(A Wholly Owned Subsidiary of Power Finance Corporation Ltd. -

A Government of India Undertaking)

invites

E-Tender

on behalf of

Odisha Power Transmission Corporation Ltd. (OPTCL)

For

"Selection of Smart Grid Implementing Agency (SGIA) for implementation of Smart Grid in Rourkela Smart City in Odisha"

Volume-II

(Technical Scope, Functional Requirement & Service Level Agreement)

Registered Office

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October 21, 2020

Disclaimer

1. The information contained in this RFP or subsequently provided to Bidder(s), whether verbally or in documentary or in any other form by or on behalf of PFCCL or any of its employees, Bidders or associates, is provided to Bidder(s) on the terms and conditions set out in this RFP and such other terms and conditions subject to which such information is provided.

2. This RFP is not an agreement and is neither an offer nor invitation by PFCCL to the prospective Bidders or any other party. The purpose of this RFP is to provide interested parties with information that may be useful to making their Bid. This RFP includes statements, which reflect various assumptions and assessments arrived at by PFCCL in relation to the Project. Such assumptions, assessments and statements do not support to contain all the information that each Bidder may require. This RFP may not be appropriate for all persons, and it is not possible for PFCCL to consider the technical capabilities, investment objectives, financial situation and needs of each party who reads or uses this RFP. The assumptions, assessments, statements and information contained in this RFP may not be complete, accurate, adequate or correct. Each Bidder should, therefore, conduct its own investigations and analysis and should check the accuracy, adequacy, correctness, reliability and completeness of the assumptions, assessments, statements and information contained in this RFP and obtain independent advice from appropriate sources.

3. Information provided in this RFP to the Bidder(s) is on a wide range of matters, some of which depends upon interpretation of law. The information given is not an exhaustive account of statutory requirements and should not be regarded as a complete or authoritative statement of law. PFCCL accepts no responsibility for the accuracy or otherwise for any interpretation or opinion on law expressed herein.

4. PFCCL or any of its employees, Bidders or associates make no representation or warranty and shall have no liability to any person including any Bidder under any law, statute, rules or regulations, principles of restitution or unjust enrichment or otherwise for any loss, damages, cost or expense which may arise from or be incurred or suffered on account of anything contained in this RFP or otherwise including the accuracy, adequacy, correctness, completeness or reliability 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 Bid stage.

5. PFCCL or any of its employees, Bidders or associates also accept 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.

6. PFCCL may in its absolute discretion, but without being under any obligation to do so, update, amend or supplement the information, assessment or assumptions contained in this RFP.

7. The issue of this RFP does not imply that PFCCL is bound to select a Bidder for the Project and PFCCL reserves the right to reject all or any of the Bidders or Bids or discontinue or cancel the bidding process without assigning any reason whatsoever.

8. 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, traveling, food, lodging, expenses associated with any demonstrations or presentations which may be required by PFCCL or any other costs incurred in connection with or relating to its Bid. All such costs and expenses will remain with the Bidder and PFCCL 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 conductor outcome of the Bidding Process.

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Definitions

1.	**"Smart Grid Implementing Agency" or "SGIA"**	:	Same as "Project Implementing Consortium"
2.	**"Bid(s)"**	:	The bid submitted by the Bidder(s) in response to this RFP
3.	**"Bidder(s)"**	:	Any or all Consortium Members including the Lead Consortium Member bidding as a response to this RFP
4.	**"Bidding Consortium"**	:	The Consortium of Bidders legally bound as per the terms and formats of this RFP to bid for the Project.
5.	**"Consortium Member"**	:	Any Member of the Bidding Consortium other than the Lead Consortium Member.
6.	**"Contract"**	:	The Agreement between WESCO and the Successful Bidder upon receiving the Letter of Award from WESCO for implementation of the Project.
7.	**"Contractor"**	:	Same as "Project Implementing Consortium"
8.	**"Employer"**	:	WESCO
9.	**"Financial Year" or "FY"**	:	Period starting from 1 April of the first calendar year to 31 March of the consecutive calendar year.
10.	**"Lead Consortium Member"**	:	The Consortium Member taking the lead in submitting this RFP with eligibility, roles and responsibilities outlined in Volume 1 Clause 4.3.2 of this RFP and duly supported by the legal agreements as per formats in this RFP.
11.	**"MTS"**	:	Minimum Technical Standards as defined in Volume 2 of this RFP.
12.	**"Party" or "Parties"**	:	OPTCL, WESCO, the Bidder, and the Project Implementing Consortium, individually or collectively, respectively.
13.	**"Project"**	:	WESCO's Smart Grid Project defined in Section 1.
14.	**"Project Implementing Consortium" or "Contractor" or "AMI-IA"**	:	The Consortium or the Contractor with the lowest Price (L-1) appointed by WESCO upon signing of the Contract subsequent to the Letter of Award

15.	**"Project Management Agency" or "PMA"**	:	Project Management Agency is PFCCL.
16.	**"Request for Proposal" or "RFP"**	:	This Tender No. SG/Rourkela/SGIA dated 21.10.2020 including all its Volumes for Appointment of Smart Grid Implementing Agency (including all clarification/ addendum/ amendment/ corrigendum/ etc. issued from time
17.	**"Rupees" or "Rs." Or "INR" or "₹"**	:	Indian Rupees
18.	**"Service(s)" or "Related Service(s)"**	:	Any service(s) performed or to be performed as a part of the Solution by the Contractor.
19.	**"Solution"**	:	The system within the Scope of Work of the Project as defined by this RFP, and implemented in its entirety including but not limited to the supply of hardware, transportation, software, installation, integration, testing, commissioning, training operation, maintenance and other services by the Project Implementing Consortium.
20.	**"Successful Bidder"**	:	Successful Qualifying Bidder/ Consortium with the lowest Price (L-1)
21.	**"Tender"**	:	Same as "RFP"

Abbreviations

ACL	Access Control List
AMC	Annual Maintenance Charges
AMI	Advanced Metering Infrastructure
ANSI	American National Standards Institute
BCS	Base Computing System
BIS	Bureau of Indian Standards
BOQ	Bill of Quantity
CAIDI	Customer Average Interruption Duration Index
CAIFI	Customer Average Interruption Frequency Index
CEA	Central Electricity Authority
CEN	European Committee for Standardization
CENELEC	European Committee for Electrotechnical Standardization
CERT-In	Indian Computer Emergency Response Team
CIM	Common Information Model
CIS	Consumer Information System
CISPR	International Special Committee on Radio Interference
CPU	Central Processing Unit
CRM	Customer Relationship Management
CT	Current Transformer
DBMS	Database Management System
CUM	Cumulative
DMZ	Demilitarized Zone
DCU	Data Concentrator Unit
DXF	Drawing Exchange Format
DT	Distribution Transformer
ESB	Enterprise Service Bus
ETSI	European Telecommunications Standards Institute
FAT	Factory Acceptance Test
GPRS	General Packet Radio Service
GIS	Geographic Information System

HDD	Hard Disk Drive
GPS	Global Positioning System
GUI	Graphical User Interface
HIDS	Host-based Intrusion Detection System
HES	Head End System
HHU	Hand Held Unit
IBMS	Integrated Building Management Systems
IDS	Intrusion Detection Systems
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
IP	Internet Protocol
IS	Indian Standard
ITU	International Telecommunication Union
ISP	Internet Service Provider
IVRS	Interactive Voice Response System
LCD	Liquid Crystal Display
kVA	kilo Volt-Ampere
kW	kilo Watt
LAN	Local Area Network
LED	Light Emitting Diode
MCB	Miniature Circuit Breaker
LT	Low Tension
MICC	Mineral-Insulated Copper-Clad Cable
MD	Maximum Demand
MDAS	Meter Data Acquisition System
MDMS	Meter Data Management System
NABL	National Accreditation Board for Testing and Calibration Laboratories
NCIIPC	National Critical Information Infrastructure Protection Centre
NAN	Neighbourhood Area Network
NIC	Network Interface Card
NIPS	Network based Intrusion Prevention System

NTP	Network Time Protocol
NMS	Network Management System
OEM	Original Equipment Manufacturer
OSF	Open Software Foundation
OS	Operating System
PT	Potential Transformer
PLCC	Power Line Carrier Communication
PV	Photovoltaic System
QA	Quality Assurance
QC	Quality Control
QR	Qualification Requirement
RAM	Random Access Memory
R-APDRP	Restructured Accelerated Power Development and Reforms Programme
RDBMS	Relational Database Management System
RF	Radio Frequency
RFP	Request for Proposal
RPO	Recovery Point Objective
RTC	Real Time Clock
RTO	Recovery Time Objective
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
SAN	Storage Area Network
SAT	Site Acceptance Test
SCADA	Supervisory Control and Data Acquisition
SLA	Service Level Agreement
SNMP	Simple Network Management Protocol
SOA	Service Oriented Architecture
SQL	Structured Queried Language
TCP	Transmission Control Protocol
TOD	Time of Day
TOU	Time of Use

UDP	User Datagram Protocol
UPS	Uninterrupted Power Supply
VEE	Validation Estimation and Editing
WAN	Wide Area Network
WPC	Wireless Planning & Coordination Wing
XML	Extensible Markup Language

1. Introduction and General Information

1.1   Background

1.1.1   OPTCL has appointed PFCCL as "Project Management Agency (PMA)" for implementation of Smart Grid in Rourkela Municipal Corporation (RMC) area of Rourkela, Odisha under Western Electricity Supply Company of Odisha (WESCO). PFCCL will select the Smart Grid Implementation Agency (SGIA) on behalf of OPTCL. WESCO would issue the Letter of Award to the successful bidder and execute the Contract Agreement with the successful bidder. The project will be transferred to WESCO at no cost at the end of the project period. The roles and responsibilities of the SGIA and payment thereof are governed by the Terms and Conditions of this RFP.

1.2   Project Objective

1.2.1   WESCO proposes to implement Smart Grid project in Rourkela Smart City in Odisha. At present, the total number of consumers is around 90,801. However, WESCO proposes to implement the project for incremental number of consumers over a period of 10 years. The total no. of consumers over a period of 10 years would be 1,20,964 as per Annexure 17 of this RfP.

1.2.2   This Request for Proposal (this "RFP") is issued by PFCCL on behalf of OPTCL for selecting a Consortium or a Contractor for supply, installation, testing, commissioning and maintenance of Advanced Metering Infrastructure (AMI), including smart meters (with/without net-metering) with Pre-paid configuration, communication infrastructure along with applications for Head End System (HES), Meter Data Management (MDM) System as well as Geographical Information System (GIS) and setting up of Smart Grid Control Centre on cloud for implementation of Smart Grid in Rourkela Smart City in Odisha under Western Electricity Supply Company of Odisha (WESCO) for around 90,801 consumers at present plus additional consumers over a period of 10 years including O&M services for a period till 8 years from Operational Acceptance of the Project. At present IPDS IT Phase II project is being implemented in the three Discoms (NESCO, WESCO, SOUTHCO). In future, SCADA and Real Time Data Acquisition System (RT-DAS) projects may be implemented in WESCO. Accordingly, the instant Smart Grid project shall also include integration of HES with MDMS and MDMS with existing and future Utility applications as mentioned above. Any other items/ accessories required for successful commissioning of the project and not specifically mentioned in the BoQ as per Annexure-10 of this RfP shall also deemed to be in the scope of the bidder.

1.2.3   The architecture of the AMI system proposed to be implemented is shown below, however, the Bidder would need to submit the best fit solution and the detail architecture including connectivity upto last mile at the time of bid submission:
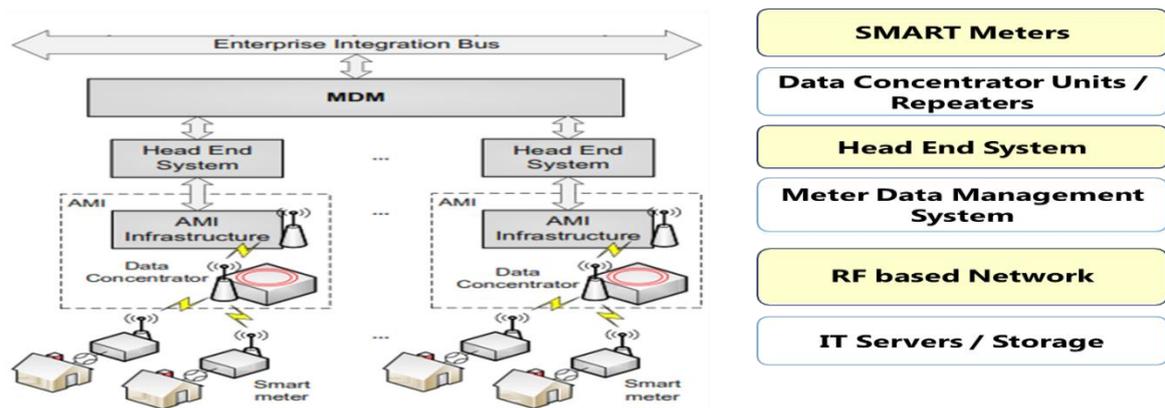
1.2.4 The key strategic objectives for AMI implementation include:

a. **Achieve Operational Efficiencies**: Reduced operating costs in areas such as meter reading and punching, connection/disconnection, consumer complaints, reduced float between meter reading and bill generation

b. **Revenue Protection**: Reduced commercial loss with accurate energy accounting, detection of meter tampering and improved meter reading accuracy

c. **Improved Load and Power Quality Management**: Better visibility of loading and power quality factors on the transformers to enable accurate capacity planning and prevention of failure/under-utilization of asset

d. **Faster Outage Detection**: Near real time notification outages to enable faster detection and restoration

e. **Keep Customer Bills Low:** achieving conservation benefits, operational efficiencies & revenue protection lead to utility rate reductions which translate directly into customer savings.

f. **Improved Customer Service:** Provide near real-time, accurate and detailed information on consumption, cost and outages

g. **Achieve Energy Efficiency:** Ability to monitor electricity consumption in near real time, consumers can manage consumption to achieve energy efficiency and save money

h. **Achieve Environment and Social Benefits:** Facilitating energy efficiency, improved load management & reduced commercial losses to enable reduced greenhouse gas emissions

i. **Support Advanced Customer Applications:** provide a substantial portion of the foundational infrastructure required to modernize the grid in support of advanced customer applications such as distributed generation, electric vehicles, demand response, micro-grids, and future applications.

1.2.5 These additional features should also be considered

a. Energy audits can be done at distribution transformer level as per desired frequency to check leakage and pilferage

b. Load pattern of individual consumer can be observed

c. Withdrawal of power above sanctioned load may be monitored and controlled

d. Tampering may be checked in near real time

e. Control actions from control centre for load curtailment may be taken

f. Sending alert to consumer for higher load withdrawal, bill non-payment etc.

g. Signal transmission for variable pricing,

h. Customer participation in demand response programmes

1.3   About WESCO and the Smart Grid Project

1.3.1   The details are given in clause 3.2 of Volume-1 of the RfP.

1.4   Scope of Work

1.4.1   The bidder's scope of work shall include, in complete conformity with subsequent sections of the specifications, site survey, planning, design, engineering, manufacturing, procure, supply, transportation & insurance, delivery at site, unloading, handling, storage, installation, integration, testing, commissioning, demonstration for acceptance, training, maintenance and documentation of:

   i. **Single phase whole current Smart Meter** (with/without net-metering) with Pre-paid configuration and with suitable communication technology (Smart Meters proposed shall be able to work in pre-paid as well as post-paid configuration as per the WESCO's Needs. There should not be restriction in case WESCO wants to use some Smart Meters in Pre-Paid and some in Post-Paid mode)

   ii. **Three phase whole current Smart Meter** (with/without net-metering) with Pre-paid configuration and with suitable communication technology (Smart Meters proposed shall be able to work in pre-paid as well as post-paid configuration as per the WESCO's Needs. There should not be restriction in case WESCO wants to use some Smart Meters in Pre-Paid and some in Post-Paid mode)

   iii. **CT operated three phase Smart Meter** (with/without net-metering) with suitable communication technology. The CT operated meters should also have capability to control external switching device, say a potential free contact (1 amp). In future if such a connect-disconnect feature is available for CT operated meters, the provision for pre-paid functionality shall be possible through software at MDM/ HES level

   iv. Replacement of old/ existing meters of WESCO as per Standard Operating Procedure mentioned at **Annexure-J**.

   v. **RF canopy or GPRS based communication:** Router based canopy type Radio Frequency (RF) network (based on Radio Frequency (RF) mesh Licensed frequency band as permitted by Wireless Planning & Coordination Wing (WPC) or in Unlicensed frequency band) (Wherever RF is not feasible GPRS based communication as per latest technology standards shall be established) for communication of data between field equipment/ smart meters and the cloud services shall be established as per the specifications mentioned in this document and to ensure the performance level given in this document to cover RMC area of Rourkela town for congested/ highly populated areas. The network would provide a medium for two-way communication between various nodes & Head End System (HES). Different nodes shall interconnect with each other using RF mesh network and they shall communicate with nearby routers/ DCU to transfer the data to access points/ HES. The degree of redundancy kept may be specified by SGIA while designing the system for self-healing features to be effectively working and the performance parameters those that capture this commitment consistently. The SGIA shall design the system so that 98% of the

communication of meters in the network should be accessible from HES. The following activities shall be performed to complete installation of RF Canopy:

    a. Site survey for identification of Consumers, Distribution Transformers, Feeders and Sub-Station for the installation of Smart Meters. The geographical boundary will be boundary of Sub-Divisions for conducting the site survey

    b. Sub-Divisions wise consumer report will be prepared for implementation of Smart Metering project

    c. The Contractor has to assess and maintain buffer so that in case of new installation, smart meters are installed by the Contractor without any delay

    d. Site survey for selection of communication technology and telecom operator.

    e. Site Survey for identification of location for installation of routers/ / DCU and collectors.

    f. Noise Analysis of RF communication through software tools.

    g. Deployment of Canopy elements viz. Routers and Collectors.

    h. Wherever RF is not feasible GPRS based communication shall be established. In the survey report, SGIA is required to provide justification towards the same.

    i. The survey report incorporating all the above points would be submitted to WESCO for their approval.

vi. Integration of Network Integration Card (NIC)/ Communication Module with meters of at least 3 manufacturers in India, to enable the respective meters to seamlessly integrate with proposed HES and MDMS thus enabling interoperability of the system. In future, it would be bidders' responsibility to integrate new meter or any other application/equipment as decided by WESCO. Bidder would have to facilitate WESCO in integration of future technologies/ new application/ equipment by providing whatever data required by WESCO at that time. General requirement for common pluggable communications module for Smart Meters has been provided under **Annexure K**.

vii. Head End System (HES) / Meter Data Acquisition System (MDAS) - The objective of HES is to obtain data from various end points and remotely monitor the data.

viii. Meter Data Management (MDM) System (shall be developed on a COTS product platform and must have been deployed and functional in at least two utilities.) Meter Data Management is the central application for AMI Solution which will contain the repository for entire details of meter, consumers and perform different operations i.e. validation, estimation & editing of received meter data. MDMS is the central data repository of all the captured data.

ix. Integration of HES with MDMS & MDMS with existing applications of WESCO. The MDMS shall be integrated with legacy applications installed under the RAPDRP Program or any other projects of WESCO. The integration would be done with the Billing system, MDAS system etc. The scope will also cover the future integration requirement given by WESCO till the contract period i.e. including O&M period. The details of existing legacy system of WESCO are as follows:

    a. <u>HT/ EHT and Three Phase Billing</u> – Meter reading is collected by AMR or MRT personnel. Advice related to billing (payment posting, sundry posting, new connections, consumer connections) is collected from Divisions. The centralized IT centre generates bills through the billing software Oracle and D2K.

b. <u>Single Phase Billing</u> - Advice related to billing (payment posting, sundry posting, new connections, consumer connections, disconnections, reconnections) is collected from Divisions. In the centralized IT centre, the input data is processed in the billing software Oracle and D2K.

c. The data uploading/ downloading/ meter reader management activities with respect to Spot Billing Activities is carried out by software in Sql server and .net.

d. The Spot Billing is carried out by meter readers through mobile app in Android.

x. **Geographical Information System (GIS)** - Generation of optimum route plan using the capabilities of the GIS and based on reading jobs (including re-reads if any) to be read in a given cycle in a given area/ route to maximize the productivity of meter readers. GIS based index database has structured customer information on GIS based map with electrical system on the foreground and all the Consumers being coded and segregated 11 kV feeder-wise and Distribution Transformer-wise. The consumer and the network data for analysis and effective visualization will be available in the GIS system. In the Commercial Database to be developed, care has to be taken that Consumers are segregated Distribution Transformer-wise,11kV Feeder-wise and 33/11kV Substation-wise so that there is no problem in energy accounting. In case of any change taking place in customer information related to electrical network equipment due to addition/ modification of network in the base GIS system, the commercial database shall be automatically updated. GIS mapping and consumer indexing data shall be integrated with advanced metering infrastructure applications and breakdown analysis through load data display on dashboard and prediction of fault location through Data Analytics and intimation to maintenance crew on field. The periodic synchronization/ updation shall be carried out. Detailed specifications have been mentioned in clause 3.9.

xi. **IT System -** Design, procure, supply, installation, testing, Cyber Security, commission and operation & maintenance of complete IT System. IT Infrastructure along with Smart Grid Control Centre shall be on cloud to host HES, MDM and Web Applications. Security of data hosted on cloud shall also be the responsibility of Contractor. System Security and access with due consideration of data privacy, confidentiality cyber security guidelines. Hosting of both DC and DR should be on GCC.

xii. Seamless integration of IT System with existing system of WESCO and to facilitate or provide full support for any new future/ new application/ equipment integration requirement of WESCO by providing whatever data required by WESCO at that time by/ through development of Web Services or any other Services. Development and monitoring of Web Services and any other services shall be in the scope of bidder. Further, if required, the Contractor has to switch all Smart Metering application and submit database in other Cloud Service Provider with details of each and every process to be followed.

xiii. Mobile app (Android and iOS based) for consumers

xiv. Other necessary software with valid licenses.

xv. Integration of different devices/equipment/software covered in scope of this project with each other as per functional requirements

xvi. Integration with external interface as defined in this specification.

