual read of the mechanical index and the MIU-captured index at the same instant, agreeing within the QAP tolerance; and pulse-count reconciliation over a test period.

SCADA — SAT verification (per station)

- *Physical installation:* RTU/enclosure fixing, cable routing and weatherproofing; cable integrity from termination points to field connections, verified before and after energisation; earthing/grounding and surge-protection installation; and hazardous-area/intrinsic-safety compliance where applicable.
- *Communication:* communication test on each SIM independently with signal quality logged; SIM-failover test confirmed without operator intervention; and DNP3 (or applicable protocol) data exchange verified end-to-end.
- *Field-device integration:* verification of pressure, temperature, flow and valve-position signals and of EVC/PLC/flow-computer interfaces, each confirmed against a concurrent local reading where feasible.
- *Control and safety (where applicable to the station type):* select-check-execute control-command test performed under GEL supervision and safe operating conditions; emergency-

shutdown/SSV command and feedback verified where present; and alarm generation, annunciation and acknowledgement confirmed.

- *Platform-side:* SCADA Platform (MMS/BMS) data receipt confirmed and correctly displayed; TLS encryption confirmed active on the field-to-platform path; and store-and-forward buffer recovery confirmed after a simulated short communication outage.

CMP

- The CMP has no field locations and is not subject to field SAT. The equivalent site-stage gate for the CMP is per-integration acceptance — each integrated source system's feed validated and reconciled against its native application — verified under *Platform Testing Framework* and accepted at the applicable CMP phase Go-Live.

3.7.6.6. Platform Testing Framework (SCADA, AMI and CMP)

The Bidder shall complete the following platform testing for each System before requesting UAT commencement. All testing shall be conducted in the production environment and architecture.

System testing

- The Bidder shall prepare a system test plan and test-case library covering every functional requirement for the System in the Functional Requirements section, submitted to GEL for review before testing begins. GEL may request test cases and results at any time.
- **AMI:** all HES functionality (device communication, on-demand reads, threshold configuration, firmware OTA, time synchronisation); all MDMS functionality (data collection, VEE rule processing, billing-determinant calculation, storage and retrieval); all NMS functionality (SIM and communication monitoring, fault detection, remote SIM/network operations); all EMS functionality (SLA event capture, billable-days calculation, compliance-report generation, GEL independent access); all alarm types and notification delivery across channels; all report types and dashboard functionality; web and mobile (iOS and Android) application functionality.
- **SCADA:** end-to-end data flow from field measurement through communication to the cloud MMS/BMS display; real-time data representation and historian write/read accuracy; supervisory control including select-check-execute, emergency shutdown and interlock logic; alarm detection, annunciation, acknowledgement and escalation; MMS↔BMS failover; analytics (line-pack, LUAG/UFG, consumption, remote CNG price change) and reporting; and web and mobile (iOS and Android) functionality including cascade-vehicle-tracking features.
- **CMP:** software deployment and configuration; ingestion from each integrated source into the Data Lake; dashboards and cascading reporting; basic and (Phase 3) AI/ML analytics; alert management and emergency-control workflow; digital-SOP linkage; E&P dashboards and data-entry/middleware paths; and web and mobile functionality with SSO and role-based access.
- Defects identified during system testing shall be classified, tracked and resolved before UAT is requested. All critical and high-severity defects shall be resolved and verified before UAT begins.

Integration testing

- The Bidder shall conduct integration testing for all interfaces before requesting UAT, covering: the SAP Billing end-to-end integration (a full billing-cycle run with simulated device data, validated from the AMI Platform through to SAP billing-record creation); SCADA↔CMP and AMI↔CMP data exchange; the SCADA↔AMI interface where applicable; and all other configured integrations (CRM/CIS, GIS, Workforce Management, legacy SCADA/AMR applications and middleware for the CMP).
- Integration testing for SAP Billing and CRM/CIS shall be conducted with GEL's IT and SAP teams in attendance; the Bidder shall coordinate scheduling at least seven working days in advance and shall provide requisite support for SAP ECC and SAP S/4HANA integration wherever requested.
- The Bidder shall prepare an integration test report for each interface, documenting test scenarios, data samples, results and issues. For the CMP, each integration test shall include a data-reconciliation check confirming the replicated data matches the source's native application. All integration defects shall be resolved before UAT begins.

Performance and load testing

- Performance testing shall verify, at minimum: platform response under simultaneous load from 100 concurrent users; data-collection/acquisition throughput from all contracted devices/sources within the defined windows; dashboard and report response times against the thresholds in the Service Level Agreement (SLA) and Penalty Framework; SAP billing-data export within the delivery window for all customer billing dates simultaneously (AMI); real-time alarm/event processing (AMI: 1,000 simultaneous alarm events; SCADA: peak alarm-flood and control-command load; CMP: concurrent alert and emergency-control dispatch) without queueing delay beyond the SLA threshold; and full DR failover within the RTO of 4 hours with data loss not exceeding the RPO of 1 hour.
- Where performance results do not meet the SLA thresholds, the Bidder shall remediate and retest before UAT begins and shall share all results with GEL.

Security testing and VAPT

- The Bidder shall conduct security testing covering application-layer security controls, network-layer security, data-centre and cloud-infrastructure security, security-configuration review of all components and mobile-application security against the OWASP Mobile Security Top 10.
- An independent Vulnerability Assessment and Penetration Test (VAPT) of the complete System — platform, all APIs, field-device communication, cloud infrastructure, modems, mobile app, web platform and all integration interfaces — shall be conducted by a CERT-In empanelled auditor before Go-Live acceptance is requested. The cost of this VAPT is entirely the Bidder's responsibility. The VAPT shall comprise both a technical assessment (including vulnerability assessment and penetration testing of systems, applications, APIs, infrastructure and devices) and a process assessment (including review of security processes, access management, patch management, change management, incident response, data handling and configuration governance). A purely technical test does not satisfy this requirement.
- A VAPT shall be conducted before the release into GEL's production environment of any new or updated version of firmware, platform software, or the mobile application. No new version shall be deployed to production until its VAPT is complete and its V1 findings are

closed, per the Service Level Agreement (SLA) and Penalty Framework. This applies to every version release, however minor, that changes code in the production environment.

- In addition, a full VAPT shall be conducted annually, or at a version release, whichever is earlier. A version-triggered VAPT that meets the full-scope requirement may satisfy the annual VAPT for that period; where no version is released within twelve months, the annual VAPT shall still be conducted.
- VAPT observations shall be classified into four severity levels V1–V4 (see *VAPT Severity Definitions*), based on CVSS. The auditor's CVSS scoring governs; GEL may escalate a level where business or safety context warrants.
- The Bidder shall remediate each finding and submit a closure report with the CERT-In auditor's independent re-test confirmation within the timeline for its severity. For the pre-Go-Live VAPT, all V1 and V2 findings shall be closed with evidence before Go-Live acceptance; V3 and V4 shall have an agreed remediation plan within their timelines.
- During the O&M Period, an annual cybersecurity review and VAPT shall be conducted by a CERT-In empanelled auditor at the Bidder's cost, with the report and remediation actions submitted to GEL within 30 days of each review. The Bidder shall submit a current SOC 2 Type II report covering the hosting and operations of the System every six months throughout the contract, each covering the preceding period with no coverage gap.
- For each VAPT the Bidder shall submit: evidence of the auditor's current CERT-In empanelment for the period of the test; the complete VAPT report listing every observation with a unique finding ID, description, affected component/asset, CVSS score and vector string, assigned severity V1–V4, evidence/proof-of-concept and remediation recommendation; an executive summary stating total findings by severity, overall risk posture and any systemic or recurring weaknesses; a closure report per finding stating the remediation action, closure date and residual status (closed / open / risk-accepted), with any risk-accepted item carrying GEL's written acceptance; the CERT-In auditor's independent re-test confirmation for each remediated finding (self-declaration of closure is not acceptable); the process-assessment output; and, for a version-triggered VAPT, the version identifier, a summary of the changes introduced and confirmation that the VAPT covered the changed components together with a regression check of previously closed findings. The report and executive summary shall be submitted within 5 working days of the auditor issuing the VAPT report and closure/re-test evidence within the severity closure timelines in the Service Level Agreement (SLA) and Penalty Framework, in a GEL-agreed format signed by the CERT-In auditor.

3.7.6.6.1. VAPT Severity Definitions

Every VAPT observation shall be classified into one of four severity levels by the CERT-In empanelled auditor using the Common Vulnerability Scoring System (CVSS) at the time of reporting. GEL may escalate a level where business or safety impact warrants. The closure report and the auditor's re-test confirmation shall be timestamped against the closure target for the assigned severity, as set out in the Service Level Agreement (SLA) and Penalty Framework.

Severity	Definition	Examples
V1 — Critical	A vulnerability that could lead directly to full system compromise, unauthenticated remote code execution, mass data breach,	Unauthenticated remote code execution on a platform; authentication bypass to billing data; an exposed field-

	or a safety impact on the gas network; CVSS 9.0–10.0.	device command interface allowing mass control.
V2 — High	A vulnerability that could lead to significant unauthorised access, data exposure or service disruption, typically requiring some condition but of serious impact; CVSS 7.0–8.9.	Privilege escalation to administrator; SQL injection exposing customer data; broken access control on an API returning other users' data.
V3 — Medium	A vulnerability of moderate impact, or requiring specific conditions, chaining or local access to exploit; CVSS 4.0–6.9.	Cross-site scripting; weak TLS configuration; missing security headers; verbose error messages disclosing system detail.
V4 — Low	A minor or informational finding with limited impact, or a process/hardening recommendation; CVSS 0.1–3.9.	An outdated but non-exploitable component version; cosmetic information disclosure; a minor configuration-hardening recommendation.

3.7.6.6.2. User Acceptance Testing (UAT)

- UAT shall be conducted for each System with GEL's designated UAT team — comprising GA Team operators, billing-team representatives, IT team and SAP team, as applicable to the System — before Go-Live acceptance is requested.
- The Bidder shall submit a UAT test plan to GEL for written approval before testing begins, including: test scripts for all operational scenarios relevant to each GEL role; defect-classification criteria (critical, high, medium, low); entry criteria (all system, integration and performance testing complete; all critical and high defects resolved); exit criteria (all critical and high-severity UAT defects resolved; UAT completion report signed); and escalation and resolution timelines per defect classification.
- UAT shall cover, at minimum: all functional requirements for the System verified from the end-user perspective; all configured integrations; all standard report types and the custom report builder; all dashboard types; the full alarm and notification workflow (generation, multi-channel notification, acknowledgement, escalation and closure); the mobile application on iOS and Android; a live DR failover test with data verified intact and GEL access confirmed from the DR site; CERT-In VAPT remediation sign-off (all critical and high findings closed); and an EMS live audit confirming GEL independent access, active SLA event capture and review of a sample quarterly report. For AMI, UAT shall additionally cover the SAP Billing end-to-end path, field-hardware-agnosticism demonstration and manual meter-reading capture with photo and GPS. For SCADA, UAT shall additionally cover supervisory control, emergency-shutdown and MMS↔BMS failover. For the CMP, UAT shall additionally cover per-source integration and reconciliation, dashboards and analytics and the alert/emergency-control workflow with digital-SOP linkage.
- Changes to a Platform identified as necessary during UAT shall not be treated as Change Requests. The Bidder shall implement all changes required to achieve UAT exit criteria within the contracted scope.

- The Bidder shall provide a UAT completion report signed by GEL's designated UAT team lead. This report is a mandatory condition of Go-Live acceptance. Any UAT defect not resolved and verified closed before signature shall be recorded as an open item; open items at critical or high severity shall block Go-Live acceptance. Where GEL's UAT team identifies a defect not covered by the test scripts, the Bidder shall classify, log and remediate it within the timelines for its severity level; GEL's defect-classification decision is final.

3.7.6.7. Go-Live Readiness and Acceptance

The Bidder shall obtain Go-Live acceptance from GEL before a System (or a zone or phase thereof) enters the O&M Period. Go-Live is a two-level construct — System/zone/phase Go-Live and Final Go-Live upon Go-Live of all three Systems — as defined in the Definitions and Acronyms section and scheduled in the Project Milestones and Implementation Timeline section. The CMP achieves Go-Live in phases (Phase 1, Phase 2 and Phase 3). For each Go-Live, the Bidder shall submit a formal Go-Live Readiness Report confirming completion of the applicable conditions below.

Common conditions (every System/zone/phase Go-Live):

#	Condition	Verification Method
1	System, integration and performance testing complete; no open critical or high defects	Bidder test completion report
2	CERT-In VAPT complete; all critical and high findings remediated with evidence	VAPT report and remediation evidence
3	UAT complete and UAT completion report signed by GEL's UAT team lead	Signed UAT completion report
4	EMS deployed, active and GEL independent access confirmed and tested	GEL IT team confirmation
5	NMS active and tracking all in-scope SIMs (SCADA/AMI); integrated view available on the System portal	GEL NMS access confirmation
6	DR failover test passed	DR test record with GEL sign-off
7	All applicable SOPs developed, approved, accessible and training delivered per the Training and Capacity Building section	Go-Live SOP checklist
8	As-built documentation complete and submitted	Document submission record

SCADA — additional conditions: 100% of in-scope stations in the zone have a signed SAT record; supervisory control, emergency-shutdown and MMS↔BMS failover validated; store-and-forward and historian integrity confirmed.

AMI — additional conditions: 100% of in-scope locations have a signed SAT record; parallel operations completed for all batches with GEL acceptance of the reconciliation reports; SAP Billing integration live with billing data successfully delivered for at least one full billing cycle; no open billing-date impacts (all devices live in time for the first billing run).

CMP — additional conditions (per phase): all in-scope source-system integrations for the phase live and reconciled against their native applications; dashboards/analytics for the phase operational;

and, for Phase 3, the alert-management and emergency-control module and AI/ML analytics operational.

GEL shall review the Go-Live Readiness Report and either issue the Go-Live acceptance certificate or provide a written list of conditions not yet satisfied. The Bidder shall resolve all outstanding conditions and resubmit. The Go-Live acceptance certificate shall be issued only when all applicable conditions are satisfied to GEL's written confirmation. The decision of GEL is final and binding.

3.7.6.8. Post-Go-Live Operational Testing

- During the three-month SLA Stabilisation Period, the Bidder shall conduct daily data-quality checks and weekly performance reviews for each System, with reports submitted to GEL. The SLA Stabilisation Period is a testing and verification phase for confirming sustained SLA compliance; it is not a payment period.
- The Bidder shall conduct quarterly performance assessments during the O&M Period, comparing actual SLA performance against targets, identifying any degradation trends and presenting findings to GEL with remediation proposals where needed.
- Where any hardware type fails at a rate indicating a systematic quality issue — defined as more than a 5% failure rate of any single hardware type in any rolling 90-day period — the Bidder shall conduct a root-cause analysis, submit findings to GEL within 15 days and propose a systematic remediation. GEL may require the Bidder to replace all units of the affected type at no additional cost.
- The Bidder shall retain all SAT records, FAT certificates, test reports, VAPT findings and UAT documentation for the full contractual period plus two years post-handover and shall make these available to GEL on request.

3.7.7. Survey, Site Assessment and Requirement Gathering

The Bidder shall conduct a comprehensive survey, site assessment and requirement-gathering exercise as the first activity of the project, corresponding to Milestone S1 in the Project Milestones and Implementation Timeline section. The survey covers the SCADA and AMI field locations; requirement gathering is undertaken for the CMP with GEL officials in parallel. No physical work at a location shall commence until its survey is complete and any resulting deviation is approved by GEL.

General (all three Systems)

- The Bidder shall record all survey and assessment findings in a structured survey document and shall obtain a requirement-gathering sign-off for the CMP, in the formats agreed with GEL (including MS/Google forms as applicable) and submit these as the Milestone S1 deliverables.
- The quantities in the Schedule of Rates (SOR) are indicative for planning. Where the quantities identified during survey differ from those in the scope of work or the SOR, the Bidder shall flag the discrepancy in writing to GEL during the survey; GEL shall issue a written clarification before installation commences. In the absence of a written clarification, the SOR quantities shall prevail for commercial purposes and payment shall be made on the actual quantities commissioned.

- The Bidder shall document any deviation from the survey findings or the proposed installation/solution design and shall propose corrective measures for GEL's approval before proceeding.
- The power design and the associated power calculations for field devices are a Milestone-related deliverable governed by the Field Installation and Hazardous-Area Safety section.

SCADA

- The Bidder shall conduct a comprehensive survey of every in-scope SCADA station during Milestone S1, assessing at minimum: existing instrumentation and equipment status; available power-supply infrastructure and grounding systems; cellular signal strength and communication feasibility; hazardous-area classification and safety requirements; space availability for new equipment; and, for underground DRS and similar locations, chamber dimensions, accessibility, structural condition and environmental conditions (moisture, ventilation, temperature).
- Based on the survey findings, the Bidder shall categorise each location and propose appropriate technical solutions — equipment specifications suitable for the installation, alternative monitoring approaches where direct installation is not feasible, infrastructure upgrades required and safety measures and access procedures — for GEL's approval.

AMI

- The Bidder shall study the existing EVC or PD-meter configuration, communication-port type and field conditions at each location before commencing physical work.
- The Bidder shall conduct a signal-strength assessment at each location to determine antenna requirements and optimal placement for the selected communication technology.
- The Bidder shall record the data-collection performance of GEL's existing AMI system at each location, to serve as the baseline for parallel-operations reconciliation.

CMP

- The Bidder shall conduct requirement gathering with GEL officials to establish the CMP scope, capturing at minimum: the source systems, applications and third-party solutions to be integrated (per Annexure 1), including existing multi-OEM SCADA platforms, legacy AMR applications, spreadsheet feeds, SAP and other applications; GEL's data philosophy, formats and standards; the required reporting dashboards and KPIs, including E&P dashboards and manual data-entry forms; and the phasing of integrations across CMP Phase 1, Phase 2 and Phase 3.
- The Bidder shall obtain a requirement-gathering sign-off from GEL as the CMP Milestone C1 deliverable.

3.7.8. Cloud Hosting, Data Centre, Disaster Recovery, MeitY Empanelment and Data Residency

All three Systems shall be delivered on a single, common private cloud. The cloud, its Data Centre (DC), its Disaster Recovery (DR) site and its empanelment status are common infrastructure inherited by SCADA, AMI and CMP alike.

General (all three Systems)

- The Bidder shall deploy all three Platforms on a single MeitY-empanelled private cloud, with all data centres located within India. The Cloud Service Provider (CSP) shall be and shall remain, an empanelled member of MeitY-empanelled CSPs, with SOC 2 Type II certification, for the entire duration of the project including any extension.
- Loss of MeitY empanelment or of SOC 2 Type II certification shall require immediate migration to a compliant provider, at the Bidder's cost, with no disruption to GEL operations.
- All Platforms shall be hosted in a primary cloud DC with a geographically separate DR site in a different geographic region. Automatic failover to the DR site shall be configured and tested, with a Recovery Time Objective (RTO) of four hours or less and a Recovery Point Objective (RPO) of one hour or less.
- The cloud architecture shall provide high availability, redundancy and scalability sufficient to meet the device/location and data volumes in the SOR and to meet all service levels in the Service Level Agreement (SLA) and Penalty Framework.
- **Data residency.** All GEL data under this contract shall reside and remain within the territorial boundaries of India at all times, throughout the contract period and any extension. "GEL data" means all field, operational, metering, processed and billing data, customer data, alarms and events, logs, telemetry, backups, archives, configuration and any derivative data held or generated by any of the three Platforms or any connected component. No GEL data shall be stored, replicated, backed up, cached, processed or transmitted to any location, data centre, service or person outside India, whether by the Bidder, the CSP, any OEM or any sub-processor.

SCADA

- The SCADA master-station functions — Main Master Station (MMS), Backup Master Station (BMS) and GA-level control — shall be cloud-hosted on the common private cloud in dual hot-standby with automatic failover and shall use the shared DR site. No physical control-centre infrastructure (video walls, UPS, security appliances) is in scope.

AMI

- The AMI Platform shall be hosted on the common private cloud with high availability and the shared, geographically separated DR site.

CMP

- The CMP, including its centralised Data Lake, shall be deployed on the common MeitY-compliant cloud environment with the shared DR site and shall observe the same data-residency requirement for all integrated and derived data.

3.7.9. Cybersecurity and Data Protection

Each System shall be designed, implemented and operated as a cyber-secure system throughout the contractual period. Cybersecurity is a baseline requirement applying to every component and layer of the SCADA, AMI and CMP System and all cybersecurity obligations are within the contracted scope at no additional cost to GEL. Breach handling and the Bidder's data-security liability are set out in SLA section along with the security testing and VAPT regime is set out in the Quality Assurance, Testing and Acceptance Criteria section.

General (all three Systems)

- **Standards compliance.** Each System shall comply with IEC 62443 (Industrial Automation and Control Systems Security) at the applicable security levels and with NCIIPC guidelines for Critical Information Infrastructure throughout the contractual period.
- **Encryption in transit.** All data communication shall be encrypted using TLS 1.2 or higher (TLS 1.3 preferred), at every boundary: field device to Platform; between Platform components (application, data and integration layers); and between the Platform and GEL's enterprise systems. Unencrypted communication paths are not permissible under any circumstances.
- **Encryption at rest.** All operational, metering, configuration and user data stored in any Platform shall be encrypted at rest using AES-128 / 256 or equivalent.
- **Secure network.** A dedicated APN or equivalent secure network configuration shall be implemented for all field SIMs.
- **Secure device identity.** All field devices shall implement device-authentication mechanisms to prevent unauthorised device spoofing, replay attacks and man-in-the-middle attacks.
- **Access control.** Each System shall implement Role-Based Access Control, Multi-Factor Authentication and Active Directory integration with Single Sign-On, as set out in the Identity and Access Management section.
- **Patch management.** Critical security patches shall be applied within 30 days and non-critical patches within 90 days of availability, with prior notification to GEL for each deployment and without affecting GEL's billing and data-collection windows.
- **Audit and review.** Tamper-proof audit logs shall be maintained as set out in the Identity and Access Management section. An annual cybersecurity review and VAPT shall be conducted by a CERT-In empanelled auditor and a current SOC 2 Type II report shall be submitted every six months, as set out in the Quality Assurance, Testing and Acceptance Criteria section.
- The Bidder shall provide GEL with a communication-security architecture document confirming the encryption standards applied at each communication boundary, as part of the implementation deliverables.

SCADA

- The SCADA System shall be secured as an operational-technology (OT) system to IEC 62443 at the applicable security levels, with certificate-based RTU authentication, IPsec / AES-256 VPN tunnelling for field-to-platform communication, secured DNP3 with TLS and network segregation of the supervisory-control path. The integrity of the select-check-execute control sequence shall be enforced as a security and safety control.

AMI

- The AMI System shall additionally comply with STQC certification and secure the metering data path end-to-end, including signed-firmware / secure-boot enforcement on field devices and secure OTA firmware delivery.

CMP

- The CMP shall be secured at the application layer, including API security through the API gateway (authentication, authorisation and rate control), access control on the Data Lake

and secure, authenticated integration with every source system, in addition to the common SSO / RBAC / MFA controls.

3.7.10. Enterprise and Cross-System Integration

Each System shall integrate with GEL's enterprise systems and with the other Systems delivered under this RFP, through open, standard interfaces. The CMP is the central aggregation hub for GEL's operational data; its detailed, source-by-source integration scope is set out in the Centralized Monitoring Platform section and this section states the common integration standards and the System-specific interfaces.

General (all three Systems)

- All integration shall use open, standard APIs (REST and OPC UA where applicable). No proprietary interface that prevents GEL from independently connecting third-party systems is acceptable.
- The Bidder shall implement an API gateway layer managing concurrent connections to enterprise systems with load management and automatic failover and shall be capable of integrating any additional GEL system through the open API layer without requiring platform-architecture changes.
- The Bidder shall implement data-lineage tracking, maintaining a complete audit trail of data sources, transformations and processing steps from the field device or source system through to enterprise-system delivery.
- Complete, up-to-date API documentation shall be provided to GEL and updated whenever any Platform API changes. Webhook-based, event-driven integration shall be supported for real-time downstream consumption where applicable. All integration shall be encrypted and authenticated as set out in the Cybersecurity and Data Protection section.
- Each System shall integrate with GEL's SAP, CRM/CIS, GIS, Workforce Management and any other enterprise system identified during the contractual period, as applicable to that System.

SCADA

- The Bidder shall integrate the SCADA System with the CMP (feeding operational data to the CMP) and, where applicable, with the AMI System and shall implement integration with existing data-logging systems, the CBG-plant systems and specialised equipment through the appropriate protocols and OEM coordination. Where required, existing control systems shall retain independent operational functionality.

AMI

- Integration with GEL's SAP Billing system is mandatory and is a hard prerequisite for Go-Live acceptance. Validated, VEE-processed billing determinants shall be delivered to SAP on each customer's scheduled billing date across all billing-cycle types, supporting both direct API and scheduled file-transfer modes, with support for SAP ECC and SAP S/4HANA. The AMI System shall additionally integrate with the SCADA System, the CMP, CRM/CIS, GIS and Workforce Management as required.

CMP

- The CMP shall integrate all source systems, existing and future, into its centralised Data Lake — SAP, the new SCADA and AMI Systems, existing multi-OEM SCADA platforms, multiple legacy AMR applications, spreadsheet feeds, middleware and future applications per Annexure 1 — with each integration validated and reconciled against its native application per the Quality Assurance, Testing and Acceptance Criteria section. Outgoing legacy applications shall remain integrated until their assets are migrated to the new Systems (mandatory coexistence). The detailed, phase-wise CMP integration scope is set out in the Centralized Monitoring Platform section.

3.7.11. Identity and Access Management (RBAC, SSO and Audit Logging)

A single, common identity and access model shall govern user authentication, authorisation and audit across the SCADA, AMI and CMP portals and mobile applications. The System-specific role catalogues are defined in the respective Functional Requirements; this section states the common model that all three shall implement.

General (all three Systems)

- **Role-Based Access Control (RBAC).** Each System shall implement RBAC with granular permissions per module and per data scope — per GA, per zone, per device group and per data scope. Access to any function or data shall be granted only where the user's assigned role permits it and only for the GAs and data scopes their role permits. The role-to-permission mapping shall be configurable by authorised GEL administrators.
- **Single Sign-On and Multi-Factor Authentication.** Each System shall integrate with GEL's Active Directory and provide Single Sign-On using SAML 2.0 or OAuth 2.0 / OpenID Connect, with Multi-Factor Authentication mandatory for all user access — web, mobile and API. Accounts inactive beyond a configurable period shall be disabled automatically.
- **Consistent web and mobile rights.** A GEL user's access rights on the mobile application shall be identical to their web-portal access rights for the same System.
- **Audit logging.** Tamper-proof audit logs covering all user actions, device commands, data modifications, configuration changes and integration events shall be maintained for each System for a minimum of two years and shall be retained and archived in accordance with the Data Management section. Audit logs shall not be modifiable or deletable by the Bidder.
- **Governance of embedded views.** The role-based, read-only NMS and EMS views embedded in each System portal shall be governed by this common RBAC model and its data-level scoping, as set out in the Integrated Portal Visibility of NMS and EMS section.

SCADA

- The SCADA role model shall additionally scope supervisory-control authority — which roles may issue control commands, set-points, remote CNG price changes and emergency-shutdown actions — with control actions restricted to authorised roles and fully captured in the audit log.

AMI

- The AMI role model shall scope GA-team, billing-team, IT and administrator roles, with data-level scoping per GA and per data scope, including access to the SAP billing-data path and the meter data.

CMP

- The CMP role model shall scope access to dashboards, analytics and the alert / emergency-control module by role and data scope, with SSO across the integrated views, such that a user sees only the operational data their role and GA scope permit.

3.7.12. Documentation, As-Built and SOPs

The Bidder shall prepare, maintain and hand over complete documentation for the SCADA, AMI and CMP System throughout the project and the O&M Period. The documentation standards in this section apply to all three Systems; the specific deliverables are produced per System.

General (all three Systems)

- The Bidder shall prepare and maintain as-built documentation for each System, comprising at minimum single-line drawings, network-topology diagrams, device- and integration-installation records and configuration records and shall submit the complete as-built package to GEL as part of the Go-Live acceptance deliverables under the Quality Assurance, Testing and Acceptance Criteria section.
- The Bidder shall develop Standard Operating Procedures (SOPs) for all critical operations of each System, submit them to GEL for comprehensive review and approval and incorporate GEL's feedback. A formal SOP approval workflow shall ensure that each procedure is validated by the appropriate GEL departments — including Operations, Safety and Engineering — before implementation.
- The Bidder shall implement a version-control system for all SOPs and documentation, maintaining records of revisions, approval dates and implementation status throughout the project lifecycle and the O&M Period and shall establish a periodic review-and-update mechanism so that all procedures remain current with system modifications, operational changes and evolving safety requirements.
- The Bidder shall provide user guides, operations and maintenance manuals, training materials and SOPs in English, Hindi and Gujarati and shall deliver training on their use in accordance with the Training and Capacity Building section. All approved SOPs shall be accessible to authorised GEL users through the relevant System, and the complete documentation set shall be handed over to GEL at contract completion in accordance with the Operations and Maintenance section.
- The Bidder shall retain all as-built records, SOPs, test and acceptance documentation for the full contractual period plus two years post-handover and shall make these available to GEL on request.

SCADA

- SOPs shall cover, at minimum, CNG price-change procedures, emergency-shutdown protocols, mobile cascade-vehicle-tracking operations, system-maintenance activities and alarm-response procedures, together with station-specific SOPs for routine operation, troubleshooting and emergency response across each station category and SOPs for the SCADA mobile application.

AMI

- SOPs shall cover, at minimum, field installation and commissioning, manual meter-reading fallback capture, VEE and billing-exception handling, alarm response and device replacement and cross-replacement continuity, together with SOPs for the AMI mobile application.

CMP

- SOPs shall cover, at minimum, dashboard and reporting operation, incident management, emergency-control and alert handling with digital-SOP linkage and E&P data-entry procedures, together with SOPs for the CMP mobile application. Documentation shall be developed in consultation with the relevant GEL departments, including the E&P team.

3.7.13. Technology Currency, Updates and Version Management

Each System shall be kept current in technology, software, firmware and protocols throughout the contractual period, at no additional cost to GEL. This is a standing obligation of the Bidder for all three Systems. The security-patch timelines and the technology-currency service levels are set out in the Cybersecurity and Data Protection section and the Service Level Agreement (SLA) and Penalty Framework and are not restated here; this section states the version-currency, upgrade, rollback and lifecycle obligations.

General (all three Systems)

- All platform updates, patches, bug fixes and major version upgrades shall be delivered at no additional cost to GEL throughout the contractual period and each System — including all protocols, application software, firmware, operating systems, database and security components — shall be implemented at the latest commercially available stable versions at the time of deployment and kept current thereafter, with no component operated beyond active manufacturer support at any time.
- Major version upgrades affecting platform functionality or user interfaces shall require GEL's written approval before deployment and shall be deployed in agreed maintenance windows. Rollback capability shall be maintained for all updates; rollback procedures shall be documented and tested before each major deployment.
- The Bidder shall implement a structured change-management process for all version updates, ensuring minimal operational disruption and shall conduct comprehensive testing of every update in a controlled environment before production deployment.
- The Bidder shall proactively identify components approaching End-of-Life or End-of-Support before any service impact and shall plan and execute migration accordingly; migration of any component reaching EOL/EOS during the contractual period shall be at no additional cost to GEL.
- The Bidder shall implement remote diagnostic and troubleshooting capabilities for all connected field devices (SCADA and AMI), covering at minimum remote reboot, remote diagnostic test, communication diagnostics, configuration read-back and device event-log retrieval.
- A complete change log shall be maintained throughout the contractual period and handed over to GEL at contract completion in accordance with the Operations and Maintenance section.

SCADA

- All communication protocols shall be implemented and kept current at their latest stable versions, including TLS (latest version, minimum 128-bit), DNP3 with Secure Authentication, Modbus RTU/TCP, MQTT/AMQP/HTTP-REST and IEC 61850 where applicable, together with encryption upgrades to stronger standards as they become industry-adopted. RTU firmware, modem firmware, field-device firmware and communication protocol-stack updates shall be provided throughout the contractual period.

AMI

- Field-device (Modem and MIU) firmware updates shall be delivered over the air using signed firmware with rollback capability, as set out in the Quality Assurance, Testing and Acceptance Criteria and Cybersecurity and Data Protection sections.

CMP

- The COTS CMP platform, its integration components and its analytics/AI-ML models shall be kept current at supported versions, with model and analytics updates delivered under the same no-cost, GEL-approved, rollback-capable regime.

3.7.14. General

If in case the SI does not perform up to the GEL's expectation in alignment with RFP requirements, GEL shall serve them with one notice, followed by 2 show cause notices and if the same is not addressed even after these 3 notices, GEL reserves the right to terminate the contract with the Bidder, including blacklist the Bidder. GEL may award such work to other agency and also reserves the right to recover the cost associated with this, including the execution and / or O&M from the Bidder.

3.7.15. Time Synchronisation

All Platforms and devices of the SCADA, AMI and CMP System shall maintain a common, accurate and consistent time reference, so that every data point, reading, event, alarm, command and audit-log entry across the System is reliably timestamped and chronologically ordered.

General (all three Systems)

- All Platforms and devices shall be synchronised to an authoritative time source using the Network Time Protocol (NTP), with Indian Standard Time (IST) as the mandatory reference.
- Accurate timestamping shall be maintained for all data points, events, alarms, commands and audit-log entries, to preserve chronological integrity for operational analysis, billing, SLA measurement and regulatory compliance.
- Original field-side timestamps (EVC, MIU, RTU, etc.) shall be preserved through store-and-forward buffering and backfilling; data recovered after a communication outage shall retain its original device-side timestamp and shall not be re-stamped on ingestion.
- Time-synchronisation failure shall be detected, alarmed and reported through the NMS and the applicable alarm framework.

SCADA

- The Bidder shall implement DNP3 time-synchronisation capabilities across the distributed RTU network to ensure accurate timestamping and correct sequence-of-events ordering of all data points, events and alarm conditions.

AMI

- The AMI platform shall support NTP-based time synchronisation across all field devices with IST as the mandatory reference and every hourly reading shall carry its original EVC-side or MIU-side timestamp.

CMP

- All data ingested from integrated source systems shall be time-normalised to IST for correct cross-source correlation on the CMP dashboards and analytics, while the original source timestamps are retained.

3.7.16.SIM and Connectivity Management (SCADA and AMI)

The Bidder shall provide, register, manage and maintain all cellular connectivity for the SCADA and AMI field devices for the entire contractual period, at no additional charge to GEL beyond the SOR. GEL prescribes 4G LTE with 2G fallback, delivered either through dual-SIM modems or through single-SIM modems with multi-network (multi-IMSI) support.

Procurement, registration and ownership

- The Bidder shall procure all SIM cards required for the industrial cellular modems across all SCADA station types and all AMI locations. All SIM cards shall be issued and registered in the name of Gujarat Energy Limited (GEL), with appropriate corporate/industrial IoT service plans and shall remain registered in GEL's name throughout the contract.
- For all dual-SIM installations, the Bidder shall procure SIM cards from two different service providers, to ensure communication redundancy and network failover.
- All SIM cards shall support 4G/LTE with 2G fallback, static IP addressing or an appropriate dedicated APN configuration (per the Cybersecurity and Data Protection section) and shall be registered for industrial/IoT applications.

Management and operational responsibility

- The Bidder shall be solely responsible for managing all SIM issues, service requests, technical support, billing queries and coordination with service providers throughout the contract, while the SIMs remain registered in GEL's name.
- The Bidder shall ensure continuous connectivity, monitor data usage, manage SIM security and provide communication diagnostics for all SIMs, at no additional charge to GEL. SIM and connectivity health is monitored through the Network Management System (NMS) as set out in the Network Management System section.
- The Bidder guarantees uninterrupted cellular communication services and shall replace any non-performing SIM immediately at no cost to GEL, including coordination with the respective service provider for resolution.
- Communication hardware and SIMs for any new SCADA field location, EVC or PD meter added during the O&M Period shall be supplied, installed, operated and maintained by the Bidder at the SOR rate applicable for that year.

3.7.16.1. SIM Failover Mechanism

The field modems supplied under this RFP are either dual-SIM modems or single-SIM modems with multi-network (multi-IMSI) capability. The Bidder shall implement and maintain an automatic SIM and network failover mechanism that preserves field communication without manual intervention and without loss of field data.

- **Dual-SIM modems.** The modem shall maintain a primary and a secondary SIM and shall fail over automatically from the primary to the secondary SIM on loss of the primary SIM's connectivity — including loss of network registration, sustained signal degradation below a configurable threshold, or a data-session failure persisting beyond a configurable timeout — and shall fail back to the primary SIM when it is restored, subject to a configurable hysteresis to prevent repeated switching (flapping).
- **Single-SIM multi-network modems.** The modem shall automatically select and register on the best-available permitted network/IMSI and shall switch networks on loss or sustained degradation of the current network, subject to the same configurable thresholds and hysteresis.
- **Configurability and Bidder responsibility.** All failover triggers, thresholds, timeouts, network-selection order and hysteresis parameters shall be configurable. Any programming or rule development required — on the NMS and/or the modem-management platform — to implement these failover mechanisms and to meet the field-communication and device-availability SLAs shall be performed by the Bidder at no additional cost to GEL, including where the NMS is provided to the Bidder by the connectivity/SIM service provider.
- **Logging and reporting.** Every failover and fail-back event shall be logged with a timestamp, the trigger cause and the SIM/network switched from and to and shall be reported through the NMS and made available to the EMS and the integrated portal view.
- **No data loss on transition.** The failover mechanism shall operate together with the field device's store-and-forward buffering, so that no field data is lost during a failover transition. Any data buffered during the transition shall be transmitted on restoration of connectivity and processed through the normal workflow, flagged as backfilled where applicable.

3.7.17.EVC Driver Library (SCADA and AMI)

Electronic Volume Correctors (EVCs) are present at SCADA locations (including DRS/CPRS, Check Metering and CBG stations) and at AMI metering locations (IMS). A single, shared EVC driver library shall serve both the SCADA and the AMI platforms: one working communication driver per EVC make and model, developed and priced once and deployed to whichever platform consumes that EVC's data. The Bidder shall not develop or price a separate driver per platform for the same EVC make and model.

The supply, installation and commissioning of EVCs are in GEL's scope; EVCs are already installed or shall be supplied by GEL. The Bidder's scope is the development, testing, deployment and maintenance of the drivers required to integrate those EVCs and the integration of GEL's existing installed base and any future EVCs GEL adds.

Existing installed base (Annexure A)

- The Bidder shall integrate all EVC makes and models listed in Annexure A (GEL's existing installed base). Working communication drivers for every Annexure A EVC make and model shall be developed, tested and available before contract award, at no additional cost to GEL, so that integration capability is proven and is not a post-award risk.

New makes not already integrated (Annexure B)

- For any EVC make or model listed in Annexure B (makes not already integrated), the Bidder shall submit, as part of its commercial bid, a per-make driver-development cost. Following price discovery, GEL shall decide, at its sole discretion, whether to proceed with driver development for each Annexure B make or to replace those EVCs. No Annexure B driver development shall commence without GEL's written instruction.

New EVC OEMs introduced after contract award

- Where a new EVC OEM not previously present in GEL's network is introduced during the contractual period and the platform does not natively support that OEM's protocol, the Bidder shall develop the required driver. The one-time cost of driver development per new EVC OEM shall be quoted separately as a distinct SOR line item and agreed with GEL before development commences. No such development shall commence without GEL's written instruction.

Interoperability and continuity

- The platforms shall support canonical data-model-based normalisation to enable standardised interoperability across multi-OEM EVC and PD-meter devices and enterprise applications.
- New EVC OEM driver delivery and the re-commissioning of a replaced EVC shall meet the shared service level defined in the *EVC Driver and EVC Replacement (SCADA and AMI)* service level in the Service Level Agreement (SLA) and Penalty Framework.
- The EVC-data continuity mechanism during an AMI Platform outage (the OEM Head-End System fallback path) is specified in the AMI platform scope and is not repeated here; it relies on the same shared drivers.

3.7.18. Field Installation and Hazardous-Area Safety (SCADA and AMI)

The Bidder shall carry out all field installation for the SCADA and AMI systems to professional standards and in full compliance with hazardous-area, electrical-safety and GEL HSE requirements. This section states the common installation and safety requirements; genuinely device- or station-specific installation activities remain in the respective SCADA station-wise and AMI hardware scopes.

Permits, regulatory compliance and coordination

- The Bidder shall obtain a work permit from GEL for each station/location for each day of work and an HSE permit-to-work (PTW) before and during work, as per GEL's prevailing terms, maintaining continuous authorisation throughout installation.
- The Bidder shall submit detailed work plans and schedules for GEL's approval before commencing work at each location and shall coordinate with the respective GEL departments for station access and scheduling to maintain operational continuity and to document anticipated blackout periods before any power-off procedure.
- The Bidder shall secure all regulatory clearances and permits required by local authorities, including PESO certification for hazardous-area work.

Safety implementation

- The Bidder shall deploy at least one qualified safety officer/engineer in each Geographical Area (GA) while installation work is being carried out in that GA.
- The Bidder shall conduct a mandatory safety briefing with all personnel before commencing work at each location and shall perform a Job Safety Analysis (JSA) for all installation activities and obtain GEL's approval before work begins.
- The Bidder shall provide and enforce the use of appropriate personal protective equipment (PPE) suitable for the hazardous-area classification at each work site and shall carry out all

work in line with GEL's health-and-safety guidelines and applicable OISD and other relevant industry/international standards.

Installation workmanship, earthing and protection

- The Bidder shall install all field equipment to a professional standard of mounting, enclosure fixing, cable routing and weatherproofing and shall conduct a signal-strength assessment at each location to determine antenna requirements and optimal placement.
- The Bidder shall implement proper earthing/grounding for all equipment and shall supply and install surge-protection devices for all I/O points, power-supply circuits and communication interfaces, together with lightning protection as required, in accordance with applicable electrical-safety standards.

Hazardous-area compliance

- All hazardous-area installations shall comply with the applicable area classification and shall carry valid ATEX/IECEx/PESO certification. The Bidder shall supply and install barrier-isolation modules for dispenser connections and other hazardous-area interfaces, ensure intrinsic-safety compliance, provide explosion-proof enclosures where applicable and maintain proper separation and isolation between safe-area and hazardous-area circuits.
- Field enclosures shall meet the minimum IP65 rating, and each Modem/MIU/RTU enclosure shall be positioned in the safe zone — confirmed outside the metering skid at a minimum of 1.5 metres from the hazardous-zone boundary — as verified at Site Acceptance Testing.

Material accountability

- The Bidder shall procure and store 100% of project materials at its own warehouses/facilities across the appropriate Zones/GAs, with proper environmental controls, security and inventory management and shall maintain complete accountability for material procurement, storage and delivery to each execution site, consistent with the Insurance section.

3.7.19. Power Design and Power Calculation

GEL does not prescribe whether field devices shall be mains-powered or battery-operated. The Bidder is free to select the power arrangement for each device type based on site conditions, provided the arrangement meets the device-availability SLA in the Service Level Agreement (SLA) and Penalty Framework and the battery-backup requirements in this RFP. The Bidder shall demonstrate the adequacy of the proposed power design through formal power calculations.

- The Bidder shall submit a power calculation and power budget for each device type to GEL before hardware installation commences.
- For EVC Modems, the Bidder may select the power arrangement (mains with backup, or battery). PD-meter MIUs shall be battery-only.
- For battery-operated devices, the power calculation shall demonstrate that the proposed battery capacity supports a minimum operating life of five (5) years under the stated data-transmission duty cycle, accounting for communication retries, signal conditions and ambient-temperature variation across GEL's operating geography and shall state the battery chemistry, rated capacity, expected current draw per operating mode (sleep, active, transmit), duty cycle and the derived battery life.
- For mains-powered devices (EVC Modems only, where mains is proposed), the power calculation shall demonstrate continuous power consumption, the rating of the proposed power-supply module and the sizing of the backup battery that maintains continuous device operation for a minimum of 72 hours (3 days) during a mains-supply failure and shall state

the backup-battery capacity, current draw during mains failure and the derived backup autonomy. This backup battery shall be rechargeable through the on-site mains power.

- The Bidder shall update the power calculation if the device configuration, transmission frequency or communication technology changes during the project. GEL reserves the right to review the power calculation and require revision where it does not adequately support the device-availability SLA or the battery-life and backup requirements. The AMI device duty cycle (hourly wake/push/listen) and the mains-failure Power-Saving profile that these calculations must sustain are specified in the AMI platform scope.

SCADA-specific installation

- At CGS and similar locations involving replacement of existing systems, the Bidder shall systematically power off existing RTU systems under GEL authorisation and established safety procedures; remove field termination cables while documenting and durably labelling the identity, function and signal type of each cable core at both panel and field ends; remove existing RTU panels and fit closure plates over unused spaces; and remove existing pressure gauges/instrumentation where new transmitters are to be installed, with proper isolation, protection of exposed process connections and preservation of reusable mounting infrastructure.

AMI-specific installation

- The Bidder shall install Modems at EVC locations and MIUs at PD-meter locations, including the shielded cable between EVC and Modem and the pulse cable between PD meter and MIU and shall provide the grid-power connection for EVCs and the power solution for Modems at GEL sites, including all associated hardware, materials and installation activities.

4. Comprehensive Operations and Maintenance

4.1. Overview

The success of this project depends as much on the O&M phase as on the implementation. Quarterly payments to the Bidder are directly linked to SLA performance — making this phase commercially significant for both parties.

The Bidder shall provide comprehensive operations and maintenance services covering all components of the SCADA, AMI and CMP System — the SCADA, AMI and CMP software platforms, cloud infrastructure and Disaster Recovery, field hardware (RTUs, Modems, MIUs and associated field devices), communication network, SIM management, all integrations and all Non-IT/passive components — for a period of five years from the date of full project Go-Live.

The O&M Period commences from the date GEL issues the formal project Go-Live acceptance certificate. Where Go-Live is achieved on a zone-wise basis, the O&M obligations and SLA measurement for each zone shall commence from that zone's Go-Live.

Support model during the O&M Period.

- For the **AMI and CMP** systems, by the time the O&M Period begins the Bidder shall have completed the knowledge transfer programme and a Knowledge Transfer Completion Certificate shall have been signed by both parties. From the certificate date, GEL operates the AMI and CMP systems with the Bidder's support delivered through the Support Team — helpdesk ticketing, remote diagnostics, incident response and scheduled maintenance — supplemented by the on-site deployed personnel. CMP application support may be provided remotely / in the background and need not be deployed on site, provided the CMP SLAs are met at all times.
- For the **SCADA** system, the Bidder shall additionally provide an on-site hand-holding period. This hand-holding period shall commence at SCADA Go-Live and shall continue until six (6) months after the end of the stabilisation period. During this period, the Bidder's on-site team shall work alongside GEL's operators and GA Teams to build independent operational capability, in addition to fulfilling all Support Team obligations. On expiry of the SCADA hand-holding period, SCADA support shall continue through the Support Team model for the remainder of the O&M Period.

The Bidder shall have back-to-back Comprehensive Annual Maintenance Contracts (CAMCs) with all relevant OEMs and service providers for every component of the SCADA, AMI and CMP System for the entire contract duration. GEL shall have the right to request copies of these CAMCs and OEM warranty certificates at any time during the contractual period.

The Bidder shall provide warranty, Comprehensive AMC and maintenance services for the entire solution covering all components — hardware, software, cloud infrastructure and non-IT components — for the entire contractual duration. GEL may ask the Bidder to share the Comprehensive AMC document during the course of the contract.

No separate payment shall be made for manpower deployed during the O&M Phase. The Bidder shall price all O&M manpower costs within the financial bid.

4.1.1. O&M Philosophy and Maintenance Manual

- The operations and maintenance requirements set out in this Section, the training requirements and the SOP requirements are indicative and representative of GEL's

minimum expectations — they are not exhaustive and do not represent the complete or final O&M scope. The Bidder shall treat them as the baseline and shall deliver the full operations and maintenance capability required to operate a complete, billing-grade SCADA, AMI and CMP System meeting all and SLAs, whether or not every individual activity, procedure, checklist or document is explicitly listed in this RFP.

- Following contract award, the Bidder shall prepare and submit to GEL, for review and written approval, a consolidated O&M Philosophy and Maintenance Manual covering the complete O&M scope of the SCADA, AMI and CMP System. The Manual shall be submitted within 60 calendar days of T1, shall be developed in consultation with GEL and shall cover as a minimum: the O&M philosophy and division of responsibility; the training plan and SOP set); preventive maintenance philosophy, scope, frequency and GA-/zone-wise routing; corrective maintenance fault taxonomy and procedures; the complete maintenance scope across the SCADA, AMI and CMP platforms, cloud infrastructure, field hardware, communication network and SIM estate; and all checklists, formats, registers, logbooks, templates and reports referenced anywhere in this RFP or required to execute the above.
- GEL's written approval of the Manual is a condition of Go-Live acceptance. No O&M activity, PM visit, checklist or format shall be used in live operation before GEL has issued written approval of the relevant content. The Bidder shall incorporate GEL's review comments and resubmit within 10 working days of receiving consolidated feedback.
- Where GEL's approval requires the Bidder to deliver activities, procedures, documents, checklists or reporting beyond those explicitly listed in this RFP, the Bidder shall deliver them at no additional cost to GEL and with no extension to any milestone. The Bidder shall be deemed to have priced the complete O&M scope in the financial bid.
- The Bidder shall maintain the Manual as a live document for the full contractual period. GEL reserves the right to require revisions at any time and the Bidder shall address such requirements within the timeline agreed with GEL at no additional cost.
- Where the approved Manual and this RFP differ, the more onerous requirement on the Bidder shall apply.

4.2. General O&M Requirements

- The Bidder shall maintain the entire SCADA, AMI and CMP System — all software, hardware, infrastructure, cloud services and integrations — in fully operational condition throughout the O&M Period, meeting all SLAs at all times and shall modify, repair or rectify any component not performing to the standards specified in this RFP at no additional cost to GEL.
- The Bidder shall maintain the connectivity between the MMS and BMS and between the primary and Disaster Recovery sites, throughout the entire contractual duration.
- The Bidder shall perform routine and periodic preventive maintenance (PM) on all field hardware — RTUs, Modems, MIUs, antennas, enclosures and associated field accessories — on a quarterly basis. PM records shall be maintained and made available to GEL on request.
- The Bidder shall carry out all scheduled and unscheduled software updates, security patches, firmware upgrades and configuration changes required to maintain SCADA, AMI and CMP platform performance and security. Critical security patches shall be applied within 30 days of availability and non-critical patches within 90 days, with prior notification to GEL. Major patching requiring downtime shall be undertaken only after GEL's confirmation and within the SLA-permitted maintenance window.

- The Bidder shall ensure the upgrade of the SCADA, AMI and CMP software as and when new versions are released by the respective OEMs during the O&M phase, at no additional cost to GEL.
- The Bidder shall update device passwords and credentials periodically. No device shall retain default credentials at any point during the contract. The Bidder shall maintain root-domain security policies — authentication mechanism (single/multi-factor), password length and complexity, account lockout, certificate policy and periodic password updation. Password updates shall be logged in the platform audit trail.
- The Bidder shall maintain an updated knowledge base of all published security vulnerabilities and threats and a centralized problem repository documenting all problems, causes and rectification procedures, accessible to GEL.
- The Bidder shall establish a governance structure to report to GEL on a daily, weekly, fortnightly and monthly basis. Daily reporting shall be provided in the format requested by GEL and the solution shall allow downloading of standard and custom monitoring reports in PDF, Excel and other formats. The Bidder shall provide all MIS reports specified in this RFP and any additional reports required by GEL.
- The Bidder shall resolve all reported faults and incidents within the SLA response/resolution times. Any component reported as down shall be repaired or replaced within the SLA timeframe stated; failure to meet these timelines will attract penalties.
- The Bidder shall provide support for the planning, optimisation and tuning of the SCADA, AMI and CMP platforms whenever required, at no additional cost to GEL.
- The Bidder shall carry out any number of modifications, additions or configuration changes to platform configuration — reports, dashboards, VEE rules, alarm thresholds, integration parameters, user roles, graphics and logic — as required by GEL during the O&M Period, at no additional cost to GEL.
- The Bidder shall arrange visits of OEM engineers for specific tasks when required at no extra cost. GEL reserves the right to reschedule or adjust the number of such visits.
- GEL may change or upgrade any module or equipment as per business requirements during the contractual period. The Bidder shall provide access to GEL or GEL-appointed third parties without affecting any terms and without any additional cost or time implication.
- The Bidder shall provide an open API/SDK, as and when required, for integration of the SCADA, AMI and CMP System with any past, present or future project of GEL, at any time during the contractual duration.
- The Bidder shall take all necessary precautions to keep the complete System secure from cyberattacks, malware, physical damage and data breaches and shall conduct annual CERT-In empanelled VAPT and cybersecurity reviews, submitting reports to GEL within 30 days of each review.
- The Bidder shall procure and deploy any device required to protect end equipment against power fluctuation and shall implement a robust quality assurance programme to ensure the reliability and durability of the entire system throughout the O&M Period.
- Where GEL adds new SCADA field locations or new AMI metering points during the O&M Period, the Bidder shall carry out all associated works — survey, supply, installation, commissioning and platform registration — at the unit rate applicable for that year as priced in the SOR and the corresponding OPEX shall become payable upon successful acceptance of the additional sites.

4.2.1. Support Team

- The Bidder shall establish and maintain a dedicated Support Team from Go-Live through to contract completion, covering the SCADA, AMI and CMP systems and shall be the single operational interface for all System issues, service requests and escalations during the O&M Phase.
- The them shall consist, at minimum, of the following:
  - **01 no. Project Director** — deployed as the senior single point of contact (SPOC) for GEL, accountable for overall O&M delivery, SLA performance and commercial/contractual coordination across all three systems. Project Director may operate out of their office.
  - **01 no. Project Manager** — deployed as the operational single point of contact (SPOC) for GEL, responsible for day-to-day O&M coordination, continuous monitoring of the SCADA, AMI and CMP platforms and field device communication status and proactive identification of issues before they breach SLAs. Project Manager may operate out of their Gujarat office.
  - **10 nos. Zonal Coordinators** — deployed full time across GEL's five (5) operational zones at the rate of two (2) per zone, at GEL-approved zonal / GA offices, coordinating field maintenance, scheduling PM visits, managing field incident resolution and assisting GEL personnel in day-to-day platform operations, integration health and technical escalations.
  - **02 nos. Head Office Coordinators** — deployed full time at GEL's corporate headquarters in Gandhinagar, providing central coordination, platform operations support and interface with GEL's corporate functions.
  - **CMP Application Support** — adequate CMP application support resources for the full O&M Period; these resources need not be deployed on site and may provide support remotely / in the background, provided they meet the CMP SLAs at all times.
  - **Field Technicians** — deployed in such numbers, locations and skill mix as required to meet the SLAs. The number and deployment of field technicians is at the Bidder's discretion; the Bidder shall size the pool such that all preventive and corrective maintenance SLAs are met at all times and no SLA breach shall be excused on the grounds of insufficient field manpower.
- The **Project Director and the Project Manager shall be the designated SPOCs for GEL** for all O&M matters.
- The team shall be available 24/7 throughout the contract period, equipped with dedicated communication channels to GEL (email, phone and WhatsApp or equivalent) with response acknowledgement times and shall have remote access to all three platforms at all times with full administrative capability to investigate and resolve platform issues without requiring site visits.
- The Bidder shall provide GEL with the complete contact details of the ST at Go-Live and shall update these within 48 hours of any personnel change. All ST members shall be trained and certified on all deployed components relevant to their role before assignment. The Bidder shall maintain a database of all team members (including subcontractor staff) and share attendance and deployment records with GEL on request.

4.2.1.1. Unified Complaint and Incident Capture

- The Bidder shall deploy and operate a single, unified complaint and incident management system that captures every complaint, service request, fault report and query raised by GEL

— regardless of the channel through which it is received — into one consolidated register. No complaint shall be lost, dropped or left unlogged on account of the channel used to raise it.

- The system shall capture complaints received through all of the following channels, at minimum: the helpdesk / ticketing portal; email; telephone / helpline; WhatsApp (or equivalent messaging); the SCADA, AMI and CMP mobile applications; and complaints raised directly by GEL's GA Teams, zonal offices or corporate office to any deployed ST member.
- Every complaint, however received, shall be logged with a unique ticket ID, timestamp of receipt, originating channel, reporting user, affected system (SCADA / AMI / CMP), affected device or location, category and priority. The Bidder shall issue an automatic acknowledgement to the originator with the ticket ID.
- The SLA response and resolution clock for each complaint shall start from the time of first receipt through any channel — not from the time the complaint is manually entered into the system. Complaints received by phone, WhatsApp or verbally to an ST member shall be logged immediately on receipt.
- The system shall track each ticket through its full lifecycle — logging, categorisation, assignment, escalation, resolution and closure — with a complete audit trail. Tickets shall not be closed without recording the resolution and, where applicable, GEL's confirmation.
- All captured complaints, their channel of origin, SLA clock and resolution outcomes shall feed automatically into the Enterprise Management System (EMS) for SLA measurement and quarterly reporting. GEL shall have direct, independent, read-only access to the complete complaint register at all times.
- The Bidder shall take prompt and reasonable action for redressal of each complaint received from users, including complaints received by GEL and shall provide GEL with periodic (at minimum monthly) complaint analytics — volumes by channel, system, category and GA/zone; average response and resolution times; and repeat-complaint analysis.

4.2.2. Preventive Maintenance

- The Bidder shall carry out Preventive Maintenance (PM) of all field hardware — RTUs, Modems, MIUs, antennas, enclosures, cables and associated accessories — on a monthly/quarterly basis across all installation locations, as set out in the approved Maintenance Manual. GEL may require PM to be logged via a GEL mobile application.
- The report from each PM cycle shall form part of the mandatory documents to be submitted with the quarterly invoice.
- PM activities shall include at minimum: visual inspection of enclosure and mounting; inspection of cable integrity and connections; cleaning, blowing and dirt removal; realignment where required; verification of antenna mounting and condition; communication test on all SIM slot(s); signal strength reading and recording; device health diagnostic; and firmware version check with update if required — all carried out with proper security and safety measures and a maintained checklist.
- The Bidder shall maintain a PM logbook for each installation location, available to GEL for inspection at any time. Where a PM visit identifies a fault or degraded performance, the Bidder shall rectify it within the corrective maintenance timelines without waiting for the next PM cycle. PM scheduling shall be coordinated with GEL's GA Teams, with at least 48 hours' advance notice of any field visit. GEL may require the PM plan to be modified to cover additional components/activities.

4.2.3. Corrective Maintenance and Field Incident Resolution

- The Bidder shall investigate and resolve all hardware faults, communication failures and platform incidents (SCADA, AMI and CMP) within the response and resolution timelines.
- For field hardware faults (RTU, Modem or MIU failures, antenna damage, enclosure damage), the Bidder shall deploy a field technician with replacement hardware within the timelines. Replacement hardware shall be of the same make and model, or equivalent or higher specification subject to GEL's acceptance and shall be commissioned and verified for data transmission before the incident is closed.
- The Bidder shall use only OEM-certified spare parts and components for all corrective maintenance. Non-OEM or third-party components shall not be used without GEL's prior written approval.
- Where any product fails on a repetitive basis and/or disrupts GEL's routine business, or has reached end-of-life/end-of-support, the Bidder shall replace it (the entire quantity where GEL so determines) with equal or higher specification at no additional cost to GEL.
- The Bidder shall maintain a structured incident management process — fed by the unified complaint capture— with ticket logging, assignment, escalation, resolution and closure workflows and shall document all problems, causes and rectification procedures in the centralized knowledge base accessible to GEL.

4.2.3.1. Maintenance Categories

The Bidder's maintenance scope shall include, at minimum, the following across the SCADA, AMI and CMP System:

- **Hardware maintenance** — diagnose and rectify hardware faults in all components; replace faulty components with new or repaired parts; perform preventive maintenance; maintain documentation; ensure adequate spares.
- **Software maintenance** — install updates, patches and new versions; configure and tune system parameters; diagnose and resolve software issues; perform database maintenance and optimisation; support configuration changes and customisations; maintain documentation.
- **Network maintenance** — monitor and maintain LAN/WAN and cellular infrastructure; diagnose and resolve connectivity issues; perform network security updates; maintain network documentation (IP addresses, configurations); optimise performance.
- **Database maintenance** — perform regular backups and verify backup integrity; optimise performance through indexing and tuning; manage growth and archiving; ensure data integrity and consistency.
- **Security maintenance** — implement security patches and updates; perform regular security assessments; monitor and respond to security events; maintain documentation; ensure compliance with security policies and standards.

4.2.4. Platform and Software Operations

- The Bidder shall maintain the SCADA, AMI and CMP platforms in a fully operational, high-availability configuration throughout the O&M Period, with the availability SLA specified and shall proactively monitor 24/7 for application performance, database health, cloud infrastructure metrics, integration status and security events, acting on any anomaly before it impacts GEL operations.

- The Bidder shall manage all cloud infrastructure scaling, capacity adjustments and resource optimisation required as the number of connected devices, integrated applications and data volumes grows and shall size and augment cloud resources (compute, storage, bandwidth) at no additional cost to GEL if the provisioned resources prove insufficient to meet SLAs.
- The Bidder shall plan and execute all software updates and platform upgrades with minimal disruption. Major updates requiring downtime shall be pre-approved by GEL and scheduled during agreed low-impact windows, with at least 72 hours' advance notice.
- If any platform component reaches EOL/EOS during the O&M Period, the Bidder shall proactively upgrade or migrate to a supported version at no additional cost to GEL, with GEL's advance notification and written approval before migration.
- The Bidder shall run automated weekly integrity verification scans on all data stores — the MDMS (AMI), the SCADA historian and the CMP Data Lake — checking for silent data corruption, record-count discrepancies and referential integrity violations and shall notify GEL of any anomaly within 4 hours of detection, with a monthly scan summary in the platform health report.
- The Bidder shall provide requisite support in executing modifications to the supplied SCADA, AMI and CMP applications; basic modifications (reports, dashboards, etc.) shall be completed within 2 working days and complex requirements on a mutually agreed timeline.

4.2.4.1. Technology Currency and Platform Compatibility

- Technology currency and compatibility maintenance are standing obligations for the full contractual period, within the contracted scope at no additional cost. No Change Request or variation order shall be raised for any activity under this section, regardless of scale or number of upgrades.
- **Technology stack upgrades.** The Bidder shall maintain all components of the SCADA, AMI and CMP platforms — operating systems, databases, frameworks, middleware, cloud services and third-party libraries — within their active manufacturer support lifecycle, initiating migration before any component reaches End-of-Support, with 30 days' notice and GEL's written approval before any major version upgrade affecting user-facing functionality, API behaviour or data structures.
- **Web portal browser and OS compatibility.** The web portals shall remain fully functional and visually consistent on the current and immediately preceding major release of Chrome, Edge, Firefox and Safari and current major versions of Windows as used in GEL's offices, with compatibility updates deployed before new versions reach general use.
- **Mobile application OS compatibility.** The mobile applications shall remain fully functional on the current major version of iOS and Android; on any new major OS release, the Bidder shall complete testing, resolve all critical/high issues and publish updated applications within 21 calendar days of general availability.
- **Proactive testing schedule.** The Bidder shall maintain a technology compatibility testing calendar, updated quarterly and shared at each quarterly review, with testing performed before each release reaches GEL's user base.

4.2.4.2. Monitoring and Management (NOC) Services

The Bidder shall provide monitoring, administration and management services for the entire infrastructure, including cloud infrastructure, throughout the contract period. The stack shall include, at minimum:

- Infrastructure monitoring, administration and management services;
- Database administration and management services;
- Storage administration and management services;
- Backup and restore services;
- Production control and job scheduling;
- Security, patch and antivirus management.

License Management and Metering

- The Bidder shall maintain, update and track all software licences — SCADA, AMI and CMP platforms and modules, cloud infrastructure components, operating systems, databases and middleware — throughout the O&M Period, ensuring no component operates with an expired, invalid or undersized licence, using standard licence-metering tools to manage the risk of unauthorised usage or under-licensing.
- Server, storage, computing power, database, OS and any other additional software/tool licences and sizing are the sole responsibility of the Bidder.

4.2.5. SIM Management and Connectivity Operations

- The Bidder shall manage all SIM cards throughout the O&M Period — service requests, technical support, billing query resolution, APN configuration and operator coordination — for all SIMs (SCADA and AMI field devices) registered in GEL name and shall work closely with the telecom service providers to establish, maintain and troubleshoot mobile-network and internet connectivity towards the cloud infrastructure.
- The Bidder shall monitor SIM and connectivity status for every field device and proactively replace or troubleshoot any SIM exhibiting degraded performance before it causes an SLA breach, replacing any non-performing SIM within the timelines at no cost to GEL, including all operator coordination.
- Where a SIM operator's network undergoes extended degradation affecting multiple sites in a GA, the Bidder shall assess alternatives and propose a SIM swap plan to GEL within 5 business days.
- The Bidder shall review SIM connectivity performance monthly and include a connectivity summary — signal strength distribution, failover events, SIM replacement count and operator-wise performance — in the monthly operations report.

4.2.6. Maintenance Spares

- The Bidder shall provide a list of manufacturer's recommended O&M spares necessary for trouble-free operation and maintenance and shall maintain a minimum spare inventory of 10% of total deployed hardware quantities (RTUs, Modems, MIUs, antennas and associated accessories) at all times throughout the implementation and O&M Period, staged at Bidder locations that enable response within the SLA timelines.
- All spare RTUs, Modems and MIUs shall be of the same make and model as the originally deployed hardware, pre-configured and ready for immediate deployment. The validity of spare-part rates shall extend throughout the contractual period and all spares shall be sourced from the same OEM manufacturing facilities as the original equipment. Non-OEM spare parts shall not be used without GEL's prior written approval.

- If any hardware component becomes unavailable or discontinued during the O&M Period, the Bidder shall procure equivalent or higher-specification replacement hardware at no additional cost to GEL before spare stock is depleted and shall replenish any spare stock drawn down (warranty, insurance or wear) within 30 days so the 10% minimum is continuously maintained.
- All hardware supplied under this RFP shall carry a comprehensive onsite warranty for the full contractual period (implementation plus O&M). 'Onsite' means all warranty diagnosis, repair and replacement is performed at the installed field location, or the device is removed, replaced with an equivalent-or-better working unit and repaired off-site by the Bidder, with no cost, logistics, freight or coordination burden on GEL. Warranty response is not contingent on manufacturer turnaround — the Bidder shall use its spare stock to restore service within SLA and settle warranty/manufacturer processes separately in the background. No SLA relief arises from the time taken by any warranty or insurance claim.

4.2.6.1. Asset Management and Lifecycle

- The Bidder shall introduce and operate a comprehensive Asset Management process and appropriate tool to manage the entire lifecycle of every component of the SCADA, AMI and CMP System — from commissioning through maintenance, replacement and eventual transfer to GEL.
- The asset register shall record, for every device, the make, model, serial number, firmware version, GPS installation coordinates, SIM ICCID, warranty/AMC status, maintenance history and current operational status and shall be available to GEL at all times.

4.2.7. Vendor and Stakeholder Management

- The Bidder shall coordinate with all relevant stakeholders — GEL's GA Teams, GEL IT, SAP team, integration platform owners, OEMs, cloud service provider and SIM operators — to resolve all issues within agreed SLA timelines, escalating unresolved issues promptly through the Bidder's internal escalation structure and notifying GEL when SLA timelines are at risk.
- The Bidder shall maintain records of all stakeholder interactions, escalations and resolutions related to SCADA, AMI and CMP System operations and shall maintain a database of all team members (including subcontractor staff), sharing attendance and deployment details with GEL on request.

4.2.8. Field Support, HSE and Transport

- The Bidder shall maintain field support resources — technicians, vehicles, tools, ladders and testing equipment — across GEL's network to carry out preventive maintenance, corrective maintenance and new device installations within the timelines specified in this RFP and shall ensure no activity is delayed due to non-availability of field resources, transport or tools.
- Field vehicles and all associated expenses (driver, fuel, maintenance, insurance) are entirely the Bidder's responsibility; vehicles and drivers shall comply with applicable RTO norms.
- All field activities shall be carried out in compliance with GEL's site safety requirements and applicable OISD standards. The Bidder shall obtain all necessary HSE approvals, including Permit to Work (PTW) before/during work, as per GEL's prevailing terms and shall support Workplace Inspection (WPI) by GEL's empanelled agency.

- On completion of work at any site, the Bidder shall restore the site to its original condition as per GEL's rules. The Bidder shall not permit any anti-social or illegal activity on any project site; any liability arising from such an event shall be borne solely by the Bidder.
- **Basic infrastructure services.** The Bidder shall proactively monitor all installed basic infrastructure and maintain an on-site logbook of basic-infrastructure maintenance that may be inspected by GEL and the Police at any time.

4.2.9. System Enhancement and Modification

- GEL may require enhancements to the SCADA, AMI or CMP platforms — new reports, dashboard modifications, VEE rule additions, analytics use cases, API extensions, new integration endpoints or UI changes — during the O&M Period. The Bidder shall deliver such enhancements within timelines agreed with GEL, at no additional cost, provided they are within the scope of the contracted System functionality.
- The Bidder shall perform SCADA software modifications including, but not limited to addition of new RTUs supplied by the Bidder or other contractors; addition of new facilities (DRS, CGS, CNG stations, etc.); integration of additional systems with SCADA; mapping of new signals; and changes in signal assignments or configurations.
- Changes that materially extend the scope beyond what is contracted — such as entirely new integration systems not within the agreed scope — shall follow the Change Request process and be priced per the SOR where applicable.

4.2.9.1. EVC OEM Driver Development and Deployment (SCADA and AMI)

- The EVC OEM driver library is common infrastructure serving both the SCADA system (EVCs at DRS/CPRS, Check Metering Stations, CBG and other locations) and the AMI Platform (EVCs at IMS metering points). A driver developed for any EVC make/model is available to both systems and driver development is charged once per OEM make/model in the SOR — not separately per system.
- Where GEL introduces a new EVC make or model during the O&M Period that is not covered by an existing driver in the shared library, the Bidder shall deliver a fully tested driver within 30 calendar days of confirming in writing that complete and accurate OEM technical documentation has been received. Obtaining OEM documentation is the Bidder's sole responsibility; where the OEM has not provided complete documentation within 5 calendar days of first request, the Bidder shall notify GEL in writing with the status and revised timeline and shall not use OEM non-cooperation as grounds for delay without this documented notification.
- On completing the driver, the Bidder shall provide a test report confirming successful data collection and submit it to GEL for written acceptance. On acceptance, the Bidder shall deploy the driver to the relevant platform(s) — SCADA historian and/or AMI Platform — within 1 calendar day and shall transfer the complete driver source code to GEL with build instructions, dependency specifications and test procedures.

4.2.9.2. EVC Replacement — Data Sync and Continuity (SCADA and AMI)

- Where GEL replaces a physical EVC at any location during the O&M Period — same make/model or different — the Bidder shall restore full platform operation for that location

within 12 hours of GEL's notification (via helpdesk ticket, mobile application task closure or email to the ST) that the physical replacement is complete, acknowledging the notification within 30 minutes. For AMI (IMS) locations, continuity is into the AMI Platform/MDMS and SAP billing; for SCADA (DRS/CMS/CBG and other) locations, continuity is into the SCADA historian and real-time monitoring.

- Within the 12-hour window the Bidder shall commission the new EVC, confirm the first successful data read and verify that historical data from the replaced EVC is preserved and correctly associated with the same location. Where the replacement is the same make/model, no driver development is required and the 12-hour window applies in full.
- Historical data from the replaced EVC (consumption, billing, alarm and asset history for AMI; historian trends for SCADA) shall be preserved without interruption and remain accessible for the same location regardless of how many EVC replacements have occurred. For AMI, if the replacement occurs within the current billing cycle, the Bidder shall ensure the billing determinants are complete using data from both the old and new EVC records without gap or duplication.

4.2.9.3. New EVC / New Field Location Onboarding During the O&M Period

- **EVC supply, installation and commissioning is GEL's scope**, not the Bidder's. The Bidder's scope is the SCADA-/AMI-side integration of each EVC once it is physically present at a location.
- The SCADA system shall be provisioned from Go-Live to accommodate **all DRS/CPRS stations** across GEL's network, whether or not an EVC is currently installed, such that any EVC subsequently installed by GEL at any DRS (or other) location can be added to SCADA under the existing provision — without re-architecture, additional licensing gate or tag-capacity constraint. *[Assumes "provision" = system/software readiness for all DRS, with per-EVC field hardware installed where an EVC exists (now) or when GEL adds one (at SOR). If GEL instead requires comms hardware pre-installed at every DRS at implementation, this clause and the SOR change accordingly.]*
- **Where an EVC is already present** at a DRS/CPRS or other location at implementation, the Bidder shall integrate it into SCADA — modem/junction box, Modbus RS-485/232 connectivity, the applicable OEM driver from the shared driver library and tag mapping — as part of the base scope.
- **Where GEL installs a new EVC** at any DRS/CPRS or other location during the O&M Period, the Bidder shall, on notification, integrate it into SCADA — supplying and installing the SCADA-side communication hardware (modem, junction box, converters, cabling as required), applying the applicable OEM driver from the shared library (developing a new driver if the make is not already in the library), configuring communication and mapping all tags — at the unit rate applicable for that year in the SOR. The EVC itself is GEL-supplied.
- The Bidder shall complete such integration and confirm the first successful data read within the timelines and shall not decline or delay any such onboarding on the grounds that the location was not individually listed at contract signing.

4.2.10. CMP-Specific Operations and Maintenance

- The Bidder shall provide Comprehensive Annual Maintenance for the CMP for the full O&M Period and shall make all required modifications, alterations, additions or deletions to the entire CMP solution during the O&M phase.

- The Bidder shall adhere to GEL's requests for modification of integration aspects, data analytics use cases, new use-case development, new SOP development, modification of any SOP, dashboard modification/alteration/addition, custom report generation, report requirement changes, communication amendments for any event, or any other change to the CMP platform and shall address these within an acceptable timeframe without raising concern.
- The Bidder shall provide timely updates and upgrades for both the CMP software and mobile application (features and security patches), upgrading to newly introduced versions/tools and shall ensure any changes in integrated native applications are mirrored in the CMP and mobile application to maintain integrity and functionality.
- The Bidder shall conduct regular load testing to simulate different user scenarios and stress conditions to ensure continuous performance during peak loads; continuously monitor system performance and conduct regular assessments to identify optimisation areas; maintain strong security protocols (encryption and authentication); and manage and update role-based access controls throughout the O&M Period.

4.2.11.Insurance

- The Bidder shall maintain valid insurance for all components installed under this project for the entire contract duration. The insurance shall cover any damage (physical and liquid) and loss, theft or vandalism to any device installed as part of this project. The cost of such insurance shall be included in the Bidder's financial bid and no SLA relief shall arise from the time taken by any insurance claim.

4.2.12.Handover at End of Contractual Period

Before the expiry of the contract, the Bidder shall complete the following handover activities to GEL or GEL's nominated successor:

Asset Transfer:

- Under the Hybrid OPEX model, the Bidder owns all hardware during the contractual term; at contract completion, the Bidder shall transfer to GEL **full title, physical custody and operational control** of the complete inventory of hardware — RTUs, Modems, MIUs, antennas, enclosures, cables and associated accessories — in fully functional condition, free of all liens and encumbrances, with support and spares available for a minimum period of five years for all components.
- Provide a complete, updated asset inventory listing every device with make, model, serial number, firmware version, GPS coordinates, SIM ICCID and operational status. All devices shall be in working condition on the day of handover, with a working demonstration provided to GEL or the successor vendor. No device shall be handed over in a non-functional state; any faulty device shall be replaced with a repaired or new device before handover.