xvii. Planning, deployment & tuning of communication systems to meet the performance requirements as specified in the bidding document

xviii. **Cloud Service Provider (CSP) Requirements**

I. Bidder may partner or appoint as a sub-contractor a local party in India to provide Cloud services for the RF Mesh Canopy solution as per clause 3.8.
II. CSP should also carry out cloud Hosting of Applications and its maintenance for the Project period
III. The Contractor shall also bear the cost of recurring charges for, Bandwidth and Cloud Hosting Charges till completion of Maintenance Support period.
IV. The Cloud service should be operational from the date of operational acceptance of the 1st lot of Smart Meters and the respective SLAs and Penalty would be applicable from that date itself.
V. In future if WESCO plans to have its own on-premise Data Centre, then the Contractor will be required to carry out all necessary migration and seamless integration from Cloud to on-premise Data Centre as well as purchasing any license(s) at mutually agreed terms and conditions.

xix. Deployment of suitable backend communication technology (GPRS, Radio, Leased Line etc.) may be considered for data communication to HES. However, cellular connectivity may be checked before deployment. GPRS SIM cards shall be provided by the contractor in the name of utility for which necessary support shall be provided by utility. Service Level Agreement with service providers shall be done by contractor and it is the responsibility of the contractor to ensure the SLAs defined in section 4 are met.

xx. Develop an overall AMI Architecture capable of upgrades and scaling out as per future requirements

xxi. Installation of additional equipment to account for additional consumers during maintenance period

xxii. Generation of analytics reports as detailed in section 3.7.11 to aid in decision making at various levels of utility

xxiii. **Baseline Study**

a. The Contractor shall carry out a baseline study to identify the targets and establish Key Performance Indicators (KPIs) for measuring benefits of the AMI Project
b. The Contractor shall carry out complete site survey of WESCO's site to prepare the Baseline Study Report as per the site conditions of WESCO
c. The Contractor shall carry out complete site survey of WESCO site for the communication system requirements and submit the survey report indicating network & sight clearance for RF.
d. "As Is" study of existing IT systems prevalent at the WESCO and do a gap analysis with respect to the AMI system to be implemented and submit "To be" report for IT system consolidation for ensuring full benefits of AMI

e. The Contractor shall prepare Baseline Study Report which would include narrative description of the project objective and rationale for its deployment, technical feasibility study, overall architecture and operational philosophy of the proposed AMI solution and methodology for achieving different functionalities, specified in this document and also highlight additional features, if any, financial projections, detailed cost benefit analysis, proposed cost recovery mechanism, implementation approach & methodology, project implementation schedule, performance incentives if any, monitoring, verification and evaluation plan, consumer engagement plan, governance framework, training and capacity building plan

xxiv. **Project Implementation & Monitoring**

a. Preparation and submission of Project Implementation Plan in consultation with PFCCL/ WESCO
b. Carrying out performance tests like Factory Acceptance Test (FAT), Site Acceptance Test (SAT) etc. and inspection of the installed infrastructure jointly with PFCCL/ WESCO team
c. Ensure implementation of the governance mechanism, and submit Monthly Progress Reports on AMI Project implementation
d. Ensuring Operational Acceptance
e. Providing Installation Record/ Certificate to PFCCL/ WESCO indicating the date of installation, serial number, capacity and make of the AMI Infrastructure, the installation date and service dates etc.
f. Submission of checklist of documents wherein WESCO approvals are required
g. Submission of all deliverables to WESCO and incorporation of suggestions/ comments, if any

xxv. **Training & Development –** Providing training of identified personnel of PFCCL and WESCO on operation and maintenance of AMI Infrastructure (at least 2 times a year during first 3 years for 6 persons per batch).

xxvi. **Operation & Maintenance (O&M) Services** - Post establishment of AMI Infrastructure, Facility Management Services (FMS) / Operation & Maintenance (O&M) Services would be provided for a period of eight (8) as per Service Level Agreements (SLA) agreed with WESCO and handover of AMI System to WESCO after completion. The services would include the following:

a. Management and maintenance of complete AMI system for the contract duration i.e. till completion of operation and maintenance phase.
b. Management of Cloud platform, IT Licences renewal, IT Software maintenance.
c. Management and Maintenance of all the hardware supplied in the project for the contract duration i.e. till completion of operation and maintenance phase.
d. Connectivity and Communication of AMI project
e. Maintaining system availability/ uptime as per agreed SLA.
f. Maintenance of entire AMI field & Back-End Infrastructure.
g. Maintenance of AMI RF / Hybrid Network.
h. Installation of Smart Meters and DCUs/ Routers, if required, for new connections, disconnection & replacement of faulty/ burnt meter on request of WESCO.
i. Smart Metering Control Centre operation & maintenance.
j. Identification and reporting of exceptional cases based on MDMS data analytics as per the agreed measurement & verification methodology.
k. Providing recommendations and improvement measures.
l. Review, analysis & validation of AMI Project results linked to KPIs.
m. Energy Audit report, Data Analytics for eliminating pilferage of Power & assistance in 'recovery measures' in collaboration with WESCO.
n. Managing projects issues and concerns.
o. Transfer of the ownership, rights and title of the installed AMI Infrastructure to the WESCOL post completion of the FMS/ O&M period.
p. Implementation of Consumer Engagement Plan and ensuring effective redressal to the consumer grievances and complaints.
q. Action for rectification of faults in AMI system as per system inputs.
r. Highlighting projects issues and concerns; providing recommendations for corrective actions

xxvii. **Assisting WESCO in adoption of AMI:** As implementation of AMI will need WESCO to adopt to the changes which is expected to be implemented on selected consumer base in a phased manner. The Contractor will assist WESCO in the following areas to ensure smoother adoption and usage of technology:

a. **Regulatory Representations and Approvals:** AMI shall enable WESCO to offer services like remote connect/ disconnect, peak load reduction, Time of Day tariffs etc. The Contractor will assist WESCO officials to facilitate regulatory approvals while offering various services to customers

b. **Restructuring of Organization Structure:** WESCO shall need to make necessary changes in the current organization structure to ensure smooth adoption and operations. The Contractor shall assist the WESCO in formulation of best organizational structure and creation of sufficient team for the project keeping in view the future roll out of Smart Meters

c. **Business Process Re-engineering:** Contractor shall do an in depth study of commercial processes of WESCO to form an understanding of "As-Is" processes being carried out. Based on this understanding a gap analysis shall be done with respect to requirements post deployment of new AMI systems & necessary

recommendations for making suitable changes in processes shall be made to WESCO.

d. **Integration Services:** Smooth operations of AMI and usage of full functionalities offered by AMI shall require its integration with many existing systems as well as planned future technology deployments**.** The Contractor shall assist WESCO engineers in identification of use cases for integration of AMI with other systems. The Contractor will integrate AMI system with existing application/systems of WESCO as per WESCO's requirement and also facilitate for integration of AMI system with future system/applications of WESCO by providing whatever data required by WESCO at that time by/ through the development of Web Services or any other Services. Development and monitoring of Web Services and any other services shall be in the scope of the bidder. Further, if required, the Contractor has to switch all Smart Metering application and database in other Cloud Service Provider with details of each and every process to be followed.

e. **Customer Engagement:** Smart meter roll out success depends to a large extent depends upon its acceptance by the end customers. The Contractor will assist WESCO officials in managing customer engagement and reach out program which shall enable smooth roll out of the smart metering project.

f. **Employee Competency Building:** During O&M phase the Contractor shall assist WESCO in designing training programs and conduct training programs which shall enable utility officials to operate and maintain AMI system on their own

g. **Consolidation of IT Systems for Optimization:** The Contractor shall do a "As Is" study of existing IT systems prevalent at the WESCO and do a gap analysis with respect to the AMI system to be implemented. Finally the Contractor shall share a "To be" report for IT system consolidation for ensuring full benefits of AMI

xxviii. To provide remote console facility at Rourkela for monitoring and other operational functions of Smart Meters in their respective area.

xxix. The Contractor shall establish the Back-End IT system with scalability features to handle all WESCO consumers i.e. entire consumers of WESCO for next 15 years.

xxx. **Smart Meters proposed *should have the provision of Pre-paid mode also*** and can be configured from the back office from post-paid to pre-paid and vice versa. WESCO's Back-End IT System and deployment approach should have the provision to configure a set of Smart Meters to Pre-paid mode as per WESCO's need. The Smart Meters with Pre-paid option should provide the following facilities to WESCO over the Conventional pre-paid metering system:

a. Credit Updation from remote
b. Revenue Protection (Tamper) Monitoring
c. Remote Tariff Rate and Slab Updation
d. Proper and Regular Energy Accounting and Auditing.
e. Last gasp and First Breathe with Outage Management System.
f. Peak Load Management and Demand Response support.
g. Manpower saving in coupon insertion.
h. Detection of faulty or Burnt Meters.
i. Real Time Tamper Alerts, Alarm/ Notification and acknowledgement.
j. Integration for pre-payment recharge coupon with existing billing application of WESCO.

xxxi. **Repair & Maintenance of installed AMI Infrastructure**

a. Action for rectification of faults in AMI system as per system inputs.

b. In case of any faulty/ malfunctioning in AMI Infrastructure, WESCO to provide details of the fault/ malfunction or the reason of failure and submit a copy of the Installation Record/ Certificate.

c. Verification of the fault/ reason for failure of the AMI Infrastructure by a Third Party Agency or Joint Team of the Contractor, PFCCL and WESCO executives, as per requirement, and intimation of the findings to PFCCL and WESCO;

d. Ensuring that faulty, burnt or defective AMI Infrastructure is repaired or replaced as soon as reasonably feasible and free of cost to the WESCO. A record of the repairs/ replacements of the AMI Infrastructure to be kept and shared with PFCCL/ WESCO on quarterly basis;

e. In case of any theft or sabotage of the AMI Infrastructure or if the reason(s) for failure/ malfunctioning or defect of the AMI Infrastructure is attributable to normal wear and tear, or mishandling or inappropriate usage of the AMI Infrastructure by WESCO, or reasons attributable to the negligence of WESCO, the Contractor will ensure replacement of same and cost will be borne by WESCO as per the price discovered through this tendering process.

xxxii. Any other services as may be required by WESCO & mutually agreed upon.

xxxiii. Cyber security audit of complete system from Cert-In certified agencies:

a. Before making system live; and
b. Annually during FMS period.

1.4.2 The Bidder has to carry out the detailed survey and collect the required data. All other associated works/items described in the Technical Specifications for a viable and fully functional system is the responsibility of Bidders.

1.4.3 The contractor shall have to maintain the system for eight (8) years after operational acceptance by WESCO. During the eight (8) years of maintenance, Contractor shall maintain

system availability as mentioned in this document. Contractor shall also maintain necessary spares such as smart meters, routers, etc. to attend problems during maintenance of the system. During maintenance period, contractor shall maintain the service level as explained in this Technical Specifications. The Contractor shall also bear the cost of recurring charges for GPRS/3G/4G, static ISP connection and any license fee for operating RF in licensed frequency band till completion of maintenance period.

1.4.4   Comprehensive warranty should be provided for the system, by the contractor(s), for 5 years after operational acceptance of the AMI system by WESCO and for the balance period (post warranty) during Engagement of the Contractor, the Contractor shall provide Annual Maintenance Support to WESCO.

2. General Requirements

2.1 General Responsibilities and Obligations

2.1.1 Bidders must conform to requirements and provide a list of equipment (including any special equipment) necessary to meet the functional & performance requirements stated herein. It should be noted that preliminary design information and Bill of Quantity (BoQ) specified in this specifications are indicative only except the quantities of smart meters. The Bidders shall verify the design data during the site surveys & detail engineering and finalize the BOQ as required for ultimate system design & development to meet performance requirements.

2.1.2 Bidder shall submit Clause by Clause compliance to Technical Specifications (forming part of RFP Document read in conjunction with amendments, if any. Deviation if any shall be clearly mentioned.

2.1.3 The bidder's proposal shall address all functional and performance requirements within this specification and shall include sufficient information and supporting documentation in order to determine compliance with this specification without further necessity for inquiries.

2.1.4 Bidder may provide all applications in one suite or multiple modules to meet all the Technical Specification requirements. The bidder's proposal shall clearly identify all features described in the specifications or in any supporting reference material that will not be implemented; otherwise, those features shall become binding as part of the final contract.

2.1.5 An analysis of functional and performance requirements of this specification and/ or site surveys, design, and engineering may lead Bidders to conclude that additional items (for example communication repeater, router etc.) are required that are not specifically mentioned in this specification. Bidders shall be responsible for providing at no added cost to the Employer, all such additional items such that a viable and fully functional AMI system is implemented that meets or exceed the capacity and performance requirements specified. Such materials shall be considered to be within the scope of the contract. To the extent possible, the bidder shall identify and include all such additional items in their proposal.

2.1.6 The offered items shall be designed to operate in varying environments. Adequate measures shall be taken to provide protection against contaminants, pollutants, rain water & moisture, lightning & short circuit, vibration and electro-magnetic interference etc. The Bidders shall demonstrate a specified level of performance of the offered items during well- structured factory and field tests.

2.1.7 All equipment provided shall be designed to interface with other equipment and shall be supporting all present requirements and spare capacity requirement identified in the Technical Specifications.

2.1.8 The Bidders are advised to visit sites (at their own expense), prior to the submission of the proposal, and make surveys and assessments as deemed necessary for proposal submission. The successful Bidder (Contractor) shall be required to visit project area for detailed site surveys for performing the design and implementation functions.

2.1.9 After the site survey the Contractor shall submit a survey report. This report shall include at least the following items (however, the exact parameter for survey & format of the survey report shall be finalized by the Contractor with the approval of WESCO):

a. Proposed routing of power, earthing, communication signal cables including trenches etc.
b. Tentative location of devices/equipment for setting up communication network.
c. Consumer indexing of the project area (mapping of consumers (including their GPS coordinates) with DTs and Feeder)
d. Confirmation of adequacy of space and AC power supply requirements.
e. Identify all additional items required for interconnection with the existing/owner provided equipment/facilities
f. Verification of all integrations with external systems as mentioned in the RFP
g. Requirement of modification to existing earthing arrangement of control centre and locations where communication equipment / devices etc. are to be installed, if any

2.2   Access to Utility Facilities

2.2.1   WESCO to facilitate, safe and reasonable access to utility premises for contractor's personnel and third party vendors. This facilitation shall include, space for data centers, working space including air conditioning, light, ventilation, electric power and outlets. The contractor's personnel shall comply with all applicable rules, regulations and requirements relating to visitors on premises of WESCO. Utility shall provide sufficient storage space, however, safety and security of stored items shall be the responsibility of the bidder.

2.3   Responsibilities for the Implementation Plan

2.3.1   Bidder's technical proposal shall include a project implementation plan and schedule spread over 24 months from date of commencement that is consistent with the implementation plan detailed in this specification. The Implementation plan shall include the activities of both the Bidders and WESCO, showing all key milestones and clearly identifying the nature of all information and project support expected from WESCO. WESCO and Bidders together shall finalize the detailed implementation plan following award of the contract.

2.4   Contractor's Responsibilities and Obligations

2.4.1   Contractor's obligations include, but are not limited to the following (as well as in clause 1.4):

1) To provide a working system that meets or exceeds the functional and performance requirements of this specification without affecting the operation of the existing systems.
2) To perform equipment engineering and design specific to each location including review of, and conformance with local environmental and earthing considerations.
3) Installation of field devices, hardware, software and communication system.
4) To develop FMS/ O&M guidelines.
5) Overall integration of equipment/subsystem as defined in this RFP document
6) Integration of new Meters/ future Meters & DCU with AMI system
7) Sharing of relevant interface details at DCU, HES and MDM layers
8) Achieving interoperability for AMI through incorporation of the communication modules (NICs) inside the Smart meters of any make of Smart meters as short listed by utility for this project area in the future.
9) Identifying, buying and maintenance of spares under AMC along with main items to ensure system availability during installation and maintenance period.
10) Project management, project scheduling, including periodic project reports (weekly/monthly basis) documenting progress during the contract period.

11) To provide engineering and technical assistance during the contract warranty and maintenance period.

12) Updation of consumer indexing in AMI system during installation and maintenance period

13) To identify all additional Equipment and services necessary to ensure compatibility between new and existing equipment.

14) To implement all minor civil works necessary for installation of proposed equipment and provide the details of such work to PFCCL/ WESCO.

15) To define source power requirements for each cabinet/ rack of equipment provided and the total power requirements to run the system

16) To ensure that all the required hardware, software, and firmware satisfy the requirements of this specification and are suitable for future scaling, optionally with upgrades.

17) To conduct factory and site acceptance testing of all hardware, software & firmware provided

18) Conduct type tests or provide documented evidence of type testing and BIS certification to WESCO as sought in specifications.

19) To provide a Quality Assurance Plan and access to manufacturing process, as required.

20) Shipment of all equipment to designated locations and/or storing areas.

21) To provide storing, maintenance of storing area and security including full responsibility for protection from theft and fire for all the items to be supplied. The warehouse may be a temporary storage area to be constructed by contractor. Space for material storage would be provided by WESCO at no extra cost for storing the supplied equipment in respective areas where project work is in progress.

22) Prepare and submit all documentation and drawings in hard copy as well as soft copy. The documents have to be submitted in serial orders with depiction of Serial Number on it.

23) Supply all required spare parts, maintenance aids, and test equipment, software maintenance and testing tools

24) Training of PFCCL/ WESCO personnel.

25) Hardware, software, and firmware maintenance, debugging, and support of the software applications, and maintenance of all supplied equipment.

26) To provide full backup of all installed software applications and data.

27) To test restoration of the system from the backup provided.

28) Availability of service, spare and expansion parts for the supplied items for the complete design life i.e. 8 years from the operational acceptance of the system as per details in various parts of this specification.

29) Auxiliary Power Supply comprising of UPS for 8 hours battery backup along with all necessary distribution.

30) Assistance in development & implementation of consumer engagement plan

2.4.2 Detailed descriptions of the Contractor's obligations, in relation to individual items and services offered, are delineated in other sections of this specification.

2.5   Exclusion from Contractor's Scope

2.5.1 Following shall be excluded from Contractor's scope:
   a. Construction of building for AMI Control Centre
   b. Interior and IBMS (Integrated Building Management System) of building for AMI Control Centre
   c. A.C. input power supply for AMI Control Centre

2.6 Employer/ Utility's Responsibilities and Obligations

2.6.1 WESCO will provide following items and services as part of this Project:

1) Review & approval of Contractor's designs, drawings, survey reports and recommendations.
2) Review and approval of test procedures.
3) Participation in and approval of "Type", factory and site acceptance tests.
4) Review and approval of training plans & reading material
5) Providing support and access to facilities at the sites, including consumer premises.
6) Arranging necessary shutdowns and work permits.
7) Implement the major civil works such as expansions or construction of rooms, trenches etc. as required for the equipment to be provided by the Contractor.
8) Provide to the extent possible drawings for AMI Control Centre building where equipment installations are planned.
9) Obtaining requisite statutory clearances and/or approvals as required to be taken by WESCO for project work.
10) Providing available details of the consumer indexing and informing the contractor of any changes in the area network during the project installation and maintenance period
11) Providing A.C. power supply inputs as defined in this specification
12) Provide equipment storage space
13) All required documents for delivery of material at site
14) Travel expenses of employer's representative during training & testing
15) Regulatory support/changes as required
16) Approvals/Suggestions for change in submitted documents/ reports to be given to contractor in time bound manner.
17) Development & implementation of consumer engagement plan
18) Overall project management
19) Organize project review meetings
20) Releasing funds to contractor as per agreed terms of Payment.

2.7 General Bidding Requirements

2.7.1 The Bidder shall be responsive to the technical requirements as set forth in this specification. The bidder's proposal shall include the compliance for Technical Proposal including the documents listed in the Table below shall be provided in the bid.

S. No	Description	Enclosure Reference	
1.	Details of the supplied hardware	Page no. Ref no.	
2.	System Sizing Requirements Annexure-G	Page no. Ref no.	
3.	Quality Assurance Program (As per Quality Assurance of Technical Specification Volume II)	Page no. Ref no.	
4.	Detailed project implementation plan (As per Technical Specification Volume II).	Page no. Ref no.	
5.	Approach paper for implementation	Page no. Ref no.	
6.	Schematic Diagram of Proposed System Configuration	Page no. Ref no.	
7.	Overall system architecture capable of scaling out	Page no. Ref no.	
8	Table of Compliance (As per Annexure-D)	Page no. Ref no.	

2.7.2 A detailed project implementation plan and schedule that is consistent with the scope of the project and WESCO's specified objectives shall be provided. The plan shall include the activities of the Bidders, WESCO, show all key milestones and clearly identify the nature of all information and project support to be provided by WESCO.

2.7.3 A commitment and a clearly defined plan to develop a system support organization, based in India and capable of providing a full range of local services (including software and hardware maintenance and upgrade support) for the life of the delivered systems.

2.7.4 The bidder may offer the bought-out items from more than one manufacturer.

2.8   Applicable Standards

2.8.1 Specifications and codes shall be the latest version, inclusive of revisions, which are in force at the date of the contract award. Where new specifications, codes and revisions are issued during the period of the contract, the Bidders shall attempt to comply with such, provided that no additional expenses are charged to the Employer without Employer's written consent.

2.8.2 In the event the bidder offers to supply material and/or equipment in compliance to any other international standard other than Standards listed in the document, the Bidders shall include with their proposal, full salient features of the new standard for comparison.

2.8.3 In case values indicated for certain parameters in the specifications are more stringent than those specified by the standards, the specification shall override the standards.

2.9   Technical Obsolescence

2.9.1 The systems which are at a risk of technical obsolescence over the operating life of the system should be identified; this should include end-of-sale and end-of-support policies governing the proposed technologies. Forward and backward compatibility need to be considered and mitigation option shall be indicated in detail and shall not be limited to periodic update from OEM/System supplier

3. AMI Specifications

3.1   AMI Functional Requirement

3.1.1   AMI shall include Smart meters, communication systems, routers/ access point/ DCU, customer associated systems, Head End System (HES)/ Meter Data Acquisition System (MDAS), Meter Data Management (MDM) software, and business analytics.

3.1.2   The main objective of AMI is to enable two way communication between smart energy meter and Head End System (HES) to enable remote reading, monitoring & control of electrical energy meters (consumer, feeder, DT meters etc.) to serve as repository of record for all raw, validated and edited data. The sanitized data may be subscribed by other utility function for higher order analysis and billing and collection engine etc.

3.1.3   The AMI system shall help utility to manage their resource and business process efficiently. AMI system shall support the following minimum functionalities:

   (i)   Remote Meter data reading at configurable intervals(push/pull)
   (ii)   Time of day (TOD)/TOU metering
   (iii)   Pre-paid functionality
   (iv)   Net Metering/Billing
   (v)   Alarm/Event detection, notification and reporting
   (vi)   Remote Load Limiter and connection/ disconnection at defined/on demand conditions
   (vii)   Remote firmware upgrade
   (viii) Integration with other existing systems as defined in this document
   (ix)   Import of legacy data from existing modules/ MDAS of RAPDRP where ever possible. The extent and modalities of integration with the existing system including RAPDRP has to be worked out by the bidder.
   (x)   Security features to prevent unauthorized access to the AMI including Smart meter & meter data etc. and to ensure authentication of all AMI elements by third party.
   (xi)   This is only an indicative but not exhaustive list. The system should be capable to support the other functionalities as per the requirement of utilities.
   (xii)   The System will accurately maintain system time synchronization across all devices to ensure accuracy of data. The system should support the interfacing with the future Smart Grid functionalities like peak load management, outage management system, distribution automation including self-healing system, GIS, distribution transformer monitoring units, Electric vehicle, distributed energy resources etc. The bidder has to design a system that will accurately maintain system time synchronization across all devices to ensure accuracy of data. Further, the bidder needs to build in a system that would support the future Smart Grid functionalities. Bidder would have to facilitate WESCO in integration of future technologies/ new application/ equipment by providing whatever data required by WESCO at that time
   (xiii) Communication network shall preferably be able to support multiple applications. Bidder needs to ascertain applications that would be required & submit bid accordingly.

3.1.4   The Bidder shall submit an approach paper describing overall architecture and operational philosophy of the proposed AMI solution and methodology for achieving different functionalities, specified in this document and also highlight additional features, if any.

3.2 General AMI System Requirement

3.2.1 Smart Meter (Single phase whole current, Three phase whole current, CT & PT operated three phase meters and CT operated three phase meters) for consumers/ system shall be provided based on Radio Frequency (RF) mesh in Licensed frequency band as permitted by WPC or in Unlicensed frequency band (Wherever RF is not feasible GPRS based communication shall be established) for communication of data between field equipment/ smart meters. Cloud services shall be established as per the specifications mentioned in this document and to ensure the performance level given in this document to cover towns of WESCO for congested/ highly populated areas. The network would provide a medium for two-way communication between various nodes & Head End System (HES). Different nodes shall interconnect with each other using RF mesh network and they shall communicate with nearby routers to transfer the data to access points/ HES. The contractor shall ensure proper data exchange among Smart meter, router/ access points/ DCU, MDM, HES and other operational/requisite software as part of fully functional AMI system.

3.2.2 Contractor shall adhere with appropriate security algorithm for encryption & decryption. For smooth functioning of entire system, it is essential that the details of such algorithm including the mechanism of security key generation be kept in a secured escrow account which shall be used by the utility only in case of termination of the contract for reasons whatsoever.

3.2.3 Contractor may design appropriate architecture for providing end to end metering solution. Contractor is free to decide upon best solution out of all available options. However, entire responsibility of fully functional AMI system shall rest with the contractor in order to meet the performance levels as given in this document. The communication provider may adopt Radio Frequency (RF) mesh in licensed frequency band as permitted by WPC or in Unlicensed frequency band or RF based canopy system (Wherever RF is not feasible GPRS based communication shall be established) or a combination of these technologies as per the site requirement adopting best available technology in the proposed area of implementation.

3.2.4 The following core components of AMI system shall be provided:
   a) Smart Meters
   b) Communication infrastructure
   c) Head End System(HES)
   d) Meter Data Management System (MDM)
   e) Web application with updated on-line data of consumers etc.
   f) IT Infrastructure over cloud to host the HES, MDM and Web Applications
   g) Mobile app: Bidder shall provide a mobile app through which consumer shall be able to log in through android/iOS/Window based mobile app to see information related to his/her energy consumption. App shall also provide platform for implementation of peak load management functionality by providing existing tariff & incentives rates, participation options etc. Features in this app which relates to demand response should be treated as provisions for future integration. This mobile app shall be part of complete system and therefore no additional cost shall be payable for upgradation/ maintenance separately.

3.3 Smart Meters

Single Phase & Three Phase whole current smart meters shall comply with IS 16444 (latest version). Three Phase CT operated meter shall comply IS 16444: Part 2. The contractor has to furnish valid BIS certification at the time of bid submission.

After meter installation, customer identification no., meter ID, its hardware & software configuration, name plate details, make, type i.e. 1 Phase or 3 Phase, DTR No., Feeder No., Multiplying factor etc. shall be updated in DCU/HES/MDM. The information would also be updated on the portal/app for providing information to consumers.

The Basic Features of Smart Meter shall be:
   a. Measurement of electrical energy parameters
   b. Bidirectional Communication
   c. Integrated Load limiting switch
   d. Tamper event detection, recording and reporting
   e. Power event alarms such as loss of supply, low/ high voltage, out of band frequency
   f. Remote firmware upgrade
   g. Remote configuration change form post-paid to prepaid or net metering or vice a versa (initially the smart meters would be operated in post-paid configuration to avoid public resistance and, subsequently, which may be shifted to pre-paid configuration)
   h. Time of Use (ToU) tariff
   i. Net metering features (for smart meters with Net-metering feature)
   j. Remote meter data reading at configurable intervals (push/pull)
   k. On demand reading
   l. Remote load limiter and connection/ disconnection at defined/ on demand conditions
   m. Integration with other existing systems like IVRS, billing & collection software, GIS mapping, consumer indexing, new connections & disconnections, analysis software, Outage Management System etc.
   n. Security features to prevent unauthorized access to the AMI system
   o. ~~The smart meter should be compatible with various communication technologies viz. RF or GPRS and can be easily be shifted from one communication technology to another without changing the meter.~~

3.3.1 Whole Current A.C. Single Phase Two Wire Smart Energy Meter Of Accuracy Class 1.0 (with/ without net-metering)

3.3.1.1 Smart Meter shall be an A.C. static-watt hour meter of accuracy class 1 for the measurement of alternating current electrical active energy of frequency 50 Hz, with time of use registers, internal connect and disconnect switches with two way communication capability. The bi- directional communication module can either be of built in type or plug-in type with suitable sealing arrangement. The meters with net-metering facility shall measure flow of both forward (import) and reverse (export) energies.

3.3.1.2 The single phase whole current Smart Meter shall conform to the standards and specification as specified in Annexure A

3.3.2 Whole Current A.C. Three Phase Four Wire Smart Energy Meter Of Accuracy Class 1.0 (with/ without net-metering)

3.3.2.1 Smart Meter shall be an A.C. static-watt hour meter of accuracy class 1 for the measurement of alternating current electrical active energy of frequency 50 Hz, with time of use registers, internal connect and disconnect switches with two way communication capability. The bi- directional communication module can either be of built in type or plug-in type with suitable sealing arrangement. The meters with net-metering facility shall measure flow of both forward (import) and reverse (export) energies.

3.3.2.2 The three phase whole current Smart Meter shall conform to the standards and specification as specified in Annexure B

3.3.3   Three phase CT operated alternating current smart meter Of Accuracy Class 0.5S

3.3.3.1   Three phase CT operated alternating current smart meter shall be four wire smart energy meter of accuracy class 0.5S with two way communication facility. The bi-directional communication module can either be of built in type or plug-in type with suitable sealing arrangement. The meters with net-metering facility shall measure flow of both forward (import) and reverse (export) energies.

3.3.3.2   The three phase CT operated Smart Meter shall conform to the standards and specification as specified in Annexure C

3.3.4 Tests

3.3.4.1 Type tests and test certificates

3.3.4.1.1   Single phase and three phase whole current Smart meter shall be type tested for all the type tests as per IS: 16444 (latest version) and three phase CT operated Smart Meter shall be type tested for all the type tests as per IS: 16444 Part-2 (latest version) in a government approved laboratory. The number of sampling for testing of meters and criteria for conformity would be as per IS 16444 and IS 16444 Part-2. The supplier shall have to submit Type Test Reports of either Single Phase or Three Phase Smart Whole Current Meter (of the required current rating as per the RfP) along with the Bid and the Type Test Reports of other variant meters before commencement of supply in line with the specifications mentioned under Volume II, Clause 3.3

3.3.4.1.2   Type test should not be older than 3 years. Without above type test certificate the offer shall not be considered. At least 15 days before the scheduled date of supply, SGIA shall offer for inspection of each lot, 10 random samples for every 10000 numbers of meter to be selected for type testing, to the officials of WESCO and any other party(ies) as decided by WESCO and if meter during type test is found failed then either the order placed shall be cancelled with Contractor to collect all meters at its cost for the supplied meters or Contractor shall have to replace all supplied meters at their cost after manufactured and successful type test within time frame given by the Employer.

3.3.4.1.3 Routine and Acceptance Test

3.3.4.1.1   The Factory Acceptance and Routine tests shall be carried out as per IS 16444 and IS 16444 Part-2. Apart from above test, meter shall be also be tested for all functional requirement through communication as part of acceptance test

3.3.5 General and Constructional Requirements for Meters

    a. Meter shall be BIS marked as per IS 16444/ / IS 16444 Part-2.
    b. General & construction requirement shall be as per IS 16444/ IS 13779/ IS 16444 Part-2

3.3.5.1 Meter Base and Cover

3.3.5.1.1   Meter base & cover shall be as per IS 16444/ IS 13779/ IS 16444 Part-2. The meter Base & cover shall be break to open design. The material for meter base and cover shall be made of high grade polycarbonate.

3.3.5.2 Terminal Block and Cover

3.3.5.2.1 As per IS 16444/IS 13779/ IS 16444 Part-2

3.3.5.3 Design

3.3.5.3.1 Voltage circuit, sealing arrangement, terminal block, terminal cover and nameplate etc. shall be in accordance with IS-16444 (latest version).

3.3.5.3.2 The meter shall be compact and reliable in design, easy to transport and immune to vibration and shock involved in transportation and handling.

3.3.5.4 Circuitry

3.3.5.4.1 As per IS 16444/ IS 16444 Part-2. The contractor shall submit the details of source/agencies from whom purchase of various components of meters have been made by them by them to the employer

3.3.5.5 Name Plate and Marking

3.3.5.5.1 The meter should bear a name plate clearly visible, effectively secured against removal and indelibly/ distinctly marked in accordance with relevant IS. In addition, in middle of name plate the words WESCO, purchase order no. & year/month of manufacturing shall either be punched or marked indelibly. The rating plate information shall be as per relevant IS.

3.3.5.6 Connection Diagram

3.3.5.6.1 As per IS 16444/ IS 16444 Part-2

3.3.5.7 Fixing Arrangement

3.3.5.7.1 The meter shall be mounted type. The Meter should have three fixing holes, one at top and two at bottom. The Top hole should be such that the holding screw is not accessible to the consumer after fixing the meters. The lower screws should be provided under sealable terminal cover. The requisite fixing screws shall be supplied with each meter.

3.3.5.8 Sealing Arrangement

3.3.5.8.1 Arrangements shall be provided for proper sealing of the meter cover so that access to the working parts shall not be possible without breaking the seal.

3.3.5.8.2 Sealing arrangement & number of seals shall be as per relevant IS/ requirement of utility.

3.3.5.9 Meter Box

3.3.5.9.1 The Meter Box would be provided as per latest standards and requirement of WESCO as per Annexure I.

3.3.5.10 Packing

3.3.5.10.1 The meters shall be suitably packed for vertical/horizontal support to withstand handling during transportation. The meter shall be packed appropriately to ensure safe transportation, handling, identification and storage. All packing materials shall be as per environment law in force. The primary packing shall ensure protection against humidity, dust, grease and safeguard the meter's performance until its installation. The secondary packing shall provide protection during transportation. The packing case shall indicate "Fragile in nature" and direction of placement of box. Each packing shall indicate marking details like Manufacturer's name, S.No. of meters, quantity etc.

3.3.5.11 Transportation

3.3.5.11.1 The meter shall be compact in design. The meter block unit shall be capable of withstanding stresses likely to occur in actual service and rough handling during transportation. The meter shall be convenient to transport and immune to shock and vibration during transportation and handling.

3.3.5.11.2 The meter should not be exposed to undue shock and mishandling during transportation. The stacking of box inside transport media should be such as to avoid their free movement. The packing should also be protected from rain and dust by transport media. The Bidder shall be responsible for any damage during transit due to inadequate or improper packing.

3.3.5.12 Testing and Manufacturing Facilities

3.3.5.12.1 The manufacturer shall have NABL accredited laboratory to ensure accurate testing calibration as per IS 16444/ IS 13779/ 16444 Part-2 for acceptance test.

3.3.5.13 Inspection

3.3.5.13.1 All meters shall be duly tested and sealed by the firm at their premises prior to inspection. Manufacturer seal may be provided on one side of meter. For the other side, the seal with engrave as WESCO may be sent in a pack for provision by WESCO after completion of test by WESCO & after receipt of the meter.

3.3.5.13.2 WESCO may select the meter randomly as per sampling plan for acceptance test as per IS 16444/ IS 16444 Part-2. The meters shall be tested for all functional requirements as part of acceptance test as per IS 16444/ IS 16444 Part-2. After testing, these sample meters shall be additionally sealed by the inspecting officer and one copy of the inspection report will be handed over to the manufacturer.

3.4 Communication Infrastructure

   a. The communication infrastructure shall be based on RF mesh network in combination with cellular network.

   b. The communication network shall be based on suitable standards from ITU/ IEC/ IEEE/ CEN/ CENELEC/ ETSI for NAN and WAN network.

   c. Communication network shall provide reliable medium for two-way communication between various nodes (smart meter) & HES.

d. RF based network shall use Unlicensed or Licensed frequency band as permitted by WPC.

e. In this type of communication network, different nodes (smart meters) shall interconnect with each other using RF mesh network and they shall communicate with nearby routers to transfer the data to access points.

f. In such communication network, if any routers/ repeaters/ access points fail, then nodes connected on that device shall automatically reconfigure the mesh with available nearby nodes.

g. The general functionalities for the Router based RF network are specified below:
    i. The communication network shall have dynamic & self-healing capability. If one of the communication element like router or access point fails then nodes connecting to that element shall switch to best available element for communication of data to HES.
    ii. It shall support IPv4 / IPv6 network addressing.
    iii. Each node shall keep a track of best available nearby nodes.
    iv. The communication network equipment shall use Unlicensed or Licensed frequency band as permitted by WPC.
    v. All the communication network equipment shall be certified by WPC, Government of India for operation in license free frequency band.
    vi. The engagement of network service provider would be in the scope of Contractor to meet the performance level as given in the document.
    vii. Suitable network management system (NMS) shall be available to monitor the performance of the communication network round the clock. The NMS shall provide viewing of all the networking elements deployed at site and enable configuration, parameterization of the networking devices and the nodes.
    viii. It shall support remote firmware upgrading
    ix. It shall be secure enough to avoid all cyber threats like DDoS, spoofing, malwares etc.
    x. The communication network shall ensure secure communication of data to HES. The communication between Router/ DCU and Smart Meters should be encrypted
    xi. The equipment shall be weatherproof, dustproof and constructed for outdoor installation on poles (minimum rating: IP-65). A suitable mounting provision shall be made for the equipment.
    xii. Enclosure: Provision for security sealing shall be provided and in case the gasket of the cover is used for protection against moisture, dust and insects, the gasket shall be made of weather and aging resistant material.
    xiii. Routers / Access Points shall have suitable power supply arrangements. Provision of battery backup for at least 5 hour shall be there to continue operation in case of power supply failure. The life expectancy of battery shall be 5 years or more.

3.4.1   General Requirements

3.4.1.1 The bidder shall design reliable, interference free & robust communication network. It shall be flexible in terms of providing communication in variable terrain & urban density.

3.4.1.2 The bidder shall design the network architecture keeping in view the existing and planned infrastructure of the utility. During designing, suitable consideration shall be

kept for future expansion as per requirement of Utility. Before designing the communication network, the bidder shall do the site survey and would provide the most efficient communication infrastructure.

3.4.1.3 The entire infrastructure & associated civil works required for installation & commissioning of equipment/devices like DCUs, repeaters, routers & access points etc. shall be in the scope of bidder. The operational testing of all the network elements has to be demonstrated by the bidder to the satisfaction of the utility.

3.4.1.4 The network solution offered by the bidder should have disaster recovery mechanism in place. The redundancy mechanism of HES and MDM and their disaster recovery plan shall also be described by the Bidder.

3.4.1.5 The quality of installation of the various equipment & power supply wiring to all field equipment shall be as per standards/ regulations/prevailing practices of the utility. The supply of electricity needed for operation and maintenance of entire AMI system shall be the provided by the utility free of cost.

3.4.1.6 A suitable network management system (NMS) shall be provided to monitor the performance of the communication network round the clock. The NMS shall provide viewing of all the networking elements deployed at site and enable configuration & parameterization of the networking devices and the nodes.

3.4.1.7 Bidder should use two Telecommunication Providers in the Project with approx. 50 % Communication through each Telecommunication Service Provider subject to availability of excellent network (data) coverage to meet RfP requirements. As per the TRAI guidelines, a tripartite agreement would be signed between the Telecommunication Provider, WESCO and the SGIA as per the guidelines issued by Telecom Regulatory Authority of India (TRAI) and SGIA to maintain the SLAs as per the RFP.

3.4.2 Network

3.4.2.1 The Network shall have adequate cyber security measures not limited to the measures as described below. The network security would be extended to all the interfaces also.

a. **Secure Access Controls**: The system shall include mechanisms for defining and controlling user access to the operating system environment and applications. Best practices from enterprise security including password strength, password aging, password history, reuse prevention etc. must be followed for access control.

b. **Authorization Controls**: A least-privilege concept such that users are only allowed to use or access functions for which they have been given authorization shall be available.

c. **Logging**: Logs must be maintained for all attempts to log on (both successful and unsuccessful), any privilege change requests (both successful and unsuccessful), user actions affecting security (such as password changes), attempts to perform actions not authorized by the authorization controls, all configuration changes etc. Additionally, the access to such logs must be controlled in accordance to the least-privilege concept mentioned above, so that entries may not be deleted, accidentally or maliciously.

d. **Hardening**: All unnecessary packages must be removed and/or disabled from the system. Additionally, all unused operating system services and unused networking

ports must be disabled or blocked. Only secure maintenance access shall be permitted and all known insecure protocols shall be disabled.

e. **Malicious Software Prevention**: Implementation of anti-virus software and other malicious software prevention tools shall be supported for all applications, servers, data bases etc.

f. **Network Security**: The network architecture of the HES must be secure with support for firewalls and encryption. The system shall also allow host-based firewalls to be configured, as an additional layer of security if the network firewall were to fail.

3.4.3   Communication Network Elements

The Bidder may either use Data Concentrator Unit (DCU) based Communication Network or Router based RF Mesh Network.

3.4.3.1   Data Concentrator Unit (DCU) based Communication Network

The Data Concentrator Unit is a gateway for communication of data between the Smart Meters and the HES. The Data Concentrator Unit receives supports information exchange from the Smart Meter on a scheduled / need basis and stores the data, which can be accessed by, to HES for onward transfer to MDM.

The DCU provides the central link between Smart Meters and HES, enabling continuous/periodic meter read and control. DCU shall exchange data from smart meters on RF communication and with HES on WAN

3.4.3.1.1 Hardware & Power Supply of DCU

* Enclosure/box of DCU shall be minimum IP65 or better compliant. A suitable mounting arrangement required for DCU installation shall also be provided.
* A suitable and optimum power supply shall be provided keeping in view that even in case of outage in one or two phases, DCU can be powered. DCU should be capable of withstanding surges & voltage spikes of 6KV as per IEC 61000-4-5 standards. Power supply shall be terminated on suitable sized MCB to facilitate isolation during on-site maintenance.
* DCU shall have battery with backup for 8 hour for normal meter reading, to push tamper event, carry out on demand reading and the network health status/ connectivity continuity & check. DCU should have the suitable feature to send power outage and restoration message to the HES. The battery shall have a guaranteed life of 5 years.
* DCU shall have built in Real Time Clock (RTC) with separate battery backup. The battery shall have a guaranteed life of 5 years. It shall have self- diagnostic feature for RTC, memory, battery, communication module, etc. Alternatively, Software driven RTC may also be used as per agreement between supplier and utility.

3.4.3.1.2 Configuration, Functionality & Interface of DCU

DCU shall have following configuration functionalities:
* It shall be able to configure the communication with underlying nodes/meters.
* It shall support data transportation from the field devices to the HES as part of push data mechanism. It should also support the HES in pulling data from the field

devices/meters. The data acquisition (Push/Pull) frequency shall be programmable. DCU shall be capable to prioritize.

- DCU shall ensure a secure communication to HES and shall have internal memory for storing interval data for at least 5 days.
- DCU shall support on demand read and ping of individual/group of meters.
- It shall support IPv4 and IPv6 network addressing.
- DCU shall push events like tamper, power off etc. to HES immediately on occurrence/receipt from field devices/meters.
- The equipment shall be weatherproof, dustproof and constructed for outdoor installation on poles (minimum rating: IP-65). A suitable mounting provision shall be made for the equipment.
- Enclosure: Provision for security sealing shall be provided and in case the gasket of the cover is used for protection against moisture, dust and insects, the gasket shall be made of weather and aging resistant material.
- The list of standards followed in all the devices/equipment used in communication network shall be furnished

3.4.3.1.3 DCU Communication

- The communication architecture shall be any, as defined under IS 16444.
- The DCU shall ensure the appropriate backhaul for secure transfer of data to HES either via latest cellular communication technology (GPRS 3G/4G etc.) or Fiber Optic communication. In case of GPRS/3G/4G backhaul, it shall support SIM card with dynamic IP from any service provider. It shall have Wide Area Network (WAN) connectivity to the HES through suitable means.
- DCU shall be able to communicate with meters either on RF mesh (Unlicensed or Licensed frequency band as permitted by WPC) or PLC.
- DCU shall periodically monitor meter reads/downstream commands and shall retry and reconnect in case of failed events/reads.
- It shall push events like tamper, power off etc. to HES immediately on occurrence/receipt from field devices/meters. DCU shall be able to acquire and send data to HES for full capacity (as per designed for no. of meters/field devices) to ensure the performance level. Full capacity of DCU is required to be indicated in the offer.
- After Power Interruption, on restoration of power supply, DCU shall establish communication with underlying devices as well as upstream application automatically.
- DCU shall be able to communicate with the nearest meters depending on topographical features. For further communication among the meters, distance of the other meters with the DCU shall not be a constraint as communication of the nearest meters shall be established with other meters through appropriate mesh formation / other formation.
- Remote Firmware Upgrade: The DCU shall support remote firmware upgrades as well as remote configuration from the control center. Configuration of programmable parameters of smart meters shall be done through HES.
- All meters falling under one DCU shall be commissioned and checked for proper communication in presence of utility in-charge.
- DCU shall keep the records of minimum of the following events:
  - No of packet failures
  - Retry attempts
  - Missed periodic readings

- ▪ Failure to connect
- ▪ Tamper events

- • Necessary redundancy has to be ensured by the SGIA to maintain the SLA.