Software, Licences and Documentation:

- Keep the SCADA, AMI and CMP platforms running until GEL onboards a new vendor; payment for this period shall be made per the SOR rate for the respective year.
- Provide full access credentials, administrative accounts and API keys for all platform components and facilitate transition without interruption to data collection, monitoring or SAP Billing integration.
- Provide complete, updated technical documentation covering SCADA, AMI and CMP platform architecture, all API specifications, integration configurations, VEE rule definitions,

analytics/dashboard definitions and operational procedures; the EVC OEM drivers developed under this contract with build instructions, dependencies and test procedures; all O&M manuals, PM procedures, troubleshooting guides and training materials in latest versions; and complete communication/network configuration documentation.

Operational Handover and Transition:

- Conduct a structured handover period of at least 90 days before contract expiry, during which the Bidder's Support Team works alongside GEL's or the successor SI's technical team to transfer operational knowledge and confirm independent operational capability.
- During the last 3 months of the O&M Period, operate the System with increased GEL staff involvement, progressively transferring responsibility, without reducing staffing without GEL's prior written approval, with GEL or the successor SI co-authorised on all platform administrative functions.
- Submit a final project completion report covering five-year O&M performance — SLA compliance history, maintenance records, incident log summary and asset condition at handover.

Platform Continuity and Data Migration:

- At least 12 months before contract expiry, notify GEL of each platform vendor's support roadmap for the next 5 years; where any platform is approaching EOL within 3 years of expiry, propose a migration path with indicative costs and timelines.
- Provide GEL with all historical SCADA, AMI and CMP data in a portable, open format (CSV, JSON or agreed database export) at contract completion and assist GEL in migrating historical data to any successor system or data warehouse at no additional cost for 3 months post-expiry.
- Within 60 days of final handover, GEL shall conduct a knowledge assessment of its own staff; where gaps are identified, the Bidder shall provide targeted additional training at no additional cost within 30 days of the assessment report.

4.2.13. General Instructions

- The Bidder shall ensure continuous data collection, monitoring and SAP Billing integration throughout the O&M Period. Any interruption to billing data delivery shall be treated as a critical incident subject to the SLA penalties.
- The Bidder shall ensure the SCADA, AMI and CMP platforms and all connected systems remain available and fully functional on all days — including public holidays, weekends and GEL billing dates — and shall not undertake any planned maintenance on GEL's billing dates without GEL's explicit advance approval.
- The Bidder shall submit a detailed project plan within the initial 15 days of issuance of the work order and shall provide detailed drawings of all finalised locations before commencing field work, initiating installation and commissioning only after GEL's approval.
- The Bidder shall conduct a comprehensive market analysis to identify state-of-the-art devices/infrastructure, ensure compliance with all local, state and national regulations (including the National Data Policy of the Government of India and DPDP), implement industry-standard security and privacy measures and prepare internal and external escalation matrices for both implementation and operational phases.
- The Bidder shall maintain a helpdesk and escalation matrix accessible to GEL's GA Teams and zonal offices at all times, integrated with the unified complaint capture, with defined response acknowledgement times for each priority level.

- The Bidder shall establish KPIs for system performance and conduct periodic evaluations to assess the effectiveness and efficiency of the system.
- GEL reserves the right to conduct periodic audits of the Bidder's O&M activities, maintenance records, spare inventory, ST staffing and cybersecurity compliance at any time. The Bidder shall cooperate fully and provide all requested information within 5 business days.
- GEL may terminate or extend the contract in accordance with the contractual terms. In the event of early termination, the Bidder shall cooperate fully with the transition and complete the handover obligations within the period specified in the termination notice.

5. Payment and Project Milestones

5.1. Overview and Principles

The Bidder shall receive milestone-linked payments against Part A of Schedule 1 (hardware) during the implementation and stabilisation phase, and shall be paid quarterly against Schedule B and C over the five-year O&M Period. The following principles govern all commercial transactions under this Contract:

- **Schedule A — milestone-linked payment during implementation.** One hundred percent (100%) of the cost quoted under Part A shall be released against the ten implementation and handover milestones. GEL's written acceptance of the corresponding milestone, together with every deliverable specified for it, is the sole trigger for each such payment.
- **Schedule B — operations and maintenance.** No payment shall be made against Part B during the implementation phase. Payment against Part B commences, for each lot, zone or phase, only from the date of that lot's/zone's/phase's Go-Live acceptance certificate issued at the end of its stabilisation period and is billed quarterly on a pro-rata basis.
- **Schedule C — one-time activity costs.** Charges quoted under this schedule (enterprise/cross-system integrations and new EVC-OEM driver development) shall be payable only on completion and GEL's written acceptance of the specific activity, at whatever point in the term that activity occurs, including during the OPEX phase.
- **Schedule D –** Underground DRS – Charges quoted under this schedule shall not be considered for the purpose of consideration of the commercial bid of this project. It shall be at the GEL’s discretion to award the work based on the POC for this particular line item.
- **Zone / lot wise Go live to Final Go live:** Bidder shall be paid as per the quarterly rate quoted by them during this phase. (**Example** – Bidder shall be paid quarterly payment from the achievement of Lot wise Go live of AMI / Zone wise Go live of SCADA (on a pro rata basis for the respective number of sites / locations made Go live) to the Final Go live achieved **ONLY** after the achievement of the Go live of all 3 components). This time period from the date of achievement of Go live of first lot of AMI to the final Go live of all 3 components may be called as an interim Go live period.
- **O&M phase:** 5 years of comprehensive O&M shall commence only after the achievement of FINAL Go live (wherein all the 3 components have been made Go live).
- **Pro-rata billing (post final Go live):** Each device shall be billed for the number of calendar days it was live and operational in the billing quarter. A device commissioned or gone-live mid-quarter is billed only from its Go-Live date to the last day of that quarter.
- **SLA-linked payment split.** Each quarterly OPEX invoice is split 80% on submission and 20% on SLA verification through the EMS report.

- **Payment basis is actual commissioned quantity.** SOR rates are used for evaluation and award; actual payments are calculated on the count and Go-Live dates of devices actually live and operational, as recorded by the EMS.
- **No double charging.** No item, service, licence, tool, resource or activity shall be charged under more than one Part or Schedule.
- **Payment is not acceptance.** No payment constitutes acceptance beyond the milestone against which it is released, nor a waiver of GEL's right to require rectification of defective work.
- **Under this business model, all hardware is owned by GEL** — title passing to GEL on release of the milestone payment covering each item — and all software is provided on a SaaS basis.

5.2. Implementation Milestones and Payment Schedule

- Bidder shall be paid as per the payment terms mentioned in this section during the implementation phase against the amount quoted under Schedule A of the price bid.
- Milestone completion timeline mentioned in this section is the overall timeline, comprising of all the batches to be completed by the Bidder, associated with the same.
- Wherever the milestone completion is mentioned in multiple batches, Bidder may raise invoice for the proportionate amount of the payment prescribed in the payment terms. Example – Bidder shall be able to raise the invoice of **2% of the CAPEX** cost (Schedule A) upon completion of I&C of one zone.
- Bidder shall adhere to the phase wise implementation timeline during the project in addition to the priorities set forth in the RFP document for completion of a particular zone for all the components. Please note that in case of non-achievement of phase wise milestone (Example – AMI Lot 1 (1000 Nos.) in 4 months post award of the contract), the Bidder shall be penalized for the delay solely attributable to the Bidder for INR 1,000 per pending location for initial 4 weeks of delay and thereafter INR 2,000 per pending location for additional 8 weeks of delay and thereafter INR 5,000 per pending location.

No payment shall be released until GEL has issued written acceptance of the corresponding milestone, with all deliverables and acceptance criteria satisfied in full. Partial or conditional acceptance shall not trigger payment; where GEL accepts a milestone subject to a punch list, payment is released only on closure of all punch-list items.

Sr.	Particular	Completion Timeline	Payment	Deliverables	Remarks
1	Survey and requirement gathering	T + 1.5 months	10% of Sch. A	Survey document - MS/Google forms (incl. service-provider signal survey per location); Final BoQ; CMP requirement-gathering sign-off document; SCADA & AMI engineering design documentation; AMI device registry; implementation plan; Unpriced PO / WO for at least 60% of the awarded quantity	Survey covers AMI and SCADA (incl. a service-provider survey at each location); CMP requirement gathering in parallel with GEL officials
2	Material Factory Acceptance Test (FAT)	T + 3 months	18% of Sch. A	QA/inspection records FAT completion certificate; GEL dispatch clearance;	Bidder shall undertake this milestone on three (3) equally distributed batches
3	I&C – AMI	T + 6 months	15% of Sch. A	Per-lot I&C SAT sign-off report (site wise); Installation completion detailed report; EVC driver register	Undertaken on batches (1,000 locations/lot); released in tranches per lot
4	Go-Live of CMP – Phase 1	T + 4 months	4% of Sch. A	Phase 1 Go-Live report; Integration test report;	—

Sr.	Particular	Completion Timeline	Payment	Deliverables	Remarks
				Data Lake & retention confirmation; UAT sign-off	
5	Go-Live – AMI	T + 6 months	10% of Sch. A	Per-lot Go-Live report; Parallel-operations reconciliation reports; UAT completion report; VAPT report; DR test record; SAP integration EMS commissioning confirmation	Five lots (four lot of 1,000 Nos. each and one lot of 800), Parallel run of ≥ 15 days; Lot wise Go live shall be declared in trenches (as mentioned above)
6	Go-Live of CMP – Phase 2	T + 7 months	4% of Sch. A	Phase 2 Go-Live report; SCADA/AMI & middleware integration test reports; UAT sign-off	—
7	I&C – SCADA	T + 8 months	12% of Sch. A	Per-zone I&C SAT sign-off report (site wise); Installation completion report (detailed); Updated as-built records	Six zones; released in tranches per zone

Sr.	Particular	Completion Timeline	Payment	Deliverables	Remarks
8	Go-Live – SCADA	T1 = T + 9 months	12% of Sch. A	Per-zone Go-Live report; system validation report; VAPT sign-off; UAT completion report; As-built documentation	Six zones; incl. thorough testing of SCADA and CMP software; released in tranches per zone
9	Go-Live of CMP – Phase 3, and Final Go-Live of all three components	T + 9 months	5% of Sch. A	Phase 3 Go-Live report; Final Go-Live confirmation; UAT sign-off	—
10	Handover of SCADA, AMI and CMP	T2 = T + 12 months	10% of Sch. A	Handover report; SOPs (SCADA, AMI, CMP); Per-lot/zone/phase stabilization SLA reports; Defect-closure report; Complete as-built; Final asset inventory	Triggers only after Go-Live of all three components

5.3. Definitions — Installation & Commissioning, Go-Live and Handover

For the purposes of this Section:

- **Installation & Commissioning (I&C).** A field location is considered installed and commissioned when both (a) a GEL-signed installation inspection report confirms it is physically installed in accordance with the approved installation methodology, site conditions and safety requirements, and (b) a GEL-signed SAT report confirms it is commissioned and transmitting verified (billing-grade for AMI; telemetry for

SCADA) data to the respective platform. A location with installation signed off but no commissioning confirmation, or transmitting data not verified as valid, is not considered commissioned.

- **Go-Live.** A lot (AMI), zone (SCADA) or phase (CMP) is considered gone-live when all its locations are commissioned; SAT is completed and GEL-accepted; UAT is completed and signed off with zero open Critical/High defects; the applicable pre-Go-Live CERT-In VAPT is cleared; the AMI parallel run (≥ 15 days) / SCADA software testing / CMP phase testing is completed and reconciled; and GEL has issued written Go-Live acceptance for that lot/zone/phase.
- **Achievement of Final Go live:** Bidder shall ensure that all 3 major components are made Go live, as per the requirements set forth in the RFP document. For the purpose of consideration of the Go live (partial / full); Bidder shall ensure that all the locations wherever the dependencies are addressed have been made live. In case where the Bidder had highlighted the dependencies during the submission of site survey report and the same was not addressed in a considerable time period, those site shall be omitted from the requirement of completion for the achievement of Go live. Please note that if the same was not highlighted earlier during the site survey phase, it shall not be considered as a dependency for non-achievement of Go live. Further to this, Bidder shall ensure to make the site Go live post addressing any dependencies from site even after the achievement of final Go live. Bidder shall be paid for the CAPEX cost post the achievement of Go live of those sites and shall be liable to be paid for the OPEX cost post the achievement of Go live of those sites.
- **Handover.** The entire solution is considered handed over when every lot, zone and phase has completed its three-month SLA stabilisation period, all defects and incidents are closed to GEL's written satisfaction, the complete as-built documentation pack and the SOPs for SCADA, AMI and CMP are submitted and accepted, all training is delivered and certified, and GEL has issued the handover acceptance certificate.

5.4. Installation and Go-Live Schedule

Each lot, zone and phase shall be taken live by its completion timeline below. The SCADA zone priority is indicative; **GEL reserves the right to re-prioritise the zones at finalisation of the event.**

5.4.1. AMI I&C Go-Live Schedule

Lot No.	AMI Locations	Go-Live Achievement Timeline
1	1,000	T + 4 months
2	1,000	T + 5 months
3	1,000	T + 5 months

Lot No.	AMI Locations	Go-Live Achievement Timeline
4	1,000	T + 6 months
5	800	T + 6 months
Total	**4,800**	

5.4.2. SCADA Go-Live Schedule

Priority	Zone	Total	Total CNG	CNG Dtr Booster	CNG Dtr Station	CNG Online	CNG Mother	LCNG	CGS	CMS	DRS	DCS	CBG	CPTR	Odoriser	LNG	E&P	Go-Live
1	Zone 4	503	230	101	4	90	35	1	—	20	200	6	1	25	15	1	4	T + 6 months
2	Zone 2	327	140	24	1	90	25	1	14	30	60	1	1	50	25	1	4	T + 7 months
3	Zone 1	249	160	68	5	62	25	1	—	15	40	6	1	8	15	1	2	T + 8 months
4	Zone 6	169	130	102	3	20	5	1	—	10	5	1	2	7	10	1	2	T + 8 months
5	Zone 5	131	100	68	—	22	10	1	—	5	10	1	1	5	5	1	2	T + 9 months
6	Zone 3	215	95	41	—	46	8	3	—	20	60	5	1	15	15	—	2	T + 9 months
	Total	**1,595**	**850**	**404**	**13**	**330**	**103**	**8**	**14**	**100**	**375**	**20**	**7**	**110**	**85**	**5**	**16**	

5.4.3. **CMP** Phase Schedule

Phase	Go-Live	Scope
1	T + 4 months	Integration with existing applications (incl. outgoing SCADA and AMR applications) and basic dashboards
2	T + 7 months	Integration with the new SCADA and AMI applications, basic analytics and layered dashboards
3	T + 9 months	Integration with new/future applications of GEL (GEL dependency) and AI/ML-driven use cases

5.5. Phased Go-Live, Per-Lot/Zone Stabilisation and Pro-Rata Billing

Go-Live is achieved progressively, lot by lot (AMI), zone by zone (SCADA) and phase by phase (CMP), on the dates in the Installation and Go-Live Schedule. Because each lot, zone and phase goes live on a different date, each has its **own three-month SLA stabilisation period**, running from its own Go-Live date. During a lot's/zone's/phase's stabilisation period, all its SLAs are measured and recorded but financial penalties are not levied. On completion of that stabilisation period, GEL issues the Go-Live acceptance certificate for that lot/zone/phase, from which its SLAs become fully operative (with penalties) and its Schedule B billing commences on a pro-rata basis.

The **Handover** milestone (Milestone 10) is achieved when the last lot, zone and phase has completed its three-month stabilisation period and the entire solution has been handed over. As the last Go-Lives occur at T + 9 months, the last stabilisation period completes at T + 12 months (T2), at which point Handover is achieved for the whole solution. Five year O&M period commences from date of the formal handover.

5.6. Detailed Implementation Milestones

The below are the indicative milestones and will be finalised post award of the contract.

5.6.1. Milestone 1 — Survey and Requirement Gathering

The Bidder shall complete a comprehensive field survey of the AMI and SCADA locations and, in parallel, the requirement gathering for the CMP with GEL officials, and shall deploy the project organisation to execute the project. During the Milestone 1 stage of the project, GEL may request the winning Bidder to amend the priority for the implementation of AMI and SCADA solution at various field locations.

5.6.1.1. Common Activities

Activity	Description
Site-access authorization and planning	The Bidder shall inform GEL at least 7 days in advance and obtain written site-access permission, secure all permits, clearances and survey authorisations, and prepare location-wise work plans and risk assessments.
PMO mobilization and kickoff	The Bidder shall hold the project kickoff within 5 working days of the Work Order, mobilise the Project Management Office with all key personnel, and establish the communication-and-escalation matrix and site-access arrangements with GEL's GA Teams.
Field survey	The Bidder shall survey all in-scope locations (representative station types for SCADA; every metering location for AMI) on the agreed MS/Google forms, capturing photographs and GPS coordinates.
Service-provider survey	At each location, the Bidder shall conduct a service-provider (cellular operator) signal survey, measuring the available operators' signal strength and coverage, to determine the optimal operator/SIM selection for that location.
Unpriced PO / WO	This Bidder shall submit unpriced PO of at least 60% of the ordered quantity during this phase of the project.
Bill of Quantities finalisation	The Bidder shall reconcile the surveyed quantities against the scope of work and the SOR, flag any discrepancy to GEL in writing, and finalise the location-wise Bill of Quantities.
Implementation planning	The Bidder shall prepare the batch/lot/zone/phase-wise rollout sequence, parallel-team deployment plan and location-wise timelines.

5.6.1.2. SCADA Specific Activities

Activity	Description
Station survey and assessment	The Bidder shall assess, at each station type, the physical, electrical and communication infrastructure, the hazardous-area classification (PESO/intrinsic-safety, gas-detection/ESD provisions) and the existing-equipment inventory (make/model, condition, I/O, interfaces).
Engineering design	The Bidder shall develop the SCADA system, communication, central-infrastructure and security architecture, and the field- and central-equipment and software specifications.

5.6.1.3. AMI Specific Activities

Activity	Description
Metering-location survey	The Bidder shall record, at each EVC (IMS) and PD-meter location, the device particulars, the communication/pulse port, power availability, signal, GPS coordinates, the cable route and the safe-zone siting (≥ 1.5 m from the metering skid), and any access constraints.
Engineering design	The Bidder shall develop the AMI platform, communication, integration and security architecture, and the field-device and software specifications.
Device onboarding	The Bidder shall register all surveyed locations and devices in the AMI Platform.
EVC OEM engagement	The Bidder shall identify all EVC OEMs in GEL's installed base and plan driver development for any OEM not natively supported.

5.6.1.4. CMP Specific Activities

Activity	Description
Software, license and cloud setup	The Bidder shall deploy the COTS CMP software, provide all licenses in GEL's name (ICCC thick/thin client, GEL agreed enterprise and concurrent licenses, Android/iOS), and set up the MeitY-compliant cloud (application, database, historian and analytics servers) with high availability and redundancy.
Requirement gathering	The Bidder shall, with GEL officials, establish the source systems and applications to be integrated (Annexure 1), GEL's data standards, the required dashboards, KPIs and E&P forms, and the phase-wise integration scope.

5.6.1.5. Payment Release

Released on GEL's written acceptance of the survey and requirement-gathering deliverables and satisfaction of the acceptance criteria below.

5.6.1.6. Acceptance Criteria

GEL shall provide its acceptance based on the review of the deliverables submitted as part of the milestone.

5.6.1.7. Deliverables

The following deliverables shall be submitted with the Bidder's tax invoice for 10% of Schedule A; GEL shall issue the milestone acceptance certificate on acceptance, against which the payment is released:

- Survey document - MS/Google forms (incl. service-provider signal survey per location);
- Final BoQ;
- CMP requirement-gathering sign-off document;
- SCADA & AMI engineering design documentation;
- AMI device registry;
- implementation plan;
- Unpriced PO / WO for at least 60% of the awarded quantity

5.6.1. Milestone 2 — Material Factory Acceptance Test (FAT)

The Bidder shall procure the project hardware and demonstrate, through Factory Acceptance Testing conducted by a Third-Party Inspection Agency (TPIA), that all supplied hardware meets the specification before dispatch to site.

5.6.1.1. Common Activities

Activity	Description
Factory Acceptance Testing	The Bidder shall conduct FAT through a Bidder-appointed and Bidder-paid TPIA along with GEL, their empaneled TPIA and / or PMC, in an environment replicating the installation configuration, on three (3) equally distributed batches. GEL is entitled to witness any or all tests; failures shall be reworked, retested and recorded as passed before dispatch. GEL may reject few / all material during the FAT phase.
Dispatch clearance	The Bidder shall submit the TPIA inspection and FAT report to GEL and obtain GEL's written dispatch clearance before dispatching any batch.

5.6.1.2. SCADA Specific Activities

Activity	Description
Manufacturing and quality control	The Bidder shall oversee the manufacture of Type-1 RTUs (critical: comprehensive I/O, redundant power, hazardous-area certification), Type-2 RTUs, industrial cellular modems and instrumentation, with incoming, in-process and final QC and traceability.
FAT — SCADA hardware	The Bidder shall conduct FAT of the RTUs, transmitters, communication and power equipment, covering data acquisition, processing, control, alarming, reporting, redundancy/failover, security and performance.

5.6.1.3. AMI Specific Activities

Activity	Description
FAT — AMI hardware	The Bidder shall conduct FAT of all Modems and MIUs, covering physical/mechanical checks, communication on both SIMs with failover, protocol drivers, firmware currency and secure boot, and (MIU) pulse-count accuracy.

5.6.1.4. Payment Release

Released on GEL's written approval of the TPIA inspection and FAT report and GEL dispatch clearance for all batches. Because this payment is released before the material reaches site: **title to and ownership of all FAT-passed material shall pass to GEL on release of this payment**, free of all encumbrances, notwithstanding that the material remains in the Bidder's or manufacturer's custody until delivered; the Bidder shall physically mark, segregate and record all such material as GEL property, and shall not sell, pledge, substitute or encumber it; the Bidder shall insure it in GEL's name as loss payee, in storage and transit, until delivery to site is confirmed; and the Bidder shall deliver it to site with delivery challans and material-receipt confirmation within the GEL-approved plan. No I&C tranche shall be released while any material paid for under this milestone remains undelivered, save with GEL's written agreement. Loss, damage or non-delivery shall be made good by the Bidder at its own cost, with no additional payment and no extension of the timeline.

5.6.1.5. Acceptance Criteria

GEL shall provide their approval based on the report submitted by TPIA, GEL's empanelled PMC and / or TPIA (if required) and their own inspection during the FAT stage.

5.6.1.6. Deliverables

The following deliverables shall be submitted with the Bidder's tax invoice for 18% of Schedule A (in 3 trenches); GEL shall issue the milestone acceptance certificate on acceptance, against which the payment is released:

- QA/inspection records
- FAT completion certificate;
- GEL dispatch clearance;

5.6.2. Milestone 3 — Installation & Commissioning, AMI

The Bidder shall install and commission the AMI field devices lot by lot, each device qualifying only on GEL-signed installation and EMS/SAT confirmation.

5.6.2.1. Common Activities

Activity	Description
Field mobilisation and installation	The Bidder shall mobilise parallel field-installation teams across all active GAs, sized to complete installation within the window, and install and commission the field hardware per the approved methodology and the hazardous-area, earthing and surge-protection requirements.
Site Acceptance Test	The Bidder shall conduct SAT at each location in the presence of GEL's GA Team, dual-sign the SAT record before the location is declared commissioned, resolve all deficiencies within 10 days, and maintain the installation progress tracker.

5.6.2.2. AMI Specific Activities

Activity	Description
Install and commission Modems and MIUs	The Bidder shall install and commission Modems at EVC locations (enclosure, antenna, cables, surge protection, SIM configuration and the intrinsically-safe serial-port power feed where required) and battery-only MIUs at PD locations, across the five lots.
Deploy EVC drivers	The Bidder shall deploy all EVC OEM drivers before installation at the relevant locations and verify the hourly communication behaviour at SAT.

Payment Release

Released in tranches per lot as installation and commissioning progress. A device qualifies toward a tranche only when both a GEL-signed installation inspection report and a GEL-signed EMS/SAT report have been issued for it (per the I&C definition). Each tranche is payable per lot, calculated as **15% of Schedule A × (qualifying AMI locations in the lot ÷ total AMI locations)**; any balance below a full lot is paid, pro-rata, on GEL's acceptance of the milestone. Each tranche claim shall be supported by both GEL-signed reports for every device in the lot and the EMS-generated device list; EMS data is authoritative in any discrepancy. Where the actual commissioned quantity differs from Q, the total released is reconciled at Milestone 5.

5.6.2.3. Acceptance Criteria

100% of the in-scope AMI locations commissioned, or a non-attributed device register accepted by GEL in writing for any exceptions; all SAT records dual-signed and filed; all deficiencies resolved and closed; and all EVC drivers loaded and operational.

5.6.2.4. Deliverables

The following deliverables shall be submitted with the Bidder's tax invoice for 18% of Schedule A; GEL shall issue the milestone acceptance certificate on acceptance, against which the payment is released:

- Per-lot I&C SAT sign-off report (site wise);
- Installation completion detailed report;

- EVC driver register.

5.6.3. Milestone 4 — Go-Live of CMP Phase 1

The Bidder shall integrate GEL's existing applications into the CMP Data Lake and deliver the Phase 1 dashboards and mobile application.

5.6.3.1. Common Activities

Activity	Description	Outcome	
Phase UAT and Go-Live acceptance		The Bidder shall complete UAT for the phase with GEL and obtain the GEL Phase 1 Go-Live sign-off.	GEL Phase 1 Go-Live sign-off.

5.6.3.2. CMP Specific Activities

Activity	Description
Integration strategy and FRS/SRS	The Bidder shall develop the integration strategy and the FRS/SRS covering all three phases.
Existing-application integration	The Bidder shall integrate the existing applications (Annexure 1 — SAP, existing multi-OEM SCADA, legacy AMR, spreadsheet feeds) into the centralised Data Lake via APIs, ETL and direct connections.
Data Lake and retention	The Bidder shall implement the centralised Data Lake with the archival database retaining KPI data for at least 5 years.
Phase 1 dashboards and mobile app	The Bidder shall deliver the Phase 1 reporting dashboards with multi-level access, the E&P dashboards with manual data-entry forms, and the Android/iOS mobile application.

5.6.3.3. Payment Release

Released on GEL's acceptance of the Phase 1 Go-Live report.

5.6.3.4. Acceptance Criteria

All Annexure 1 integrations live and reconciled against their native applications; the Data Lake and 5-year retention confirmed; dashboards and mobile application accepted; UAT completed and the Phase 1 Go-Live sign-off issued.

5.6.3.5. Deliverables

The following deliverables shall be submitted with the Bidder's tax invoice for 4% of Schedule A; GEL shall issue the milestone acceptance certificate on acceptance, against which the payment is released:

1. Phase 1 Go-Live report;
2. Integration test report;
3. Data Lake & retention confirmation;
4. UAT sign-off.

5.6.4. Milestone 5 — Go-Live, AMI

The Bidder shall take the AMI system live lot by lot, following the mandatory parallel run and the completion of billing integration, UAT and security testing.

5.6.4.1. Common Activities

Activity	Description
UAT	The Bidder shall conduct UAT with GEL's GA, billing, IT and SAP teams and resolve all Critical/High defects.

Security and DR readiness	The Bidder shall complete the pre-Go-Live CERT-In VAPT with all Critical/High findings remediated and conduct a live DR failover test within the RTO.
SOPs, training and Go-Live acceptance	The Bidder shall ensure all approved SOPs are accessible and training is complete, and obtain GEL Go-Live acceptance for each lot.

5.6.4.2. AMI Specific Activities

Activity	Description
Billing and enterprise integration	The Bidder shall complete the mandatory SAP Billing end-to-end integration (all three billing-cycle types, all customer categories, gap/exception handling) and all other configured integrations (SCADA, CMP, CRM, GIS).
Parallel operations and lot Go-Live	The Bidder shall run parallel operations for a minimum of 15 days per lot (existing and new AMI systems collecting concurrently), with weekly and batch-level reconciliation, and obtain GEL's written Go-Live acceptance per lot.

5.6.4.3. Payment Release

Released in tranches per lot on GEL's written Go-Live acceptance for each lot. A lot qualifies when it has completed parallel operations (≥ 15 days) with GEL-accepted reconciliation and meets the Go-Live definition. Each tranche is **10% of Schedule A × (lot locations ÷ total AMI locations)**. This milestone reconciles all Milestone 3 tranche payments against the actual commissioned quantity, with any excess or shortfall adjusted here.

5.6.4.4. Acceptance Criteria

All AMI lots live and transmitting billing-grade data (save GEL-accepted non-attributed devices); UAT signed off with zero open Critical/High defects; CERT-In VAPT cleared; SAP Billing confirmed operational across all cycles; EMS operational with GEL access and SLA tracking; and parallel-operations reconciliation accepted for all lots.

5.6.4.5. Deliverables

The following deliverables shall be submitted with the Bidder's tax invoice for 10% of Schedule A (released in tranches per lot); GEL shall issue the milestone acceptance certificate on acceptance, against which the payment is released:

1. Per-lot Go-Live report;
2. Parallel-operations reconciliation reports;
3. UAT completion report;
4. VAPT report;
5. DR test record;
6. SAP integration
7. EMS commissioning confirmation.

5.6.5. Milestone 6 — Go-Live of CMP Phase 2

The Bidder shall integrate the new SCADA and AMI systems and the middleware applications into the CMP, deliver basic analytics and layered dashboards, and take CMP Phase 2 live.

5.6.5.1. Common Activities

Activity	Description
Phase UAT	The Bidder shall conduct UAT for the phase with GEL, covering all Phase 2 integrations, analytics and dashboards, and resolve all Critical/High defects.
Go-Live acceptance	The Bidder shall obtain GEL's written Phase 2 Go-Live sign-off.

5.6.5.2. SCADA Specific Activities

Activity	Description	Outcome
Provide SCADA integration interfaces	The Bidder shall provide and expose the SCADA integration interfaces (APIs/feeds) required by the CMP, with real-time data synchronisation of SCADA operational data into the CMP.	SCADA operational data available to the CMP.

5.6.5.3. AMI Specific Activities

Activity	Description
Provide AMI integration interfaces	The Bidder shall provide and expose the AMI integration interfaces (APIs/feeds) required by the CMP, synchronising AMI consumption/metering data into the CMP.

5.6.5.4. CMP Specific Activities

Activity	Description
New SCADA and AMI integration	The Bidder shall integrate the new SCADA and AMI systems implemented under this project with the CMP, ensuring unified operational visibility and real-time synchronisation of SCADA field data, AMI customer data and the CMP analytics platform.
Middleware application integration	The Bidder shall integrate the new middleware applications (Annexure 2 — Project Management System, Customer Management System, HR Management Solution and other business applications) into the CMP, developing and implementing the required APIs for communication between the CMP and each application.
Basic analytics	The Bidder shall develop basic analytics capabilities including operational-performance monitoring, customer-consumption analysis, network-utilisation tracking and equipment-performance trending.
Layered/cascading dashboards	The Bidder shall implement multi-level cascading reporting dashboards providing role-based access and customisable views for the different stakeholder groups and migrate E&P data entry to middleware integration.

5.6.5.5. Payment Release

Released on GEL's acceptance of the Phase 2 Go-Live report.

5.6.5.6. Acceptance Criteria

The new SCADA and AMI systems and the middleware applications integrated and reconciled into the CMP; real-time data synchronisation validated; basic analytics functional; multi-level cascading dashboards accepted with role-based access verified; and UAT completed with the Phase 2 Go-Live sign-off issued.

5.6.5.7. Deliverables

The following deliverables shall be submitted with the Bidder's tax invoice for 4% of Schedule A; GEL shall issue the milestone acceptance certificate on acceptance, against which the payment is released:

1. Phase 2 Go-Live report;
2. SCADA/AMI & middleware integration test reports;
3. UAT sign-off.

5.6.6. **Milest**one 7 — Installation & Commissioning, SCADA

The Bidder shall install and commission the SCADA field infrastructure zone by zone, each station qualifying only on GEL-signed installation and EMS/SAT confirmation.

Scope of Work

5.6.6.1. Common

Activity	Description
Installation planning & site preparation	The Bidder shall finalise the zone-wise location priority with GEL, execute civil works and infrastructure modifications where required, obtain work permits/PTW, and coordinate logistics, qualified personnel and tools.

Activity	Description
Site Acceptance Test	The Bidder shall conduct SAT at each station in the presence of GEL's GA Team, dual-sign the SAT record before commissioning, resolve deficiencies within the agreed period, and maintain the installation progress tracker.

5.6.6.2. SCADA Specific Activities

Activity	Description
RTU, communication and instrumentation installation	The Bidder shall install RTUs (Type-1/Type-2 as applicable) in appropriate enclosures with environmental protection, grounding and surge protection; deploy communication equipment with optimal antenna placement and dual-SIM configuration; and install field instrumentation (pressure/temperature transmitters, EVC/PLC/flow-computer interfaces) with proper impulse-line routing and intrinsically-safe installation in hazardous areas.
Power, cabling, earthing and surge protection	The Bidder shall install power distribution with backup and conditioning as designed; install and test all power, signal and communication cables (routing, protection, identification, continuity, continuity, insulation-resistance and signal-integrity tests); and install comprehensive grounding, lightning and surge protection.
System integration and configuration	The Bidder shall interface the SCADA with the field/station systems (PLCs, flow computers, EVCs, specialised equipment) with protocol conversion and data-accuracy verification, establish the communication networks with addressing/routing/security, and configure data acquisition (polling rates, alarm limits, validation), logging and trending.
Central system configuration	The Bidder shall configure the cloud-hosted MMS/BMS, the real-time and historical databases (historian), the HMI/mimic displays, alarm management and role-based access, for the commissioned stations.
Testing and commissioning	The Bidder shall conduct individual device/communication testing (I/O, calibration, response times, redundancy, store-and-forward and data recovery) and integration testing (data flow, control functionality, alarm management) at each station.

5.6.6.3. Payment Release

Released in tranches per zone as installation and commissioning progress. A station qualifies toward a tranche only when both a GEL-signed installation inspection report and a GEL-signed EMS/SAT report have been issued for it (per the I&C definition). Each tranche is **12% of Schedule A ×**

(that zone's stations ÷ total SCADA stations), supported by both GEL-signed reports and the EMS station list (EMS authoritative). The total released is reconciled at Milestone 8.

5.6.6.4. Acceptance Criteria

Physical installation verified and workmanship accepted by GEL zone by zone; safety and environmental-protection adequacy; communication reliability and data integrity confirmed; 100% of the in-scope SCADA stations commissioned (or a GEL-accepted non-attributed register for exceptions); all SAT records dual-signed and filed; and all deficiencies resolved.

5.6.6.5. Deliverables

The following deliverables shall be submitted with the Bidder's tax invoice for 12% of Schedule A (released in tranches per zone); GEL shall issue the milestone acceptance certificate on acceptance, against which the payment is released:

1. Per-zone I&C SAT sign-off report (site wise);
2. Installation completion report (detailed);
3. Updated as-built records

5.6.7. **Milestone** 8 — Go-Live, SCADA

The Bidder shall take the SCADA system live zone by zone, following thorough testing of the SCADA and CMP software, system validation, an operational-reliability demonstration and security testing.

Scope of Work

5.6.7.1. Common

Activity	Description
UAT	The Bidder shall conduct UAT with GEL's operations teams and resolve all Critical/High defects.
Security and DR readiness	The Bidder shall complete the pre-Go-Live CERT-In VAPT with all Critical/High findings remediated, and conduct a live DR/failover test verifying RTO/RPO.
Go-Live acceptance	The Bidder shall obtain GEL Go-Live acceptance for each zone, cascaded GA → Zone → HO.

5.6.7.2. SCADA Specific Activities

Activity	Description
System validation	The Bidder shall verify connectivity and operation of all stations in the zone, data acquisition from all configured points (accuracy and timing), all control functions and command execution, and performance/load under maximum loading (peak acquisition, concurrent users, full historian).
Operational-reliability demonstration	The Bidder shall demonstrate stability through continuous operation under actual field conditions for a minimum of 30 consecutive days without failures affecting operational capability, with immediate issue response and root-cause analysis.
Supervisory control and failover	The Bidder shall take supervisory monitoring and control live, verify the select-check-execute control sequence and emergency-shutdown handling, and verify the automatic MMS↔BMS failover with data continuity.
CMP/ICCC integration and dashboards	The Bidder shall integrate the SCADA field assets with the CMP/ICCC, configure real-time displays, KPI monitoring and analytics dashboards, and verify real-time data flow and alarm integration.
Remote access, mobile and as-built	The Bidder shall configure secure remote access and authorised remote-control functions with audit logging, deploy the iOS/Android mobile application, deliver role-based training, and complete the as-built documentation.
SCADA/CMP software testing	The Bidder shall complete thorough testing of the SCADA and CMP software (jointly), covering functional, performance and security aspects.

5.6.7.3. CMP Specific Activities

Activity	Description
CMP software testing (joint)	The CMP software shall be thoroughly tested together with the SCADA software as part of this milestone's testing.

5.6.7.4. Payment Release

Released in tranches per zone on GEL's written Go-Live acceptance for each zone. A zone qualifies when it meets the Go-Live definition. Each tranche is **12% of Schedule A × (that zone's stations ÷ total SCADA stations)**. This milestone reconciles all Milestone 7 tranche payments against the actual commissioned quantity.

5.6.7.5. Acceptance Criteria

All SCADA zones live with supervisory monitoring and control operational; thorough testing of the SCADA and CMP software completed; performance, security and reliability compliance (incl. the 30-day demonstration); MMS↔BMS failover verified; CMP/ICCC integration and dashboards accepted; remote access and mobile accepted; UAT signed off with zero open Critical/High defects; and CERT-In VAPT cleared.

5.6.7.6. Deliverables

The following deliverables shall be submitted with the Bidder's tax invoice for 12% of Schedule A (released in tranches per zone); GEL shall issue the milestone acceptance certificate on acceptance, against which the payment is released:

1. Per-zone Go-Live report; system validation report;
2. VAPT sign-off;
3. UAT completion report;
4. As-built documentation.

5.6.8. Milestone 9 — Go-Live of CMP Phase 3, and Final Go-Live of all three components

The Bidder shall deploy the CMP's AI/ML analytics and emergency-control capabilities, integrate future applications, and confirm Final Go-Live of all three systems.

Scope of Work

5.6.8.1. Common

Activity	Description
Phase UAT	The Bidder shall complete Phase 3 UAT with GEL covering the AI/ML analytics and the emergency-control workflow, and resolve all Critical/High defects.
Final Go-Live confirmation	The Bidder shall confirm that all three systems (SCADA, AMI and CMP) are live and integrated.

5.6.8.2. SCADA Specific Activities

Activity	Description
Confirm live and integrated	The SCADA system (live under Milestone 8) shall be confirmed integrated with CMP Phase 3.

5.6.8.3. AMI Specific Activities

Activity	Description
Confirm live and integrated	The AMI system (live under Milestone 5) shall be confirmed integrated with the CMP.

5.6.8.4. CMP Specific Activities

Activity	Description
AI/ML advanced-analytics engine	The Bidder shall deploy the AI/ML-driven advanced-analytics engine (predictive, prescriptive and descriptive) and the finalised use cases agreed with GEL (e.g., predictive maintenance, demand forecasting, network optimisation, asset/energy management, customer-service enhancement).
Emergency-control and alert-management module	The Bidder shall implement the alert-management and emergency-control system — automated workflow triggers, multi-system interfacing, e-signature approval, incident-lifecycle management, real-time incident detection and response, and critical-infrastructure control.
Advanced dashboards	The Bidder shall deploy the AI/ML-driven and predictive-insights dashboards supporting strategic decision-making.
Future-application integration	The Bidder shall integrate new/future GEL applications (subject to GEL dependency) into the CMP.

5.6.8.5. Payment Release

Released on GEL's acceptance of the Phase 3 Go-Live report and confirmation of Final Go-Live.

5.6.8.6. Acceptance Criteria

The AI/ML analytics engine and use cases live and accepted; the emergency-control and alert-management module live and validated; advanced dashboards accepted; UAT completed; and all three systems (SCADA, AMI and CMP) live, constituting Final Go-Live (T1).

5.6.8.7. Deliverables

The following deliverables shall be submitted with the Bidder's tax invoice for 5% of Schedule A; GEL shall issue the milestone acceptance certificate on acceptance, against which the payment is released:

1. Phase 3 Go-Live report;
2. Final Go-Live confirmation;
3. UAT sign-off

5.6.9. Milestone 10 — Handover of SCADA, AMI and CMP

The Bidder shall complete each lot's, zone's and phase's three-month SLA stabilisation period and hand over the entire solution with the SOPs and as-built documentation.

5.6.9.1. Common

Activity	Description
SLA stabilisation	The Bidder shall operate each lot, zone and phase through its three-month SLA stabilisation period (SLAs measured, penalties waived), meeting all SLAs continuously as evidenced by the EMS reports.
Defect closure	The Bidder shall resolve all defects and incidents raised during stabilisation to GEL's written satisfaction, with root cause and corrective action.
Documentation, training and handover	The Bidder shall deliver the complete as-built documentation and the version-controlled SOPs, complete all training and certification, and complete the structured handover of the entire solution.

5.6.9.2. SCADA Specific Activities

Activity	Description
SCADA handover and hand-holding	The Bidder shall deliver the SCADA as-built documentation, configuration baselines and SOPs, and continue the on-site SCADA hand-holding from Go-Live to six months after the SCADA stabilisation period.

5.6.9.3. AMI Specific Activities

Activity	Description
AMI handover	The Bidder shall deliver the AMI as-built documentation, configuration baselines and SOPs.

5.6.9.4. CMP Specific Activities

Activity	Description	Outcome
CMP handover	The Bidder shall deliver the CMP as-built documentation, configuration baselines and SOPs, and confirm the future-integration framework.	CMP handed over with SOPs.

5.6.9.5. Payment Release

Released on GEL's issuance of the handover acceptance certificate, once every lot, zone and phase has completed its three-month SLA stabilisation period, and on final reconciliation of all tranche payments against actual commissioned quantities. From this certificate, the five-year O&M Period is fully operative and OPEX billing applies.

5.6.9.6. Acceptance Criteria

All SLAs met continuously through each stabilisation period (EMS reports); all defects and incidents closed to GEL's written satisfaction; the complete handover pack and the SOPs for SCADA, AMI and CMP submitted and accepted; all training delivered and certified; and final tranche reconciliation completed.

5.6.9.7. Deliverables

The following deliverables shall be submitted with the Bidder's tax invoice for 10% of Schedule A; GEL shall issue the milestone acceptance certificate on acceptance, against which the payment is released:

1. Handover report;
2. SOPs (SCADA, AMI, CMP);
3. Per-lot/zone/phase stabilization SLA reports;
4. Defect-closure report;
5. Complete as-built;
6. Final asset inventory.

5.7. Post Go-Live Operation & Maintenance Payment Milestones

5.7.1. Overview

For each quarter of the O&M Period, the Bidder shall submit its invoice at the end of the quarter, accompanied by the EMS-generated SLA compliance report with the SLA penalties for that quarter calculated by the EMS. GEL shall verify the EMS report and the penalty computation before releasing payment.

From final handover of all the three components the start date of the five-year O&M Period for each component shall remain the same. However if the go live for any lot's, zone's or phase's commenced prior to this date, for those lot's, zone's or phases' billing will be done on pro-rata basis to match the final handover date. The following principles govern the O&M phase:

- **Billing unit for device O&M:** per device per day, calculated from the annual per-device rate quoted in Schedule B of the SOR.
- **Billing for cloud hosting, disaster recovery, application licences (including CMP, billed entirely through Schedule B) and communication charges:** quarterly, at one quarter of the applicable annual rate for the relevant O&M year, adjusted for the actual node/licence/connection count in that quarter.
- **SLA-linked split:** each quarterly OPEX invoice is split 80% on submission and 20% on SLA verification.
- **Payment basis is actual commissioned quantity**, as recorded by the EMS; no payment is made against Schedule B during the implementation phase.
- **SITC of additional devices/stations** quoted under Schedule B is released on installation, commissioning and GEL acceptance of each addition, not on a recurring basis.

5.7.2. O&M Milestones

The O&M Period is delivered against the following recurring milestones. Each quarterly milestone is a condition of the quarterly OPEX payment; the periodic milestones are conditions of the SLA-linked (20%) payment for the quarter in which they fall due.

Sr.	O&M Milestone	Frequency	Description	Payment link

1	Quarterly OPEX invoice and SLA report	Quarterly (Q1–Q20)	Invoice submitted at the end of the quarter with the EMS-generated SLA compliance report and EMS-calculated penalties, and the device-wise billable-day computation reconciling to the EMS	Quarterly Schedule B OPEX payment (80% primary + 20% SLA-linked)
2	Preventive maintenance	Quarterly	Preventive maintenance completed for all devices, with PM logbooks submitted	Condition of the 20% SLA-linked release
3	SLA performance and penalty computation	Quarterly	EMS SLA report verified by GEL; penalties computed by the EMS and deducted from the 20% component	Determines the 20% SLA-linked release and any deduction
4	New onboarding	On completion (as instructed)	New device/station/source onboarded, commissioned and accepted; SITC/integration charge invoiced	Schedule B2 SITC (one-time) / Schedule C (integration/driver)
5	Annual cybersecurity review and VAPT	Every 12 months	Annual cybersecurity review report and CERT-In VAPT report submitted	Deliverable gating the SLA-linked payment for that quarter (within Schedule B)
6	Annual asset-condition and platform-health assessment	Every 12 months	Annual asset-condition report and platform-health assessment submitted	Deliverable within Schedule B for that quarter

5.7.3. Pro-Rata Billing Mechanism

Devices, lots, zones and phases gone-live at different points in time are billed for the actual number of calendar days they were live and operational in each billing quarter. For each device, the EMS records the exact Go-Live/commissioning date; the billable amount for that device in a quarter is the applicable annual per-device rate ÷ 365 × the number of calendar days it was live and operational within that quarter. Days on which a device was not live and operational are not billable, such as where the downtime falls within a pre-approved scheduled-maintenance window or a GEL-accepted force-majeure event. Devices/stations added during the O&M Period are billable from their actual commissioning date at the applicable year's rate.

5.7.4. Deliverables during the O&M Phase

The below are the indicative milestones and will be finalised post award of the contract. The Bidder shall submit the deliverables below with each quarterly invoice; an invoice submitted without the complete set applicable to that quarter shall not be treated as a valid invoice and shall not start the payment-release timeline. Periodic (annual and six-monthly) deliverables shall be submitted with the invoice for the quarter in which they fall due.

5.7.4.1. Quarterly Deliverables

5.7.4.1.1. Common (Overall)

Deliverable	Description	Frequency
Quarterly tax invoice with billable-day computation	The tax invoice for the quarter, submitted at quarter-end, with the device-wise billable-day computation reconciling in full to the EMS record.	Quarterly
EMS quarterly SLA compliance report	The EMS-generated report covering every SLA in the Service Level Agreement (SLA) and Penalty Framework (field devices and application infrastructure), with device-level drill-down and the EMS-calculated penalties for the quarter.	Quarterly
Support Team resource-deployment confirmation	Confirmation of the O&M Support Team's deployment for the quarter, reconciled to the EMS attendance record.	Quarterly
Unified complaint and incident summary	All complaints and incidents logged in the quarter, by channel, priority and affected system, with resolution status and root cause for any repeat/critical incident.	Quarterly
New-onboarding confirmation	For any device/station onboarded in the quarter, the I&C certificate and post-commissioning (and, for AMI, post-parallel-run) confirmation issued by GEL.	Quarterly, as applicable
SLA compliance report for parameters not calculated with EMS	The bidder-generated report covering every SLA in the Service Level Agreement (SLA) for all applicable field devices and application infrastructure, with device-level drill-down which are not calculated by EMS.	Quarterly
Preventive-maintenance report (SCADA and AMI)	PM records and logbooks for all SCADA field hardware maintained in the quarter (RTUs, modems, transmitters, voltage stabilisers, switches, etc.), with next scheduled maintenance dates.	Quarterly

	PM records and logbooks for all AMI field hardware maintained in the quarter (Modems, MIUs, antennas, enclosures), with next scheduled maintenance dates. GEL may ask the bidder to carry out the preventive maintenance through a digital platform provided by GEL (through SOP defined by GEL)	
SIM / connectivity performance report	Per-SIM communication-success, signal-quality and failover statistics for all SIMs deployed.	Quarterly
battery-health report where batteries have been provided by the bidder	Battery-health assessment and any battery replacements.	Annual, or on low-battery/battery health fail alert

5.7.4.1.2. SCADA

Deliverable	Description	Frequency
MMS↔BMS failover / DR test record	Record of the witnessed automatic failover and DR test, with RTO/RPO verified.	Quarterly
Historian integrity-scan report	Consolidated weekly historian integrity-scan results confirming zero silent data loss.	Quarterly

5.7.4.1.3. AMI

Deliverable	Description	Frequency
Billing-data delivery confirmation	Confirmation of billing-data delivery to SAP for every commissioned meter on each billing date in the quarter, with an exception log.	Quarterly
VEE and billing-exception report	Summary of VEE processing and billing exceptions handled in the quarter.	Quarterly

5.7.4.1.4. CMP

Deliverable	Description	Frequency

Integration-availability & reconciliation report	Per-source integration availability and data-freshness, with reconciliation against each source's native application.	Quarterly
Analytics / AI-ML model-refresh report	Model-performance and retraining/tuning report for the AI/ML analytics use cases.	Periodic (with the quarter due)
Dashboard / report change log	Record of dashboard/report configuration changes delivered at GEL's request in the quarter.	Quarterly
Alert & emergency-control readiness-test record	Record of the witnessed critical-alert and emergency-control dispatch test and digital-SOP auto-linkage verification.	Half-yearly (with the quarter due)

5.7.4.2. Periodic Deliverables

Deliverable	**Description**	**Frequency**
Annual cybersecurity review report	The IEC 62443 / NCIIPC review report, within 30 days of review completion.	Annual
Annual VAPT report (CERT-In)	The CERT-In empanelled VAPT report with closure/re-test evidence for all findings.	Annual (or at a version release, whichever earlier)
SOC 2 Type II report	The current SOC 2 Type II report with no coverage gap.	Every 6 months
Annual asset-condition report	Physical-condition assessment of all deployed SCADA and AMI field hardware, with recommendations.	Annual
Annual platform-health assessment	Assessment of platform performance, capacity, patch and EOL/EOS status (SCADA, AMI, CMP).	Annual

5.7.5. Payment Release Conditions

Each quarterly OPEX invoice is split **80% primary + 20% SLA-linked**. The **80% primary** component is released on submission of a complete invoice at quarter-end with the EMS SLA compliance report and the resource-deployment confirmation, and no pending material breach. The **20% SLA-linked** component is released after GEL verifies the EMS SLA report and the EMS-calculated penalties against all metrics in the Service Level Agreement

(SLA) and Penalty Framework, confirms completion of the quarter's preventive maintenance (PM logbooks submitted) and any periodic deliverable due, and confirms no material non-compliance. SLA penalties, as computed by the EMS and verified by GEL, are deducted from the 20% component, subject to the caps in the Service Level Agreement (SLA) and Penalty Framework.

5.7.6. New Onboarding During the O&M Period

During the O&M Period, GEL may add new field locations, complete stations and source systems. The Bidder shall onboard all such additions on GEL's prior written instruction; there shall be no free onboarding, and the Bidder shall not decline or delay any onboarding on the ground that the location/source was not individually listed at contract signing. Each onboarding comprises a **one-time supply/installation/integration charge** (released on installation, commissioning and GEL acceptance, at the SOR rate for the O&M year of commissioning) and **ongoing O&M** (billed quarterly, pro-rata, from the commissioning date at the applicable annual rate).

Type of onboarding	**Bidder's scope**	**One-time charge**	**Ongoing O&M**
New AMI EVC / PD meter	Survey (incl. service-provider survey); supply and install Modem/MIU, antenna, enclosure and cabling; WAN; commission in the AMI Platform; confirm data collection (EVC/PD supplied by GEL).	Annual per-device SITC rate (SOR)	Quarterly, pro-rata from commissioning, at the year's annual per-device O&M rate
New SCADA station, or new EVC at a station	For a new EVC: SCADA-side communication hardware, driver from the shared library, tag mapping, commissioning. For a new complete SCADA station (e.g., new CNG/CGS/DRS/etc.): full SCADA-side SITC and integration (field instrumentation/EVC supplied by GEL).	Annual per-station / per-EVC SITC rate (SOR)	Quarterly, pro-rata from commissioning, at the year's annual O&M rate
New CMP source / application integration	Integrate the new source into the Data Lake; reconcile against the native application; dashboards as required.	Schedule C one-time integration charge	Within CMP Schedule B O&M

Deliverables for new onboarding (submitted for the one-time charge): GEL onboarding instruction; survey/readiness assessment; I&C sign-off (GEL-signed installation inspection + EMS/SAT report); commissioning/first-data confirmation with commissioning date; and the updated asset register. Thereafter the device/station is billed with the quarterly OPEX deliverables.

5.7.7. Schedule C — One-Time Costs

Schedule C covers one-time activities — enterprise/cross-system integrations and EVC-OEM driver development. Each Schedule C item is payable only on completion and GEL's written acceptance of the specific activity, at the Schedule C/SOR rate, at whatever point in the term it occurs (including during the OPEX phase). No Schedule C activity shall commence without GEL's prior written instruction; no item shall be charged under Schedule C and any other Part/Schedule. Schedule C payments are one-time and are subject to the 80/20 split.

Schedule C item	**Payment basis**	**Deliverables for payment**
One time driver development cost for makes of EVCs as per Annexure B	Per-OEM one-time SOR rate, on completion and GEL acceptance	Driver-development completion report; driver test results demonstrating a successful data read for the make/model (GEL-witnessed); updated driver-library register; GEL written acceptance
Integration of a new make of EVC / PD meter	One-time SOR rate, on completion and GEL acceptance	Integration test report; data-read demonstration for the make; GEL written acceptance
Enterprise / cross-system integration (SAP ECC/S4 HANA, GIS, CRM, ESB, cross-system, etc.)	One-time SOR rate per integration, on completion and GEL acceptance	Integration design document; integration test report with data reconciliation against the source; UAT sign-off; updated API documentation; GEL written acceptance

6. Service Level Agreement (SLA) and Penalty Framework

The Bidder shall provide the SCADA, AMI and CMP System at the service levels defined in this Section for the full duration of the Contract, and shall be liable for the penalties stated for non-achievement. Following section mentions the SLA requirement for the project during both the implementation and the O&M phase of the project along with the prescribed penalties for violation of those SLAs.

Throughout this Section, a penalty expressed as a percentage is a percentage **of the Quarterly Payment** for the relevant system (as defined in Clause 6.1.4) during the O&M phase, and a percentage **of the overall contract value of Schedule A** during the implementation phase; a penalty expressed in INR is an absolute amount. All caps are set out in Clause 6.1.5.

Overall penalty for the entire project is capped at 10% of the project cost. In case the same is triggered, GEL reserves the right to terminate the contract and onboard a new agency to undertake the work.

6.1. Framework and Principles

6.1.1. Measurement authority

SLA measurements shall be based on data generated by the Enterprise Management System (EMS) – wherever applicable, which is the authoritative and sole reference for SLA performance calculation and penalty computation across SCADA, AMI and CMP; SIM and communication-network metrics are drawn from the Network Management System (NMS), which feeds the EMS. The web application, the thin and thick clients and the mobile application are **not** measured by the EMS: the Bidder shall test these applications jointly with GEL once every quarter against their availability and performance service levels, and the signed result of this joint quarterly test shall be the measurement basis for those service levels (Clause 6.5). In case of any EMS-related glitch, the on-field status shall be considered final. The EMS SLA computation shall be audited by GEL at the initial stage of deployment through trials and uptime checks; only designated officers of GEL shall download reports from the EMS before payment clearance. Any SLA event not attributable to the Bidder shall not be considered for penalty calculation.

6.1.2. Scheduled maintenance

Pre-approved scheduled-maintenance windows shall be excluded from availability SLA calculations, subject to prior notification to GEL at least 72 hours in advance, maintenance not scheduled on any GEL billing date, and GEL's written approval of the window.

6.1.3. SLA stabilisation period

The three-month period from respective Go-Live date shall be treated as the SLA Stabilisation Period. During this period all SLAs shall be measured, recorded and reported by the EMS and the Bidder shall submit the quarterly SLA report, but financial penalties shall not be levied. This period allows the System to stabilise under live operating conditions before penalties commence; penalties for all systems, shall commence upon expiry of the respective SLA Stabilisation Period.

6.1.4. Basis of "Quarterly Payment"

"Quarterly Payment" means the total quarterly OPEX invoice raised by the Bidder at the end of each quarter, inclusive of all applicable SOR components in that quarter. Every percentage penalty in the O&M phase is calculated against this amount.

6.1.5. Penalty caps

The following capping applies to all penalties

- **Per service level:** the penalty for any/all SLA/s in a quarter is capped at **20% of the Quarterly Payment (excluding GST)**.
- **Over the Contract:** the cumulative penalty across all SLA heads over the full Contract is capped at **10% of the overall contract value (excluding GST)**.

6.1.6. Contract termination

During the implementation phase, GEL may terminate the Contract and invoke the Performance Bank Guarantee if the penalty reaches 10% of the overall contract value (excluding GST).

During the O&M phase, GEL may terminate the Contract and invoke the Performance Bank Guarantee if the cumulative penalty exceeds 10% of the overall contract value (excluding GST), or if the SLA penalty reaches 20% of that quarter's payment for three consecutive quarters. Where critical infrastructure is impacted on a repetitive basis without permanent resolution within a maximum of one month, GEL may invoke termination immediately.

In addition: if the Bidder does not perform up to GEL's expectation in alignment with the RFP and SLA requirements, GEL shall serve the Bidder with one notice, followed by two show-cause notices; if the same is not addressed even after these three notices, GEL reserves the right to terminate the

Contract with the Bidder, including blacklisting the Bidder. GEL may award such work to another agency and also reserves the right to recover the associated cost, including the cost of execution and/or O&M, from the Bidder.

6.2. Definitions

Sr.	Term	Definition
a.	Uptime / Availability	The percentage of time for which the service or component is available for use: **Availability % = {1 − [Downtime ÷ (Total Time − Scheduled Maintenance Time)]} × 100**.
b.	Downtime	The period during which the service or component is not available for use, excluding downtime attributable to approved scheduled maintenance, force majeure and causes not attributable to the Bidder.
c.	Quarterly Payment	As defined in Clause 6.1.4 — the quarterly OPEX invoice for the relevant system. All percentage O&M penalties are of this amount.
d.	EMS / NMS	The Enterprise Management System (sole SLA authority) and the Network Management System (SIM/communication health, feeding the EMS).
e.	Joint quarterly test	A test of the web and mobile application, thin/thick clients and mobile application conducted by the Bidder together with GEL once per quarter, whose signed result measures those applications' availability and performance service levels.
f.	Incident	Any event in the SCADA, AMI or CMP System that leads, or may lead, to a disruption of normal operation.
g.	Acknowledgement Time / Resolution Time	Time from first receipt of an incident on any channel to (respectively) the Support Team assigning it to a technical resource with a ticket reference, and to full restoration of service.
h.	Priority P1 — Critical	A platform (SCADA/AMI/CMP) fully or substantially unavailable; SAP Billing integration down; billing data unavailable on a billing date; loss of supervisory control; a data-loss event. *(e.g., platform outage; control loss; billing-day failure; > 20% of the network offline.)*
i.	Priority P2 — High	Significant data-collection/monitoring failure affecting > 5% of a device/site category; alarm notification not functioning; communication failure affecting billing or monitoring. *(e.g., alarm engine down; VEE failure; > 5% device category offline.)*
j.	Priority P3 — Medium	Individual device failures; non-critical feature unavailability; delayed data delivery not affecting billing.

Sr.	Term	Definition
k.	Priority P4 — Low	Minor issues; cosmetic defects; informational or configuration-change queries.
l.	VAPT Severity V1–V4	V1 Critical (CVSS 9.0–10.0); V2 High (7.0–8.9); V3 Medium (4.0–6.9); V4 Low (0.1–3.9), assigned by the CERT-In empanelled auditor.
m.	Billing Date	A date on which GEL raises customer bills and on which validated billing determinants are required in SAP for each commissioned AMI location and CNG station.
n.	Pending Location	A field location (AMI metering location and/or SCADA station) not installed-and-commissioned, or not gone-live, by the scheduled date for its lot/zone in the Installation and Go-Live Schedule (used for the Implementation-phase penalty).
o.	Web / Thin-Thick / Mobile Application	The browser web portal; the CMP/SCADA locally-installed (thick) and lightweight (thin) clients; and the GEL-staff Android/iOS application, of a system.
p.	Go-Live / Final Go-Live (T1) / Handover (T2)	Go-Live: GEL's written acceptance that a system (or lot/zone/phase) is live. Final Go-Live for all three components (T1 = T + 9 months) and handover (T2 = T + 12 months).

6.3. Penalty for Delay in Implementation Milestones

Any delay in the delivery of the project deliverables (solely attributable to Bidder) would attract following liquidated damage per week of the overall value of schedule A.The Bidder shall complete each implementation milestone by its completion timeline. Delay shall be measured in weeks from the completion timeline to GEL's written acceptance. Go-Live is phased: **AMI by lots and SCADA by zones**, each lot and each zone having its own scheduled date in the Installation and Go-Live Schedule as below

6.3.1. AMI I&C and Go-Live Schedule

Lot No.	AMI Locations	Go-Live achievement Timeline
1	1000	T + 4 months
2	1000	T + 5 months
3	1000	T + 5 months
4	1000	T + 6 months
5	800	T + 6 months

6.3.2. SCADA Go-Live Schedule

Priority	Zone	Total	CNG	LCNG	CGS	CMS	DRS	DCS	CBG	CPTR	Odoriser	LNG	E&P	Go-Live Achievement Timeline
1	Zone 4	**503**	230	1		20	200	6	1	25	15	1	4	T + 6 Months
2	Zone 2	**327**	140	1	14	30	60	1	1	50	25	1	4	T + 7 Months
3	Zone 1	**249**	160	1		15	40	6	1	8	15	1	2	T + 8 Months
4	Zone 6	**169**	130	1		10	5	1	2	7	10	1	2	T + 8 Months
5	Zone 5	**131**	100	1		5	10	1	1	5	5	1	2	T + 9 Months
6	Zone 3	**211**	90	3		20	60	5	1	15	15	-	2	T + 9 Months
	Total	**1590**	**850**	**8**	**14**	**100**	**375**	**20**	**7**	**110**	**85**	**5**	**16**	

The Bidder shall achieve each lot's and each zone's Go-Live by its scheduled date, and delay shall be measured **per lot and per zone** against that date. For milestones denominated by field location (Installation & Commissioning and Go-Live of the AMI lots and the SCADA zones), the penalty is **per Pending Location per week**; for all other milestones, the penalty is a percentage **of the overall value of Schedule A** per week.

Sr.	Milestone	Completion Timeline	SLA (Service Level Requirement)	Penalty for Non-Achievement
1.	Survey and requirement gathering	T + 1.5 months	Completed and accepted by T + 1.5 months	0.05% of the overall value of Schedule A per week for initial 4 weeks and thereafter 0.1% per week from week 5 to week 8 and thereafter 0.2% per week
2.	Material Factory Acceptance Test (FAT)	T + 3 months	Completed and accepted by T + 3 months	0.05% of the overall value of Schedule A per week for initial 4 weeks and thereafter 0.1% per week from week 5 to week 8 and thereafter 0.2% per week
3.	Go-Live — AMI (per lot)	Lot wise Go-Live date as mentioned in section 6.3.1	Each AMI lot made live by its scheduled lot wise Go-Live date as mentioned section 6.3.1	INR 1,000 per week per Pending Location for initial 4 weeks INR 2,000 per week per Pending Location for week 5 - 12

Sr.	Milestone	Completion Timeline	SLA (Service Level Requirement)	Penalty for Non-Achievement
				INR 5,000 per week per Pending Location for week 13 onwards
4.	Go-Live of CMP — Phase 1	T + 4 months	CMP Phase 1 live and accepted by T + 4 months	0.05% of the overall value of Schedule A per week for initial 4 weeks and thereafter 0.1% per week from week 5 to week 8 and thereafter 0.2% per week
5.	Go-Live of CMP — Phase 2	T + 7 months	CMP Phase 2 live and accepted by T + 7 months	0.05% of the overall value of Schedule A per week for initial 4 weeks and thereafter 0.1% per week from week 5 to week 8 and thereafter 0.2% per week
6.	Go-Live — SCADA (per zone)	Zone wise Go-Live date as mentioned in 6.3.2	Each SCADA zone made live by its scheduled zone wise Go-Live date as mentioned in 6.3.2	INR 1,000 per week per Pending Location for initial 4 weeks INR 2,000 per week per Pending Location for week 5 - 12 INR 5,000 per week per Pending Location for week 13 onwards
7.	Go-Live of CMP — Phase 3, and Final Go-Live	T + 9 months	CMP Phase 3 live and Final Go-Live achieved by T + 9 months	0.05% of the overall value of Schedule A per week for initial 4 weeks and thereafter 0.1% per week from week 5 to week 8 and thereafter 0.2% per week
8.	Handover of SCADA, AMI and CMP	T + 12 months	Handover and SOPs completed and accepted by T + 12 months	0.05% of the overall value of Schedule A per week for initial 4 weeks and thereafter 0.1% per week from week 5 to week 8 and thereafter 0.2% per week

6.4. Manpower SLAs

The Bidder shall keep the committed key personnel and Support Team available throughout their respective phases. Availability is measured against attendance/deployment records submitted to GEL. A leave allowance of 24 days per calendar year applies to each key resource; Bidder shall deploy a replacement resource in case of planned leave of more than 10 working days or more than 5 working days in case of unplanned leave. Additionally,

the following penalties shall be levied from their quarterly invoice. Please note that below penalties will be levied in addition to deduction of actual wages for the period of absence based on the rate schedule.

Phase	Resource	Leave allowance	Penalty for Non-Availability
Implementation	Project Director / Project Manager	24 days leave per calendar year	INR 10,000 per day beyond the leave allowance
Implementation	SCADA / AMI / CMP Technical Lead / System Architect		INR 10,000 per day beyond the leave allowance
Implementation	System experts (RTU, HES/MDMS, Modem/MIU, ICCC/CMP, analytics, EVC)		INR 5,000 per day beyond the leave allowance
Implementation	All other central-team roles		INR 5,000 per day beyond the leave allowance
O&M	Project Director / Project Manager (SPOCs)		INR 10,000 per day beyond the leave allowance
O&M	Zonal Coordinators / Head Office Coordinators		INR 6,000 per day of absence beyond 2 days' leave
O&M	CMP application support (remote/background)	Available to meet CMP incident SLAs at all times	INR 5,000 per day of committed-resource unavailability beyond allowance

6.5. Common SLAs (SCADA, AMI and CMP)

The Bidder shall meet the following service levels, which are identical across all three systems. Each is measured by the EMS/NMS on the stated frequency, **except** the web application, the thin and thick clients and the mobile application, whose availability and performance are measured by the **joint quarterly test** the Bidder conducts with GEL (Clause 6.1.1). In the Penalty column, every percentage is **of the Quarterly Payment** (Clause 6.1.4) unless an absolute INR amount is stated; each availability service level is capped at 20% of the Quarterly Payment.

<table>
<tr><th>Sr. No.</th><th>SLA</th><th>Target</th><th>Penalties</th></tr>
<tr><td>1.</td><td>Availability / Uptime of Applications and Software (AMI, SCADA, CMP and EMS application) – Includes both Web and mobile application</td><td>99%</td><td>
<table>
<tr><th>SLA</th><th>Penalty</th></tr>
<tr><td>>= 99%</td><td>No penalty</td></tr>
<tr><td><99% to >=98.5%</td><td>2% of quarterly OPEX cost</td></tr>
<tr><td><98.5% to >=98%</td><td>4% of quarterly OPEX cost</td></tr>
<tr><td><98% to >=97%</td><td>6% of quarterly OPEX cost</td></tr>
<tr><td><97% to >=96%</td><td>8% of quarterly OPEX cost</td></tr>
<tr><td><96% to >=95%</td><td>10% of quarterly OPEX cost</td></tr>
</table>
If the uptime goes below 95%, additional penalty of 2% will be charged on quarterly OPEX cost for each slab of 1% downtime. For the calculation of the applicable penalty, figure will be rounded off to the lower integer figure. (e.g. 93.99 shall be rounded off to 93). Penalty capping shall be of 20% of the quarterly payment.
</td></tr>
<tr><td>2.</td><td>Availability / Uptime of End Devices (Modem, MIUs, RTUs, Field switches, etc.)</td><td>95%</td><td>
<table>
<tr><th>SLA</th><th>Penalty</th></tr>
<tr><td>>= 95%</td><td>No penalty</td></tr>
<tr><td><95% to >=94%</td><td>2% of quarterly OPEX cost</td></tr>
<tr><td><94% to >=93%</td><td>4% of quarterly OPEX cost</td></tr>
<tr><td><93% to >=92%</td><td>6% of quarterly OPEX cost</td></tr>
<tr><td><92% to >=91%</td><td>8% of quarterly OPEX cost</td></tr>
<tr><td><91% to >=90%</td><td>10% of quarterly OPEX cost</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Sr. No.</th><th>SLA</th><th>Target</th><th>Penalties</th></tr>
<tr><td></td><td></td><td></td><td>• If the uptime goes below 90%, additional penalty of 2% will be charged on quarterly OPEX cost for each slab of 1% downtime. For the calculation of the applicable penalty, figure will be rounded off to the lower integer figure. (e.g. 88.99 shall be rounded off to 89). The penalty capping shall be of 20% of the quarterly payment.</td></tr>
<tr><td>3.</td><td>Availability / Uptime of Cloud infrastructure</td><td>99.95%</td><td>
<table>
<tr><th>SLA</th><th>Penalty</th></tr>
<tr><td>>= 99.95%</td><td>No penalty</td></tr>
<tr><td><99.95% to >=99%</td><td>2% of quarterly OPEX cost</td></tr>
<tr><td><99% to >=98%</td><td>4% of quarterly OPEX cost</td></tr>
<tr><td><98% to >=97%</td><td>6% of quarterly OPEX cost</td></tr>
<tr><td><97% to >=96%</td><td>8% of quarterly OPEX cost</td></tr>
<tr><td><96% to >=95%</td><td>10% of quarterly OPEX cost</td></tr>
</table>
• If the uptime goes below 95%, additional penalty of 2% will be charged on quarterly OPEX cost for each slab of 1% downtime. For the calculation of the applicable penalty, figure will be rounded off to the lower integer figure. (e.g. 93.99 shall be rounded off to 93). Penalty capping shall be of 20% of the quarterly payment.
</td></tr>
<tr><td>4.</td><td>Disaster Recovery (BMS)</td><td>Recovery Time Objective (RTO) - <=4 hours

Recovery Point Objective (RPO) - <=1 hour</td><td>• This shall be measured during the mandatory quarterly DR drill / on an ad-hoc basis, and penalty shall be 5% of quarterly payment (per breach)</td></tr>
</table>

Sr. No.	SLA	Target	Penalties
5.	Cloud compliance	Necessary MeITY empanelment for CSP	• INR 50,000 per day of non-compliance beyond the initial notice of 30 days from the date of identification of the compliance concern.
6.	Web Application performance	• Login - <2 seconds • Screen navigation - <2 seconds • Data refresh - <3 seconds • Standard report retrieval - <10 seconds • Complex report retrieval - <60 seconds • Monthly data query response - <30 seconds	• INR 5,000 per parameter found in joint quarterly / ad hoc verification with GEL officials
7.	Application compatibility	• Application must be compatible with current and immediately preceding OS / runtime	• INR 25,000 per day of delay in resolution post initial notice to resolve the concern within 21 calendar days
8.	Mobile application performance	• Cold launch - <5 seconds • Screen navigation - <2 seconds • Dashboard refresh - <3 seconds • Standard report retrieval - <10 seconds • Alarm list - <2 seconds • Offline transition - <3 seconds • Offline synchronization - <10 seconds	• INR 5,000 per parameter found in joint quarterly / ad hoc verification with GEL officials

Sr. No.	SLA	Target	Penalties
9.	Web and mobile application bug fix	• Resolution of bugs within 3 calendar days	• INR 10,000 per day of delay beyond the permitted timeline
10.	VAPT assessment	• Version triggered VAPT should be closed before pushed to the production environment • Periodic VAPT within 1 year • Closure of issues – V1 / V2 / V3 / V4 within 15 / 30 / 60 / 90 days respectively	• INR 1,00,000 per instance along with the roll back • INR 50,000 / week of delay • V1 – INR 25,000; V2 – INR 15,000; V3 – INR 7,000 and V4 – INR 3,000 per finding per day beyond target closure date agreed during the report submission
11.	Onboarding / relocation	• Completion of I&C and integration of a new station (CNG / CGS / CMS / DRS / IMS, etc.) within 60 days of written confirmation by GEL • Integration of new application with CMP platform	• INR 5,000 per day per site beyond 60 calendar days • INR 5,000 per day per site beyond 60 calendar days
12.	System downtime for maintenance purpose	Not more than 2 hours per month / 6 hours per quarter	• If the overall system downtime is more than the defined time period, penalty of 2% of complete OPEX cost for a particular period shall be levied for every 1 additional hour of downtime. The penalty amount shall be capped at 20% of OPEX cost.
13.	Preventive Maintenance (PM) activity	Once in a quarter (at least)	• If the Bidder fails to carry out Preventive Maintenance (PM) of any device / system, penalty of 5% of complete OPEX shall be deducted from the quarterly payout.

6.6. O&M SLAs — SCADA, AMI and CMP

The Bidder shall meet the following system-specific O&M service levels. Availability service levels are measured quarterly by the EMS as available ÷ scheduled minutes × 100; field-device availability is measured monthly, per device, by the NMS (a multi-operator TSP-side mass outage is excluded; a single-operator failure where the device had a functional second operator is not excluded). In the Penalty column, every percentage is **of the Quarterly Payment** (Clause 6.1.4) unless an absolute INR amount is stated; each availability service level is capped at 20% of the Quarterly Payment.

SCADA specific SLAs

<table>
<tr><th>Sr. No.</th><th>SLA</th><th>Target</th><th>Penalties</th></tr>
<tr><td>1.</td><td>SCADA – control and safety</td><td>• Command success - >=99.5%
• Round trip latency - <=5 seconds
• Safety critical command (ESD / SSV) – zero failures</td><td>
<table>
<tr><th>SLA</th><th>Penalty</th></tr>
<tr><td>>= 99.5%</td><td>No penalty</td></tr>
<tr><td><99.5% to >=99%</td><td>2% of quarterly OPEX cost</td></tr>
<tr><td><99% to >=98%</td><td>4% of quarterly OPEX cost</td></tr>
<tr><td><98% to >=97%</td><td>6% of quarterly OPEX cost</td></tr>
<tr><td><97% to >=96%</td><td>8% of quarterly OPEX cost</td></tr>
<tr><td><96% to >=95%</td><td>10% of quarterly OPEX cost</td></tr>
</table>
• If the SLA goes below 95%, additional penalty of 2% will be charged on quarterly OPEX cost for each slab of 1% downtime. For the calculation of the applicable penalty, figure will be rounded off to the lower integer figure. (e.g. 93.99 shall be rounded off to 93). Penalty capping shall be of 20% of the quarterly payment.
• INR 1,00,000 per safety critical failure</td></tr>
</table>

<table>
<tr><th>Sr. No.</th><th>SLA</th><th>Target</th><th>Penalties</th></tr>
<tr><td>2.</td><td>SCADA platform</td><td>• poll/scan success ≥ 99.5%</td><td>
<table>
<tr><th>SLA</th><th>Penalty</th></tr>
<tr><td>>= 99.5%</td><td>No penalty</td></tr>
<tr><td><99.5% to >=99%</td><td>2% of quarterly OPEX cost</td></tr>
<tr><td><99% to >=98%</td><td>4% of quarterly OPEX cost</td></tr>
<tr><td><98% to >=97%</td><td>6% of quarterly OPEX cost</td></tr>
<tr><td><97% to >=96%</td><td>8% of quarterly OPEX cost</td></tr>
<tr><td><96% to >=95%</td><td>10% of quarterly OPEX cost</td></tr>
</table>
If the SLA goes below 95%, additional penalty of 2% will be charged on quarterly OPEX cost for each slab of 1% downtime. For the calculation of the applicable penalty, figure will be rounded off to the lower integer figure. (e.g. 93.99 shall be rounded off to 93). Penalty capping shall be of 20% of the quarterly payment.
</td></tr>
</table>

AMI specific SLAs

<table>
<tr><th>Sr. No.</th><th>SLA</th><th>Target</th><th>Penalties</th></tr>
<tr><td>1.</td><td>Industrial customer billing – CRITICAL</td><td>Billing data push to SAP on each billing day respectively</td><td>
<table>
<tr><th>SLA</th><th>Penalty</th></tr>
<tr><td>>= 99.5%</td><td>No penalty</td></tr>
<tr><td><99.5% to >=99%</td><td>5% of quarterly OPEX cost</td></tr>
<tr><td><99% to >=98%</td><td>10% of quarterly OPEX cost</td></tr>
<tr><td><98% to >=97%</td><td>15% of quarterly OPEX cost</td></tr>
<tr><td><97% to >=96%</td><td>20% of quarterly OPEX cost</td></tr>
</table>
</td></tr>
<tr><td>2.</td><td>Industrial customer billing</td><td>100% billing of commissioner sites</td><td>• INR 500 per meter per missed billing date; in addition to the above-mentioned penalties.

Note: In this scenario, GEL shall send their representative at site for meter reading collection.</td></tr>
<tr><td>3.</td><td>SAP integration on billing date</td><td>100% during GEL billing window</td><td>• INR 50,000 per hour of unavailability on billing date</td></tr>
</table>

Sr. No.	SLA	Target	Penalties
4.	Data reconciliation – HSE to MDMS discrepancy escalation	• Auto resolution – 100% within 1 hour Auto escalation to alarm in case of non-auto resolution	• INR 5,000 per device per hour beyond the 1 hour trigger

CMP SLAs

<table>
<tr><th>Sr. No.</th><th>SLA</th><th>Target</th><th>Penalties</th></tr>
<tr><td>1.</td><td>Integration of CMP with other applications</td><td>• 99% integration availability</td><td>
<table>
<tr><th>SLA</th><th>Penalty</th></tr>
<tr><td>>= 99%</td><td>No penalty</td></tr>
<tr><td><99% to >=98%</td><td>2% of quarterly OPEX cost</td></tr>
<tr><td><98% to >=97%</td><td>4% of quarterly OPEX cost</td></tr>
<tr><td><97% to >=96%</td><td>6% of quarterly OPEX cost</td></tr>
<tr><td><96% to >=95%</td><td>8% of quarterly OPEX cost</td></tr>
<tr><td><95% to >=94%</td><td>10% of quarterly OPEX cost</td></tr>
</table>
</td></tr>
</table>

Sr. No.	SLA	Target	Penalties
			• If the SLA goes below 94%, additional penalty of 2% will be charged on quarterly OPEX cost for each slab of 1% downtime. For the calculation of the applicable penalty, figure will be rounded off to the lower integer figure. (e.g. 93.99 shall be rounded off to 93). Penalty capping shall be of 20% of the quarterly payment.

6.7. Penalty Deduction Process

The EMS generates the quarterly SLA compliance report automatically at quarter-end. The Bidder submits the quarterly invoice with the EMS SLA report attached. GEL reviews the report within 21 calendar days and calculates any deductions, and notifies the Bidder in writing of the amount, the specific SLA metric, the EMS reference and the calculation basis before deducting. The Bidder may raise a formal dispute within 7 calendar days and shall continue all services without interruption during the dispute; disputes are resolved through the Contract's dispute-resolution mechanism, with EMS/NMS data as the primary reference. Penalty deductions are applied to the SLA-linked component of the quarterly invoice (per the Payment and Milestones section). Where total capped deductions in a quarter reach the cap, no further capped deductions apply that quarter.

6.8. SLA Exclusions

The following are excluded from SLA measurement and penalty, subject to the Bidder's written notification to GEL within 24 hours of the event and documentary evidence within 5 business days: pre-approved scheduled maintenance (≥ 72 hours' notice, not on billing dates); force-majeure events; multi-operator (TSP-side) mass network outages (connectivity SLAs only — data-collection SLAs are not excluded where the device had a functional second operator); and outages directly caused by GEL's own actions (GEL network outages, GEL-side source-system unavailability). Devices offline for reasons exclusively within GEL's control (GEL-scope EVC/PD replacement pending, GEL-directed site-access restrictions, GEL's own meter maintenance) shall be excluded for the affected period, flagged in the EMS with a GEL-approved reason code and subject to GEL's written acceptance. GEL reserves the right to determine the validity of any exclusion claim.

.

7. Training and Capacity Building

7.1. Training Strategy

- The Bidder shall offer a training schedule with all training modules for approval to GEL and complete one batch of training before the Go-Live of each system (SCADA, AMI and CMP).
- The Bidder shall deliver refresher training at each ZONE every six months throughout the O&M Period and at GEL's Head Office on a needs basis.
- The Bidder shall manage all logistics for training delivery — materials, training-environment access, attendance tracking and registration management.
- All training content and materials shall be submitted to GEL for review and written approval before being delivered to participants.
- The courses below are indicative and will be subject to GEL's approval once the contract is awarded to the successful Bidder.

7.2. Indicative Training Courses

- **SCADA Operator Training** — GEL GA Team operations staff responsible for day-to-day SCADA monitoring and supervisory control: real-time monitoring, alarm and event management, supervisory control (select-check-execute), trends and historian and GA-level operations.
- **AMI Operator Training** — GEL GA Team operations staff responsible for day-to-day AMI monitoring and exception management: metering-data monitoring, VEE/exception handling and data-collection performance review.
- **CMP Dashboard, Analytics and Emergency-Control Training** — GEL operations and management users: dashboards and drill-downs, AI/ML analytics and insights, alert management and emergency-control operations.
- **Billing Team Training** — GEL Billing Team: billing determinants, SAP billing-data delivery (normal procedure and failure resolution).
- **System Administrator Training** — GEL IT and system-administration staff responsible for SCADA, AMI and CMP platform user management, RBAC, security and configuration.
- **Field Technician Training** — GEL GA Team field technicians and supervisors responsible for installation oversight, site visits and field-issue resolution across RTUs, Modems and MIUs, including SAT and device replacement.
- **Management and Executive Overview** — GEL management and executives: cross-system dashboards, KPIs, reporting and value realisation across SCADA, AMI and CMP.

7.3. Training Materials

- The Bidder shall develop comprehensive training materials for all courses before the training schedule begins.

- The Bidder shall produce, for each course, as a minimum: a **Training Manual** (complete course content, step-by-step procedural guides, screenshots and reference material) provided in hard copy and soft copy, plus quick-reference guides and hands-on exercises.
- All materials shall be in English as a minimum; field-operations and mobile-application materials and user guides, shall additionally be provided in Hindi and Gujarati.
- The Bidder shall update all training materials and user manuals whenever any platform (SCADA, AMI or CMP) is updated or system procedures change, at no additional cost to GEL and distribute updated materials to GEL's training team and the training environment within 30 days of any platform update.
- All training materials, once approved by GEL, become the property of GEL.

7.4. Knowledge Transfer

- The Bidder shall run a structured knowledge-transfer (KT) programme across all three systems, transferring operational, administrative and troubleshooting knowledge to the relevant GEL teams so that GEL can operate each system independently.
- The KT programme culminates in the Knowledge Transfer Completion Assessment and Certificate defined under Go-Live Support below, per role group and per system.

7.5. Training Evaluation

- The Bidder shall evaluate training effectiveness for every course delivered, covering both participant competency (pre/post assessment, practical demonstration) and programme quality (participant feedback) and shall provide remedial/repeat training at no additional cost where competency criteria are not met.

7.6. Standard Operating Procedures

7.6.1. SOP Development Framework

The Bidder shall develop SOPs, with GEL's approval, covering at minimum the following categories across SCADA, AMI and CMP:

7.6.1.1. Platform Operations:

- Daily platform health check and data-collection/monitoring performance review (SCADA, AMI, CMP)
- Billing data delivery to SAP — normal procedure and failure resolution (AMI)
- VEE rule review and update — authorisation workflow and version control (AMI)
- User account creation, modification, deactivation and RBAC/access review (all platforms)
- Platform update and patch deployment — pre-deployment checklist, deployment steps, verification and rollback (all platforms)
- DR failover test execution and results documentation (all platforms)
- Report, dashboard and analytics generation, scheduling and distribution (all platforms); integration-health monitoring (CMP)

7.6.1.2. Control and Supervisory Operations (SCADA):

- Supervisory control via select-check-execute; set-point changes; remote CNG price change; ESD handling
- MMS↔BMS failover procedure and verification

7.6.1.3. Alarm and Exception Management:

- Safety-critical alarm response — tamper, reverse flow, pressure exceedance, power failure — with field escalation steps and the applicable response SLA (SCADA and AMI)
- Communication-failure alarm response — triage, root-cause classification and field dispatch decision
- Data-quality exception handling — VEE flag review, manual edit authorisation and audit-trail completion (AMI)
- Revenue-protection alert investigation — from first alert to case closure (AMI)
- CMP alert and emergency-control response — alert triage, SOP linkage, escalation and dispatch (CMP)

7.6.1.4. Mobile Application:

- Login, navigation and role-based feature access
- Field work-order receipt, task execution and closure; alarm acknowledgement, update and resolution
- Manual meter-reading capture — photograph, GPS, index entry, reason code, submission confirmation (AMI)
- Offline data capture, sync verification and discrepancy reporting; issue raising and ticket submission

7.6.1.5. Field Operations:

- RTU installation, configuration and commissioning (SCADA)
- Modem installation at EVC/IMS locations and MIU installation at PD-meter locations (AMI); EVC onboarding at SCADA locations
- SAT procedures and sign-off (SCADA and AMI)
- Device replacement — RTU, Modem, MIU, SIM and battery — with historical-data-continuity verification and NMS/MDMS record update
- Enclosure inspection, cleaning and preventive maintenance

7.6.1.6. Emergency and Incident Response:

- Platform outage (SCADA/AMI/CMP) — immediate triage, DR failover decision tree and GEL notification

- Data loss or corruption incident — containment, assessment, recovery and reporting
- Cybersecurity incident — detection, isolation, CERT-In notification and remediation
- SAP integration failure — manual billing-data preparation and SAP-team coordination (AMI)
- CMP emergency-control activation — dispatch, coordination and stand-down
- Parallel-operations discrepancy — investigation procedure and reconciliation sign-off (AMI)

7.6.1.7. SOP Review and Approval

- GEL reserves the right to request SOP revisions at any time during the contractual period. The Bidder shall address such requests within the timeline agreed with GEL.

7.6.1.8. SOP Training and Implementation

- The Bidder shall train all relevant GEL roles on the approved SOPs before the corresponding system's Go-Live and shall embed the SOPs (including digital SOPs in the CMP) into the live platforms for role-based access.

7.6.1.9. SOP Checklist for Go-Live

#	Deliverable	Responsible	Acceptance Condition
1	All SOPs drafted and submitted	Bidder	Submitted to GEL ≥ 4 weeks before UAT start
2	GEL written approval of all SOPs	GEL	Signed approval issued; no open review comments
3	SOP version-control register live on the platform	Bidder	Accessible to GEL from web portal
4	All SOPs accessible through the platform (web and mobile)	Bidder	GEL confirms accessibility for all user roles
5	SOP training delivered for all roles	Bidder	Training register shows 100% completion for GA Teams across all active GAs
6	Critical SOP simulation exercises completed and passed	Bidder	Pass records signed by GEL's Training Coordinator
7	Emergency-response SOPs tested during UAT (platform outage, cybersecurity incident, emergency control)	Bidder	UAT test scripts include SOP walkthrough; outcomes documented
8	SOP adherence monitoring plan agreed for the SLA stabilisation period	Bidder + GEL	Written plan signed by both parties

7.7. Go-Live Support, Shadowing and Knowledge Transfer Transition

7.7.1. Support Model

The support model for each system follows the three stages below and is consistent with the Comprehensive Operations and Maintenance section.

Stage	Period	Bidder's Role	GEL's Role
Stage 1 — Go-Live Support	System Go-Live to end of the stabilisation period	Full support; resolve all issues; deliver hand-holding	Operate with Bidder support; build operational capability
Stage 2 — Shadowing During Stabilisation	The three-month SLA stabilisation period	Shadow GEL operations; same-day guidance on request	Operate independently; Bidder shadows
Stage 3 — Support Team Model	From the Knowledge Transfer Completion Certificate for the full remaining O&M period	Support via the helpdesk/Support Team per SLA	Operate independently; raise all issues via the helpdesk

SCADA hand-holding. For SCADA, the on-site hand-holding period commences at SCADA Go-Live and continues until six (6) months after the end of the stabilisation period, extending Stage 1/2 on-site support for SCADA before transition to the Support Team model. For AMI and CMP, transition to the Support Team model follows the Knowledge Transfer Completion Certificate.

7.7.2. Knowledge Transfer Completion Assessment

The Bidder shall administer a KT completion assessment for each GEL role group, per system. Independent capability must be demonstrated without Bidder guidance. Indicative assessment areas:

#	Operational Area	GEL Role Assessed	Independent Capability Criteria
1	SCADA daily monitoring and supervisory control	GEL GA Team Operator	Monitors the network, acknowledges alarms and executes a supervisory control action via select-check-execute per SOP
2	AMI platform daily health check and monitoring	GEL IT Administrator	Performs daily health check per SOP; identifies and escalates anomalies without Bidder guidance
3	SAP billing data monitoring and failure resolution	GEL Billing Team	Confirms SAP delivery for each billing date; follows failure-resolution SOP independently
4	VEE rule review and update	GEL IT Administrator	Modifies a VEE rule, versions it and validates the outcome without Bidder involvement
5	CMP dashboards, analytics and alert/emergency-control	GEL Operations/Management	Navigates dashboards, interprets analytics and executes an alert/emergency-control workflow per SOP
6	Alarm acknowledgement, assignment and escalation	GEL GA Team Supervisor	Acknowledges, assigns and closes alarms following SOP; initiates field dispatch correctly
7	Field task and manual meter-reading capture via mobile	GEL GA Team Field Staff	Receives and closes a field task; captures a manual reading with photograph, GPS and reason code and submits correctly

#	Operational Area	GEL Role Assessed	Independent Capability Criteria
8	Work order receipt, dispatch and task closure	GEL GA Team Supervisor	Receives a platform-dispatched batch, distributes to field staff and tracks completion
9	Issue raising and helpdesk ticket management	All GEL roles	Raises a ticket correctly; tracks status; responds to Bidder updates; closes on resolution
10	RBAC and user account management	GEL IT Administrator	Creates a user, assigns a role, verifies access and deactivates an account independently across platforms
11	Revenue-protection investigation workflow	GEL GA Team	Opens a case, logs evidence, generates a service order and closes it following SOP
12	Report/dashboard generation and scheduling	GEL GA Team / Billing Team	Generates a standard report, creates a custom report/dashboard and sets a scheduled delivery independently

7.7.3. Knowledge Transfer Completion Certificate

- The Bidder shall administer the assessment for each GEL role group in the presence of GEL's Training Coordinator. On successful demonstration of independent capability for a system, both parties sign a Knowledge Transfer Completion Certificate for that system, which is a condition of Go-Live acceptance and the trigger for the Stage 3 Support Team model for that system.

7.7.4. Stage 3 — Support Team Model for the Full Contract Duration

From the Knowledge Transfer Completion Certificate date, the following applies for the full remaining contract period, including all five O&M years:

- GEL raises all issues through the platform helpdesk/ticketing system. No issue shall be treated as raised unless it is in the ticketing system (which captures complaints from all channels per the unified complaint capture in the Comprehensive Operations and Maintenance section).
- The Bidder's Support Team shall respond within the SLA timelines defined in the Service Level Agreement section for each priority level.

8. Schedule of Rates

8.1. Schedule A – Hardware Costs

Sr. No.	Material/Service SAP Master Code*	Description	UoM	Qty	Rate	GST %	Total
1.	TBC	SITC of Modem -Type 1 (without mandatory ethernet port) and related accessories	Nos.	3300			
2.	TBC	SITC of Modem – Type 2 (With mandatory ethernet port) and related accessories	Nos.	1500			
3.	TBC	SITC of MIUs and related accessories	Nos.	1500			
4.	TBC	Type-1 RTU with accessories including redundant power supply, cabinet, CPU, memory, Digital and Analogue IO cards, communication cards, chassis, power supply modules, cabling, isolation barriers etc.	Nos.	15			
5.	TBC	Type-2 RTU with accessories including redundant power supply, cabinet, CPU, memory, Digital and Analogue IO cards, communication cards, chassis, power supply modules, cabling, isolation barriers etc.	Nos.	920			
6.	TBC	Voltage stabilizer	Nos.	920			
7.	TBC	4 port ethernet Managed network switch	Nos.	600			
8.	TBC	Pressure transmitter	Nos.	470			
9.	TBC	Temperature transmitter	Nos.	20			
10.	TBC	Workstation with related accessories and licenses including OS license, end point protection, productivity suite, etc.	Nos.	35			

8.2. Schedule B – Recuring Costs and ARC

8.2.1. Schedule B1 – Recuring Costs

Sr. No.	SAP master code	Description	UoM	Qty	Yearly Rate
1	TBC	Comprehensive O&M of Modem (Type 1) and related accessories	Yearly	3300	
2	TBC	Comprehensive O&M of MIU and related accessories	Yearly	1500	
3	TBC	Cloud hosting charges - **AMI software** (excluding DR) as per Qty. (Nodes)	Yearly	5800	
4	TBC	Cloud hosting charges - **AMI software** for DR as per Qty. (Nodes)	Yearly	5800	
5	TBC	AMI Mobile application User License (Android & iOS)	Yearly	122	
6	TBC	AMI Web Application User License	Yearly	62	
7	TBC	SIM (Single SIM with multi network / Dual SIM) Communication charges per Modem and MIU	Yearly	7700	
8	TBC	Cloud hosting charges - **CMP** (excluding DR)	Yearly	94	
9	TBC	Cloud hosting charges - **CMP** for DR	Yearly	94	
10	TBC	**CMP** Web Application User License	Yearly	94	
11	TBC	**CMP** Mobile application User License (Android & iOS)	Yearly	94	
12	TBC	Cloud hosting charges - SCADA (excluding DR) as per Qty. (Nodes)	Yearly	2000	
13	TBC	Cloud hosting charges - SCADA for DR as per Qty. (Nodes)	Yearly	2000	
14	TBC	SCADA Web Application User License	Yearly	62	
15	TBC	SCADA Thick client user License	Yearly	35	
16	TBC	SCADA Mobile application User License (Android & iOS)	Yearly	122	
17	TBC	Comprehensive O&M of Type 1 RTUs with accessories	Yearly	15	
18	TBC	Comprehensive O&M of Type 2 RTUs with accessories	Yearly	920	
19	TBC	Comprehensive O&M of Modem (Type 2) and related accessories	Yearly	1500	

8.2.1. Schedule B2 – Annual Rate Contract Costs

Sr. No.	SAP master code	Description	UoM	Qty	Year 1 rate	Year 2 rate	Year 3 rate	Year 4 rate	Year 5 rate
1	TBC	SITC of additional Modem (Type 1) with accessories	EA	50					
2	TBC	SITC of additional MIUs with accessories	EA	150					
3	TBC	Comprehensive O&M of additional Modem (Type 1) with accessories	EA	50					
4	TBC	Comprehensive O&M of additional MIUs with accessories	EA	150					
5	TBC	Removal of Modem/MIU along with all associated hardware	EA	10					
6	TBC	Reinstallation of Modem/MIU along with all associated hardware	EA	10					
7	TBC	SITC of additional Type 2 RTUs with accessories	EA	50					
8	TBC	SITC of additional Modem (Type 2) with accessories	EA	80					
9	TBC	Comprehensive O&M of additional Type 2 RTUs with accessories	EA	50					
10	TBC	Comprehensive O&M of additional Modem (Type 2) with accessories	EA	80					
11	TBC	SITC of additional managed 4-port managed ethernet switches	EA	25					
12	TBC	Comprehensive O&M of additional managed 4-port managed ethernet switches	EA	25					
13	TBC	Removal of Type 2 RTUs along with all associated hardware	EA	20					
14	TBC	Reinstallation of Type 2 RTUs along with all associated hardware	EA	20					

8.3. Schedule C – One Time Costs

Sr. No.	Material SAP Master Code*	Description	UoM	Qty	Rate
1	TBC	Integration of new make of EVC with AMI System	EA	5	
2	TBC	Integration of new make of PD Meter with AMI System	EA	5	
3	TBC	AMI System Integration with SAP ECC	EA	1	
4	TBC	AMI System Integration with SAP S4 HANA	EA	1	
5	TBC	AMI System Integration with SCADA	EA	1	
6	TBC	AMI System Integration with CMP	EA	1	
7	TBC	AMI System Integration with GIS	EA	1	
8	TBC	AMI System Integration with CRM	EA	1	
9		AMI System Integration with GEL Middleware / ESB	EA	1	
10	TBC	AMI System Integration with other GEL software	EA	1	
11	TBC	One time driver development cost for makes of EVCs as per Annexure B	Nos.	5	
12	TBC	SCADA system integration with CMP	EA	1	
13	TBC	SCADA system integration with SAP ECC	EA	1	
14	TBC	SCADA system integration with SAP S4 HANA	EA	1	
15	TBC	SCADA system integration with GIS	EA	1	
16	TBC	SCADA system integration with GEL middleware / ESB	EA	1	
17	TBC	SCADA system integration with other GEL software	EA	1	
18	TBC	CMP system integration with GEL middleware / ESB	EA	1	
19	TBC	CMP system integration with GIS	EA	1	
20	TBC	CMP system integration with SAP ECC	EA	1	
21	TBC	CMP system integration with SAP S4 HANA	EA	1	
22	TBC	CMP system integration with existing applications (multiple applications)	EA	20	
23	TBC	CMP system integration with new GEL applications	EA	15	

8.4. Important Notes to Bidders

- The specified quantity is indicative for tendering which shall be used for bid evaluation and placement of Annual Rate Contract. Ordering with firm quantities will be carried out based on GEL Operational requirement within the Supply contract validity period
- The Schedule of Rates shall be read together with the full RFP, Scope of Work, technical specifications, SLAs, payment terms, implementation requirements, O&M requirements and handover requirements.
- The rates quoted by the Bidder shall be complete and inclusive of all costs required to deliver the solutions as per the RFP. No extra payment shall be claimed later for any activity, item, service, installation and testing tools(hardware and software), licence, integration, testing, support or documentation required for successful project delivery, unless it is specifically mentioned as separately payable in the Schedule of Rates.
- The Bidder shall quote for all applicable line items. Blank, zero, conditional or unclear rates may be treated as included in other quoted rates or may be considered non-responsive at GEL's discretion.
- All costs for project management, mobilisation, site coordination, transportation, insurance, installation support, testing, commissioning, training, reporting, documentation, permits, safety compliance and statutory compliance shall be included in the quoted rates unless separately listed in the Schedule of Rates.
- The Bidder shall be fully responsible for end-to-end integration and working of all supplied hardware, software, communication network, SIM/connectivity, cloud/platform components, mobile and web applications and interfaces with GEL systems.
- Payments shall be made to the bidders as per the payment milestone and their respective deliverables as specified in the RFP.
- The Bidder shall ensure that there is no double charging across CAPEX, OPEX, platform, connectivity, licence, support, manpower or maintenance items.
- In case of any arithmetic error, the unit rate shall prevail over the total amount. In case of difference between words and figures, the amount written in words shall prevail.
- The Bidder shall review the full RFP, site requirements, technical requirements, quantity assumptions, integration needs and project risks before quoting. Submission of the bid shall mean that the Bidder has understood the scope and has included all required costs in its quoted rates.
- Rates quoted by bidder shall be inclusive of door delivery up to GEL store/site, Packing and Forwarding, Loading and Unloading Charges, Freight and Transit Insurance.
- Splitting is not applicable in this tender.
- Comprehensive O & M charges shall be payable till the respective services are taken by GEL during the contract.
- Bidder shall consider location conditions for the pricing as per site survey performed before the pre-bid meeting.

Explanation for various schedules mentioned thereof:

Schedule A:

- Amount quoted under this Schedule A shall be paid during the implementation phase of the project.
- Bidder shall be paid against the respective milestones for the cost mentioned in this schedule of the SOR during the implementation phase of the project. This shall be treated as a financial assistance to the Bidder to ensure requisite financial viability to undertake the entire project.
- Additionally, it is also to be noted that the cost quoted under this schedule shall not exceed by more than 40% of the overall cost of the contract (comprising of schedule A, schedule B and schedule C). In case of any deviation against this clause in the commercial bid submitted by the Bidder on (n)Procure portal, this shall be considered as a non-compliant Bid and necessary actions shall be triggered following the same and bid shall also be rejected.

Schedule B:

- This schedule is for the cost to be claimed during the O&M phase of the project. Year 1 shall trigger after the achievement of final Go live of the project wherein, all 3 major components – SCADA, AMI and CMP have gone live.
- Bidder shall provide comprehensive O&M services for the duration of 5 years from the date of achievement of final Go live of the project. Please note that the Bidder shall be paid O&M charges in the interim phases at the Year 1 rate on a pro rata basis post the achievement of interim / partial Go live. (Example – Bidder shall be paid the proportionate amount upon achievement of Go live of 1 lot of AMI solution and shall continue to receive this amount till the achievement of final Go live of the project).
- Comprehensive O & M charges shall be payable till the respective services are taken by GEL during the contract.
- Bidder shall quote yearly cost under the Schedule B1 which shall be considered for 5 years from the date of the final go-live. For the purpose of determination of costs associated with each of the line item mentioned in the schedule, quoted cost shall be multiplied by five (5) and the quantity.

  Example:

Sr. No.	SAP master code	Description	UoM	Qty	Yearly Rate	Total amount without tax
1	-	Comprehensive O&M of Modem (Type 1) and related accessories	Yearly	3300	100 (example)	= 3300 * 100 * 5 = 16,50,000

- Bidder shall quote cost for each year under the Schedule B2. For the purpose of determination of costs associated with each of the line item mentioned in the schedule, quantity mentioned shall be multiplied by the cumulative yearly cost.

  Example

Sr. No.	SAP master code	Description	UoM	Qty	Year 1 rate	Year 2 rate	Year 3 rate	Year 4 rate	Year 5 rate	Total amount without tax
1	-	SITC of additional Modem (Type 1) with accessories	EA	70	100 (example)	110 (example)	120 (example)	130 (example)	140 (example)	= 70 *(100 + 110 + 120 + 130 + 140) = 42,000

- For Schedule B2, Year 1 mentioned in the table shall commence right after the achievement of final go live of the project.
- Cost pertaining to the schedule B1 and B2 shall be released based on the payment terms and conditions mentioned in this RFP document.
- Line items in SERVICE CHARGES FOR COMPREHENSIVE OPEARATION AND MAINTENANACE charges are payable per device/location per Quarter basis and same shall be invoiced at the end of every quarter.
- Charges pertaining to new locations for AMI/SCADA onboarded during the O&M Period are billed at the annual per-device rate applicable for the O&M year in which they are commissioned, per the SOR. The pro-rata, day-weighted billing mechanism applies — the device is billed from its commissioning date for the remaining days of the same quarter.
- Additionally, it is also to be noted that the cost quoted under this schedule (B1 and B2) shall be a minimum of 55% of the overall cost of the contract (comprising of schedule A, schedule B and schedule C).

Schedule C:

- Bidder shall be required to quote the cost associated with one time integration / other activities which are expected to be undertaken only once during the tenure of the project. Please note that the rate quoted under this schedule shall remain valid for the entire contractual duration (Final Go live + 5 years of O&M phase).
- Additionally, it is also to be noted that the cost quoted under the schedule C shall not exceed by more than 5% of the overall cost of the contract (comprising of schedule A, schedule B and schedule C).

9. Manpower Requirement

The Bidder shall deploy adequate, qualified and experienced manpower to deliver the SCADA, AMI and CMP System through the implementation phase and to operate and maintain it through the five-year O&M Period. This Section sets out the minimum key personnel for the implementation phase and the minimum Support Team for the O&M phase, together with the common requirements governing deployment, qualification, availability and replacement. The Bidder shall include, in its technical bid, a project organisation chart and the curriculum vitae of all proposed key personnel; GEL reserves the right to interview and to reject any proposed resource who does not meet the requirements.

The numbers, qualifications and experience below are indicative minimums; the Bidder shall propose its complete team and shall be responsible for deploying sufficient manpower to meet all milestones and all SLAs at all times. No SLA breach shall be excused on the grounds of insufficient manpower.

9.1. Implementation-Phase Key Personnel

The Bidder shall deploy, at minimum, the following key personnel for the implementation phase, from contract award through Final Go-Live and Handover. All key personnel shall be deployed within seven (7) days of the Work Order.

#	Role	Nos. (min.)	Minimum Qualification	Minimum Experience
1	Project Director	1	B.E./B.Tech (or equivalent); PMP/PRINCE2 preferred	15+ years, including 10+ years managing large IT/OT or utility digital-transformation projects; SPOC for GEL, accountable for overall delivery
2	Project Manager	1	B.E./B.Tech; PMP/PRINCE2 preferred	10+ years in project delivery, including at least one SCADA or AMI implementation of comparable scale; SPOC for GEL
3	SCADA Technical Lead / Architect	1	B.E./B.Tech (Instrumentation / E&C / CS or equivalent)	10+ years in SCADA/OT for oil & gas or utilities; knowledge of IEC 62443, DNP3/Modbus and cloud-hosted SCADA
4	AMI Technical Lead / Architect	1	B.E./B.Tech	10+ years in AMI / HES / MDMS / smart metering; DLMS/COSEM and VEE experience
5	CMP Technical Lead / Architect	1	B.E./B.Tech	10+ years in integration, command-and-control / ICCC or analytics platforms
6	Field Implementation Lead	1	B.E./B.Tech / Diploma	8+ years in field installation and commissioning in gas/utilities, including hazardous-area (ATEX/IECEx/PESO) work
7	Enterprise Integration Expert	1	B.E./B.Tech	8+ years in enterprise integration (SAP ECC/S4 HANA, GIS, CRM,

#	Role	Nos. (min.)	Minimum Qualification	Minimum Experience
				ESB/API), including SAP Billing integration
8	Cybersecurity / VAPT Expert	1	B.E./B.Tech + a recognised security certification (CISSP / CEH / CISM)	8+ years in OT/IT cybersecurity; IEC 62443, CERT-In VAPT and cloud security
9	Cloud / Infrastructure Architect	1	B.E./B.Tech	8+ years in cloud infrastructure design (private / MeitY-empanelled), high availability and DR
10	QA / Testing Lead	1	B.E./B.Tech	8+ years in QA and testing (functional, performance, security), including FAT/SAT/UAT for field-system projects
11	EVC / Metering Integration Expert	1	B.E./B.Tech	8+ years in EVC / flow-computer / metering integration, including multi-OEM driver development
12	Data / Analytics Expert	1	B.E./B.Tech / M.Sc.	6+ years in data analytics, AI/ML and dashboarding, ideally for utilities/energy
13	Project Coordinator / Documentation Specialist	1 (or more)	Graduate	5+ years in project coordination, MIS reporting and technical documentation

The Bidder may combine or add roles subject to all responsibilities being covered and all qualification minimums being met; the Project Manager and the three system technical leads shall be distinct, dedicated individuals, remaining resources may be shared / as proposed by the Bidder. Additionally, Bidder is not required to depute any resources on GEL site.

9.2. O&M-Phase Support Team

The Bidder shall establish and maintain a dedicated Support Team (ST) from Go-Live through to contract completion, covering the SCADA, AMI and CMP systems, as the single operational interface for all System issues, service requests and escalations during the O&M Phase.

#	Role	Nos. (min.)	Deployment	Responsibilities
1	Project Director	1	Senior SPOC for GEL	Accountable for overall O&M delivery, SLA performance and commercial/contractual coordination across all three systems
2	Project Manager	1	SPOC for GEL	Day-to-day O&M delivery, complaint/incident governance, reporting and review cadence
3	Zonal Coordinators	10	Full time, two (2) per zone across GEL's five (5) operational zones,	Coordinate field maintenance and PM visits, manage field-incident resolution, assist GEL personnel in day-to-day platform operations, integration health and technical escalations

#	Role	Nos. (min.)	Deployment	Responsibilities
			at GEL-approved zonal/GA offices	
4	Head Office Coordinators	2	At GEL Head Office	Central coordination, MIS/SLA reporting, GEL liaison
5	SCADA platform support	As required	Remote / on-site as needed	SCADA platform operation, historian, control, failover and integration support
6	AMI platform support	As required	Remote / on-site as needed	HES/MDMS/VEE, billing-integration and device-management support
7	CMP application support	As required	Remote / background (need not be on site, provided CMP SLAs are met at all times)	CMP dashboards, integrations, analytics and emergency-control support
8	Cybersecurity & patch support	As required	Remote	Patch management, VAPT remediation, security monitoring
9	Helpdesk / ticketing support	As required	Remote	Unified complaint capture, ticketing, first-line response and escalation
10	Field Technicians	Bidder-sized	Across GAs as required	Preventive and corrective maintenance and field hardware replacement (SCADA and AMI). The number, location and skill mix are at the Bidder's discretion; the pool shall be sized so that all PM and corrective-maintenance SLAs are met at all times

The Project Director and the Project Manager shall be the designated SPOCs for GEL for all O&M matters.

SCADA on-site hand-holding. In addition to the Support Team model, the Bidder shall provide an on-site hand-holding period for SCADA, commencing at SCADA Go-Live and continuing until six (6) months after the end of the SCADA stabilisation period, as set out in the Comprehensive Operations and Maintenance section. For AMI and CMP, support transitions to the Support Team model on signature of the Knowledge Transfer Completion Certificate.

7.3 Common Manpower Requirements

- **Deployment.** All committed resources shall be deployed within seven (7) days of the Work Order.
- **Single Points of Contact.** The Project Director and the Project Manager shall be GEL's SPOCs in both phases and shall be reachable and responsive at all times for project and O&M matters.
- **Dedication.** Key implementation personnel shall be dedicated to this project for its implementation phase; the O&M Support Team's zonal, head-office and CMP-support roles

shall be dedicated as specified. CMP application support may be provided remotely/in the background provided the CMP SLAs are met at all times.

- **Replacement.** The Bidder shall not replace the Project Director, the Project Manager or any system technical lead without GEL's prior written approval. Any replacement shall be of equal or superior qualification and experience. Only one replacement per profile shall be permitted during the implementation phase (a replacement necessitated by resignation, accident, death or other cause beyond the Bidder's control shall not count against this limit).
- **Leave and backup.** A leave allowance of 24 days per calendar year applies to each key resource. In the event of absence or planned leave, a backup resource of equal or higher qualification shall be deployed; failing which the non-availability penalty applies from Day 1 of absence.
- **Language.** All GEL-facing and field/GA-facing resources shall be proficient in English; field, GA and helpdesk resources shall additionally be proficient in Hindi and/or Gujarati as required for effective coordination with GEL's GA Teams and field personnel.
- **Non-availability penalties.** The consequences of non-availability of key personnel and the Support Team — for both the implementation and O&M phases — are set out in the Manpower Availability service levels of the Service Level Agreement (SLA) and Penalty Framework and are not repeated here.
- **No separate O&M manpower payment.** No separate payment shall be made for manpower deployed during the O&M Phase; the Bidder shall price all O&M manpower costs within the financial bid. Implementation-phase manpower is likewise deemed included in the milestone-linked prices.
- **GEL's rights.** GEL reserves the right to interview any proposed resource, to require the replacement of any resource whose performance is unsatisfactory, and to verify credentials at any time. The Bidder shall maintain an up-to-date deployment register (name, role, qualification, location, contact) accessible to GEL throughout the contract.

10. Technical Bid Submission Documents

This section defines the comprehensive list of technical documents and submissions required from the BIDDER as part of their technical proposal. All documents shall be submitted in the prescribed format and shall demonstrate full compliance with the technical specifications, functional requirements and project scope outlined in this RFP.

10.1. Mandatory Technical Submission Documents

10.1.1. Deviation Form

• This is a NO DEVIATION TENDER. All bidders must complete the attached Deviation Form. Any deviations noted outside of this prescribed form will render the offer non-responsive and liable for rejection, as per the form's instructions,

DEVIATION FORM

Name of Bidder :

Schedule of Deviation :

Bidder shall; note that this is a **"NO DEVIATION TENDER"**

1. Bidder may give here a consolidated list of deviations/ clarifications/ comments of all sections of the bid package, which for an appropriate offer are considered unavoidable by him.

2. Deviations/ clarifications mentioned elsewhere in the offer shall not be bidding on the Client

/ Consultant and any such deviations if indicated elsewhere other than this form will render the offer non-responsive and shall be liable to be rejected.

3. Bidder shall state the reasons for the deviations in the 'Remark' column.

4. All other clauses of the bid package shall be deemed to be fully complied by the Bidder.

5. **Only the deviations listed herein, in conjunction with the Bid package, shall constitute the contract requirements for the award of job to the Bidder.**

Sl. No.	Page No.	Clause No.	Requirement	Deviations as per Bid package	Clarification/ Comments by Bidder	Remarks
1						

Signature of the Bidder authorized signatory

Name of the Bidder authorized signatory

Stamp and Date

10.1.2. Equipment Specifications and Technical Datasheets

The BIDDER shall provide a detailed Technical Specification for Hardware Compliance Matrix addressing each requirement specified in this RFP.

• The compliance matrix shall be provided in the following format:

Requirement Description	BIDDER Compliance (Y/N)	BIDDER Comments
[Exact text of requirement as specified in RFP]	[Y = Yes (fully compliant), N = No (not compliant)]	[Detailed explanation in case of exceptions]

For any requirements marked as "N" (not compliant), the BIDDER shall provide a clear explanation of the non-compliance and any proposed alternatives or workarounds.

The compliance matrix shall include references to supporting documentation, technical specifications and vendor certifications where applicable.

The BIDDER shall provide complete technical specifications and datasheets for all proposed hardware including:

- Make and model information with manufacturer, technical specifications, environmental ratings, certifications details
- Manufacturer Authorization Form (MAF) from hardware OEM
- Power consumption and redundant power supply specifications
- Physical dimensions and mounting requirements.

10.1.3.Software Specifications and Licensing Documentation

SCADA Software Specifications: • The BIDDER shall provide comprehensive SCADA software specifications including:

- Software name, version and vendor information
- Manufacturer Authorization Form (MAF) from SCADA software OEM/vendor
- System architecture and deployment models (cloud-based requirements)
- Tag capacity and scalability specifications (minimum 150,000 tags, expandable to 300,000+)
- User licensing specifications (concurrent users, named users, role-based access)
- Database specifications and historical data management capabilities
- Integration capabilities (OPC UA, APIs, third-party system interfaces)
- Security features and compliance certifications
- Mobile application specifications (iOS and Android support)

AMI Software Specifications: • The BIDDER shall provide comprehensive AMI software specifications including:

- Software name, version and vendor information
- Manufacturer Authorization Form (MAF) from AMI software OEM/vendor
- System architecture and scalability for minimum 5,000 meters (expandable to 20,000)
- Communication protocol support (Modbus, DLMS/COSEM, proprietary EVC protocols)
- Data management and billing integration capabilities

- User licensing specifications (minimum 50 concurrent users, 125 total users)
- Cloud deployment specifications and MeITY compliance
- Mobile application capabilities for field operations

CMP Software Specifications: • The BIDDER shall provide comprehensive CMP software specifications including:

- Software name, version and vendor information
- Manufacturer Authorization Form (MAF) from CMP software OEM/vendor
- Integration capabilities with existing and future applications
- Analytics and dashboard development capabilities
- Data lake/alternative storage solution specifications
- AI/ML analytics engine specifications and capabilities
- Alert management and emergency control system specifications
- Multi-phase implementation support and scalability

Database and Middleware Software: • The BIDDER shall provide specifications for all database and middleware software including:

- Database software: Name, version, licensing terms, scalability specifications
- Manufacturer Authorization Form (MAF) from database software vendor
- Operating system software: Name, version, licensing terms, security features
- Manufacturer Authorization Form (MAF) from OS vendor
- Virtualization software: Name, version, licensing terms, performance specifications

- Manufacturer Authorization Form (MAF) from virtualization software vendor
- Security software: Name, version, licensing terms, protection capabilities
- Manufacturer Authorization Form (MAF) from security software vendor

Cloud Infrastructure Software: • The BIDDER shall provide specifications for all cloud infrastructure software including:

- Cloud platform services: Provider name, service specifications, compliance certifications
- Manufacturer Authorization Form (MAF) from cloud service provider
- Backup and recovery software: Name, version, capabilities, recovery time objectives
- Manufacturer Authorization Form (MAF) from backup software vendor
- Monitoring and management software: Name, version, capabilities, integration features
- Manufacturer Authorization Form (MAF) from monitoring software vendor

Licensing Documentation: • The BIDDER shall provide detailed software licensing information including:

- License type (subscription) and terms
- User license specifications and expansion options
- Development and testing environment licensing
- Third-party software licensing requirements
- Cloud infrastructure licensing and usage terms
- Mobile application licensing and distribution terms
- Software maintenance and support terms during 5-year O&M period

10.1.4.System Architecture and Design Documentation

Overall System Architecture: • The BIDDER shall provide comprehensive system architecture documentation including:

- High-level system architecture diagrams showing all major components
- Network architecture diagrams with communication paths and protocols
- Data flow diagrams from field devices to central systems
- Security architecture with defense-in-depth implementation
- Cloud infrastructure architecture with redundancy and disaster recovery
- Integration architecture with existing and future systems

Detailed Design Documentation: • The BIDDER shall provide detailed design documentation including:

- RTU configuration and I/O mapping strategies
- Communication network design with bandwidth calculations
- Database design with capacity planning and performance optimization
- Mobile application architecture and functionality design
- Cybersecurity implementation with specific technologies and protocols

10.1.5.Bill of Materials (BoM) and Procurement Documentation

Comprehensive Bill of Materials: • The BIDDER shall provide a detailed Bill of Materials including:

- Station-wise and zone wise breakdown of all hardware components

- Part numbers, specifications and quantities for each item
- Manufacturer information and model numbers
- Unit prices and total costs (for 100% of quantities)
- Delivery schedules and lead times for each component
- Spare parts recommendations and availability

Unpriced BoM for Initial Procurement: • The BIDDER shall provide an unpriced Bill of Materials for sixty percent (60%) of total equipment quantities within three (3) weeks of order placement, including:

- Detailed item descriptions and specifications
- Manufacturer part numbers and model information
- Quantities for initial procurement phase
- Technical specifications and compliance documentation
- Delivery schedules for initial procurement items

10.1.6.Power and Load Calculations

Electrical Load Analysis: • The BIDDER shall provide comprehensive power calculations for all installations including:

- Individual equipment power consumption specifications
- Total power requirements per station type
- Power quality requirements and conditioning needs
- Solar power system sizing where applicable

- Electrical protection and grounding requirements

Battery Backup Calculations: • The BIDDER shall provide detailed battery backup calculations including:

- Equipment power consumption during normal and emergency conditions
- Battery capacity requirements for specified backup durations
- Battery life expectancy and replacement schedules
- Charging system specifications and requirements
- Environmental considerations for battery installations

10.1.7. Communication and Network Design

Network Design Documentation: • The BIDDER shall provide comprehensive network design including:

- Communication topology for each station type
- Bandwidth requirements and traffic analysis
- Network security implementation with specific technologies
- Redundancy and failover mechanisms
- Performance optimization strategies
- Network monitoring and diagnostic capabilities

Protocol Implementation Details: • The BIDDER shall provide detailed protocol implementation documentation including:

- DNP3 implementation with security features

- Modbus RTU/TCP configuration and optimization
- OPC UA implementation for enterprise integration
- Custom protocol conversion requirements and solutions
- Communication testing and validation procedures

10.1.8.Integration and Interface Documentation

Existing System Integration: • The BIDDER shall provide detailed integration plans for existing systems including:

- Flow computer integration strategies and protocol requirements
- Gas chromatograph interface specifications and protocols
- PLC integration approaches for various manufacturers and models
- EVC integration for different makes and communication methods
- Cathodic protection system integration requirements

Enterprise System Integration: • The BIDDER shall provide integration specifications for enterprise systems including:

- AMI integration for billing and customer management
- CMP system integration for asset management and mapping
- Mobile application integration with field operations
- Third-party system APIs and interface specifications
- Data exchange formats and validation procedures

10.1.9.Project Implementation and Execution Plans

Project Execution Methodology: • The BIDDER shall provide comprehensive project execution plans including:

- Project phases and milestone definitions with timelines
- Resource allocation and personnel deployment strategies
- Quality assurance and quality control procedures
- Risk management and mitigation strategies
- Stakeholder coordination and communication plans

Installation and Commissioning Plans: • The BIDDER shall provide detailed installation and commissioning plans including:

- Site preparation requirements and procedures
- Equipment installation sequences and dependencies
- Testing and validation procedures for each component
- System integration and commissioning strategies
- Performance verification and acceptance criteria

10.1.10. Training and Support Documentation

The BIDDER shall provide compliance checklist against the requirement detailed in the training and capacity building.

11. Annexures

11.1. Functional Requirement

All functional requirements specified in this tender document are mandatory and non-negotiable. No deviations, modifications, substitutions, or alternative proposals shall be permitted or accepted from any of the functional requirements outlined herein. Bidders must demonstrate full compliance with each and every functional requirement as specified. Any bid that proposes deviations from the stated functional requirements or fails to meet the exact specifications shall be deemed non-responsive and will be rejected without further evaluation. Bidders are advised to carefully review all functional requirements and ensure complete adherence before submission of their proposals

11.1.1. SCADA Functional Specification

S.No.	Category	Requirement Description
1	SCADA Functional Requirements	**Primary Function** • The primary function of the SCADA system shall be to provide an operational interface to support the operation of the complete pipeline and distribution network. • This interface shall provide the capability to acquire data from pipeline and associated facilities operating conditions, various third-party applications and status, show abnormal or alarm conditions and remotely operate the valves. • The SCADA system shall have a centralized dashboard for field collected data, third party application data and with various KPIs and layers to enable effective monitoring and control of the entire network. • Call up time and updation time of any graphic display on color monitor of MMS/BMS/GA Control centre shall not exceed 5 seconds to ensure responsive operation.
2	SCADA Functional Requirements	**General Architecture Requirements** • The system shall be designed with high reliability, security and performance, incorporating redundancy at multiple levels. • The SCADA system shall utilize a cloud-based architecture. • MeITY-approved private cloud service provider with data centers located in India. • The cloud infrastructure shall support redundancy, security, scalability and comprehensive disaster recovery capabilities. • The SCADA software on the cloud-based server shall be configured in dual hot standby mode as Primary and Secondary. • If the Primary Server fails completely due to any reasons including, but not limited to, CPU

S.No.	Category	Requirement Description
		failure, disk failure, power supply failure, or software failure, the secondary server shall become the Primary server with automatic changeover without causing any loss of data or control functionality. • The operator shall be informed about server failures or changes via suitable event/message notifications. • On re-induction of failed SCADA Server, the operator shall be informed by a suitable event message that the Server is fully synchronized with the primary SCADA Server. • Based on the decision by supervisor or system engineer, the restored machine shall continue to be hot standby, or its status may be changed to Primary Server. • SCADA primary cloud server shall update real-time data and alarms/events in the secondary cloud server and view client at any location. • In case of Primary cloud server failure, Secondary cloud Server shall poll data from all devices and update the web interface, then backfill the data to primary cloud server once it returns to normal operation. • The SCADA servers shall synchronize their time through Cloud/AD provided by GEL. • Web server will be installed for viewing/controlling the instruments and to access data server with historian. • The same SCADA Software shall support both cloud server and on-premise server environments to ensure flexibility and future migration options.
3	SCADA Functional Requirements	**Field Communication Requirements** • Field devices shall communicate with the SCADA system using 4G/LTE with 2G fallback capability. • Type-1 RTU with Dual-SIM/Single-SIM multi-network support modems shall be installed at CGS. • Type-2 RTU with Dual-SIM/Single-SIM multi-network support modems shall be installed at CNG stations, LCNG stations and Decompression skids and Cathodic Protection Systems. • Dual-SIM industrial cellular modems shall be installed at DRS/CPRS and Check Metering Stations. • Single-SIM industrial cellular modems shall be installed at IMS/IPRS and Compressed Biogas Plants. • API connection shall be established with CBG OEM System. • All communication shall use DNP3 protocol with TLS encryption (128-bit minimum). • SCADA software shall communicate with these devices.
4	SCADA Functional Requirements	**Communication Security Requirements** • VPN tunneling using IPsec protocol with AES-256 encryption shall be implemented. • Certificate-based authentication for each RTU device shall be implemented. • Continuous monitoring of tunnel status with automatic reconnection shall be implemented. • Dual-layer encryption (DNP3) for defense in depth shall be implemented. • The system shall implement store-and-forward functionality to buffer data during communication outages, with automatic backfill of historical data after communication restoration. • Communication redundancy shall be provided through Dual-SIM/Single-SIM multi-network support cards from different service providers with automatic failover between carriers where

S.No.	Category	Requirement Description
		Dual-SIM/Single-SIM multi-network support capability is specified. • Communication between RTU and SCADA server shall be identification/registration based, ensuring only registered RTUs can communicate with the SCADA Server. • Dedicated communication for data connectivity shall be ensured so that the SCADA system remains operational even in case of failure of one link. • The switching from primary to secondary link shall be automatic without any interruption to operations. • The SCADA vendor shall propose suitable communication media and firewalls with appropriate measures complying with cyber security norms as per standard ISO 27001.
5	SCADA Functional Requirements	**Functional Requirements** • The SCADA software shall provide real-time monitoring and control of all field devices with continuous data acquisition, processing and presentation. • The system shall collect, store and manage historical data for trending, analysis and reporting purposes, with configurable collection rates and storage durations. • The software shall implement comprehensive alarm management capabilities, including detection, prioritization, notification, acknowledgment and historical recording of alarm events. • The system shall provide trending and analysis tools to visualize historical and real-time data with configurable time ranges, parameters and display options. • The software shall include reporting capabilities with standard report templates, custom report development tools and scheduled report generation and distribution features. • The system shall provide a graphical user interface with representations of field devices, process values and operational states in multiple visualization formats. • The software shall implement role-based access control with definable user roles, permissions and authentication methods to ensure appropriate system access. • The system shall maintain comprehensive audit logs of all user actions, system events and configuration changes for security and compliance purposes. • The software shall synchronize time across all system components to ensure consistent timestamps for data, events and audit records. • The system shall support integration with third-party systems through standard protocols and interfaces for enterprise data exchange. • The software shall provide mobile access capabilities through web interfaces and/or native applications with appropriate security controls. • The system shall support industry-standard protocols for communication with field devices, including Modbus, DNP3 and OPC UA. • The software shall provide configurable dashboards for different user roles with customizable layouts, widgets and information presentation. • The system shall include calculation and analytics capabilities to derive additional parameters from raw data and perform statistical analysis.

S.No.	Category	Requirement Description
6	SCADA Functional Requirements	**Specific Functional Requirements** • The software shall provide configuration management capabilities for field devices, including parameter setting, firmware management and configuration backup and restoration. • The system shall implement state-based alarm management with prioritization based on severity, operational impact and response requirements. • The software shall provide multi-level hierarchical views of the gas distribution network from system-wide overview to detailed equipment display. • The system shall integrate with Geographic Information System (GIS) to display equipment locations, network topology and geographical context. • The software shall provide historical data trending with multiple time frames, from real-time to multi-year historical analysis. • The system shall support custom calculations and derived parameters based on raw field data, with user-configurable calculation methods. • The software shall include automated report generation and distribution capabilities with configurable schedules, formats and delivery methods. • The system shall implement condition-based monitoring and alerting based on user-defined thresholds, trends and patterns. • The software shall maintain audit trails for all control actions with user identification, timestamp, action details and previous and new values. • The system shall provide statistical process control functions for monitoring and analyzing process stability and capability. • The software shall include event sequence recording and playback capabilities to analyze operational sequences and incident timelines. • The system shall support integration with enterprise systems including SAP, ERP and asset management applications.
7	SCADA Functional Requirements	**Minimum Requirements** • The software shall provide tools for system and database configuration, including tag database, communication parameters and application settings. • The system shall acquire data from RTUs/IEDs via cellular connections and manage the real-time database with appropriate update rates and data validation. • The software shall generate and manage historical data with appropriate compression, storage and retrieval mechanisms for efficient trending and archival. • The system shall implement alarm handling functions including detection, storage, display and printout of alarm conditions with appropriate operator notification. • The software shall generate, store and present mimic diagrams with dynamic information reflecting current system status on workstation monitors. • The system shall provide display management for alarms, alerts, mimic diagrams, analog and digital values, trend graphs and bar charts in high-resolution color graphic modes. • The software shall support free-format report generation, storage and printout with user-configurable content, layout and scheduling. • The system shall implement data logging at periodic intervals, on operator request and automatically on occurrence of events with configurable parameters and retention policies. • The software shall transmit control commands and configuration

S.No.	Category	Requirement Description
		parameters to outstations with appropriate validation, security and confirmation mechanisms. • The system shall provide redundancy, fail-over and recovery processes to ensure continuous operation in the event of component failures. • The software shall support integration with third-party application software via non-proprietary industry standards with documented interfaces and examples.
8	SCADA Functional Requirements	**Connectivity** • The software shall support connectivity with Microsoft Excel and Microsoft Access for data export, import and analysis purposes. • The system shall provide integration capabilities with enterprise applications such as SAP and ERP systems through standard interfaces. • The software shall support intranet access to system data and functionality through secure web interfaces. • The system shall implement OPC UA server and client functionality for enterprise integration with industrial systems. • The software shall provide industry-standard web services and APIs for custom integration with external systems.
9	SCADA Functional Requirements	**Data Acquisition** • The data acquisition function shall provide all aspects needed to support data collection from the field including the requesting of data from RTUs/PLCs/IEDs and the processing of analog and digital data received from the same. • The frequency of data polling from all sites shall be configurable and the duration may vary from 10 seconds up to 24 hours. The system shall support polling a device once in a day if required. • The total number of IEDs being polled through Terminal Server shall be distributed across all the serial ports of the terminal server in such a manner that data traffic is equally distributed on all the ports. • It shall be possible to configure the poll rate for each remote station (RTU/IED/PLC) separately to optimize network bandwidth utilization. • All polled data shall be time tagged at the RTU end. However, where IED is being directly polled by the SCADA Server, the time tagging will be at the MMS end. • All analog polled data shall be checked for High, High-High, Low-Low and Low alarm limit violations at the SCADA server. Similarly, all polled digital inputs shall be checked for alarm violations/events immediately upon receipt of data at the server.
10	SCADA Functional Requirements	**Data Types** • 4-20 mA for parameters like Pressure, Temperature, etc. • Dry contacts, On-Off for status indications like valve position, compressor Run/Stop, etc. • From IEDs (PLCs and Flow computers) through RTUs or directly by the MMS • For valves, it shall be possible to use two digital inputs i.e., open status and close status to derive four states of the valve - Open, Close, Travel and Error
11	SCADA Functional Requirements	**Other Data Acquisition Requirements** • The system shall support data acquisition from various third-party applications through API/OPC/WMS servers with required intervals. • The system shall utilize event-driven

S.No.	Category	Requirement Description
		protocols where possible to reduce network traffic and optimize bandwidth utilization. Polling shall be supplemented with event-driven reporting where sensors inform the SCADA system upon parameter change.
12	SCADA Functional Requirements	**Data Validity** • The SCADA system shall include data validity analysis function. This validity analysis shall be for, But not limited to, out of range, Instrument Bad, scan failure, manual input, point in alarm, alarm inhibition, point off-scan, RTU off-scan, point in manual mode, etc. • Database qualifiers shall be indicated in database, displayed in the graphics and logged in the reports. These quality tags shall be implemented on all tags in the SCADA system.
13	SCADA Functional Requirements	**MMS Polling** • To poll RTU/PLC/IEDs/Modems immediately on demand from the User • To enable a complete RTU/PLC or (IED if polled directly from the MMS) to be disabled from the polling function • Facility to disable a port of Terminal server thereby inhibiting polling on that port • Configurable scheduler for polling large/small/medium industrial customers and GPRS based locations
14	SCADA Functional Requirements	**Control Functions** • The control function shall include the basic open/close and set point capabilities. The basis of all control actions shall be the select-check back-execute sequence. • Digital control like Valve open, Close etc. shall be provided. • Set point control like flow controller set point etc. shall be provided. • ON/OFF Operation of Compressor, CO2 flooding system, ESD Operation of system shall be provided. • Dispenser Price Change shall be provided. • The system must ensure that all the control actions are reconfirmed before the actual control action is taken. If the confirmation is not given within a specified time (configurable), the control action shall be aborted.
15	SCADA Functional Requirements	**Telemetry Fail and Poll Inhibit** • Reliable detection and correction mechanism shall be implemented for data communication. • If valid data is not received from an RTU/IED/PLC in response to a poll request, the software shall attempt to obtain the valid data from that RTU/IED/PLC. The number of re-tries to be attempted shall be configurable. • The operator shall have the capability to inhibit the entire RTU/PLC and/or individual IEDs from poll processing. In this situation, the operator must be provided with the option of putting the points in manual mode and substitute values for the data for points with defective telemetry or which have been inhibited for poll processing. The substitute value shall be retained until poll processing on that point or station is restored.
16	SCADA Functional Requirements	**User Administration** • The system shall provide centralized user management capabilities for all SCADA components, ensuring consistent access control across the platform. • The software shall implement role-based access control with granular permission assignments for functions, screens, equipment and data. • The

S.No.	Category	Requirement Description
		system shall support integration with Active Directory/LDAP infrastructure when required, enabling enterprise authentication services while maintaining local authentication capabilities. • The software shall provide comprehensive user profile management including contact information, responsibility areas, notification preferences and interface settings. • The system shall enforce configurable password policies including minimum complexity requirements, expiration periods, history restrictions and account lockout parameters. • The software shall support multi-factor authentication for administrative access and critical control functions using a combination of passwords, tokens, biometrics, or certificates. • The system shall implement session management with configurable timeout periods, concurrent session controls and forced logout capabilities for security incidents. • The software shall maintain comprehensive activity logging including login attempts, session details, function access and configuration changes with user identification and timestamps. • The system shall support user group management to simplify permission assignment and maintenance for users with similar responsibilities. • The software shall provide temporary access provisioning with automatic expiration for contractors, vendors and temporary staff. • The system shall implement periodic access review and recertification processes to ensure permissions remain appropriate as responsibilities change. • The software shall include self-service password reset capabilities with appropriate identity verification to reduce administrative overhead.
17	SCADA Functional Requirements	**System Security** • The system shall implement a defense-in-depth security architecture with multiple security layers protecting critical assets from unauthorized access or tampering. • The software shall enforce network segmentation through security zones with controlled communication between zones, utilizing firewalls with appropriate rule sets and monitoring. • The system shall deploy intrusion detection and prevention capabilities at network boundaries and critical internal points to identify and respond to potential security incidents. • The software shall implement malware protection for all applicable system components using regularly updated definitions and behavioral analysis techniques. • The system shall secure all communications using industry-standard protocols including TLS 1.2 or higher with strong cipher suites and proper certificate management. • The software shall encrypt data at rest using FIPS-compliant algorithms for sensitive configuration data, credentials and historical information. • The system shall implement formal security patch management processes for all software components with appropriate testing, approval and deployment procedures. • The software shall include vulnerability scanning and management capabilities to identify, prioritize and remediate security weaknesses across the platform. • The system shall provide security event monitoring and alerting for

S.No.	Category	Requirement Description
		potentially malicious activities, configuration changes, or system anomalies. • The software shall document and implement incident response procedures for security events, including containment, investigation, remediation and reporting processes. • The system shall generate security compliance reports demonstrating adherence to relevant standards and policies including IEC 62443, NERC CIP, or equivalent. • The software shall integrate with physical security systems where required, enabling correlation between physical and logical access events.
18	SCADA Functional Requirements	**System Configuration Management** • The system shall maintain version control for all configuration items, tracking changes with user identification, timestamps and change descriptions. • The software shall implement change management workflow with request documentation, impact assessment, approval routing, scheduling and implementation tracking. • The system shall provide configuration backup and recovery capabilities for all system components with automated backup scheduling and verification. • The software shall include configuration audit and verification tools to confirm system settings match authorized baselines and identify unauthorized changes. • The system shall provide configuration comparison tools to identify differences between versions, environments, or baseline configurations. • The software shall implement rollback capabilities for configuration changes, enabling rapid recovery from problematic modifications. • The system shall maintain comprehensive configuration documentation automatically updated to reflect the current system state. • The software shall provide a test environment for configuration changes, allowing verification before deployment to production systems. • The system shall implement a formal deployment workflow for approved changes with appropriate scheduling, notification, implementation and verification steps. • The software shall track configuration dependencies to identify potential impacts when changes are proposed or implemented. • The system shall verify configuration compliance against security policies, operational standards and vendor recommendations. • The software shall incorporate disaster recovery procedures for configuration data, ensuring rapid restoration in the event of system failure.
19	SCADA Functional Requirements	**System Monitoring and Diagnostics** • The system shall provide real-time performance monitoring for all critical system components including servers, databases, networks and applications. • The software shall track resource utilization including CPU, memory, disk space and network bandwidth with historical trending and threshold alerting. • The system shall monitor communication link status for all field connections, providing real-time visibility into connection health and data quality. • The software shall include database performance

S.No.	Category	Requirement Description
		monitoring with query analysis, index optimization recommendations and capacity planning tools. • The system shall implement application performance monitoring with transaction timing, error rates and user experience metrics. • The software shall collect and analyze logs from all system components with correlation capabilities to identify related events across the platform. • The system shall provide system health dashboards with role-appropriate views for operators, technicians, administrators and management. • The software shall generate alerts for system issues based on configurable thresholds, patterns and event correlations with appropriate routing and escalation. • The system shall include diagnostic tools for troubleshooting, enabling efficient root cause analysis for system issues. • The software shall maintain historical performance trends to identify gradual degradation, capacity constraints and cyclical patterns. • The system shall provide capacity planning tools with growth trend analysis and resource requirement projections. • The software shall generate preventive maintenance alerts based on equipment age, utilization patterns and vendor recommendations. • Comprehensive diagnostics and test facilities for each sub-system shall be an integral part of the SCADA system. • The presentation and layout of the display of the SCADA system shall be consistent and logical. It shall be flexible enough to accommodate future requirements. • All displays shall be completely configurable by a manager or supervisor using a Display Editor. • Configurable items shall include static background information, dynamic data (real-time or calculated) and active areas.
20	SCADA Functional Requirements	**Backup and Recovery** • The system shall implement comprehensive backup procedures for all system components including configuration data, historical data and application files. • The software shall support multiple backup types including full, incremental and differential with appropriate scheduling and retention policies. • The system shall verify backup integrity through automated validation processes, ensuring backups are complete and restorable. • The software shall implement secure backup storage with appropriate encryption, access controls and physical protection measures. • The system shall provide clearly documented recovery procedures for various failure scenarios from single component failures to complete system recovery. • The software shall support granular recovery capabilities, allowing restoration of specific data or configuration elements without full system recovery. • The system shall implement regular recovery testing to verify procedures, validate backup integrity and train personnel in recovery operations. • The software shall track recovery time objectives (RTO) and recovery point objectives (RPO) for various system components, with performance measured during recovery tests. • The system shall provide automated notifications for

S.No.	Category	Requirement Description
		backup success, failure, or integrity issues to appropriate personnel. • The software shall maintain appropriate separation between production systems and backup storage to prevent simultaneous compromise.
21	SCADA Functional Requirements	**Audit and Compliance** • The system shall maintain comprehensive audit trails for all user actions, system events and configuration changes with tamper-evident logging. • The software shall provide audit log protection through encryption, access controls and write-once storage to prevent unauthorized modification. • The system shall implement log collection and retention in compliance with relevant regulatory requirements and organizational policies. • The software shall include audit log search and reporting capabilities with filtering, correlation and export functions. • The system shall provide compliance reporting for relevant industry standards, regulations and internal policies. • The software shall support periodic compliance assessments with automated evidence collection and documentation. • The system shall implement separation of duties for critical functions, preventing single users from performing high-risk operations without oversight. • The software shall support regulatory inspection and audit processes with appropriate documentation, log access and demonstration capabilities. • The system shall maintain an audit committee dashboard showing compliance status, open issues, remediation progress and upcoming deadlines. • The software shall provide technical control measurement against defined security baselines with gap identification and remediation tracking.
22	SCADA Functional Requirements	**Software Licensing** • The software licenses shall be provided on an enterprise-wide basis for all SCADA components without artificial restrictions on deployment within the organization. • Licenses shall be provided for all required operating systems, databases and supporting software components necessary for system operation. • The licensing shall include separate environments for development, testing, production and disaster recovery with appropriate isolation and functionality. • Client access licenses shall be provided for all required user connections, including workstation, web and mobile clients. • Mobile application licenses shall be provided for all required mobile users on supported platforms. • Complete documentation of all licensing terms and restrictions shall be provided, including any limitations on usage, transfer, or future expansion. • A license management system shall be provided to track and monitor license usage, ensure compliance and plan for future requirements. • A clear license upgrade path shall be defined for future expansion, including pricing models and procedures for license additions. • License support and maintenance shall be included for the duration of the contract with clear terms for renewals and extensions.

S.No.	Category	Requirement Description
23	SCADA Functional Requirements	**License Specifications** • The software licenses shall support a minimum of 140,000+ tags/data points, scalable to 300,000 tags without requiring architecture changes. • The licensing shall support a minimum of 100 concurrent users, scalable to 300 concurrent users without requiring architecture changes. • The licenses shall include unlimited read-only web clients to maximize visibility into system operations across the organization. • The licensing shall include unlimited (read only??) mobile application users to support field personnel and management staff. • Full development environment licenses shall be provided to support system configuration, customization and testing. • Test environment licenses shall be provided to validate changes before deployment to the production environment. • Disaster recovery environment licenses shall be provided to ensure system availability during primary site failures. • All required integration connector and middleware licenses shall be included to support specified integration requirements. • Any required database licenses shall be included with appropriate sizing for the specified data volumes and retention periods. • Any required operating system licenses shall be included for all servers and components in the system architecture.
24	Analytics, Dashboard and Reporting	**Network Calculations** • The system shall calculate and display line pack parameters including real-time gas volume in the pipeline network, pressure and temperature compensated volumes and available gas reserves. • The software shall provide emergency supply duration prediction capabilities based on current line pack, consumption rates and network configuration. • The system shall trend and visualize network pressure profiles to identify potential operational issues and optimize pressure management. • The software shall perform network-wide gas balance calculations to identify and locate potential losses within the distribution system. • The system shall reconcile input versus output measurements across the network with appropriate corrections for pressure, temperature and gas quality variations. • The software shall support section-by-section balance calculations to isolate areas with potential unaccounted for gas (UFG) issues. • The system shall provide time-based trend analysis of gas balance calculations to identify patterns, anomalies and seasonal variations. • The software shall include geographical mapping of potential loss locations based on balance calculations and network topology.
25	Analytics, Dashboard and Reporting	**Consumption Monitoring** • The system shall track consumption by segment, customer type and geographic area with appropriate aggregation and drill-down capabilities. • The software shall compare current consumption patterns with historical data, identifying deviations from expected behavior based on day-type,

S.No.	Category	Requirement Description
		season and weather conditions. • The system shall analyze demand patterns including daily and weekly profiles, peak demand periods and seasonal variations. • The software shall detect consumption anomalies using statistical analysis and machine learning techniques, with appropriate notification of potential issues. • The system shall compare actual consumption against forecasted values, with analysis of variance factors and forecast accuracy metrics. • The software shall support customer segmentation analysis to identify usage patterns, efficiency opportunities and targeted service improvements.
26	Analytics, Dashboard and Reporting	**Automated Logbook** • The system shall provide digital log book templates matching existing manual formats to ensure operational continuity and compliance with established procedures. • The software shall automatically populate log book entries with relevant system data, reducing manual data entry requirements and improving accuracy. • The system shall maintain historical records of all log book entries with appropriate retention periods and archiving capabilities. • The software shall identify and timestamp all entries with operator identification to maintain a clear audit trail of operational activities. • The system shall provide search and retrieval capabilities for log book entries based on multiple criteria including date, time, operator, equipment and event type. • The software shall support both automatic entries from system events and manual entries by operators with appropriate validation and verification.
27	Analytics, Dashboard and Reporting	**Remote Price Change** • The system shall provide centralized price update management for CNG stations, enabling price changes to be applied from the control center. • The software shall support simultaneous price updates across multiple stations or scheduled updates for individual stations or groups of stations. • The system shall implement validation procedures to ensure price changes are within authorized ranges and properly formatted for target dispensers. • The software shall generate automated notifications to relevant stakeholders when price changes are scheduled, implemented, or encounter errors. • The system shall maintain a comprehensive audit trail of all price changes including user, timestamp, old price, new price, affected stations and status of implementation. • The system will confirm price update at each CNG station at individual dispenser level and also perform a dispenser lock action wherever such price update feedback is not received by the system. Also the system should send auto-messages/alerts to pre-defined GEL employees with list of such dispensers which are locked (not allowed to dispense gas) for further investigation at site and necessary corrective actions. • The software shall provide confirmation of successful price changes with verification from station equipment when available.

S.No.	Category	Requirement Description
28	Analytics, Dashboard and Reporting	**Network-Wide LUAG Analytics** • The software shall calculate real-time LUAG percentage across the entire network with appropriate corrections for pressure, temperature and gas composition • The system shall generate automated daily, weekly and monthly LUAG reports with configurable thresholds and exception alerting • The software shall provide historical trending of LUAG metrics with correlation to operational events, weather conditions and maintenance activities • The system shall support zonal LUAG analysis with division of the network into configurable monitoring zones to isolate problem areas • The software shall generate visual heat maps of LUAG hotspots for at-a-glance identification of network sections requiring attention • The system shall implement pattern recognition algorithms to identify recurring LUAG issues and suggest potential remediation strategies • The software shall correlate LUAG anomalies with operational events, maintenance activities and system changes to support root cause analysis
29	Analytics, Dashboard and Reporting	**Station-Wise LUAG Calculations** • The system shall calculate station-specific LUAG metrics for each facility type (CGS, CNG, LCNG, DRS/CPRS, etc) • The software shall monitor and compare incoming gas volume versus outgoing distribution volumes at custody transfer points • The system shall track odorization rates and correlate with gas flows for compliance monitoring and odorant efficiency analysis • The software shall generate station-specific LUAG audit reports with appropriate filtering, sorting and export capabilities • The system shall reconcile all metered inputs and outputs at each station to identify station-specific losses • The software shall compare LUAG metrics across similar station types to identify outliers and performance benchmarks • The system shall generate exception reports for locations with abnormal LUAG patterns, prioritized by volume and financial impact
30	Analytics, Dashboard and Reporting	**Compressor Line Loss Calculation** The system shall implement compressor line loss calculation functionality at CNG stations with the following capabilities: • The software shall calculate real-time line loss for each compressor based on suction and discharge measurements • The system shall display line loss metrics on compressor operation screens with appropriate visual indicators for normal and abnormal conditions • The software shall generate alerts when line loss exceeds configurable thresholds based on compressor type, operating conditions and historical baseline • The system shall track line loss trends over time to identify performance degradation and maintenance requirements • The software shall compare line loss metrics across similar compressor types and models to establish benchmarks and identify underperforming units • The system shall identify operational patterns that minimize line loss to inform operator training and standard

S.No.	Category	Requirement Description
		operating procedures • The software shall generate efficiency rankings for compressors across the network with drill-down capability to analyze specific performance attributes • The system shall provide statistical benchmarks for expected line loss under various conditions including ambient temperature, suction pressure and discharge pressure • The SCADA should able to calculate Penalty associated with different compressor OEMs based on the above calculation and should provide a detailed KPIs and reporting for the same
31	Analytics, Dashboard and Reporting	**Power Consumption Monitoring** The system shall implement power consumption monitoring for CNG and LCNG stations through the following capabilities: • The software shall track real-time power consumption through integration with station supply power meters • The system shall monitor compressor-specific power consumption metrics including kWh per unit volume compressed • The software shall calculate energy efficiency ratios for all compression equipment with comparison against manufacturer specifications • The system shall compare energy consumption across similar station types and equipment to identify efficiency improvement opportunities • The software shall identify optimal operating conditions for energy efficiency through pattern analysis of historical performance data • The system shall track seasonal variations in energy consumption and correlate with operational factors and ambient conditions • The software shall calculate energy cost per unit of gas compressed with trend analysis and forecasting capabilities • The system shall generate energy cost reports by station, equipment type and time period with appropriate filtering and export options • The software shall monitor peak power demand periods and analyze load profiles for optimization opportunities • The system shall provide predictive analytics for demand management with energy cost optimization recommendations
32	Analytics, Dashboard and Reporting	**Data Analytics Implementation** • The system shall collect data from all relevant sources including field devices, weather services, energy markets and enterprise systems for comprehensive analytics. • The software shall preprocess and validate input data to ensure accuracy, consistency and completeness before use in analytical calculations. • The system shall provide a calculation engine for derived parameters with configurable formulas, trigger conditions and update frequencies. • The software shall visualize calculation results through dashboards, trends and reports with appropriate context and comparative information. • The system shall provide historical trending of calculated values with the same functionality as primary measured parameters. • The software shall generate alerts for anomalous conditions detected through analytical calculations based on configurable thresholds and patterns. • The system shall document calculation

S.No.	Category	Requirement Description
		methodologies within the software, including formulas, assumptions and referenced standards. • The software shall include verification and validation procedures for calculation accuracy, with periodic comparison against manual calculations or alternative sources.
33	Analytics, Dashboard and Reporting	**Standard Analytics Package** • All standard data analytics capabilities offered by the SCADA system shall be provided as part of the base solution at no additional cost to GEL. • This shall include, at minimum, the standard analytics models, calculation engines, anomaly detection algorithms, trend analysis tools and visualization components that are part of the Bidder's commercial SCADA offering. • The standard analytics package shall include network-wide calculations for line pack, unaccounted for gas (UFG) analysis, consumption monitoring, automated logbooks and operational optimization algorithms. • Standard dashboards shall include network overview, station monitoring, equipment health, energy efficiency and safety compliance views • All licenses, configuration tools and software required to utilize these standard analytics capabilities shall be included in the base price of the solution. • Any future updates or enhancements to these standard analytics features released during the contract period shall be provided to GEL without additional licensing fees.
34	Analytics, Dashboard and Reporting	**Reporting** • The system shall provide standard operational reports including daily, weekly, monthly and annual summaries, performance reports, alarm reports and maintenance reports. • The software shall include compliance reports for regulatory requirements, safety standards and environmental regulations with appropriate formatting and content. • The system shall generate financial reports including sales summaries, energy consumption costs and operational expense analysis for management review. • The software shall provide a custom report generator with user-configurable templates, parameter selection and time period definition. • The system shall support export to various formats including PDF, Excel and CSV to facilitate further analysis and distribution. • The software shall enable scheduled report generation with automatic execution at defined intervals (hourly, daily, weekly, monthly).