3.4.3.2 Router based RF Mesh Network

In this type of communication network, different nodes (smart meters) shall interconnect with each other using RF mesh network and they shall communicate with nearby routers to transfer data to access points/ HES. In such communication network, if any routers/repeaters/access points fail, then nodes connected on that device shall automatically reconfigure mesh with available nearby nodes.

3.4.3.2.1 General Requirement of Router based RF Mesh Network:

3.4.3.2.1.1 The general requirements for the Router based RF network are specified below:

a. The communication network shall have dynamic & self-healing capability. If one of the communication element like router or access point fails then nodes connecting to that element shall switch to best available element for communication of data to HES.
b. It shall support IPv4 and IPv6 network addressing.
c. Each node shall keep a track of best available nearby nodes.
d. The communication network equipment shall use Unlicensed or Licensed frequency band as permitted by WPC.
e. All the communication network equipment shall be certified by WPC, Government of India for operation in license free frequency band.
f. Suitable Network Management System (NMS) shall be available to monitor the performance of the communication network round the clock. The NMS shall provide viewing of all the networking elements deployed at site and enable configuration, parameterization of the networking devices and the nodes.
g. It shall support remote firmware upgrading
h. It shall be secure enough to avoid all cyber threats like DDoS, spoofing, malwares etc.
i. The communication network shall ensure secure communication of data to HES.
j. The equipment shall be weatherproof, dustproof and constructed for outdoor installation on poles (minimum rating: IP-65). A suitable mounting provision shall be made for the equipment.
k. Enclosure: Provision for security sealing shall be provided and in case the gasket of the cover is used for protection against moisture, dust and insects, the gasket shall be made of weather and aging resistant material.
l. The list of standards followed in all the devices/equipment used in communication network shall be furnished.
m. Routers / Access Points shall have suitable power supply arrangements. Provision of battery backup for at least 8 hour shall be there to continue operation in case of power supply failure. The life expectancy of battery shall be 5 years or more.
n. Necessary redundancy has to be ensured by the SGIA to maintain the SLA.

3.4.3.2.2 Configuration, Functionality & Interface

3.4.3.2.2.1 Access points shall have following configuration functionalities:
a. It shall be able to configure the communication with underlying nodes/end points.
b. It shall support on demand read and ping of individual/group of meters.
c. It shall push events like tamper, power off etc. to HES immediately on occurrence/receipt from field devices/meters.
d. It shall have Wide Area Network (WAN) connectivity to HES through suitable means.
e. It shall communicate with routers/nodes/end points on RF mesh (Unlicensed or Licensed frequency band as permitted by WPC).
f. It shall periodically monitor communication network downstream and shall retry and reconnect in case of communication failure to any node in the network.
g. After power Interruption, on restoration of power supply, it shall establish communication with underlying devices as well as upstream application (HES) automatically.
h. Access point shall facilitate recording of:
   i. No of packet failures
   ii. Retry attempts
   iii. Missed periodic reading
   iv. Failure to connect
   v. Tamper events
i. It shall be capable to handle interval data of suitable nos. of any type of smart meter (1ph/3ph). Access point shall be able to acquire and send data to HES for full capacity (No. of meters/field devices it is designed for) within a suitable time period to achieve the performance level. Full capacity of access point is required to be indicated in the offer.
j. Access point shall support remote firmware upgrades as well as remote configuration from the control center.

3.4.3.2.3 Testing of the DCU /Access Point

3.4.3.2.3.1 DCU/Access Point shall be tested for the following:
a. Radio interference measurement (CIS PR 22)
b. Surge test (IEC 610004-5)
c. Fast transient burst test (IEC 61000-4-4)
d. Test of immunity to electrostatic discharges (IEC 61000-4-2)
e. Test of immunity to electromagnetic HF field (IEC 61000-4-3)

The bidder shall provide IP-65 compliance test certificate for DUC/Access Point.

3.5 Head End System (HES)

a. The main objective of HES is to acquire meter data automatically avoiding any human intervention and monitor parameters acquired from meters.

b. HES will be suitable to support collection and storage of data as per performance level for a defined no. of smart meters with facility of future expansion as per requirement of WESCO.

c. HES would perform all the requisite functions as per the defined functionalities of AMI and it is the responsibility of the bidder to supply the requisite software and hardware to achieve the defined functionalities of AMI. HES shall ensure data integrity checks, for example, checksum, time check, pulse, overflow, etc. on all metered data

d. HES shall be developed on open platform based on distributed architecture for scalability without degradation of the performance using additional hardware. HES shall support storage of raw meter data, alarms and alerts for minimum 45 days. Adequate data base and security features for storage of data at HES need to be ensured.

e. The key functions of HES (not limited to) may be as follows:
    i. Acquisition of meter data on demand & at user selectable periodicity
    ii. Two way communication with meter/ DCU
    iii. HES shall ensure data integrity checks, for example, checksum, time check, pulse, overflow, etc. on all metered data
    iv. Signals for connect & disconnect of switches present in end points like meter
    v. Audit trail and Event & Alarm Logging
    vi. Encryption of data for secure communication
    vii. Maintain time sync with DCU / meter
    viii. Store raw data for defined duration (minimum 3 days)
    ix. Handling of Control signals / event messages on priority
    x. Setting of Smart meter configurable parameters
    xi. Communication device status and history
    xii. Network information in case more than one technology is deployed in field between the two devices. Technology provider to provide all network information.
    xiii. HES shall export all meter data (as per IS 15959) to MDM via CIM/XML. In addition, it should conform to IEC 61968-9 as well as MultiSpeak v3.0 standards to interface with pre-existing MDM solution. In case, Discom has implemented any SOA/ ESB architecture, the data exchange to and from HES shall be through this ESB. The export of all data would be as per Clause 6.2 of CEA's "Functional Requirements of Advanced Metering Infrastructure (AMI) In India"
    xiv. Critical reporting functionality for the following suggestive critical events:
        ▪ Alarms and event log for meter events like tamper/power failures etc.
        ▪ Data not received from DCU/Meter
        ▪ Relay not operating for connect / disconnect
        ▪ Communication link failure with DCU/Meter
        ▪ Network failure, etc.
    xv. Non-Critical reporting functionality for the following suggestive non-critical events:
        ▪ Retry attempts on communication failure
        ▪ Periodic reading missing
        ▪ Failure to connect etc.
    xvi. To automatically request first breath message from Smart Meters in case the Smart Meter is communicating after last gasp message
    xvii. Signal Strength monitoring of devices on which GPRS SIMs are installed

3.5.1 Configuration

3.5.1.1 HES shall facilitate programming of following meter parameters:

a. Load profile capture period
b. Demand integration period
c. Setting of parameters for time of day (TOD/TOU) billing. The same would be as defined for meter in IS16444
d. Prepaid function
e. Net metering
f. Billing date
g. Clock setting/time synchronizations
h. Load curtailment limit
i. Event setting for connect/disconnect
j. Number of auto reconnection attempt
k. Time interval between auto reconnection attempt
l. Lock out period for relay
m. Remote firmware upgrade
n. Password setting
o. Push schedule
p. Setting threshold limits for monitored parameters
q. Provision for adding more programming features in future (The bidder may suggest more parameters as per the requirement)

3.5.2 Communication

a. HES shall communicate with DCUs/access points using WAN technology
b. HES shall be able to accept data according to IS 15959 part-I/part-II
c. HES shall automatically retry for missed data; the number of retry attempts shall be configurable
d. To receive confirmation on successful execution of a command
e. HES shall ensure data integrity checks, for example, checksum, time check, pulse, overflow, etc. on all metered data

3.5.3 Monitoring and Reporting Capability

HES shall have critical and non-critical reporting functionality. The critical & non critical information generated from this reporting functionality shall be made available to MDM at user configurable periodicity.

3.5.3.1 Critical Reporting

a. HES shall have alarms & event log for node's (meter) events (tamper/power failures etc.)
b. If data not received from nodes/end points
c. If relay does not operate for connect / disconnect
d. Communication link failure with nodes/end points
e. Network Failure
f. Signal Strength monitoring of devices on which GPRS SIMs are installed
g. Last Gasp message and First Breath message monitoring

3.5.3.2 Non Critical Reporting

3.5.3.2.1 HES shall report and keep record of following communication failure events:
   a. Retry attempts
   b. Missed periodic reading
   c. Failure to connect

3.5.3.2.2 HES shall support reporting of communication failure history of nodes/routers/access points etc. and give an exception report for nodes/routers/access points not communicating for last 0 – 24 hours (the reporting period shall be on user configurable period). HES shall send all notification to MDM and MDM should send email/SMS notification of configured alarms & events to selected users.

3.5.4   Integration

3.5.4.1 HES shall export all meter data (as per IS 15959) to MDM via CIM/XML. In addition, it should conform to IEC 61968-9 as well as MultiSpeak v3.0 standards to interface with pre-existing MDM solution. In case, utility has implemented any SOA/ ESB architecture, data exchange to and from HES shall be through this ESB. The export of all data would be as per Clause 6.2 of CEA's "Functional Requirements of Advanced Metering Infrastructure (AMI) In India"

3.6   Meter Data Management System (MDMS)

The Meter Data Management System shall support storage, archiving, retrieval & analysis of meter data and various other MIS along with validation & verification algorithms. It shall act as a central data repository with interactive dashboard. MDMS shall have capability to import raw or validated data in defined formats and export the processed and validated data to various other systems sources and services in the agreed format. It shall provide validated data for upstream systems such as billing, analytics, reporting, etc.

MDMS also supports future requirement of WESCO & supports integration of other Smart Grid functionalities like consumer information system, customer care, network planning & analysis, load analysis/forecasting, Peak Load Management, Outage management, Distribution Transformer Monitoring system, self-healing system etc. as & when implemented by WESCO.

MDM shall have the following core functionalities:

The key use cases to be enabled by AMISP are provided below. Please note that these are illustrative list of use cases only and is not an exhaustive list. Further please note that all IS Standards shall be applicable.

Sr.	Use Case Activity Description	Source	Destination	Info Exchanged
1.	**Scheduled Meter Read Automatically from Consumer Premises**			
1.1	At scheduled frequency meter sends data to HES. Consumption details including non-critical events will be in 15 min block data, and data could be incremental to what was sent by meter in preceding instance	Meter	HES	Meter Number, reading date & time, kW, kVA, kWh, kVAh, PF, Non-critical Event Code / Date
1.2	At scheduled frequency meter sends billing Data to HES	Meter	HES	Meter Number, reading date & time, kW, kVA, kWh,

Sr.	Use Case Activity Description	Source	Destination	Info Exchanged
				kVAh, PF
1.3	Scheduled meter data reaches MDM	HES	MDM	Meter Number, reading date & time, kW, kVA, kWh, kVAh, PF, Non-critical Event Code / Date
2.	**Remote Meter disconnection / reconnection**			
2.1	Meter re-connect / disconnect operation command	MDM	HES	Meter Number, group of meters, instruction to close switch
2.2	Consumer meter re-connection / disconnection	HES	Meter	Meter number, action (reconnect/ disconnect)
2.3	Connection Status Update	Meter	HES	Meter Number, switch status
2.4	Connection Status Update	HES	MDM	Meter Number, group of meters, switch status
3.	**Utility detects tampering at consumer site**			
3.1	High priority events captured by Meter sent to HES as and when occurred	Meter	HES	Meter Number, event date & time, event Code /description
3.2	High priority events reach MDM for further action.	HES	MDM	Meter Number, event date & time, event Code /description
3.3	Notify utility personnel for site inspection	MDM	Email/SMS Gateway	Consumer number, Meter Number, Tamper code, address
3.4	On analysis and detection of valid tamper event or malfunction, connection is disconnected.	MDM	HES	Consumer number, meter number, action to be triggered (disconnect), action date & time
3.5	HES sends disconnect command to meter	HES	Meter	Meter Number, action (disconnect)
3.6	Tamper event shared with CIS. Billing determinants are updated for tamper invoicing	MDM	CIS / Billing Determinants	Meter Number, event date & time, event Code /description
3.7	Meter re-connection order once tamper issue is resolved	MDM	HES	Meter number, action (re-connect)
3.8	HES sends re-connect command to meter	HES	Meter	Meter Number, action (re-connect)
4.	**Missed interval readings**			
4.1	On identifying missed interval, HES will re-acquire data for the missing period from meter	HES	Meter	Meter Number, from date & time, to date & time (for which data is missing)
4.2	On receiving data request command, meter will send data to HES	Meter	HES	Meter Number, reading date & time, kW, kVA, kWh, kVAh
4.3	Missed Interval and Reads Data acquired by MDM	HES	MDM	Meter Number, readings with date & time
5.	**Consumer connection outage/restoration event**			
5.1	Outage/restore event recorded by meter is sent to HES as and when event occurs	Meter	HES	Meter Number, Outage / restoration Date / Time, Power On or Off count
5.2	Outage / Restoration Notification	HES	MDM	Meter Number, Outage / restoration Date / Time,

Sr.	Use Case Activity Description	Source	Destination	Info Exchanged
				Power On or Off count
5.3	Sharing Outage / Restoration Notification	MDM	OMS/CIS-CRM	Meter Number, Outage / restoration Date / Time, Power On or Off count
5.4	Meter read request from OMS to identify service outage / restoration	OMS	MDM → HES	Meter Number,
5.5	Meter responds to event poll from HES	Meter	HES	Meter number, Status (live/dead)
6.	**Remote firmware upgrades/ meter configuration changes**			
6.1	Remote firmware upgrade	MDM → HES	Meter	Firmware
6.2	Configuration Commands: Change tariff parameters, Synchronize clock, Registers reset (status, max, tampering)	MDM → HES	Meter	Meter number, tariff parameters, registers status, event type and priority
6.3	Status update of Firmware / Configuration	Meter	HES → MDM	
7.	**Load monitoring at demand side**			
7.1	When there is a load violation event recorded in the meter, the information is sent to the CC	Meter	HES → MDM	Meter Number, max demand, date & time of load violation
8.	**Time synchronization**			
8.1	Synchronising RTCs of meters / DCUs/ACP	HES	DCU/Meter	Time Setting
9.	**Metering network changes**			
9.1	Change / new installation in Meter / DCU Network Hierarchy	Meter / DCU	HES	Network identification info including DCUs
9.2	Change / new installation in Meter / DCU Network Hierarchy	HES	MDM	Network identification info including DCU
10.	**New consumer connection**			
10.1	Receive pre & post-paid new consumer requests	CIS-CRM	MDM	Consumer name, address. Connection request etc.
10.2	Verify new consumer has paid as per regulation	Billing	MDM	Consumer connection request, Payment details
10.3	Generate meter installation order	MDM	CIS-CRM /WFM	Consumer ID & details
10.4	Receive meter installation report	WFM	MDM	Meter number, DT no, Feeder & reading
10.5	Requesting instant, interval & events data from meters	MDM	HES → Meter	Meter Number, Reading date & time, reading params (kWh, kVAh, kW etc.)
10.6	Acquire instant, interval / events data from meter by HES which then reaches MDM system.	HES	MDM	Meter Number, Reading date & time, reading params (kWh, kVAh, kW etc.)
10.7	Once new meter remote read verification is over, confirm new connection with other applications	MDM	Billing / CIS-CRM	Consumer ID, Consumer address, Meter Number, initial reading etc.
11.	**Migrate post-paid consumer to prepaid mode**			
11.1	Receive migration request	CIS-CRM	MDM	Migration request for post-

Sr.	Use Case Activity Description	Source	Destination	Info Exchanged
				paid consumer with profile
11.2	Get billing attributes	Billing	MDM	Billing attributes
11.3	Setup prepaid consumer profile in prepaid engine. If no change in meter is required, skip next two steps	MDM	Prepaid Engine	Prepaid consumer profile
11.4	Generate prepaid meter installation order if required	MDM	CIS-CRM / WFM	Consumer ID & details
11.5	Receive meter installation report	WFM	MDM	Meter number, DT no, Feeder & reading
11.6	Enable prepaid mode in meter	Prepaid engine	HES → Meter	Engineering token
11.7	Receive activation confirmation	HES	MDM	Activation status
11.8	Request instant, interval & events data from meter	MDM	HES → Meter	Meter Number, Reading date & time, reading params (kWh, kVAh, kW etc.)
11.9	Acquire instant, interval / events data from meter by HES which then reaches MDM system.	HES	MDM	Meter Number, Reading date & time, reading params (kWh, kVAh, kW etc.)
11.10	Once meter remote read verification is over, share migration request completion detail with other modules	MDM	Billing / CIS-CRM	Prepaid consumer profile
12.	**Migrate prepaid consumer to post-paid mode**			
12.1	Receive migration request	CIS-CRM	MDM	Migration request for prepaid consumer with profile
12.2	Request meter data	MDM	HES → Meter	Meter Number, Consumer ID
12.3	Acquire instant, interval / events data from meter by HES which then reaches MDM system.	HES	MDM	Meter Number, Reading date & time, reading params (kWh, kVAh, kW etc.) with balance credit
12.4	Send meter disconnect command	MDM	HES → Meter	
12.5	Receive connection status	HES	MDM	Disconnect status
12.6	Enable post-paid mode in meter	MDM	HES → Meter	Engineering token
12.7	Receive activation of post-paid mode	HES	MDM	Activation Status
12.8	Request instant, interval & events data from meter	MDM	HES → Meter	Meter Number, Consumer ID
12.9	Acquire instant, interval / events data from meter by HES which then reaches MDM system.	HES	MDM	Meter Number, Reading date & time, reading params (kWh, kVAh, kW etc.)
12.10	Once meter remote read verification is over, share migration request completion detail with other modules	MDM	Billing / CIS-CRM	Post-paid consumer profile and meter data along with credit balance
13.	**Consumer Registration in Consumer Portal/ App**			

Sr.	Use Case Activity Description	Source	Destination	Info Exchanged
13.1	Consumer clicks on new user on consumer portal/ App, provides RMN or email ID and submits data	Portal/ App	MDM	Request for registration with RMN/email ID
13.2	Utility receives request for registration and sends OTP after verification	MDM	Email/Mess age Gateway	OTP
13.3	Consumer submits OTP	Portal/ App	MDM	
13.4	Consumer receives registration detail	MDM	Email Gateway	Login ID and default password
13.5	Consumer submits first login request	Portal/ App	MDM	
13.6	System seeks password change	MDM	Portal/ App	
13.6	Consumer changes default password	Portal/ App	MDM	
14.	**Consumer Access to Consumption, Billing & Profile Data**			
14.1	Consumer logs in to Portal/ App	Portal/ App	MDM	
14.1	Consumer Profile for Portal/ App	CIS-CRM	MDM →Portal/ App	Name, Account, Address, Service Points, K Number
14.2	Consumption Data	MDM	Portal/ App →UI	Consumption profile
14.3	Billing (post-paid) / Credit Balance (prepaid)	Billing → MDM	Portal/ App	Post-paid Billing history/ Current Bill, Prepaid Recharge history
15.	**Prepaid Consumer Recharge**			
15.1	Consumer logs into Portal / Mobile App	Mob App / Portal	UI	Login
15.2	Consumer fills-in required detail in UI and requests recharge	UI→ Prepaid App	Payment Gateway	Consumer ID, Recharge amount
15.3	Consumer selects payment method	Payment Gateway	Net banking /Credit Card / Wallet etc.	
15.4	Consumer receives payment acknowledgement	Payment Gateway	Prepaid App→Portal →UI	
15.5	Calculate credit balance for prepaid consumer & update prepaid meter	Prepaid App	HES→Meter	Consumer credit balance (virtual token)
15.6	Notify credit balance to consumer	Prepaid App	Email/SMS Gateway	Credit Balance
16.	**Post-Paid Consumer Bill Payment**			
16.1	Consumer logs into Portal / Mobile App	Mob App / Portal	UI	Login
16.2	Consumer is presented with Billing history and current outstanding Bill	Billing → MDM	Portal/ App→UI	Outstanding Bill
16.3	Consumer requests bill payment. Option to download bill	UI→Billing	Payment Gateway	
16.4	Consumer selects payment method	Payment Gateway	Net banking /Credit Card / Wallet etc.	