S.No.	Category	Requirement Description
		• The system shall support report distribution via email or file sharing with configurable recipient lists and delivery options. • The software shall maintain a report archive with search and retrieval capabilities based on report type, date range and content. • The system shall provide ad-hoc reporting capabilities allowing users to generate reports on demand with custom parameters and filters. • The software shall include interactive data exploration tools within reports, enabling drill-down for detailed analysis of summarized information. • All standard reporting capabilities offered by the SCADA system shall be provided as part of the base solution at no additional cost to GEL. • This shall include, at minimum, the standard report templates, scheduling mechanisms, distribution tools, export formats and archiving capabilities that are part of the Bidder's commercial SCADA offering. • The standard reporting package shall include daily/weekly/monthly operational summaries, alarm and event reports, equipment performance reports, maintenance reports, compliance reports and management dashboards. Standard export formats shall include PDF, Excel, CSV and other industry-standard formats. • All licenses, configuration tools and software required to utilize these standard reporting capabilities shall be included in the base price of the solution. • Any future updates or enhancements to these standard reporting features released during the contract period shall be provided to GEL without additional licensing fees.
35	Analytics, Dashboard and Reporting	**Station Specific Screens** • The SCADA systems shall have individual screens for each location providing a clear visual layout of that location and display all the control and monitoring parameters of that location as applicable. The number of such screens provided may vary depending on location size and complexity. • Consolidated screens need to be developed for each Zone, GA, or any other geographical type or distribution based on Bidder's experience, asset/location density or at the request of GEL. • Enterprise-level or organization level screens also need to be provided at the MCS and BCS per GELs request, without any software or license limitations or additional costs. • Screen layouts and all associated objects, shapes, pop-outs, callups, etc. must be configurable, with appropriate branding guidelines and templates as advised by GEL.
36	Analytics, Dashboard and Reporting	**Customized Data Analytics Implementation** • The specific requirements for data analytics capabilities shall be refined and finalized during the detailed engineering design phase based on GEL's operational needs. • The Bidder shall engage with GEL stakeholders to identify, document and implement specific analytics use cases across all facility types. • Analytics models, calculations, derived parameters, anomaly detection

S.No.	Category	Requirement Description
		algorithms and visualization techniques shall be customized according to GEL's specific business objectives and operational priorities. • The Bidder shall document all finalized analytics requirements in a detailed specification document for GEL approval prior to implementation. • The analytics platform shall maintain flexibility to accommodate new data sources, calculation methods and business intelligence needs throughout the system lifecycle without requiring significant system redesign • Any customization that requires additional engineering effort beyond standard configuration shall be subject to the change management process defined in the contract.
37	Analytics, Dashboard and Reporting	**Customized Reporting Implementation** • The specific reporting requirements shall be refined and finalized during the detailed engineering design phase based on GEL's management and operational needs. • The Bidder shall engage with GEL stakeholders to identify, document and implement specific report templates, content, formats and distribution requirements. • Compliance reports, financial reports and operational reports shall be customized according to GEL's exact specifications and regulatory obligations. • Report scheduling, export formats, distribution methods and archiving policies shall be configured to GEL's requirements during detailed engineering. • The Bidder shall document all finalized reporting requirements in a detailed specification document for GEL approval prior to implementation. • The reporting system shall provide authorized GEL users with the ability to create and modify custom reports based on available system data throughout the system lifecycle. • Any customization that requires additional engineering effort beyond standard configuration shall be subject to the change management process defined in the contract.
38	Analytics, Dashboard and Reporting	**Implementation Requirement** • The system shall develop standard templates for each station type, ensuring consistency while accommodating the specific requirements of individual installations. • The software shall implement a logical navigation hierarchy allowing operators to move efficiently between system overview, area views, station displays and equipment details. • The system shall provide station-specific functionality appropriate to each facility type, including relevant control capabilities, parameter monitoring and performance metrics. • The software shall integrate with the alarm and event system, highlighting abnormal conditions within the station displays with appropriate visual indicators. • The system shall implement approved control functions with appropriate security, verification and feedback mechanisms. • The software shall provide trend displays relevant to each station type, with preconfigured parameter groupings for common analysis requirements. • The system shall enable report access directly from station screens, providing context-

S.No.	Category	Requirement Description
		sensitive access to relevant operational and performance reports. • The software shall include comprehensive documentation of screen layouts and functions to support operator training and system maintenance activities.
39	Main Master Station Server Requirements	**Server Components** • **Cellular Communication Server**: Manages all communications with field RTUs and modems; handles protocol translations between DNP3 and internal SCADA formats; manages store-and-forward for field devices during communication outages • **SCADA Server**: Processes real-time data from all field devices; executes control logic and calculations; manages tag database (70,000+ tags, expandable to 200,000+); coordinates all system components • **DMZ Server**: Creates secure boundary between SCADA core and external networks; implements data diode functionality where required; provides secure proxy services for external communications • **Web Server**: Hosts web-based SCADA interface; provides browser-based access to authorized users; delivers HTML5 visualizations and controls • **OPC UA Server**: Provides standardized interface for data exchange; implements OPC UA security features; enables third-party system integration • **Dashboard and Workstation Server**: Generates real-time visual displays for operators; processes complex visualizations and animations; manages display hierarchy and navigation • **Mobile Gateway Server**: Provides optimized interface for mobile applications; manages mobile authentication and security; compresses data for efficient mobile transmission • **Historian Server**: Stores all time-series data for 8-year retention; implements data compression algorithms; provides high-performance data retrieval • **Alarm Management Server**: Processes alarm conditions from all field devices; implements alarm prioritization and filtering; manages alarm routing and notification • **Reporting Server**: Generates scheduled and on-demand reports; processes complex data analytics; manages report distribution
40	Main Master Station Server Requirements	**Server Infrastructure Requirements** • All servers shall be sized appropriately for the anticipated load with capacity for future expansion.
41	Main Master Station Server Requirements	**High Availability** • Servers shall be implemented with high-availability configuration and automatic failover capabilities.
42	Main Master Station Server Requirements	**Security Architecture** • The server infrastructure shall be secured through defense-in-depth architecture with multiple security layers including IT and OT network segmentation, firewalls, intrusion detection, encryption and comprehensive access controls.

S.No.	Category	Requirement Description
43	Main Master Station Server Requirements	**Workstation Requirements • SCADA Operator Workstations - 6 Nos. • Engineering Workstations - 3 Nos. • Report Development Workstations - 2 Nos.**
44	Main Master Station Server Requirements	**Workstation Software and Security** • All workstations shall include Windows 11 Professional (64-bit) or latest enterprise-grade OS, with all necessary software pre-installed including SCADA client software, antivirus/endpoint protection, VPN client, remote access software and document readers. • All workstations shall support secure boot and trusted platform module (TPM 2.0), full disk encryption, multi-factor authentication, role-based access control, USB port control/lockdown and advanced threat protection.
45	Backup Master Station Server Requirements	**BMS Server Components • SCADA Server**: Processes real-time data from all field devices; executes control logic and calculations; manages tag database (70,000+ tags, expandable to 200,000+); coordinates all system components • **Web Server**: Hosts web-based SCADA interface; provides browser-based access to authorized users; delivers HTML5 visualizations and controls • **OPC UA Server**: Provides standardized interface for data exchange; implements OPC UA security features; enables third-party system integration • **Dashboard and Workstation Server**: Generates real-time visual displays for operators; processes complex visualizations and animations; manages display hierarchy and navigation • **Mobile Gateway Server**: Provides optimized interface for mobile applications; manages mobile authentication and security; compresses data for efficient mobile transmission
46	Backup Master Station Server Requirements	**BMS Workstation Requirements • SCADA Operator Workstations - 3 Nos. • Engineering Workstations - 2 Nos.**
47	Backup Master Station Server Requirements	**BMS Synchronization and Testing** • The BMS shall maintain synchronization with the MMS and provide independent system health monitoring. • The BMS shall periodically test failover capability to ensure readiness in case of MMS failure. • Continuous data synchronization between MMS and BMS shall be maintained to ensure no data loss during failover situations.
48	Historian	**Historian Features** Historian should have at least following features: • Should support historization of custom tags e.g. IoT or any other devices that are not part of SCADA • Should support configuration of high-low range values of each tag to generate alarm / mail / SMS based alerts based on same • Historian shall be part of SCADA (OT) network and it's data should be available for integration with IT network (ERP & other applications) through firewall

S.No.	Category	Requirement Description
49	Operator Stations	**Hardware Requirements** • The Operator Stations shall be based on branded off-the-shelf workstation hardware running on a Windows-based operating system.
50	Operator Stations	**Operational Capability** • It shall be possible to perform any operator action from any station in the system, subject to appropriate authorization.
51	Operator Stations	**Display Performance** • Graphic display pages shall be capable of a minimum of 1,200 analogue tags, with updates of on average of two seconds (for all data to appear or change on the page).
52	Operator Stations	**Graphics System** • The graphics system shall support full 32-bit (65 million) colors and be capable of displaying images imported from 3rd party packages for use within the displays, including animating and color flooding the image.
53	Operator Stations	**Display Navigation** • It shall be possible to display other graphics pages by selecting screen targets and to automatically display any screen based on the condition of a tag, e.g., automatically call a graphic display when an alarm occurs.
54	Operator Stations	**Synchronized Animation** • When multiple objects on a page are configured for flashing, then all objects shall flash synchronously.
55	Operator Stations	**Pop-up Windows** • The system shall have the capability to provide pop-up windows for trends, loops, device status pages or any other graphical display purpose. To minimize operator confusion, pop-up windows shall be capable of being configured so that multiple copies of the same popup cannot be opened on the same workstation at the same time.
56	Operator Stations	**Display Information** • All full-size display pages shall include the page name, current time and date together with details of the last 3 alarms that have occurred.
57	Operator Stations	**Keyboard Entry** • Each display object shall support keyboard entry that will allow adjustment of any tag in the system. When an operator wants to enter a value, the object should be selected then the operator input shall be displayed as the input is typed (such as a tooltip adjacent to the object). The system shall check the value entered is in an approved range before action is taken.
58	Operator Stations	**Communication Status Indication** • If communications to an I/O tag fails for any reason, then wherever that data is displayed the system shall post a visual indication that the tag is not valid.

S.No.	Category	Requirement Description
59	Operator Stations	**Navigation Methods** • The user shall be able to navigate around the graphics system utilizing a variety of navigation methods, including Windows style navigation menus to access any configured page in the system from any other page and "hot spots" where a user can click on an area and drill down into a detailed view (if available) of the plant area.
60	Alarm Management	**Alarm Display** • With appropriate privileges, it shall be possible to display or acknowledge any alarm and/or the most recent alarm on any page. • The system shall provide alarm priority or category. The priority of an alarm shall be identifiable by the color and font settings of the alarm message on the screen. A detailed alarm philosophy shall be incorporated in the Functional Design Specification. • Sound indication for each alarm category shall be configurable. This must be possible at each station. It shall be possible to have the alarm sound either by internal or external speaker. • The software shall have a standard alarm display page that can be modified for the project. The standard alarm page shall have the facility for scrolling through multiple pages of alarms and for acknowledgment and disablement of individual alarms.
61	Alarm Management	**Alarm Information** • It shall be possible to display the following information for each alarm as it appears on an alarm display page: Alarm Tag Name, Location, Alarm Description, Value of the Tag, Alarm Status (Disabled, Acknowledged, Unacknowledged), Alarm Category, Alarm Priority, Time & Date in International Formats and Value of any Tag or result of any calculation. • It shall be possible to display each alarm category in a different font and color (including flashing colors) dependent on whether the alarm is Active Unacknowledged, Active Acknowledged, Acknowledged Cleared, Unacknowledged Cleared or Disabled. • The alarm display shall support both proportional and fixed fonts with all alarm fields displayed in properly aligned columns. • It shall be possible to disable alarms on individual basis, by page, by alarm category, or for all alarms. When an alarm is disabled, the alarm will be displayed on a separate disabled alarms page so every user of the system can easily determine which alarms have been disabled.
62	Alarm Management	**Alarm Comments and Automation** • The system shall allow for operator comments to be attached to any alarm when it is acknowledged or later. These operator comments shall either be displayed with the alarm or displayed by clicking on the alarm. • It shall be possible to automatically display any graphic display when an alarm occurs or to dynamically change the appearance of any graphical object based on whether an alarm is On, Off, Acknowledged, Communications Error, or Disabled.

S.No.	Category	Requirement Description
63	Alarm Management	**Alarm Filtering** • The alarm display shall have a mechanism for operators to dynamically define filtering of alarms by alarm tag, alarm name, alarm description, date/time range, state including sub-states for analogue alarms, type, area, category and priority.
64	Alarm Management	**Alarm Documentation and Export** • The SCADA system shall provide ability to attach documents and other artifacts to incidents and other entities. The Alarm summary shall have provision to extract in standard Excel format for selected period.
65	Alarm Management	**Alarm Sorting** • It shall be possible to sort (ascending and descending) active alarm displays by one or more alarm fields without grouping restrictions. Alarm fields that can be used for sorting include: Tag, Name, Category, Priority, Area, Privilege, State, On Time, Off Time, AckTime. • SCADA Systems shall deliver messages to a set of subscribers. The Notification service shall be as per OEM standard facility.
66	Alarm Management	**Alarm Management Interface** • The system shall provide an alarm summary display showing current active alarms with appropriate sorting, filtering and acknowledgment capabilities. • The software shall implement alarm acknowledgment functionality with appropriate security controls and audit logging. • The system shall provide alarm filtering and sorting capabilities based on multiple criteria including priority, area, equipment type, time and acknowledgment status. • The software shall maintain alarm history and reporting functions with configurable time ranges, grouping options and export capabilities. • The system shall visualize alarm priority through distinct color coding, positioning and optional audible signals based on severity and operational impact. • The software shall provide alarm shelving and suppression capabilities with appropriate time limits, documentation requirements and visibility of suppressed alarms. • The system shall include alarm documentation and help functions providing operators with cause information, potential responses and related procedures. • The software shall track and display alarm statistics and key performance indicators including alarm rates, standing alarms, frequent alarms and operator response times. • The system shall provide alarm rationalization tools to support ongoing alarm management optimization in accordance with industry best practices. • The software shall implement mobile alarm notification for critical alarms requiring immediate attention from personnel outside the control room. • The system shall visualize alarm escalation status, clearly indicating when alarms have been escalated to supervisory or management attention. • The software shall comply with ISA 18.2 or equivalent standards for alarm management systems, implementing the alarm lifecycle and management principles defined therein. • IEC 62682

S.No.	Category	Requirement Description
67	Trend Management	**Trend Display** • Trend displays shall comprise line graphs with time on a linear, continuous horizontal and the trended value on the vertical or horizontal axis. Resolution of each graph shall be to within 1% of full scale. Where more than one tag is graphed, the graph of each tag and associated information shall be displayed in a different color. • Trend displays shall support both analogue and digital pens on the same graph. Trend pens assignments shall be user definable and retrievable in runtime to allow easy creation and management of favorite trend groups. • Each trend graph shall be capable of displaying up to minimum 8 pens with adjustable time base to one second samples and reporting up to 10,000 points with user-specifiable time ranges (span), using the standard software. The graph shall be capable of viewing the entire archived trend history for a group of pens on a single display. • Each pen shall display individual ranges and engineering units. Each pen shall be scalable for display purposes independently of other pens displayed on a page. • The display shall include the capability to pan backward and forward within a selected time range to read the exact value of any displayed tag, by selecting a point on the graph or chart. • The trend display shall have an independent cursor that can be moved over the page that will provide indication of the date, time and value at the intersection of the slide wire and the trend tags. • The trend display shall provide "zoom" facility for both the trended tag range and the time axis range. The "zoom" facility shall allow an operator to compress or expand the axis range whilst the "pan" facility shall allow an operator to shift the origin of the axis. The system shall allow a user to define any zoom area by dragging a mouse across the trend. • The system shall provide Minimum, Maximum and Average summaries for all displayed analogue pens. • Each operator or login shall be able to access their own fully customized trend pages. These pages must be customizable on-line by each user in a drop and drag manner, or by using standard windows configuration popup features. • Any setting available to be made in a configuration environment shall be available to the user to modify the trend graphs in runtime. As a minimum these include the pen color, pen scaling, background color, grid and Trend Tag assignments for each trend page. • The system shall support the creation, management and retrieval of trend templates which define a set of tags, time ranges and display characteristics for commonly monitored process areas. • It shall be possible to export trend data to common file formats including CSV, Excel and PDF to facilitate offline analysis and reporting. • Multiple trend windows shall be capable of being displayed concurrently to allow comparison between different process areas or time periods. • Trend displays shall support automatic refresh to ensure that the most current data is always visible when a real-time display is active. • The system shall

S.No.	Category	Requirement Description
		provide statistical analysis functions including rate of change calculations, standard deviation and correlation between trended parameters.
68	Trend Management	**Trend Data Management** • Trend data shall be collected based on configurable parameters including: a. Time-based collection at defined intervals b. Exception-based collection when values change by a specified amount c. Combination of time and exception-based collection d. Event-triggered collection • The system shall support multiple trend collection rates to optimize storage requirements while providing appropriate detail for different parameter types: a. Fast collection (1 second to 1 minute) for critical process variables b. Medium collection (1 minute to 15 minutes) for general process monitoring c. Slow collection (15 minutes to 1 hour) for slowly changing parameters • Trend data shall be stored in a manner that optimizes storage requirements while maintaining data integrity and historical accuracy, including compression techniques that retain significant process events. • The system shall automatically manage trend storage tiers, moving data from high-performance to archival storage based on age and access patterns while maintaining seamless access to all historical data. • Administrators shall be able to configure trend collection parameters, storage requirements and archival policies through a graphical interface without requiring specialized database knowledge.
69	Historical Data Archiving System	**Historical Data Requirement** • The system must display alarm states in parallel with the analogue and discrete trend pens on a timeline chart. This chart shall support the entire trend requirements as per RFP (or as per GEL requirement), in addition to those described below. • The alarm pen shall clearly indicate the active/inactive/acknowledged state of the alarm through visual cues, as well as providing detailed information at any point which the operator selects. For example, High or Deviation states should be shown upon operator interrogation. • The alarm pens shall scroll similarly to trend pens to provide a 'real-time' view of the alarm state. The operator shall be able to select which alarm pens to monitor with which trend pens to build up a complete 'view' of a particular process unit or area on the historical display. • When accessing historical data, the alarm pens shall display their historical states on the historical display in parallel to trend pen histories. The operator shall be able to make a single request for a specific date and time for historical display and all pens configured for display, both alarms and trends, shall be retrieved for that time. • Sampling shall support Periodic and Exception methods with minimum periodicity of 1 minute and minimum exception or threshold of 0% of current value (i.e., Historian records any changes recorded by real-time database).

S.No.	Category	Requirement Description
70	Historical Data Archiving System	**Historical Database Requirement** • The historical RDBMS shall support the following minimum features: a. Report editing/generation capabilities b. Forms editing/generation capabilities c. Data integrity checking, transaction recovery capabilities d. Complete implementation of the SQL Interface language e. Network access to the database from other clients on the network f. Client/server architecture supporting multiple servers, which each operates independently from one another leveraging clustering technologies g. Mirroring/shadowing of the on-line database to a backup storage device h. ODBC compliance • The SCADA system shall have live access to the historical data for use in reports and on displays without requiring manual extraction or conversion. • On-line historical data shall be accessible to controllers for reports, queries, analysis, display and trending. It shall be possible to save the following data types as on-line historical data: a. Status point values b. Analog point values c. Rate point accumulator values or rate point flow-rate values d. Hourly and daily volumes e. Alarms f. Events g. Messages h. Communication statistics for host to field devices • Historical data storage shall be provided for the following intervals: a. Instantaneous b. Top of hour and hourly minimums, maximums, averages c. Top of day and daily minimums, maximums, averages d. Top of month and monthly minimums, maximums, averages e. Top of year and yearly minimums, maximums, averages
71	Historical Data Archiving System	**Historical Archiving and Data Management** • The SCADA system shall have a mechanism for automatically archiving historical data onto offline storage media that has aged beyond a user configurable period. This data is no longer required to be kept on-line in the historical database. • The data shall archive to a Write Once, Read Many (WORM), or similar optical storage device, after which the system administrator shall easily purge (or automate the purging) of all archived on-line historical data to make room for new data. • The Historical Data Subsystem shall allow for different on-line and off-line archiving of data. For example, the system shall allow for events to be kept on-line for a different period than the communications statistics. • The SCADA system shall generate an alarm when historical RDBMS tables are nearing capacity. The alarm shall serve to indicate a requirement for additional fine-tuning of the frequency of data archiving and purging or addition of historical disks. • It shall be possible to recover off-line archived data. The system shall provide an interactive utility to access archived information. The SCADA system shall support the on-line access to historical/archived historical data. The Historical system shall support selectable archived data output formats.

S.No.	Category	Requirement Description
72	Historical Data Archiving System	**Data Editing and Validation** • Occasionally, it may be necessary to edit certain historical data in order to correct errors or omissions caused by upset conditions. The system shall provide a facility to edit this data. It shall be possible for appropriately authorized personnel to edit the online historical database and manually overwrite questionable or missing data. • The system shall provide a means of adding or changing the following historical information: a. Field communication statistics b. Real-time values c. Accumulator values • If a record is edited, the system shall automatically ensure that the changed data is archived, even if the original data was already archived. • All data edits shall be logged with the user ID, timestamp, original value and new value to provide a complete audit trail of historical data changes. • The system shall provide validation mechanisms to ensure that entered data conforms to expected ranges and formats before committing changes to the historical database.
73	Historical Data Archiving System	**Performance Requirements** • The historical system shall be capable of storing and retrieving data for a minimum of 8 years at full resolution for all configured points. • The historical system shall be sized to accommodate a minimum of 140,000+ initial data points, scalable to 300,000 data points. • The historical system shall support at least 100 concurrent users accessing historical data without degradation in system performance. • The retrieval performance for historical data shall be optimized to support trend displays with a maximum retrieval time of 5 seconds for 1 year of data for 8 trend pens at 1-minute resolution. • The historical system shall be capable of processing a minimum of 18,000,000 data points per day.
74	Engineering Station	**System Development** • The engineering software shall be menu driven. It shall be easy to configure and context sensitive online help should be available. • The system should be configured using either nested or pop-up menus and fill-in-forms to simplify configuration tasks and reduce training requirements. • The system should provide configuration tools and wizards to simplify and significantly reduce the initial configuration by minimizing data entry and providing templates for common configuration tasks. • Fields for tag names, loop names and equipment names shall accommodate at least 32 characters. Configuration databases shall be in an open standard file format, to allow editing and manipulation by other database or spreadsheet editing packages. Database management shall be configurable by engineers but transparent to the operators. • The ability to import and export whole or in part, the automation project database details including network information, data servers, operating and monitoring, controllers and network nodes shall be included as a standard feature. • Importing of tag definitions from field device configuration/programming packages shall be

S.No.	Category	Requirement Description
		included as a standard feature to facilitate efficient system integration and reduce configuration errors. • The exported files can be edited or viewed by using any text editor or Excel to allow for bulk modifications and updates. • The system should support the ability to copy and paste, in part or in whole, components of automation system created in the project to facilitate efficient configuration of similar elements.
75	Engineering Station	**System Libraries** • The system will provide a standardized system library generically suitable for process applications. This library contains different process objects and objects to support the usage of devices including fieldbus communication. • All libraries shipped with the system contain sets of objects with facets to logic and visualization to interconnect the tools in the system. • The objects in the system libraries come with all functionality embedded, that are needed to create process applications: a. Logic part of each object b. Interface with physical IOs c. Interlocks and fail condition d. Parameterization e. Visualization symbols with necessary pop ups f. Control functions for the operators g. Alarm messages and - filtering h. Operator logs i. Maintenance information like running hours of motors j. Documentation for each object including help file k. Trending of analogue values l. Access level for operations • The system will provide tools for developing libraries. The system libraries can be customized, adapted and enhanced including the visualization and the logical part. It enables the user to use them as the template to develop process/project specific objects.
76	Engineering Station	**Graphical Builder Software** • The graphic builder shall be interactive and menu-driven, requiring no programming for standard configuration tasks. • The software shall have the ability to directly import graphics and text from the standard formats to leverage existing graphical assets. • Imports using different color palettes and depths shall support both dithering and non-dithering at the user's discretion. • The graphics builder shall be capable of creating screens composed of both static and dynamic objects. To create these objects, the vendor shall provide sample screens and a set of standard shapes or symbols in a library at no charge. The developer shall be able to include these symbols by reference or create new symbols/objects. • The graphics builder shall provide the following tools: a. Grid and guidelines (which can be displayed on screen) together with snap to grid and snap to guidelines to assist in aligning objects precisely b. Horizontal and vertical alignment together with even spacing c. Infinite layering with Send to Front/Back; Bring Forwards one Layer; Send Backwards one Layer d. Bitmap editing including pixel drawing, image resizing, image cropping e. Color swap from one color to another for a group of selected objects including colors within a bitmap f. Color swap shall also include swapping a range of colors such as all reds to all greens so that

S.No.	Category	Requirement Description
		shaded objects can be color changed without redrawing or re-rendering g. Color adjustment including from one spectrum to another, as well as Lightness/Darkness and Saturation levels h. Editing of nodes on polylines that provides the addition or removal of nodes plus movement of nodes • The graphics builder shall support a large number of "undo" and "redo" features to facilitate efficient development and avoid errors. • The graphics system shall support full 32-bit (65 million) colors and supply a palette of 'favorite' colors for ease of development. It shall allow user defined flashing colors. • Common static and dynamic objects shall be stored in libraries and 'linked' such that changes to the master objects (including dynamic configuration changes), in the library are propagated to all instances of the object throughout the project without needing to access each object instance. Pages shall be based on Templates and 'linked' such that changes to the master template in the library are propagated to all pages throughout the project without needing to access each page. Commonly used pages such as Alarm and Trend pages shall be included with the software and not require any development to use them at runtime. • The system must be designed with the ability to make changes to the graphics while the system is running. Shutting down the system shall not be required to make changes. • The Graphics Builder shall be able to modify all displays in the system including standard displays supplied with the software such as alarm, trend, startup, tag, reports and utilities displays.
77	Engineering Station	**Graphics Object Capabilities** • The graphics builder software shall support the following dynamic objects as a minimum: a. Straight lines b. Rectangles c. Text d. Buttons (of the latest WinXP style) e. 3D Pipes f. Bitmaps • Dynamic objects shall have properties that shall modify the object according to the value of either a tag or an expression. It shall be possible to use these properties concurrently. • Color change shall support all of the following types: a. On-Off: On Color and Off-Color changes based on the result of an expression b. Multi-State: A definable color shall display for each possible boolean result of up to five conditions c. Integer: A definable color shall display for each different integer value. Up to 255 different colors shall be definable d. Threshold: A definable color shall display based on multiple threshold expressions. For example, a fill color should change to red when the speed of a motor is greater than or equal to 4500 rpm and to white when less than or equal to 100 rpm, but remains gray for all speeds in between e. Gradient: Color shall change through the spectrum according to the value of an analog tag. It shall be possible to define a starting and ending color • The following types of graphics shall, as a minimum, be made available as applicable: a. Master and Sub Index Displays b. CNG stations/Field overall status display c. Pipeline single line diagram Displays for all CNG stations/Field d. Network and Station Overview Displays (Google Geographical map) e. Station Displays f.

S.No.	Category	Requirement Description
		Alarm and Event List Displays g. Data Trending h. Bar Graph Displays i. Electrical parameters j. Configuration Management Displays k. Database Review Displays l. RTU status display m. Communications status Displays & Communication statistics displays n. SCADA System Utility, Support & Diagnostic Displays o. System Resource [CPU, Memory, Disk loading] p. SCADA reports
78	Engineering Station	**Configuration Management** • The engineering station shall provide comprehensive configuration management capabilities including: a. Version control for all configuration items b. Change tracking with date, time and user identification c. Ability to compare different versions of configuration items d. Capability to roll back to previous versions if required e. Automated backup of configuration databases f. Export/import capabilities for configuration transfer between systems • The system shall provide a structured approach to testing and deploying configuration changes including: a. Simulation capabilities to test configurations before deployment b. Ability to deploy changes to runtime systems without interruption of operations c. Validation of configuration integrity before deployment d. Audit trails of all configuration changes • The engineering station shall support multi-user development with appropriate locking mechanisms to prevent conflicting changes.
79	Cloud Infrastructure	**General Requirement** • The SCADA system shall be hosted on a private cloud infrastructure provided by a MeITY-approved private cloud service provider with data centers located within India. • The cloud service provider shall comply with all relevant Indian regulations pertaining to data sovereignty, data security and critical infrastructure protection. • The cloud infrastructure shall maintain a minimum of 99.9% availability with appropriate redundancy measures implemented at all levels. • The cloud infrastructure shall be scalable to accommodate growth in data points, field devices, users and storage requirements over the lifetime of the system without requiring architectural redesign. • The system shall include comprehensive disaster recovery capabilities with geographically separated backup facilities within India. • The cloud infrastructure shall implement security measures including firewalls, intrusion detection systems, encryption and access controls in compliance with industry standards and best practices. • Regular security audits and vulnerability assessments shall be conducted, with remediation plans implemented for any identified issues.
80	Cloud Infrastructure	**Capacity Requirements** • The cloud infrastructure shall be sized to accommodate a minimum of 140,000+ data points at initial implementation, with the capability to scale to at least 300,000 data points without architectural changes. • The system shall support monitoring and control of 4,730 field locations at initial implementation, with the capability to scale to at least 10,000 locations. • The system shall support a minimum

S.No.	Category	Requirement Description
		of 100 concurrent users at initial implementation, with the capability to scale to at least 300 concurrent users. • The cloud infrastructure shall deliver real-time data refresh rates of 5 seconds or better for critical parameters under normal operating conditions. • The system shall provide for historical data storage for a minimum period of 10 years, with appropriate data tiering to optimize storage costs and performance. • The cloud infrastructure shall be capable of handling a minimum of 18,000,000 data points per day at initial implementation, with the capacity to scale as the system expands.
81	Cloud Infrastructure	**Certifications** • The cloud service provider shall maintain current ISO 27001 certification for information security management systems. • The cloud service provider shall maintain current ISO 27017 or equivalent certification for cloud security. • The cloud service provider shall maintain current ISO 27018 or equivalent certification for protection of personally identifiable information in public clouds. • The cloud service provider shall maintain SOC 1 and SOC 2 compliance or equivalent for service organization controls. • All certifications shall be valid during the contract period, with renewal evidence provided to GEL as applicable.
82	Cloud Infrastructure	**Architecture Requirement** • The cloud infrastructure shall include separate environments for production, development, testing and disaster recovery to ensure proper isolation and control. • The architecture shall include appropriate backup and archiving systems for historical data with automated backup procedures and verification. • The network connectivity shall incorporate redundancy with automatic failover to prevent single points of failure. • Comprehensive monitoring and management tools shall be implemented to provide visibility into system performance, availability and security status. • The cloud infrastructure shall support secure integration with on-premises systems at GEL's control centers. • The architecture shall incorporate defense-in-depth security through multiple security zones with appropriate access controls. • All data shall be encrypted both in transit and at rest using industry-standard encryption algorithms and key management practices. • The architecture shall include resource isolation to ensure separation of environments and protection against resource contention. • Automated scaling capabilities shall be implemented to address variations in workload and accommodate growth over time.
83	Cloud Infrastructure	**Implementation** • A detailed implementation plan shall be provided, including provisioning, configuration, deployment, testing and cutover procedures. • Comprehensive documentation shall be provided, including architecture diagrams, network topology, security architecture and operational procedures. • Regular performance optimization and capacity management activities shall be conducted to ensure optimal system

S.No.	Category	Requirement Description
		performance. • Security patch management processes shall be implemented to maintain current security updates across all system components. • Regular backup and recovery testing shall be conducted to verify the effectiveness of data protection measures. • Technical support for cloud infrastructure issues shall be available 24x7, with defined escalation procedures. • Formal change management procedures shall be implemented for all infrastructure changes, with appropriate testing, approval and rollback capabilities. • Monthly reports shall be provided on cloud resource utilization, performance metrics, security events and capacity planning recommendations.
84	Mobile Application	**General Requirements** • The system shall provide a mobile application for remote monitoring and limited control of the SCADA system from mobile devices. • The mobile application shall support real-time monitoring of key operational parameters with appropriate refresh rates based on network conditions and parameter criticality. • The software shall provide alarm notification and acknowledgment capabilities with configurable filters and prioritization. • The mobile application shall include trend viewing and analysis functions with configurable time ranges, parameter selection and comparison capabilities. • The software shall implement task management for field operations including assignment, tracking, completion verification and documentation. • The mobile application shall provide equipment inspection checklists with step-by-step procedures, validation rules and completion tracking. • The software shall include barcode/QR code scanning capabilities for asset identification, ensuring accurate data association and reducing manual entry errors. • The mobile application shall leverage GPS integration for location-based features including nearest asset identification, navigation assistance and geofencing. • The software shall provide offline capability with local data storage and synchronization when connectivity is restored, ensuring continuous operation in areas with limited network coverage. • The mobile application shall include photo capture and annotation features for documenting equipment conditions, issues and completed work. • The software shall provide access to relevant documents and reference materials including manuals, procedures, drawings and safety information. • The mobile application shall implement secure authentication and authorization, ensuring appropriate access controls for all functions.
85	Mobile Application	**Mobile Functionality** • The mobile application shall provide facility-specific views and information, optimized for the mobile form factor while maintaining consistency with the main SCADA interface. • The software shall implement parameter monitoring with visual indicators for normal, warning and alarm conditions based on

S.No.	Category	Requirement Description
		configurable thresholds. • The mobile application shall display graphical trends with touch interaction for time range adjustment, parameter comparison and value inspection. • The software shall provide map-based navigation to facilities with location filtering, status indication and routing assistance. • The mobile application shall include task assignment and tracking functions integrated with the enterprise work management system when available. • The software shall provide access to maintenance procedures specific to the equipment being serviced, with step-by-step instructions and verification. • The mobile application shall enable access to equipment documentation including specifications, vendor information and maintenance history. • The software shall support field data collection with appropriate validation, units conversion and data quality checks. • The mobile application shall provide communication capabilities with the control room through structured messaging, reducing radio traffic for routine matters. • The software shall include notification management with prioritization, acknowledgment and follow-up tracking. • The mobile application shall support user profile and preference management to customize the experience for individual users while maintaining security controls. • The software shall provide help and support resources including user guides, FAQs and troubleshooting procedures accessible within the application.
86	Mobile Application	**Platform Support** • The mobile application shall be provided for iOS devices, supporting the latest version and two previous major versions and all future major versions of the operating system during the contract period. • The software shall be provided for Android devices, supporting the latest version and two previous major versions and all future major versions of the operating system during the contract period. • The system shall include a responsive web application accessible through standard browsers for platform-independent access when native applications are not available or preferred. • The mobile applications shall provide consistent functionality across platforms while leveraging platform-specific capabilities where appropriate to enhance the user experience. • The software shall include platform-specific optimizations for performance, battery usage and data consumption appropriate to each supported operating system. • The mobile applications shall support various screen sizes and resolutions, automatically adjusting layout and content presentation for optimal usability. • The software shall comply with platform design guidelines to ensure a native look and feel that aligns with user expectations on each platform. • The mobile applications shall optimize performance for each platform with appropriate caching, background processing and resource management. • The software shall integrate with platform notification systems to deliver alerts and updates in a manner consistent with other applications on the device.

S.No.	Category	Requirement Description
87	Mobile Application	**User Roles** • The mobile application shall support field technician roles with functionality focused on equipment inspection, maintenance, alarm response, troubleshooting and task management. • The software shall support operations supervisor roles with capabilities for performance monitoring, analysis, resource allocation, scheduling and approval workflows. • The mobile application shall provide management-specific functions including key performance indicator dashboards, exception reporting and strategic decision support. • The software shall implement role-based access control to ensure users can only access functions and data appropriate to their responsibilities. • The mobile application shall provide role-specific user interfaces optimized for the typical tasks and information needs of each role. • The software shall enable customizable dashboards and views within the constraints of each role's permissions and responsibilities. • The mobile application shall provide data access filtered by role, limiting visibility to appropriate stations, parameters and functions. • The software shall implement task assignment based on role qualifications, location and workload balancing. • The mobile application shall filter notifications by role relevance to reduce information overload while ensuring critical information reaches appropriate personnel. • The software shall support role hierarchy and delegation for temporary responsibility transfers during absences or special situations.
88	Mobile Application	**Security Requirements** • The mobile application shall implement multi-factor authentication using a combination of password, biometric, or token-based mechanisms appropriate to the sensitivity of accessible functions. • The software shall enforce role-based access control consistent with the main SCADA system, with appropriate granularity for mobile operations. • The mobile application shall encrypt all communications using TLS 1.2 or higher with strong cipher suites and certificate validation. • The software shall implement secure data storage on the device using platform-approved encryption methods and secure storage areas. • The mobile application shall support remote wipe capability to remove sensitive data from lost or stolen devices when initiated by administrators. • The software shall enforce session timeout and automatic logout after configurable periods of inactivity to prevent unauthorized access to unattended devices. • The mobile application shall maintain comprehensive audit logs of all activities with user identification, timestamp, location and action details. • The software shall comply with GEL security policies and maintain consistency with enterprise mobile device management requirements. • The mobile application shall implement industry-standard encryption (TLS 1.2 or higher) for all communications with appropriate certificate validation. • The software shall securely store credentials using platform-specific secure storage mechanisms, never storing plaintext passwords or tokens. • The mobile application shall support biometric authentication including

S.No.	Category	Requirement Description
		fingerprint and facial recognition where supported by the device. • The software shall incorporate protection against common mobile vulnerabilities as identified in the OWASP Mobile Top 10 or equivalent security standard. • The mobile application shall implement certificate pinning for communication to prevent man-in-the-middle attacks. • The software shall include anti-tampering measures to detect and respond to device rooting, jailbreaking, or application modification. • The mobile application shall log and monitor security events with appropriate alerting for potential security incidents. • The software shall undergo regular security testing and updates to address newly discovered vulnerabilities in a timely manner.
89	Integration Requirements	**Compressed Bio-Gas System Integration** • The system shall implement integration with Compressed Bio-Gas (CBG) manufacturer systems using standardized data exchange protocols and formats. • The software shall collect real-time data from CBG production systems including production rates, gas quality parameters and system status. • The system shall monitor quality parameters including methane content, CO2 content and H2S content to ensure compliance with network injection standards. • The software shall track injection flow rates and cumulative volumes with appropriate pressure and temperature compensation. • The system shall integrate alarms from CBG production systems into the main SCADA alarm management system with appropriate categorization and prioritization. • The software shall collect and store historical data from CBG systems with the same retention policies as other SCADA data. • The system shall incorporate CBG production and injection data into reporting and analytics functions, enabling performance analysis and optimization. • The software shall implement appropriate security measures for external system integration, including encrypted communications, access controls and audit logging. • The system shall interface with CBG plant control systems using the plant's native protocols with appropriate protocol conversion where required. • The software shall validate and verify all data received from CBG systems before incorporation into the SCADA database to ensure data integrity.
90	Integration Requirements	**CNG Stations** • The system shall support communication with various PLC makes and models commonly used in CNG stations, including but not limited to Modbus RTU/TCP, Ethernet/IP and proprietary protocols. • The software shall map and transform data between PLC data formats and SCADA database formats, ensuring consistent representation across the system. • The system shall collect real-time data from compressors and dispensers including status, pressures, temperatures, flow rates and alarm conditions. • The software shall support control command implementation for authorized remote operations of CNG station

S.No.	Category	Requirement Description
		equipment within defined safety parameters. • The system shall integrate alarms from PLC systems into the main SCADA alarm management system with appropriate mapping of severity and category. • The software shall collect and store historical data from PLC systems with appropriate sampling rates and compression. • The system shall monitor performance metrics for CNG station equipment, enabling efficiency analysis and predictive maintenance. • The software shall implement security measures for PLC integration including access controls, command validation and comprehensive audit logging of all control actions. • The system shall provide protocol conversion capabilities for non-standard PLCs to ensure compatibility with the SCADA communication architecture. • The software shall include diagnostic data collection from PLC systems to support remote troubleshooting and maintenance activities.
91	Integration Requirements	**LCNG Stations** • The system shall support communication with various PLC makes and models commonly used in LCNG stations, including but not limited to Modbus RTU/TCP, Ethernet/IP and proprietary protocols. • The system shall implement integration with LCNG station control systems, covering LNG storage, vaporization, compression and dispensing subsystems. • The software shall support appropriate communication protocols for LCNG equipment, including Modbus RTU/TCP, Ethernet/IP and manufacturer-specific protocols. • The system shall map and transform data between LCNG control system formats and SCADA database formats, ensuring consistent representation across the system. • The software shall collect real-time data from LNG storage systems including tank levels, pressures, temperatures and boil-off gas management parameters. • The system shall provide protocol conversion capabilities for non-standard PLCs to ensure compatibility with the SCADA communication architecture. • The system shall interface with vaporization system controls to monitor operating parameters, efficiency metrics and alarm conditions. • The software shall collect data from compression systems including operating status, pressures, temperatures and performance metrics. • The system shall interface with dispensing system controls to monitor sales data, dispenser status and alarm conditions. • The software shall implement control command capabilities for authorized remote operations within defined safety parameters. • The system shall ensure security and validation for all control actions, including authorization verification, command confirmation and comprehensive audit logging. • The software shall provide documentation of all interface specifications, data mappings and control capabilities for LCNG station integration.

S.No.	Category	Requirement Description
92	Integration Requirements	**Cathodic Protection** • The system shall implement integration with cathodic protection monitoring systems, supporting proprietary CP protocols through appropriate protocol conversion. • The software shall map and transform data between CP system formats and SCADA database formats, ensuring consistent representation across the system. • The system shall collect real-time data from transformer-rectifier (TR) units and monitoring systems including pipe-to-soil potentials, output voltages and output currents. • The software shall integrate CP system alarms into the main SCADA alarm management system with appropriate categorization and prioritization. • The system shall collect and store historical data from CP systems with appropriate sampling rates and retention policies for regulatory compliance. • The software shall monitor protection levels across the pipeline network, identifying areas with potential protection issues. • The system shall implement security measures for CP system integration including access controls, data validation and audit logging. • The software shall interface with CP monitoring units using the most efficient communication method available, including direct connection, cellular communication, or API integration. • The system shall provide protocol conversion for proprietary CP monitoring protocols to ensure compatibility with the SCADA communication architecture. • The software shall document all CP system interface specifications, data mappings and alarm configurations to support maintenance and troubleshooting activities.
93	Integration Requirements	**Future Readiness** • The system shall provide standard, documented APIs for third-party system integration to facilitate future expansion and additional system connections. • The software shall include comprehensive documentation of all integration interfaces including data formats, protocols, security requirements and limitations. • The system shall provide testing tools for integration validation to verify compatibility and performance before production implementation. • The software shall support industry-standard protocols including OPC UA, MQTT, REST and SOAP to maximize interoperability with future systems. • The system shall implement an expandable integration framework that can accommodate new types of equipment and systems without requiring core SCADA modifications. • The software shall provide a security framework for external system connectivity with appropriate authentication, authorization, encryption and audit capabilities. • The system shall include open, documented APIs for data access with appropriate security controls and performance management. • The software shall support RESTful web services for modern application integration using standard HTTP methods and JSON data formats. • The system shall support OPC UA and other standard industrial protocols for integration with control and automation systems. • The software shall implement message queue support for asynchronous integration scenarios, ensuring reliable data exchange

S.No.	Category	Requirement Description
		with external systems. • The system shall provide data transformation and mapping tools to facilitate integration with systems using different data models and formats. • The software shall include integration testing and validation tools to verify proper operation before production deployment. • The system shall implement security features for API access control including token-based authentication, rate limiting and comprehensive access logging. • The software shall provide documentation and examples for integration to accelerate future connectivity projects and reduce implementation time.
94	Geographic Area (GA) Control Centers	**GA Control Center Requirements** • The system shall provide dedicated control facilities for each defined Geographic Area (GA) with appropriate monitoring and limited control capabilities for assets within that region. • Each GA Control Center shall be equipped with two Workstations with the required minimum specifications. • The GA Control Center workstations shall support area-specific monitoring and control functions with visibility limited to assets within the defined geographic region. • The system shall provide alarm filtering capabilities at GA Control Centers, showing only alarms relevant to the specific geographic area under supervision. • The software shall implement user permissions limited to the specific geographic area, preventing operators from accessing or controlling assets outside their assigned region. • The system shall maintain continuous synchronization between GA Control Centers and central MMS/BMS systems during normal operations to ensure consistent data and configuration. • The software shall support limited local operations during WAN communication outages, with appropriate functionality to maintain critical monitoring and control within the geographic area. • The system shall implement store-and-forward capabilities to capture all transactions during communication outages and synchronize with central systems when connectivity is restored. • The GA Control Centers shall support the same Ui/UX standards, graphic layouts, alarm management and operational workflows as the central control centers to ensure operational consistency. • The system shall provide clearly defined handover procedures between central and GA Control Centers during normal operations, emergency situations and planned maintenance activities.
95	Geographic Area (GA) Control Centers	**Field Maintenance Equipment** • The system shall provide one Field Maintenance Laptop per Geographic Area (GA) with the required minimum specifications. • The Field Maintenance Laptops shall include all necessary RTU configuration software, diagnostic tools and documentation required for field maintenance activities. • The system shall enable direct connection to field RTUs for maintenance, configuration, diagnostics and firmware updates through appropriate physical interfaces and security controls. • The

S.No.	Category	Requirement Description
		software shall support secure VPN connection to central SCADA systems from field locations, enabling remote access to configuration data, historical information and support resources. • The system shall include all necessary adapters, cables and interface devices required for connection to various field equipment types. • The software shall implement automated backup and synchronization capabilities to ensure field changes are properly documented and incorporated into central configuration management systems. • The system shall provide offline documentation access including equipment manuals, procedures, drawings and troubleshooting guides for use in areas with limited connectivity. • The Field Maintenance Laptops shall include appropriate physical security measures including disk encryption, BIOS passwords and lockable carrying cases to protect sensitive configuration information. • The software shall implement strong authentication and authorization controls for field maintenance applications, ensuring only qualified personnel can perform configuration changes. • The system shall maintain comprehensive audit logs of all maintenance activities performed on field equipment, including configuration changes, diagnostic tests and firmware updates.
96	Geographic Area (GA) Control Centers	**Communication Infrastructure** • The system shall implement secure communication infrastructure between GA Control Centers and the central MMS/BMS using redundant WAN connections. • The software shall prioritize critical operational traffic over routine data transfers to ensure control and monitoring functions remain responsive during network congestion. • The system shall monitor communication health between central systems and GA Control Centers with appropriate alerting for degradation or failures. • The software shall implement data compression and optimization techniques to minimize bandwidth requirements between central systems and GA Control Centers. • The system shall provide appropriate fallback mechanisms for communication failures, including local caching of critical data and configuration information. • The software shall secure all inter-site communications using VPN tunneling, encryption and authentication to prevent unauthorized access or data interception. • The system shall include communication diagnostic tools to troubleshoot connectivity issues between sites, identify bottlenecks and verify security configurations. • The software shall implement bandwidth management to ensure fair allocation of network resources across multiple GA Control Centers during normal and peak operations.
97	Geographic Area (GA) Control Centers	**Operational Procedures** • The system shall provide clearly documented operational procedures specific to GA Control Centers, defining roles, responsibilities and workflows for normal and emergency operations. • The

S.No.	Category	Requirement Description
		software shall implement shift handover tools to document system status, ongoing activities and pending issues when transitioning between operators within a GA Control Center. • The system shall define escalation procedures for issues that cannot be resolved at the GA Control Center level, with clear criteria for escalation and contact information. • The software shall provide collaborative tools for communication between central control room and GA Control Centers during coordinated operations and emergency response. • The system shall implement periodic testing procedures to verify operational readiness of GA Control Centers, including communication, functionality and operator proficiency. • The software shall maintain GA-specific incident logs, operational notes and action items to track issues and improvements relevant to each geographic area. • The system shall provide training materials and simulation capabilities specific to GA operations, enabling operator skill development and scenario-based training. • The software shall implement coordination procedures for maintenance activities that span multiple geographic areas or require central control room involvement.
98	Operator Interface	**General Requirements** • The SCADA operator interface shall be fully web-based and allow the operator to easily and intuitively navigate through the operator displays in a browser-like environment. The operator interface shall be designed for intranet deployment and deliver the benefits of incorporating web technology. • The operator interface shall allow the grouping of SCADA data into logical categories such as process mimics, alarm and event views, historical and real-time trending, faceplates and reports (which can be step-less zoomed and panned in real-time). Furthermore, the process mimics shall contain multiple dynamic layers and visibility groups which become active and visible depending on user privileges, process conditions, zoom level, etc. • The system shall provide multi-touch and gesture controls such as panning & zooming, swipe, clutter & declutter of graphical layers and a larger view of the process. An extensible library of over 500 pre-designed 'intelligent' and customizable visualization objects & templates shall be provided. • The operator interface shall be freely configurable to meet specific application needs. The basic elements that can be enabled as part of the operator environment for supervision and control shall include: a. Layout b. Menu c. Toolbar d. Status line • The operator interface shall, as a minimum, include the following functions: a. Display requests b. Supervisory control c. Alarm and event message display d. Alarm message acknowledge e. Alarm inhibit, poll inhibit, point scan inhibits f. Report and log output request g. Monitor hard copy printout h. Monitor analogue trending i. Manual data entry j. Assignment of console or workstation operating modes k. Display page definition and modification l. Report and log definition, modification and control

S.No.	Category	Requirement Description
99	Operator Interface	**User Interface** • The user interface shall be designed according to modern operator interface principles, focusing on: a. Situational awareness - highlighting abnormal conditions b. Task-based design - organizing displays around operator tasks c. Minimizing unnecessary detail to reduce cognitive load d. Consistent use of colors, symbols and navigation elements e. Clear hierarchy of information with appropriate drill-down capabilities • The operator interface shall utilize a consistent color scheme with the following principles: a. Use of grayscale or muted colors for normal operating conditions b. Bright colors reserved for abnormal conditions, alarms, or for drawing attention c. Consistent color coding for process states (running, stopped, fault) d. Consideration for color-blind users with redundant indicators beyond color • The operator interface shall support screen layouts optimized for various display configurations: a. Single monitor workstations b. Dual monitor workstations c. Quad monitor workstations d. Large format displays and video walls e. Mobile device displays with responsive design • The operator interface shall provide intuitive navigation through: a. Hierarchical navigation from system overview to detailed displays b. Breadcrumb trail showing current location in the display hierarchy c. Favorites or bookmarks for frequently accessed displays d. Context-sensitive navigation based on current alarms or events e. Quick access to recently viewed displays
100	Operator Interface	**Process Visualisation** • The operator interface shall provide comprehensive process visualization capabilities including: a. Schematic representations of equipment and processes b. Dynamic indicators of process values and states c. Animation of process flows and equipment operation d. Integrated trending of process values directly on process displays e. Color and shape changes to indicate equipment and process states • The operator interface shall support multiple visualization techniques including: a. P&ID style displays for process equipment b. Geographical/map-based displays for distributed assets c. Dashboard displays for KPI monitoring d. Tabular displays for data-intensive applications e. Custom visualizations for special requirements • The operator interface shall allow operators to customize certain aspects of their displays including: a. Trend selection and configuration b. Dashboard layout and content c. Alarm filtering and sorting d. Display favorites and shortcuts e. Personal preferences for non-critical visualization elements
101	Operator Interface	**Operator Interaction** • The operator interface shall support multiple interaction methods including: a. Mouse and keyboard for traditional workstations b. Touch screen for control room and field applications c. Multi-touch gestures for modern workstations d. Function keys and keyboard shortcuts for power users e. Context menus for efficient access to common functions • The operator interface shall implement a secure control paradigm

S.No.	Category	Requirement Description
		including: a. Select-before-operate methodology b. Confirmation dialogs for critical operations c. Clear indication of control actions in progress d. Automatic timeout of incomplete control sequences e. Audit trail of all control actions with user identification • The operator interface shall provide feedback mechanisms including: a. Visual confirmation of successful operations b. Clear error messages for failed operations c. Status indicators for in-progress operations d. Notification of changes made by other users e. Command history accessible to operators
102	Operator Interface	**Performance Requirement** • The operator interface shall meet the following performance requirements: a. Display call-up time not exceeding 5 seconds for any display b. Real-time data updates within 2 seconds of change c. Control action response (from operator input to feedback) within 3 seconds under normal conditions d. Smooth animation and transitions without visible lag e. Support for at least 20 concurrent client sessions without degradation • The operator interface shall be designed to maintain performance during: a. High system load conditions b. Large numbers of simultaneous alarms c. Communication disruptions with automatic recovery d. Multiple simultaneous user interactions e. Background activities such as report generation • The operator interface shall be optimized for the network environment by: a. Minimizing bandwidth usage for remote clients b. Supporting compression for low-bandwidth connections c. Implementing intelligent caching mechanisms d. Prioritizing critical data during constrained conditions e. Providing offline capabilities with synchronization when reconnected.
103	Comprehensive Network Line Pack and LUAG Calculations	**Complete Network Coverage** Line pack and Line Unaccounted for Gas (LUAG) calculations shall cover the entire GEL distribution network infrastructure, including but not limited to: • High Pressure (HP), Medium Pressure (MP) and Low Pressure (LP) networks • Steel pipeline network of all diameters and pressure ratings • PE (Polyethylene) pipeline network including all service connections • Distribution mains, service lines and customer connections • All pressure regulation stations and metering points • Complete customer connection infrastructure across all customer categories
104	Comprehensive Network Line Pack and LUAG Calculations	**Pipeline Infrastructure Data Integration** The Bidder shall: • Obtain complete pipeline network data including length, diameter, material and pressure ratings for all network segments • Integrate GIS pipeline mapping data with pressure and flow monitoring points • Create comprehensive network topology models incorporating all pipeline segments • Establish pipeline segment identification and classification systems • Map all pressure regulation points and metering stations within the network

S.No.	Category	Requirement Description
105	Comprehensive Network Line Pack and LUAG Calculations	**SCADA Data Integration for Line Pack Calculations** The Bidder shall integrate real-time data from SCADA system including: • Pressure readings from all monitoring points across the network • Temperature measurements from field instrumentation • Flow rates from custody transfer and check metering stations • Valve positions and operational status from automated systems • Gas quality parameters including composition and heating value • Real-time operational data from all CGS, DRS and metering stations
106	Comprehensive Network Line Pack and LUAG Calculations	**External System Integration for Consumption Data** The Bidder shall integrate consumption data from multiple external systems: **SAP System Integration:** • Daily, monthly and annual consumption volumes for all customer categories • Customer billing data and consumption patterns • Industrial and commercial customer demand profiles • Historical consumption trends and seasonal variations **ERP System Integration:** • Customer master data and consumption allocations • Billing cycle information and meter reading schedules • Customer category classifications and consumption baselines **AMI System Integration:** • Real-time consumption data from smart meters and EVCs • Hourly and daily consumption profiles from industrial customers • Automated meter reading data for commercial customers **Manual Data Sources Integration:** • Periodic meter readings from non-automated customer connections • Manual consumption reports from large industrial customers • Field inspection data and manual logbook entries
107	Comprehensive Network Line Pack and LUAG Calculations	**Line Pack Calculation Methodology** The system shall implement comprehensive line pack calculations including: • Real-time gas inventory calculations for all network segments • Temperature and pressure compensation using actual field measurements • Gas composition adjustments based on supply source variations • Compressibility factor calculations for different gas compositions • Segment-wise line pack calculations considering pipeline material properties • Dynamic line pack variations due to operational changes and demand fluctuations • Historical line pack trending and analysis for operational optimization
108	Comprehensive Network Line Pack and LUAG Calculations	**LUAG Calculation Framework** The Bidder shall implement detailed LUAG calculations covering: **Input Data Sources:** • Total gas input volumes from all supply sources (CGS, interconnects) • Gas purchases and receipt confirmations from upstream suppliers • Gas quality and energy content variations from different sources **Output Data Sources:** • Measured consumption from all customer categories (domestic, commercial, industrial) • CNG station sales data and dispensing records • Industrial customer consumption from EVCs and manual readings • Export volumes to other networks or third parties **System Loss Components:** • Technical losses including leakage estimations and venting operations • Operational losses from maintenance activities

S.No.	Category	Requirement Description
		and system purging • Measurement uncertainties and instrumentation errors • Theft and unauthorized consumption detection and quantification
109	Comprehensive Network Line Pack and LUAG Calculations	**Calculation Engine Requirements** The LUAG calculation system shall: • Perform real-time mass balance calculations across the entire network • Generate hourly, daily, monthly and annual LUAG reports • Implement statistical analysis for LUAG trend identification • Provide variance analysis and exception reporting for unusual LUAG values • Support multiple calculation methodologies for cross-verification • Include confidence intervals and uncertainty analysis in LUAG calculations
110	Comprehensive Network Line Pack and LUAG Calculations	**Data Validation and Quality Assurance** The Bidder shall implement: • Automated data validation rules for all input sources • Cross-verification between SCADA, SAP, ERP and AMI data sources • Data quality scoring and reliability indicators • Exception handling for missing or erroneous data • Manual data entry capabilities with approval workflows • Audit trails for all data modifications and adjustments
111	Comprehensive Network Line Pack and LUAG Calculations	**Reporting and Analytics** The system shall provide comprehensive reporting including: • Real-time line pack status dashboards for operational monitoring • Daily, weekly and monthly LUAG summary reports • Trend analysis and historical comparison reports • Network segment-wise loss analysis and identification • Regulatory compliance reports for PNGRB and other authorities • Executive dashboards with key performance indicators
112	Comprehensive Network Line Pack and LUAG Calculations	**Integration APIs and Data Exchange** The Bidder shall develop: • Real-time APIs for data exchange between SCADA, SAP, ERP and AMI systems • Automated data synchronization schedules with error handling • Standard data formats and protocols for system interoperability • Data archiving and historical data management capabilities • Export capabilities for regulatory reporting and third-party analysis
113	Comprehensive Network Line Pack and LUAG Calculations	**Accuracy and Performance Requirements** The system shall achieve: • Line pack calculation accuracy within ±2% of actual inventory • LUAG calculation precision with monthly variance analysis • Real-time calculation updates within 15 minutes of data receipt • 99.5% system availability for continuous calculation operations • Data integration from all sources with 95% completeness minimum
114	Compliance	**PNGRB Compliance for Open Access Gas Network Regulatory Framework Compliance:** The SCADA system shall include comprehensive gas management capabilities to ensure full compliance with current and upcoming Petroleum and Natural Gas Regulatory Board (PNGRB) guidelines for open access gas networks,

S.No.	Category	Requirement Description
		including but not limited to: • PNGRB (Authorizing Entities in City or Local Natural Gas Distribution Networks) Regulations • PNGRB (Access Code for City or Local Natural Gas Distribution Networks) Regulations • Common Carrier and Contract Carrier obligations • Third-party access provisions and non-discriminatory access requirements **Open Access Network Infrastructure Management:** The gas management system shall support multi-party network operations including: **Network Access Management:** • Multiple gas suppliers injection point monitoring and control • Third-party customer connection point management • Network capacity allocation and reservation systems • Non-discriminatory access monitoring and reporting **Injection and Offtake Point Management:** • Real-time monitoring of all gas injection points from various suppliers • Customer offtake point measurement and validation • Pressure maintenance requirements across injection and offtake points • Gas quality monitoring and compliance at all entry and exit points
115	Compliance	**Dynamic Line Pack and Balancing Calculations** The system shall implement advanced balancing capabilities including: **Real-Time Network Balancing:** • Continuous line pack calculations across entire network for multiple gas sources • Dynamic gas inventory tracking with supplier-wise allocation • Real-time imbalance detection and quantification • Automated balancing alerts and notifications to network users **Multi-Party Gas Accounting:** • Supplier-wise gas injection tracking and allocation • Customer-wise consumption allocation and billing support • Cross-subsidization prevention through accurate cost allocation • Transportation charge calculation based on actual network usage **Operational Balancing Management:** • Daily, weekly and monthly balancing calculations • Imbalance tolerance band management as per PNGRB guidelines • Penalty calculation for tolerance band violations • Cash-out mechanisms for persistent imbalances
116	Compliance	**Nomination and Scheduling System Integration** The Bidder shall implement comprehensive nomination and scheduling capabilities: **Gas Nomination Management:** • Daily gas nomination submission and processing from all network users • Nomination validation against network capacity and technical constraints • Re-nomination processing for operational adjustments • Nomination matching between suppliers and customers **Scheduling and Allocation:** • Hourly gas scheduling based on approved nominations • Real-time allocation adjustments based on actual flows • Pro-rata allocation during network constraints • Priority customer identification and preferential treatment mechanisms **Capacity Management:** • Available network

S.No.	Category	Requirement Description
		capacity calculation and publication • Capacity reservation and allocation systems • Interruptible and firm capacity management • Secondary market support for capacity trading
117	Compliance	**Regulatory Reporting and Compliance Monitoring** The system shall provide automated regulatory compliance including: **PNGRB Mandated Reporting:** • Monthly operational reports including network utilization statistics • Annual network development and expansion reports • Gas quality and safety compliance reports • Non-discriminatory access compliance documentation **Financial and Commercial Reporting:** • Network tariff calculation and justification reports • Revenue sharing and cross-subsidy elimination reports • Third-party access revenue tracking and reporting • Stranded cost recovery and investment tracking **Technical Compliance Reports:** • Network pressure and flow analysis reports • Gas quality monitoring and compliance reports • Safety and emergency response compliance documentation • Network reliability and availability statistics
118	Compliance	**Third-Party Access Management** The system shall support comprehensive third-party access including: **Access Request Processing:** • Online third-party access request submission and tracking • Technical feasibility assessment and approval workflows • Network impact assessment and mitigation planning • Access agreement management and monitoring **Non-Discriminatory Treatment Monitoring:** • Equal treatment verification for all network users • Access denial justification and documentation • Preferential treatment prevention mechanisms • Complaint handling and resolution tracking
119	Compliance	**Market Operations Support** The Bidder shall implement market operation capabilities including: **Gas Exchange Integration:** • Integration with gas trading platforms and exchanges • Real-time price discovery and publication mechanisms • Transaction settlement support for spot and term contracts • Market maker obligations and monitoring **Balancing Gas Procurement:** • Automatic balancing gas procurement from market sources • Least-cost balancing gas selection algorithms • Balancing gas cost allocation among causers of imbalance • Emergency gas procurement mechanisms **Wheeling and Transportation:** • Inter-network gas transportation tracking • Wheeling charge calculation and billing support • Network exit and entry point management • Cross-border gas flow monitoring and reporting
120	Compliance	**Emergency Response and Network Security** The system shall provide enhanced emergency management including: **Supply Security Management:** • Force majeure event impact assessment and response • Emergency gas allocation and rationing mechanisms • Priority customer protection during supply disruptions •

S.No.	Category	Requirement Description
		Alternative supply arrangement coordination **Network Emergency Procedures:** • Automated emergency isolation and sectioning capabilities • Emergency communication systems for all network users • Incident reporting and regulatory notification systems • Business continuity and disaster recovery procedures
121	Compliance	**Data Management and Transparency** The Bidder shall implement comprehensive data management including: **Public Information Disclosure:** • Network capacity and availability information publication • Tariff and pricing transparency mechanisms • Non-discriminatory access policy publication • Network development plan disclosure and consultation **Confidentiality Management:** • Commercial information protection and segregation • Chinese wall implementation between regulated and competitive activities • Data access control and audit trail management • Insider trading prevention mechanisms
122	Compliance	**Future Regulatory Adaptability** The system architecture shall be designed to accommodate: • Evolving PNGRB regulations and guidelines • Additional compliance requirements and reporting formats • New market mechanisms and trading arrangements • Technology upgrades and enhancement requirements • Integration with national gas grid and cross-country pipelines
123	Compliance	**Performance Standards and SLAs** The gas management system shall achieve: • 99.9% availability for critical balancing and nomination functions • Real-time data processing within 5 minutes for all transactions • 100% regulatory reporting accuracy and timeliness • Full audit trail maintenance for minimum 7 years • 24/7 monitoring and support for open access operations
124	Time Synchronization & GPS Requirements	**GPS Time Server Integration** • The GPS time server shall be connected with the SCADA system at MMS. The primary SCADA server at MMS shall be the "Master Clock" for the overall system Date and Time Facility utilising GPS time reference and the entire node on the LAN shall be synchronised with the Master clock with the resolution of 100 msec. In case of failure of Master Clock, the redundant SCADA server shall receive the signals from GPS time server and shall have the Master Clock.
125	Time Synchronization & GPS Requirements	**RTU Time Synchronization** • RTU time synchronization shall be done w.r.t. MMS periodically with the time intervals as system definable parameters. The RTU internal circuitry shall compensate for the delay due to message structure, transmission delay and baud rate to arrive at the correctly matching time. Positive acknowledgement for the time synchronization shall be sent by the RTU. Should there be a discrepancy between time at a remote station and the time received from MMS by telemetered synchronization signal, then

S.No.	Category	Requirement Description
		the remote station local intelligence shall automatically re-set and synchronize local time with MCC time within resolution of 100 msec. This synchronization shall be recorded as an EVENT and printed out.
126	Time Synchronization & GPS Requirements	**System-wide Time Coordination** • All the nodes on the dual LAN at the MMS shall be synchronized with the master clock every one minute permitting maximum 100 msec time difference. Whenever the MMS date and time is set or reset, an automatic synchronizing signal shall be transmitted by telemetry to all remote stations. Any remote station subject to a "Station Failure" shall automatically be sent a synchronization signal on restoration of telemetry. In case of failure of MMS, the LAN equipment & RTU to get synchronized by GPS time server through BMS.
127	Time Synchronization & GPS Requirements	**Time System Infrastructure** • A Gregorian Date and Twenty Four Hour Clock Time Facility shall be incorporated in the MMS equipment. The calendar programme shall automatically compensate date for months of less than 31 days and for leap years. The clock time facilities shall be crystal controlled and battery backed-up to overcome the problems associated with power supply frequency fluctuations and interruption. At the MMS there shall be capability for initial calibration, setting up and subsequent adjustment and correction of date and time.
128	Historical Data Management & Archiving	**Automated Data Archiving** • The SCADA system shall have a mechanism for automatically archiving historical data, onto offline storage media, that has aged beyond a user configurable period. This data is no longer required to be kept on-line in the historical database. The data shall archive to a Write Once, Read Many (WORM), or similar optical storage device, after which the system administrator shall easily purge (or automate the purging) of all archived on-line historical data to make room for new data.
129	Historical Data Management & Archiving	**Flexible Archival Periods** • The Historical Data Subsystem shall allow for different on-line and off-line archiving of data. For example, the system shall allow for events to be kept on-line for a different period than the communications statistics. The SCADA system shall generate an alarm when historical RBDMS tables are nearing capacity. The alarm shall serve to indicate a requirement for additional fine-tuning of the frequency of data archiving and purging or addition of historical disks.
130	Historical Data Management & Archiving	**Data Recovery & Access** • It shall be possible to recover off-line archived data. The system shall provide an interactive utility to access archived information. The SCADA system shall support the on-line access to historical/archived historical data. The Historical system shall support selectable archived data output formats.

S.No.	Category	Requirement Description
		The system shall provide facilities for browsing, searching and retrieving archived historical data with appropriate user interfaces.
131	Historical Data Management & Archiving	**Historical Data Editing** • Occasionally, it may be necessary to edit certain historical data in order to correct errors or omissions caused by upset conditions. The system shall provide a facility to edit this data. It shall be possible for appropriately authorized personnel to edit the online historical database and manually overwrite questionable or missing data. The system shall provide a means of adding or changing the following historical information: Field communication statistics, Real-time values and Accumulator values. If a record is edited, the system shall automatically ensure that the changed data is archived, even if the original data was already archived.
132	Historical Data Management & Archiving	**Advanced Database Features** • The historical RDBMS shall support the following minimum features: Report editing/generation capabilities, Forms editing/generation capabilities, Data integrity checking, transaction recovery capabilities. The historical RDBMS shall support a complete implementation of the SQL Interface language. The historical RDBMS shall support network access to the database from other clients on the network. The historical RDBMS depends on client/server architecture and supports multiple servers, which each operates independently from one another leveraging clustering technologies. The historical RDBMS shall support mirroring/shadowing of the on-line database to a backup storage device. The historical RDBMS shall be ODBC compliant.
133	Emergency Response Personnel Database	**Emergency Response Integration** • The SCADA system shall have built-in programs to assist the operators in taking actions which are complementary with the overall emergency response plan. These shall consist of a database from which the operator can retrieve names and contact information for the responsible emergency response personnel in the area where the incident occurs and the overall emergency response personnel.
134	Emergency Response Personnel Database	**Location-Based Emergency Contacts** • The system shall provide capability to retrieve emergency response personnel information based on geographical location of incidents. The database shall include contact details, roles, responsibilities and escalation procedures for different types of emergencies. The system shall support automated notification and alert mechanisms for emergency situations.
135	Emergency Response Personnel Database	**Emergency Procedures Integration** • The emergency response database shall be integrated with the alarm management system to provide automated guidance and contact information when specific alarm conditions

S.No.	Category	Requirement Description
		occur. The system shall provide step-by-step emergency response procedures and checklists accessible through the operator interface.
136	Advanced Alarm Management Features	**Alarm Inhibition & Control** • Inhibited alarms shall not be annunciated or displayed although an inhibited alarm list shall display all these points having inhibited alarms. The action of inhibiting or enabling alarm shall be logged as event. It shall be possible to disable alarms on individual basis, by page, by alarm category, or for all alarms. When an alarm is disabled, the alarm will be displayed on a separate disabled alarms page so every user of the system can easily determine which alarms have been disabled.
137	Advanced Alarm Management Features	**Alarm Priority & Sound Management** • The system shall provide alarm priority or category. The priority of an alarm shall be identifiable by the color and font settings of the alarm message on the screen. A detailed alarm philosophy has to incorporate in Functional design specification. Sound indication for each alarm category shall be configurable. This must be possible at each station. It shall be possible to have the alarm sound either by internal or external speaker.
138	Advanced Alarm Management Features	**Advanced Alarm Display Features** • It shall be possible to display the following information for each alarm as it appears on an alarm display page: Alarm Tag Name, Location, Alarm Description, Value of the Tag, Alarm Status - Disabled, Acknowledged, Unacknowledged Alarm Category, Alarm Priority, Time & Date in International Formats, Value of any Tag or result of any calculation. It shall be possible to display each alarm category in a different font and color (including flashing colors) dependent on whether the alarm is Active Unacknowledged, Active Acknowledged, Acknowledged Cleared, Unacknowledged Cleared or Disabled.
139	Advanced Alarm Management Features	**Operator Alarm Interaction** • The system shall allow for operator comments to be attached to any alarm when it is acknowledged or later. These operator comments shall either be displayed with the alarm or displayed by clicking on the alarm. It shall be possible to automatically display any graphic display when an alarm occurs or to dynamically change the appearance of any graphical object based on whether an alarm is On, Off, Acknowledged, Communications Error, or Disabled.
140	Advanced Alarm Management Features	**Dynamic Alarm Filtering** • The alarm display shall have a mechanism for operators to dynamically define filtering of alarms by alarm tag, alarm name, alarm description, date/time range, state including sub-states for analogue alarms, type, area, category and priority. The alarm display shall support both proportional and fixed fonts with all alarm fields displayed in properly aligned columns.

S.No.	Category	Requirement Description
141	Advanced Alarm Management Features	**Alarm Reporting Features** • The system shall generate alarm duration reports and current alarms reports. Alarm reports shall include comprehensive statistics on alarm frequency, duration, acknowledgment times and resolution times. The system shall provide capabilities for alarm analysis and trending to identify recurring issues and system performance metrics.
142	Display & Visualization Enhancements	**Bar Chart Display Capabilities** • Analog measurement values and digital values shall also be capable of display as horizontal and vertical bar charts, in which the length/height of the bar shall vary according to the current value of the measurement function. The bar chart displays shall support configurable scaling, colors and threshold indicators for operational awareness.
143	Display & Visualization Enhancements	**Enhanced Trending Features** • The display of trending parameters from the screen should be user configurable up to at least 08 parameters. Facility to access trend data in text file for subsequent processing as required. Facility to select using mouse, the required time period of displayed trend for zooming and to fall back to previous trend screens. It shall be also possible to see the value at a particular time on the trend curve by clicking the mouse on the curve.
144	Display & Visualization Enhancements	**Geographic & Network Displays** • Network and Station Overview Displays (google Geographical map). The system shall provide geographical representation of the network with real-time status indicators, alarm conditions and operational parameters overlaid on map displays. Integration with geographic information systems (GIS) for enhanced spatial awareness and network visualization.
145	Display & Visualization Enhancements	**Advanced Color & Graphics** • Color display capabilities shall include: Integer display with definable color for each different integer value (up to 255 different colors), Threshold display with definable color based on multiple threshold expressions, Gradient display with color change through the spectrum according to the value of an analog tag with definable starting and ending color. The system shall support dynamic color changes based on operational conditions and alarm states.
146	Display & Visualization Enhancements	**Comprehensive Display Types** • The following types of graphics shall, as a minimum, be made available as applicable: Master and Sub Index Displays, CNG stations/Field overall status display, Pipeline single line diagram Displays for all CNG stations/Field, Station Displays, Alarm and Event List Displays, Data Trending, Bar Graph Displays, Electrical parameters, Configuration Management Displays, Database Review Displays,

S.No.	Category	Requirement Description
		Communications status Displays & Communication statistics displays, SCADA System Utility, Support & Diagnostic Displays, SCADA reports.
147	Real-Time Database & API Requirements	**Comprehensive API Suite** • Complete suite of APIs, callable from C/C++ programs shall be provided. It shall be possible to read all real time parameter values, their quality tags, time tags and other attributes using these APIs. It shall also be possible to write parameter values, their quality tags, time tags and other attributes using these APIs. Once parameter values or their attributes are written into the SCADA real time database using these APIs (from a third party software), the SCADA system shall treat these parameters in the same manner as the SCADA system acquired values for all purposes including storing, archiving, controls, etc.
148	Real-Time Database & API Requirements	**Data Exchange Capabilities** • SCADA system shall be able to provide and receive data in excel, csv (comma separated values) and flat files from third party applications. For providing the data, it shall give the EPN Name (Point Id) in one column, Point description in second column and its value in the third column measurement unit in fourth column. For receiving the data, it shall fetch the data in the format mentioned above.
149	Real-Time Database & API Requirements	**OPC Compatibility** • SCADA system shall be OPC compliant to fetch data from third party applications. For this, it should have OPC UA and DA server and OPC UA and DA client as a minimum. It should be able to exchange data with OPC classic versions like OPC 3.0 and OPC 2.0. It shall be able to read values along with quality and time tag and write values along with quality and time tag to the third party applications through OPC. The required parameter shall be configured in the OPC table for exchange of the values with third party applications.
150	Sequential Control & Advanced Control Functions	**Sequential Control Implementation** • The sequential control function shall initiate the execution of previously defined sequence of control command. The function shall be implemented for possible application as per operation and control philosophy. Sequential control shall support complex multi-step procedures with conditional logic, timing constraints and safety interlocks.
151	Sequential Control & Advanced Control Functions	**Multi-step Interactive Control** • Supervisory control functions shall comprise a multi-step interactive procedures to avoid accidental operation of plant items. These interactive procedures to be supported shall include: Start/stop/close/open control, Set point control, Sequential control. Additionally shall follow the

S.No.	Category	Requirement Description
		sequence: Identification of the device to be controlled by cursor positioning, Selection of the device for control, Execution of the control.
152	Sequential Control & Advanced Control Functions	**Control Safety & Verification** • The SCADA system shall lead the operator through all of the correct steps necessary to successfully operate the selected device and minimize the chances of incorrect operation. Using SCL 'command scripts' it shall be possible to automate many of the operators procedures such that mouse click operation is all that is required to change set points, while performing logical checking permissive, authorization checking, check before execute security functions and time out functions.
153	Enhanced Performance Specifications	**Display Response Requirements** • Callup time including display of dynamic points for any graphic display on each HMI of MMS/BMS and RTU HMI: not to exceed 2 seconds. Callup & updation time for any historical trend graphics on each HMI of MMS/BMS and RTU HMI: not to exceed 5 seconds. These performance requirements shall be measured under defined standard operating conditions.
154	Enhanced Performance Specifications	**Historical Data Performance** • Historical data query response times shall meet specific performance criteria for different data ranges and complexity. The system shall provide optimized data retrieval mechanisms for large historical datasets. Performance monitoring and measurement tools shall be provided to verify compliance with specified response times.
155	Calculation & Data Processing Enhancements	**Server Resident Calculations** • The SCADA system shall have host resident (at MMS/BMS) Accumulator points to accumulate running total and yesterday total using the instantaneous flow rate. Server resident analog accumulator points shall be configurable for various totalizing and calculation requirements.
156	Calculation & Data Processing Enhancements	**Advanced Arithmetic Functions** • The arithmetic operators will include as a minimum +, -, *, /, SQRT, MAX, MIN. and logical operators will include AND, OR, NOT functions on the real time operational parameters. The calculation tool shall also include all types of database access and starting of programs with features of specifying customer specific formulae.
157	Calculation & Data Processing Enhancements	**Custom Calculation Engine** • These calculated results can be embedded for the purpose of display, reports etc. The system shall support user-defined calculation algorithms and custom mathematical functions. Integration with external calculation engines and third-party mathematical libraries shall be supported where required.

S.No.	Category	Requirement Description
158	Comprehensive Reporting Features	**Operational Reports** • SCADA system shall be able to generate Gas reconciliation reports based on desire frequency like hourly/daily/monthly. For Gas reconciliation system shall also consider Domestic & Commercial consumption based on manual entry or field instruments. Along with above reports following are general reports envisaged: Equipment status report, Equipment Availability Report, Equipment Breakdown Report, SCADA System status reports.
159	Comprehensive Reporting Features	**Report Generation Features** • Report editing/generation capabilities, Forms editing/generation capabilities shall be provided as part of the historical database system. It should be possible to generate other daily/monthly on demand reports. SCADA vendor shall ensure that the correct tag nos. with respect to the parameters list, correct point IDs and calculated variables in the database along with point descriptors are properly incorporated in the various reports.
160	Comprehensive Reporting Features	**Report Formatting & Distribution** • All the reports shall include report header at the center. Reports shall be defined as an output of pre-selected data organized in a specific format. Report software to support output to any of the three defined destinations-screen, printer and memory. Reports shall be printed on demand or on the occurrence of predefined trigger events, such as the time of the day, shift wise, daily, monthly. The SCADA shall allow the definition of new report formats and the modification of existing report formats as a system maintenance mode function.
161	Enhanced User Management & Security	**Multi-level Authorization System** • The facility shall be provided for restriction of access. Using this facility, the names, authorized access level, access codes, duty times and time/date of entry shall be entered. It is intended that access code shall not be displayed when entry is made for reasons of security. Each workstation (including web client workstation and RTU HMI workstation) shall have no. of defined authorization for process control and for control system interaction along with login capability with password protection.
162	Enhanced User Management & Security	**Role-based Access Control** • Each operator login account shall define the level of access and the control for various GAs. The password security shall be built on all workstations including remote workstation for at least 16 divisions, broadly within the following levels: Manager (Top level limited to persons authorized to modify software and allocate access authority called Manager Level. This is in addition to Engineer, Supervisor and Operator privileges), Engineer, Supervisor, Operator. These shall be finalized during FDS stage.

S.No.	Category	Requirement Description
163	Enhanced User Management & Security	**Console & User-based Control** • The HMI to support use of login access control and assignment of control area to the operator either by console basis as well as user login basis. Engineer should be able to access and perform various tasks, such as adding new locations, configuring new devices, managing adapters and so on. However, not all users can perform all tasks. Each user should be associated with one or more roles and each role is assigned a certain set of permissions.
164	Data Polling & Backfilling Requirements	**Configurable Data Polling Intervals** • The time interval for data polling from field devices shall be configurable as per GEL requirements. The system shall support flexible polling intervals ranging from seconds to hours based on the criticality and nature of field parameters. Each field device and parameter type shall be individually configurable for polling frequency to optimize communication bandwidth and system performance while meeting operational requirements.
165	Data Polling & Backfilling Requirements	**Data Backfilling Granularity** • Data backfilling granularity shall be minimum of 1 hour for all field devices. If the polling interval is configured shorter than 1 hour for any specific device or parameter, then that shorter interval shall prevail for data backfilling to ensure no data loss. The system shall automatically determine the appropriate backfilling granularity based on the configured polling intervals for each device.
166	Data Polling & Backfilling Requirements	**Adaptive Polling Management** • The system shall provide intelligent polling management that can automatically adjust polling frequencies based on data variability, communication quality and operational requirements. Priority-based polling shall be implemented where critical parameters can be polled more frequently than non-critical ones. The system shall support event-driven polling in addition to time-based polling for efficient data acquisition.
167	Data Polling & Backfilling Requirements	**Data Recovery & Gap Filling** • In case of communication interruptions, the system shall automatically perform data backfilling once communication is restored. The backfill process shall retrieve all missed data points based on the configured granularity intervals. The system shall provide mechanisms to identify and fill data gaps with appropriate quality flags and timestamps to maintain data integrity and continuity.
168	System Diagnostics & Maintenance	**Comprehensive Diagnostic Framework** • SCADA System shall have comprehensive test facilities and self-diagnostic routines that shall facilitate full functional testing of all subsystem including the modules for workstations, routers, switches, MODEMs etc. Comprehensive diagnostics and the test facility for each sub-system shall be an integral part of the SCADA system.

S.No.	Category	Requirement Description
169	System Diagnostics & Maintenance	**System Health Monitoring** • The system shall provide continuous monitoring of all system components including servers, communication links, field devices and network infrastructure. Automated health checks and status reporting shall be implemented for all critical system elements. Performance monitoring and trending of system parameters shall be provided for proactive maintenance planning.
170	System Diagnostics & Maintenance	**Maintenance & Support Tools** • The system shall provide integrated maintenance tools and utilities for system configuration, database management, user administration and system optimization. Remote diagnostic capabilities shall be implemented for efficient troubleshooting and support. Documentation and help systems shall be integrated into the system for operational support.
171	Primary Function	**Operational Interface** • The primary function of the SCADA system shall be operational interface to support the operation of the complete CGD network of each GA & distribution network. The system shall provide Monitoring and supervisory control facilities. This interface shall provide the capability to acquire data from the facilities of each GA, show abnormal or alarm conditions and remotely change prices and interlock sequences as per the requirement.
172	Data Acquisition	**Field Data Collection** • The data acquisition function shall provide all the aspects needed to support data collection from the field including the requesting of data from RTUs/DRS/ IMS/IEDs etc and the processing and controlling of data received from the same. • All polled data shall be time tagged and quality tagged at the server immediately upon receipt of the data. • All analog polled data shall be checked for High, High-High, Low - Low and Low alarm limit violation at the SCADA server. Similarly all polled inputs shall be checked for alarm violation/events immediately upon receipt of data at the server.
173	Data Acquisition	**Data Types from Field Devices** The following types of data are to be retrieved from the various types of field devices: • Analog data. The configurable ADC features and registers should be available to get the correct value as per the field devices • Digital data like status of valve, compressor Run/Stop etc. • Serial data from DRS, MRS, DCU • Digital Output – control feature to open/close of the valve, start/stop of other system, pumps etc in trip/close. Latched, momentary raise close and other combination. The control point should have interlocking feature to provide the safe, verified and protected command • Analog output – set point, price change to Serial IEDs. The configurable ADC scaling feature should be available to send the correct value as per the field devices. • Accumulator point – The provision should have to accumulate any points (e.g. Flow rate, volume dispensed etc) for yesterday, weekly, fortnightly, monthly, total (last 24 hours value), Running

S.No.	Category	Requirement Description
		total value, hourly average etc • All the control functions to be properly logged with date and time & other relevant information. Each user shall be able to set password
174	Data Acquisition	**Communication Protocols** • The SCADA system shall support DNP 3.0, IEC-5-101, IEC-5-104 and Modbus protocols for polling. It shall be possible to read and write data (analog and digital) directly from IEDs/field devices through serial link using Modbus protocol. The SCADA system shall have provision for all type of Modus functions (e.g. reading and writing of 16 bit registers, 32 bit registers, 64 bit registers, signed, unsigned, LSB and MSB reading etc). • The system shall have the provision for polling through report by exception. • For some devices e.g. for valves, compressors, etc. it shall be possible to use two digital inputs i.e. open status and close status to derive four states of the valve - Open, Close, Travel and Error.
175	Display Requirements	**General Display Requirements** • The SCADA HMI shall support the comprehensive range of displays to enable maximum operational, engineering, maintenance and planning benefit to be obtained from the system. All displays shall be subject to approval by the Client. • The station displays to be split in such a manner to ensure proper view ability and legibility covering all the facilities and covering all the signals & controls as per SCADA telemetry database document • The soft keys/buttons for accessing single line diagrams, station schematic displays, SCADA system status displays, SCADA reports be available at all the time for direct access. Further displays shall have navigation built-in covering Page forward, Page backward, Page up, Page down facilities indicating the corresponding names of the displays for navigation.
176	Display Requirements	**Minimum Display Types** The following list shows the types and numbers of displays that are minimum requirement: • Master and Sub Index Displays • Station Overall status Displays • Single Line Diagram Displays for all stations • Network and Station Overview Displays • Station displays • Alarm and Event List Displays • Data Trending • Trend Buffer Assignment Displays • Bar Graph Displays • Electrical parameters Displays • Configuration Management Displays • Database Review Displays • System Resource and Error Statistics Displays • System Resource [CPU, Memory, Disk loading] • Diagnostics displays • Single point display • Any other customizable display as per the requirement of GEL
177	Display Requirements	**System Status Displays** • The following displays shall show the complete overview of the different equipments i.e. workstations, RTUs, MODEMs, Printers, communication channels etc. showing the status & health of each equipment including RTU, MODEM modules by different color combinations and appropriate text. Whenever change in status of any subsystem is detected by the system self-diagnostic, it shall be

S.No.	Category	Requirement Description
		instantaneously updated in the display. The color schemes for various states of different subsystems and format of the display shall be as defined below • MMS / BMS/ Web Client System Status Display • MMS /BMS/ EMS /RTU/ MODEM Communications Equipment status Displays • Communications status Display & communication statistics displays • RTU, MODEM Status Display • SCADA System Utility, Support and Diagnostic Displays • SCADA report • Display of asking rate for the receiving / dispatch terminals with alarm indication using proper color (when asking rate is more than allowed flow rate be some %) and comparison of contractual and actual pressure / temperatures. • Color Scheme: Green : Normal, Yellow: standby, Red - failed
178	Trending	**Real-time and Historical Trends** • Real time trends and historical trends shall be possible on any parameters or variable like measured variable, set point, output, calculated variable and digital parameters etc., which shall also be capable of being drawn-out on printers as hardcopy. Bidder to ensure that all analog inputs, analog outputs and calculated parameters in SCADA database are configured in both real time and historical database with correct telemetry tag names and engineering units and ranges. • Historical and real time trends shall be done at both the MMS /BMS. It shall be possible to view any historical trends from remote workstation and through Web Client. Also, in case one MMS /BMS is down for certain period, or restoration, the trended data for the down period shall be restored from the other MMS /BMS.
179	Trending	**Trend Display Capabilities** Trend display capability shall be according to the following functional requirements: • Trend displays shall be single line type or bar graph type with additional information like tag no., engineering units, span, present value of the trended point, alarm status etc. displayed. The display of trending parameters from the screen should be user configurable up to at least 08 parameters. • Selection of the tag no. and sampling time for real time and historical trending shall be possible from operator keyboard. • It shall be possible to select no of measurements for sampling and storing over selected polling intervals. • The time periods shall be selectable for any period up to the duration of history archived for all parameters • Exceeding this upper or lower limit shall generate an alarm. However, the alarm shall be capable of being muted by the operator and when muted the alarm shall be signified on the graph by stroke marks. • The trace colours shall not normally match with run time annotation colour. Further to distinguish multiple traces having same run time annotation colour, the different markers shall be used on the trends. • Facility to access trend data in text file for subsequent processing as required. • Facility to select using mouse, the required time

S.No.	Category	Requirement Description
		period of displayed trend for zooming and to fall back to previous trend screens. It shall be also possible to see the value at a particular time on the trend curve by clicking the mouse on the curve.
180	Report and Logging Requirements	**General Reporting** • The SCADA System shall support the definition, generation, assembly, scheduling, buffering, spooling and printing of both logs and reports.
181	Report and Logging Requirements	**Display of Measurement Values** • Further it shall be possible to display the measurement values on the main display panel showing the mimic of any station with all analog measurement associated with the station that are sent to the MMS/ BMS
182	Report and Logging Requirements	**Bar Chart Display of Measurements** • Analog measurement values and digital values shall also be capable of display as horizontal and vertical bar charts, in which the length/height of the bar shall vary according to the current value of the measurement function.
183	Data Archiving	**Archiving Function** • The Bidder shall provide, as an integral part of the system, data archiving functions and facilities at MMS/ BMS. • The archiving process shall automatic except for those tasks where manual operation is a fundamental requirement. • The archiving function shall not interfere with the operational functionality of the SCADA and shall be decoupled from it.
184	Operator and Engineering Functions	**Function Initiation** • All operator and engineering functions shall be initiated from the keyboards and mouse associated with the works stations. • The HMI to support use of login access control and assignment of control area to the operator either by console basis as well as user login basis.
185	Access Security	**Access Control Framework** • The facility shall be provided for restriction of access. Using this facility, the names, authorized access level, access codes, duty times and time/date of entry shall be entered. It is intended that access code shall not be displayed when entry is made for reasons of security. Each workstation (including web client workstation and RTU HMI workstation) shall have no. of defined authorization for process control and for control system interaction along with login capability with password protection. • Each operator login account shall define the level of access and the control for various GAs. The password security shall be built on all workstations including remote workstation for at least 16 divisions, broadly within the following levels. These shall be finalized during FDS stage. Any changes as per the requirement of Client shall be carried out by the bidder. • **Manager:** Top level limited to persons authorized to modify software and allocate access authority called Manager Level. This is in addition to Engineer, Supervisor and Operator privileges.

S.No.	Category	Requirement Description
186	Real Time Variable Calculations	**Computed Variables Capability** • The system shall have capability of defining computed variables (including server resident analog accumulator points) by arithmetic and logical operators from the real time parameters. The arithmetic operators will include as a minimum +, -, *, /, SQRT, MAX, MIN. and logical operators will include AND, OR, NOT functions on the real time operational parameters. • The calculation tool shall also include all types of database access and starting of programs with features of specifying customer specific formulae. • These calculated results can be embedded for the purpose of display, reports etc. • The SCADA system shall have host resident (at MMS/ BMS) Accumulator points to accumulate running total and yesterday total using the instantaneous flow rate.
187	Real Time Database Access	**Third Party Application Interface** The supplied SCADA system shall have necessary provision for interfacing (data interchange) with third party applications etc. To achieve this, the following facilities as a minimum shall be provided with the SCADA system: • SCADA system shall be OPC compliant to fetch data from third party applications. For this, it should have OPC UA and DA server and OPC UA and DA client as a minimum. It should be able to exchange data with OPC classic versions like OPC 3.0 and OPC 2.0 It shall be able to read values along with quality and time tag and write values along with quality and time tag to the third party applications through OPC. • The SCADA system shall read station wise scheduled quantity from the third party applications and write into its Real time database for further calculation of asking rate by SCADA system. • Similarly third party applications shall read and write values along with quality and time tag to the SCADA system through OPC. • The required parameter shall be configured in the OPC table for exchange of the values with third schedule Applications
188	Real Time Database Access	**API Suite and Data Exchange** • Complete suite of APIs, callable from C/C++ programs shall be provided. • It shall be possible to read all real time parameter values, their quality tags, time tags and other attributes using these APIs. It shall also be possible to write parameter values, their quality tags, time tags and other attributes using these APIs. Once parameter values or their attributes are written into the SCADA real time database using these APIs (from a third party software), the SCADA system shall treat these parameters in the same manner as the SCADA system acquired values for all purposes including storing, archiving, controls, etc. • SCADA system shall be able to provide and receive data in excel, csv (comma separated values) and flat files from third party applications. For providing the data, it shall give the EPN Name (Point Id) in one column, Point

S.No.	Category	Requirement Description
		description in second column and its value in the third column measurement unit in fourth column. For receiving the data, it shall fetch the data in the format mentioned above.
189	Gas Reconciliation Reports	**Report Generation** • SCADA system shall be able to generate Gas reconciliation reports based on desire frequency like hourly/daily/monthly. For Gas reconciliation system shall also consider Domestic & Commercial consumption based on manual entry or field instruments. • Along with above reports following are general reports envisaged: Equipment status report, Equipment Availability Report, Equipment Breakdown Report, SCADA System status reports. • It should be possible to generate other daily/monthly on demand reports • SCADA vendor shall ensure that the correct tag nos. with respect to the parameters list, correct point IDs and calculated variables in the database along with point descriptors are properly incorporated in the various reports. All the reports shall include report header at the center.
190	Set Point Control	**Set Point Control in SCADA Screen** The set point control function shall be used to provide a set point for controllers. Operator shall have a facility to change flow and pressure set points manually from SCADA. The action required to perform the above steps shall be as follows: • Select a display which shows the required controller. Position the cursor to the required controller and click the controller symbol. At this stage the permissive and flags (for local /remote modes) are checked. In case not valid then suitable message to be displayed and printed as event, otherwise message Set-Point Control Initiated shall be displayed. • The operator shall verify that the correct point has been selected, enter the new set point value. This step shall be supervised, if the value is not entered within defined period, then the same shall be automatically cancelled and the dialogue box cleared. For entry of set point made within this time the event set point control selected shall be generated. • For Set point change from SCADA to be permitted when controller remote/local switch (digital input to the RTU) is in remote mode, otherwise suitable message that permissive is not available to the generated. • The operator shall issue a 'control after select' command which shall cause the RTU to rout the selected set point analog output value to controller. Any command other than 'control after select' shall cause the RTU to cancel the selection. Further if the 'control after select' is not received within a predefined period, the RTU shall automatically reset the circuit cancelling the selection. • Executed the elected set point control function. This enables set point command to be sent to RTU and then out of the RTU. This step shall be supervised, if the value is not entered within defined period, then the same shall be automatically cancelled and the dialogue box cleared. • The actual set point feedback signal is an analog in put to the RTU coming

S.No.	Category	Requirement Description
		from the controller in both local & remote modes. • All the messages for set point changes shall be properly listed as event. The Event message for "Set point control initiated", "Set point control selected", "set point control executed", "set point successfully changed" etc be available in the event summary and also printed.
191	Display Requirements	**Measurement Display** • Further it shall be possible to display the measurement values on the main display panel showing the mimic of any station with all analog measurement associated with the station that are sent to the MMS/ BMS

11.1.2.AMI Platform Functional Requirements

11.1.2.1. Guiding Principle

- The requirements in this Section define the functional outcomes GEL requires from the AMI Platform. The Bidder may deliver these requirements through a unified combined platform or through separate integrated software components — the architecture is at the Bidder's discretion. What is mandatory is that every requirement in this Section is fully met, demonstrated during the Field Trial/POC and sustained throughout the contractual period.
- References to "HES functionality" and "MDMS functionality" in this Section identify the functional domain of each requirement. They do not mandate a specific product or architecture.
- All requirements in this Section are Mandatory, with the sole exception of the modules classified as Desirable in the module classification table. No deviations are permitted against any Mandatory requirement. Any bid that proposes alternatives to, or exclusions from, any Mandatory requirement listed in this Section shall be considered non-responsive.

11.1.2.2. FRS/SRS Development

The functional requirements set out in this Section are **indicative and representative of GEL's minimum expectations — they are not exhaustive**. The requirements describe what GEL requires the AMI System to do, but they do not represent the complete or final set of functional and system requirements for the project. The Bidder shall treat these requirements as the baseline and shall deliver the full functional capability needed to operate a complete, billing-grade AMI System, whether or not every individual function is explicitly listed in this Section.

- Following contract award, the Bidder shall prepare a detailed Functional Requirements Specification (FRS) and System Requirements Specification (SRS) in consultation with GEL, covering the complete functional scope of the AMI System, all interface and integration requirements, data models, workflows, user roles, reports and system behaviour.
- The FRS and SRS shall expand on the indicative requirements in this Section and shall capture all additional functional and system requirements identified during the detailed design phase, including any requirements raised by GEL's GA Teams, billing team, IT team and SAP team.
- The FRS and SRS shall be submitted to GEL for review and written approval during the Phase 2 (AMI Platform Deployment) stage, before the AMI Platform configuration is finalised. GEL's approval of the FRS and SRS is a prerequisite for proceeding to platform configuration and integration.

- The GEL-approved FRS and SRS shall form the binding functional baseline against which the AMI System is configured, tested (UAT) and accepted at Go-Live. Any function described in this Section, or reasonably implied by it, or subsequently agreed in the approved FRS/SRS, shall be delivered by the Bidder at no additional cost.
- Where a requirement is identified during FRS/SRS development that is a reasonable and necessary part of a complete AMI System but was not explicitly listed in this RFP, the Bidder shall include it in the FRS/SRS and deliver it within the contracted scope. The Bidder shall not treat the absence of an explicit listing in this Section as grounds for exclusion or additional charge.

11.1.2.3. AMI Platform System Architecture and General Requirements

Module	Feature	Requirement
4.2.1 Cloud Hosting	MeITY Empanelment	The AMI Platform shall be deployed on a MeITY-empanelled private cloud with all data centres within India. The Cloud Service Provider shall maintain active MeITY empanelment for the full contractual period including any extensions; loss of empanelment shall require immediate migration to a compliant provider at the Bidder's cost without service disruption to GEL.
4.2.1 Cloud Hosting	On-Premise Restriction	On-premise or hybrid on-premise deployment is not acceptable. The AMI Platform shall be fully cloud-hosted.
4.2.2 High Availability and DR	Primary and DR Sites	The AMI Platform shall operate from a primary cloud data centre and a geographically separate Disaster Recovery site physically and administratively distinct from the primary region.
4.2.2 High Availability and DR	RTO and RPO	Automatic failover to the DR site shall be configured and tested. Recovery Time Objective shall be four hours or less. Recovery Point Objective shall be one hour or less.
4.2.2 High Availability and DR	DR Drills	The Bidder shall conduct quarterly DR drills with documented results submitted to GEL within 10 working days of each drill.
4.2.2 High Availability and DR	DR Failover Demonstration	A live DR failover test shall be conducted as part of UAT before Go-Live acceptance is requested; successful completion is a mandatory UAT exit criterion.
4.2.3 Scalability	Metering Point Scale	The AMI Platform shall support the contracted metering scope and shall be scalable to a minimum of 7,000 metering points without architectural change, performance degradation, or additional per-node licence cost beyond the contracted rate.
4.2.3 Scalability	Concurrent Users	The platform shall support a minimum of 100 concurrent GEL users, scalable to 150 concurrent users without architectural change or additional per-user licence cost.
4.2.3 Scalability	Horizontal Scaling	The platform shall be built on an open, distributed architecture that scales horizontally through addition of hardware without performance degradation.

Module	Feature	Requirement
4.2.4 COTS Platform	COTS Requirement	The Bidder shall deploy a COTS AMI Platform. Bespoke core platform development is not acceptable.
4.2.4 COTS Platform	Utility References	The Bidder shall demonstrate at least two live utility references for the proposed AMI Platform at the time of bid submission.
4.2.5 Hardware Standards	New Hardware Only	All hardware supplied under this contract shall be newly manufactured. Refurbished or previously deployed hardware is not acceptable.
4.2.5 Hardware Standards	EOL/EOS Restriction	No hardware component, software product, operating system, database, or middleware forming part of the AMI System shall be at or beyond its End-of-Life or End-of-Support date at the time of supply.
4.2.5 Hardware Standards	Manufacturer Support Life	All components shall carry a minimum remaining manufacturer support life of five years from the planned Go-Live date.
4.2.6 Layered AMI Architecture	Four Functional Layers	The AMI Platform shall implement four functional layers: HES (Head-End System), MDMS (Meter Data Management System), NMS (Network Management System) and EMS (Enterprise Management System). All four layers shall be operational before Go-Live acceptance.
4.2.7 Device Hierarchy	Logical Hierarchy	The AMI Platform shall organise all connected devices within a logical hierarchy covering at minimum: Geographical Area (GA) → Zone/District → Customer Type (Industrial/Commercial) → Location → Device. All reports, dashboards and drill-down navigation shall support each level of this hierarchy.
4.2.8 Platform Visualisation	Operational Status View	The AMI Platform interface shall visualise device communication status, scheduled and re-dial activities, customer locations, data collection status and data validation and sharing status across the deployed network.
4.2.9 Platform Health and Capacity	Automated Health Checks	The Bidder shall implement automated health checks across all platform components — application, database, communication and integration services — with automated alerting to GEL for any abnormal condition without manual intervention.

Module	Feature	Requirement
4.2.9 Platform Health and Capacity	Capacity Dashboard	The Bidder shall provide GEL with a platform capacity dashboard covering storage utilisation, processing load and connectivity bandwidth trends, with configurable threshold alerts for capacity planning.
4.2.10 Bandwidth Recommendation	GA and Head Office	The Bidder shall estimate and recommend minimum bandwidth requirements for each of GEL's GA offices and head office to access the cloud-based AMI Platform; this recommendation shall be submitted as part of Phase 2 deliverables.
4.2.11 Location Hierarchy	Logical Device Grouping	The AMI Platform shall support a logical location hierarchy for all devices covering at minimum: Geographical Area (GA) → Zone/District → Customer Type (Industrial/Commercial) → Location → Device. All reports, dashboards and alerts shall support drill-down at each level of this hierarchy.
4.2.12 Platform Health Monitoring	Automated Health Checks	The Bidder shall implement automated health checks across all platform components — application, database, communication and integration services — with automated alerting for abnormal conditions without manual intervention.
4.2.12Platform Health Monitoring	Capacity Dashboard	GEL shall be provided with a platform capacity dashboard covering storage utilisation, processing load and connectivity bandwidth trends, with configurable threshold alerts for capacity planning.
4.2.13 Maintenance Mode	Device and Group Maintenance	The AMI Platform shall support maintenance mode for individual devices or device groups, with appropriate alarm suppression during planned maintenance activities. Maintenance mode shall be time-limited and shall auto-cancel if not closed within the configured period.
4.2.13 Maintenance Mode	Maintenance Activity Logging	All maintenance activities performed on assets shall be logged with the action taken, the user responsible and the outcome.
4.2.14 Layered AMI Architecture	HES-MDMS Pre-Integration — Acceptable Options	Where HES and MDMS functionality are delivered as separate products, the following options are acceptable: (a) a single unified COTS platform — preferred; (b) separate COTS products from the same OEM, pre-integrated by that OEM, with documented proof; (c) separate COTS products from different OEMs pre-integrated as a documented partnership, with at least one prior reference deployment of the same product combination and documented operational performance metrics.

Module	Feature	Requirement
4.2.14 Layered AMI Architecture	HES-MDMS Pre-Integration — Unacceptable Approaches	The following are not acceptable: bespoke integration developed by the Bidder at implementation time; middleware-only stitching without native data flow; HES-to-MDMS data flow requiring manual export-import, batch file transfer at intervals greater than 15 minutes, or operator intervention as the primary mechanism.
4.2.14 Layered AMI Architecture	Pre-Integration Evidence	For Option (b), the bid shall include documentation of pre-integration architecture, data flow and at least one prior reference deployment. For Option (c), a joint OEM declaration confirming the partnership and commitment for the contractual period is mandatory in addition.
4.2.15 Platform Module Implementation	Minimum Module List	The Bidder shall implement separate functional modules within the AMI Platform covering at minimum: device communication, data collection scheduling, data validation and management, billing integration, alarm and event management, asset management, reporting and analytics, user access management and GEL staff mobile application.

11.1.2.4. Interoperability and Open Standards

Module	Feature	Requirement
4.3.1 Open Interface Standards	No Proprietary Lock-In	The AMI Platform shall be built on open, documented standards at every layer. No proprietary interfaces that prevent GEL from independently connecting third-party systems, onboarding new field devices, or migrating to an alternative platform are acceptable.
4.3.1 Open Interface Standards	API Documentation	Complete API documentation shall be provided to GEL on delivery and updated whenever the platform API changes; documentation shall cover all northbound, southbound and integration interfaces.
4.3.2 Field Hardware Agnosticism	Post-Contract Flexibility	At contract expiry, GEL or its successor shall be able to onboard field devices from any compliant manufacturer through the platform's open APIs and standard protocol interfaces — Modbus RTU/TCP, DLMS/COSEM, MQTT — without requiring architectural change to the AMI Platform.

Module	Feature	Requirement
4.3.2 Field Hardware Agnosticism	UAT Demonstration	The Bidder shall demonstrate field hardware agnosticism during UAT by simulating the onboarding of a device from a manufacturer different from the originally deployed hardware.
4.3.3 Standard Data Models	Integration Standards	All integration interfaces shall conform to industry-standard data models — including IEC 61968-9 CIM or equivalent — as agreed with GEL before Go-Live.
4.3.3 Standard Data Models	HES-MDMS Interface Standard	The native HES-to-MDMS interface shall use IEC 61968-9 CIM messaging or an equivalent industry-standard data model; the interface shall exist at the time of bid submission and shall not be a deliverable to be built at implementation; real-time data synchronisation shall not exceed five minutes for billing-grade data.

11.1.2.5. Device Communication and Data Acquisition

Layer 1 — Head-End System (HES) Functionality

Module	Feature	Requirement
4.5.1 Device Registration	Automatic Discovery	The HES shall automatically discover and register every field device on commissioning without manual intervention beyond initial provisioning.
4.5.1 Device Registration	Device Profile Storage	The HES shall store a complete profile per device including: device type, OEM, model, hardware version, firmware version, device IDs, communication module ID, GPS coordinates, metering location association and logged-in/out timestamps.
4.5.1 Device Registration	Multi-Device Type Support	EVC Modems and PD meter MIUs shall be handled through a unified registration workflow with device type driving the appropriate data handling path.
4.5.2 Communication Protocols	Modbus	The HES shall support Modbus RTU and Modbus TCP for EVC communication.

Module	Feature	Requirement
4.5.2 Communication Protocols	DLMS/COSEM	The HES shall support DLMS/COSEM per IEC 62056 for device types requiring this protocol.
4.5.2 Communication Protocols	MQTT and REST	The HES shall support MQTT and REST APIs for cloud-native device communication.
4.5.2 Communication Protocols	Proprietary Protocols	The HES shall support all proprietary EVC OEM protocols required by the OEMs in GEL's network.
4.5.2 Communication Protocols	Backward Compatibility	Backward compatibility with all existing protocol versions across EVC OEMs in GEL's network shall be maintained.
4.5.3 Multi-Network Support	NB-IoT	The HES shall support 4G LTE with 2G fall back and NB-IoT connectivity.
4.5.3 Multi-Network Support	Technology-Agnostic Operation	Devices on different communication technologies shall be managed through a single unified interface with no operational differentiation visible to the GEL user.
4.5.4 Bidirectional Communication	Push and Pull	Both device-initiated push and system-initiated pull communication shall be supported.
4.5.4 Bidirectional Communication	Unicast and Multicast	Unicast (single device) and multicast (device group) communication shall be supported for reads and configuration commands.
4.5.5 Data Collection	Minimum	The HES shall collect data at a minimum: Each device shall record metering data at hourly intervals (or stored logs in EVC could be fetched by the modem as required) and shall push, in push (device-initiated) mode, all twenty-four (24) hourly readings for a day to the AMI Platform at least once per day. Each device shall record all alarms and events as they occur and shall push them to the AMI Platform on its next hourly listening-window wake, clubbed with the hourly data push, with a maximum latency of one hour.

Module	Feature	Requirement
		Hourly pull-request check (listening window). Each device shall establish a session with the AMI Platform **at least once every hour** and check for and execute, any pending pull request, configuration push, or queued command from the platform. **Operational data push to EMS and NMS on each wake.** On each hourly wake, in addition to the above, each device shall push its own operational and health telemetry to the EMS and the NMS
4.5.5 Data Collection	GEL Flexibility	GEL reserves the right to modify the data collection frequency, tier structure and parameters for any device or device group at any time during the contractual period; the Bidder shall implement such changes within a timeline agreed with GEL at no additional cost.
4.5.5 Data Collection	Comprehensive Parameter Collection	All parameters present in the hourly logs of connected EVCs and MIUs shall be collected and transmitted to the AMI Platform at the configured periodicity; no parameter available from the device shall be excluded from collection without GEL's written agreement.
4.5.5 Data Collection	Customer Grouping	The AMI Platform shall support customer grouping by customer type (Industrial/Commercial), geography, GA, billing cycle (7-day, 10-day, 15-day) and any other configurable filter as required by GEL.
4.5.6 Scheduled Dialing	Configurable Schedule	Scheduled data acquisition shall be configurable per device and per parameter with frequencies from real-time to daily.
4.5.6 Scheduled Dialling	Automatic Re-Dial	On communication failure, the HES shall automatically re-dial with configurable retry count and interval per device type. A configurable threshold shall be set above which retry failures trigger an alarm rather than further retry.
4.5.7 On-Demand Read	Individual Device	On-demand read for any individual device shall be available at any time with results available within 5 minutes for 95% of requests.
4.5.7 On-Demand Read	Group Read	On-demand read for device groups — by GA, zone, or customer category — shall be supported.
4.5.7 On-Demand Read	Multi-Interface Access	On-demand reads shall be initiatable through the web portal, mobile application and APIs.

Module	Feature	Requirement
4.5.8 Remote Configuration	Alarm Threshold Updates	The HES shall support remote updates of EVC and MIU alarm thresholds for consumption, pressure, temperature and signal strength.
4.5.8 Remote Configuration	Parameter Configuration — Desirable	Remote configuration beyond alarm threshold updates is classified as a Desirable Module per RFP. Where Offered and activated by GEL, the HES shall execute such writes subject to the authorisation, audit trail, safety interlock and read-back verification requirements in the RFP.
4.5.9 Time Synchronisation	NTP-Based Sync	NTP-based time synchronisation shall be maintained across all devices with IST (UTC+5:30) as the mandatory reference.
4.5.9 Time Synchronisation	Drift Alerting Modems	The HES shall verify time synchronisation status per modem with AMI Platform and alert on the drift beyond a configurable tolerance.
4.5.9 Time Synchronisation	Drift Alerting for EVC with Modems	The HES shall verify time synchronisation status between EVC and modems and alert on the drift beyond a configurable tolerance.
4.5.9 Time Synchronisation	Timestamp Integrity	All collected data records shall carry device-side timestamps validated against the IST reference; timestamp integrity is critical for billing accuracy and any record with an invalid or unsynchronised timestamp shall be flagged before VEE processing.
4.5.10 Firmware OTA	Signed Firmware Only	The HES shall accept only digitally signed firmware; integrity validation shall be mandatory before deployment to any field device.
4.5.10 Firmware OTA	Staged Rollout	Firmware delivery shall support staged rollout to configurable device groups, with delivery confirmation tracking per device before proceeding to the next group.
4.5.10 Firmware OTA	Deployment Modes	Firmware updates shall support both single-device (unicast) and group (multicast) deployment.
4.5.10 Firmware OTA	Rollback	Firmware rollback shall be supported if an update causes operational issues; rollback procedures shall complete within 24 hours of identification.
4.5.10 Firmware OTA	Status Visibility	Firmware upgrade status — current version, last upgrade date and upgrade result — shall be visible per device in the platform asset register.
4.5.11 Store-and-Forward	Automatic Backfill	Store-and-forward data from devices shall be automatically ingested on communication restoration with no data loss.

Module	Feature	Requirement
4.5.11 Store-and-Forward	Gap Detection and Conflict Resolution	Data gaps shall be detected and backfilling triggered automatically; conflict resolution for overlapping data periods and duplicate records shall be handled without manual intervention.
4.5.12 Device Listening Window	Minimum One Hour	Every Modem and MIU shall enter listening mode and establish a session with the AMI Platform at least once every hour to check for and execute any pending pull request and queued command. The listening interval shall be configurable by GEL.
4.5.12 Device Listening Window	Independent of Push Schedule	The hourly listening window is the single point at which the device transmits. Scheduled data, pull-request execution, EMS/NMS telemetry and all alarms and events are consolidated into this hourly wake. A device shall not omit an hourly wake on the basis that no scheduled push was due, as the wake is also the alarm-reporting and pull-check opportunity.
4.5.12 Device Listening Window	Monitoring	The NMS/EMS shall record the last listening-window session timestamp per device and shall alert where any device has missed a configurable number of consecutive listening windows.
4.5.12 Device Listening Window	Power Sizing	The Bidder shall size the power arrangement and battery to sustain the hourly listening duty cycle for the full contractual period. Battery depletion shall not be grounds for extending the listening interval.
4.5.12 Device Listening Window	NMS and EMS push	On each hourly listening window, in addition to checking for pull requests, every Modem and MIU shall push its operational and health telemetry — online status, last successful read timestamp, RSSI/SINR per active SIM, active SIM identity, battery/power status, firmware version, packet-loss indicators and self-diagnostic flags — to the NMS and the EMS, without manual intervention.
4.5.12 HES-to-MDMS Data Reconciliation	Record Count Reconciliation	For each device per scheduled collection window, the HES shall log the count of data records dispatched to the MDMS. The MDMS shall log the count of records received for the same device and window. The platform shall automatically reconcile these counts after each collection cycle; any discrepancy between records dispatched by HES and records received by MDMS shall be detected, logged and trigger an automatic retry or alert within 15 minutes.
4.5.12 HES-to-MDMS Data Reconciliation	Reconciliation Dashboard	A reconciliation dashboard shall be available to GEL's IT team showing, per device and per collection window, the dispatch count from HES, the receipt count at MDMS and any outstanding discrepancy. Discrepancies unresolved after 1 hour shall escalate to an alarm.
4.5.12 HES-to-MDMS Data Reconciliation	Monthly Reconciliation Report	A monthly reconciliation report covering HES-dispatched vs MDMS-received record counts across the entire network shall be generated automatically and made available to GEL without the Bidder needing to produce it manually.

Module	Feature	Requirement
4.5.13 EVC HES Fallback	Independent Fallback Path	The Bidder shall provide an independent fallback data path for EVC field data that remains available when the AMI Platform (primary and DR) is unavailable, so that GEL retains visibility of live EVC field data and no EVC field data is lost during a platform outage.
4.5.13 EVC HES Fallback	Delivery Options	The fallback shall be delivered via the individual EVC OEM Head-End System for each EVC make, by one of: (a) the Bidder hosting the OEM HES on the Bidder's infrastructure, ensuring EVC field data flows to it and providing GEL portal access; or (b) ensuring EVC field data reaches the OEM HES and providing GEL direct access to the field data held on it. GEL's access shall carry no separate licence cost to GEL and shall last the full contract period.
4.5.13 EVC HES Fallback	Continuous Availability	The fallback path shall be live and continuously available, not built or activated only after an outage. It may run in parallel with the AMI Platform during normal operation and shall be the means of EVC field-data visibility during an AMI Platform outage.
4.5.13 EVC HES Fallback	GEL Access and Roles	GEL shall have at minimum read access to the EVC field data on the OEM HES, with role-based visibility consistent with RBAC and the NMS/EMS view model.
4.5.13 EVC HES Fallback	Reconciliation on Restoration	On AMI Platform restoration, all EVC field data collected during the outage shall be reconciled into the AMI Platform with no loss, gap or duplication, keeping the AMI Platform as the complete system of record. This is additional to device store-and-forward backfill.
4.5.13 EVC HES Fallback	MIU Scope Exclusion	For PD-meter MIU locations, which have no OEM Head-End System, outage continuity is provided by device store-and-forward and backfill; no OEM HES fallback is required for MIU data.
4.5.13 EVC HES Fallback	Data Ownership and Exit	All EVC field data on any OEM HES, whether Bidder-hosted or OEM-hosted, is GEL data. The Bidder shall ensure GEL access, security per the platform security framework and return or deletion at contract end per the data-portability and exit provisions.
4.5.14 Device Configuration	Configurable Parameters	All device behaviour parameters — data logging interval, push schedule and frequency, listening-window interval, telemetry push frequency, alarm reporting behaviour and profile parameter sets — shall be configurable by authorised GEL users through the AMI Platform, over the air, without vendor involvement or firmware change, within the mandatory minimums in this RFP. Changes shall be versioned with effective dates and a full audit trail.
4.5.14 Device Configuration	Stored Behaviour Profiles	Each Modem shall store multiple named behaviour profiles — at minimum Normal and Power-Saving — each a complete set of configurable behaviour parameters. GEL shall define, edit and assign profiles through the AMI Platform. Devices shall switch profiles on a defined trigger or on GEL command.

Module	Feature	Requirement
4.5.14 Device Configuration	Automatic Power-Failure Switching	At mains-powered EVC Modem locations, on detection of mains-supply failure the Modem shall automatically switch to the GEL-approved Power-Saving profile, configured so the backup battery sustains operation for a minimum of 72 hours (3 days). On mains restoration the Modem shall automatically revert to Normal. Metrology and event logging shall continue throughout; deferred communication shall be buffered and backfilled on reversion.
4.5.14 Device Configuration	Metrology Continuity in Power-Saving	The Power-Saving profile may reduce communication frequency but shall not stop metrology or event recording. No billing or event data shall be lost during a power-failure event; all such data shall backfill on reversion to Normal.
4.5.15 Configuration Impact	Battery-Impact Simulation	Before any device-behaviour configuration is applied, the AMI Platform shall calculate and display the effect of the proposed configuration on device battery endurance: for EVC Modems, the resulting backup-battery autonomy against the 72-hour (3-day) target; for PD-meter MIUs, the resulting battery life against the 5-year target. The calculation basis (current draw per mode, duty cycle, retries) shall be transparent to GEL.
4.5.15 Configuration Impact	Breach Warning and Override	Where a proposed configuration would breach the 72-hour EVC backup target or the 5-year MIU life target, the platform shall warn the user, prevent silent application and require an explicit authorised override, recording the override, the user and the projected impact in the audit trail.

11.1.2.6. Meter Data Storage and Collection

Layer 2 — Meter Data Management System (MDMS) Functionality

Module	Feature	Requirement
4.6.1 Central Data Repository	7-Year Retention	The MDMS shall retain all collected and processed meter data for a minimum of 7 years with full retrieval and export capability for any historical period without impact on current operations.
4.6.1 Central Data Repository	Tamper-Proof Raw Data	Original raw data received from field devices shall be stored in a non-manipulated, tamper-proof state alongside VEE-processed data throughout the retention period; no user, including system administrators, shall be able to modify or delete raw data records.

Module	Feature	Requirement
4.6.1 Central Data Repository	Backup Requirements	Automated data backup shall meet the RPO of one hour; the Bidder shall conduct quarterly backup restoration drills with results submitted to GEL.
4.6.2 Customer Grouping	By Type, GA, Billing Cycle	The MDMS shall support customer grouping by customer type (Industrial/Commercial), geography, GA, billing cycle and any other configurable filter as required by GEL.
4.6.3 Data Archival	Automated Archival	Automated data archival shall be performed at intervals specified in the approved FRS.
4.6.3 Data Archival	Restoration	Archival and restoration procedures shall be documented and demonstrated to GEL before Go-Live; archived data shall be retrievable within a defined SLA.
4.6.4 Data Aggregation	Multi-Level	The MDMS shall aggregate data at DRS, SLP, GA and customer levels for operational reporting and gas balance analysis.
4.6.4 Data Aggregation	Configurable Time Periods	Aggregation shall support hourly, daily, weekly, monthly, quarterly and annual time periods.
4.6.5 Database Integrity Verification	Periodic Integrity Scan	The MDMS shall run automated integrity verification scans on the data store at a minimum weekly frequency, checking for silent data corruption, record count discrepancies, checksum mismatches and referential integrity violations across all metering records.
4.6.5 Database Integrity Verification	Integrity Scan Reporting	Results of each integrity scan shall be logged in an immutable scan log. Any anomaly detected shall generate an alert to the platform operations team and to GEL's designated IT contact within 4 hours of detection. GEL shall receive a monthly summary of scan results as part of the platform health report.
4.6.5 Database Integrity Verification	Remediation	Where an integrity scan identifies corrupted or missing records, the Bidder shall investigate and report the root cause to GEL within 5 working days, restore affected records from backup where possible and log all restoration actions in the immutable audit trail. Records that cannot be restored shall be treated as data loss as per the RFP

11.1.2.7. Validation, Estimation and Editing (VEE)

Module	Feature	Requirement
4.7.1 Validation Rules	Threshold Checks	The VEE engine shall apply configurable upper and lower threshold checks for consumption, pressure, temperature, flow rate and battery voltage.
4.7.1 Validation Rules	Cumulative Register Reconciliation	The VEE engine shall reconcile cumulative register reads against interval-accumulated volumes and flag discrepancies.
4.7.1 Validation Rules	Zero Consumption Detection	Zero consumption over user-configurable durations per customer category shall be detected and flagged.
4.7.1 Validation Rules	Consecutive Identical Readings	Consecutive identical readings — indicative of a stuck meter or communication fault — shall be detected.
4.7.1 Validation Rules	Negative Flow Detection	Negative flow (reverse flow) shall be detected and flagged as a potential tamper event.
4.7.1 Validation Rules	Digit Overflow	Digit overflow in cumulative register reads shall be detected with appropriate correction applied.
4.7.1 Validation Rules	Pulse Coherence	Pulse coherence between MIU and PD meter readings shall be verified per device.
4.7.2 Estimation Methods	Standard Methods	The VEE engine shall implement: maximum and average of past N days; maximum and average of past N similar weekdays; maximum and average of similar blocks across past N similar weekdays.
4.7.2 Estimation Methods	Configurable Per Segment	Estimation method selection shall be configurable per customer segment by authorised GEL users without vendor involvement.
4.7.3 Editing Workflows	Authorized Editing	Authorized GEL users shall manually override validated or estimated values.
4.7.3 Editing Workflows	Reason Code and Authorization	Every manual edit shall require a reason code from a configurable list and an authorisation workflow appropriate to the edit's significance.

Module	Feature	Requirement
4.7.3 Editing Workflows	Audit Trail	Every edit shall be logged with editor identity, timestamp, original value, replacement value and reason code in an immutable trail.
4.7.4 Anomaly-Driven Estimation	Automatic Trigger	The VEE engine shall automatically flag, alarm and trigger estimation when anomalies appear in cumulative register reads, interval reads, or demand register reads.
4.7.4 Anomaly-Driven Estimation	Configurable Workflow	The estimation workflow shall be configurable: auto-application, manual review before application, or estimated value as a suggestion pending GEL approval.
4.7.5 Data Quality Checks	Duplicate Detection	Duplicate records shall be detected and resolved automatically; all instances shall be logged.
4.7.5 Data Quality Checks	Gap Identification	Missing reads per device per scheduled collection window shall be identified and logged automatically.
4.7.5 Data Quality Checks	Corrupt Packet Handling	Corrupt or malformed packets shall be detected, logged and excluded; automatic retry and GA Team notification shall follow.
4.7.5 Data Quality Checks	Manual Reading Entry	The MDMS shall accept manual readings for locations where automated collection has failed and a field read has been obtained; manual entries shall be logged with user identity, date, time, entry method and reason code.
4.7.6 VEE Rule Configuration	User-Configurable	VEE rules shall be configurable by authorised GEL users through the platform interface without vendor involvement.
4.7.6 VEE Rule Configuration	Rule Versioning	Rule changes shall be versioned with effective dates and rationale notes retained in the platform.
4.7.7 Data Quality Report	Daily Automated Report	An automated daily data quality report covering completeness, accuracy and flagged discrepancies shall be generated and made available to GEL's GA Teams.

11.1.2.8. Billing Determinant Calculation

Module	Feature	Requirement
4.8.1 Billing Determinants	Total Gas Consumption	The MDMS shall calculate total gas consumption (SCM) per customer per billing cycle.
4.8.1 Billing Determinants	Energy Consumption	Energy consumption (MMBTU or GJ) shall be calculated using the applicable Calorific Value per customer per billing cycle.
4.8.1 Billing Determinants	Peak Flow	Peak/Maximum Flow Rate (m^3/h) shall be calculated per customer per billing cycle.
4.8.1 Billing Determinants	Imbalance Quantity	Imbalance Quantity (excess consumption over Annual Quantity or Contract Demand) shall be calculated per customer.
4.8.1 Billing Determinants	Average CV	Average Calorific Value ($kcal/m^3$) shall be calculated per customer per billing cycle.
4.8.1 Billing Determinants	ToD Block Consumption	Consumption per Time-of-Day block shall be calculated per customer per billing cycle.
4.8.2 Multi-Cycle Billing	Concurrent Cycles	The MDMS shall run 7-day, 10-day and 15-day billing cycles concurrently with each customer assigned to one cycle.
4.8.2 Multi-Cycle Billing	Independent Operation	Billing determinant extraction shall operate correctly and independently for each customer's assigned cycle.
4.8.3 ToD/Tariff Configuration	Multi-Category Support	Configurable ToD tariff options shall be available by customer category (Industrial PNG, Commercial PNG, CNG), day type (weekday, weekend, public holiday) and season.
4.8.3 ToD/Tariff Configuration	Configurable Time Blocks	ToD blocks shall be configurable by number and duration per customer category.
4.8.4 Special Metering	Check Metering	Check metering at industrial locations shall be handled with separate billing determinant calculation for the check meter alongside the primary meter.

Module	Feature	Requirement
4.8.4 Special Metering	Sub-Metering	Sub-metering at industrial complexes shall support both consolidated and individual billing determinant calculation.
4.8.4 Special Metering	Bi-Directional	Bi-directional metering shall be handled where applicable.
4.8.4 Special Metering	Multiple Meters at Premises	Multiple meters at the same customer premises shall be correctly accounted for in all billing and reporting calculations.
4.8.5 SAP Billing Integration	Automated Delivery	Validated billing determinants shall be delivered automatically to SAP Billing on each customer's scheduled billing date.
4.8.5 SAP Billing Integration	Format Configuration	The SAP upload format shall be agreed with GEL's SAP team before Go-Live and shall be modifiable at GEL's request at no additional cost.
4.8.5 SAP Billing Integration	Multi-Mode Support	Direct API integration and scheduled file transfer modes shall both be supported and configurable by GEL.
4.8.6 Imbalance and Contract Demand	Daily Tracking	Contract Demand utilisation and imbalance quantity shall be tracked per customer on a daily basis.
4.8.6 Imbalance and Contract Demand	Threshold Alerts	Alerts shall be generated when a customer approaches or exceeds Contract Demand or Annual Quantity thresholds.
4.8.7 Manual Reading Entry	Workflow	A workflow for manual reading entry shall be available where automated collection has failed before the billing date.
4.8.7 Manual Reading Entry	SAP Flagging	Manual entries shall be flagged as such in the billing determinant export to SAP, enabling GEL to track manual versus automated reads.
4.8.8 Billing Date Delivery	100% Target	All commissioned meters shall have validated billing determinants available for SAP Billing on or before each customer's scheduled billing date. SLA and penalty provisions
4.8.9 Billing-Date Criticality Monitoring	Incomplete Determinant Flag	Where a complete billing determinant cannot be generated for a metering point due to an unresolved data gap, the platform shall flag the record with a reason code and notify the GA Team, enabling alternate data collection before the billing date.

Module	Feature	Requirement
4.8.9 Billing-Date Criticality Monitoring	Priority Alert	Where a metering point's billing date is approaching and data collection is incomplete, the platform shall generate a priority alert to the GA Team with sufficient lead time for resolution; the lead time threshold shall be configurable per billing cycle length.

11.1.2.9. Asset Management

Module	Feature	Requirement
4.9.1 Asset Repository	Master Data	The MDMS shall maintain a master repository of all installed meter assets including: device ID, make, model, serial number, firmware version, installation date, meter location (premises address), customer information (name, BP number), service line number, meter type, meter configuration parameters, GIS coordinates, SIM ICCID numbers for both SIM slots, current operational status and last successful communication timestamp.
4.9.1 Asset Repository	Configuration Management	Device configuration parameters per asset shall be stored with comparison capability between current and historical configurations.
4.9.1 Asset Repository	Customer Hierarchy	The repository shall maintain associations between each asset and upstream infrastructure (DRS, SLP, CGS, Distribution Main).
4.9.2 Lifecycle Tracking	Status Tracking	Meter and communication equipment status shall be tracked through: Installed, In Service, Faulty, Decommissioned and Removed.
4.9.2 Lifecycle Tracking	Configuration History	Configuration changes shall be tracked with timestamp and authorising user identity.
4.9.3 GIS Information	Coordinate Storage	Longitude and latitude coordinates shall be maintained for every installed device.
4.9.3 GIS Information	Network Association	Associations between devices and upstream infrastructure shall be maintained and visualised on map.

Module	Feature	Requirement
4.9.3 GIS Information	Map Visualisation	A map-based (GIS) view of all connected devices shall be available with real-time status overlays — communicating, non-communicating and alarmed — with GA boundary display and click-through to device-level detail.
4.9.3 GIS Information	Device Health on Map	Real-time device health data — communication status, last successful read timestamp, RSSI for active SIM slot, battery level where reported and firmware version — shall be visible per device through the platform dashboard.
4.9.4 In-Service History	Complete History	Complete in-service location history per device shall be maintained with start and end dates for each location association.
4.9.4 In-Service History	Movement Tracking	Device movements between locations, spare parts use and refurbishment events shall be tracked in the history.
4.9.5 Damage Logging	Damage Events	Damage and deterioration events shall be loggable including corrosion, diaphragm failure and physical damage.
4.9.5 Damage Logging	Attribution	Damage events shall be tagged with cause attribution: customer, operations, or environment.
4.9.6 Bulk Import and Navigation	Bulk Import	Asset data bulk import through file upload shall be supported with validation against existing records and error reporting.
4.9.6 Bulk Import and Navigation	Hierarchical Navigation	Hierarchical navigation from network level to GA level to zone level to individual device level shall be available.
4.9.7 Cross-Replacement Continuity	No Data Loss	Gas consumption history shall be tracked correctly across meter, EVC and MIU replacements with no loss of individual device data.
4.9.7 Cross-Replacement Continuity	Customer-Level Continuity	Consumption continuity shall be maintained at the customer level regardless of changes to the underlying meter, EVC, or MIU.

11.1.2.9.1. A Field Device Maintenance Management

Module	Feature	Requirement
4.9A.1 Maintenance Schedule	Schedule per Device Type	The AMI Platform shall maintain a configurable preventive maintenance schedule per device type (Modem, MIU), specifying the inspection interval applicable to each.
4.9A.1 Maintenance Schedule	Next-Due Visibility	Per-device maintenance due dates shall be visible through the platform, showing last maintenance date, maintenance type performed and next scheduled maintenance date.
4.9A.2 Condition-Based Triggers	Battery Replacement	The platform shall generate a maintenance work order automatically when a device's battery level falls below a configurable threshold, flagging it for battery replacement before failure.
4.9A.2 Condition-Based Triggers	Communication Degradation	Persistent signal quality degradation below a configurable threshold shall trigger a field inspection work order for the affected device.
4.9A.3 Maintenance Work Orders	Auto-Generation	Planned maintenance work orders shall be generated automatically based on schedule or condition trigger and routed to the relevant GA Team through the platform's task management workflow.
4.9A.3 Maintenance Work Orders	Manual Generation	Authorised GEL users shall be able to raise maintenance work orders manually for any device at any time.
4.9A.4 Service History	Per-Device Record	A structured service history shall be maintained per device, recording for each maintenance event: date, maintenance type, technician, findings, action taken, parts replaced and outcome.
4.9A.4 Service History	Accessible from Device View	Service history shall be accessible directly from the device's asset record without requiring a separate search.
4.9A.5 Maintenance Dashboard	Overdue and Due-Soon	A maintenance dashboard shall show devices overdue for scheduled maintenance and devices whose maintenance is due within a configurable look-ahead window, segmented by GA and device type.
4.9A.5 Maintenance Dashboard	Compliance by GA	Maintenance compliance — percentage of devices with current maintenance status — shall be reported per GA.

11.1.2.10. Desirable Modules - Device Lifecycle and Reconciliation

Module	Feature	Requirement
4.10.1 Lifecycle Workflow	End-to-End Lifecycle	A complete device lifecycle workflow shall be implemented covering registration, installation, provisioning, operations, maintenance and decommissioning.
4.10.1 Lifecycle Workflow	Status Transitions	The workflow shall enforce defined status transitions with appropriate authorisation requirements per transition.
4.10.2 Auto-Reconciliation	Installed vs Communicating	Automated reconciliation reports shall identify meters installed but not communicating for a configurable period and shall be generated daily, made available to GA Teams before GEL operations begin the next working day.
4.10.2 Auto-Reconciliation	Segmentation	Reports shall be segmented by GA, communication technology and customer category.
4.10.3 Exception Generation	Non-Performing Devices	Exceptions shall be generated automatically for devices not delivering accurate meter data post-installation.
4.10.3 Exception Generation	Configurable Criteria	Exception criteria shall be configurable per device type and per customer category.
4.10.4 Installation Dashboard	Real-Time Status	A real-time dashboard shall show pending, in-progress, installed and decommissioned device counts by GA at all times.
4.10.5 Real-Time Device Health	Per-Device Visibility	Real-time device health monitoring shall be visible per device through the platform dashboard, covering: communication status, last successful read timestamp, RSSI for active SIM slot, battery level where reported by the device and firmware version.
4.10.5 Real-Time Device Health	Daily Reconciliation Report	Automated meter-vs-communication reconciliation reports shall be generated daily showing: total devices registered, devices actively communicating, devices with complete data collection and devices below the SLA threshold with drill-down to the non-compliant device list; these reports shall be available to GA Teams by the start of GEL's next working day.

11.1.2.11. Alarm, Event and Exception Management

Module	Feature	Requirement
4.11.1 Alarm Framework	Categorisation	Alarms shall be categorised by type — Safety, Device Health, Data Quality, Operational — and by priority: Critical, High, Medium, Low.
4.11.1 Alarm Framework	Configurable Categories	Alarm categories, priorities and escalation rules shall be configurable by authorised GEL users without vendor involvement.
4.11.2 Safety Alarms	Tamper Detection	Magnetic tamper, device cover open and pulse cable cut alarms shall reach the AMI Platform within 1 hour end-to-end from the device event.
4.11.2 Safety Alarms	Reverse Flow	Reverse flow events shall be flagged in real time.
4.11.2 Safety Alarms	Pressure Anomaly	Pressure alarms beyond MAOP or below MOP shall be generated in real time.
4.11.2 Safety Alarms	Power Supply Failure	Power supply failure at any device shall generate a real-time alert.
4.11.2 Safety Alarms	Unauthorised Configuration	Unauthorised configuration attempts at any field device shall generate a real-time security alert.
4.11.3 Device Health Alarms	Low Battery	Low battery alerts shall be generated at configurable charge level thresholds for battery-operated devices.
4.11.3 Device Health Alarms	Communication Module Failure	Communication module failure at any device shall generate an alarm.
4.11.3 Device Health Alarms	Device Malfunction	Device malfunction conditions shall be detected and alarmed.
4.11.3 Device Health Alarms	Metrological Sensor Failure	Metrological sensor failure conditions shall be detected and alarmed.

Module	Feature	Requirement
4.11.3 Device Health Alarms	Pulse Coherence Failure	Pulse coherence failures between MIU and PD meter shall generate an alarm.
4.11.3 Device Health Alarms	Volume Under Alarm	Volume under alarm (Vbs), spare volume and locked spare volume conditions shall generate alarms.
4.11.4 Data Quality Alarms	Zero and False Readings	Zero readings and false readings inconsistent with historical patterns shall be flagged.
4.11.4 Data Quality Alarms	Validation and Upload Exceptions	Cumulative validation exceptions, wrong uploads and data acceptance failures shall generate alarms.
4.11.5 Operational Alarms	Time Sync Issues	Date and time synchronisation issues on any device shall generate an operational alarm.
4.11.5 Operational Alarms	Devices Not on AMI Network	Industries or customers in scope but not connected to the AMI network shall be flagged as operational exceptions.
4.11.6 Configurable Threshold Alarms	Consumption Thresholds	Configurable upper and lower consumption thresholds shall trigger alarms per customer.
4.11.6 Configurable Threshold Alarms	Qmin, Qt and Qmax	Qmin (minimum flow), Qt (transition flow) and Qmax (maximum flow) thresholds shall be configurable per EVC/device in the AMI Platform and shall trigger alarms when breached.
4.11.6 Configurable Threshold Alarms	Pressure and Temperature	Configurable thresholds for pressure and temperature shall trigger alarms.
4.11.6 Configurable Threshold Alarms	Signal Strength	Configurable signal strength thresholds shall trigger communication quality alarms.
4.11.6 Configurable Threshold Alarms	DOQ Threshold Alerts	Configurable Daily Order Quantity thresholds per industrial customer shall be supported; alerts shall be triggered when actual daily consumption exceeds the configured DOQ.
4.11.7 Communication Failure Alerts	Configurable Duration	Alerts shall be generated when a device fails to communicate for a configurable duration.

Module	Feature	Requirement
4.11.7 Communication Failure Alerts	Root Cause Tagging	Alerts shall be tagged with root cause where determinable: signal quality, SIM issue, device hardware, or network outage.
4.11.8 Zero Consumption Alerts	Configurable Per Customer	Zero consumption alerts shall be configurable per customer to accommodate seasonal customers with legitimately extended zero-consumption periods.
4.11.8 Zero Consumption Alerts	Pattern Distinction	The platform shall distinguish expected from unexpected zero consumption based on historical patterns.
4.11.9 Multi-Channel Notification	Channels	Notifications shall be delivered via Email, SMS, WhatsApp and mobile application push notification.
4.11.9 Multi-Channel Notification	Category-Based Routing	Routing shall be configurable per alarm category and per recipient role.
4.11.9 Multi-Channel Notification	Delivery Confirmation	Notification delivery confirmation shall be logged for audit.
4.11.10 Alarm Workflow	Acknowledgement	Alarm acknowledgement by authorised users shall be logged with timestamp and user identity.
4.11.10 Alarm Workflow	Escalation	Unacknowledged alarms shall escalate per configurable rules.
4.11.10 Alarm Workflow	Resolution Tracking	Alarms shall be tracked to resolution with resolution notes mandatory before closure and final timestamp recorded.
4.11.10 Alarm Workflow	Recurring Issue Analysis	The platform shall identify devices with repeated alarm instances of the same type within a configurable rolling period and surface these as priority exceptions for GA Team review.
4.11.12 Communication Logs	All Attempts	Detailed communication logs for all communication attempts — successful, failed and retried — with diagnostic information per device shall be maintained.
4.11.13 Event and Communication Logs	Event Log Search	The event log shall be searchable and filterable by device, alarm type, user, date range and GA.

Module	Feature	Requirement
4.11.13 Event and Communication Logs	Communication Attempt Logging	Detailed communication logs shall be maintained for all communication attempts — successful, failed and retried — with diagnostic information per device and per attempt.
4.11.13 Event and Communication Logs	Maintenance Activity Logging	All maintenance activities performed on field assets — actions taken, user responsible and outcome — shall be logged against the relevant device record with timestamp.
4.11.11 Service Order Generation	Auto-Generation	Service orders shall be auto-generated from configured alarm types including meter stoppage, tampering, communication failures and pressure exceedances.
4.11.11 Service Order Generation	WFM Integration	Service orders shall route to GEL's Workforce Management system through standard APIs.
4.11.11 Service Order Generation	Safety SLA	Gas leak and safety emergency service orders shall carry a mandatory one-hour field response SLA.
4.11.12 Alarm History	Complete History	The full alarm and event history shall be maintained for the retention period.
4.11.12 Alarm History	Trend Reports	Alarm trend reports shall be available by alarm type, device, customer and GA.

11.1.2.12. Revenue Protection and Loss Analytics

Module	Feature	Requirement
4.12.1 Tampering Analysis	Tamper Flag Analysis	The platform shall analyse meter tamper flags — magnetic, cover open — to identify potential revenue loss patterns.
4.12.1 Tampering Analysis	Repeat Event Prioritisation	Repeat tamper events at the same location shall be escalated at higher priority.
4.12.2 Zero Consumption Detection	Pattern-Based	Zero consumption patterns inconsistent with a customer's historical usage shall be detected.

Module	Feature	Requirement
4.12.2 Zero Consumption Detection	Configurable Periods	Detection periods and thresholds shall be configurable per customer category.
4.12.3 DRS/SLP Material Balance	Input vs Output	DRS/SLP-level material balance comparing measured input with aggregate metered output shall be performed to identify Non-Technical Loss.
4.12.3 DRS/SLP Material Balance	Daily Reconciliation	Material balance shall be performed daily; anomalies shall be flagged automatically for investigation.
4.12.4 Configurable Business Rules	User-Configurable	Revenue protection alert business rules shall be configurable through a user interface accessible to authorised GEL users without programming skills.
4.12.4 Configurable Business Rules	Rule Versioning	Rule changes shall be versioned with effective dates and rationale notes.
4.12.5 Field Activity Filtering	Suppression	Revenue protection alerts triggered by authorised field activities — planned maintenance, meter replacement — shall be suppressed when the activity is recorded in the field activity calendar.
4.12.5 Field Activity Filtering	Activity Calendar	A field activity calendar driving alert suppression shall be maintained by authorised GEL users.
4.12.6 Historical Pattern Analytics	Usage Profiling	Historical consumption analytics and profiling shall be available to validate suspected revenue protection cases.
4.12.6 Historical Pattern Analytics	Comparable Customer Analysis	Customer usage patterns shall be comparable against similar customers in the same category and geography.
4.12.7 Investigation Workflow	Case Management	A case management workflow for suspect customers shall allow investigators to log activities, evidence and outcomes.
4.12.7 Investigation Workflow	Multi-User Collaboration	The workflow shall support multi-user collaboration with role-based access.
4.12.8 Service Order for Investigation	Auto-Generation	Service orders for field investigation of suspect cases shall be auto-generated and routed to the appropriate GA Team.

Module	Feature	Requirement
4.12.8 Service Order for Investigation	Outcome Tracking	Investigation outcomes shall be logged back to the case, enabling pattern analysis of revenue protection effectiveness.

11.1.3.CMP Functional Specification

#	Functions	Minimum Specifications
1.	Solution & Platform	The Centralized Monitoring Platform should be Commercial-of-the-shelf (COTS) product.
2.		The Centralized Monitoring Platform should comply with industry open standards.
3.		Must have built-in fault tolerance, load balancing and high availability.
4.		Proposed solution shall be available with complete transparency including operation manuals, help documents and source code for customization.
5.		CMP Solution (consisting of Application, Database and any other component) must not be restricted by the license terms of the OEM from scaling out on sensors or number of cores or processors or servers or no. of domain systems or use cases, etc. during future expansion.
6.		CMP Solution must provide a comprehensive API (Application Program Interface) or SDK (Software Development's Kit) to allow interfacing and integration with third party systems/application and sensors.
7.		The solution should be network and protocol agonistic and provide option to connect various domain systems / devices through API's, DB Connectors, Message broker etc. with either read, write or both options. It should connect diverse on premise and/or cloud platform's and makes it easy to exchange data and services between them.
8.		The platform should be able to normalize the data coming from different devices of same type (e.g. Different lighting sensor from different OEMs, different energy meters from different OEMs etc.) and provide secure access to that data using data API(s) to application developers

#	Functions	Minimum Specifications
9.		System Platform – The platform should provide a common data integration layer which can collect and contextualize information from disparate data sources regardless of protocol. The platform should support templatization to allow “build once-deploy everywhere” functionality. Workflow and Incidents Lifecycle engine – This function should allow users to define and modify new workflows. The workflow could cut across multiple systems via the interfacing modules. Workflow for operational alerts and escalations should be triggered automatically without human intervention. Workflow approvals should have facility to approve from any device with e-signature. This function should provide facility to trigger a corrective action workflow and define the stakeholders for the same. Should manage the life cycle of incidents and related entities via pre-define workflows. The workflow could cut across multiple systems via the interfacing modules. Workflow for operational alerts and escalations should be triggered automatically without human intervention. Incidents Planning – should manage the planning preparations of an incident including resource allocation, tasks management etc. Analytics and MIS – should provide users with business analytics reporting and tools to organize, evaluate and efficiently perform day to day operations Security & Roles – should manage roles definition for internal as well as external access Centralized data archiving for operational data: Should provide facility for centralized storage of operational data (time-series or transactional) with high granularity and data compression capability
10.		The system shall allow seamless integration with all of the department's existing and future initiatives
11.		The platform should be able to integrate with any type of sensor platform being used by GEL irrespective of the technology used.
12.	Convergence of Multiple feeds / services	System needs to have provision to integrate various services and should enable to monitor and operate them. System should have capability to source data from various systems implemented to create actionable intelligence
13.	Compliance to / Support for Industry Standards for the Command & Control Centre Solution	The solution should adhere to the industry standards for interoperability, data representation & exchange, aggregation, virtualization and flexibility
14.		IT Infrastructure Library (ITIL) standards for Standard Operations Plan & Resource Management
15.		Geo Spatial Standards like GML & KML etc.

#	Functions	Minimum Specifications
16.		Business Process Model and Notation (BPMN) or equivalent for KPI Monitoring.
17.	Command & Control Centre Components	Solution should provide web-based, one-stop portals to event information, overall status and details. The user interface (UI) to present customized information in various preconfigured views in common formats. All information to be displayed through easy-to-use dashboards.
18.		Solution to provide a set of services for accessing and visualizing data. Should be able to import data from disparate external sources, such as databases and files. It should provide the contacts and instant messaging service to enable effective, real-time communication. It should provide business monitoring service to monitor incoming data records to generate key performance indicators. It should also provide the users to view key performance indicators, standard operating procedures, notifications and reports, spatial-temporal data on a geospatial map, or view specific details that represent a city road, building or an area either on a location map, or in a list view. The application server should provide security services that ensure only authorized users and groups can access data.
19.	Incident Management Requirements	The system must provide Incident Management Services to facilitate the management of response and recovery operations:
20.		Should support comprehensive reporting on event status in real time manually or automatically by a sensor.
21.		Should support for sudden critical events and linkage to standard operating procedures automatically without human intervention.
22.		Should support for multiple incidents with both segregated and/or overlapping management and response teams.
23.		Should support Geospatial rendering of event and incident information.
24.		Should support plotting of area of impact using polynomial lines to divide the area into multiple zones on the GIS maps.
25.		Should support incorporation of resource database for mobilizing the resources for response.
26.		Should provide facility to capture critical information such as location, name, status, time of the incident and be modifiable in real time by multiple authors with role associated permissions (read, write). Incidents should be captured in standard formats to facilitate incident correlation and reporting.
27.		The system must identify and track status of critical infrastructure / resources and provide a status overview of facilities and systems
28.		Should provide detailed reports and summary views to multiple users based on their roles.

#	Functions	Minimum Specifications
29.		A Reference Section in the tool must be provided for posting, updating and disseminating plans, procedures, checklists and other related information.
30.		Provide User-defined forms as well as Standard Incident Command Forms for incident management.
31.	Integrated User Specific & Customizable Dashboard	Should provide integrated dashboard with an easy to navigate user interface for managing profiles, groups, message templates, communications, tracking receipts and compliance
32.		• Collects major information from other platforms. • Should allow different inputs beyond cameras, such as, PC screen, web page and other external devices for rich screen layout • Multi-displays configurations • Use of, GIS tool which allows easy map editing for wide area monitoring (Google map, Bing map, ESRI Arc GIS map, etc.).
33.		Should provide tools to assemble personalized dashboard views of information pertinent to incidents, emergencies & operations of command center
34.		Should provide historical reports, event data & activity log. The reports can be exported to pdf or html formats.
35.		Should provide dashboard filtering capabilities that enable end-users to dynamically filter the data in their dashboard based upon criteria, such as region, dates, product, brands, etc. and capability to drill down to the details
36.	Device Status, Obstruction Detection and Availability Notification	Should provide icon based user interface on the GIS map to report non-functional device.
37.		Should also provide a single tabular view to list all devices along with their availability status in real time.
38.		Should provide User Interface to publish messages to multiple devices at the same time.

#	Functions	Minimum Specifications
39.	Event Correlation	Command & Control Centre should be able to correlate two or more events coming from different subsystems (incoming sensors) based on time, place, custom attribute and provide correlation notifications to the operators based on predefined business and operational rules in the configurable and customizable rule engine.
40.	Standard Operations Procedures (SOP)	Command & Control Centre should provide for authoring and invoking un-limited number of configurable and customizable standard operating procedures through graphical, easy to use tooling interface.
41.		Standard Operating Procedures should be established, approved sets of actions considered to be the best practices for responding to a situation or carrying out an operation.
42.		The users should be able to edit the SOP, including adding, editing, or deleting the activities.
43.		The users should be able to also add comments to or stop the SOP (prior to completion).
44.		There should be provision for automatically logging the actions, changes and commentary for the SOP and its activities, so that an electronic record is available for after-action review.
45.		The SOP Tool should have capability to define the following activity types:
46.		**Manual Activity** - An activity that is done manually by the owner and provide details in the description field.
47.		**Automation Activity** - An activity that initiates and tracks a particular work order and select a predefined work order from the list.
48.		**If-Then-Else Activity** - A conditional activity that allows branching based on specific criteria. Either enter or select values for Then and Else.

#	Functions	Minimum Specifications
49.		**Notification Activity** - An activity that displays a notification window that contains an email template for the activity owner to complete and then sends an email notification.
50.		**SOP Activity** - An activity that launches another standard operating procedure.
51.	Key Performance Indicator	Command & Control Centre should be able to facilitate measurement or criteria to assay the condition or performance of departmental processes & policies.
52.		**Green** indicates that the status is acceptable, based on the parameters for that KPI, no action is required.
53.		**Yellow** indicates that caution or monitoring is required, action may be required.
54.		**Red** indicates that the status is critical and action is recommended.
55.	Reporting Requirements	Command & Control Centre should provide easy to use user interfaces for operators such as Click to Action, Charting, Hover and Pop Ups, KPIs, Event Filtering, Drill down capability, Event Capture and User Specific Setup
56.		The solution should generate Customized reports based on the area, sensor type or periodic or any other customer reports as per choice of the administrators
57.	Collaboration Tools	Should provide tools for users to collaborate & communicate in real-time using instant messaging features.
58.	Communication Requirements	The solution should adhere to the below mentioned communication requirements.
59.		Provide the ability to search/locate resources based on name, department, role, geography, skill etc. for rapidly assembling a team, across department, divisions and agency boundaries, during emergency
60.		Provide the capability to Invite - Using information provided during the location of those individuals or roles, invite them to collaborate and to share valuable information.
61.		Provide a single web-based dashboard to send notifications to target audiences using multiple communication methods including voice-based notification on Cellular, SMS, WhatsApp, Voice mail, E- mail, etc.