Sr.	Use Case Activity Description	Source	Destination	Info Exchanged
16.5	Consumer receives payment acknowledgement	Payment Gateway	Billing→ Portal/ App→UI	
16.6	Payment acknowledgement through email/SMS	Billing	Email/SMS Gateway	Payment acknowledgement
17.	**Consumer Service Request**			
17.1	Consumer logs in to Portal/ App	Portal/ App	MDM	
17.2	Consumer requests for service	UI	MDM	Service request
17.3	System assigns SRN & sends acknowledgement	MDM	Portal/ App→UI, Email/SMS Gateway	
17.4	System resolves request & updates consumer records	MDM	Portal/ App→UI, CIS/CRM	
17.5	System closes SRN	MDM	Email/SMS Gateway	
18.	**Consumer Complaints**			
18.1	Consumer logs into Portal/ App	Portal/ App	MDM	
18.2	Consumer registers complaint	UI	MDM	Specific complaint
18.3	System assigns CRN & sends acknowledgement	MDM	Portal/ App→UI, Email/SMS Gateway	
18.4	System assigns resolution based on nature of complaint	MDM	CIS / OMS / WFM	
18.5	Target system reports completion of complaint	OMS / WFM	MDM	
18.6	System updates records and closes CRN	MDM	CIS, Email/SMS Gateway	
19.	**Demand read of meters from consumer premises**			
19.1	Requesting instantaneous, interval, load profile & events data from meters	MDM	HES→Meter	Meter Number, Reading date & time, reading params (kWh, kVAh, kW etc.)
19.2	Acquire instant, interval, load profile & events data from meters by HES which then reaches MDM system.	Meter→ HES	MDM	Meter Number, Reading date & time, reading params (kWh, kVAh, kW etc.)
20.	**Staff User Access to Utility Portal**			
20.1	User logs in to Portal	Portal	MDM	Login with appropriate credentials
20.2	User selects available functions	MDM	Portal → UI	
20.3	User logs out	Portal → UI	MDM	

3.6.1 Asset Management

a. MDM shall maintain information and relationships between current installed meter location (apartment, shop, industry/ address etc.), Consumer information (Name etc.), Consumer account no, Meter ID, Type of Meter (type of consumer, 1 phase/ 3phase, with or without relay, etc.), Meter configuration (Demand integration period, Load profile capture period etc.), GIS supplied information (longitude, latitude, connection with feeder/ transformer/ pole etc.), Pole No., DTR No., Feeder No. and Substation Number etc.

b. MDM shall also support device lifecycle management from device registration, installation, provisioning, operations and maintenance to decommissioning etc. The MDM shall generate exceptions for meter or modules not delivering the correct meter data after installation. The MDM shall provide a reconciliation report that identifies the meters that have been installed but not communicating for a designated (configurable) period. MDM shall generate reports on the number of meters installed in comparison to the number of meters successfully communicating.

c. The software should support tracking the status of meters and communication equipment from the date when they are installed in the field. The history of in-service asset location is maintained throughout the device life with start and end dates associated with each in-service location reference.

d. Ability to report & log any damage/ deterioration in meter attributable to consumer /utility.

e. New meter should first fetch the Consumer ID, DTR No., Feeder No. etc. from the CRM application of WESCO

f. MDM should also check for any duplicate meter no. that may exist in the CRM before its updation into system

3.6.2 AMI Installation Support

a. The MDM shall also support device lifecycle management from device registration, installation, provisioning, operations and maintenance to decommissioning etc. The MDM shall generate exceptions for meter or modules not delivering the correct meter data after installation.

b. The MDM shall provide a reconciliation report that identifies the meters that have been installed but not communicating for a designated (configurable) period. MDM shall generate reports on the number of meters installed in comparison to the number of meters successfully communicating.

3.6.3 Meter Data

a. The MDM shall accept input, process, store, and analyze Meter data from HES and meter data collected through hand held meter reading instruments and manual meter reads. In case of manual reads, provision should be there to insert associated notes like assessed energy, etc.

b. The MDM should accept input, process, store, and analyze non-billing meter data such voltage and power quality data (like under/over voltage, out of band frequency, etc.) as they are available from AMI Head End Systems. The MDM shall also support schedule and on-demand meter reads and pinging of meter energized states by authorized users and by other Discom systems.

c. The MDM shall provide storage of all collected Meter Data, events and alarm. It shall have capacity of storing 5 years data or more via archiving.

d. The archiving of data should be done monthly and all data older than 30 days/hours should be archived. Bidder's solution should describe the process of archiving and restoration from the archive.

e. Correctly track & resolve energy usage across meter changes with no loss of individual meter data.
f. Provide complete history and audit trail for all data collected from meters including commands sent to meters and other devices for 30 days (configurable period).
g. Execute on-demand read processes.
h. Handle special metering configurations like net metering/pre-paid metering/multiple meters at same premises.
i. The MDM shall have the ability to manage at a minimum 15 minute interval data.
j. The contractor shall ensure data integrity checks on all metered data received from data collection systems.
k. In case of meter change, MDM should record last reading of old meter and initial reading of new meters and should, accordingly, maintain the proper accounting of Consumer ID wise energy consumption
l. Hierarchy should be maintained Consumer ID wise

3.6.4 Data Validation, Estimation and Editing (VEE)

3.6.4.1 Validation and estimation of metered data shall be based on standard estimation methods (Like max/avg. of past three days, max/avg. of past 4 number of similar week days, max/avg. of similar blocks of past 4 numbers of similar week days etc.).

3.6.4.2 The MDM should also support and maintain following data:
a. Registered Read Data including register reads, daily billing cycle, as well as derived billing determinants like TOU
b. Interval Data channels with variable intervals and variable units of measure
c. Calculated Data that is derived or computed such as billing determinants and aggregated loads.
d. Event data storage of all collected event and alarm data from meters, network equipment, and MDMS itself

3.6.4.3 MDM shall flag, alarm and trigger an estimating process including but not limited to when the following anomalies occur in the cumulative ("CUM") register reads
a. CUM Decrements within a billing cycle (except net-metering)
b. CUM reads increments more than configurable threshold
c. Future or old read dates
d. Number of digits exceeds number of meter dials

3.6.4.4 MDM shall detect, flag, alarm and trigger an estimating process including but not limited to when the following anomalies occur in Time of Use (TOU) register reads
a. Register Decrements (except net-metering)
b. Resets (to zero) (except net-metering)
c. CUM reads increments more than configurable threshold
d. Future or old read dates
e. Erratic compared to CUM read (sum of TOU reads minus CUM read)

3.6.4.5 MDM shall detect, flag, alarm and trigger an estimating process including but not limited to when the following anomalies occur in Demand register reads
a. Do not reset on cycle
b. Do not reset coincident with customer move-out or move-in

      c.   Reset off cycle inappropriately

      d.   Too high

3.6.4.6   All data shall be transferred to billing system after meter data validation and estimation including transformer / feeder station wise energy audit.

3.6.4.7   MDM shall estimate usage for non-metered service points such as street lights, farm lights, traffic signals, etc.

3.6.4.8   The MDM shall maintain both the original received raw data in a non-manipulated state, in addition to VEE data.

3.6.4.9   Notwithstanding the latency of data collection via the AMI system, once the MDM receives meter read data, the VEE process occurs in real-time and the post-VEE data is then immediately available to user or external systems.

3.6.4.10 The MDM shall be able to automatically flag data changes from manual edits, VEE (Validating, Editing and Estimating) rules and data source corrections and electronically generate audit trail with timestamps and user-ids.

3.6.5   Billing Determinants Calculations

3.6.5.1   The MDM Shall allow configuring multiple TOU/TOD options (e.g. the number and duration of TOU rate periods) by customer type, tariffs and day type (weekend, weekdays, and holidays) and by season.

3.6.5.2   MDM would support the processing of interval data into billing determinants to include the Total Consumption in different time blocks for ToU billing, Maximum Demand (in kW and kVA), Number of tamper counts and Average power factor

3.6.5.3   MDM shall support the processing of interval data into billing determinants to include the following at a <u>minimum</u>:
    a) Total Consumption
    b) Consumption in different time blocks for ToU billing
    c) Maximum Demand (in kW and kVA)
    d) Number of tamper counts
    e) Average power factor

3.6.5.4   MDM shall process interval data and frame it into appropriate TOU periods for consumption & demand; for example, roll up 15/30 minute data intervals into hourly data.

3.6.5.5   MDM shall have the ability to properly account for special metering situations such as prepaid metering and net metering when calculating billing determinants and sending them to billing and other systems.

3.6.5.5.1 MDM shall have the ability to properly account for special situations including, but not limited to, curtailment requests, demand response scenarios (based on use cases provided in **Annexure L**) when calculating billing determinants and sending them to billing software. A process needs to be defined and implemented after approval from WESCO that any meter change will not have any effect on the TODs of a particular consumer

3.6.6   Exception Management

3.6.6.1 Ability to capture and log data exceptions, problems and failures and to generate management reports, provide trend analysis, automate generation of service requests and track corrective actions.

3.6.6.2 Ability to group, prioritize, filter and send system generated alarms and events to predetermined email addresses, cellular text messages to phone numbers/SMS/customer care etc.

3.6.6.3 Exception Generation - MDM shall generate exceptions based on configurable business rules including but not limited to the following:
   a. Meter tamper alerts
   b. Communication module health alerts for Meter/DCU
   c. If the consumption is less/more than pre-defined average consumption
   d. Negative Consumption (not for net-metering)
   e. Power outage indications received from the Smart meter

3.6.7 Service Orders

3.6.7.1 The MDM shall generate service orders based on configurable rules for various events and alarms such as stop meter, tampers, problem in communication networks, etc.

3.6.7.2 MDM shall send service orders via SMS, email, etc. with the email addresses / phone numbers being configurable. MDM shall receive feedback on action taken on the service order and track the status of service orders until resolution.

3.6.7.3 Service order tickets could be generated by MDM but processed and closed under jurisdiction of the HES-NMS combine. If the utility already has a separate Workforce Management System (WFM), then the service order tickets can be routed from the MDM and the NMS to the WFM for completion of the tasks and reporting.

3.6.8 Customer Service Support

3.6.8.1 The solution shall provide customers with access to current and historical consumption and interval data, outage flags, voltage and power quality indications. The data shall be displayed in graphical and tabular form depending on user choice. The Customer may also access data through customer portal. The solution shall integrate via a user friendly graphical interface.

3.6.8.2 MDM shall support email/SMS notification of configured alarms & events to selected users

3.6.8.3 MDM shall support the web portal or shall have the ability to interface with the 3rd party portal/utility portal to provide the consumer near real time online views of both usage and cost and helping consumers to understand electricity usage and cost information, alerts and notifications and energy savings tips with different levels of detail. The portal should support the view for past electricity usage, last week's, yesterday's, current days or other period etc. as per selection. The portal should provide user friendly access to consumer for their data via colorful graphs and charts and can download the data into a spreadsheet

3.6.8.4 MDM shall support mobile app through which consumer shall be able to log in through android/iOS/Window based mobile app to see information related to his energy consumption. App shall also provide platform for implementation of peak load

management functionality by providing existing tariff & incentives rates, participation options etc

3.6.9 Revenue Protection Support

3.6.9.1 Ability to analyze meter tampering flags, power outages, usage trends & usage profiles to identify potential energy diversion situations, and produce daily reports, monthly reports and service order requests for investigation.

3.6.9.2 Business rules for revenue protection alerts shall be configurable via a user-friendly interface.

3.6.9.3 MDM shall filter out revenue protection alerts that may be caused by field activities if the field activity information is provided to the MDM.

3.6.9.4 MDM shall support the analytics/investigation (i.e. view current and historical usage patterns) to validate suspected revenue protection issues

3.6.10 Analytics

3.6.10.1 The MDM shall have analysis capability based on configurable business rules including but not limited to the following:

a. Display consumption/load profiles by configurable period (15/30 min, hour, day, month, year etc.) day type (weekday, weekend, holiday, festival wise etc.) and by tariff, customer type (hospitals, schools, govt. offices, multiplexes, commercial, residential, industrial etc.), or any user specified collection of meters.

b. Generate peak & off-peak load patterns by aggregating all loads of consumer group/consumer type/DT/Feeder over configurable period/day type.

c. Perform DT/feeder wise energy audit for configurable period. These energy audit reports shall clearly bring out the technical losses at Feeder level and DT level through detailed analysis of supply side energy data and corresponding aggregated consumption data of connected consumers. In this analysis it has to factor in data of energy export from net-metered consumers

d. Perform load analysis for different groups and categories of consumers

e. Ability to provide the data to load forecasting, load research or demand response applications and perform error management like: Missed reads and intermittent meter reads before sharing data with load forecasting, load research or demand response

f. Ability to configure the system to effectively visualize consumption trends, identify unusual patterns, and visualize load analysis to understand which assets are being over utilized.

g. Analyzing data to identify new patterns of usage, Setting fraud alert / transformer overload alerts / demand – supply gap alert etc.

h. Ability to receive and store outage and restoration event data from smart meters and outage systems and to log all such events for analysis. Five reliability indices shall be calculated:

   i. System Average Interruption Duration Index (SAIDI), which is sum of all customer interruption durations in a given period over total number of customers served

   ii. System Average Interruption Frequency Index (SAIFI), which is the total number of sustained interruptions in a given period over total number of consumers served.

   iii. Consumer Average Interruption Duration Index (CAIDI), which is sum of all customer interruption durations in a given period over the total number of sustained interruptions in that given period

   iv. Consumer Average Interruption Frequency Index (CAIFI), which is the total number of sustained interruptions in a given period over the total number of distinct consumers interrupted in that given period

   v. Momentary Average Interruption Frequency Index (MAIFI), which is the total number of customer interruptions less than the defined time (1 or 5 minutes) over the total number of customers served

i. These reliability indices shall be calculated for each month, for individual feeders and aggregated annually for the whole utility. The source data for outage shall be last gasp and the first breath messages from DT/Feeder level meters. These computations shall be independent of similar computations made by any OMS application

j. Ability to alerts on DT/ Feeder level overvoltage & back-to normal event and under-voltage and back-to-normal events. Based on these alerts the system should calculate the duration in which the DT/Feeder remained outside the nominal zone of defined voltage. Similar calculations should be allowed for power factor and current unbalance

k. Identify & visualize poor performing assets like feeder/DT on multiple criteria like energy losses, outage duration etc. through appropriate colour coding depending on severity thresholds

l. Analyze data of net-metering consumers to identify patterns of energy export to grid on hourly/weekly/monthly/yearly basis

m. Ability to keep track of meters from which first breath message is not received and to request meter to resend first breath message in case the meter did not send it after it started communicating

3.6.11 Reporting

3.6.11.1 The Report function shall enable Utility to deliver reports in standard digital format such as PDF, Excel, etc. All queries for report generation shall be made through user driven drop down menu in GUI. Bidder shall provide example queries to support internal report generation needs. The GUI shall have provisions to set up or change report delivery to configurable email addresses, network file directories, ftp sites or printer systems without modifying source program code and without any proprietary language skills.

3.6.11.2 The solution shall support users modifying standard reports to better meet specific reporting requirements. The list of the standard reports that shall be provided with the MDM include but not limited to following:

a. Daily data collection report
b. Usage exceptions
c. VEE validation failures
d. Missing interval Read date and times (on hourly, daily, weekly & monthly basis)
e. Physical meter events (install, remove, connect, disconnect) & meter reset report
f. Meter flags

g. Meter inventory

h. defective meters

i. AMI performance measurements

j. Threshold Exception

k. Ability to provide daily & weekly interface exception reports between MDM and other subsystems e.g. billing, outage, etc.

3.6.11.3 Following high level reports for Utility Management shall be generated at specified frequencies to help management with business decisions. For purpose of generating these reports, the system shall be capable of receiving data from external system through standard interfaces via CIM / XML.

Below is an example of reports that may be generated. These reports should be defined and agreed between employer and utility

Category	Report	Frequency
Energy Audit	Energy Audit Report (feeder wise/ DT wise/ Voltage wise): • A daily automatic feeder loss report (Feeder Head reading minus summation of all DT meters readings) • Automatic LT Energy loss report (DT meter reading minus summation of readings of all those consumer meters served by the selected DT) would be reported • Identify the best as well as worst performing feeders and DTs	Daily, Weekly, Monthly and User Selectable Time Period with configurable near real time alerts for exceeding defined loss threshold
Reliability Indices	SAIFI and SAIDI; CAIFI and CAIDI; MAIFI of the feeder(s) and connected consumers would be tracked to measure improvement in the same overtime and establishing reference levels	Daily, Monthly and User Selectable Time Period
Load Management	DT Loading (Categorize DT as overloaded, optimally loaded, near-optimal, under loaded)	Daily, Monthly and User Selectable Time Period with configurable near real time alerts
	Load recording (Consumers): Actual consumption recorded higher than the sanctioned load identifying the top consumers	Daily, Monthly and User Selectable Time Period with configurable near real time alerts
	Load Management Report (Identify top overloaded DTs)	Monthly and User Selectable Time Period
Power Quality	Voltage Deviation Index and Frequency Deviation Index (DT/ Feeder)	Daily, Monthly and User Selectable Time Period with configurable near real time alerts
	Low Power Factor (DT/ Feeder)	Daily, Monthly and User Selectable Time Period with configurable near real time alerts

Category	Report	Frequency
	Meter Current Unbalance (DT/ Feeder)	Daily, Monthly and User Selectable Time Period with configurable near real time alerts
Commercial Loss Detection	Tamper Alert: as per IS 15959 Part 2	Daily, Monthly and User Selectable Time Period with configurable near real time alerts
	Comparison Consumption (system used to detect & track theft suspects)	
	Consumption lower than the expected pattern (pattern of previous year applied to the monthly average) or monthly average	
Management Summary Report (Dashboards)	Summary report on top high loss DTs/ Feeders, top overloaded DTs/ Feeders, Top feeders/ DTs with most outages (number and duration), Top feeders with most power quality issues (over voltage, under voltage, current unbalance, out of band frequency), DTs with high failure rate	Monthly and User Selectable Time Period

Further, the report function shall generate reports on the following project KPIs for a user configurable time period. This will enable tracking the progress of project benefit parameters. Below is a list of suggestive KPIs to be monitored. These KPIs need to be defined and agreed between employer and utility

KPI Parameter	Baseline Scenario Value	Expected Value Post AMI Implementation
Billing Efficiency	<X>	<X>
Collection Efficiency	<X>	<X>
Peak Load	<X>	<X>
SAIFI	<X>	<X>
SAIDI	<X>	<X>
CAIFI	<X>	<X>
CAIDI	<X>	<X>
Transformer Failure Rate	<X>	<X>

3.6.12   Other Smart Grid Functionality Support

3.6.12.1   MDM should also support the interfacing of other smart grid functionalities like Demand Response, Outage Management System, Distribution Transformer Monitoring system, Electric vehicle charging Infrastructure, Roof Top PV Integration etc. as and when implemented by the utility.

3.6.13   Additional Features

3.6.13.1   **Net-Metering**

3.6.13.1.1   MDM shall flag, alarm and trigger an estimating process including but not limited to when the following anomalies occur:
   a. CUM decrements of forward energy within a billing cycle

b. Register decrements for Time of Use (ToU) of forward energy
c. Power generated(exported) by any net-metering consumer more than the installed capacity of solar PV rooftop system
d. Energy exported(exported) in any given day by any net-metering consumer more than the programmable threshold value

3.6.13.2 Prepaid functionality

3.6.13.2.1 The prepaid functionality can either be availed at smart meter level or through MDM. In case of MDM, following shall apply
a. The MDM should support pre-payment metering and capability to interface with pre-payment application.
b. The prepayment should support system that payment and connection parameters are stored centrally and the details are being updated to consumer portal/ app.
c. The system should periodically monitor the energy consumption of prepaid consumer and decrease the available credit based on consumption.
d. The system should send connect/disconnect command on the basis of available credit as per notified rules & regulations.
e. The system should send low-credit notifications to the consumer when their balance approaches a threshold.

3.6.13.3 Utility User Interface

3.6.13.3.1 User interface for utility shall have ability for at least the following functionality:
a. Compare total energy costs on one rate schedule vs. one or many alternative rates.
b. Enable the user to see how different options within a rate affect costs.
c. Display meter data at a user defined configurable cycle through a GUI that allows authorized users to view energy usage patterns and the data behind them for selected customers.
d. Allow authorized users to view metered data, initiate and view reports, modify configurations, and initiate and update service requests via a GUI.
e. Display via a GUI the energy usage profile for a single meter or group of meters. The load profile shall illustrate energy consumption and peak demand in user defined intervals for a user-specified time period.
f. Display via a GUI the energy usage profile for a single meter or group of meters according to Time of Use (ToU) tariff.
g. The GUI shall support a configurable utility dashboard for Operations and Utility Management
h. Access to a minimum of 5 years of historical energy usage and meter reads through the GUI.
i. GUI to clearly and visually distinguish between metered, estimated, allocated and substituted data.
j. GUI to provide role-based access based on user identity and user role. Shall have following types of users:
   i.   Administrator
   ii. Operator
   iii. Field staff
   iv. Viewer/Guest

k. Configure the look, feel, and functionality of the MDM in accordance with business needs, business processes, and business conventions. (E.g. GUI, content, look and feel of screens, validation rules, exception handling, etc.).

l. Ability for utility through user interface to set up alarm and event notifications that can be directed to a combination of configurable email addresses, cellular text messages or phone numbers.

m. User interface for utility to update the credit amount of prepaid consumers to MDM. Such type of user interface before login shall require password & login ID for authentication. User interface after getting information like consumer id., mobile number & recharge amount etc. shall update the same to MDM. The details of payment information shall also update to consumer through SMS, email etc.

3.6.14 Integration with other Systems

3.6.14.1 MDM shall interface with other utility systems on standard interfaces, and the data exchange models and interfaces shall comply with CIM / XML / IEC 61968/ MultiSpeak / IS15959. MDM solution shall be Service Oriented Architecture (SOA) enabled.

3.6.14.2 The aim of the above interface standards is to ensure generic two way interfacing of the MDM with 3rd party applications. Towards this WESCO shall make arrangements to provide documented information on interface detail and specificity in implementation, of its existing systems, which need to interface with the MDM.

3.6.14.3 MDM integration with other systems shall include but not be limited to the following:
    a. Utility Administration
    b. HES for data exchange with AMI solutions
    c. Billing and collection system like Base Computing System (BCS)
    d. Existing other Data Collection Systems
    e. Support of interface with HHU or manual reading system etc.
    f. Consumer Portal
    g. Existing AMR system with data exchange format.
    h. SAP & GIS system.

3.6.14.4 The supplied MDM shall be ready for integration with IVRS, billing & collection software, CRM, GIS and CIS new connections & disconnection, analysis software, Outage Management System etc. systems of the utility based on the standard interfaces as mentioned above.

3.6.14.5 Contractor should provide suitable number of HHUs to read and update the data in MDM to meet contingency requirement in case of communication failure between meter and HES/MDM.