#	Functions	Minimum Specifications
62.		The solution should provide Dispatch Console integrates with various communication channels. It should provide rich media support for incidents, giving dispatchers the power to consolidate information relating to an incident and instantly share that information among responder teams. It should assess the common operating picture, identify & dispatch mobile resources available nearby the incident location. Augment resources from multiple agencies for coordinated response.
63.	Authentication	Use authentication information to authenticate individuals and/or assign roles.
64.	Instant messaging	Provide ability to converse virtually through the exchange of text, audio and/or video-based information in real time with one or more individuals within the emergency management community.
65.	Events and Directives control	Should provide the capability for the events that are produced from a sub- system and are forwarded to the Command & Control Centre. Events could be a single system occurrence or complex events that are correlated from multiple systems. Events could be ad hoc, real-time, or predicted and could range in severity from informational to critical. At the Command & Control Centre, the event should be displayed on an operations dashboard and analysed to determine a proper directive.
66.		Directives issued by the Command & Control Centre should depend on the severity of the monitored event. Directives will be designed and modified based on standard operating procedures, as well as state legislation. A directive could be issued automatically via rules, or it could be created by the operations team manually.
67.	What-if Analysis Tool	The solution should provide the capability to manage the emergencies and in-turn reducing risks, salvaging resources to minimize damages and recovering the assets that can speed up recovery.
68.		To take proactive decisions that help minimize risks and damages, the solution should provide Analytical and Simulation systems as part of the Decision Support System. The solution should help simulate what if scenarios. It should help visualize assets/resources at risk due to the pending/ongoing incident, should render impacted region on a GIS/3D map. The solution should help build the list of assets, their properties, location and their interdependence through an easy-to-use Graphical User Interface. When in What if Analysis mode the solution should highlight not only the primary asset impacted but also highlight the linked assets which will be impacted. The user should be able to run the What-if Analysis mode for multiple types of emergency events such as Bomb Blast, Weather events, Accidents etc.

#	Functions	Minimum Specifications
69.	Resource and Route Optimisation	The system should provide the software component for the message broadcast and notification solution that allows authorized personal and/or business processes to send large number of messages to target audience (select-call or global or activation of pre-programmed list) using multiple communication methods including WhatsApp, SMS, Voice, Email, etc.
70.	Alert & Mass Notification Requirements	Provide a single web-based dashboard to create/generate and send notifications/alert to target audiences using multiple communication methods including voice-based notification on PSTN/Cellular, SMS, Pager, Voice mail, E-mail, etc.
71.		Provide Role based security model with Single-Sign-On to allow only authorized users to access and administer the alert and notification system.
72.	Security & Access Control	Provide comprehensive protection of web content and applications on back-end application servers, by performing authentication, credential creation and authorization.
73.	Internet Security	Comprehensive policy-based security administration to provide all users specific access based on user's responsibilities. Maintenance of authorization policy in a central repository for administration purposes.
74.	Authorization	Should support to enable assignment of permissions to groups and administration of access control across multiple applications and resources. Secure, web-based administration tools to manage users, groups, permissions and policies remotely
75.	User group	Provide policies using separate dimensions of authorization criteria like Traditional static Access Control Lists that describe the principals (users and groups) access to resource and the permissions each of these principals possess.
76.	Provide multi-dimensional access control	SSO to Web-based applications that can span multiple sites or domains with a range of SSO options.
77.	Flexible single sign-on (SSO)	Support LDAP authentication mechanism
78.	Real Time Data Analysis	Should have ability to respond to real-time data with intelligent & automated decisions

#	Functions	Minimum Specifications
79.	Rule Engine & Optimization	Should provide an environment for designing, developing and deploying business rule applications and event applications.
80.		The ability to deal with change in operational systems is directly related to the decisions that operators are able to make
81.		Should have at-least two complementary decision management strategies: business rules and event rules.
82.	Situational Awareness COP (Common Operational Picture)	• The CMP should be able to combine data from various sources and present it as different views tailored to different operator's needs. • The CMP should automatically update the information based on alarms and incidents that are presented to it via the business rules engine. The polling and CMP database refresh cycle shall be configurable to match the status of the situation (whether there is an emergency or crisis or just monitoring only). • Common Operational Picture should comprise of a comprehensive view of the incident or a group of related incidents as on a specific date and time which should include but not be limited to the following: - Tasks assignment and their status - Agencies involved - Resources deployed - Incident status across relevant parameters of the incident e.g. household affected by a transformer shut down - Timeline view of the situation Suggested actions from the system with their status
83.	Task Management	• The system should be able to create, assign, track and report on the lifecycle of tasks during a particular incident. • The system should allow a particular task to be decomposed into sub-tasks. • The system should provide an easy to interpret management dashboard view of the progress of all tasks during an incident. • The system should be able to organise the visual representation of tasks into prioritized list, filtered list, as well as colour coded representation for ease of understanding. • The system should be able to perform the following functions around task management: - Create a task with unique ID. (Subtasks shall follow parent ID with second level numbering). - Assign a target completion date and time for the task, either directly or as a timespan from the task's creation.

#	Functions	Minimum Specifications
		- Date and time stamp of the creation of the task. - Log and track status of tasks. System should provide capability to define status of tasks during its lifecycle. These status definitions could be mapped to other task attributes such as the task type. - Key-word search against task list. 1. • The above attributes shall be colour coded. • The system shall allow the tasks to be filtered on the real-time dashboard by agency then by task status. This filtering should allow an operator to filter for all tasks of a particular state or a combination of state; and by the time remaining until (or time elapsed since) the target completion time. • The system should allow multiple individual workstations to select specific agencies of interest on each workstation simultaneously. • The system should allow GEL to display all agencies' tasks simultaneously as well. • The tasks should be displayed on a real-time timeline. The criticality of tasks should be dynamically changed depending on the performance of the incident response.
84.	Timeline and Charting	• The system should provide a facility to see incidents and actions (tasks) added to the CMP in a tabular list form as well as Gantt chart format filtered by day, week, month, year or any specific date range. • The system should provide a facility to see incidents, actions and interdependencies between actions in a clear visual graphical manner. • The system should be able to filter the information based on at least the following parameters: - Incident information - Resources information - Agency type - Tasks - Criticality or priority
85.	Integration with social media	Should provide integration of the Incident Management application with the social media. Should Provide analytics based on the social media feed collected from the open source intelligence and collate with the other inputs to alert the responders for immediate action on the ground.
86.		Should extract messages and display it in an operational dashboard.
87.		Should be able to correlate the extracted message from the social media with existing other events and then should be able to initiate an SOP.

#	Functions	Minimum Specifications
88.		Should be able to identify the critical information and should be able to link it to an existing SOP or a new SOP should be started.
89.		Should provide notifications to multiple agencies and departments (on mobile) that a new intelligence has been gathered through open source/social media.
90.	GIS Display	**Note:** It is expected that CMP solution proposed should have either inbuilt or integrated capabilities to provide various features GIS/Map display. All necessary licenses required to achieve the said functionalities should be provisioned as part of the proposed solution. The proposed solution shall able to provide following functionalities: • Shall be capable to visualise details on geospatial or fixed composite computer-generated (JPEG, BMP, AutoCAD, etc.) map • Should allow user to view sensor and related name from the displayed map • Should allow all resources, objects, sensors and elements on the map to be geo-referenced such that they have a real-world coordinate. • Should visually display a camera sensor with related camera orientation, camera range and camera field of view angle. • Should visually display an alarming sensor on map • Should visually differentiate sensor alarm severities on map through different color and icon identifiers • Should immediately view alarm details (including description, video, etc.) and investigate the alarm from the map • Should allow user to choose camera and other sensors from map to view live video and the data • Should allow user to choose camera and take live video image snapshot and save to file from any camera • Should allow user to choose camera from map to move PTZ cameras • Should allow users to choose camera to play, pause, stop, fast-forward, rewind, and play recorded video from preset time • Should allow user to choose camera and take recorded video image snapshot and save to file or print from any live or recorded video • Should allow user to jump from one map to the next with a single click of a mouse with map links • Should allow map information “layers” to be displayed/hidden on items such as – - Sensor names - Sensors

#	Functions	Minimum Specifications
		- Sensor range (e.g. camera – orientation, range, field of view angle) - Locations and zones - Perimeter ranges - Resource tracks • Allow user to zoom in/out on different regions of map graphic The proposed solution should be able to import and export the map details along with one or multiple layers in the form of KML files.
91.	Video Display	• Shall view live or recorded video from resizable and movable windows • Should have an ability to perform video controls for video systems from workstation • Shall play, fast-forward, rewind, pause and specify time to play recorded video • Shall take a video still image (snapshot) from live or recorded video • Shall export video for user specified time and duration • Shall have the capability to move PTZ cameras • Shall view Video in Video Matrix • Shall display in 1x1, 2x2, 3x3 and 4x4 window formats • Shall enable operator to specify video windows to be displayed in matrix • Shall enable matrix settings to be saved per user • Shall view either live or recorded video can be displayed in the video matrix window. • Shall enable video snapshot to be taken and saved from any window pane in the matrix view • Shall rotate video in “virtual” video guard tour • Shall rotate through multiple video views based on predefined video camera sequence and duration. • Shall enable the user to pause the rotation of video and resume the video rotation again • Shall enable times between new video to be adjusted • Shall enable both live video and recorded video to be played through the video guard tour. • Shall enable alarms to be generated from any video pane • Shall enable user to only view and control video for which they have been assigned permissions by the administrator • Shall manually create an alarm from the live or recorded video with specified severity and description
92.	Alarm Display	• Should have an ability to display alarm condition through visual display and audible tone • Should have an ability to simultaneously handle multiple alarms from multiple workstations

#	Functions	Minimum Specifications
		• Should have an ability to automatically prioritize and display multiple alarms and status conditions according to pre-defined parameters such as alarm type, location, sensor, severity, etc. • Should display the highest priority alarm and associated data / video in the queue as default, regardless of the arrival sequence
93.	Historical Alarm Handling	• Should have an ability to view historical alarms details even after the alarm has been acknowledged or closed. • Should have an ability to sort alarms according to date/time, severity, type and sensor ID or location.
94.	Alarm Reporting	• Should have an ability to generate a full incident report of the alarm being generated. • Should have an ability to display report on monitor and print report • Should have details of alarm including • severity, time/date, description and location • Captured video image snapshots • Relevant sensor data such as SCADA sensors • Response instructions • Alarm activities (audit trail) • Should have an ability to export alarm report in various formats including pdf, jpeg, html, txt and mht formats • Should have an ability to generate an alarm incident package including the full incident report and exported sensor data from the incident in a specific folder location.
95.	Alarm Policies and Business Logic Administration	• The solution should have the following ability to handle the workflow alarms through graphical user interface. • Should have an ability to match keywords or text from the alarming subsystem's incident description to raise an alarm using criteria including exact match, exact NOT match, contains match, wildcard match and regularly expression match (such as forced door alarm, denied access, door open too long, etc.) • Should have an ability to optionally match alarming subsystem's incident status, incident severity, and sensor type • Should have an ability to apply any alarm policy to one or more monitoring area(s) or zone(s) without having to reapplying the policy multiple times. • Should have an ability to apply any alarm policy to one or more sensors without having to reapply the policy multiple times. • Should have an ability to assign specific actions for each alarm • Should have an ability to activate or deactivate alarms as required • Should have an ability to create exceptions

#	Functions	Minimum Specifications
		• Should Create batch-wise rules and process them • Should Check and rectify logical errors and contradictory rules • Should have an ability to schedule execution of rules • Should Suspend or Terminate the application of rule • Should archive unused or deactivated rules

11.1.3.1. Data lake

Sr. No.	Minimum specification
1.	The data lake must support structured, semi-structured and unstructured data formats to accommodate diverse data types from various sources.
2.	It should include scalable storage architecture, ensuring the capacity to handle growing volumes of data over time without impacting performance.
3.	Integration capabilities with existing systems, including the CMP and the ESB, to allow seamless data flow to and from the data lake.
4.	The data lake must offer robust security features, including access controls, encryption and audit logs, to protect sensitive data.
5.	Support for real-time data ingestion and processing to ensure timely availability of data for analysis and decision-making.
6.	Advanced metadata management tools to facilitate efficient data categorization, search and retrieval procedures.
7.	Capabilities for data governance and compliance, ensuring alignment with regulatory requirements and data management best practices.
8.	High-performance analytics engines integrated within the data lake to support complex data queries and analytical tasks.
9.	Automated data lifecycle management, including data retention and deletion policies, to optimize storage and maintain data relevance.
10.	Compatibility with popular data visualization and business intelligence tools to enable effective data interpretation and presentation.
11.	Provision for disaster recovery and backup solutions to safeguard data integrity and ensure business continuity.
12.	The data lake must support multi-tenancy, allowing for segregation and protection of data belonging to different departments or business units.
13.	Collaboration and data sharing capabilities between users and systems within the organization to enhance data utility and collective insights.
14.	Availability of machine learning and AI integration facilities to leverage advanced analytics and predictive modelling capabilities.
15.	The data lake should provide an API interface for programmatic access, enabling developers to build customized applications and solutions.

Sr. No.	Minimum specification
16.	expected ingestion rates and throughput to ensure the data lake can handle peak loads from various sources including IoT devices, sensors and transactional systems.
17.	Set acceptable latency thresholds for data retrieval and processing to ensure timely analysis and reporting.
18.	Specify how the data lake should interface with existing IT infrastructure, including network specifications and protocols.
19.	Define preferred storage technologies and configurations (e.g., distributed file system, block storage) based on data types and access patterns.
20.	Requirements for data compression algorithms to conserve storage space and improve retrieval times.
21.	Requirements for data replication mechanisms to ensure data availability and fault tolerance across multiple geographic locations.
22.	Specifications for dynamically scaling storage and computational resources based on data influx and processing demands.
23.	Details of network bandwidth and connectivity specifications to ensure reliable and fast data transfer.
24.	Specifications for supported APIs and SDKs allowing integration with third-party applications and tools.
25.	Define requirements for monitoring tools to oversee data lake performance, health and security in real-time.
26.	Robust cybersecurity e.g. Digital Personal Data Protection Act, 2023 (DPDP Act), IT Act (2000) or CERT-In Guidelines.

11.1.3.2. Functional and technical specifications of the Mobile Application Platform

#	Minimum Specifications
1.	Applications and services including all appropriate channels such as SMS, USSD, IVRS and development of corresponding mobile applications leveraging the Mobile Service Delivery Gateway (MSDG) and Mobile App Store.
2.	Application platform should support the latest smartphone mobile OS, including Android 12 and above, IOS 14 and above and modern mobile web apps, ensuring broad compatibility and modern feature access.
3.	Support for target packaging components like mobile websites, hybrid apps, native apps, web apps and applications development. Utilize modern development tooling platforms beyond Eclipse, such as Android Studio and Xcode.
4.	Support the ability to write code once and deploy efficiently across multiple mobile operating systems using frameworks such as React Native or Flutter.
5.	Support integration with native device APIs to access critical features such as GPS, camera, biometrics and notifications.
6.	Support utilization of all native device features, including sensors and biometric authentication, for enhanced user experiences.
7.	Support development of applications using contemporary programming languages like Kotlin, Swift, or JavaScript (via frameworks like React Native).
8.	Support integration with mobile vendor SDKs for app development, testing, analytics and enhancement processes.

#	Minimum Specifications
9.	Support for HTML5, CSS3 and advanced JavaScript standards (ES6 and above) to ensure modern, responsive design capabilities.
10.	Support common protocol adapters for connections to back-office systems, accommodating RESTful APIs, JSON, XML, HTTP, HTTPS and SOAP formats.
11.	Support seamless data transformation capabilities, including JSON to XML transitions and XHTML message handling, ensuring system compatibility.
12.	Support multilingual services and comprehensive localization capabilities to cater to diverse user language preferences.
13.	Support robust encrypted messaging between server and client components, adhering to modern encryption standards like TLS 1.3 for maximum data protection.
14.	Ensure the application is compliant with accessibility standards (such as WCAG) providing an inclusive experience for users with disabilities.
15.	Include support for Progressive Web Apps to provide an app-like experience on the web without requiring downloads from app stores.
17.	Seamless data sync between online and offline modes.

11.1.4.Cross Cutting Common Functionality

11.1.4.1. Network Management System (NMS) Functionality

Module	Feature	Requirement
4.13.1 Network Topology	Topology View	The NMS shall provide a topology view of all field communication devices segmented by GA, zone and communication technology.
4.13.1 Network Topology	Real-Time Connectivity Status	The view shall show real-time connectivity status per device: online, offline, or degraded.
4.13.2 Device Communication Health	Online/Offline Tracking	Online and offline status per device shall be tracked with last successful communication timestamp and consecutive failure count.
4.13.2 Device Communication Health	SNMP or Native Telemetry	Communication health shall be tracked through SNMP or native device telemetry based on device capability.

Module	Feature	Requirement
4.13.3 Signal Quality Tracking	RSSI and SINR	RSSI and SINR (or equivalent quality indicator) per device shall be tracked and retained for the full contractual period.
4.13.3 Signal Quality Tracking	Packet Loss	Packet loss percentage per device shall be tracked.
4.13.3 Signal Quality Tracking	Configurable Thresholds	Configurable quality thresholds shall trigger network performance alerts.
4.13.4 SIM-Level Monitoring	Per-SIM Tracking	Active SIM identity, data usage per billing cycle, per-SIM signal quality and failover events between primary and secondary SIM shall be tracked per device.
4.13.4 SIM-Level Monitoring	Per-Operator Statistics	Per-operator performance statistics shall be available in reports to inform GEL's SIM operator selection decisions.
4.13.5 Network Fault Detection	Automated Detection	Automated fault detection shall trigger alerts when devices fail to communicate within configured thresholds.
4.13.5 Network Fault Detection	Notification	Faults shall trigger notifications through Email, SMS and mobile application push.
4.13.6 Remote Device Control	Modem Reboot	Remote modem reboot shall be supported.
4.13.6 Remote Device Control	SIM Switchover	Remote SIM switchover commands shall be supported.
4.13.6 Remote Device Control	Configuration Push	Remote network configuration push — APN, retry parameters — shall be supported.
4.13.7 Performance Reports	Communication Success Rate	Communication success rate shall be reported per device, per zone and per GA.
4.13.7 Performance Reports	Signal Quality Distribution	Signal quality distribution across the network shall be reported.

Module	Feature	Requirement
4.13.7 Performance Reports	SIM Failover and TSP Outage	SIM failover frequency and TSP-attributable outage time per operator shall be reported.
4.13.8 Root-Cause Categorisation	Fault Classification	Communication failures shall be categorised as: signal quality, SIM issue, device hardware, network outage, planned maintenance, GEL-attributable, or TSP-attributable.
4.13.8 Root-Cause Categorisation	SLA Linkage	Root-cause categorisation shall drive SLA exclusion application.
4.13.9 TSP Coordination	Operator Interface	Where supported, the NMS shall interface with TSP networks to view operator-side planned outages and coverage advisories.
4.13.9 TSP Coordination	Bidder Responsibility	The Bidder shall coordinate directly with each TSP for network-level issues; GEL shall not be required to manage TSP relationships on the Bidder's behalf.

11.1.4.2. SLA Monitoring and Compliance Reporting (EMS)

Module	Feature	Requirement
4.14.1 SLA Authority	Authoritative Source	The EMS shall be the authoritative and sole reference for SLA performance calculation and penalty computation.
4.14.1 SLA Authority	Automated Capture	All SLA events shall be captured automatically without manual entry by the Bidder.
4.14.2 Device-Level Tracking	Uptime	Per-device uptime shall be tracked as the percentage of scheduled data collection windows in which the device successfully transmitted data.
4.14.2 Device-Level Tracking	Communication Success Rate	Per-device communication success rate shall be tracked over each quarter.
4.14.2 Device-Level Tracking	Data Quality Metrics	Per-device data quality metrics — completeness, accuracy and validation pass rate — shall be tracked.

Module	Feature	Requirement
4.14.3 Billable Days	Per Device Per Quarter	Pro-rata billable days per device per quarter shall be calculated using the methodology.
4.14.3 Billable Days	Daily Rate	Daily Rate = Annual Per-Device Rate ÷ 365. The EMS shall apply this formula per device.
4.14.4 Quarterly Compliance Report	Automatic Generation	Quarterly compliance reports shall be generated automatically at the end of each quarter.
4.14.4 Quarterly Compliance Report	Standard Format	Reports shall follow a format agreed with GEL before Go-Live, suitable for attaching to the quarterly invoice.
4.14.5 Immutable Event Log	No Modification	The Bidder shall not modify, delete, or override any recorded SLA event.
4.14.5 Immutable Event Log	Correction Exception	Where a correction to an incorrectly recorded event is required, it shall follow a documented exception process requiring GEL's prior written consent.
4.14.6 GEL Independent Access	Always-On Read-Only	GEL shall have direct, independent, read-only access to all EMS data at all times without requiring any Bidder action or approval.
4.14.6 GEL Independent Access	Disable Proof	Access shall be through a dedicated GEL administrative view the Bidder cannot disable, restrict, or intercept.
4.14.7 Trending Alerts	Pre-Breach Alerts	Alerts shall be generated when any SLA metric is trending towards a breach before the threshold is reached.
4.14.7 Trending Alerts	Configurable Thresholds	Trending alert thresholds shall be configurable per SLA metric.
4.14.8 Penalty Calculation Engine	Automated Computation	The penalty framework shall be applied automatically to actual SLA performance.
4.14.8 Penalty Calculation Engine	Joint Visibility	Calculated penalty amounts shall be visible to GEL and the Bidder simultaneously in real time.
4.14.9 Invoice Validation Reports	Per Device	Each report shall show per device: Go-Live date, billable days, daily rate, calculated invoice amount, SLA compliance status and applicable penalty deduction.

Module	Feature	Requirement
4.14.9 Invoice Validation Reports	Independent Verification	The report shall allow GEL to verify every quarterly invoice independently without requesting data from the Bidder.
4.14.10 Historical Performance	Full Contract Period	Historical SLA performance data shall be retained for the full contractual period plus two years post-handover.
4.14.10 Historical Performance	Self-Service Query	GEL shall query any quarter's performance in detail without Bidder involvement.
4.14.11 API Data Export	Standard Formats	All EMS performance data shall be exportable via API in JSON, CSV and XML.

11.1.4.3. Reporting and Dashboards

Module	Feature	Requirement
4.15.1 Network-Wide Dashboard	Heat Map Visualisation	A network-wide dashboard with heat map visualisation shall show device and customer status by GA and zone.
4.15.1 Network-Wide Dashboard	Colour-Coded Status	Status colour coding shall represent data collection performance, communication health and alarm status simultaneously.
4.15.1 Network-Wide Dashboard	Real-Time Refresh	All dashboards shall refresh in real time without requiring manual page refresh; data displayed shall reflect the current platform state at all times.
4.15.1 Network-Wide Dashboard	Platform Status Visualisation	The platform interface shall visualise device communication status, scheduled and re-dial activities, customer locations, data collection status and data validation and sharing status across the network.
4.15.2 GA-Wise Dashboards	GA Drill-Down	Each GA shall have a dedicated dashboard with operations-relevant metrics.
4.15.2 GA-Wise Dashboards	Configurable Widgets	GA dashboards shall support configurable widgets per role: operations, billing, management.

Module	Feature	Requirement
4.15.2 GA-Wise Dashboards	Real-Time Refresh	All dashboards shall refresh in real time without manual page refresh.
4.15.3 Administrative Dashboard	User and System Management	An administrative dashboard shall be available for GEL's system administrators covering user management, permission assignments, API activity monitoring, system health indicators and audit log access.
4.15.3 Customer 360° View	Single-Screen View	A complete single-screen view per customer shall show consumption history, billing history, alarms, communication history and service requests.
4.15.3 Customer 360° View	Role-Based Scope	Access to customer data shall be restricted based on the user's role; payment and bank information shall not be visible to field-level roles.
4.15.4 Consumption Reports	Standard Types	Customer-wise consumption reports shall be available covering: daily, monthly, historical, trend analysis, minimum and maximum flow, flow analysis and customer-wise parameter logs. Reports for pressure, temperature, volume, volume under alarm and spare volume shall also be available.
4.15.5 Alarm and Event Reports	Alarm Report Types	Alarm and event reports shall include: alarm summary, alarm detail, event log, alarm history, communication failure, EVC RTC drift, Modem RTC drift, tamper event, sensor failure and critical alarm reports.
4.15.6 Billing Reports	Billing Report Types	Billing reports shall include: SAP upload reports, billing critical data reports, billing validation exception reports and customer billing consumption reports.
4.15.7 System Health Reports	Health Report Types	System health reports shall include: AMI system uptime, device connectivity, communication availability, network health and device health status reports.
4.15.8 Data Quality Reports	Quality Report Types	Data quality reports shall include: validation failure reports, false reading reports, zero reading exception reports, missing data reports, wrong upload reports and overall data integrity status reports.
4.15.9 Custom Report Builder	User-Configurable	A custom report builder shall be accessible to authorised users without programming requirements.
4.15.9 Custom Report Builder	Saveable and Schedulable	Custom reports shall be saveable, shareable across authorised users and schedulable for recurring delivery.

Module	Feature	Requirement
4.15.10 Scheduled Reports	Daily SAP Upload	A daily SAP upload report shall be generated and delivered automatically by 08:00 IST.
4.15.10 Scheduled Reports	Configurable Schedules	All other reports shall support configurable schedules: daily, weekly, monthly, quarterly.
4.15.10 Scheduled Reports	Email Delivery	Scheduled reports shall be delivered via email to configured recipient lists.
4.15.11 Regulatory Reports	PNGRB Compliance	All reports required for PNGRB compliance shall be generated on the required schedule.
4.15.12 Export Formats	Multi-Format	All reports shall be exportable in PDF, XLSX, CSV and XML.
4.15.12 Export Formats	API Access	Report data shall be accessible through APIs for downstream integration.
4.15.13 Data Quality Dashboard	Issue Tracking	A data quality dashboard shall highlight issues detected during collection and processing, with drill-down by device, GA and issue type.
4.15.14 Administrative Dashboard	System Administrator View	An administrative dashboard shall be available for GEL's system administrators covering: user management, permission assignments, API activity monitoring, system health indicators, platform capacity indicators and audit log access.
4.15.14 Administrative Dashboard	System Admin View	An administrative dashboard for GEL's system administrators shall cover: user management, permission assignments, API activity monitoring, system health indicators and audit log access.

11.1.4.4. Integration with GEL Enterprise Systems

Module	Feature	Requirement
4.16.1 SAP Billing Integration	Mandatory	SAP Billing integration is mandatory. Validated billing determinants shall be delivered to SAP on each customer's scheduled billing date across all three billing cycle types.
4.16.1 SAP Billing Integration	Modes	Direct API and scheduled file transfer modes shall both be supported and configurable by GEL.
4.16.1 SAP Billing Integration	Format	The SAP upload format shall be agreed with GEL's SAP team before Go-Live and shall be modifiable at GEL's request at no additional cost.
4.16.2 SCADA Integration	Mandatory Interface	The AMI Platform shall integrate with GEL's SCADA system; the integration shall be configured and tested before Go-Live.
4.16.3 CMP Integration	Standard API	Integration with GEL's Centralised Monitoring Platform shall use standard APIs without bespoke development.
4.16.4 CRM/CIS Integration	Customer Data Sync	Customer data shall synchronise with GEL's CRM/CIS through standard APIs.
4.16.4 CRM/CIS Integration	Service Request Routing	Service requests originating in the AMI Platform shall route to CRM for case management.
4.16.5 GIS Integration	Coordinate Sync	Device GIS coordinates shall synchronise with GEL's GIS system.
4.16.5 GIS Integration	Map Layer	The AMI Platform map view shall consume GIS layers for pipeline network, DRS and SLP context where available.
4.16.6 Workforce Management Integration	Service Order Routing	Service orders shall route to GEL's Workforce Management system through standard APIs.
4.16.6 Workforce Management Integration	Outcome Sync	Service order outcomes shall sync back to the AMI Platform for closure and audit.
4.16.7 API Gateway	REST/SOAP/MQTT	REST, SOAP and MQTT APIs shall be available for third-party integration.

Module	Feature	Requirement
4.16.7 API Gateway	Concurrent Connection Management	The API gateway shall manage concurrent connections to enterprise systems with load management and automatic failover capability.
4.16.7 API Gateway	Secure Access	All API access shall require authentication and authorisation per the platform's RBAC framework.
4.16.7 API Gateway	Documentation	Complete, up-to-date API documentation in OpenAPI/Swagger standard shall be provided to GEL and maintained throughout the contractual period; documentation shall be updated with each platform release.
4.16.8 Data Lineage	Complete Audit Trail	A complete audit trail of data sources, transformations and processing steps from field device through to enterprise system delivery shall be maintained and available for any data point at any time.
4.16.9 Enterprise Service Bus	ESB Compatibility	The AMI Platform shall integrate with GEL's Enterprise Service Bus where deployed, using standard protocols.
4.16.9 Enterprise Service Bus	Standard Protocols	ESB integration shall use MQTT, AMQP and REST.
4.16.10 Webhook Integration	Real-Time Events	Webhook-based event publishing shall be supported for real-time downstream data consumption.
4.16.10 Webhook Integration	Configurable	Webhook event types, payloads and recipients shall be configurable by GEL.
4.16.11 Open API Layer	Any Additional GEL System	The AMI Platform shall be capable of integrating with any additional GEL system through its open API layer without requiring platform architecture changes.

11.1.4.5. Security and Compliance

Module	Feature	Requirement
4.17.1 Standards Compliance	IEC 62443	The Platforms shall comply with IEC 62443 for industrial automation cybersecurity throughout the contractual period.
4.17.1 Standards Compliance	NCIIPC	The platform shall comply with NCIIPC guidelines for Critical Information Infrastructure throughout the contractual period.
4.17.2 Communication Security	Field-to-Platform TLS	All communication between field devices and the Platforms shall use TLS 1.2 or higher; unencrypted field-to-platform communication paths are not acceptable.
4.17.2 Communication Security	VPN Tunnelling	The Bidder shall implement VPN tunnelling or equivalent secure channel for all communication between field devices and the AMI Platform cloud infrastructure, in addition to TLS encryption.
4.17.2 Communication Security	Device Authentication	All field devices shall be authenticated by the Platforms before data is accepted, preventing unauthorised device spoofing and replay attacks.
4.17.2 Communication Security	APN Configuration	A dedicated APN or equivalent secure network configuration shall be implemented for all SIM cards, preventing unauthorised access to the communication channel.
4.17.3 Data Encryption	Data in Transit	All data in transit between all Platform components and between the platform and enterprise systems shall use TLS 1.2 or higher.
4.17.3 Data Encryption	Data at Rest	All data at rest shall use AES-128 / 256 encryption.
4.17.3 Data Encryption	Key Management	Encryption key management shall implement periodic rotation per the platform security policy.
4.17.4 RBAC	Granular Permissions	RBAC shall implement granular permissions per module, per function, per device group, per GA and per data scope.
4.17.4 RBAC	Custom Roles	Authorised administrators shall create and modify custom roles without vendor involvement.
4.17.5 MFA and SSO	MFA Mandatory	Multi-factor authentication shall be mandatory for all user access — web interface, mobile application and API. Supported methods shall include at minimum TOTP and SMS OTP.
4.17.5 MFA and SSO	SSO Standard	Single Sign-On shall be implemented using SAML 2.0 or OAuth 2.0/OpenID Connect.

Module	Feature	Requirement
4.17.5 MFA and SSO	AD Integration	Integration with GEL's Active Directory for user authentication and authorisation shall be implemented.
4.17.6 Audit Logging	Scope	All user actions, device commands, data modifications, configuration changes and integration events shall be logged.
4.17.6 Audit Logging	Retention	Audit logs shall be retained for a minimum of two years.
4.17.6 Audit Logging	Tamper-Proof	Audit logs shall be tamper-proof; no user shall modify or delete entries.
4.17.7 Pre-Go-Live VAPT	CERT-In Auditor	An independent penetration test of the complete AMI System — platform, APIs, field device communication, modems, mobile app and all integrations — shall be conducted by a CERT-In empanelled security auditor before requesting Go-Live acceptance.
4.17.7 Pre-Go-Live VAPT	Go-Live Gate	All critical and high severity findings shall be remediated and remediation evidence provided to GEL before Go-Live acceptance is granted; this is a mandatory Go-Live acceptance condition.
4.17.8 Annual Cybersecurity Review	O&M Period	An annual cybersecurity review of the complete AMI System shall be conducted during each year of the O&M Period.
4.17.8 Annual Cybersecurity Review	Reporting	The review report and identified remediation actions shall be submitted to GEL within 30 days of the review date.
4.17.9 Security Patching	Critical Patches	Critical security patches shall be applied within 30 days of availability.
4.17.9 Security Patching	Non-Critical Patches	Non-critical patches shall be applied within 90 days of availability.
4.17.9 Security Patching	Advance Notice	GEL shall be notified with a minimum of 48 hours' advance notice before each patch deployment.
4.17.10 Inactive Account Management	Auto-Disable	Inactive accounts shall be automatically disabled after a configurable inactivity period; disablement shall be logged; reactivation shall require administrator action.
4.17.11 Data-Level Access Control	Restriction	The platform shall restrict user access to specific devices, customer segments, GAs, or data scopes based on assigned role.

Module	Feature	Requirement
4.17.12 Transmission-Layer Data Integrity	Message Authentication	All metering data transmitted between field devices and the AMI Platform shall be protected by a message authentication mechanism — HMAC-SHA256 or equivalent — at the application layer, in addition to TLS channel encryption. This ensures that data content cannot be altered in transit without detection, independent of the encryption layer.
4.17.12 Transmission-Layer Data Integrity	Tampered Packet Rejection	The AMI Platform shall reject and log any data packet whose message authentication code does not match the expected value. Rejected packets shall generate an alert, shall not be written to the data store and shall be flagged for investigation.
4.17.12 Transmission-Layer Data Integrity	API Response Integrity	All API responses carrying metering data or billing determinants shall include a response checksum or digital signature enabling the receiving system to verify that the payload was not altered between platform and consumer.

11.1.4.6. GEL Staff User Interfaces

Module	Feature	Requirement
4.18.0 UI/UX Principles	Consistent Design Language	The web portal and mobile application shall follow a consistent design language — common navigation patterns, iconography, terminology and interaction behaviour — so that a user trained on one interface can operate the other without retraining.
4.18.0 UI/UX Principles	Role-Based Home Screen	Each user's home screen shall be personalised to their role, surfacing the dashboards, alerts and quick actions most relevant to that role on login without manual configuration.
4.18.0 UI/UX Principles	Page Load Performance	All dashboard and report pages shall load within three seconds on a standard broadband connection; data-heavy pages shall render progressively so the user sees meaningful content before the full page is complete.
4.18.0 UI/UX Principles	Accessible Design	The web portal shall meet WCAG 2.1 Level AA accessibility requirements, including sufficient colour contrast, keyboard navigability and screen reader compatibility.
4.18.0 UI/UX Principles	In-Application Guidance	Contextual help, field-level tooltips and guided workflows shall be available for complex tasks — such as VEE rule configuration, alarm threshold setup and report building — without requiring users to refer to external documentation.

Module	Feature	Requirement
4.18.0 UI/UX Principles	Session Management	User sessions shall time out after a configurable period of inactivity; the platform shall warn the user before session expiry and shall preserve unsaved work where technically feasible.
4.18.0 UI/UX Principles	Notification Centre	A consolidated notification centre shall be available on both web and mobile interfaces, showing all platform alerts, alarm notifications, task assignments and system messages in a single inbox with read/unread status and filtering.

Module	Feature	Requirement
4.18.1 Web Portal	Responsive Design	The web portal shall be responsive across desktop, tablet and mobile devices, automatically adapting to device form factor.
4.18.1 Web Portal	Browser Support	Current versions of Chrome, Edge, Firefox and Safari shall be supported.
4.18.2 Mobile Application	iOS and Android	A native mobile application shall be available for both iOS and Android.
4.18.2 Mobile Application	App Distribution	The application shall be published via the Apple App Store and Google Play Store or delivered through enterprise MDM distribution and maintained throughout the O&M Period.
4.18.2 Mobile Application	Access Parity	A GEL staff member's access rights on the mobile application shall be identical to their web platform access rights; the same RBAC, Active Directory integration, SSO and MFA shall apply to the mobile application.
4.18.3 Dashboard Capabilities	Network and GA Dashboard	The mobile application shall provide a network-wide and GA-level AMI System status dashboard with drill-down to device level.
4.18.3 Dashboard Capabilities	Alarm List	An active alarm list with filtering by type, priority, GA and assignment status shall be available.
4.18.3 Dashboard Capabilities	On-Demand Read	The ability to initiate an on-demand data read from any device shall be available through the mobile application.

Module	Feature	Requirement
4.18.4 Alarm Management on Mobile	View and Action	Alarms and exceptions shall be viewable, acknowledgeable, assignable, updatable and closeable from the mobile interface.
4.18.4 Alarm Management on Mobile	Resolution Notes	Resolution notes entry and resolution code selection shall be available from the mobile interface.
4.18.5 Reporting on Mobile	All Standard Reports	Access to all standard reports in a mobile-optimised view shall be available.
4.18.5 Reporting on Mobile	Export and Share	Export and sharing of reports from the mobile device shall be supported.
4.18.6 Field Operations	Survey Data Capture	Field survey data capture with GPS-tagged and time-stamped photograph upload shall be supported.
4.18.6 Field Operations	Installation Confirmation	A step-by-step field commissioning checklist completable from the mobile interface shall be provided.
4.18.6 Field Operations	Exception Logging	Exception logging from the field with photograph and GPS attachment shall be supported.
4.18.6 Field Operations	Manual Meter Reading Capture	Where AMI data has not been received for a device by its scheduled read time, field staff shall be able to capture a manual meter reading through the mobile application. The following shall be mandatory before the reading can be submitted: a photograph of the meter display, GPS coordinates captured automatically by the device, a device-generated timestamp not editable by the field staff, the index value as read by the field staff and a reason code selected from a configurable list.
4.18.6 Field Operations	Reading Evidence Submission	On submission, the manual reading with its photograph, GPS coordinates, timestamp and reason code shall be transmitted to the MDMS and queued in the manual reading authorisation workflow. The field staff member shall receive a submission confirmation reference number before leaving the site. Readings submitted offline shall queue on the device and transmit automatically when connectivity is restored.

Module	Feature	Requirement
4.18.6 Field Operations	Reading Traceability	Every manually captured reading shall be flagged as such in the MDMS and in the SAP billing export, distinguishing OCR-accepted from field-corrected readings. The photograph, GPS evidence, OCR-extracted value, OCR confidence and final confirmed value shall be stored against the reading record and retrievable for audit for the full retention period.
4.18.6 Field Operations	OCR Extraction	On capture of the meter-display photograph for a manual reading, the mobile application shall automatically extract the index value using on-device or server-side OCR and pre-populate it into the reading field for review. OCR shall function across the meter and EVC display types deployed in GEL's network; the Bidder shall confirm supported display types and demonstrate accuracy at UAT.
4.18.6 Field Operations	Human Review and Confirmation	The OCR-extracted value shall never be submitted automatically. The field user shall review the pre-populated value against the physical meter and shall confirm it or edit it to the correct value before submission. No manual reading shall be accepted without an explicit confirm or edit action on the OCR value. Where OCR returns no value or low confidence, the field user shall enter the reading manually.
4.18.6 Field Operations	OCR Confidence Indicator	The application shall display an OCR confidence indicator alongside the pre-populated value, prompting closer field verification where confidence is low.
4.18.6 Field Operations	OCR-vs-Confirmed Log	Each reading record shall store, in addition to the photograph, GPS, timestamp and reason code: the raw OCR-extracted value, the OCR confidence level, the final field-confirmed value and a flag indicating whether the field user accepted the OCR value unchanged or overrode it. Where the two differ, the record shall be flagged as an OCR correction and both values shall be retained and retrievable for audit for the full retention period.
4.18.6 Field Operations	OCR Accuracy Reporting	The AMI Platform shall provide a report of OCR performance — reads attempted, auto-accepted, field-corrected and correction rate — per device type and per GA, so GEL can monitor OCR reliability and identify display types where OCR underperforms.
4.18.7 Task Management	Field Tasks	Field technicians shall be able to view all assigned tasks from the mobile interface — installation tasks, maintenance visits, manual reading visits and investigation work orders — with device ID, location, GPS coordinates, last communication date and visit instructions per task.
4.18.7 Task Management	Platform-Dispatched Work Orders	When the AMI Platform identifies a group of devices that have not communicated for a configurable period, it shall generate a batch of field visit work orders. A supervisor shall be able to review the batch on the web portal or mobile application, assign individual work orders to specific field staff or distribute them across the team and dispatch the full batch in a single operation.

Module	Feature	Requirement
4.18.7 Task Management	Geographic Distribution	Work order assignment shall display the geographic spread of pending visits on a map. The supervisor shall be able to assign by geographic proximity, by GA zone, or by individual field staff.
4.18.7 Task Management	Batch Status Tracking	Supervisors shall be able to track the status of all dispatched work orders in a batch — pending, in-progress, completed, deferred — from a single dashboard view on both web and mobile, without contacting individual field staff.
4.18.7 Task Management	Rescheduling	Task rescheduling shall be available from the mobile interface with automatic notification to the supervisor on rescheduling.
4.18.7 Task Management	Task Closure	Field staff shall close tasks from the mobile interface on completion, with mandatory outcome entry — issue resolved, device replaced, reading captured, fault escalated — before closure. Closed tasks with manual readings shall link directly to the reading evidence record in the MDMS.
4.18.8 Offline Mode	Read-Only Access	Read-only access to the last synchronised data shall be available when network connectivity is unavailable, covering device status, task list and alarm history.
4.18.8 Offline Mode	Offline Capture and Sync	The following data capture operations shall be fully functional offline: manual meter reading capture with photograph and GPS, survey data entry, field commissioning checklist completion, exception logging and task closure with outcome entry. All offline data shall sync automatically and in full when connectivity is restored, without requiring any manual action from the field staff member.
4.18.8 Offline Mode	Sync Confirmation	After connectivity is restored and sync is complete, the field staff member shall receive a notification confirming which records were successfully submitted and flagging any that require attention.
4.18.9 Push Notifications	Critical Alarms	Real-time push notifications for all critical alarms shall be delivered to authorised mobile application users, identifying alarm type, device, location and GA.
4.18.10 Language Support	English	Both the web portal and mobile application shall support English as minimum language options.
4.18.11 Holiday Access	Continuous Availability	Both interfaces shall be available continuously including on public holidays and weekends; no calendar-based access restrictions are acceptable.

Module	Feature	Requirement
4.18.12 Issue Raising and Helpdesk Ticketing	Issue Raising by GEL Staff	GEL staff shall be able to raise issues directly from both the web portal and mobile application against any device, data record, report discrepancy, platform function, or field incident. The issue form shall capture: issue type (hardware, platform, data, integration, field), priority, free-text description and supporting photograph or screenshot. Issue raising shall require no more than three steps from the point the user identifies the problem.
4.18.12 Issue Raising and Helpdesk Ticketing	Ticket Generation to Bidder	Every issue raised by GEL staff shall generate a timestamped ticket assigned to the Bidder's support team. A ticket reference number shall be displayed to the GEL staff member immediately on submission. The Bidder shall not be able to modify the original ticket content after it is raised by GEL.
4.18.12 Issue Raising and Helpdesk Ticketing	Response and Resolution SLA	Response and resolution SLAs per ticket priority — Critical, High, Medium, Low. The EMS shall track SLA compliance for all GEL-raised tickets. Tickets not acknowledged within the defined response SLA shall escalate automatically to the Bidder's escalation contact and to GEL's nominated contact simultaneously.
4.18.12 Issue Raising and Helpdesk Ticketing	Status Visibility	GEL staff shall be able to view the status of all their raised tickets — open, acknowledged, in-progress, pending GEL action, resolved, closed — with the Bidder's latest update and estimated resolution date visible without contacting the Bidder. GEL staff shall be able to add comments and additional evidence to an open ticket at any time.
4.18.12 Issue Raising and Helpdesk Ticketing	Resolution and Closure	Tickets shall be closed by GEL staff after they confirm the issue is resolved; the Bidder shall not close tickets unilaterally. Where GEL does not respond to a resolved ticket within a configurable period, the platform shall prompt the GEL staff member.
4.18.12 Issue Raising and Helpdesk Ticketing	Ticket History	A full history of all tickets raised — initial report, Bidder responses, actions taken, resolution notes and closure details — shall be retained for the full contractual period and accessible to GEL at any time without Bidder involvement.
4.18.12 Issue Raising and Helpdesk Ticketing	Monthly Ticket Summary	The EMS shall generate a monthly ticket summary report covering: total tickets raised by category and priority, first response SLA compliance rate, resolution SLA compliance rate, recurring issues by device or location and open tickets carried forward. This report shall be available in the EMS without the Bidder needing to produce it manually.

Module	Feature	Requirement
4.18.13 Platform Performance Monitoring	Continuous Monitoring	The Bidder shall implement continuous performance monitoring of the AMI Platform with automated alerting when application response times, database query latency, data throughput, API response times, or cloud resource utilisation exceed configurable thresholds.
4.18.13 Platform Performance Monitoring	ITSM Integration	The Bidder shall integrate the AMI Platform with GEL's or the Bidder's IT service management system for automated service ticket creation from platform-generated alarms and exceptions where GEL requires this integration.
4.18.13 Platform Performance Monitoring	Planned Maintenance Notice	The Bidder shall notify GEL a minimum of 72 hours before any planned maintenance on the AMI Platform. Planned maintenance shall be scheduled during agreed low-impact windows and shall not coincide with any GEL billing date.

11.1.4.7. Data Migration from Existing AMI System

Module	Feature	Requirement
4.19.1 Parallel Operations	Mandatory Period	A mandatory parallel operations period shall be conducted per batch of 600 — a minimum of 30 days or as agreed with GEL — during which both the existing AMI system and the new AMI System shall simultaneously collect data from the same field devices.
4.19.1 Parallel Operations	Reconciliation Report	At the end of each batch's parallel period, the Bidder shall submit a zone-level reconciliation report demonstrating that the new system matches or exceeds the data collection performance of the existing system.
4.19.2 Historical Data Migration	Migration Scope	3-year historical meter data and asset records from the existing AMI system shall be migrated into the new AMI Platform; no historical data shall be lost or rendered inaccessible after migration.
4.19.2 Historical Data Migration	Methodology	The Bidder shall document the migration methodology — including data mapping, validation procedures and rollback plan — and agree it with GEL before migration commences.

Module	Feature	Requirement
4.19.3 Gap Resolution	Investigation and Resolution	Any data gaps or discrepancies identified during the parallel period shall be investigated and resolved by the Bidder within a timeline agreed with GEL.
4.19.4 Billing Continuity	Zero Disruption	The Bidder shall ensure zero disruption to GEL's billing operations and data continuity throughout the transition from the existing system to the new AMI System.

11.1.4.8. Maintenance, Updates and Version Management

Module	Feature	Requirement
4.20.1 Platform Updates	Zero Additional Cost	All platform updates, patches and version upgrades throughout the contractual period shall be at no additional cost to GEL.
4.20.1 Platform Updates	Latest Versions	All platform components shall be on the latest commercially available versions at the time of deployment.
4.20.2 Remote Diagnostics	Covered Capabilities	Remote diagnostic and troubleshooting capabilities shall be implemented for all connected field devices, covering at minimum: remote reboot, remote diagnostic test, communication diagnostics, configuration read-back and device event log retrieval.
4.20.3 Security Patching	Critical Patches	Critical security patches shall be applied within 30 days of availability.
4.20.3 Security Patching	Non-Critical Patches	Non-critical patches shall be applied within 90 days of availability.
4.20.3 Security Patching	Advance Notice	GEL shall be notified with a minimum of 48 hours' advance notice before each patch deployment.
4.20.4 Major Version Upgrades	GEL Approval	Major upgrades affecting platform functionality or user interfaces shall require GEL's written approval before deployment.

Module	Feature	Requirement
4.20.4 Major Version Upgrades	Maintenance Window	Major upgrades shall be deployed within agreed maintenance windows to minimise operational impact.
4.20.5 EOL/EOS Management	Proactive Identification	Components approaching End-of-Life or End-of-Support shall be identified and replacement planned before service impact.
4.20.5 EOL/EOS Management	Migration Cost	Migration when any component reaches EOL or EOS during the contractual period shall be at no additional cost to GEL.
4.20.6 Rollback Capability	All Updates	Rollback capability shall be maintained for all updates with immediate restoration procedures if issues arise.
4.20.6 Rollback Capability	Tested Procedures	Rollback procedures shall be documented and tested before each major deployment.
4.20.7 Change Management	Documentation	All version changes shall be documented with version number, change summary, impact analysis and verification results.
4.20.7 Change Management	Change Log	A complete change log shall be maintained throughout the contractual period and handed over to GEL at contract completion.
4.20.8 System Enhancements	GEL Modification Requests	Reasonable GEL requests for modifications to platform configuration, report formats, integration parameters and VEE rules shall be implemented within timelines agreed with GEL at no additional cost.

11.1.4.9. Quality Assurance, FAT, SAT and UAT

Module	Feature	Requirement
4.21.1 Quality Assurance Plan	Submission	The Bidder shall submit a QAP covering all hardware, software, integration and field installation activities before procurement and deployment commence.

Module	Feature	Requirement
4.21.1 Quality Assurance Plan	GEL Approval	The QAP shall be approved by GEL before any procurement or deployment activity begins.
4.21.1 Quality Assurance Plan	Scope	All field activities shall be carried out in the presence of GEL's designated GA Team representative following approved QAP procedures with complete documentation of all results and corrective actions.
4.21.2 Factory Acceptance Testing	Third-Party Inspection	FAT shall be conducted by a third-party inspection agency (TPIA) appointed and paid for by the Bidder; the TPIA shall be an accredited inspection body recognised by GEL.
4.21.2 Factory Acceptance Testing	GEL Witnessing	GEL may witness any FAT activity with or without advance notice; FAT certificates shall be issued before hardware dispatch; no unit that fails FAT shall be dispatched without rework, retest and a GEL-accepted FAT pass record.
4.21.2 Factory Acceptance Testing	FAT Checklist	FAT shall verify at minimum: physical condition and build quality; firmware version and EOL/EOS compliance; communication on both SIM slots — data transmission, failover and signal integrity; protocol driver operation for all EVC OEM protocols in scope; firmware reception and confirmation; environmental protection — IP rating verified; ATEX/PESO certification validity; and for MIUs — pulse count accuracy against a calibrated reference. verify, for EVC makes that require it, that the Modem correctly supplies serial-port power within intrinsic-safety limits and the EVC communicates on that feed.
4.21.3 Site Acceptance Testing	Per Location	SAT shall be conducted at each field location before that location is declared commissioned.
4.21.3 Site Acceptance Testing	PD Meter Index Check	At each PD meter location, SAT shall include a simultaneous manual read of the mechanical index and the MIU-captured index with agreement within the tolerance defined in the QAP.
4.21.3 Site Acceptance Testing	Platform-Side SAT Checklist	SAT shall verify at minimum: communication test on both SIM slots independently with RSSI logged; SIM failover test — primary SIM disabled, automatic failover confirmed; protocol communication test — data read confirmed against a concurrent manual reading; AMI Platform data receipt — data transmitted is received and correctly processed in the AMI Platform; end-to-end data flow test — data for the device reaches the SAP billing data export; TLS encryption confirmation on the communication path; firmware capability confirmation — platform successfully pushes a test firmware package to the device.

Module	Feature	Requirement
4.21.3 Site Acceptance Testing	Dual Sign-Off	SAT records shall be signed by both the Bidder's representative and GEL's GA Team representative before the location enters operational status.
4.21.3 Site Acceptance Testing	Deficiency Resolution	Locations where SAT identifies deficiencies shall be flagged, reworked and retested before the batch is declared ready for parallel operations.
4.21.4 User Acceptance Testing	Multi-Team	UAT shall be conducted with GEL's GA Teams, billing team, IT team and SAP team.
4.21.4 User Acceptance Testing	Coverage	UAT shall cover all AMI Platform functional requirements, all configured integrations, all standard report types and mobile application functionality.
4.21.4 User Acceptance Testing	DR Failover Test	A live DR failover test shall be conducted as part of UAT; successful completion is a mandatory exit criterion before Go-Live acceptance is granted.
4.21.4 User Acceptance Testing	CERT-In Sign-Off	Evidence of remediation of all critical and high severity findings from the pre-Go-Live CERT-In VAPT shall be provided to GEL as a mandatory UAT exit criterion.
4.21.4 User Acceptance Testing	Defect Resolution	All critical and high severity UAT defects shall be resolved before Go-Live acceptance is granted.
4.21.5 UAT Documentation	Test Plan	The Bidder shall prepare a UAT test plan with test scripts covering all operational scenarios relevant to GEL's GA Teams and submit it to GEL for written approval before testing begins.
4.21.5 UAT Documentation	Completion Report	A UAT completion report signed by GEL's designated UAT team lead is a mandatory condition of Go-Live acceptance.

11.2. Technical Specifications for Hardware Components

11.2.1. General Technical Requirements

11.2.1.1. General Site Information:

All the equipment supplied under this contract shall be suitable for continuous operation under the environmental conditions prevailing at site. It shall be suitable for operation under the following site conditions:

Sand & Dust:

With a built up of dust on operational surface to a level such as may occur because of imperfections in the sealing of equipment, housing and conditions prevailing in sub-tropical dust conditions and pipeline installations.

Topicalization:

The equipment shall be fully tropicalised

Shock & vibration:

The equipment shall withstand transportation and handling by air, sea and road under packed condition confirming to standards, confirming to MIL 810 B specification or commercial equivalent.

The equipment shall also be resistant to termite, fungus, rodents and salty environments.

4..1.1. Environmental Specification of Equipment to be Supplied

All the equipment of SCADA system servers shall operate satisfactorily in controlled/ uncontrolled environment under the following conditions.

FOR	TEMPERATURE	HUMIDITY
Operation	0 to 50°C	20 to 80 % RH

Storage & transportation	0 to +60 °C	5 to 95 % RH

All the RTUs shall be designed for storage and operation under the non-air conditioned environment with the limits given below-

FOR	TEMPERATURE	HUMIDITY
Operation	0 to 60°C	10 to 95 % RH
Storage & transportation	0 to +70 °C	5 to 95 % RH

All SCADA equipment cabinet and power supply, distribution cabinet structures to be supplied shall be constructed to allow free air flow to dissipate heat generated. Construction shall be such that ventilation grills will not be obstructed when equipment is mounted in its installed position. Manufacturer shall calculate the heat dissipation and where the calculations prove necessity and then air flow ventilation shall be assisted by integral low power silent running air extraction fans. Inlet ventilation grills shall be fitted with dust filters.

All equipment to be supplied shall withstand international standards of vibration for industrial application.

4..1.2. Power Supply

The power supply for each equipment of the SCADA system shall be provided by the bidder. All the equipments of the SCADA system have to be powered through Power provided by client at each station. Any power supply converter/ hardware etc required to achieve the desired voltage level of SCADA equipments shall be supplied by the bidder. All the works required for providing power to SCADA system is in scope of bidder. Only power connection at a single point shall be provided by Client.

SCADA vendor shall furnish power consumption details with detailed break-up for each subsystem/equipments including inrush current and its duration during detailed engineering.

Power Supply Level -

Sl No	RTU Type	Power Source	Power supply	Max. Allowable load (Watts)
1	Type-1 RTU	UPS (Grid)	240C AV	200 W

2	Type-2 RTU	UPS (Grid)	240C AV	200 W
3	Modems	UPS (Grid) & Solar power	24 V DC	60 W
5	RTU Test Jig Unit	UPS (Grid)	240V AC	200 W

Reliable and rugged SMPS power supply shall be supplied with equipment to generate isolated and stable voltage levels required for equipment operation.

4..1.3. Surge Protection, Transit Suppressors, RFI Filters

All the equipment shall be designed with built-in safety to protect against the effects of monitor induced high voltages, effects of surges, transients (RF)

Each RTU, Each Server Rack should have surge/lightening protection for power supply & communication channel. Surge protector shall be provided for all input supply / communication apart from the inbuilt surge which is available on RTU

Surge protection device for the power and communication shall be considered of both internal and external type confirming to IEC or UL standards. Surge Protection devices shall be provided as per following philosophy-

- For all incomer power supply to each panel (UPS , Solar, Non-UPS)
- For Each MODBUS communication Channel
- Power supply feeder to Modems
- Antenna cable

4..1.4. Earthing

Each supplied RTU cabinet, Server cabinet / rack in the MMS /BMS locations shall be provided with earthing lugs with their frames. All these lugs/ strips shall be properly secured to the electrical earthing bus. Earthing of the SCADA equipment is in scope of bidder. Separate earthing shall be provided for AC and DC systems . Bidder shall extend the copper earth strip from earth pit upto the RTU panel / server panel.

All the system ground of various cards and equipments, shields of instrument cables shall be connected to system ground bus which is electrically isolated from the ac mains earthing bus. The equipment shall provide separate earthing strip for the same. The system ground bus shall be connected to independent ground buses through insulated wires.

a. SCADA vendor shall note that for new RTUs, separate earthing shall be provided for:-

- System grounding (Earth resistance less than 1 ohm)
- Frame and AC mains grounding (Earth resistance less than 5 ohm)

Accordingly the RTUs shall provide separate earthing strips as mentioned above and SCADA vendor shall also take care of onwards earthing connections from equipment to earthing strips.

b. Following guideline shall be considered while doing the earthing work:

- Panel metalwork- electrical AC mains supply earth – 2 off M10 brass studs per panel section. These brass studs shall be fitted with vibration proof nuts and washers.
- Instrument “Clean” earth – electrically insulated copper bus bar 75 mm2 minimum separated from the panel metalwork by 25mm minimum. 2 off M10 brass earth studs to be provided at each end of the bars with associated shake proof nuts and washers.
- An intrinsically earth bar similar in construction to the instrumentation clean bar shall be installed. This bar shall comply entirely with the requirements of IS 3043. The bar shall incorporate a removable section to facilitate earth continuity testing.

c. On intrinsically safe circuits the following shall be considered:

- Unused cores of the multicare cables nominated as spares shall be terminated to earth via dummy barriers. All other unused cores shall be taken directly to the I.S. earth bar.
- The earth connection via dual shake proof screws or clamps.
- Brass studs shall be incorporated on the I.S. earth bar for connection of dual I.S. earth cables.

- The I.S. earthing system shall be labeled “Safety earth-Do not disconnect”.

Similarly unused cores of Non- I.S. field cables and system cables shall be terminated and connected to the instrumentation “clean” earth. A minimum of 30 % spare capacity shall be provided within system cables and ELCO connectors.

4..1.5. Electromagnetic Compatibility-EMC

The equipment shall be efficiently screened against EMI, RFI and conductive interference and shall not interfere with other equipment in the vicinity or installed in the same building.

- The equipment shall be required to meet one of relevant EMC standards (IEC, MIL, VDE, BS, IEEE etc.)

4..1.6. System Availability Requirements

- The SCADA vendor shall ensure the system availability SLAs
- The SCADA vendor shall ensure that the MTTR of RTU
- System Design covering future expansion takes calculation of availability into account

4..1.7. Installation Materials

- All installation materials such as all types of cables, data cables, cable trays, relays, connectors, switches, MCBs, frames, supports, structural steel, SS cable tags, fuses, terminations, TBs, distribution boxes and other items required but not mentioned herein shall be provided by the SCADA vendor.
- SCADA vendor to note that detailed scope of cables including power cables with other accessories for interfacing with different equipment shall be supplied by the vendor.
- Necessary erection accessories, cabling between the LED monitor and the EWS unit is in the bidder's scope."
- The quality of materials used shall be of the highest order and shall conform to the international standards and safety standards as per relevant hazardous area classification.

4..1.8. Civil works

All civil works required for installation of the SCADA equipments shall be carried out by the bidder.

4..1.9. Safety Requirements

- It is the intent of the Client that operational hazards be reduced to a minimum. The SCADA vendor shall use sound engineering judgment to complete an installation that will perform the required function without compromising this aim.
- All controls shall be in fail-safe mode. a failsafe mode is defined as if a plant equipment or system fails, it shall be safe to the system
- Provision shall be made to isolate all incoming signals to a cabinet before gaining access to cabinet internals. Shrouding terminal with warning labels shall be provided with these terminal being segregated from other incoming terminals.
- SCADA vendor must ensure that the equipments will not be damaged due to blackouts / burnouts.
- SCADA vendor shall provide the startup procedure of the system. Further SCADA vendor to indicate steps to be taken for fail safe operations of the system under following criterion

    a. power failure

    b. voltage variation more that ± 10%

    c. frequency variation more than ± 3%

    d. air conditioning failure

4..1.10. Finish

- All the frame and the steel work of the cabinets shall be degreased then phosphate treated or coated with primer followed by at least two undercoats and a final coat of matte finished enamel paint of SHADE RAL 7035. The finished of the equipments shall be of the finest quality and capable of long and unattended service. The inside of the cabinets shall be painted pale cream color (IS-352).

All the SCADA Cabinet / racks and RTU cabinets shall have „Nameplates" correlating with the Project details, type and location of the cabinet. In addition, all the SCADA Cabinet / racks and RTU cabinets shall have „Tag plates" correlating with the type and location of the cabinet

4..1.11. Calibration

The calibration procedure along with periodicity required for ensuring the accuracy of test instruments supplied under this contract shall be taken care by the SCADA vendor. The SCADA vendor shall supply calibration charts from independent test laboratory for all input/output subsystems, during the warranty period.

4..1.12. Electrical Works

For MMS / BMS, RTU locations, ELECTRICAL work shall consist of:

- Providing PDB/ dedicated feeder and interconnecting cabling from power supply unit in electrical control room to SCADA / RTU room & all equipments supplied by bidder
- Providing interconnecting cabling with telecommunication system along with cable routing and dressing.
- All the cable work including earthing up to the panel from the dedicated earthing point, system grounding for the supplied equipments.
- Any temporary electrical works associated with the erection & commissioning of the system
- Testing and certification of all the electrical works within the scope.
- All power cabling (including supply of cables, glanding, ferruling, termination etc.) from the power distribution cabinet to the SCADA equipment shall be carried out by SCADA vendor.

1.1.1.1 Remote Telemetry Units

For Type-1 and Type-2 RTU

4..1.13. General

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
1	Processor	32-bit microprocessor based programmable units		
2	Memory	Erasable RAM and ROM memory		
3	Power Supply	Battery backed power supply unit		
4	Communication Processors	Confirming communication protocols like DNP 3.0, Modbus, IEC-60870-5-104 and Ethernet		
5	I/O Cards	Complete in all respects		
6	Environmental Capability	Rugged, capable of working in non-air conditioned environment with temperature grade up to 70°C		
7	Ports	Ethernet TCP/IP ports (minimum dual redundant) and serial ports		
8	Safety	Intrinsically safe, suitable for use in hazardous environments (Zone 1, Group IIA/B) and certified as per applicable international standards		
9	I/O Modules	Hot-swappable without any interruption to system operation		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
10	Design	No single point of failure; no failure of any printed circuit board or component shall cause a control mal-operation, result in false operation, or continuous communication transmission		
11	Cabinets	Weather proof with IP65 rating, suitable for non-air-conditioned room installation		
12	Engineering	Actual layout of RTU along with its internal wiring, mounting arrangement etc. shall be carried out in detailed engineering		
13	Illumination	Proper LED illumination shall be provided inside the RTU cabinet		

4..1.14. Environmental

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
1	**Ambient Temperature**	55°C, Design Temperature – (-10) to 70°C		
2	**Humidity**	05-95% RH, non-condensing		
3	**Environment**	Non-airconditioned environments		
4	**Hazardous Area Classification**	Zone 1, Group IIA/B (as applicable)		
5	**Vibration Resistance**	0.5 g continuous, 1 g intermittent		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
6	**EMI/RFI Immunity**	As per IEC 61000-4		

4..1.15. Power supply

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
1	**Available Power Supply**	230V AC ±10%, 50 Hz ±3%		
2	**RTU Operating Power Supply**	24V DC		
3	**Redundant Power Supply Modules**	Provided with automatic failover		
4	**Power Supply Modules**	Hot-swappable, includes appropriate surge protection, input filtering and isolation		
5	**Power Supply Sizing**	Each power supply shall be sized to handle 130% of the maximum expected load		
6	**Reliability**	Ensure reliability during peak demand periods		
7	**Power Consumption Details**	Detailed power consumption of each equipment shall be furnished by the bidder		

4..1.16. RTU subsystems

The RTUs shall comprise the following subsystems:

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
1	**Central Processor**	Central processor to operate with system software		
2	**Memory Subsystem**	Availability of Battery backup (non-volatile)		
3	**Analog Input Module(s)**	Included		
4	**Digital (Contact) Input Module(s)**	Included		
5	**Digital (Contact) Output Module(s)**	Included		
6	**Analog Output Module(s)**	Included		
7	**Ethernet Ports**	Minimum 2 Ethernet ports (10/100/1000 Mbps) for connecting to MODEM through TCP/IP		
8	**Ports for PDT**	Serial ports and Ethernet port to connect Portable Diagnostic Test Unit (PDT)		
9	**Ports for IEDs**	Serial ports for connecting IEDs e.g. Dispensers, Odorizers, etc.		
10	**Power Supply**	Battery backed power supply (SMPS) with redundancy		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
11	**Diagnostic Tools**	Advanced diagnostic tools		
12	**Interposing Relays**	For Digital Output		
13	**Cybersecurity Features**	DNP3-SA, encryption, authentication		
14	**Time Synchronization Module**	With 1ms resolution		
15	**Real-Time Clock**	High-precision real-time clock with ±1ppm accuracy		

For Type-1 RTU (for CGS locations):

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
1	**I/O Cards**	Separate IO cards for each type of IO shall be provided		
2	**I/O Points Handling**	Designed to handle approximately 100 I/O points per CGS		
3	**Installation**	Installed in free-standing panel		
4	**Flow Calculations** **Ports**	Full support for inbuilt AGA flow calculations or interface with existing flow computer Minimum of 6 serial ports and 2 ethernet ports are required with a minimum of 1 Spare for each after installation		
5	**Diagnostics**	Comprehensive local and remote diagnostics		
6	**Total I/O Count**	As per the IO list along with spares		
7	**Minimized Interdependence**	Configured such that interdependence of function is minimized and failure of any part of a RTU Module subsystem except the common logic subsystem shall not directly affect the integrity of the unit as a whole		
8	**Alarm/Event Storage**	Minimum 10,000 alarm/events with timestamps in non-volatile memory in case of communication failure until communication is restored		
9	**System Software**	Provides overall management of the supervision, monitoring and control function within the RTU, manages the local Programmable Diagnostic Test Unit, communications, comprehensive diagnostic facilities and RTU start up procedures		
10	**Programmability**	Programmable with facilities for developing logic to interface with the IEDs as and when required		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
11	**Programming Tools**	All necessary tools, software and documentation shall be part of the supply of the RTUs within the scope of this tender		
12	**Programming Environment**	Supports IEC 61131-3 standard languages including Function Block Diagram (FBD), Ladder Diagram (LD), Structured Text (ST) and Sequential Function Chart (SFC)		

For Type-2 RTU (for CNG, L-CNG, Decompression skids):

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
1	**I/O Cards**	Separate IO cards or combined IO module/Mixed IO module can be provided		
2	**Data Ports**	Minimum of 4 serial ports and 2 ethernet ports are required with a minimum of 1 Spare for each after installation		
3	**Installation**	Installed in wall-mounted panel		
4	**IED Integration**	Optimized for IED integration via serial and Ethernet interfaces		
5	**Protocol Conversion**	Designed for efficient protocol conversion and data handling		
6	**Total I/O Count**	As per the IO list along with spare		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
7	**Minimized Interdependence**	Configured such that interdependence of function is minimized and failure of any part of a RTU Module subsystem except the common logic subsystem shall not directly affect the integrity of the unit as a whole		
8	**Alarm/Event Storage**	Minimum 10,000 alarm/events with timestamps in non-volatile memory in case of communication failure until communication is restored		
9	**System Software**	Provides overall management of the supervision, monitoring and control function within the RTU, manages the local Programmable Diagnostic Test Unit, communications, comprehensive diagnostic facilities and RTU start up procedures		
10	**Programmability**	Programmable with facilities for developing logic to interface with the IEDs as and when required		
11	**Programming Tools**	All necessary tools, software and documentation shall be part of the supply of the RTUs within the scope of this tender		
12	**Programming Environment**	Supports IEC 61131-3 standard languages including Function Block Diagram (FBD), Ladder Diagram (LD), Structured Text (ST) and Sequential Function Chart (SFC)		

4..1.17. Digital inputs

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
1	**Input Type**	Min. 16 nos. of Volt free contacts (2 wire isolated)		
2	**Contact Wetting**	2-4mA per input at 24V DC		
3	**Resistance Recognized (Closed Contact)**	Not exceeding 1 Kilo Ohms		
4	**Resistance Recognized (Open Contact)**	Not less than 50 Kilo Ohms		
5	**Isolation**	Using optocouplers with 4000V isolation		
6	**Insulation Resistance**	20 M ohms at 500V DC inputs		
7	**Input Filtering**	0.5-10 msec configurable debounce time		
8	**Input Response Time**	<1ms		
9	**Indicators**	Loop & State LEDs for each DI point		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
10	**Voltage Withstand Capacity**	2.5 KV RMS		
11	**No/NC Contacts**	Mixing of NO/NC contacts in the same card		
12	**Surge Protection**	Built-in surge arrestors for each input		
13	**Short Circuit Protection**	Built-in current limiting		
14	**Field Voltage Range**	12-30V DC		

4..1.18. Digital outputs

Typical specification of Digital Output Modules to be supplied is as given below:

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
1	Output Type	Min. 08 nos. of relay contacts		
2	Indicators	LED indication for each DO point		
3	Relay Type	Miniature power relay, solid-state options available		
4	Contact Arrangement	1 NO + 1 NC relay contacts configuration to be provided up to the RTU terminal block		
5	Contact Rating	Potential free contact rating of output interposing relay for each DO point (Contact rating 24V DC, 5A; 230V AC, 2A)		
6	Isolation	3KV RMS Contacts to Logic		
7	DO Command Activation	Configurable Pulse duration (min 2 sec to 60 minutes)		
8	Security	Output contacts shall be monitored via Opto-isolators and must be short circuit proof and protected by suitable mechanism like fuse with suitable fuse blow indication provided		
9	Response Time	<10ms		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
10	Relay Lifetime	>1,000,000 operations at rated load		

4..1.19. Analog inputs

Typical specification of Analog Input Modules to be supplied is as given below:

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
1	Input Type	Min 16 isolated, Current/Voltage Inputs		
2	Ranges	4-20 mA, 0-20mA, 0-5V, 0-10V, ±10V, configurable per channel		
3	HART Support	Built-in HART modem for smart transmitter interface		
4	Input Impedance	Not less than 250K for Voltage input, Not more than 250Ω for current Input		
5	Multiplexer	High-precision, low-drift		
6	ADC Type	16-bit binary (exclusive of sign bit)		
7	Sampling Rate	Configurable up to 100 samples/second per channel		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
8	Series Mode Rejection	Greater than 40 dB at 50 Hz		
9	Common Mode Rejection	Greater than 120 dB at 50 Hz		
10	Roll Over Error	0.5 bit		
11	Temperature Coefficient	0.002% per degree C		
12	Accuracy	± 0.05% of range including drop in resistor		
13	Resolution	0.0015% (16-bit)		
14	Channel-to-Channel Isolation	1500V DC		
15	Input Filter	Programmable digital filter per channel		
16	Broken Wire Detection	Included		
17	Over-Range Protection	±30V continuous		

4..1.20. Analog outputs

Specifications of Analog Output modules to be supplied is as given below:

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
1	Output Type	Min. 4 Completely Isolated current (4-20 mA) outputs		
2	DAC Type	16-bit binary (exclusive of sign bit)		
3	DAC Span	10V or 5V		
4	Output Range	4-20 mA DC, 0-20mA, 0-10V, configurable		
5	Isolation	Each output shall be isolated from logic and others to 1500 Volts		
6	Loading	1K ohm for Current outputs		
7	Differential Linearity	¼ L.S.B.		
8	Accuracy	± 0.05% of range		
9	Temperature Coefficient	0.005% per degree C		
10	Update	Within 5 msec		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
11	Resolution	0.0015% (16-bit)		
12	Retentivity	Set-point value to be held by AO card till update by new set-point value from MS/EMS		
13	Short Circuit Protection	Included		
14	Open Circuit Detection	Included		

4..1.21. Communications

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
1	Internal and External Communications	Supports both internal and external communications functions		
2	Internal Communication Network	Designed to ensure data and command exchange between modules is not prevented by the failure of any module not directly involved in the communication exchange; network shall not become overloaded under the heaviest traffic possible in the RTU's ultimate expansion configuration.		
3	Addressing Function	SCADA server and Master RTU shall initiate communications with a selected RTU by the addressing function; each RTU shall recognize its own unique address and shall have the capability of being assigned any address within a range of possible addresses (minimum 65,536); possible to address all or selected number of RTUs from the SCADA server and Master RTU for global or broadcast messages		
4	LED Indication	Provided in the RTU to check the health of RTU communication		
5	Supported Protocols	DNP 3.0 (TCP/IP) with Level 4 authentication and secure authentication (SAv5), IEC 60870-5-104, Modbus RTU/ASCII/TCP, IEC 61850 (for substations), MQTT, AMQP, HTTP/REST API (for IoT/cloud integration)		
6	Polling	RTU shall be polled through Ethernet port with redundant connections		
7	Communication Security Features	TLS/SSL encryption with 256-bit AES, X.509 certificate-based authentication, Role-based access control, Secure key management, Audit logging of all communication attempts, Denial-of-service attack protection		

1.1.1.1.1.1.1 Central processor module

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
1	Microprocessor	32-bit or 64-bit high-performance microprocessor based programmable unit		
2	Memory	Non-volatile RAM and FLASH memory		
3	Central Processor Module	CPU & power supply for total functionality of the RTU		
4	Processor Clock Speed	Minimum 0.3 GHz		
5	Processor Memory	Minimum 128 MB RAM, 1GB ROM		
6	Processor Operating System	Real-time OS with cybersecurity hardening		
7	Processor Processing Capability	Minimum 50,000 tags with 1-second update rate		
8	Processor Event Buffer	Minimum 100,000 events with timestamps		
9	Processor Watchdog Timer	Hardware and software watchdogs		
10	Processor Diagnostic Capabilities	Advanced self-diagnostics with detailed logging		

1.1.1.1.1.1.2 RTU features

The RTU sub-system shall support the following:

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
1	**High-speed Scanning**	Configurable scan rates down to 1 ms		
2	**Priority Processing**	Fast scanning of selected I/O points with priority processing		
3	**Field Input Control**	Discrete control action with configurable logic		
4	**Remote Control Command**	Discrete control action corresponding to Remote Control Command reception		
5	**Operator Control**	• Operator initiated discrete control action with check before execute and timeout feature • Operator initiated discrete control action with sequencing and interlocking		
6	**Calculated Digital Points**	Logical functions: AND, OR, NOT, XOR, etc. from Digital and Analog input points		
7	**Calculated Analog Points**	Arithmetic functions: +, -, /, *, sq, root, etc. with 32-bit floating point accuracy		
8	**Counter Values**	Deviation of counter values using integration of hardware and software generated analog points		
9	**IED Interfacing**	RS-485 ports for serial data from IEDs (Dispensers, Odorizers, Compressors, etc.), UPS panel		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
10	**Rate of Change Alarm**	Configurable rate thresholds for rate of change of alarm		
11	**Accumulator Points**	RTU resident accumulator points driven by analog points		
12	**AGA Flow Calculations**	AGA 3, 7, 8 and 11 for natural gas flow measurement		
13	**Data Logging**	Inbuilt data logging with configurable intervals		
14	**Custom Algorithms**	Custom algorithm implementation capability		
15	**Trending Features**	Advanced trending features		
16	**Statistical Calculations**	Min, max, average, standard deviation		
17	**Time Synchronization**	• Automatic time synchronization from SCADA server with 1 ms resolution • Support for NTP/PTP synchronization • Internal high-precision real-time clock with battery backup		
18	**Self-diagnostics**	• Self-diagnostic feature and software watchdog timer devices • Monitor and report healthiness of CPU, memory, power supply, comm. interfaces and I/O modules • Support remote diagnostics from SCADA server and RTU status graphics shall be displayed on SCADA		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
19	**Self-calibrating Analog Cards**	• Self-calibrating analog input and output cards • Event sent to SCADA server for out of calibration. This shall be part of RU status graphic		
20	**Predictive Diagnostics**	Predictive diagnostics to detect potential failures and generate maintenance alerts		
21	**Configurable Scan Cycles**	Scan and acquire parameters with configurable scan cycles from 1 ms to 60 seconds per point		
22	**Analog Data Processing**	• Process analog data for high-low limit violations and communicate the same to SCADA server along with time stamping • Linear conversion to engineering units and input filtering, in case engineering unit conversion is being done at RTU level [conversion of raw data to normalized values (e.g. 0 to 1.0) for communication shall also be acceptable] • Support for multiple linearization methods including square root, custom polynomials and lookup tables		
23	**Remote Reconfiguration**	Support remote reconfiguration and downloading of parameters from workstations i.e. addition, deletion, modification and reassignment with different range, limits etc. from workstations to avoid local engineering at RTU level.		
24	**Remote Configuration from SCADA**	• Remote configuration from of analog alarm limits, scaling factors, threshold values, smoothing factors, etc. • Automatic update to standby SCADA server • The features of Alarm generation, association of the alarm priority and engineering unit conversion are implemented at the RTU level.		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
25	**PDT Configuration Unit**	PDT configuration unit to create configuration file for • I/O modules attached to the RTUs • Type of each I/O modules and time stamping requirements for points in each module • Software logic in RTUs • Physical and software interfaces connected to the RTUs		
26	**Online Configuration Transfer**	Transfer configuration file online from MS/EMS using existing data channels		
27	**Time Stamping**	Time stamping of all exception reports with 1 ms resolution		

[However, the SCADA vender has the option to implement the features of Alarm generation, association of the alarm priority and engineering unit conversion at the RTU level or SCADA server level].

RTU shall comply with the following:

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
1	Data and Configuration Storage	• Update process parameters and configuration data in built-in memory • Time stamping of all field values • Continue scanning parameters and updating database during communication failure • Retain complete analog and digital information until read by SCADA server • Memory buffer sized to store all changing data without loss		
2	Long-term Communication Outage	Store up to 100,000 field exception reports during communication outage		
3	Time Tagging	Attach time tag to each digital event signal with 1 ms resolution		
4	Inbuilt Web Server	Basic configuration and diagnostics without special software		
5	Alarm Priority	• Highest priority alarms sent to SCADA server • Option to implement alarm priority at RTU or SCADA server level		
6	Check Before Execute	'Check before Execute' feature with configurable timeout and sequence validation		
7	Control Status Reporting	Report status of control point after execution Report to SCADA server if status does not change within specified time		
8	False Control Signal Prevention	No false control signals due to power supply on-off or firmware updates		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
9	Report by Exception	Support communication protocol for report by exception		
10	Error Detection and Control	Ensure data integrity with CRC checking and message sequence verification		
11	Programmable Diagnostic Test Unit (PDT)	• Connect pluggable PDT with keyboard and monitor for diagnostics and programming • Modern interface with graphical displays and trending capabilities		
12	Input Signal Filtering	• Apply filtering and scaling for engineering units conversion • Advanced filtering options: Low pass filters, Moving average filters, Rate-of-change limits, Noise rejection algorithms, Custom filtering algorithms		
13	Off-scan Capability	• Off-scan complete RTU or individual points from SCADA server • Generate one alarm for complete RTU failure or off-scan • Data integrity qualifier flag for off-scan points		
14	Power Failure Data Retention	• Store configuration data and process database for at least one month during power failure • Resume normal operation automatically after power restoration • "Blackout start" capability for automatic function restoration		
15	Service Requirement Initiation	Initiate service requirement to SCADA server for re-initialization after RTU failure		
16	Power Supply	• Operate as per site power availability • Separate on/off power supply switch and fuse • Indicate power consumption for all RTUs		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
		• Provide isolation, over-voltage and short circuit protection		
17	I/O Termination Blocks	• Male and female portions for isolating field wiring • Printed tube type Cross ferruling • Screw clamp type terminal blocks rated for wire size and current capacity		
18	Wiring and Components	• Detail shelf and inter-shelf wiring • Easy access cabinet wiring for maintenance • High temp rating and low power consumption components • Neatly arranged and clearly labeled wiring		
19	RFI Immunity	• Immune to radio frequency interference meeting international standards (IEC 61000, etc.)		
20	Preventive Maintenance	• Function continuously without requiring preventive maintenance • Minimum MTBF of 50,000 hours		
21	Channel Failover	• Respond to SCADA server on secondary channel without data loss • Status on channel availability • Failover within 100ms		
22	AI & DI Output	• Output AI & DI point values as AO & DO to any RTU • Configurable DO command contact closure duration • Write data from SCADA to each IED through RTU		
23	Channel Selection and Failover Logic	• Non-availability of one communication channel should not affect other RTUs • Automatic channel selection and failover logic		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
24	Valve Status Wiring	• Open/close status of valves wired consecutively in RTUs		
25	PDT Interface	• Connect pluggable PDT with keyboard and monitor for diagnostics and programming • Modern interface with graphical displays and trending capabilities		
26	Shelf and Inter-shelf Wiring	• Detail shelf and inter-shelf wiring • Easy access to cabinet wiring for maintenance • High temperature rating and low power consumption components		
27	Identification Labels	• Identification labels for RTUs, card files, power distribution boards, terminations, etc. • Permanent labels with systematic naming convention		
28	Local Scan Rate	• Local scan rate to achieve time-tagging resolution and system performance • Provide minimum & maximum SCAN time • Scan rate not to exceed 10 msec for direct I/Os and 100 msec for IED data		
29	Contact Output Subsystem	• Potential free contact relay output for equipment operation. • Configurable DO command contact closure duration from 10ms to 60 minutes • Voltage free contacts • No energizing of unselected outputs		
30	RTU Restart	No reset of output circuits or false control signals after RTU restart Cancel pending control selection		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
31	I/O Protection	Protection against reverse polarity, surge arrestors, filters and isolation circuitry		
32	RTU Panels	• Free standing (Type-1) and Wall Mounted (Type-2) conforming to IP65 (IP52 minimum) • Lockable front and rear doors, bottom cable entry, gasket and fitting to keep out moisture, dust, gases and corrosives • Naturally cooled with ventilation fans and dust filters • Metal fabrication with adequate reinforcement to limit vibrations • Well-organized components and tidy panel look		
33	Shelf and Inter-shelf Wiring Details	• Detail shelf and inter-shelf wiring • Gold plated edge connectors for PCB to back frame wiring • Easy access to cabinet wiring for maintenance • Termination panel for I/O point wires		
34	System Functioning Guarantee	Guarantee satisfactory functioning of system hardware in panels even with air-conditioning failure		
35	Spare I/O Terminals	Provision for fully wired 30% spare additional I/O terminals for future additions		
36	Burn-in Operation	Hardware mounted and wired panels subjected to burn-in operation for minimum 15 days before dispatch		

1.1.1.1.1.1.3 Serial link requirement

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
1	**RS-485 Ports**	• The RTU shall be equipped with the necessary RS-485 ports for polling the IEDs as specified in the tender elsewhere. • Additionally, one more RS-232C or TCP/IP port shall be provided for connecting PDT for configuration of the RTU.		
2	**SCADA Vendor Responsibilities**	• SCADA vendor shall develop, configure and establish the communication for reading/writing of data from/to the IEDs. • The make & model no., protocol details of these IEDs shall be provided to the SCADA vendor during detailed engineering or prior to SAT. • SCADA vendor shall simulate the above devices using protocol analyzers/PC/other means to demonstrate during FAT.		
3	**Software Tools and Programs**	• SCADA vendor shall provide all the software tools and programs (source code) used to interface RTUs with IEDs. • It shall be possible for Client to integrate other IEDs with the RTU in future. • To achieve the same, the RTUs shall have provision for integrating IEDs and all necessary software, compilers, tools, etc. shall be supplied by the SCADA vendor. • The alarms for power supply/serial link failure/flow computer & other IEDs malfunction through serial link shall be implemented. • The integration of IED's (of any protocol not just Modbus) with the RTUs shall be totally end user configurable.		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
4	**Alarm Implementation**	• The alarms for power supply/serial link failure/flow computer, CP panel & gas chromatograph malfunction through serial link shall be implemented.		
5	**RTU Memory Sizing**	• The RTU memory sizing shall be adequate for required nos. (as application) of IOs, IEDs serially connected with the RTU.		
6	**IED Data Scanning**	• The IED data shall be scanned by the RTU much faster than RTU poll time by SCADA server.		
7	**Input/Output Points and Serial Ports**	• The SCADA vendor shall supply the RTUs equipped with I/O cards & serial ports (for IED interfacing) as per the I/O count and serial ports requirement defined elsewhere. • The RTUs shall be user programmable for interfacing with any kind of IED.		
8	**Portable RTU Configuration and Diagnostic Unit**	• RTU shall have feature of connecting a pluggable Programmable configuration and maintenance terminal along with all hardware and software necessary to interface to the RTU. • This unit will function as a diagnostic and programming aid to troubleshoot and configure RTU and input/output boards. • It shall be possible to exercise all the functions of RTU's without disconnecting the RTU from process. • The diagnostic unit shall provide graphical representations of real-time data, trending capabilities and comprehensive diagnostic information. • Remote access to this diagnostic information shall be supported through secure connections.		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
9	**Packaging**	• The RTU shall be packaged to withstand rough handling during ocean shipment and in-land journey. • It shall be vendor's responsibility to make good any deterioration that occurs during shipment. • Sling points shall be clearly indicated on crates.		
10	**Data and Drawing Detail**	• Vendor shall furnish all the documents as per "Vendor Data Requirements" enclosed with Material Requisition/Job Specifications. • All the other documents as per Technical specification and the documents required for better understanding and execution of the job to be supplied by the Vendor. • A certificate from statutory authorities confirming suitability of design/construction of all electrical and electronic items for use in hazardous area classification has to be furnished.		

RTU DIAGNOSTIC AND CONFIGURATION SOFTWARE

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
1	**Overall Management**	• The RTU diagnostic and configuration software shall provide the overall management of the supervision, monitoring and control function within the RTU and communications, comprehensive diagnostic facilities and RTU startup procedures.		
2	**Licensed Software**	• Bidder to supply licensed RTU configuration software in each of the supplied Laptop (PDT).		
3	**Compatibility**	• The software shall be compatible with the latest Windows-based operating system. It shall be the responsibility of the vendor to install & configure the software in the Laptop supplied by the vendor.		
4	**DNP/IEC Index Viewing**	• DNP/IEC index of all I/O points along with real-time field value shall be viewable in diagnostic software table/window.		
5	**Control Issuance**	• Facility to issue controls (DOs) from RTU to field.		
6	**IED Configuration**	• The RTU configurator shall have provision for configuring/interfacing IEDs over multiple protocols including MODBUS (ASCII and RTU), DNP3, IEC 61850, HART and proprietary protocols with the RTU.		
7	**Self-Diagnostic Feature**	• The RTUs shall have a self-diagnostic feature (without uploading/downloading RTU configuration to PC/Laptop) and software watchdog timer devices to monitor and report the healthiness of CPU, memory, power supply, comm. interfaces (both DNP communication with SCADA system and serial communication) and input/output modules at the local level. Further, the RTUs shall support remote		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
		diagnostics from SCADA system so that all these statuses shall be transmitted to SCADA system for displaying in SCADA graphics.		
8	**Modbus Configuration**	• The RTU configurator shall have provision for configuring RTU serial port as Modbus slave for polling by third-party systems (other than SCADA servers). It should be possible to assign AI and DI data available in RTU to Modbus register addresses for accessing by 3rd party systems.		
9	**Configuration Download**	• It should be possible to download configuration to RTUs from the SCADA system/PDT online and offline.		
10	**License Form**	• RTU configurator licenses shall be provided in software (software key) form instead of hardware (dongle).		
11	**Error Detection/Control**	• RTU shall have error detection/control feature to ensure data integrity.		
12	**Offline Configuration**	• It shall be possible to configure, generate and compile RTU configuration file in offline mode that can be downloaded in RTU.		
13	**Simulation Mode**	• The software shall provide a simulation mode to test configurations before deployment.		
14	**Version Control**	• The software shall include version control capabilities to track changes and allow rollback to previous configurations.		
15	**Cybersecurity Features**	• The software shall include cybersecurity features such as password protection, role-based access controls and audit logging.		

SERIAL PORT FOR POLLING IED OVER MODBUS (Master and Slave)

The RTU shall be equipped with the necessary number of serial ports for polling the IEDs as specified. Each serial port of the RTU shall have following provision for communication with IEDs:

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
1	**Communication Type**	• RS-485 communications (2-wire and 4-wire options)		
2	**Baud Rates**	• Support for baud rates from 1200 bps to 115.2 kbps		
3	**Parity**	• Variable parity: Odd, Even, None		
4	**Data Bits**	• Variable data bits: 7, 8, 9		
5	**Modbus Function Codes**	• Support for various Modbus function codes including 1, 2, 3, 4, 5, 6, 15, 16, 22, 23		
6	**Modbus Support**	• Support for Modbus ASCII and RTU		
7	**Modbus Configuration**	• Provision to be configured as Modbus Master or slave with multi-master capability		
8	**Port Type**	• DB-9 port for serial communication with optional RJ-45 adapters		
9	**Diagnostic Feature**	• Diagnostic feature for Modbus communication; possible to view the Modbus data transfer either in the RTU serial card or through the RTU configuration software for diagnostic purposes		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
10	**Data Mapping**	• Data mapping capability from Modbus to DNP3/IEC 60870-5-104		
11	**Retry Mechanism**	• Automatic retry mechanism for failed communications with configurable retry count and timeout		
12	**Store and Forward**	• Store and forward capability for Modbus networks		
13	**Modbus over TCP/IP**	• Support for Modbus over TCP/IP through Ethernet ports		
14	**Modbus Exception Codes**	• Support for Modbus exception codes with detailed error reporting		

INBUILT AGA FLOW CALCULATIONS

The RTU shall support inbuilt AGA flow calculations for natural gas measurement with the following capabilities:

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
1	**Support for Industry Standard AGA Flow Calculations**	• AGA-3 (1992): Orifice metering of natural gas • AGA-7: Turbine metering of natural gas • AGA-8: Compressibility factors of natural gas and related hydrocarbon gases • AGA-11: Coriolis metering of natural gas • Any other AGA standard applicable for GEL		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
2	**Flow Calculation Features**	• Calculation of flow rates, totalized volumes and energy content • Automatic correction for pressure, temperature and gas composition • Compressibility factor calculation per AGA-8 • Heating value calculation • Real-time calculation with configurable update rates • Historical flow data storage with timestamps • Calculation of daily, hourly and monthly flow volumes		
3	**Configuration Capabilities**	• Configurable meter parameters (orifice diameter, pipe diameter, etc.) • Configurable gas composition (up to 24 components) • Selectable units of measurement • Input validation and range checking • Audit trail of configuration changes		
4	**Reporting and Diagnostics**	• Flow calculation diagnostic alarms • Out-of-range parameter detection • Event recording for calibration and configuration changes • Meter verification capabilities		

The RTU shall perform these calculations continuously and independently of the SCADA system, ensuring reliable flow measurement even during communication outages.

CYBER SECURITY FEATURES

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
1	**Authentication and Access Control**	• DNP3 Secure Authentication • Role-based access control with multiple privilege levels • Strong password enforcement • Session timeouts and account lockout after multiple failed login attempts • X.509 certificate support for device authentication		
2	**Communication Security**	• TLS encryption with configurable cipher suites • Secure key management • VPN support • Secure protocols (DNP3-SA, IEC 62351) • Message authentication codes • Sequence number validation		
3	**System Hardening**	• Removal of unnecessary services • Port hardening with unused ports disabled • Secure boot process • Firmware signing and verification • Protection against buffer overflow attacks • Memory protection mechanisms		
4	**Monitoring and Logging**	• Comprehensive audit logging of security events • Intrusion detection capabilities • Authentication failure logging • Configuration change logging		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
		• Secure log transmission to central logging server		
5	**Compliance with Standards**	• IEC 62443 (Industrial Automation and Control Systems Security) • NIST SP 800-82 (Guide to Industrial Control Systems Security) • API 1164 (Pipeline SCADA Security) • IEEE 1686 (Substation Intelligent Electronic Devices Cyber Security)		
6	**Additional Features**	• Secure firmware update process • Protection against denial-of-service attacks • Whitelisting of allowed IP addresses/connections • Backup and restore of security configurations • System integrity monitoring • Malware protection • Physical security features (tamper detection)		

ANNEXURE-1

TECHNICAL SCHEDULE TO BE FILLED BY THE TENDERER

The Bidder shall fill the following technical particulars and submit the same with the offer for selected Remote Telemetry Unit.

Item	Description	Particulars
GENERAL		
1.	Make	
2.	Model no.	
3.	Degree of protection (IP No.)	
4.	Operating temperature range (degree centigrade)	
5.	Operating relative humidity range %	
6.	Maximum number of I/O modules per subrack Main subrack Extension subrack	
7.	Maximum number of communication modules per subrack	
8.	Selectable communication speed range	
9.	Resolution of time tagging	
10.	High/low limit checking (yes/no)	
11.	Whether RTU supports self-checkback-execute and time out feature (yes/no)	
12.	Interfacing with flow computers of different makes (yes/no)	
13.	Remote configuration and downloading of parameters from Master Station supported (yes/no)	
14.	Self-diagnostic of RTU and reporting it to Master Station (yes/no)	
15.	Number of serial ports supported in addition to redundant communication links with Master Station (minimum 4 nos.)	
16.	Whether RTU supports connection of portable maintenance diagnostic test unit (yes/no)	
17.	Whether hardware for 30% spare installed I/O's for RTU included (yes/no)	

Item	Description	Particulars
18.	MTBF for a fully equipped RTU (hours)	
19.	Equipment availability (%)	
20.	MTTR for a fully equipped RTU (hours)	
21.	Power requirement for a fully equipped RTU (watts)	
22.	Maximum number of I/O modules per RTU (separately for each type to be given)	
23.	Spare capacity for each type of I/O	
ADVANCED FEATURES		
24.	AGA flow calculation capability (yes/no)	
25.	Supported AGA standards (list all)	
26.	IEC 61131-3 programming capability (yes/no)	
27.	Supported IEC 61131-3 languages (list all)	
28.	HART support (yes/no)	
29.	Maximum number of HART channels supported	
30.	Redundant power supply (yes/no)	
31.	Hot-swappable I/O modules (yes/no)	
CYBERSECURITY FEATURES		
32.	DNP3 Secure Authentication (yes/no)	
33.	Authentication level supported	
34.	TLS encryption (yes/no)	
35.	Role-based access control (yes/no)	
36.	Audit logging capability (yes/no)	
37.	Third-party security certifications (list all)	

Item	Description	Particulars
COMMUNICATION CAPABILITIES		
38.	DNP3 (TCP/IP) support (yes/no)	
39.	IEC 60870-5-104 support (yes/no)	
40.	Modbus RTU/ASCII/TCP support (yes/no)	
41.	IEC 61850 support (yes/no)	
42.	MQTT, AMQP, HTTP/REST API support (yes/no)	
43.	Number of Ethernet ports	
44.	Ethernet speed supported (10/100/1000 Mbps)	
ENVIRONMENTAL SPECIFICATIONS		
45.	Hazardous area classification	
46.	Vibration resistance	
47.	EMI/RFI immunity standards compliance	
48.	Conformal coating on PCBs (yes/no)	
PERFORMANCE SPECIFICATIONS		
49.	Maximum number of tags supported	
50.	Processor type and speed	
51.	Memory capacity (RAM/Flash)	
52.	Minimum scan rate (milliseconds)	
53.	Data logging capacity (number of events)	

11.3. Type 2 - Industrial Cellular Modem

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
1	Type	• Rugged industrial-grade cellular modem		
2	Network Compatibility	• 4G/LTE with 2G fallback		
3	SIM Slots	• Dual-SIM/Single-SIM multi-network support with automatic failover capability (Physical SIMs) • Optional – e-SIM for both sims		
4	Operating Temperature	• -10°C to 70°C		
5	Humidity	• 5-95% RH, non-condensing		
6	Power Supply	• 24V DC or as required by the RTU system		
7	Ethernet Ports	• Min 2 Ethernet ports		
8	Serial Ports	• Min 3 Serial ports		
9	Protocol Support	• Modbus RTU/TCP, DNP3 authentication		
10	Encryption	• TLS (128-bit minimum)		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
11	Data Transfer	• Store-and-forward capability during communication outages (Minimum 3 day hourly data with minimum parameters)		
12	Transmission Modes	• Push (scheduled and event-driven) and Pull (on-demand) capability		
13	Router Functionality	• Modem shall function as Router for different subnet devices		
14	Communication Status	• LED indication for signal strength and connection status		
15	Antenna Connection	• SMA or suitable RF connector for external antenna		
16	Mounting	• DIN rail or panel mounting options		
17	Enclosure	• Suitable for use in explosion-proof junction boxes		
18	Certification	• PESO certified for Zone 1, Gr IIA/B as per IEC 60079		

11.4. Modem Antenna

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
1	Type	• Omnidirectional cellular antenna		
2	Frequency Range	• Compatible with 4G/LTE and 2G bands used in India		
3	Gain	• Minimum 5-7 dBi		
4	VSWR	• ≤1.5:1		
5	Impedance	• 50 Ohms		
6	Connector	• SMA or compatible with modem connection		
7	Cable	• Low-loss RF cable with appropriate length as per site requirement		
8	Mounting	• Pole mount or wall mount with bracket		
9	Environmental Protection	• IP65 or better for outdoor installation		
10	Operating Temperature	• -20°C to +70°C		
11	Housing Material	• UV-resistant, weather-proof material		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
12	Lightning Protection	• Built-in lightning arrestor		

11.5. Explosion-Proof Junction Box

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
1	Certification	• PESO certified for Zone 1, Gr IIA/B as per IEC 60079 (Ex d or Ex e)		
2	Protection Type	• As per ATEX Directive 95/IEC 60079: Ex ia, Ex ib, Ex d, or Ex e as appropriate		
3	Material	• Cast aluminum alloy or stainless steel		
4	IP Rating	• IP66 minimum		
5	Gland Plates	• Removable bottom gland plates		
6	Cable Entries	• As required for application with certified Ex cable glands		
7	Breather	• Explosion-proof breather where required		
8	Mounting	• Wall or pole mounting options with brackets		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
9	Temperature Rating	• T6 temperature classification (-20°C to +60°C)		
10	Internal Mounting	• Din rail and mounting plate for equipment installation		
11	Dimensions	• Sized appropriately for the equipment to be housed with adequate clearance		
12	Door	• Hinged door with special fasteners and provision for padlocking		
13	Earthing	• Internal and external earth terminals		

11.6. Solar Power System (Optional for DRS)

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
1	Solar PV Panel	• Sized based on power consumption of MODEM and battery charging requirement		
2	Panel Type	• Mono/Polycrystalline silicon with minimum 15% efficiency		
3	Battery	• SMF VRLA type with 3-day backup for MODEM power consumption		
4	Battery Capacity	• Sized to provide 72 hours of continuous operation		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
5	Charge Controller	• Dual charging capability (Solar PV and 230V AC external supply)		
6	Charge Controller Features	• Serial port for RS-485 communication• Battery voltage and charging current monitoring• Overcharge and deep discharge protection• Temperature compensation		
7	Junction Box	• Explosion-proof for housing battery and solar charge controller		
8	Mounting Structure	• Weather-resistant with adjustable tilt angle		
9	Cabling	• FRLS cables with appropriate sizing and glands		
10	Operating Temperature	• -10°C to +70°C		
11	Housing Protection	• IP65 minimum for all outdoor components		

11.7. Managed ethernet switches (For CNG Station/LCNG Station)

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
1	Type	• Managed Ethernet Switch		
2	Ports	• Minimum 4 ports, or higher as per requirement, with 25% spare capacity		
3	Speed	• 10/100 Mbps auto-negotiation		
4	Connector	• RJ-45		
5	Power Supply	• 24V DC or as per RTU system		
6	Mounting	• DIN rail or panel mounting		
7	Operating Temperature	• -10°C to +70°C		
8	Status Indicators	• Power and link/activity LEDs for each port		
9	Surge Protection	• Built-in protection against electrical transients		
10	Housing	• Metal housing for EMI protection		
11	Standards	• IEEE 802.3, IEEE 802.3u		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
12	Installation Location	• Inside RTU panel or compressor PLC panel as applicable		

11.8. Pressure Transmitter

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
1	Type	• Electronic pressure transmitter with local display		
2	Range	• Suitable for application, rated for 100 kg/cm² pressure		
3	Output	• 4-20 mA DC, HART protocol compatible		
4	Power Supply	• 24V DC loop-powered		
5	Accuracy	• ±0.075% of span or better		
6	Stability	• ±0.1% of URL for 12 months		
7	Ambient Temperature Effect	• ±0.05% of span per 10°C change		
8	Process Connection	• ½" NPT (M) with SS manifold		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
9	Mounting	• On a post near pipeline with height 1.6 meters		
10	Protection	• IP66/67, intrinsically safe for hazardous area		
11	Housing Material	• Die-cast aluminum with epoxy paint or 316 SS		
12	Wetted Parts Material	• 316 SS		
13	Accessories	• • SS tubes (½", 0.075" thickness)• SS valves• SS manifolds• SS ferrules• SS connectors• FRP canopy		
14	Certification	• PESO certified for Zone 1, Gr IIA/B		
15	Display	• LCD with engineering unit display		

11.9. Temperature Transmitter

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
1	Type	• RTD based temperature transmitter with local display		
2	Sensor Element	• Pt100, 3 or 4 wire		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
3	Range	• -50°C to +150°C (adjustable)		
4	Output	• 4-20 mA DC, HART protocol compatible		
5	Power Supply	• 24V DC loop-powered		
6	Accuracy	• ±0.1% of span or better		
7	Stability	• ±0.1% of URL for 12 months		
8	Process Connection	• ½" NPT (M) with thermowell		
9	Mounting	• Direct mounting with thermowell		
10	Protection	• IP66/67, intrinsically safe for hazardous area		
11	Housing Material	• Die-cast aluminum with epoxy paint or 316 SS		
12	Wetted Parts Material	• 316 SS		
13	Accessories	• • Thermowell, 316 SS• Sensor head• Connection fittings• Mounting accessories• FRP canopy for outdoor installation		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
14	Certification	• PESO certified for Zone 1, Gr IIA/B		
15	Display	• LCD with engineering unit display		

Isolation Barrier Modules

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
1	Type	• Galvanic isolation barrier for hazardous area		
2	Application	• For Modbus cabling to RTUs at CNG and LCNG stations (1 per 3 dispensers)		
3	Power Supply	• 24V DC or as required by the system		
4	Input/Output	• RS-485 Modbus signals		
5	Isolation	• 2.5 kV minimum between input, output and power		
6	Mounting	• DIN rail mounting		
7	Protection	• Suitable for Zone 1, Gr IIA/B hazardous areas		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
8	Certification	• PESO certified		
9	Operating Temperature	• -10°C to +70°C		
10	Status Indication	• Power and signal status LEDs		
11	Connection	• Screw terminals for easy wiring		
12	Installation	• Inside RTU panel or junction box		

11.10. Surge Protection Devices

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
1	General	• Multi-stage surge protection for electrical and signal circuits		
	Power Line Surge Protectors	•		
1	Type	• Class I+II+III combined surge arrester for AC power lines		
2	Application	• Protection of RTU, MODEM and other electronic equipment power supplies		
3	Rated Voltage	• 230V AC, 50Hz		
4	Maximum Continuous Operating Voltage	• 275V AC minimum		
5	Protection Modes	• L-N, L-PE, N-PE		
6	Nominal Discharge Current (8/20 µs)	• 20 kA minimum per mode		
7	Maximum Discharge Current (8/20 µs)	• 40 kA minimum per mode		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
8	Voltage Protection Level	• <1.5 kV		
9	Response Time	• <25 ns		
10	Short Circuit Withstand	• 10 kA minimum		
11	Operating Temperature	• -40°C to +80°C		
12	Status Indication	• Visual fault indicator		
13	Connection	• DIN rail mounting with screw terminals		
14	Standards Compliance	• EC 61643-11 • UL 1449 4th Edition		
	Signal Line Surge Protectors (Analog)	•		
1	Type	• Multi-stage surge arrester for 4-20 mA current loops		
2	Application	• Protection of analog inputs, outputs and transmitter connections		
3	Rated Voltage	• 24V DC		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
4	Maximum Continuous Operating Voltage	• 30V DC		
5	Protection Modes	• Line-line and line-ground		
6	Nominal Discharge Current (8/20 µs)	• 10 kA		
7	Operating Current	• 4-20 mA (max. 1A)		
8	Voltage Protection Level	• <40V line-line, <600V line-ground		
9	Series Resistance	• <10 Ohms per line		
10	Response Time	• <1 ns		
11	Bandwidth	• DC to >2 MHz for HART communication		
12	Connection	• DIN rail mounting with screw terminals		
13	Standards Compliance	• IEC 61643-21		
	Signal Line Surge	•		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
	Protectors (Digital)			
1	Type	• Multi-stage surge arrester for digital I/O signals		
2	Application	• Protection of digital inputs and outputs		
3	Rated Voltage	• 24V DC		
4	Maximum Continuous Operating Voltage	• 30V DC		
5	Protection Modes	• Line-line and line-ground		
6	Nominal Discharge Current (8/20 µs)	• 10 kA		
7	Operating Current	• Up to 1A		
8	Voltage Protection Level	• <40V line-line, <600V line-ground		
9	Series Resistance	• <10 Ohms per line		
10	Response Time	• <1 ns		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
11	Connection	• DIN rail mounting with screw terminals		
12	Standards Compliance	• IEC 61643-21		
	Communication Line Surge Protectors	•		
1	Type	• Multi-stage surge arrester for RS-485 lines		
2	Application	• Protection of serial communication interfaces		
3	Rated Voltage	• 5V DC		
4	Maximum Continuous Operating Voltage	• 6V DC		
5	Protection Modes	• Line-line and line-ground		
6	Nominal Discharge Current (8/20 µs)	• 5 kA		
7	Operating Current	• Up to 500 mA		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
8	Voltage Protection Level	• <10V line-line, <600V line-ground		
9	Data Rate	• Up to 10 Mbps		
10	Series Resistance	• <10 Ohms per line		
11	Capacitance	• <50 pF		
12	Response Time	• <1 ns		
13	Connection	• DIN rail mounting with screw terminals		
14	Standards Compliance	• IEC 61643-21		
	Ethernet Surge Protectors	•		
1	Type	• RJ45 surge protector for Ethernet lines		
2	Application	• Protection of Ethernet connections		
3	Ethernet Standard	• 10/100/1000 Base-T		
4	Protection	• All 8 conductors plus shield		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
5	Nominal Discharge Current (8/20 µs)	• 2 kA per conductor		
6	Voltage Protection Level	• <60V line-line		
7	Series Resistance	• <2 Ohms per line		
8	Capacitance	• <25 pF		
9	Data Rate	• Up to 1 Gbps		
10	Connection	• RJ45 in/out with shield connection to ground		
11	Standards Compliance	• IEC 61643-21		
	RF Surge Protectors	•		
1	Type	• Coaxial surge protector for antenna connections		
2	Application	• Protection of cellular modem antenna inputs		
3	Frequency Range	• 698-2700 MHz (covering all cellular bands)		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
4	Insertion Loss	• <0.2 dB		
5	VSWR	• <1.3:1		
6	Nominal Discharge Current (8/20 µs)	• 10 kA		
7	RF Power	• 50W maximum		
8	Impedance	• 50 Ohms		
9	Connectors	• N-type female or SMA female as required		
10	Standards Compliance	• IEC 61643-21		

11.11. Cabling Infrastructure

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
Power Cables				
1	Cable Type	• FRLS (Fire Retardant Low Smoke) armored copper conductor cables		
2	Construction	• Conductor: Annealed bare copper wire, stranded • Insulation: XLPE or PVC • Inner Sheath: Extruded PVC compound • Armor: Galvanized steel wire/strip • Outer Sheath: FRLS PVC compound		
3	Size	• For RTU/panel main supply: 3C x 2.5 sq.mm minimum • For internal distribution: 3C x 1.5 sq.mm minimum		
4	Voltage Grade	• 650/1100V		
5	Core Identification	• Color coded cores as per standards		
6	Operating Temperature	• -20°C to +70°C		
7	Standards	• IS 1554 Part-1 • IEC 60332-1 (Flame retardant) • IEC 60754-1 (Low acid gas content) • IEC 61034 (Low smoke density)		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
	Control/Signal Cables			
1	Cable Type	• FRLS (Fire Retardant Low Smoke) armored copper conductor signal cables		
2	Construction	• Conductor: Annealed bare copper wire, stranded• Insulation: XLPE or PVC • Inner Sheath: Extruded PVC compound • Armor: Galvanized steel wire/strip • Outer Sheath: FRLS PVC compound • Overall aluminum mylar tape screening with drain wire		
3	Size	• For analog signals: 2/3C x 1.5 sq.mm screened and armored • For digital signals: 2/3/4/6/8/12C x 1.5 sq.mm as required		
4	Voltage Grade	• 650/1100V		
5	Core Identification	• Numbered cores		
6	Operating Temperature	• -20°C to +70°C		
7	Standards	• IS 1554 Part-1 • IEC 60332-1 (Flame retardant) • IEC 60754-1 (Low acid gas content) • IEC 61034 (Low smoke density)		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
	RS-485 Communication Cables	•		
1	Cable Type	• FRLS (Fire Retardant Low Smoke) armored and screened twisted pair cable		
2	Construction	• Conductor: Annealed bare copper wire, 7 strand • Insulation: XLPE or PVC • Twisted Pair: Twisted with optimum lay • Screen: Aluminum mylar tape with drain wire, 85% coverage minimum • Inner Sheath: Extruded PVC compound • Armor: Galvanized steel wire/strip • Outer Sheath: FRLS PVC compound		
3	Size	• 1 pair x 1.5 sq.mm		
4	Impedance	• 120 Ohms ±10%		
5	Capacitance	• <45 pF/m		
6	Voltage Grade	• 300V		
7	Operating Temperature	• -20°C to +70°C		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
8	Standards	• IS 1554 Part-1 • IEC 60332-1 (Flame retardant) • IEC 60754-1 (Low acid gas content) • IEC 61034 (Low smoke density)		
	CAT-6 Ethernet Cables	•		
1	Cable Type	• FRPVC (Fire Retardant PVC) armored CAT-6 cable		
2	Construction	• Conductor: 23 AWG solid bare copper • Insulation: High-density polyethylene • Pairs: 4 color-coded twisted pairs • Screen: Aluminum mylar tape with drain wire • Inner Sheath: PVC compound • Armor: Galvanized steel wire/strip • Outer Sheath: FRPVC compound		
3	Electrical Specifications	• Characteristic Impedance: 100 Ohms ±10% • Mutual Capacitance: <56 pF/m • Conductor Resistance: <9.38 Ohms/100m • Velocity of Propagation: >0.65c • Return Loss: >20 dB • Attenuation: As per EIA/TIA 568B standards		
4	Bandwidth	• 250 MHz minimum		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
5	Operating Temperature	• -20°C to +70°C		
6	Standards	• ANSI/TIA-568.2-D Category 6 • ISO/IEC 11801 Class E • IEC 60332-1 (Flame retardant)		
	Cable Installation Accessories	•		
1	Cable Glands	• Material: Nickel-plated brass • Type: Double compression • Size: As per cable OD • Certification: PESO approved for Zone 1 Gr IIA/B for hazardous areas		
2	GI Cable Trays	• Material: Hot-dip galvanized steel (min 2.5mm thickness) • Type: Perforated with cover • Width: As per cable load plus 40% spare • Accessories: Coupler plates, bends, reducers, tees and mounting hardware		
3	PVC Conduits	• Material: Heavy duty PVC • Size: As per cable quantity and size • Accessories: Bends, couplers, junction boxes and fixing clips		
4	Cable Lugs	• Type: Tubular for all terminations • Material: Tinned copper • Crimping: Hydraulic crimping with proper dies		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
5	Cable Markers	• Material: UV resistant PVC • Type: Wrap-around with cable number • Information: Cable number, source and destination		
6	Ferruling	• Material: PVC • Type: Printed tube type • Information: Terminal number cross-ferruling		
	Underground Cable Installation	•		
1	Trench	• Depth: 750mm minimum below finished grade • Width: As per cable quantity plus 200mm• • Bottom: Sand bedding of 75mm		
2	Protection	• Warning tape: 150mm wide placed 300mm below grade • Protective layer: Brick or concrete protection tiles		
3	Backfilling	• First layer: Sand 75mm above cable • Intermediate layer: Excavated soil free from stones • Top layer: Matching existing surface		
4	Road Crossings	• HDPE pipe: Minimum PN6 rating • Depth: 1000mm minimum below road surface • Number: One working plus one spare pipe		
5	Markers	• Concrete cable route markers at 30m intervals and at changes in direction		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
	Cable Termination	•		
1	Preparation	• Gland installation with proper tightening • Cable armor earthing using suitable earthing tag • Proper stripping of insulation without damage to conductor • Heat shrink sleeves for core insulation		
2	Termination	• Tubular lugs of appropriate size • Hydraulic crimping with proper die • Insulation sleeves for bare conductors • Proper tightening of terminal screws		
3	Identification	• Ferrule marking as per approved drawing• Cable tags at both ends • Terminal identification as per drawing		
4	Testing	• Insulation testing before and after termination • Continuity testing of each core • Functional testing after termination		

11.12. Technical Specifications for RTU and Modem Cabinets

Below are the technical specifications for cabinets to house Type-1 RTUs, Type-2 RTUs, Dual-SIM modems. These specifications are for non-explosion-proof cabinets.

1.1.2Cabinet Specifications for RTUs and Modems

4..1.22. Type-1 RTU Cabinet Specifications

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
1	Cabinet Type	• Free-standing floor mount, industrial grade		
2	Dimensions	• Minimum 800mm (W) x 2000mm (H) x 600mm (D)		
3	Material	• 2mm thick cold rolled steel, powder coated		
4	Color	• Light gray (RAL 7035)		
5	Protection Rating	• IP55 minimum (non-hazardous areas)		
6	Mounting Configuration	• 19" rack mounting rails with adjustable depth		
7	Cooling	• Forced ventilation with filtered fan units and exhaust		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
8	Cable Entry	• Bottom entry with removable gland plates		
9	Doors	• Front and rear doors with 3-point locking mechanism		
10	Security	• Key-lockable doors with provision for padlocking		
11	Grounding	• Dedicated copper ground bus bar		
12	Power Distribution	• Internal power distribution with MCBs		
13	Terminal Blocks	• DIN rail mounted, screw-type, 20% spare capacity		
14	Cable Management	• Vertical and horizontal cable management system		
15	Internal Lighting	• LED cabinet light with door switch		
16	Temperature Management	• Thermostat-controlled fans with temperature alarm		
17	Documentation Pocket	• Inside door document holder		
18	Labels	• Engraved nameplates for cabinet identification		
19	Spare Capacity	• Minimum 30% physical space for future expansion		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
20	Plinth	• 100mm plinth for floor mounting		
21	Standards Compliance	• IEC 62208, IEC 61439-1		

4..1.23. Type-2 RTU Cabinet Specifications

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
1	Cabinet Type	• Wall-mounted, industrial grade		
2	Dimensions	• Minimum 600mm (W) x 800mm (H) x 300mm (D)		
3	Material	• 1.5mm thick cold rolled steel, powder coated		
4	Color	• Light gray (RAL 7035)		
5	Protection Rating	• IP55 minimum (non-hazardous areas)		
6	Mounting Configuration	• Wall mounting with internal mounting plate		
7	Cooling	• Passive ventilation with filtered vents		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
8	Cable Entry	• Bottom entry with removable gland plates		
9	Doors	• Single front door with 2-point locking mechanism		
10	Security	• Key-lockable door with provision for padlocking		
11	Grounding	• Dedicated copper ground bus bar		
12	Power Distribution	• Internal power distribution with MCBs		
13	Terminal Blocks	• DIN rail mounted, screw-type, 20% spare capacity		
14	Cable Management	• DIN rail and cable management accessories		
15	Temperature Management	• Optional thermostat-controlled fan		
16	Documentation Pocket	• Inside door document holder		
17	Labels	• Engraved nameplates for cabinet identification		
18	Spare Capacity	• Minimum 30% physical space for future expansion		
19	Standards Compliance	• IEC 62208, IEC 61439-1		

4..1.24. Dual-SIM Modem Cabinet Specifications

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
1	Cabinet Type	• Wall-mounted, industrial grade		
2	Dimensions	• Minimum 400mm (W) x 400mm (H) x 200mm (D)		
3	Material	• 1.5mm thick cold rolled steel, powder coated		
4	Color	• Light gray (RAL 7035)		
5	Protection Rating	• IP55 minimum (non-hazardous areas)		
6	Mounting Configuration	• Wall mounting with internal mounting plate		
7	Cooling	• Passive ventilation with filtered vents		
8	Cable Entry	• Bottom entry with gland plates		
9	Doors	• Single front door with locking mechanism		
10	Security	• Key-lockable door		
11	Grounding	• Copper ground connection point		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
12	Power Distribution	• DIN rail mounted power distribution terminal		
13	Terminal Blocks	• DIN rail mounted, screw-type		
14	Cable Management	• Internal cable tie points		
15	Temperature Range	• -10°C to +55°C operating temperature		
16	Documentation Pocket	• Adhesive document holder		
17	Labels	• Engraved or printed nameplates		
18	Spare Capacity	• Minimum 30% physical space for future expansion		
19	Standards Compliance	• IEC 62208		

4..1.25. General Cabinet Requirements for All Types

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
1	Construction	• Robust construction with reinforced mounting points		
2	Surface Treatment	• Degreasing, phosphating and powder coating		
3	Door Gaskets	• EPDM rubber gaskets to maintain IP rating		
4	Hardware	• Stainless steel hinges and mounting hardware		
5	Cable Management	• Proper strain relief for all cables		
6	Ingress Protection	• Designed to prevent dust and water ingress		
7	Condensation Prevention	• Ventilation and/or anti-condensation measures		
8	Identification	• Clear identification of cabinet and contents		
9	Documentation	• Full technical documentation including load calculations		
10	Certifications	• Manufacturer's declaration of conformity		
11	Lightning Protection	• Provision for lightning protection connection		

S.No.	Category	Requirement Description	Bidder Compliance (Y/N)	Bidder Comments
12	Thermal Management	• Thermal design calculations provided		
13	EMC Protection	• EMC considerations in design and construction		
14	Earthing Facilities	• Multiple earth points with star configuration		
15	Access	• Unobstructed access to all components when door is open		
16	Installation	• Mounting template and hardware provided		
17	Maintainability	• Components arranged for easy maintenance		
18	Quality Assurance	• Manufacturer ISO 9001 certified		

11.13. AMI Modem and MIU —Technical Specifications

1.1.3General Hardware Principles

The specifications in this Section are indicative minimum requirements. Although GEL owns all field hardware, the Bidder is fully responsible for designing, selecting, supplying, installing and maintaining that hardware to meet GEL's functional and SLA requirements for the entire contractual period. The Bidder is therefore responsible for all hardware design decisions — including power supply arrangement, enclosure design, barrier and surge protection, communication technology selection and cable sizing. GEL does not specify exact implementation values for these design parameters and GEL's ownership of the hardware does not transfer design responsibility, performance risk, or maintenance and replacement cost to GEL. A specification stated as an indicative minimum does not relieve the Bidder of responsibility for delivering hardware that meets every SLA.

What GEL specifies are the minimum functional, environmental, communication and cybersecurity requirements that each device shall meet. The Bidder shall design the field hardware to meet these requirements and to satisfy the device availability and data collection SLAs. GEL reserves the right to review and reject proposed hardware that does not meet the specifications in this Section.

All hardware supplied under this RFP shall:

- Be newly manufactured — no refurbished or previously deployed hardware is acceptable
- Carry a remaining manufacturer support life of at least five years from the planned Go-Live date
- Not be at or beyond End-of-Life (EOL) or End-of-Support (EOS) at the time of supply
- Carry a minimum IP65 ingress protection rating for outdoor industrial installation
- Be ATEX/PESO certified for the hazardous area classification applicable at the installation site
- Be RoHS compliant

1.1.3.1EVC Communication Modem — Technical Specifications

1.1.3.1.1 General Requirements

Sr. No.	Parameter	Specification
1	Type	Rugged industrial-grade cellular communication modem for direct interface with Electronic Volume Correctors
2	Application	Remote automated data acquisition from EVCs at metering skids (IMS); two-way communication between EVC and AMI Platform
3	EVC Compatibility	Modem shall support integration with all EVC makes and models in GEL's installed base (List provided separately as Annexure). A comprehensive compatibility list shall be submitted with the bid.
4	Serial Interface	Minimum one serial ports — supporting both RS-232 and RS-485 — for connection to EVC communication port
5	Protocol Support	Modbus RTU, Modbus TCP, DLMS/COSEM and proprietary EVC OEM protocols as required for all EVC makes and models in GEL's network. Protocol documentation shall be shared with GEL at no cost as part of device supply.
6	Mounting	DIN rail or panel mounting; suitable for installation within a weatherproof outdoor enclosure

Sr. No.	Parameter	Specification
7	Certifications	ATEX/PESO certified for Zone-1/Zone-2, Group IIA/B as per IEC 60079; RoHS compliant. Modem, safety barrier or any other device such as power supply which needs to be interfaced with the EVC as part of the AMI solution, shall comply in full EVC specific ATEX requirements. Where the Modem supplies power to the EVC serial port, that power feed shall be intrinsically safe / ATEX-compliant to the EVC's hazardous-area classification and shall not compromise the EVC's own certification
8	EVC Powering	The Modem shall be capable of supplying regulated power to the EVC serial/communication port where the EVC requires externally-supplied loop or interface power to maintain communication. The Bidder shall confirm, per EVC make and model in Annexure A, whether serial-port power feed is required and shall provision it accordingly. Any such power feed shall comply in full with the EVC's ATEX/intrinsic-safety requirements.
9	Stored Behaviour Profiles	The Modem shall store at minimum two complete behaviour profiles (Normal, Power-Saving), each configurable over the air by GEL and shall switch between them automatically on mains-failure detection and on GEL command.
10	Power-Saving Autonomy	In the Power-Saving profile, the Modem's backup battery shall sustain operation for a minimum of 72 hours (3 days) during a mains-supply failure, while continuing metrology and event logging.

1.1.3.1.2 Communication and Network

Sr. No.	Parameter	Specification
1	Network Technology	The Bidder shall select the communication technology — 4G LTE or NB-IoT,— based on site-level signal survey results and the SLA requirements. The Bidder is not restricted to any single technology and may deploy different technologies at different locations.
2	SIM Slots	Dual physical SIM slots/Single physical SIM slot with multi-operator capability with automatic failover. In case of Dual physical SIM, SIM cards from two different operators shall be used across the two slots.
3	SIM Failover	Automatic failover from primary to secondary SIM on detection of network failure, with automatic restoration to primary when the primary network recovers. Failover event shall be logged and notified to the AMI Platform.
4	SIM Registration	All SIM card/s shall be registered in GEL name under industrial/IoT service plans.
5	Transmission Modes	Push (scheduled one day push) and Pull (on-demand, server-initiated), both via the hourly listening window. All alarms and events are clubbed with the hourly push (maximum latency one hour); there is no separate real-time alarm push.

		The hourly listening window also serves server-initiated pull requests and the hourly operational data push to EMS/NMS. All modes are mandatory.
6	Encryption	TLS 1.2 or higher (TLS 1.3 preferred) for all data communication between Modem and AMI Platform. Unencrypted data transmission to the platform is not acceptable.
7	Communication Architecture	Push communication, pull communication, event-driven communication, retry handling, session persistence, heartbeat monitoring and configurable polling intervals — all supported.
8	Connectivity Status	LED or LCD indication for SIM 1 and SIM 2 signal strength and active connection status.
9	Antenna Connection	SMA or compatible RF connector for external high-gain antenna.

1.1.3.1.3 Data Storage and Transmission

Sr. No.	Parameter	Specification
1	Store-and-Forward	Modem shall store data locally during communication outages and transmit automatically on communication restoration, with no data loss. Minimum local storage capacity: 30 days of hourly interval data, plus alarm logs, event logs, communication logs and command execution logs.
2	Timestamp Preservation	All stored data records shall carry the EVC-side timestamp at the time of reading. Where the Modem stores EVC parameters in internal memory, the original EVC date and time stamp shall be preserved and transmitted to the AMI Platform, with no substitution of server-side timestamps for EVC-side timestamps.
3	Backfill	On restoration of communication after an outage, the Modem shall backfill all stored data to the AMI Platform in chronological order.
4	Data Integrity	Checksum validation on all transmitted data. The Modem shall not transmit partial, corrupt, or zero-value packets as valid data reads.
5	Retry Logic	Configurable automatic retry on failed transmission, with configurable retry count and interval. Retries shall stop automatically after successful transmission to avoid unnecessary communication overhead.

1.1.3.1.4 Power Supply

Sr. No.	Parameter	Specification
1	Transmission Modes for battery life calculation	Battery life shall be measured against the device duty cycle of: 24 hourly interval logs per day; once-daily bulk data push; an hourly listening-window wake that in a single session performs the pull-request check, EMS/NMS

		telemetry push and alarm/event push. No separate real-time alarm session is included, as all alarms are clubbed with the hourly wake.
2	If Bidder proposes battery-only power	Battery life shall be a minimum of 5 years under the device communication duty cycle specified (24 hourly logs, once-daily push, hourly listening window, hourly EMS/NMS telemetry, alarms).
3	If Bidder proposes mains power with battery backup	Mains supply as primary; battery backup minimum duration of **72 hours (3 days)** to maintain continuous Modem operation during mains supply failure. Battery shall be industrial grade and field-replaceable. This battery shall be rechargeable through the mains power on site.
4	Power failure detection	Modem shall detect and report mains supply failure to AMI Platform in real time. Battery charge level shall be reported to AMI Platform at configurable intervals.
5	Battery replacement	When battery level falls below 20% remaining capacity, the AMI Platform shall generate an alert. Battery replacement is within the Bidder's O&M scope at no additional cost to GEL.
6	Requirement	GEL does not prescribe the power source. Whatever arrangement the Bidder proposes, it shall meet the device availability SLA and the battery life requirements above.
7	Power Source	The Bidder shall determine the power supply arrangement — mains, battery, solar, or hybrid — required to meet the device availability SLA.
8	Requirement	The Modem shall operate continuously without interruption under the power arrangement selected by the Bidder. Power supply failure that results in data loss or communication outage counts against the device availability SLA.
9	Optimisation	The Modem shall implement intelligent power management including sleep/wake cycles and configurable retry limits to optimise power consumption under the selected power arrangement. Power optimisation shall not extend the wake/listening interval beyond one hour.

1.1.3.1.5 Device Management

Sr. No.	Parameter	Specification
1	Firmware	Remote firmware upgrade Over-the-Air with no data loss from device memory. For each deployed modem the Bidder shall either configure OTA firmware update capability through the AMI Platform or firmware update through wired connection. The bidder shall be responsible for all firmware updates either via OTA or through on-ground wired connection throughout the contractual duration. Full rollback to previous firmware version in case of upgrade failure.
2	Remote Diagnostics	Remote diagnostics accessible from AMI Platform including: remote reboot, communication diagnostics, signal quality monitoring, network registration status, data session status, reboot history and power interruption events.

3	Local Configuration	Local configuration and diagnostics via Bluetooth or optical interface. All local configuration access shall be password/OTP-based. Necessary accessories (Bluetooth dongle or optical cable) shall be supplied with each Modem.
4	Auto Recovery	Automatic watchdog with self-reboot on communication failure or abnormal device condition, without data loss.
5	Geo-tagging	GPS coordinates of Modem installation captured at I&C, accurate to within ±1 metre, stored in the AMI Platform asset register.
6	Device Identification	OEM name, model, firmware version, IMEI, ICCID (both SIM slots), SIM status and signal strength captured at I&C and available in the AMI Platform.
7	Telemetry	The Modem shall continuously report the following telemetry to the AMI Platform: signal strength per SIM slot, SIM status, network registration status, data session status, packet loss indicators, reboot history, power events and communication latency indicators.

1.1.3.1.6 Real-Time Clock and Time Synchronisation

Sr. No.	Parameter	Specification
1	RTC Architecture	Temperature-Compensated Crystal Oscillator (TCXO) based Real-Time Clock
2	RTC Accuracy	Timestamp accuracy within ±2 minutes per year under TCXO architecture
3	RTC Backup	Minimum 10-year RTC battery backup
4	Time Synchronisation	Modem RTC shall be automatically synchronised with the NTP server clock provided by the Bidder at the AMI Platform end. RTC synchronisation logs shall be available in the AMI Platform.

1.1.3.1.7 Environmental and Mechanical Requirements

Sr. No.	Parameter	Specification
1	Operating Temperature	-10°C to +55°C minimum
2	Storage Temperature	-10°C to +65°C minimum
3	Relative Humidity	5% to 95% RH, non-condensing
4	Ingress Protection	Minimum IP65 for the complete installed assembly (Modem within weatherproof enclosure)

5	Hazardous Area	ATEX/PESO certified Zone-1/Zone-2, Group IIA/B as per IEC 60079 for installation in or adjacent to hazardous classified areas
6	Environmental Standard	IP 65 or latest equivalent for vibration, shock and environmental protection
7	EMC Compliance	IEC/EN applicable EMC standards
8	Enclosure	Modem shall be installed within a weatherproof outdoor enclosure supplied by the Bidder. The enclosure shall be positioned outside the metering skid in the safe zone, at a minimum distance of 5 feet from the skid. Enclosure material shall be powder-coated SS304, polycarbonate, or equivalent non-corrosive material suitable for outdoor coastal and industrial environments.
9	Cable	Shielded communication cable between EVC and Modem. Cable routing and fixing shall protect against mechanical damage and environmental exposure.

1.1.3.1.8 Display, Keypad and User Interface

Sr. No.	Parameter	Specification
1	Display	Single-line, dual-line, OLED, or LCD — type at Bidder's design discretion
2	Display Parameters	Visual indication for meter reading, battery status, signal strength and alarm status
3	Display Power Saving	Display shall switch off after a configurable period of inactivity and shall be activated by a button on the Modem
4	Keypad	Navigation and manual trigger buttons
5	Local Configuration	Local configuration and diagnostics via Bluetooth or optical interface, protected by password/OTP-based secure access. Necessary accessories (optical cable or Bluetooth dongle) shall be supplied with each MIU.
6	Manual Transmission	Provision to trigger a manual data transmission from the Modem
7	Diagnostics	Real-time network diagnostics and communication logs viewable locally

1.1.3.1.9 Cybersecurity Requirements

Sr. No.	Parameter	Specification
1	Encryption	AES-128 / 256 minimum for data at rest on device; TLS 1.2 or higher for data in transit

2	Secure Boot	Secure boot implementation — device shall only execute digitally signed firmware
3	Signed Firmware	All firmware updates shall be digitally signed. The Modem shall reject unsigned firmware packages.
4	Device Authentication	Unique device identity authentication with the AMI Platform before data exchange is permitted
5	Secure Credential Storage	Encryption keys and credentials stored in secure, tamper-resistant storage
6	Role-Based Access	Role-based access control for local and remote configuration
7	Session Management	Automatic session timeout and logout functionality
8	Audit Trail	Complete audit trail of all configuration activities, firmware changes and access events
9	VAPT	Modem shall be included in the CERT-In VAPT conducted before Go-Live and in each subsequent VAPT as specified in the RFP

1.1.3.1.10 Alarm and Tamper Features

Sr. No.	Alarm / Feature	Requirement
1	Magnetic tamper detection	Mandatory
2	MIU cover open alert	Mandatory
3	Pulse cable cut or disconnect alert	Mandatory
4	Low battery alert (user-configurable threshold)	Mandatory
5	Communication failure alert	Mandatory
6	Threshold-based alerts for minimum and maximum flow and consumption (user-configurable thresholds)	Mandatory
7	Signal strength alert	Mandatory
8	Unauthorised configuration alert	Mandatory

1.1.3.1.11 Antenna Requirements

Sr. No.	Parameter	Specification
1	Type	Omnidirectional external high-gain antenna compatible with the communication technology deployed at each site
2	Frequency	Compatible with all cellular/LPWAN bands used by selected operators in India
3	Gain	Minimum 5 dBi for cellular; appropriate gain for NB-IoT as applicable
4	Connector	SMA or compatible with Modem connection
5	Cable	Low-loss RF cable of appropriate length for the site layout
6	Mounting	Pole mount or wall mount with bracket, positioned for optimum signal reception

7	Environmental	IP65 minimum; UV-resistant, weather-proof housing; operating temperature -10°C to +55°C
8	Lightning Protection	Built-in lightning arrestor

1.1.3.1.12 Continuous Diagnostics

- The Modem shall support continuous heartbeat diagnostics for network, device health and communication status monitoring.
- A timestamped log of Modem network registration events and AMI Platform communication history shall be maintained in the device and available to the AMI Platform.
- The Modem shall support automatic soft reset/auto-reboot on detection of communication failure conditions, without data loss.
- Device diagnostics shall include: battery status, signal quality, firmware version and communication health.
- Network diagnostics shall include: signal strength, registration logs and communication history — all available through the AMI Platform.
- Signal strength history logs shall be stored on the device and transmitted to the AMI Platform.
- Battery percentage and battery history logs shall be stored on the device and transmitted to the AMI Platform.

1.1.3.1.13 Battery Backup Calculation Assumptions

The Bidder shall provide detailed battery backup calculations including:

- Battery-only installations: demonstrated calculation showing a minimum five-year operational life under the specified data collection and communication duty cycle
- Mains-powered installations with battery backup: demonstrated calculation showing a minimum 72-hour (3-day) backup capability on a full charge
- Battery state-of-health monitoring capability and replacement trigger thresholds
- Charging system specifications for mains-powered installations
- Environmental considerations (temperature range, humidity) and their impact on battery performance

Ref	Device activity	Prescribed minimum frequency
D1	Scheduled data push — 24 hourly readings pushed to the AMI Platform	1 per day
D2	Hourly wake — listening window to check for pull requests, Alarm and Events check and push to the AMI Platform if found, Operational-data (telemetry) push to NMS and EMS	24 per day (once per hour)

1.1.3.2Meter Interface Unit (MIU) — Indicative Technical Specifications

1.1.3.2.1 General Requirements

Sr. No.	Parameter	Specification
1	Application	Remote data acquisition from Positive Displacement (Diaphragm) gas meters via pulse output interface
2	Meter Compatibility	MIU shall be compatible with all PD meter makes and models in GEL's installed base (List provided separately as Annexure A). A comprehensive compatibility list shall be submitted with the bid.
3	Supported Meter Interfaces	MIU shall support magnetic/reed switch-based index and Cyble-based pulse interfaces.
4	Mounting	MIU shall snap-fit directly to the meter wherever the meter make/model supports it. Where snap-fit is not feasible, the MIU shall be connected to the PD meter via a pulse cable supplied by the Bidder. A wire seal provision shall be present on the MIU (or pulse cable connection) so that the MIU or cable cannot be removed from the meter without breaking the seal. Wire sealing shall be carried out by GEL.
5	Built-in or External Modem	Each MIU shall incorporate either a built-in communication modem or be paired with a dedicated external communication modem. Communication from the MIU to the AMI Platform shall not depend on any shared or intermediate infrastructure.
6	Enclosure Material	Powder-coated SS304, polycarbonate, or equivalent non-corrosive material suitable for outdoor industrial and coastal environments across all GEL operating locations.
7	Certifications	ATEX/PESO Zone-1/Zone-2 certified

1.1.3.2.2 Meter Interface and Pulse Cable

Sr. No.	Parameter	Specification
1	Pulse Cable	A pulse cable compatible with the specific meter make and model shall be supplied with each MIU where snap-fit mounting is not feasible.
2	Mounting — Non Snap-fit	Where the MIU is not of snap-fit type, the MIU shall be installed within a weatherproof enclosure with a hinged, lockable door and appropriate mounting accessories (pole mount or wall mount as required for the site). The enclosure shall be supplied and installed by the Bidder with each MIU unless MIU is directly mounted to Index head of the meter.
3	Pulse Constant Configuration	The MIU shall support configuration of the pulse constant to match the rated pulse output of the PD meter at the installation site.

1.1.3.2.3 Communication and Network

Sr. No.	**Parameter**	**Specification**
1	Network Technology	The Bidder shall select the communication technology — 4G LTE with 2G fall back or NB-IoT— based on site-level signal survey results and the SLA requirements.
2	SIM Slots	Dual physical SIM slots/Single physical SIM slot with multi-operator capability with automatic failover. In case of Dual physical SIM, SIM cards from two different operators shall be used across the two slots.
3	Communication Protocol	MQTT, DLMS/COSEM and equivalent industry-standard open protocols. Full protocol documentation shall be shared with GEL at no cost as part of supply.
4	Transmission Modes	Push (scheduled hourly bulk push) and Pull (on-demand, server-initiated), both via the hourly listening window. All alarms and events, including tamper and safety alarms, are clubbed with the hourly push (maximum latency one hour); there is no separate real-time alarm push. All modes are mandatory.
5	Scheduled Push	As a minimum, once per day push to AMI Platform, transmitting all stored hourly logs for the preceding 24 hours, covering consumption, minimum/maximum flow rates, battery percentage, signal percentage alarm status, etc.
6	Alert Latency	Maximum latency for real-time alerts (tamper, device cover open, pulse disconnect, etc.) reaching the AMI Platform: **1 hour** from event occurrence.
7	Encryption	TLS 1.2 or higher for all communication between MIU and AMI Platform.
8	Antenna	External high-gain antenna, with signal strength visible on MIU display or through configuration software.

Sr. No.	Parameter	Specification
9	Antenna Connection	SMA or compatible RF connector.

1.1.3.2.4 Power Supply

Sr. No.	Parameter	Specification
1	Power Source	MIUs shall be battery-only. Battery life shall be a minimum of 5 years under the device communication duty cycle. Battery shall be industrial grade and field-replaceable.
2	Battery replacement	When battery level falls below 20% remaining capacity, the AMI Platform shall generate an alert. Battery replacement is within the Bidder's O&M scope at no additional cost to GEL.
3	Requirement	GEL does not prescribe the power source. Whatever arrangement the Bidder proposes, it shall meet the device availability SLA and the battery life requirements above.
4	Requirement	The MIU shall operate continuously without interruption under the battery power arrangement selected by the Bidder. Power supply failure that results in data loss or communication outage counts against the device availability SLA.
5	Optimization	The Modem shall implement intelligent power management including sleep/wake cycles and configurable retry limits to optimize power consumption under the selected power arrangement.

1.1.3.2.5 Real-Time Clock and Time Synchronisation

Sr. No.	Parameter	Specification
1	RTC Architecture	Temperature-Compensated Crystal Oscillator (TCXO) based Real-Time Clock
2	RTC Accuracy	Timestamp accuracy within ±2 minutes per year under TCXO architecture
3	RTC Backup	Minimum 10-year RTC battery backup
4	Time Synchronisation	MIU RTC shall be automatically synchronised with the NTP server clock provided by the Bidder at the AMI Platform end. RTC synchronisation logs shall be available in the AMI Platform.

1.1.3.2.6 Device Management

Sr. No.	Parameter	Specification
1	OTA Firmware	Remote firmware upgrade Over-the-Air with no data loss from device memory. Full rollback to previous firmware version in case of upgrade failure.
2	Remote Diagnostics	Remote diagnostics accessible from AMI Platform including: remote reboot, communication diagnostics, signal quality monitoring, network registration status, data session status, reboot history and power interruption events.
3	Local Configuration	Local configuration and diagnostics via Bluetooth or optical interface. All local configuration access shall be password/OTP-based. Necessary accessories (Bluetooth dongle or optical cable) shall be supplied with each Modem.
4	Auto Recovery	Automatic watchdog with self-reboot on communication failure or abnormal device condition, without data loss.
5	Geo-tagging	GPS coordinates of Modem installation captured at I&C, accurate to within ±1 metre, stored in the AMI Platform asset register.
6	Device Identification	OEM name, model, firmware version, IMEI, ICCID (both SIM slots), SIM status and signal strength captured at I&C and available in the AMI Platform.
7	Telemetry	The Modem shall continuously report the following telemetry to the AMI Platform: signal strength per SIM slot, SIM status, network registration status, data session status, packet loss indicators, reboot history, power events and communication latency indicators.

1.1.3.2.7 Data Logging and Storage

Sr. No.	Parameter	Specification
1	Memory	Non-volatile memory — data shall be retained during power failure or device reset
2	Interval Logs	Configurable interval — 10, 20, or 30 minutes
3	Hourly Logs	Minimum 6 months of hourly logs
4	Daily Logs	Minimum 12 months of daily logs
5	Monthly Logs	Minimum 10 years of monthly logs
6	Event Logs	Communication failures, cable disconnect, low battery, device reboot/reset and configuration changes
7	Parameter Logs	Interval, hourly, daily and monthly logs shall include minimum and maximum values for consumption and flow rate within each logging period

8	Communication Failure Buffer	Minimum 30 days of hourly data storage available under communication failure conditions
9	Backfill	MIU shall backfill all stored data to the AMI Platform on communication restoration, in chronological order

1.1.3.2.8 Alarm and Tamper Features

Sr. No.	Alarm / Feature	Requirement
1	Magnetic tamper detection	Mandatory
2	MIU cover open alert	Mandatory
3	Pulse cable cut or disconnect alert	Mandatory
4	Low battery alert (user-configurable threshold)	Mandatory
5	Communication failure alert	Mandatory
6	Threshold-based alerts for minimum and maximum flow and consumption (user-configurable thresholds)	Mandatory
7	Signal strength alert	Mandatory
8	Unauthorised configuration alert	Mandatory

1.1.3.2.9 Environmental and Mechanical Requirements

Sr. No.	Parameter	Specification
1	Operating Temperature	-10°C to +55°C minimum
2	Storage Temperature	-10°C to +65°C minimum
3	Relative Humidity	5% to 95% RH, non-condensing
4	Ingress Protection	Minimum IP65 for the complete installed assembly
5	Hazardous Area	ATEX/PESO certified Zone-1/Zone-2, Group IIA/B as per IEC 60079 for installation in or adjacent to hazardous classified areas
6	Environmental Standard	IP 65 or latest equivalent for vibration, shock and environmental protection
7	EMC Compliance	IEC/EN applicable EMC standards

8	Enclosure	MIUs shall be installed within a IP65 weatherproof outdoor enclosure supplied by the Bidder. The enclosure shall be positioned outside the metering skid in the safe zone, at a minimum distance of 5 feet from the skid. Enclosure material shall be powder-coated SS304, polycarbonate, or equivalent non-corrosive material suitable for outdoor coastal and industrial environments.
9	Cable	Shielded communication cable between EVC and Modem. Cable routing and fixing shall protect against mechanical damage and environmental exposure.

1.1.3.2.10 Cybersecurity Requirements

Sr. No.	Parameter	Specification
1	Encryption	AES-128 / 256 minimum for data at rest; TLS 1.2 or higher for data in transit
2	Secure Communication	TLS 1.2 or higher mandatory
3	Device Authentication	Unique device authentication with AMI Platform mandatory before data exchange
4	Secure Firmware	Digitally signed firmware only; MIU shall reject unsigned firmware packages
5	Audit Trails	Complete audit trail of all user and configuration activities
6	Access Control	Role-based access control for local and remote configuration
7	VAPT	MIU shall be included in the CERT-In VAPT conducted before Go-Live and in each subsequent VAPT
8	Key Management	Secure encryption key management
9	Session Management	Automatic logout/session timeout

1.1.3.2.11 AMI Platform Integration Requirements

Sr. No.	Parameter	Specification
1	Data Integration	Compatible with AMI Platform (HES/MDMS functionality), SAP/Billing system
2	API Support	Open APIs for third-party integration
3	Push/Pull	All MIU parameters, diagnostics and event logs shall be pushed to AMI Platform. All parameters shall be available for on-demand pull.
4	Export Formats	Data exportable in CSV/XLSX format and compatible with SAP/Billing integration
5	Timestamps	Mandatory on all logged records
6	Time Synchronisation	Mandatory
7	Remote Configuration	Remote configuration and diagnostics through AMI Platform

8	Data Synchronisation	Automatic synchronisation after communication restoration (backfill)
9	Transmission Frequency	All parameters (logged hourly) shall be transmitted to the AMI Platform by the MIU at minimum once every 24 hours

1.1.3.2.12 Continuous Diagnostics

- The MIU shall support continuous heartbeat diagnostics for network, device health and communication status monitoring.
- A timestamped log of MIU network registration events and AMI Platform communication history shall be maintained in the device and available to the AMI Platform.
- The MIU shall support automatic soft reset/auto-reboot on detection of communication failure conditions, without data loss.
- Device diagnostics shall include: battery status, signal quality, firmware version and communication health.
- Network diagnostics shall include: signal strength, registration logs and communication history — all available through the AMI Platform.
- Signal strength history logs shall be stored on the device and transmitted to the AMI Platform.
- Battery percentage and battery history logs shall be stored on the device and transmitted to the AMI Platform.