3.7 Customer Portal

3.7.1 Customer Portal solution shall be based on Web as well as Mobile based native apps that provide on-line two-way communication between utility and its customers. The solution shall integrate via a user friendly graphical interface. It shall provide for self service capabilities like usage management, billing, service requests, participation in energy efficiency programs etc. Features shall include:

a. The consumer portal solution shall provide customers with access to current and historical consumption and interval data, outage flags, voltage and power quality indications for selected period.

b. The portal/MDM shall support communication preferences for notification via email/SMS of configured alarms & events to selected users.

c. The web portal or 3rd party portal/utility portal to provide the consumer near real time online views of both usage and cost differentiating high energy usage periods, helping consumers to understand electricity usage and cost information, alerts and notifications and energy savings tips with different levels of detail. The portal should support the view for past electricity usage, last week's, yesterdays, current days or other period etc. as per selection. The portal should provide user friendly access to consumer for their data via colorful graphs and charts and can download the data into a spreadsheet.

d. Consumer mobile app through which consumer shall be able to log in through android/iOS/Window based native mobile app to see information related to its energy consumption. App shall also provide platform for implementation of peak load management functionality by providing existing tariff & incentives rates, participation options etc.

e. Provide cross-browser compliant software (compatible with Internet Explorer, Chrome, Firefox, and Safari)

f. The portal shall be linked to the on-line payment facility and gateway of the utility.

g. Pre-paid consumers shall be provided facility to recharge their account

h. Shall support the utility and in turn its customers with a system for logging, managing, and communicating technical issues.

i. When a Pre-Paid consumer recharges his account, estimation should be done in such a way that he should be informed that in how many days he will exhaust his consumption. Accordingly, logic should be developed that consumer should be informed through email and SMS to recharge his account (10 day, 5 day, 2 day, 1 day) before the expiry of his Pre-Paid consumption which should be calculated based on his previous consumptions and current balance

j. Consumer should be able to get his hour, day-wise Pre-Paid Consumption and balance remaining

k. Provision to be made that client should be registered first before giving access of Smart Metering project Dashboard/ Applications/ Modules. The clients that are not registered should not be able to access the Smart Metering project Dashboard/ Applications/ Modules

l. The communication between Client and Smart Grid Dashboards/ Applications/ Modules should be encrypted

3.7.2 User interface to consumer portal to access consumer's data from MDM for all authorized consumers shall have ability for at least the following functionality:

a. The UI of the Portal shall allow selection of preferred language for dialogue like English, Hindi or any Local language

b. View metered data, initiate and view reports

c. View data according to Time of Use(ToU) tariff

d. Can make request for connection/disconnection

e. User can update mobile number/email

f. Can initiate service requests for maximum demand updating, meter checking etc.

g. In case on net-metering consumers, user can view data for both import & export

     h. In case of prepaid consumers, consumers can view recharge history & present balance.

     i. User interface shall require consumer id., mobile number & password for secure login.

3.7.3   Software patches, updates, and minor version upgrades, when they become available for general release, should be part of ongoing support and maintenance services.

3.8 Cloud Service Provider (CSP) Requirements

3.8.1 Operational Management

a. CSP should provide access of cloud virtual machines either by SSH in case of Linux and RDP in case of Windows servers.

b. CSP should enable WESCO to get console access of cloud virtual machine from portal and perform operations.

c. WESCO CSP should upgrade its hardware time to time to recent configuration to delivery expected performance for this Project.

d. Investigate outages, perform appropriate corrective action to restore the hardware, operating system, and related tools.

e. CSP should manage their cloud infrastructure as per standard ITIL framework in order to delivery right services to Project.

f. CSP should allow different users with different level of access on CSP portal. For example, billing user should not be able to provision resources or delete any resources

g. CSP should allow quota management for each department/ISV/Group. The resources to specific department/group/ISV should be as per allocated quota only. If there is any request for more than quota request, then it should be sent as request to admin.

3.8.2 Compatibility Requirements

a. CSP must ensure that the virtual machine format is compatible with other cloud provider.

b. CSP should give provision to import cloud VM template from other cloud providers.

c. CSP should ensure connectivity to and from cloud resources used for this project is allowed to/ from other cloud service providers if require.

3.8.3 Cloud Network Requirement

a. CSP must ensure that cloud virtual machine of project is into separate network tenant and virtual LAN.

b. CSP must ensure that cloud virtual machines are having private IP network assigned to cloud VM.

c. CSP must ensure that all the cloud VMs are in same network segment (VLAN) even if they are spread across multi datacenters of CSP.

d. CSP should ensure that cloud VMs are having Internet and Service Network (internal) vNIC cards.

e. CSP should ensure that Internet vNIC card is having minimum 1 Gbps network connectivity and service NIC card is on 10 Gbps for better internal communication. The same to be as per MEITY Guidelines

f. In case of scalability like horizontal scalability, the CSP should ensure that additional require network is provisioned automatically of same network segment.

g. CSP must ensure that the public network provisioned for cloud VMs is redundant at every point.

h. CSP must ensure that cloud VMs are accessible from WESCO private network if private links P2P/MPLS is used by WESCO.

i. CSP must ensure that there is access to cloud VMs if WESCO require to access it using IPSEC/SSL or any other type of VPN.

j. CSP should ensure that cloud VM network is IPV6 compatible.

k. CSP should have provision of dedicated virtual links for data replication between their multiple datacenter in order to provide secure data replication for DR services.

l. CSP should ensure use of appropriate load balancers for network request distribution across multiple cloud VMs.

3.8.4 Cloud Data Center specifications

a. The datacenter of CSP must be within India only.

b. All the physical servers, storage and other IT hardware from where cloud resources are provisioned for this project must be within Indian datacenters only.

c. The datacenters of CSP should be spread across different geolocation in different seismic zones.

d. The CSP datacenters should have adequate physical security in place.

e. The CSP datacenters should comply/certified Tier III datacenter norms.

f. The Data Center should conform to at least Tier III standard (preferably certified under TIA 942 or Uptime Institute certifications by a 3rd party) and implement tool-based processes based on ITIL standards.

3.8.5 Cloud Storage Service Requirements

a. CSP should provide scalable, dynamic and redundant storage.

b. CSP should offer provision from self-provisioning portal to add more storage as and when require by WESCO.

c. CSP should clearly differentiate its storage offering based on IOPS. There should be standards IOPS offering per GB and high-performance disk offering for OLTP kind of workload. CSP should delivery minimum 3000 IOPS per TB for OLTP load. However IOPS should be sufficient to cater to performance requirement of project during its entire life cycle

d. The IOPS for NON OLTP load should be minimum 3000 per TB.

e. CSP should have block disk offering as well as file/object disk offering to address different kind of Project needs.

3.8.6 Cloud Security Requirements

a. CSP should ensure there is multi-tenant environment and cloud virtual resources of this project are logically separated from others.

b. CSP should ensure that any OS provisioned as part of cloud virtual machine should be patched with latest security patch.

c. In case, CSP provides some of System Software as a Service for project, CSP is responsible for securing, monitoring, and maintaining the System and any supporting software.

d. CSP should implement industry standard storage strategies and controls for securing data in the Storage Area Network so that clients are restricted to their allocated storage

e. CSP should deploy public facing services in a zone (DMZ) different from application services. The Database nodes (RDBMS) should be in a separate zone with higher security layer.

f. CSP should give ability to create non-production environments and segregate (in a different VLAN) non-production environments from the production environment such that the users of the environments are in separate networks.

g. CSP should have built-in user-level controls and administrator logs for transparency and audit control.

h. CSP cloud platform should be protected by fully-managed Intrusion detection system using signature, protocol, and anomaly based inspection thus providing network intrusion detection monitoring.

3.8.7 Data Management

a. CSP should clearly define policies to handle data in transit and at rest. The same to be as per MEITY Guidelines

b. CSP should not delete any data at the end of agreement without consent from WESCO.

c. In case of scalability like horizontal scalability, the CSP should ensure that additional generated data is modify/deleted with proper consent from WESCO.

3.8.8 Disaster Recovery Management

a. CSP is responsible for Disaster Recovery Services so as to ensure continuity of operations in the event of failure of primary data center and meet the RPO and RTO requirements.

b. RPO and RTO requirements shall strictly be as per MEITY Guidelines i.e. RPO should be less than or equal to 2 hours and RTO shall be less than or equal to 4 hours. The key transaction data shall have RPO of 15 minutes

c. There shall be asynchronous replication of data between Primary DC and DRDC and the CSP will be responsible for sizing and providing the DC-DR replication link so as to meet the RTO and the RPO requirements.

d. During normal operations, the Primary Data Center will serve the requests. The Disaster Recovery Site will not be performing any work but will remain on standby. During this period, the compute environment for the application in DR shall be available but with minimum possible compute resources required for a functional DR as per the solution offered. The application environment shall be installed and ready for use. DR Database Storage shall be replicated on an ongoing basis and shall be available in full (100% of the PDC) as per designed RTO/RPO and replication strategy. The storage should be 100% of the capacity of the Primary Data Center site.

e. In the event of a site failover or switchover, DR site will take over the active role, and all requests should be routed through that site. The pre-requisite to route request to DR should be articulated properly and shared by CSP.

f. Whenever there is failover from primary to secondary, compute environment for the application at DR site shall be equivalent to DC

g. The installed application instance and the database shall be usable and the same SLAs as DC shall be provided.

h. The bandwidth at the DR shall be scaled to the level of Data center when DR is activated.

i. The CSP shall clearly define the procedure for announcing DR based on the proposed DR solution. The CSP shall also clearly specify the situations in which disaster shall be announced along with the implications of disaster and the time frame required for migrating to DR. The CSP shall plan all the activities to be carried out during the Disaster Drill and issue a notice to the Department at least two weeks before such drill. The number of mock DR Drill required in a year would be at least 2.

j. The CSP should offer dashboard to monitor RPO and RTO of each application and database.

k. Any lag in data replication should be clearly visible in dashboard and alerts of same should be sent to respective authorities.

l. Hosting of both DC and DR should be on GCC along with latest generation of servers

3.8.9 Managed Services

a. Network and Security Management:
  i.   Monitoring & management of network link proposed as part of this solution.
  ii. Bandwidth utilization, latency, packet loss etc.
  iii. Call logging and co-ordination with vendors for restoration of links, if need arises.
  iv. Addressing the ongoing needs of security management including, but not limited to, monitoring of various devices / tools such as firewall, intrusion protection, content filtering and blocking, virus protection, and vulnerability protection through implementation of proper patches and rules.
  v.   Ensuring that patches / workarounds for identified vulnerabilities are patched / blocked immediately
  vi. Ensure a well-designed access management process, ensuring security of physical and digital assets, data and network security, backup and recovery etc.
  vii. Adding/ Changing network address translation rules of existing security policies on the firewall
  viii. Diagnosis and resolving problems related to firewall, IDS /IPS.
  ix. Managing configuration and security of Demilitarized Zone (DMZ) Alert / advise WESCO about any possible attack / hacking of services, unauthorized access / attempt by internal or external persons etc.

b. Server Administration and Management:

  i. Administrative support for user registration, User ID creation, maintaining user profiles, granting user access, authorization, user password support, and administrative support for print, file, and directory services.
  ii. Installation/ re-installation of the server operating systems and operating system utilities
  iii. OS Administration including troubleshooting, hardening, patch/ upgrades deployment, BIOS & firmware upgrade as and when required/ necessary for Windows, Linux or any other O.S proposed as part of this solution whether mentioned in the RFP or any new deployment in future.
  iv. Ensure proper configuration of server parameters, operating systems administration, hardening and tuning
  v. Regular backup of servers as per the backup & restoration
  vi. Managing uptime of servers as per SLAs.
  vii. Preparation/ updation of the new and existing Standard Operating Procedure (SOP) documents on servers & applications deployment and hardening

3.8.10 Backup Services

a. CSP must provide backup of cloud resources. The backup tool should be accessible

b. To perform backup and restore management as per policy & procedures for backup and restore, including performance of daily, weekly, monthly, quarterly and annual backup functions (full volume and incremental) for data and software maintained on the servers and storage systems using Enterprise Backup Solution.

c. Backup and restoration of Operating System, application, databases and file system etc. in accordance with defined process / procedure / policy.

d. Monitoring and enhancement of the performance of scheduled backups, schedule regular testing of backups and ensure adherence to related retention policies

e. Ensuring prompt execution of on-demand backups & restoration of volumes, files and database applications whenever required.

f. Real-time monitoring, log maintenance and reporting of backup status on a regular basis.

g. Prompt problem resolution in case of failures in the backup processes.

h. Media management including, but not limited to, tagging, cross-referencing, storing (both on-site and off-site), logging, testing, and vaulting in fire proof cabinets if applicable.

i. Generating and sharing backup reports periodically

j. Coordinating to retrieve off-site media in the event of any disaster recovery

k. Periodic Restoration Testing of the Backup

l. Maintenance log of backup/ restoration

m. CSP should provide network information of cloud virtual resources.

n. CSP must offer provision to monitor network uptime of each cloud virtual machine.

3.8.11 Web Application Firewall as Service

a. Cloud platform should provide Web Application Filter for OWASP Top 10 protection

b. CSP WAF should be able to support multiple website security.

c. CSP WAF should be able to perform packet inspection on every request on 7th (Application layer of OSI) layer.

d. CSP WAF should be able to block invalidated requests.

e. CSP WAF should be able to block attacks before it is posted to website.

f. CSP WAF should have manual control over IP/Subnet. i.e., Allow or Deny IP/Subnet from accessing website.

g. The attackers should receive custom response once they are blocked.

h. CSP must offer provision to customize response of vulnerable requests.

i. CSP WAF should be able to monitor attack incidents & simultaneously control the attacker IP.

j. CSP WAF should be able to Greylist or Backlist IP/Subnet.

k. CSP WAF should be able to set a limit to maximum number of simultaneous requests to the web server & should drop requests if the number of requests exceed the threshold limit.

l. The WAF should be able to set a limit to maximum number of simultaneous connections per IP. And should BAN the IP if the threshold is violated.

m. Should be able to set a limit to maximum length of path to URL.

n. Should be able to limit maximum size of request to Kilobytes.

o. CSP WAF should be able to limit maximum time in seconds for a client to send its HTTP request.

p. Should be able to BAN an IP for a customizable specified amount of time if the HTTP request is too large.

q. Should be able to limit maximum size of PUT request entity in MB

r. The WAF should be able to close all the sessions of an IP if it is ban.

s. Should be able to Ban IP on every sort of attack detected and the time span for ban should be customizable. There should be a custom response for Ban IP.

t. The Dashboard should show a graphical representation of
   i. Top 5 Attacked Websites.
   ii. Top 5 Attacking IP.
   iii. Top 5 Attack types.
   iv. Top 5 Attacked URLs.

u. For analysis purpose the Dashboard should contain following information:

    i.   Number of requests to web server.
    ii.   Number of attacks.
    iii.   Number of Attackers.
    iv.   Types of error messages and on. Of error messages sent to the users.
    v.   Total Bytes sent during transaction

3.8.12 Database support service

a. Installation, configuration, maintenance of the database (Cluster & Standalone).

b. Regular health checkup of databases.

c. Regular monitoring of CPU & Memory utilization of database server, Alert log monitoring & configuration of the alerts for errors.

d. Space monitoring for database table space, Index fragmentation monitoring and rebuilding.

e. Performance tuning of Databases.

f. Partition creation & management of database objects, Archiving of database objects on need basis.

g. Patching, upgrade & backup activity and restoring database backup as per defined interval.

h. Schedule/review the various backup and alert jobs.

i. Configuration, installation & maintenance of Automatic Storage Management (ASM), capacity planning/sizing estimation of the Database setup have to be taken care by the vendor.

j. Setup, maintain and monitor the 'Database replication' / Physical standby and Asses IT infrastructure up-gradation on need basis pertaining to databases.

3.8.13 Cyber Security

a. Bidder shall submit detailed document on end-to-end implementation of security architecture detailing.

b. System shall comply to the best security standards and practices followed in Power Utilities.

c. The system should be having the features of token based authentication system, tracking and log maintenance of successful and failed login attempts, archiving of failed login attempts, user access control, encrypting passwords,

d. The system should have the implementation of Password revocation, tokens for authentication, encryption mechanisms, intrusion detection mechanism and prevention

e. The system should be able to detect service impact attack and mitigation plan

f. Certifications from standard laboratory for cyber security compliances should be submitted.

g. System should have encryption mechanisms for security patches & software delivered over internet.

h. The software delivered by the bidder should be free from backdoors, Trojans viruses and worms and other malicious vulnerabilities.

i. The supplier shall provide necessary firewalls, anti-virus software and other malicious software detection, prevention and removal tools.

j. Cyber security audit of complete system from Cert-In certified agencies:

    i. Before making system live; and
    ii. Annually during FMS period.

3.9 GIS Implementation

3.9.1 Integration of GIS software with existing Billing and MDM/MDAS software for enablement of Energy accounting.

3.9.2 Development of web GIS application to allow users to use GIS application software from internet.

3.9.3 Preparation of different documents of GIS system like design document, process document, user manual, administration guide etc.

3.9.4 Defining boundary fencing during digitization of electrical network, WESCO will provide area of interest to the SGIA.

3.9.5 The GIS mapping of the project area was done in the year 2018, therefore the SGIA shall have to conduct survey for verification of the same and highlight the delta changes in electrical network asset.

3.9.6 After full expected GIS survey related to the project area, selected agency must submit all data in hard copy as well as soft copy for final checking. The checking shall be done by the WESCO-in-charge. In case there is mismatch during verification of data then the selected agency needs to correction free of cost.

3.9.7 Details of existing network data of GIS and Energy Audit (EA) systems in WESCO areas will be given to the SGIA in soft copy along with legend, schema & nomenclature details so as to enable the bidder to design schema, nomenclatures, and structures in a pattern which is similar/ identical to the existing coding schema for GIS/EA systems.

3.9.8 Detailed Scope of Work:

a. SGIA will submit the survey data in hard and soft copy to WESCO in-charge for verification.

b. WESCO in-charge shall perform checking of work done at HT level up to DTR as submitted by SGIA.

c. WESCO in-charge shall perform checking of work done at LT level up to tagged consumer as submitted by the SGIA.

d. In case of mismatch or incorrect survey and mapping of network assets identified by the competent authority of WESCO, SGIA shall conduct re-survey of network assets identified by WESCO.

e. Data verified from WESCO In-charge will be uploaded on GIS System/database.

f. Creation of updated base maps of project area using specified mono data type satellite imagery of 2.5 M resolution and geo-referencing the same. Base map should also include the building footprint digitization.

g. Preparation of physical area maps for the areas, based on collected information, digitization of network entities and landmarks, overlaying of features on the base map with predefined scale for viewing graphically with the aid of suitable existing GIS software. The mapping must be done with 2.5-meter location accuracy with differential corrections.

h. To meet the requirement and depending on the specific area to be mapped, bidders may adopt satellite-imaging technique on predefined scales as suggested for Urban/Cities/Metros areas on 1:1000 scales & for Semi urban on 1:2500 scale. Satellite imagery map (as per Satellite Imagery to be procured by the successful bidder in digital form for the towns. The Spatial map resolution of GIS mapping less than or equal to 2.5-meter GSD per pixel for Urban/Cities/Metros/Semi urban Area. Satellite Imagery maps of the relevant areas are to be obtained/ prepared by SGIA at his own cost. WESCO will issue the necessary letter of authority for obtaining any permission for acquiring such maps from appropriate authority.

i. All information thus obtained by the SGIA shall be treated strictly confidential and shall be used solely for the intended purpose under the contract and shall be returned to the WESCO on completion of the work.

j. In case there is a failure in the GIS data sync, SGIA which is already been developed in application due to in sufficient data capturing not followed by given data model or lacking of data quality checking then the successful bidder will be responsible for the correction of the same.

k. During the data digitization SGIA needs to adhere with the existing data model of geo data base file. If it is found that the integrated functionalities are not working properly due to data discrepancy in GIS end, then SGIA will be responsible to provide the correct data.

l. After completion of one-time activity as mentioned above, SGIA will capture the incremental changes in Assets data for project area as well as delta changes.

m. SGIA will have to do GPS survey for incremental changes in Network assets.

n. The data collected for each of the towns will be forwarded to town in-charge and subsequently after verification will forward the incremental data changes to SGIA.

o. SGIA will upload these data in the GIS database. The process will be repeated at least once in every 6 months so that GIS data of all electrical assets will be up to date. The duration of delta change will be for Three (3) years.

p. The GIS data thus prepared by the SGIA in specified format after necessary GPS survey and mapping of assets is desired to be integrated in the Web Application developed along with network SLD and shape files regularly as per time-frame in supervision of the WESCO. Delivered survey data will further go through Pre-Production configuration, QC/QA, etc. and upon successful Pre-Production configuration the survey data will be uploaded/imported to web application production database which shall be completed by SGIA.

q. The SGIA has to establish relationship between electricity network entities database and Customer database so that electricity network entities can be referred spatially in relation to geographical/ land-based features.

r. IT infrastructure and devices required for project needs to be arranged by SGIA without additional cost to WESCO.

s. It shall be the responsibility of SGIA to provide skilled and trained resources for the entire project duration. The SGIA shall ensure that it shall provide GIS Experts (minimum 2 in number) for controlling & validating the day-to-day changes being made in GIS system and managing complex GIS data management activities at Head offices of WESCO.

t. Only sitting space for a GIS Expert and two GIS executives will be provided by WESCO and required hardware and software with licenses etc. needs to be arranged by SGIA.

u. In addition, during the period of contract, SGIA will regularly educate WESCO staff for smooth hand holding of the GPS instruments, survey process, GIS applications and all GIS related Business complete process in a well-defined documented manner on regular basis.

v. It shall be the responsibility of SGIA to conduct the knowledge transfer sessions for the officials of the Company. The knowledge transfer activity shall include training of Database maintenance of the GIS system and other related applications.

w. SGIA has to follow SRS document's condition for further detailing. In future, if there is any change in process/ workflow then same has to be adhered by the SGIA.

x. SGIA has to collect the attributes and GIS co-ordinates of all electrical elements up to pole, DT up to the End Point / Cut Point of HT or LT Line before consumer. List of attributes and enumerators to be collected shall be shared with the SGIA.

y. SGIA also has to tag the major landmarks & point-of-interest such as Bus Stops / Railway Station/ Hospitals / Hotels / Crossings / Fire Stations / Police Stations / Religious Places / Cinema / Petrol Pumps / Schools / Colleges / Universities etc.

z. Pole & DT code generation will be done as per existing codification schema that will be shared with SGIA and codification of each asset will be indexed with their upstream and downstream source of supply.

aa. Non-digitized areas being surveyed will be digitized using existing Schema.

bb. All attributes like make, capacity etc. as mentioned in the Data Model of Distribution Transformers (DTs), Power Transformers, Sub Stations etc. should be marked and mapped.

cc. SGIA shall prepare the PGDB/.shp file and SLD of collected data and then conduct QA/QC of data in coordination with WESCO. Data will then be handed over to & accepted by utility.

dd. **Mapping of additional assets by using the DGPS/GPS instruments**: SGIA has to make provision for hosting the software required for gathering data from the GPS devices including hardware infrastructure cost that the SGIA may incur on the work of collection and collation of GIS data in utility's defined formats.

ee. **SGIA shall provide the dashboard for GIS:** The indicative list of content coverage is mentioned below:

   i. All information to be sorted and reported Circle wise, Division wise, Subdivision wise,

   ii. Section wise, so that the information is mapped and made available to officer concern to their login/mobile app.

   iii. Based on the data provided by WESCO minimum common Artificial Intelligence will be created by the SGIA to report the health of the network based on tilted pole, broken insulator, Irregular joints, vegetation near conductor, Alignment of line etc.

   iv. Generate associated reporting/ warning mechanism to the concern officials & provision to capture the compliance by them for reporting their rectification/ compliance work.

   v. SGIA needs to develop Web Application having services mentioned in scope of work.

   vi. Support and maintenance of Dashboard for period of eight years of FMS.

   vii. Bidders have option to use any suitable technology such as Drone/ mobile or both for GIS survey necessary permission will be provided by WESCO

ff. GIS system shall be hosted by SGIA over cloud.

gg. The end point hardware (i.e. firewall, networking, Computer with Operating system etc.) and bandwidth, if required, for development & testing shall be provided by the SGIA who also needs to arrange necessary DB licenses and other required application software over cloud to implement GIS system for development, production, and test environment.

hh. SGIA will provide Operating System (OS) and other hardware as per clause 6.3.4. In case GIS application provided by SGIA is not compatible with the latest version of the OS, then SGIA has to bring the required OS licenses.

ii. SGIA shall provide integration services for End to End integration of supplied GIS system with existing IT/ Business Solutions of WESCO.

jj. The GIS application and licenses shall be available for 8 years after Go-Live.