1.1.3.2.13 Battery Backup Calculation Assumptions

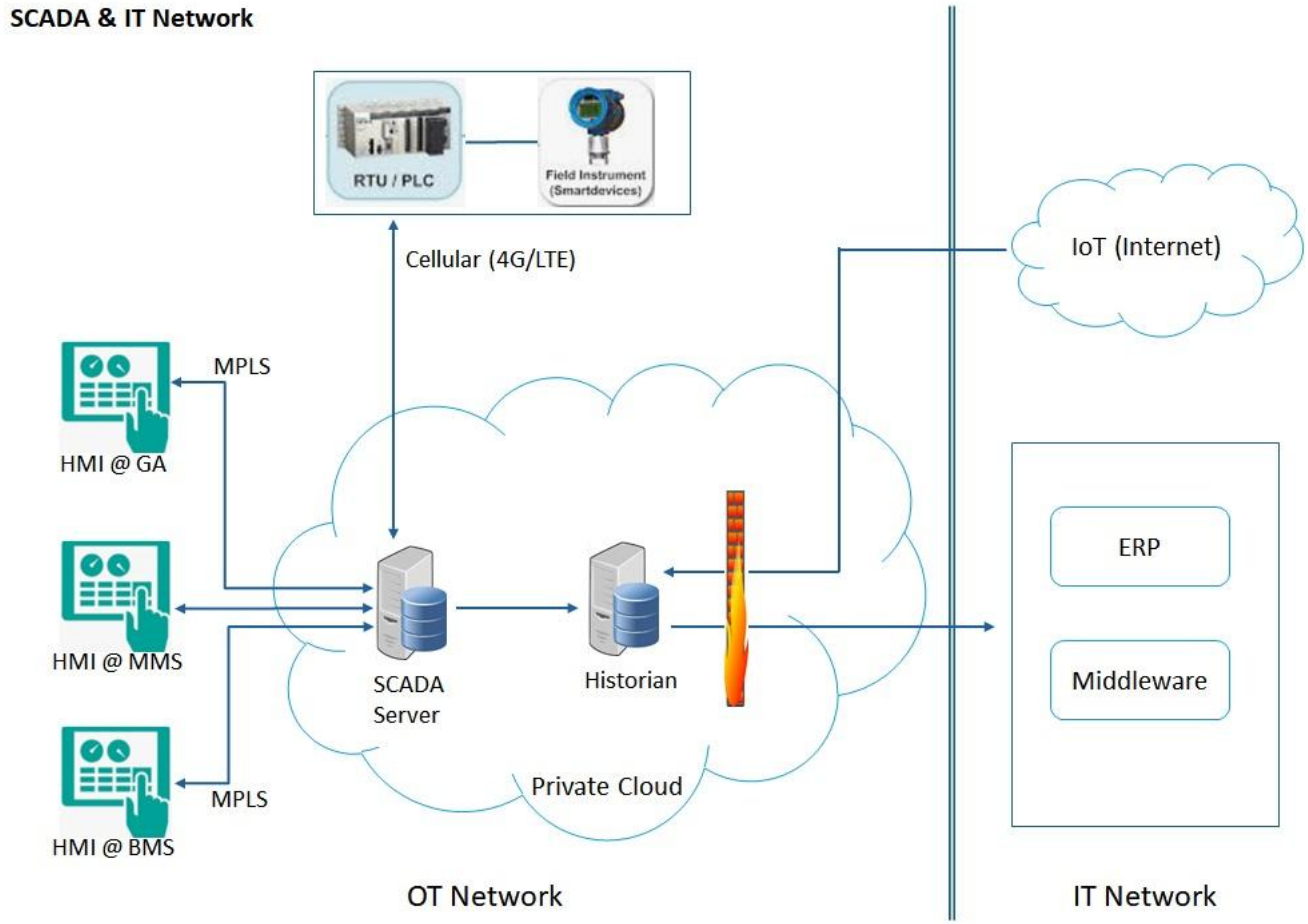
The Bidder shall provide detailed battery backup calculations including:

- Battery-only installations: demonstrated calculation showing a minimum five-year operational life under the specified data collection and communication duty cycle
- Mains-powered installations with battery backup: demonstrated calculation showing a minimum 72-hour (3-day) backup capability on a full charge
- Battery state-of-health monitoring capability and replacement trigger thresholds
- Charging system specifications for mains-powered installations
- Environmental considerations (temperature range, humidity) and their impact on battery performance

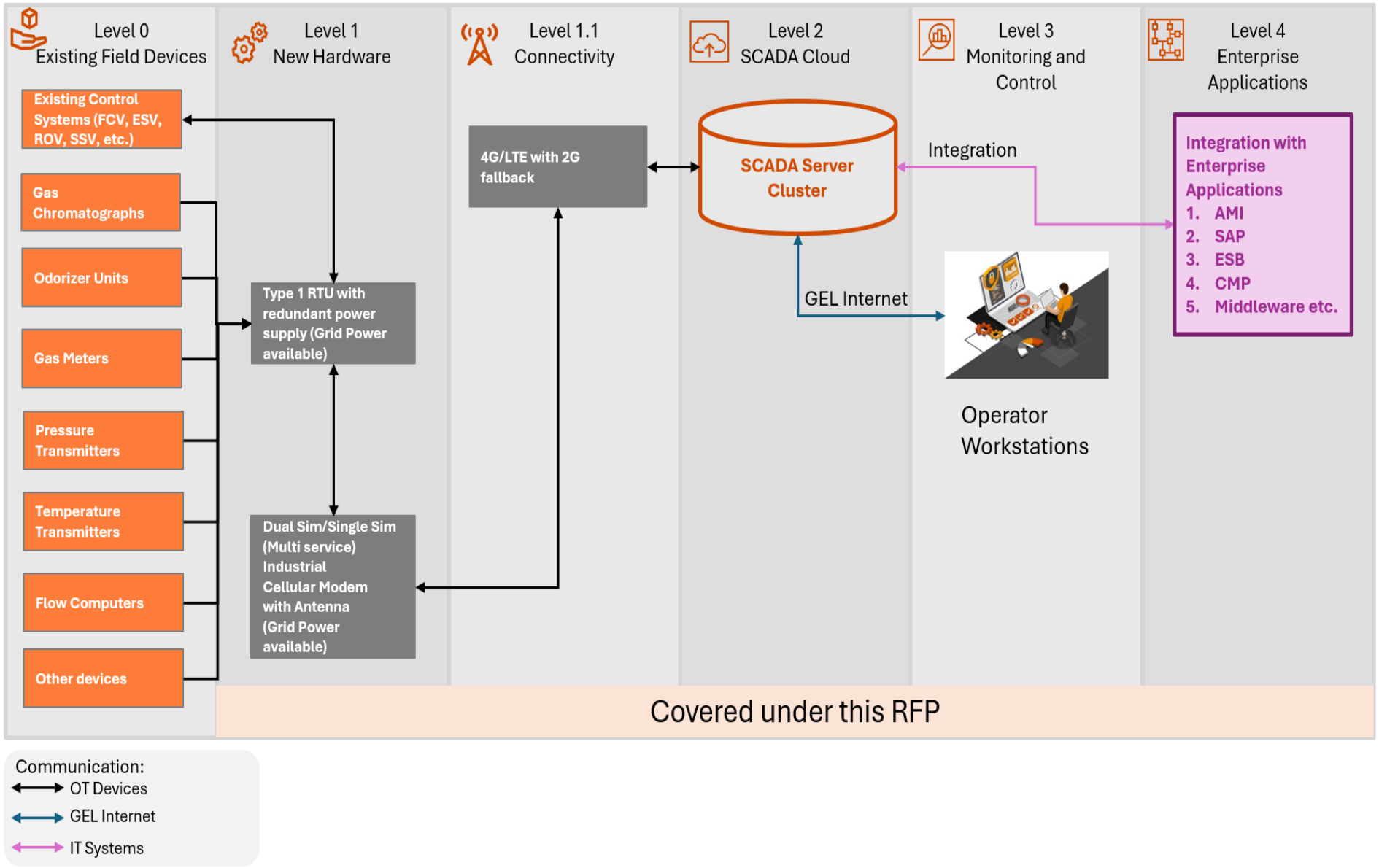
Ref	Device activity	Prescribed minimum frequency
D1	Scheduled data push — 24 hourly readings pushed to the AMI Platform	1 per day
D2	Hourly wake — listening window to check for pull requests, Alarm and Events check and push to the AMI Platform, Operational-data (telemetry) push to NMS and EMS	24 per day (once per hour)

12. Indicative SCADA Architecture

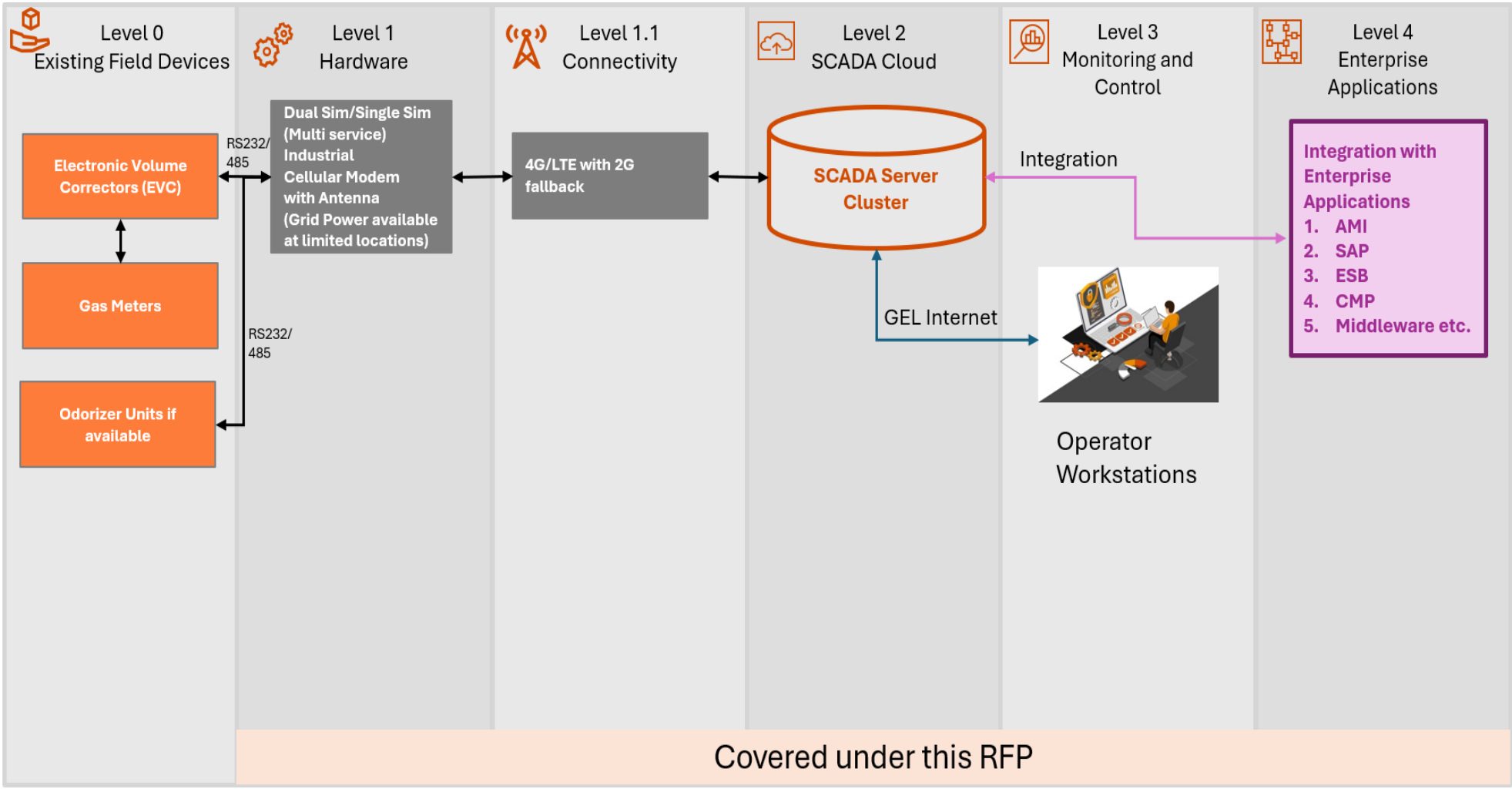
Below is an indicative overall and station wise SCADA architecture for each type of station. However, final architecture for each type of station shall be finalized during detail engineering and provided by bidder to GEL.



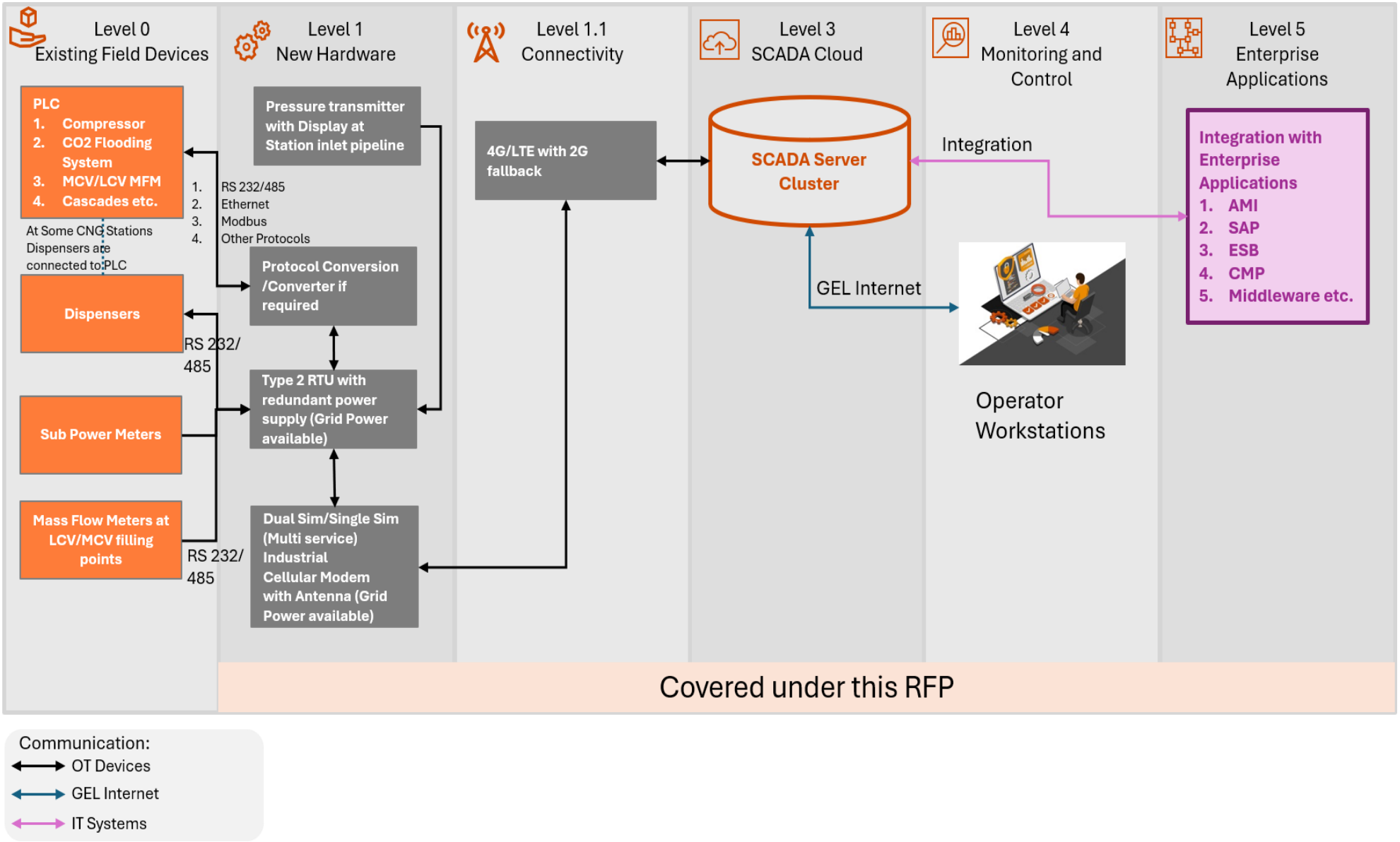
12.1. City Gate Station



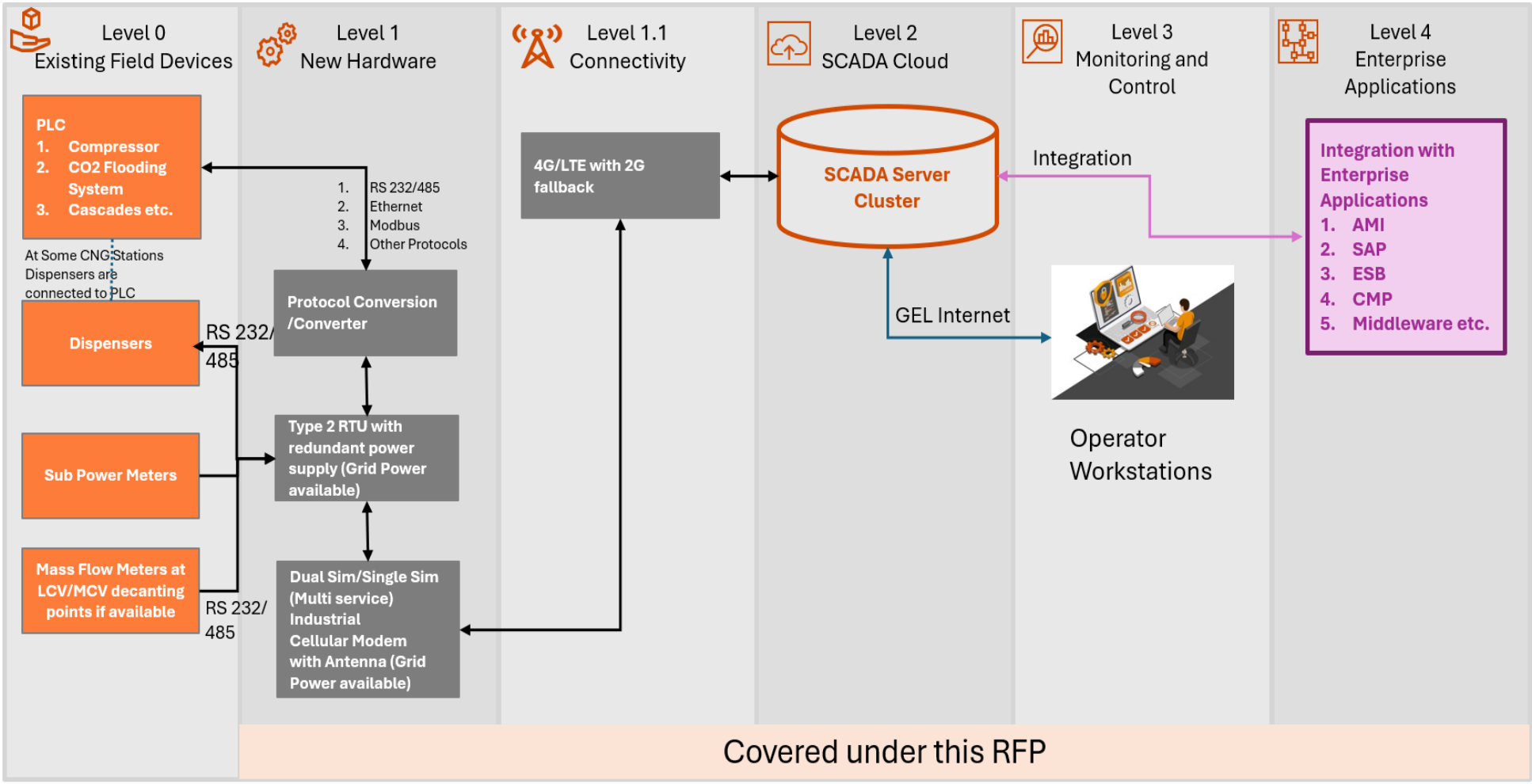
12.2. Check Metering Stations



12.3. Mother/Online CNG Stations

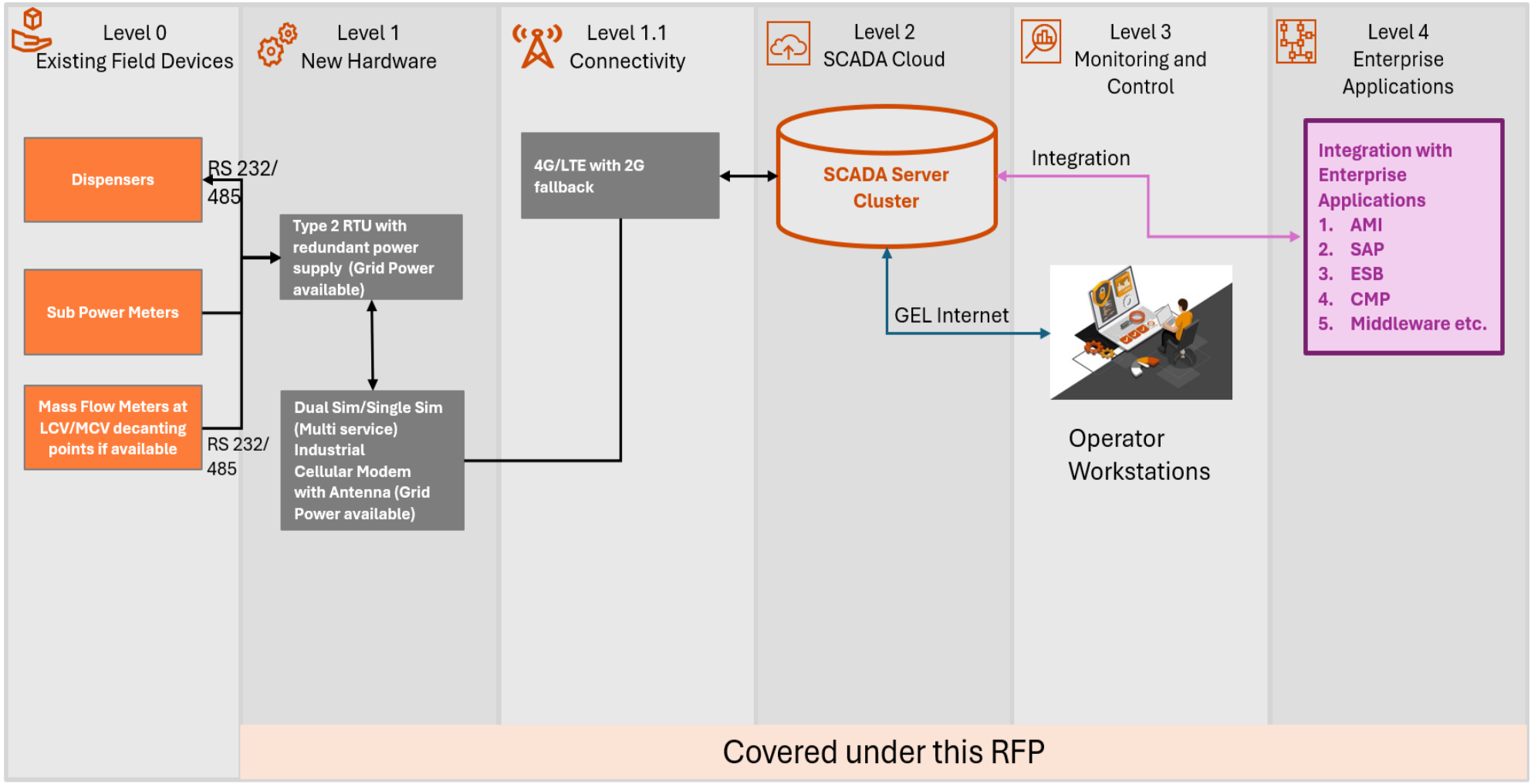


12.4. Daughter Booster CNG Station

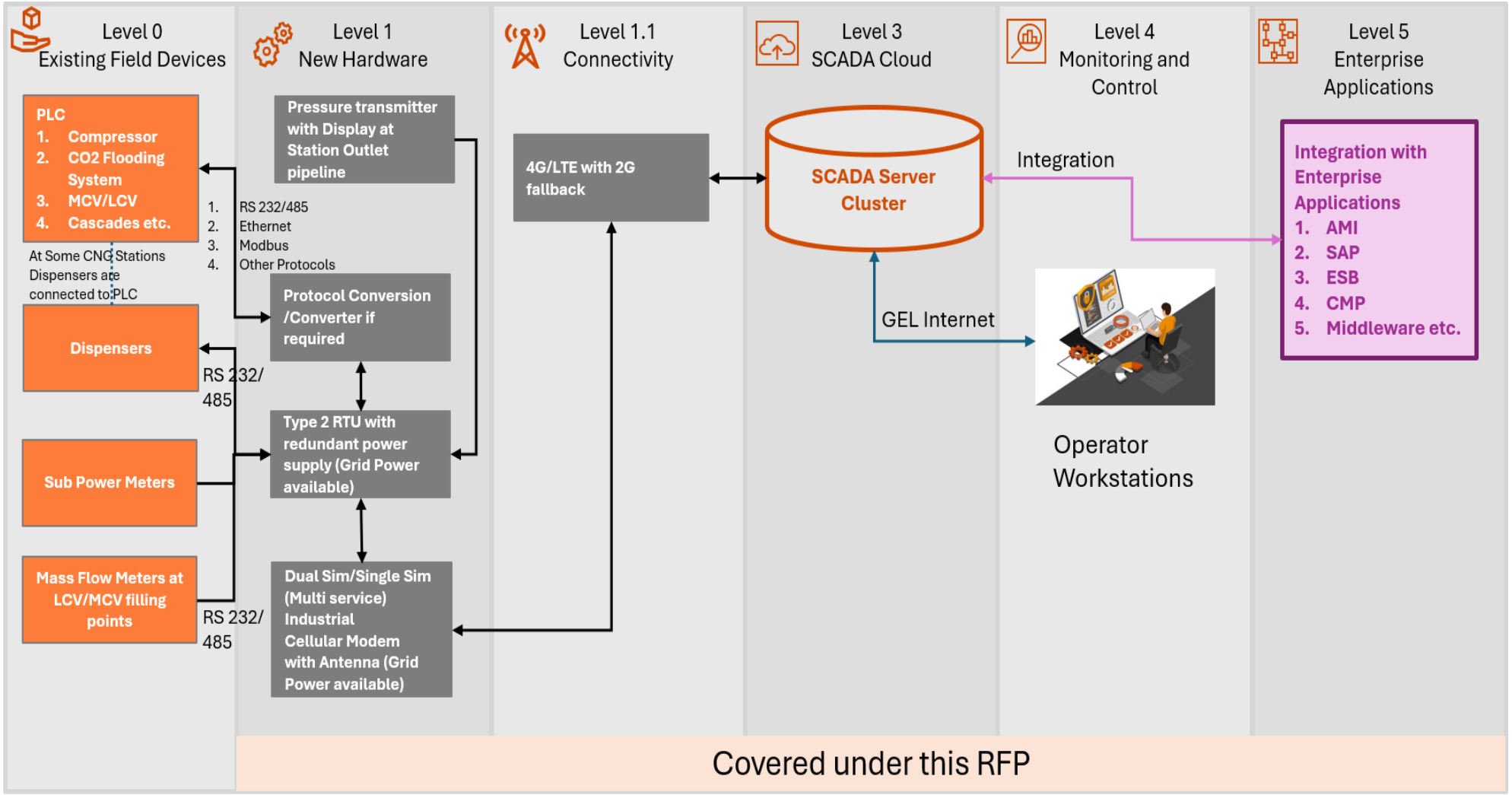


Communication:
- OT Devices
- GEL Internet
- IT Systems

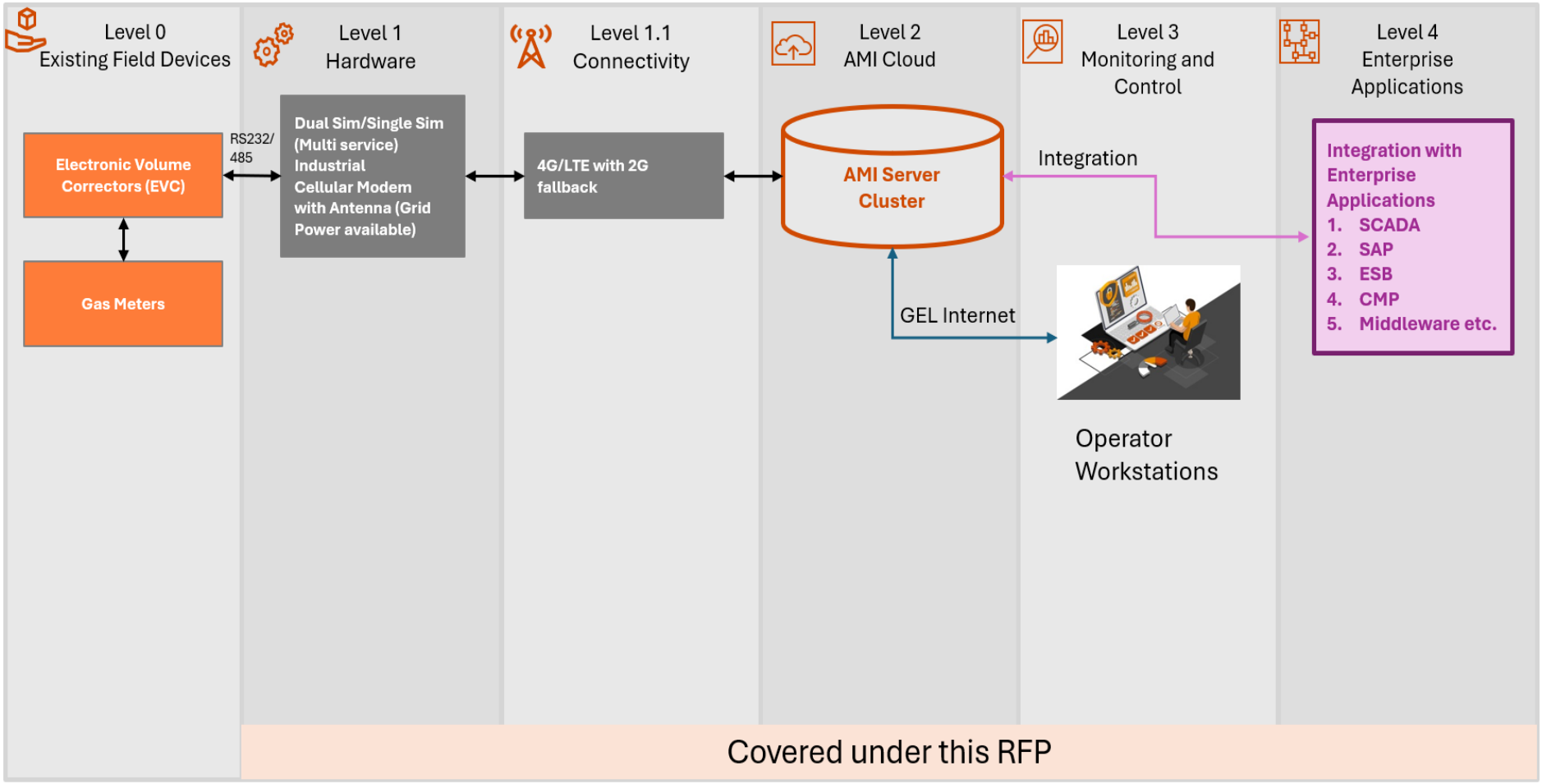
12.5. Daughter CNG Station



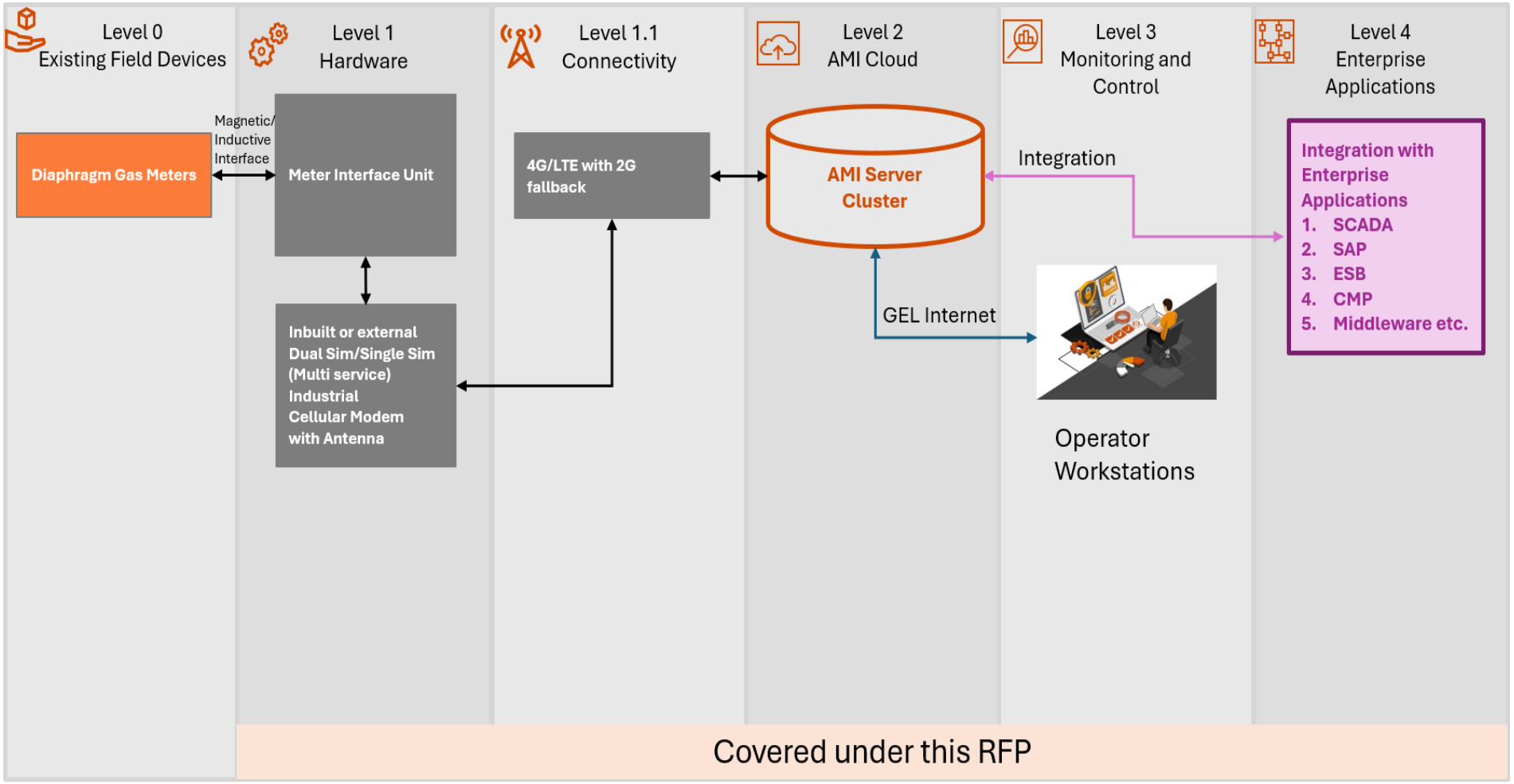
12.6. LCNG Station



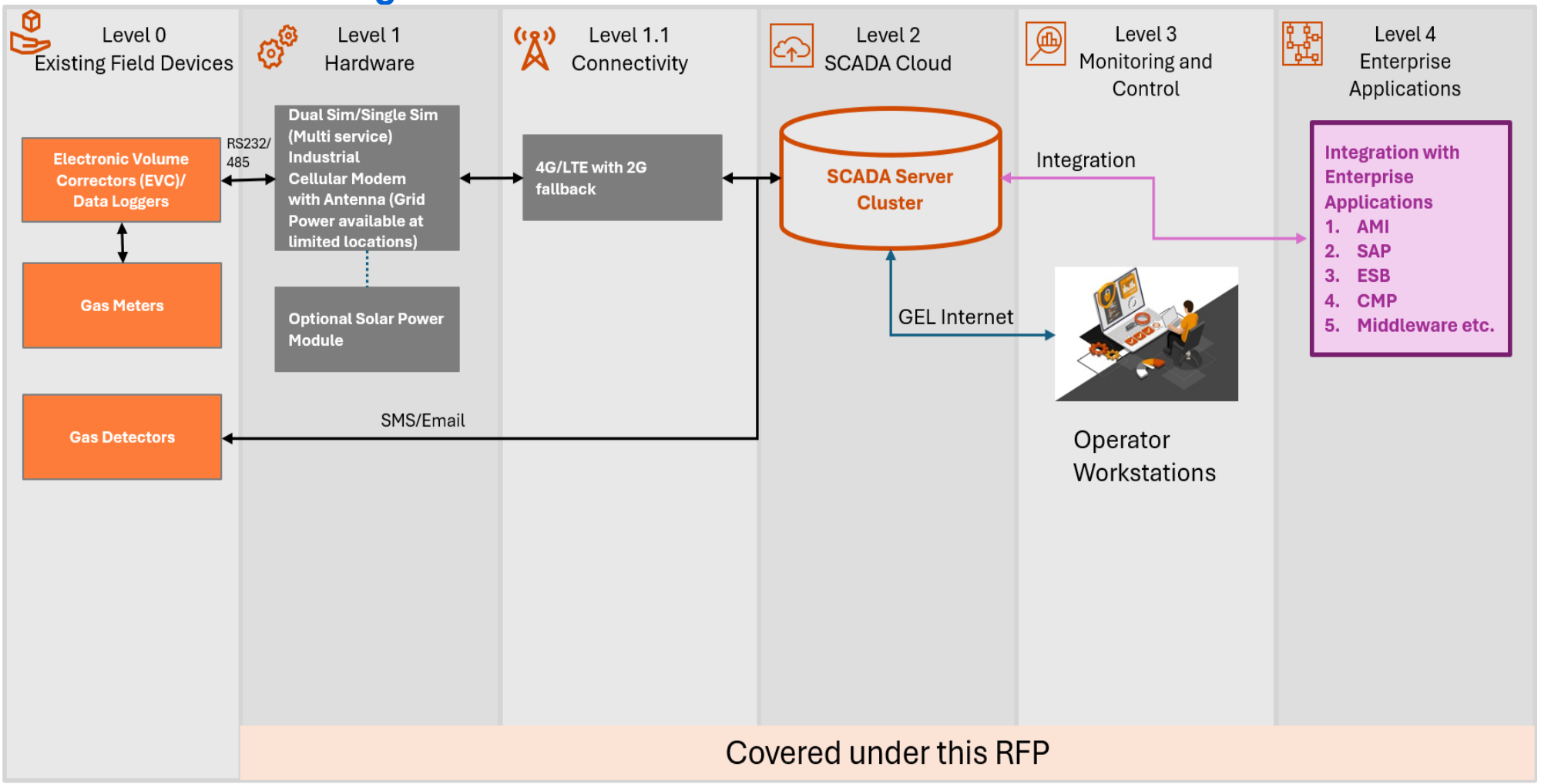
12.7. Industrial/Commercial Metering Skids with EVC



12.8. Industrial/Commercial Metering Skids with Diaphragm Meters

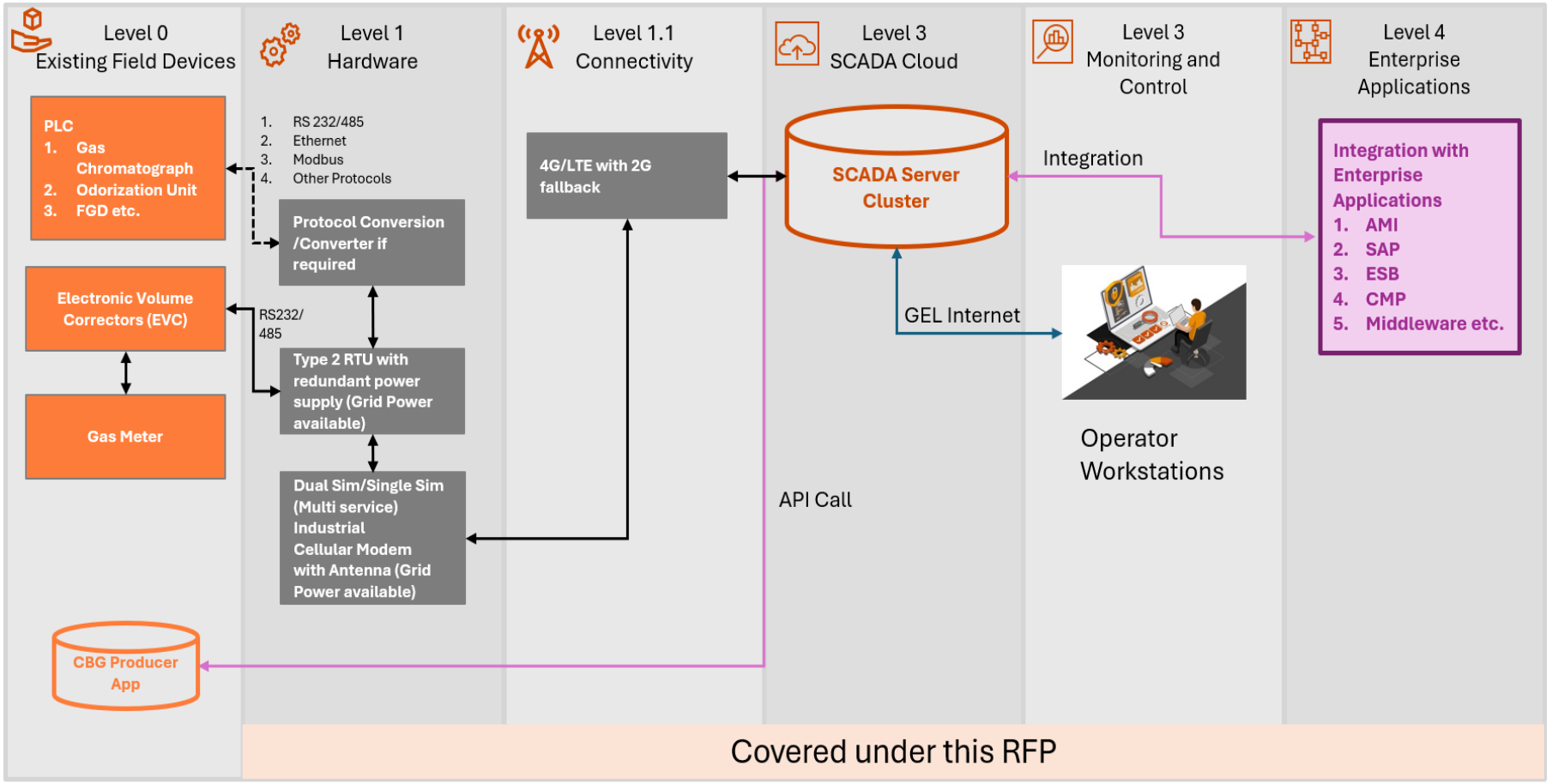


12.9. District Regulation Skids

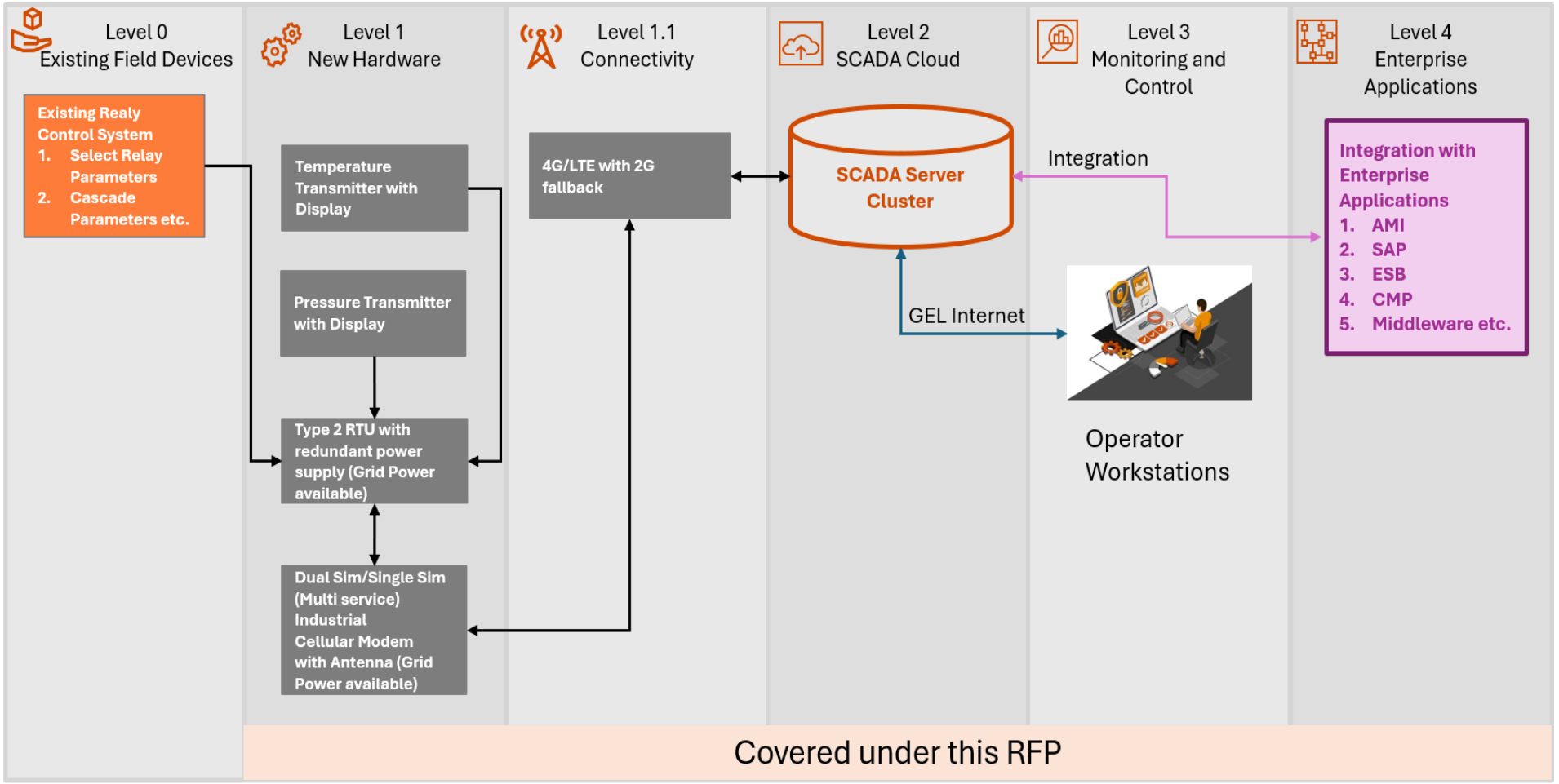


Communication:
- OT Devices
- GEL Internet
- IT Systems

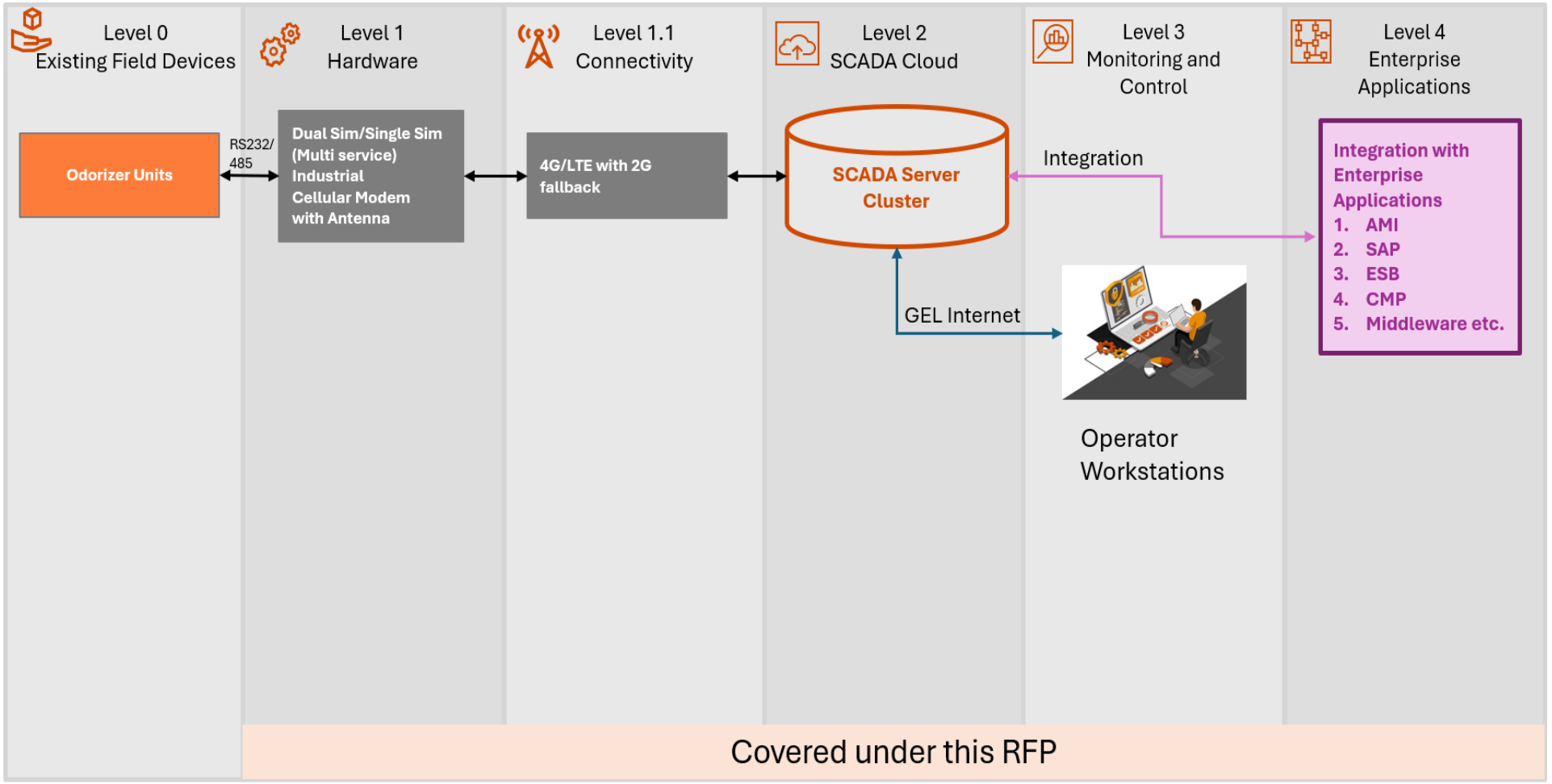
12.10. Compressed Biogas Plants



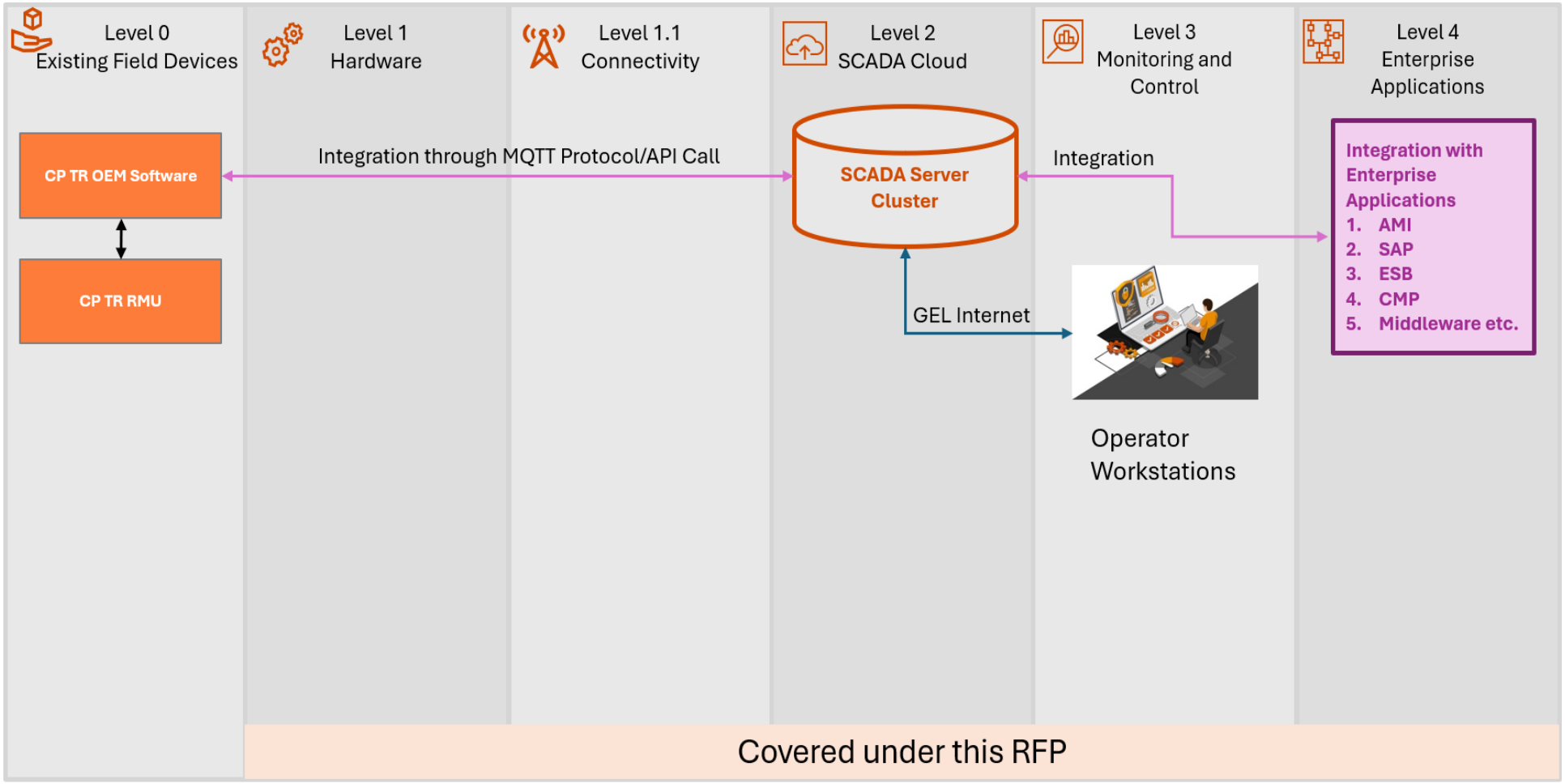
12.11. Decompression Skids



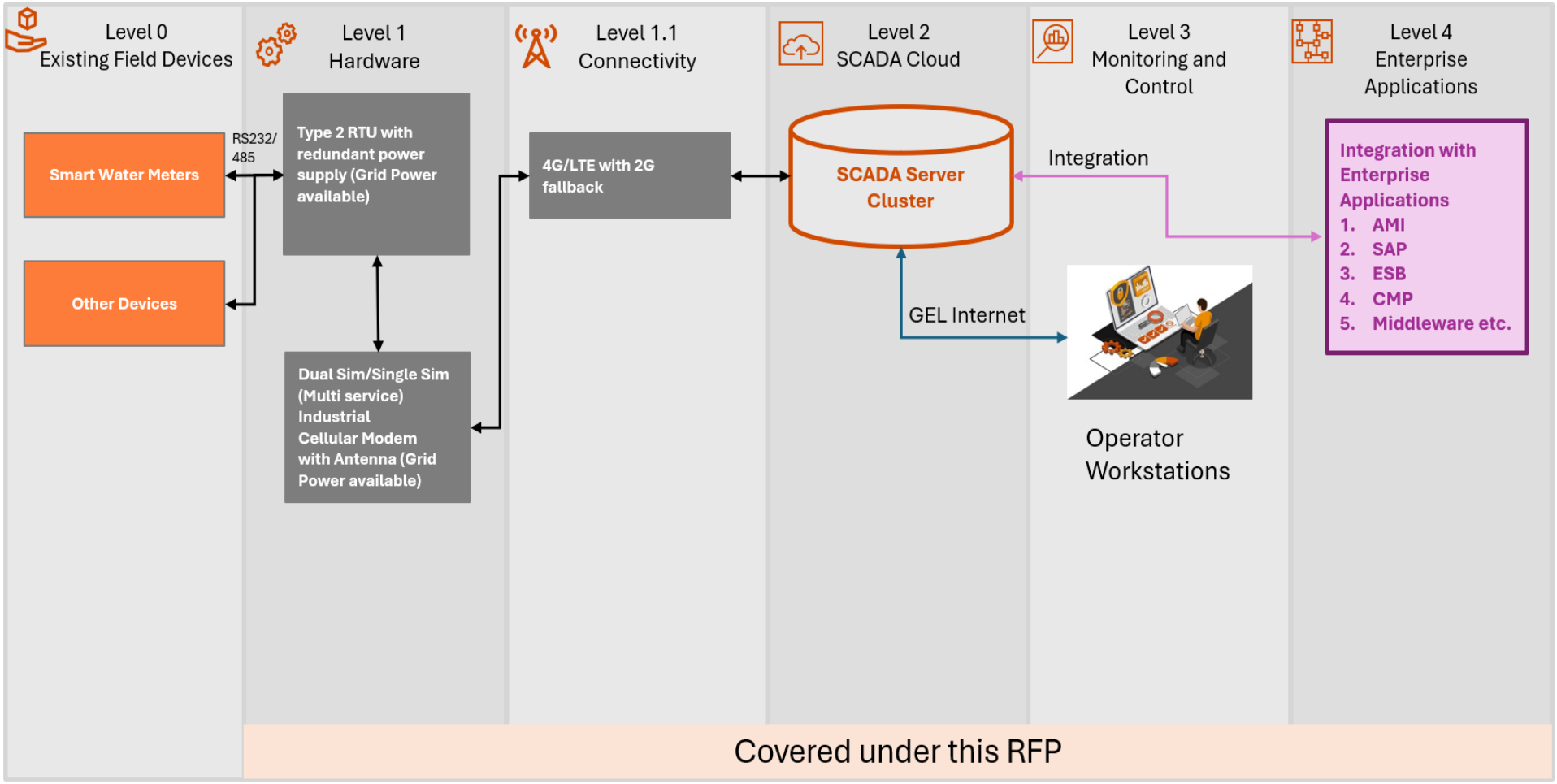
12.12. Odorizer Units



12.13. Cathodic Protection Unit



12.14. Gas Exploration Sites



13. Indicative Reports for Stations

Below is the list of indicative reports for each type of station. However, final reporting shall be finalized during detail engineering and provided by bidder to GEL.

S.No.	Asset class	Indicative Reports	
1	IMS with EVC/ Sites with PD meters	1. Customer wise Daily consumption report	9. Gas Temperature analysis report
		2. GA wise Daily consumption report	10. CF Monitoring Report
		3. Zone wise Daily consumption report	11. LF1 & LF2 Coherence check report
		4. Companywide Daily consumption report	12. Customers requiring Battery replacement
		5. Consecutive 5 days (or as configured) Zero consumption customers list	13. Highest (Top 5% / configurable) and lowest (Top 10% / configurable) consuming customers for a defined period
		6. Consumption Trend analysis report	14. Customers consuming gas 24 hours non-stop over a configurable period.
		7. Flow rate analysis report	15. Customers with average hourly flow rate below Min. Threshold & above Max. Threshold set value over a configurable period.
		8. Gas Pressure analysis report	
2	CNG/LCNG	1. CNG Station wise Sales report	9. Report on Transit loss between Mother station and DB stations / Daughter / DCS stations
		2. GA wise CNG Sales report	10. Station up time report

S.No.	Asset class	Indicative Reports	
		3. Zone wise CNG Sales report	11. Station utilization report
		4. Company-wide CNG Sales report	12. MCV utilization report
		5. Station loss report – GA wise, Zone wise	13. Sub meter and Compressor energy meter reconciliation
		6. Forecourt loss report – GA wise, Zone wise	14. Station inlet pressure report
		7. Compression loss report – GA wise, Zone wise	15. Odorization dozing report – Gas Quality report if applicable
		8. KwH/Kg report – Compressor wise	16. Odorant storage tank level monitoring report if applicable
3	CGS	1. Flow rate analysis report	5. Odorization dozing report
		2. Inlet & Outlet Pressure analysis report	6. Odorant storage tank level monitoring report
		3. Gas temperature monitoring report	7. Event based Gas leak report, Flame detection report
		4. Gas quality report	
4	DRS	1. Inlet & Outlet Pressure analysis report	4. Gas Consumption report
		2. Gas temperature monitoring report	5. Event based Gas leak report
		3. Flow rate analysis report	
5	CP	1. TR Unit report daily once – All parameters	
6		1. Flow rate analysis report	4. CF Monitoring Report

S.No.	Asset class	Indicative Reports	
	Check Metering Stations	2. Gas Pressure analysis report	5. Odorization dozing report – Gas Quality report if applicable
		3. Gas Temperature analysis report	6. Odorant storage tank level monitoring report if applicable
7	DCS	1. Flow rate analysis report	4. CF Monitoring Report
		2. Gas Pressure analysis report	5. Inlet MFM report
		3. Gas Temperature analysis report	6. Reconciliation Report

14. Tentative Monitoring and Control Parameters

The list of signals below is tentative and minimum list of signals to be fetched from each system. However, final list of signals for interfacing with SCADA for each system shall be finalized during detail engineering and provided to bidder for interfacing.

All works required for interfacing of signals, including supply of all hardware and software required at both ends shall be included in scope of the bidder.

S.No.	Type of Station	Function	Parameters
1	City Gas Station (CGS)	MONITORING	• Inlet Gas Pressure • Outlet Gas Pressure • Gas Flow Rate • Gas Temperature• Corrected Flow Rate • Corrected Consumption (Today, Last 24 hrs, Cumulative) • Interval/Hourly/Daily/Monthly Logs • Active and Memorized Alarms • Event and Parameter Logs • Control Valve Positions (SSV- through limit switch) • Emergency Shutdown System Status • Fire & Gas Detection Signals • Gas Composition • Specific Gravity • Z-factor • Calorific Value • Odorization Level
		CONTROL	• Remote Pressure Setpoint (PCV)Adjustment through LC 21 • Flow Rate Limitation Settings (through FCV) • Remotely Operated Valve (ROV) (Percentage) Operation • Remote ESV Activation
2	CNG Stations	MONITORING	• Compressor Status (Running/Stopped/Fault) • Compressor Suction/Discharge Pressures • Compressor Temperature (Various Stages) • Gas Flow to Compressor • Compressor MFM for inlet and outlet

S.No.	Type of Station	Function	Parameters
			• Power Consumption through Compressor meter • Hours Meter Reading (HMR) • Start/Stop Count • Alarms (Active and Historical) • Component Status (Cooling Fan, Main Motor) • Compressor Performance Metrics • Log Sheet Records • Compressor Isolation Status • High/Medium/Low Bank Pressure • Gas Inventory • Priority Panel Status • Dispenser Operational Status • CNG Price • Last Filled Batch Details • Cumulative Display Totalizer • Flowmeter Totalizer • Cumulative Amount • Dispenser Pressure • Fire & Gas Detection Signals • CO2 Flooding System Status • Emergency Shutdown Status • Energy consumption monitoring through Station Supply Power Meter • LCV MFM Totalizer Reading • LCV Fill Gas Pressure • LCV Batch Reading • •Any other IO currently available on PLC
		CONTROL	• Remote Price Update Capability • Remote ESD Activation for Compressors Only
		Compressor INTEGRATION	• Data Collection • Communication Interface • Network Expansion
3		MONITORING	• Inlet Gas Pressure • Outlet Gas Pressure

S.No.	Type of Station	Function	Parameters
	District Regulating Station (DRS/CPRS)		• Corrected Flow Rate• Uncorrected Flow Rate • Corrected Consumption (Today, Last 24 hrs, Cumulative) • Uncorrected Consumption Values • Correction Factor • Gas Temperature • Interval/Hourly/Daily/Monthly Logs • Active and Memorized Alarms • Event and Parameter Logs • Battery Status • Automated Logbook Data • Domestic/Commercial Consumption Analysis • Set threshold values of Flow Max and Min • Data Push Capability • On-demand Data Pulling • Security Switch of EVC status
		CONTROL	• NONE
4	Decompression Skids	MONITORING	• Inlet Gas Pressure • Outlet Gas Pressure • Gas Temperature • Interval/Hourly/Daily/Monthly Logs • Active and Memorized Alarms • Event and Parameter Logs • Battery Status • Automated Logbook Data • Inlet MFM readings
		CONTROL	• NONE (Existing relay-based control system remains independent)
5	Industrial Metering Skid (IMS/IPRS)	MONITORING	• Corrected Flow Rate • Uncorrected Flow Rate • Corrected Consumption (Today, Last 24 hrs, Cumulative) • Uncorrected Consumption Values • Interval/Hourly/Daily/Monthly Logs • Gas Pressure

S.No.	Type of Station	Function	Parameters
			• Gas Temperature • Correction Factor • Active and Memorized Alarms • Event and Parameter Logs • Battery Status • Set threshold values of Flow Max and Min • Data Push Capability • On-demand Data Pulling • Security Switch of EVC status Through AMI • Billing Data Integration • Abnormal Consumption Detection • Consumption Pattern Analysis • Data Validation for Billing • Customer Usage Profiling • Industrial Consumption Analysis
		CONTROL	• • NONE
6	Cathodic Protection System	MONITORING	• Pipe-to-Soil Potential • Output Voltage • Output Current • AC Input Voltage • TR Unit Status • Reference Cell Status • Under-protection Alarms • Over-protection Alarms • Reference Electrode Failure Detection • TR Unit Door Open Security Alerts • AC Supply Failure Notification • Test Lead Point (TLP) Data • Protection Levels • Corrosion Risk Assessment

S.No.	Type of Station	Function	Parameters
			• CP Data Interface Connection • Communication Protocol Conversion • Parameter Mapping • Data Collection Configuration • Alarm Integration • Automated Logbook Data
		CONTROL	• NONE (Control remains with existing CP system)
7	LCNG Station	MONITORING	• Tank Level Parameters • LNG Volume Calculation • Tank Pressure• Tank Temperature • Boil-off Gas Management • Inventory Tracking • Hold Time Calculation • LP Pump Status • HP Pump Status • Suction Pressure • Discharge Pressure • Pump Temperature • Hours Meter Reading (HMR) • Pump Performance Metrics • Alarms and Status • Dispenser Status • CNG/LNG Price • Last Filled Batch Details • Cumulative Totalizer • Flowmeter Totalizer • Cumulative Price • Dispenser Pressure • Unmetered Gas Detection • Dispenser Performance • Fire & Gas System Status • Temperature at Various Points • Pressure at Various Points • Mass Flow Meters at Key Points

S.No.	Type of Station	Function	Parameters
			• Emergency Shutdown Status • Alarm Management • Set Parameters • System Performance Monitoring • MCV Fill MFM Totalizer Reading • MCV Fill Gas Pressure • Station Sales Reconciliation • Automated Logbook Data • LNG to CNG Conversion Efficiency Analysis
		CONTROL	• Remote Price Update Capability in CNG Dispensers
		LCNG PLC INTEGRATION	• Data Collection • Communication Interface • • Network Expansion
8	Compressed Bio-Gas Plant (Cbg)	MONITORING ONLY	• Raw Biogas Production Rate • Production System Status • Production Parameters • Production Efficiency Metrics • Raw Biogas Quality • Biogas Composition • Methane Content • CO2 Content • H2S Content • Purification Efficiency • Compressed Gas Pressure • Safety Parameters • Gas Flow to GGL Grid • Gas Injection Flow Rate • Injection Pressure • Injection Temperature • Grid Connection Status • Odorization Status (if applicable) • • Automated Log Book Data

S.No.	Type of Station	Function	Parameters
		CONTROL	• NONE (Control remains with CBG plant systems)
9	Check Metering Station (CMS)	MONITORING ONLY	• Check Meter Validation • Volume Totalization • Meter Health Monitoring • Real-time Flow Rate • Corrected Flow Rate • Uncorrected Flow Rate • Corrected Consumption (Today, Last 24 hrs, Cumulative) • Uncorrected Consumption Values • Gas Temperature • Interval/Hourly/Daily/Monthly Logs • Active and Memorized Alarms • Event and Parameter Logs • Battery Status • Set threshold values of Flow Max and Min • Correction Factor • Audit Trail
		CONTROL	• NONE
10	Odorizer Units	MONITORING ONLY	• Battery Voltage • Odorant Injection Rate • Odorant Injected • Pump Displacement • Verometer Level • Odorant Tank Level • Odorant Inlet Pressure • Odorant Total Injection High • Odorant Total Injection Low • Expansion Tank Pressure • Proportional to Time Stroke Rate • Low Battery Status • Proportional Time • Pump Failure

S.No.	Type of Station	Function	Parameters
			• System Stop Status
		CONTROL	• NONE (Control remains with existing odorizer system)

15. Indicative Station Wise I/O Details

S.No.	Infrastructure Type	I/O Details per Location
1.	City Gate Stations (CGS)	• 24 Digital Inputs• 3 Digital Outputs• 45 Analog Inputs• 3 Analog Outputs• 6 MODBUS ports• 2 Ethernet ports
2.	CNG Stations	• Varies by station type: - Mother stations: 88 PLC I/Os, 10 dispenser points - Daughter-Booster: 44 PLC I/Os, 10 dispenser points - Daughter: 10 dispenser points
3.	District Regulating Stations (DRS/CPRS)	• 12-15 EVC parameters via Modbus
4.	Industrial Metering Stations – with EVC and RPD meters (IMS/IPRS)	• 12-15 EVC parameters via Modbus
5.	Check Metering Stations	• 12-15 EVC parameters via Modbus
6.	Compressed Bio-Gas Plants	• 12-15 EVC parameters via Modbus
7.	LCNG Stations	• 88 PLC I/Os• 10 dispenser points• 3 Modbus ports• 2 Ethernet ports
8.	Decompression Skids	• 8-12 Digital Inputs
9.	Cathodic Protection Systems	• 8-12 parameters via MQTT
10.	Odorizer Units	• 8-12 parameters via Modbus
11.	Underground DRS solutions	Bidder to evaluate
12.	Industrial metering stations (IMS / IPRS) – with PD meters	5-10 parameters
13.	E&P Smart Meters	8-12 parameters via Modbus
	TOTAL	

Note:

- All Flow computers, Gas Chromatographs, Odorizer, Gas Detection System and Fire Detection system shall be connected point to point, ie, 1 port for each device For each AI signal (including spares), Active IS Barriers shall be provided.
- The Final IO list shall be prepared by the bidder for each station and to be submitted for approval.
- The above is the min I/O requirement. Any additional I/Os required to meet the functionality specified in the tender and safety regulations shall be provided. interposing relays shall be provided for each DO channel , including the spare DO channel.
- A minimum of 10% spare of each type of I/O (AI, DI, DO) shall be provided. Wherever relays are used for field interface, additional 10% relays shall be provided as pre-wired installed spare. All Spares shall be wired in the panel till the TBs
- If any number of the IO points (including the RTU MODBUS port) mentioned in the IO list is not used for its intended purpose, the same shall be utilised by GGL for other purpose as deemed necessary by GGL. The scope of bidder in such case shall be as per the tender.
- All dispensers shall be connected point to point, ie, 1 port shall be used for 2 dispenser.
- Odorizer, Fire and Gas Detection System etc shall be connected in 1 multidrop loop. However, final decision shall be taken during detail engineering The Final IO list shall be prepared by the bidder for each station of each GA considering all the facilities and to be submitted for approval.
- The above is the min I/O requirement. Any additional I/Os required to meet the functionality specified in the tender and safety regulations shall be provided. interposing relays shall be provided for each DO channel , including the spare DO channel.
- A minimum of 10% spare of each type of I/O (AI, DI, DO) shall be provided. Wherever relays are used for field interface, additional 10% relays shall be provided as pre-wired installed spare.
- All Spares shall be wired in the panel till the TBs
- If any number of the IO points(including the RTU MODBUS port) mentioned in the IO list is not used for its intended purpose, the same shall be utilised by GGL for other purpose as deemed necessary by GGL. The scope of bidder in such case shalll be as per the tender.

16. Annexure A - Indicative List of Existing EVCs and PD Meters

EVC Metering sites by GA, Make and Model

GA Name	Qty.
Morbi	816
Bharuch, Narmada & Dahej	582
Valsad	514
Surendranagar	256
Surat+Hazira	235
Rajkot	181
Thane	100
Bhavnagar	89
Panchmahal	71
Dadra & Nagar Haveli	62
Ahmedabad Rural	53
Jamnagar	35
Gandhinagar	27
Nadiad	26
Amritsar	25
Navsari	17
Anand	17
Kutchh	15
Amreli	4
Dahod	4
Jalore Sirohi	2

Make	Model	Qty.
Itron	Corus	1628
Elgas	ELCOR lite	1259
Elgas	midi ELCOR	100
Elgas	ELCOR PLUS	84
Elgas	mini Elcor	60
	Grand Total	**3131**

Grand Total	3131

PD Metering Sites by GA, Make and Index Type

GA Name	Qty.
Rajkot	396
Valsad	267
Surat	189
Bharuch, Narmada & Dahej	184
Jamnagar	114
Surendranagar	70
Navsari	41
Bhavnagar	37
Dahod	23
MORBI	19
Panchmahal	14
Thane	13
DNH	10
Anand	9
Ahmedabad Rural	9
Nadiad	7
Amritsar	6
Kutch	6
Amreli	3
Bathinda	2
Jalore & Sirohi	1

Make	Qty.
Itron	756
Apator	472
GMT	157
Pietro	24
BK	8
Capital	2
Raychem RPG	1
Zenner	0
Grand Total	1420

Index Type	Qty.
Cyble Based	677
Magnetic Standard Index	743
Grand Total	1420

Grand Total	1420

17. Annexure B - Indicative List of Existing EVCs

EVC Metering sites by GA, Make and Model

GA Name	Qty.
Surendranagar	52
Morbi	27
Valsad	12
Bharuch, Narmada & Dahej	9
Surat + Hazira	8
Panchmahal	4
Ahmedabad Rural	3
Dadra & Nagar Haveli	3
Gandhinagar	3
Anand	2
Bhavnagar	2
Rajkot	1
Navsari	1
Nadiad	1
Grand Total	**128**

Make	Model	Qty.
RMFTEK	Rflo-Micro Z3	67
ROMET	ADEM PTZ	36
ROMET	ECM-2	18
ROMET	INSTROMET	3
PLUM	MacBat V	2
DRESSER	DRESSER	1
ROMET	ECM-2-AT	1
	Grand Total	**128**

18. Annexure C: Indicative List of integration requirements for existing GGL applications,

but not limited to as mentioned in Phase 1 of the scope

Indicative List of Existing applications	
1. Enterprise Dashboard	16. e-Registration Customer Login - Public Access
2. Enterprise GIS Web	17. Customer e-Registration - DMA & Middleware application
3. Vendor Invoice Submission Application	18. Spot Billing (DOM-COM) Application
4. IT Helpdesk Service Ticket Approval (BMC)	19. Annual Service Maintenance System
5. New IT Support System - Incidents support	20. Ind Customer Demand Estimation collection (Morbi)
6. HR Benefits Online Forms/Workflows (Mobile / Laptop / IPR / Edu.Asst., etc.)	21. HSE Portal
	22. HSE Lite Web App for Near-miss, Hazard reporting
7. New HRMS Portal for QR Code Attendance regularization	23. AMR System for Surat-Ank-Vapi
8. PMS - OPTIMA GSPC Group 2024-25	24. AMR System for Morbi
9. PaySquare Payroll System	25. AMR System for Central Gujarat & Others
10. CNG DODO Application – Public	26. Onspot Industrial EVC-Mechanical Meter Verification App
11. CNG DODO - GA Login	27. Website - Customer Feedback Form
12. CNG Station Reading Collection Web App	28. Pre-Registration for PNG - Commercial / Non-Commercial Connection
13. CNG VTS - Vehicle Tracking System (Consolidated app)	
14. LNG Transportation Management	29. Pre-Registration for PNG - Industrial Connection
15. Customer Portal - Login for registered customers	30. Lease Accounting System from KPMG
	31. Existing SAP (ECC) and new SAP S4 HANA

19. Annexure D: Indicative List of Use Cases for running AI/ML module driven Advanced Analytics Dashboard

Category	Use Case	Description
Predictive Maintenance	Machine learning models analyze historical data on equipment performance to predict failures or maintenance needs.	CMP will consolidate data on equipment metrics such as pressure levels and flow rates to provide predictive insights, allowing for proactive maintenance scheduling and reducing operational downtime.
Demand Forecasting	Algorithms analyze historical consumption data, weather patterns, and other factors for accurate gas demand predictions.	CMP will synthesize consumption patterns and environmental data to accurately forecast demand, assisting in optimizing the supply chain and delivery schedules.
Pipeline and Network Optimization	Analyzes real-time data on gas supply, demand, and weather to optimize gas pipeline operations.	CMP will leverage real-time data to dynamically adjust pipeline operations, enhancing efficiency, minimizing energy waste, and ensuring safety.
Asset and Energy Management	Predicts equipment lifespan and identifies energy-saving opportunities by analyzing historical data and sensor readings.	CMP will provide insights into asset conditions and energy use, enabling strategic maintenance planning and identification of energy-saving opportunities.
Cascade Vehicle and Logistics	Analyzes logistical data to optimize mobile cascade usage and fuel transportation routes.	CMP will integrate logistical data to refine transportation routes, reducing fuel consumption, and ensuring timely gas deliveries.
Monitoring and Control Systems	Real-time monitoring using SCADA systems for parameter tracking and valve control to optimize network performance.	CMP will offer real-time insights for adjusting operational parameters, optimizing performance, and enhancing control over network systems.
Operation Efficiency	Uses data from sensors for predicting equipment failure and detecting operational anomalies.	CMP will employ predictive analytics to identify and address potential failures and anomalies, thereby improving operational efficiency.
Safety and Reliability	Develops protocols and manages incidents using data analytics for rapid response.	CMP will enhance system reliability and safety by utilizing real-time data analytics for incident management and preventive measures.
Customer Service Enhancement	Utilizes digital tools for customer interaction, real-time updates, and online services.	CMP will analyze customer interaction data to improve engagement and service provision through integrated platforms like mobile apps and chatbots.
Regulatory Compliance	Facilitates compliance through data tracking and reporting while ensuring gas quality.	CMP will consistently monitor compliance-related data, ensuring adherence to safety standards and facilitating regulatory reporting.
Strategic and Market Planning	Provides insights for pricing strategies and customer trends for strategic planning.	CMP will synthesize market and customer data to inform strategic decisions and pricing strategies, enhancing market competitiveness.

Category	Use Case	Description
Capacity and Performance Planning	Simulates demand scenarios and provides real-time performance metrics.	CMP will model various demand scenarios, delivering real-time insights for effective capacity planning and performance optimization.
Cross-Functional Coordination	Facilitates team coordination and community programs on energy efficiency.	CMP will promote coordination across teams and support community energy initiatives through data-driven educational content and program management.

“SPECIAL TERMS AND CONDIONTS”

1. The Bidder shall submit a Contract Performance Bank Guarantee (CPBG) for Six (6) years ensuring continuous coverage from implementation till completion of O&M period and 3-month complaint lodgement period.
2. L1 and reverse auction are not applicable for this tender.
3. **QCBS – Evaluation methodology**

Financial bid Evaluation

- The bid price shall include all taxes and levies and shall be in Indian Rupees and mentioned separately.
- Total Price shall be calculated based on the format provided in **Volume II Schedule of Rates (Schedule A, B and C) of the tender**.
- Each of the Commercial bids shall be evaluated on a score of **100 points**. The Commercial Score of the Bidder shall be calculated with respect the lowest Total Price by any Bidder. The methodology of Commercial Score shall be as follows:
- For the purpose of calculation of the commercial score, the amount quoted **without GST** shall be considered.

Evaluation Criteria of Technical Bid

- "Technical bid" will be evaluated only for the Bidders who comply with the prequalification criteria mentioned in – Minimum Eligibility Criteria/Pre-Qualification Criteria and have successfully passed the field trials as per RFP.
- Commercial bid shall be opened only for bidders who score 70 or more marks in the technical qualification criteria.
- GEL shall verify the documentary evidence for the criteria(s) set forth in Technical qualification criteria mentioned BQC document.
- Each Technical Bid will be assigned a Technical Score out of a maximum of 100 points.

This tender shall be evaluated on Quality and Cost based (QCBS) – 70:30 (Technical: Commercial) model.

After opening and evaluating the Financial Proposals of technically qualified bidders, a final combined score is arrived based on predefined relative weightage.

The proposal with the highest weightage combined score (quality and cost) shall be selected Calculation

Formula= B=[(Clow /C)*0.3]+[T*(0.7)]

Where C=evaluated Bid price

Clow=The lowest of all evaluated Bid price among responsive Bids

T= the total Technical score awarded to the Bid

In the case of a tie between two or more bidders (i.e. equal commercial quote), the bidder with higher score under individual technical evaluation shall be ranked first in order. In case of same individual technical score, the bidder with higher Average Annual Turnover (over the last 3 years) shall be ranked first in order.

4. Non-disclosure agreement

Post award of contract, a confidentiality agreement shall be signed between the bidder and GEL.

Additionally, it is also to be noted that the cost quoted under this schedule shall not exceed by more than 40% of the overall cost of the contract (comprising of schedule A, schedule B and schedule C). In case of any deviation against this clause in the commercial bid submitted by the Bidder on (n)Procure portal, this shall be considered as a non-compliant Bid and necessary actions shall be triggered following the same and bid shall also be rejected.

5. Site Survey

All bidders are encouraged to participate in the site survey which will help them assess the site conditions for individual assets and their specific requirements/conditions. This is a one-time activity which shall not be conducted again, in case any bidder is unable to attend.

The detailed schedule and specific dates for such survey shall be communicated to the bidders at a later stage by GEL one week in advance. This survey will take place before the pre-bid meeting so that bidder may gather and submit their pre-bid queries accordingly.