3.9.9 Scope of work for Change Management

a. SGIA shall be required to carry out time to time addition survey and/or re-survey of electrical assets and their connected network upon network change intimation from competent WESCO authorities.

b. The Change Management phase of GIS survey work shall start only after completion of the re-survey of Project Area.

c. A network changes up to 20% of total quantity, per year, which can be variable up to +50% is envisaged over the stipulated Eight (8) years of change management period.

d. Scope of work is basically an ongoing forward activity which includes the following:

   i. This includes incorporation of field changes in electrical network in terms of assets and consumer along with relevant network to centralized geo database.

   ii. Activity will be restricted to incorporation of new network "bifurcated network after the award of the project. Selected agency will have to add and update the GIS data of new networks, bifurcated networks on the basis of information provided by utility on regular basis.

   iii. Identification of gaps in asset mapping: The differential of as on date electrical assets (along with network present on field versus the electrical assets (along with network hierarchy) existing in current geo database.

   iv. Field survey shall be conducted by SGIA for the newly augmented network assets and newly recorded consumers after the date of award of the project.

   v. GPS based survey of additional network. Additional network means electrical network which is there on ground as on date but not being appended to the geo-database.

   vi. Creation and submission of revised electrical network diagrams (soft copies) after incorporating the additional assets. Realignment and updating of attributes of assets currently in GIS will be done (If required).

   vii. In field, asset painting shall be done for all new identified assets and newly augmented assets networks.

   viii. Painting shall be done for existing assets for which old code need to be redefined after addition of new assets.

   ix. The vendor shall also intimate discom regarding existing assets on which paint codes are not visible in field. Re-painting of such faded/ worn out paint codes shall be carried out by the vendor where instructions for the same may be received from zonal nodal officer (GIS) of the discom who will assess need and quantity for carrying out such re painting.

   x. SGIA shall be required to keep in hand sufficient manpower to meet the time to time change management requirements of the discoms. SGIA shall from time to time perform quality improvement, data cleaning, topology creation and de- duplication of GIS data and the improvement part need to be shared with the SGIA.

   xi. In this phase, SGIA would be liable to upkeep data of ever-growing assets of Discom on rooster basis provided by Discom Divisions/IT office.

   xii. GIS data created in the system shall be checked thoroughly though internal QC QA processes to meet the application requirement. Utility will verify the GIS data on ground and through GIS application.

   xiii. SGIA shall share survey methodology and survey sheets.

   xiv. SGIA shall submit or mention the QA/QC tool and process.

xv. SGIA shall submit the defined quantity/amount of QA/QC report to the SI for both field survey data and digitized data.

xvi. SGIA must have a QA/QC team who will be responsible for carrying out the inspection of captured data and its topology with existing and new data.

xvii. QA/QC team shall ensure the capturing of each attributes and its accuracy so that new data can be integrated with existing GIS data. Team will also ensure the quality of existing data and will cover the completeness of existing through field survey.

xviii. Submission of final updated data in database in finalized format after conducting QA/QC and taking approval from Discom Nodal teams, so that collected re-survey additional survey data can be updated on the existing GIS maps by utility's GIS system SI.

xix. SGIA has to undergo change management for existing network as per requirement of WESCO.

3.9.10 Security and User Management

The system:

a. Shall support single sign-on in the system

b. Shall allow Active Directory, LDAP, or other security source

c. Shall allow group-based security policies

d. Shall not require opening of any special protocols for connecting the user client to the web/application server used by the package. All communication shall be on HTTP or HTTPs.

e. No special configuration should be required to configure the firewall.

f. Application users shall not have direct access to the database.

g. Any changes to data shall be recorded in a separate table and shall be stamped with the identity of the user/program and the date / time of the creation/change.

h. Shall provide reports on user activity based on the role and the application that was used.

i. The SGIA shall be responsible to get the application Security Audited by the Cert-In empanelled Security Auditors.

j. System shall have necessary security features against hacking and defacement.

k. System shall comply fully with relevant guidelines for website development issued by the Government of India and the Government of Odisha (if any) from time to time.

l. System should support configurable password policies including:
   i. Password expiry
   ii. Password complexity

        iii. Password history and reuse policy
        iv. Forced password change on first log on Capability of self-service reset of passwords in case of forgotten passwords or Locked accounts.

m. Shall support security system with a full-fledged Role Based Access Control (RBAC) model.

n. Should have online help files and user manual with use cases for the end user.

o. SGIA should make provision for development, customization, and integration service within the open source Web GIS

p. Should provide a simple and easy to manage integration architecture for all external applications.

q. The design shall be decomposed to responsive HTML's which will be compatible with the latest version of browser & all smart devices.

r. The browsers supported would be Internet Explorer 7, 8 & 9+ Latest version of Chrome, Mozilla & Safari.

s. The application is expected to realign and fit to the smart mobile devices (iPad, iPhone, Android etc.).

t. The Solution should be compatible with various open standards and technologies and should not restrict WESCO in using the Solution data for any other applications.

u. The proposed architecture should adhere to the latest industry standards in implementation, security, and data privacy

v. SGIA should facilitate to all internal as well as external users, including, but not limited to the following:
      i. Comprehensive unrestricted access to all features of entire Web GIS solution
      ii. Unlimited iterations to drawings, maps, and plans
      iii. No restrictions to store and access data from external, disparate data sources.
      iv. User Training for both internal & external users.
      v. Handholding of all users, in the form of Helpdesk Support, up-gradation of application and facility for inclusion of new functionality, etc.

w. All application software, data, plans, drawings, specifications, designs, reports, and other documents procured or developed by the selected vendor in the execution of the contract shall remain the property of WESCO, right from the beginning of the contract

x. The source code of the customized part of the application software will remain the exclusive property of WESCO, even after the termination or expiry of the contract.

3.9.11 Migration of Legacy Data

a. SGIA shall evaluate core available datasets for completeness and detail to ensure that it is sufficient for supporting WESCO's newly proposed as well as future planned business needs and identify potential data efficiency improvements (e.g. data normalization/data architecture).

b. SGIA shall perform all related tasks to make sure that legacy data is successfully migrated to standardized data models. SGIA must perform the analysis of the data that needs to be converted/ migrated, prepare, and submit a plan for the conversion/ migration, and also deliver utilities and programs to achieve the conversion/ migration. These tasks shall include.

   i. Data scrubbing: Flag & notify WESCO and line department of any errors detected in legacy data, assist with corrective actions as required, add any necessary information in the attribute fields not found in legacy data.
   ii. Data conversion: Convert data to the standard format to be used in the new data model
   iii. Data migration: Migrate data to the new data model
   iv. Data operability: Ensure migrated data is bug free and fully operable
   v. Meta data: SGIA shall be responsible for formulating a comprehensive and consistent metadata standard which complies with industry standards and follows National Mapping guidelines. Most features do not have existing metadata. Identify and flag gaps and inconsistencies within metadata and assist the WESCO with completing the data.

3.9.12 Documentation

The project team shall provide the following documentations in hardcopy as well as soft copies:

a. Source database statistics report
b. GIS Data-model report with E.R Diagram
c. Gap Analysis report
d. Migrated Data Statistics Report
e. Migrated data
f. Integration Approach & methodology document
g. Solution Architecture
h. QA/QC approach
i. Complete source code with required documentation for the customization component of the application
j. Complete set of GIS database
k. Deployment of fully functional applications
l. Test Plans and Test cases (including Unit Test Plan, User Acceptance Test (UAT) Plan, Security Test Plan, Load Test Plan)
m. Training Manuals and literature
n. Systems Administration Manuals
o. Database Administration Manuals
p. Application User manuals
q. Installation Manuals
r. Operational Manuals
s. Maintenance Manuals
t. Escalation Mechanism

3.9.13 Deliverables of the SGIA

a. Supply of updated Base map of project area both in hard and soft copy, overlaid with digital network maps of designated areas both in hard and soft copy.

b. Perpetual Licenses of GIS software and related systems (Web based GIS Application & Mobile application, Interaction tools, Digitization tools, Database and Spatial database etc.)

c. Spatial and non-spatial database for electrical and non-electrical objects of project area as specified in this document.

d. Coded Asset database of sub-transmission and distribution networks (33KV & below) of the town will be delivered.

e. The deliverable outputs mainly but not limited to in a format that would enable carrying out of the existing functionality. All the deliverables shall be computerized outputs and the vendor shall submit each deliverable in both soft and hard copy forms for approval / comments by the WESCO.

f. Satellite base maps & imagery, GPS & total station based digitized network for the designated areas.

g. Progress reports in the format as required by the purchaser.

h. QÅ/QC of the surveyed and uploaded data in the database will be done by WESCO & WESCO nominated GIS team and/or by third party appointed by WESCO.

The Project deliverables mentioned above are indicative and will be finalized based on agreement and discussion between WESCO and SGIA.

SGIA will provide respective deliverables as per the captured schedule to WESCO for their review and feedback within stipulated timelines.

WESCO will provide feedback within the agreed timelines to make necessary changes, corrections, if required. SGIA will be required to resubmit the revised deliverables.

Feedback and revision of documents and deliverables will be an iterative process.

4. Service Level Agreements

4.1 These performance levels shall apply to the complete AMI system.

4.2 AMI system includes the communications links provided by Network Provider /third parties such as telecommunications companies and bidder has to ensure the desired performance level.

4.3 The performance levels exclude force majeure events.

4.4 The Contractor shall ensure achieving the following Service Levels during the project operation & maintenance phase :

Data Type	Performance Requirement	Remarks
1. Scheduled Interval data readings at a fixed periodicity during the day as decided by utility		
Periodic collection of the 15/30 minute interval load profile data after every 15/30/60/120 minutes	From 95% of meters within 8 hours From 98% of meters within 12 hours	**Penalty -** Deduction of 0.2% of Meter Rent per Consumer per Month as quoted by the Bidder for every 1% or part there of capped at 1% penalty.
2. Scheduled daily meter readings (as per IS 16444/15959)		
Daily collection of the previous day's interval energy data and total accumulated energy	From 99.9% of meters within 24 hours after midnight	**Penalty -** Deduction of 0.2% of Meter Rent per Consumer per Month as quoted by the Bidder for every 1% or part there of capped at 2% penalty.
3. Scheduled billing/ load profile data for bill period		
Collection of billing/load profile data for the bill period for entire installed population	**Collection of Billing Data for bill period** • From 99.9% of meters before the next periodic collection is scheduled. **One-month block load profile for installed meters** • From 98% of the meters in 12 hours after the midnight **Billing profile data for installed meters** • From 98% of the meters in 12 hours after the midnight	**Penalty** - Deduction of 0.5% of AMISP Monthly Fee for every 0.5% or part there of capped at 3% penalty
4. On-Demand Remote reads of meters		

Data Type	Performance Requirement	Remarks
Collection of 7 days of interval energy data and the current total accumulated energy from a group of 10% of installed meters	Action performed within 2 hours	-
Collection of 7 days of interval energy data & current total accumulated energy from a selected individual meter	Action performed within 30 seconds	-
5. Updating of data on consumer portal/ app		
Updating of individual consumer data on portal/ app after receiving the data in MDM	Action performed for active on portal consumers within 5 minutes after receiving the data in MDM	-
6. Ping Response with acknowledgement/ response for selected meters		
For a installed meters	Action performed at 99.9% of meters within 1 minute; and	-
For an individual meter	Action performed within 3 seconds	-
7. Remote load control commands for selected meters with acknowledgement/ response for selected meters		
For a group of 10% of installed meters	Action performed at 95% of meters within 5 minutes; and	-
	Action performed at 99% of meters within 10 Minutes	-
For an individual meter	Action performed within 5 seconds	-
8. For remote connect/disconnect with acknowledgement/ response for selected meters		
For a group of 10% of installed meters	Action performed at 90% of meters within 15 minutes	-
	Action performed 99.9% of meters within 6 hours.	-
For an individual meter	Action performed in less than 3 minutes	-
9. Meter loss and restoration of supply		
Receiving of alert for all affected AMI meters	Alert to be received within 3 minutes for 60% of meters	-
10. Meter Tamper Alerts		
Receiving of alert for an individual meter	Alert to be received within 3 minutes	-
11. Power Quality Alerts		
Receiving of alert for an individual meter	Alert to be received within 5 minutes	-
12. Remotely altering settings in meter/ firmware upgrade with acknowledgement/ response for selected meters		
For a group of 10% of installed meters	**Remotely altering settings in meter** • Action performed at 99% of meters within 30 minutes; and	-

Data Type	Performance Requirement	Remarks
	• Action performed at 99.9% of meters within 1 hour	
	Firmware upgrade with acknowledgement/ response for selected meters • Action performed at 99% of meters within 1 hour; and • Action performed at 99.9%of meters within 2 hours	-
13. Remotely read events logs		
For reading the full event log for a group of 10% of installed meters	Action performed at 90% of meters within 30 minutes; and	
	Action performed at 99% of meters within 1 hour; and	
	Action performed at 99.9% of meters within 6 hours.	
14. **AMI Network (all hardware, software, smart meters, Cloud Infrastructure and field equipment) Uptime**	≥99.5% on Monthly basis	**Penalty** - Deduction of 0.6% of Meter Rent per Consumer per Month as quoted by the Bidder for every 0.5% or part there of reduction in availability capped at 6.0% penalty
15. Cloud Infrastructure uptime	99%	-
16. Recovery Point Objective for AMI MDM and HES System	RPO and RTO requirements shall strictly be as per MEITY Guidelines i.e. RPO should be less than or equal to 2 hours and RTO shall be less than or equal to 4 hours. The key transaction data shall have RPO of 15 minutes.	-
17. Recovery Time Objective for AMI MDM and HES System		-
18. SLA in respect of Pre-Paid recharge, Pre-Paid meter disconnection, Pre-Paid balance updation etc	To be decided mutually between WESCO and the Contractor after Award of Contract	Penalties to decided mutually between WESCO and the Contractor after Award of Contract

4.5 For the above performance requirement, WESCO will review the performance of Contractor against the SLA after every 30 days. Post evaluation, an audit report of the same will be submitted by the Contractor to WESCO.

4.6 Further, for meeting SLAs as defined above, MDMS should be able to generate standard reports for these parameters. During performance evaluation, the generated reports shall be randomly checked with data by WESCO.

4.7 The user interface performance testing shall be done as per following criteria:

S.No.	User Interface Requirements	Response Time
1	Any real time display and application display on workstation console along with data values shall appear on screen.	Within 2 sec
2	Manual data entry of the new value appears on screen.	Within 2 sec
3	Display Update rate	2 sec for 4 displays together
4	Response time for display of Alarm and event after receipt in system	Within 1 sec of receipt in system
5	Requests for printing of displays (to be acknowledged with an indication of request is being processed).	Within 2 sec
6	Requests for generation of reports (to be acknowledged with an indication of request is being processed).	Within 2 sec

4.7.1   The user interface performance testing shall be taken by WESCO or their designated representatives after every 30 days in presence of the contractor. A audit report of the same will be submitted by the contractor to WESCO or their designated representatives.

5. Training Requirements

5.1 General

5.1.1 General requirement for training to be imparted is as follows:

a. Training would have to be provided to the identified personnel of WESCO or their designated representatives on operation and maintenance of AMI Infrastructure (at least 2 times a year during first 3 years for 6 persons per batch)
b. Training shall be conducted by Contractor personnel who are experienced instructors and speak understandable English.
c. The contractor shall provide training to various user groups nominated by WESCO. The bidder shall provide the Training Approach in the response
d. All necessary training material shall be provided by the Contractor. Each trainee shall receive individual copies of documents used for training. Training material shall be organized by functional process that will serve as the training documentation for a particular functional area.
e. Training materials, including the documents provided to the trainees as well as handouts, shall become the property of WESCO. WESCO reserves the right to copy such materials, but for in-house use only.
f. The schedule, location, detailed contents, for each course shall be finalized during detail engineering. The number of participants in the training program may undergo change. However, all the training courses shall preferably be conducted in single batch.
g. The training will consist of a curriculum of courses to address the issues of system operation, business-wide application, changed business processes and general use of the new system.
h. Representatives from the contractor, WESCO or their designated representatives project management teams will be involved throughout in the development of training strategy, training material design and development, standards and training delivery to ensure that change management issues are incorporated, and that training strategies and materials are aligned to the requirements of the project and as business-specific as possible.
i. The contractor is required to quote on per day basis for Training
j. WESCO will have option to cancel any or all training. In the case of cancellation, the rate quoted against the respective training will not be paid to the Contractor.

5.1.2 The training modules shall include but not limited to –
a. AMI Administration & Configuration
b. AMI Installation and Trouble-Shooting
c. Application Management
d. Application Data Analysis

5.1.3 The contractor shall be required to organize following training for personnel of WESCO or their designated representatives-

a. **Professional Training** - This is the training for the core group of implementation team of WESCO or their designated representatives. This team will comprise of members from all the Business Functions and IT sections. Each member would be trained in the relevant function/ module. It is the responsibility of contractor to deliver this training.

Standard curriculum, designed and agreed by WESCO or their designated representatives for hardware, software and network preferably shall be arranged by the contractor for each group. WESCO or their designated representatives will prefer if a portion of the training is conducted on-site.

b. **End User Training** - The contractor will provide training to the owner's team on a "Train the Trainer" basis. WESCO team so trained will then train all of the WESCO's end users. These training sessions will be required to be conducted at any of the sites. The recommended training material can be in paper / electronic media with courses on Business Process Automation software fundamentals, business process overview, job activity training, and delivery options being on-line, CBTs, instructor led class rooms, etc.

5.1.4   In addition two Engineer's from WESCO/ OPTCL shall be stationed at the contractor's works during development/customization of solution as per tender. The deputed WESCO/ OPTCL engineers shall be involved with the project till its completion.

6. System Hardware Requirements

This section describes the technical requirements of all the hardware envisaged in the BOQ for the control centre system. The minimum hardware specifications (Processor, RAM, Aux. Memory, interfaces etc.) for all equipment are specified in Technical Specification for hardware. The contractor has to submit the details of the supplied hardware along with the bid. The Contractor shall asses the adequacy of hardware specified in the BOQ & if any additional hardware or higher end hardware configurations are required to meet all the requirements of the Technical Specifications, the same shall be included in the offer. The Bidder's proposal shall include necessary calculations to clearly establish that the proposed hardware meets the functional and performance requirements of the Technical Specification.

The Bidders are encouraged to optimize the requirement of hardware for servers and processors where one or more applications can be combined or distributed in any combination with adequate redundancy without affecting the performance requirement. However critical applications shall have redundancies in hardware.

The System Hardware Requirements shall be as per MEITY guidelines for cloud.

6.1   Technical Requirements for Hardware

All hardware shall be manufactured, fabricated, assembled and finished with workmanship of the highest production quality and shall conform to all applicable quality control standards of the original manufacturer and the Contractor. All hardware components shall be new and suitable for the purposes specified.

All hardware shall include self-diagnostic features. On restoration of power after interruption they shall resume operation automatically. All servers, workstations and network equipment (Switches, routers, firewall etc.) shall be compatible for remote monitoring using secure SNMP Ver. 3.0. All hardware shall support both IPv6 and IPv4 simultaneously.

The contractor shall ensure that at the time of final approval of hardware configuration and BOQ, all the hardware is as per the current industry standard models and that the equipment manufacturer has not established a date for termination of its production. Any hardware changes, except version upgrade in same series, proposed after contract agreement shall be subject to the following:-

a) Such changes/updates shall be proposed and approval obtained from WESCO along with the approval of Drawings/documents.
b) The proposed equipment shall be equivalent or with better features than the equipment included in the Contract.
c) Complete justification along with a comparative statement showing the original and the proposed hardware features/parameters including brochures shall be submitted to WESCO for review and approval.
d) Changes/updates proposed will be at no additional cost to the Employer.
e) The porting of software shall be at no additional cost in case of replacement of hardware during the AMC period.

6.2 Hardware Configuration

In this Technical Specification all hardware has been broadly classified as "Server" and "Peripheral device". The term "server" (also referred as "processor") is defined as any general- purpose computing facility used for hosting application functions as defined in the specification. The servers typically serve as the source of data, displays and reports. The term "Peripheral Device" is used for all equipment other than servers. Peripheral device includes workstation consoles, WAN router, LAN, printer, firewalls etc.

Redundant hardware such as Servers, Firewall, and LAN etc. shall work in hot stand by manner. All servers and networking equipment (Firewalls, LAN equipment etc.) shall be mounted in rack panel.

The minimum technical specification to be followed for any hardware equipment required would be as per the requirement of WESCO.

6.3 General Device Configuration of Network Equipment

The device configuration of all the network equipment shall be as per the latest Cyber Security guidelines given by CERT-In / NCIIPC/ Ministry of Power or any other competent authority.

6.3.1 Firewall

Firewalls should be properly configured to segregate networks into different segments. The following strategies shall be followed for secure configuration of firewalls.
   a) Cleanup rule.
   b) Place a "Deny Any-Any" rule at the end of the rule base.
   c) Never create an "Allow any-any" rule.
   d) Allow rules should be created only for required services.
   e) This will result in all traffic being disallowed, unless specifically allowed.
   f) Lockdown/stealth rule
   g) All traffic destined for the firewall itself should be disallowed.
   h) Place anti-spoofing rule as per RFC 2827.
   i) Enable DoS/DDoS features on Firewall
   j) Enable application level filtering of firewall

6.3.1.1 Firewall with UTM solution

GENERAL REQUIREMENTS	
1.	The proposed system must be appliance based and rack mountable.
2.	All UTM features like Firewall, Anti-Virus, Anti-Spam, Web & Application filtering up to Layer 7, IPS, DNS Security, SSL Decryption Technology, Wildfire & Sandbox Technology, DOS Protection with Protect interface & Zone Label, Data Filtering and File Blocking should be available for UTM requirement.
3.	Licensing should be per device and not user/IP based.
4.	The proposed solution should support Load Balancing and Failover among more than 2 ISP Links (with USB port 3G/4G and Wimax Support).

5.	The proposed solution should support integration with Windows NTLM, Active Directory, LDAP, Radius, RSA SecurID, Novell e-Directory or Local Database for user authentication and Guest User authentication via SMS
6.	The proposed solution must be able to be capable of deploying in Route (Layer 3) and Transparent mode (Layer 2), individually and simultaneously.
7.	The proposed solution should support dynamic routing like RIP1, RIP2, OSPF, BGP4.
8.	The proposed solution must support Automatic Transparent Single Sign On for user authentication
9.	The proposed solution should support DNS, DDNS, NTP, SNMP, DHCP (Server/Relay), VLANs etc.
10.	The proposed solution should support user, IP and mac binding that can map username with corresponding IP and MAC addresses for security reason.
11.	The proposed solution must support User based policy configuration for security and Internet management.
12.	The proposed solution should support High Availability Active/Passive and Active/Active

HARDWARE REQUIREMENTS

1	The proposed solution must be based on ASIC or Multicore Parallel Processing Architecture
2	Proposed solution should support inbuilt HDD 250GB for storage or external device for Logs and Reports to meet the UTM Features.
3	The proposed solution should have minimum 8 x Copper GbE ports & Expandable to 24 x Copper GbE ports for Future Expansion & Segregation of Zones.
4	There should be provision to Load Fibre modules (1G & 10G) for future Enhancements
5	The proposed solution should have minimum 2 USB ports.

PERMORMANCE REQUIREMENTS

1	The Proposed Solution should meet the following performance criteria & should mandatorily produce valid references for the same at the time of bidding:
	a. Firewall Throughput of 20,000 Mbps or Above
	b. Concurrent sessions: 3,200,000 or Above
	c. New sessions/second: 1,00,000 or Above
	d. IPSec VPN throughput: 1,300 Mbps or Above
	e. SSL VPN throughput: 500 Mbps or Above
	f. Antivirus throughput: 2,900 Mbps or Above
	g. IPS throughput: 4,000 Mbps or Above
	h. UTM Throughput (Firewall, IPS, Web & App. Filtering and Anti-Virus): 1,700 Mbps or

UTM FEATURES REQUIREMENTS

1.	The proposed solution should facilitate the application of UTM policies like AV/AS, IPS, Content filtering, Bandwidth policy and policy-based routing decision on the firewall rule itself. Also, UTM controls should be able to be applied on inter zone traffic.
2.	The proposed system must provide Mac Address (Physical Address) based firewall rule configuration to provide
3.	The proposed solution must support Application/Web Category-based Bandwidth Management which allows administrator to create application/web category-based bandwidth policies.
4.	The proposed solution should have minimum 4000 signatures in its database & provision for Custom IPS Policies.

5.	The proposed solution should support Anti-Virus scanning for SMTP, SMTPS, POP3, IMAP, FTP, HTTP, HTTPS, FTP over HTTP protocols.
6.	For POP3 and IMAP traffic, the proposed solution should strip the virus infected attachment and then notify the recipient and administrator.
7.	The proposed solution should support spam scanning for SMTP, SMTPS, POP3, IMAP.
8.	The proposed solution must support on-appliance quarantine facility and also a personalized user-based quarantine area which allows you to release legitimate emails.
9.	The proposed solution should support real time spam detection and proactive virus detection technology which detects and blocks new outbreaks immediately and accurately.
10.	The proposed solution should have specific Web categories that broadly classify websites. For instance, websites that reduce employee productivity, bandwidth choking sites or malicious websites.
11.	The proposed solution should support creation of cyclic policies on Daily/Weekly/Monthly/Yearly basis for Internet access on individual users/group of users.
12.	The proposed solution should provide option to define different bandwidth for different schedule in a single policy and bandwidth should change as per schedule on the fly.
13.	The proposed solution must be capable of identifying hidden applications running over standard ports (80, 443, 22 etc.)
14.	The proposed solution must be capable of blocking the following type of applications: P2P, VOIP, Games, Remote; Control, Chats etc

VPN REQUIREMENTS

1	The proposed solution should support IPSec, L2TP, PPTP and SSL VPN connection.
2	The proposed solution should support DES, 3DES, AES, Twofish, Blowfish, Serpent encryption algorithms.
3	The proposed solution must support automatic failover of Point to Point link (MPLS) with VPN for redundancy purpose.
4	The proposed solution must support Apple iOS and Android VPN clients

LOGGING & REPORTING REQUIREMENTS

1	The proposed solution should have On-Appliance, integrated reporting solution or External Device
2	The proposed solution should allow exporting of reports in PDF and Excel format.
3	The proposed solution should support logging of Antivirus, Antispam, Content Filtering, Traffic discovery, IPS, Firewall activity on syslog server.
4	The proposed solution should provide connection-wise reports for user, source IP, destination IP, source port, destination port or protocol.
5	The proposed solution should provide compliance reports for SOX, HIPPA, PCI, FISMA and GLBA compliance.
6	The proposed solution should support multiple syslog servers for remote logging.
7	The proposed solution should have customizable email alerts/automated Report scheduling

WARRANTY, SUPPORT & CERTIFICATION REQUIREMENTS

1	Warranty & UTM Features Subscription: 36 months
2	OEM Web/Phone/Chat Support: 24x7 (36 Months)
3	The Proposed Solution should meet the following Certification Criteria:
	a. Common Criteria - EAL4+
	b. "IPv6 Ready" Gold Logo
	c. ICSA Firewall or Equivalent

6.3.2 Router

Necessary control should be applied on router to stop unwanted traffic and attacks at the perimeter itself. In the secure configuration of a router, the following strategies should be considered.
   a. Deploy proper access management and avoid remote administration.
   b. Enable password.
   c. Change default SNMP community string.
   d. ACLs (Access Control Lists) should include
      i. Apply egress/ingress filter
      ii. Filter all RFC 1918, 3330 address space and special/reserved address
      iii. Permit the required services for the required IP addresses only
      iv. Deny everything else.
   e. Turn on logging to a central syslog server.

6.3.3 Intrusion Detection & Prevention System

The required features of the Host Based Intrusion Detection Systems (HIDS) and Network based Intrusion Prevention System (NIPS) are described below:

6.3.3.1 Intrusion Detection and Prevention System (Host Based)

Host based Intrusion Detection and Prevention System module shall be provided for all machines. IDS shall be able to perform following actions:

   a. Capability for Detecting the intrusion attempt that may take place, intrusion in progress and the intrusion that has taken place.
   b. Flag and check unauthorized access
   c. Notify/Alarm/message of intrusion to:
      i. Management console
      ii. Event log
      iii. Administrator by e-mail
   d. Create an audit trail for user and file access activity, including file accesses, changes to file permissions, attempts to install new executables and/or attempts to access privileged services
   e. In an event where user accounts are added, deleted, or modified, changes to key system files and executables is done in by unauthorized account or there is unauthorized attempt to overwrite vital system files, to install Trojan horses or backdoors suitable action should be taken such as:
      i. Terminate User (intruder) Login
      ii. Disable User (intruder) Account
      iii. Forge a TCP FIN packet to force intruder connection to terminate
   f. Should provide events check for suspicious file transfers, denied login attempts, physical messages (like an Ethernet interface set to promiscuous mode) and system reboots.

6.3.3.2 Network based Intrusion Prevention System (NIPS)

The NIPS shall provide complete inline protection from network-based application layer threats by scanning packet payloads for malicious traffic. It shall detect, classify and stop malicious application, viruses, worms and spyware/adware etc.

After detecting an intrusion attempt NIPS should be able to perform following actions:

a. Reconfigure the firewalls provided in this package
b. Send an SNMP Trap datagram to the management console.
c. Send an event to the event log.
d. Send e-mail to an administrator to notify of the attack.
e. Save the attack information (timestamp, intruder IP address, victim IP address and port, protocol information)
f. Force intruder connection to terminate.

6.3.4 Other Hardware Configurations

A. Desktop

S.No.	Description	Minimum Specification
1.	Form Factor (Computer Type)	Desktop Mini/Micro (Provision to mount the CPU behind it)
2.	Processor & Chipset	10th Generation Minimum Core i7-8700T (Min 2.4 GHz with Turbo up to 4 Ghz, 12 MB Cache, 6 cores, 12 threads) or higher Q370 Chipset or higher
3.	Monitor	19.5" or higher IPS Panel LED backlit with TCO 7.0 and 1440 x 900 Resolution
4.	Memory	32 GB of ECC DDR4 Memory and scalable up to 512 GB memory (Memory slots free for expansion)
5.	RAM	4 GB delivered, expandable upto 8GB
6.	Display	Minimum 2 Nos. * 17" (1280x1024), Antiglare LED Monitor. Should have display port and VGA connector. Provision to mount the CPU behind it. Both monitors to be connected to CPU with proper connector/video cables
7.	Mounting	Desktop mounting
8.	Operating System	Windows 10 Professional (64 bit) with latest Service Packs pre-installed
9.	Operating System (OS) support	Windows 10; 64 bit (Original OS CDs and license keys to be provided)
10.	Processor speed	3.0 GHZ each processor
11.	Internal Auxiliary memory	500GB delivered, expandable upto 1TB
12.	Speakers	Two internal speakers
13.	Interfaces	• 1 GB dual Ethernet ports • Min 4 USB Ports, of which atleast 2 USB Ports in Front • Front I/O: (2) USB 3.1 Gen1 Ports, Universal Audio jack • Port for cartridge magnetic tape drive • Graphic adapter cards (HDMI) • Rear I/O: (4) USB 2.0 ports, (2) USB 3.1 Gen 1 Ports, (1) VGA video port; (1) DisplayPort Port, (1) RJ-45 network connector, (1) RS-232 serial port, (2) PS/2 Ports, 3.5mm audio in/out jacks
14.	User interface	Three/Two (as per BOQ) 24" wide screen (16:9 aspect ratio), HD

S.No.	Description	Minimum Specification
		Resolution (1920x1080) TFT Colour monitors, keyboard & optical mouse
15.	Graphics	Integrated Intel® HD Graphics 630 or higher
16.	Audio	High Definition Integrated Audio with Internal Speaker
17.	Hard Disk Drives	1TB 2.5" SATA III 6.0Gbps HDD @ 7200 rpm, Partitioned into 2 drives.
18.	Ethernet	Integrated Gigabit (10/100/1000 NIC) LAN
19.	Connectivity	Integrated Gigabit LAN Network Connection 10/100/1000 Mbps NIC with RJ45/UTP Interface.
20.	Keyboard	USB 104 keys or higher OEM make.
21.	Mouse	2 Button USB Optical scroll mouse, OEM make
22.	Chassis Volume	Max. 1.2 litre (without Mounting Kit). CPU must be mounted behind the monitor.
23.	Power Supply	Minimum 65W or above External Indian Power Adapter for CPU with average efficiency of 87% or more
24.	Security Features	TPM 2.0, Setup/BIOS Password, Slot for locking CPU using lock and key. (Lock with 2 / 3 keys should be provided)
25.	Software (loaded in Desktop)	Office 365 Enterprise
26.	Diagnostics Tool	Inbuilt Pre-Boot BIOS Diagnostics
27.	Security	TPM 1.2 Security Chip, SATA port disablement (via BIOS), Serial, USB enable/disable (via BIOS), Removable media write/boot control, Power-On password (via BIOS), Administrator password (via BIOS), Setup password (via BIOS), Support for chassis padlocks and cable lock devices
28.	Warranty	5 years Comprehensive onsite warranty
29.	Compliance & Certification	Energy Star ver 6.1, EPEAT Certified for India for quoted desktop & Monitor, TCO Certified for both Desktop & Monitor, FCC, CE, RoHS certified, UL Certified ISO 9001, 14001, 27001, Certified OEM
30.	Information Accessibility	Product details, specifications, and brochure to be available in public domain
31.	Support	Drivers should be available for download from OEM site for at least 5 years from the date of purchase order

B. Workstations with Monitors

Workstation for development system shall consist of dual monitors & single keyboard and a cursor positioning device/ mouse. The user shall be able to switch the keyboard and cursor-positioning device as a unit between both monitors of console. Workstation consoles shall also be used as development console to take up developmental/ maintenance activities such as generation/ updation of database, displays etc. and to impart training.

The minimum hardware configuration of operator workstation and Display monitors are as follows:

S.No.	Item	Description
A. Operator Workstation		
1.	Spec	As per the base runtime requirements of SPEC CPU 2017 V1.0 Benchmarking Standards.
2.	RAM	8 Gb expandable upto 16 GB

S.No.	Description	Minimum Requirements
3.	Processor Speed	3.0 GHz
4.	Internal Auxiliary Memory	2x500 GB RAID, expandable upto 1 TB
5.	Speakers	2 internal speakers
6.	Interface	1GB dual Ethernet Ports Min 4 USB Ports Port for Cartridge magnetic type drive Graphic adapter cards (HDMI)
7.	User Interfaces	24" wide screen (16:9 aspect ratio) as per BoQ HD resolution (1920x1080), TFT Colour Monitors, keyboard and optical mouse
8.	Mounting	Desktop Mounting
9.	Power Supply	Dual AC Power Supply
10.	Operating System	Microsoft Windows 8.1 or Latest Professional (compatible with the OEM Software)

B. Monitors

S.No.	Description	Minimum Requirements
1.	Diagonal Viewable Size	Yes
2.	Colour Support	16.7 million
3.	On Screen Control	Required
4.	Anti-Glare and Anti-Static	Yes
5.	Tilt, Swivel	Yes
6.	Aspect Ration	16:9

C. UPS – 2kVA Line Interactive INTELLIGENT UPS for Desktop PC

S.No.	Description	Minimum Requirements
1.	Capacity	2 kVA Line Interactive
2.	Back up Time	10 Minutes on 450 VA Continuous Load; Overload capacity: 125% of required capacity for at least 1 Minute
3.	Input Voltage	230 V AC, Single Phase 3 wire
4.	Input Voltage Range	160 V AC to 270 V AC
5.	Input Frequency Range	45 to 55 Hz
6.	Input Over Voltage	280 V AC
7.	Input Under Voltage	155 V AC
8.	Over Voltage Cut-Off	Should be offered externally
9.	Output Voltage	230 + 5% (On Battery) Automatic Voltage Regulation
10.	Output Over Voltage	245 V AC Single Phase
11.	Output Under Voltage Protection	210 V AC Single Phase
12.	Load Power Factor	0.8 Lag to Unity
13.	Short Circuit Protection	Soft shut down should occur without blowing any fuse.
14.	General Features	Automatic Voltage Regulation, Lightning & Surge Protection Output Wave form — Modified Sine wave Audio Alarms: Low Battery; Battery ON; Overload Protection: Overload, Short circuit, spike & surge
15.	Switching Time	Less than 5 MS without data loss
16.	Operating Temp.	Up to 40 Deg. C.
17.	Operating Humidity	Up to 90%, Non-condensing
18.	Battery Type	SMF-Hitachi/ Exide/ Global Yuasa/ Panasonic make or equivalent

S.No.	Description	Minimum Requirements
19.	Make	APC, Liebert, TVSE, Powerware (Invensys), Guard/NEXUS, Wep, HCL or equivalent.
20.	Others	Output Sockets - Min 3 Nos., each 6 Amp- 3 Pin with all Sockets wired for UPS output Socket of UPS must be compatible with PC and Printer.
		UPS input power plug should be of Indian standard.
		Software: Required for health monitoring of battery & Power mgmt. system RS232-C Serial port or USB port with interface cable, Min 3 Ft Long.

D. A4 B/W Network Laser Printer

S.No.	Description	Minimum Specification
1.	Make & Model	To be Specified
2.	Type	Dry Type Laser Electro Photography
3.	Function	Print, Copy, Scan
4.	Resolution Colour	1200 x 1200 dpi
5.	Speed (colour)	32 PPM or higher for A4 in normal mode, first page out 8
6.	Memory	256 MB or Higher
7.	Processor	466 MHz or better
8.	Paper Size	A4 and Legal including Envelops & letter
9.	Type of Media	Bond Paper, Transparency Sheets, Envelopes, Labels, Cards
10.	Paper Handling	250 Sheet Input Tray, 50 Sheet Bypass Tray. 150 Sheet output Tray
11.	Std Paper Trays Input	Two trays (Total paper Input capacity 300 Sheets or more
12.	Printing Languages	PCL 6, PCI 5, postscript 3 emulation
13.	Interface	Hi-Speed USB 2.0
14.	Duplex printing Capability	Automatic Duplex
15.	Duty Cycle	50,000 Pages per month or higher
16.	Connectivity	Hi Speed USB, 2.0, Gigabit 10/100/1000
17.	N/W Print Mgmt S/W	Needed. Built-in wireless networking. Fast Ethernet network port
18.	Power Requirement	Less than 750 Watts
19.	Copy	Copy Speed : Black (A4) : Up to 20 cpm 1200 x 2400 dpi; Originals content settings; Text, Text/Photo, Photo, Map; Reduce/Enlarge scaling: 25 to 400%; Copy quantity settings: 1 to 999; Darkness controls: Scan 600 First Copy Time :9.0 sec Maximum Number of Copies : 999 Copy Features : Memory Sort, 2 on 1, 4 on 1, ID card Copy
20.	OS Support	Vendor to provide drivers for supporting all the required OS
21.	Scanner Specification	Flatbed scanner handles up to 8.5 x 14 in (216 x 356 mm) paper
		Scan File Format: PDF, Single-Page-TIFF, JPEG, Multi-Page-TIFF, Single-Page-PDF, TIFF
		Scanner Resolution: 1200 x 2400 dpi
		Scanning Depth (Input/Output) Color: 48 Bit / 24 bit Greyscale: 16 Bit/ 8 bit

E. A4 Size Inkjet/ Bubble Jet Printer

S.No	Description	Minimum Specification
1.	Printer Type	Inkjet/ bubble jet;
2.	Functionality	Print, Scan, Copy; Printer Output - Color
3.	Connectivity	Wi-Fi and USB
4.	Compatibility	Windows 10, Windows 8, Windows 7 SP1, Windows Vista SP2,Mac OS X v10.8.5 and later
5.	Power requirements:	AC 100 - 240 V, 50/60 Hz
6.	Power consumption	Manual-off: 0.2 W; Standby : 1.6 W
7.	USB support	USB 2.0
8.	Pages per minute	4 pages (Color),8 pages (Black)
9.	Page size supported	A4, A5, B5, Letter, Legal, 4 x 6", 5 x 7", Envelopes (DL, COM10), Square (5 x 5"), Custom size (width 101.6 - 215.9mm, length 127 - 676mm); Duplex Print - Manual
10.	Print resolution	4800 × 600 dpi
11.	Scan resolution	600 x 1200dpi

F. A3 Size Inkjet Color Printer / All-in-one Color laser jet Printer

S.No.	Description	Minimum Specification
1	Make & Model	To be Specified
2	Power Requirements	220 to 240 VAC (+/- 10%), 50 Hz (+/- 2 Hz)
3	Copier	
	Paper Size	A3
	Resolution	Up to 600 x 600 dpi
	Copy Speed (A3 Colour & Black)	Upto 15 ipm Mono, 11ipm Color
	Copier Resize	Reduce or Increase document sizes from 25% to 400% in 1%
4	Printer	
	Print Speed (Colour & B/W)	22 ipm mono & 20 ipm color
	Paper Size	A4, LTR, EXE, A3, LGR, LGL, A5, A6, Photo (10x15cm), Indexcard (13x20cm), Photo-L (9x13cm), Photo-2L (13x18cm), Com-10, DL Envelope, C5, India Legale
	Paper Capacity	Standard Tray - 250 Sheets Lower Trays - 250 Sheets Multi Purpose Tray - 100 Sheets Automatic Document Feeder (ADF) - 50 Sheets
	Memory	512MB
	Resolution	Upto 4800 x 1200dpi
	Interface	Hi-Speed USB 2.0; Print wirelessly without having to use a wireless access point (both automatic and manual methods
	Supported OS	Windows 7/Mac OS
5	Flatbed Scanner	
	Scan Type	A3 Flatbed Scanner with ADF
	Scan Technology	CMOS CIS
	Scan Speed	A4 portrait: 18 ipm / 18 ipm A4 landscape: 11 ipm / 11 ipm A3: 8 ipm / 8 ipm
	Duplex Scanning	Required
	Duplex Scan Speed	40 IPM or better
	Scan Resolution	Minimum 600*600 dpi in ADF, 1200*1200 dpi or better in Flatbed

S.No.	Description	Minimum Specification
	Daily Duty Cycle (ADF)	1500 pages or more
	Memory	512 MB
	Processor Speed	120MHz or higher
	Scanning Options (ADF)	Single Pass Duplex
	Bit Depth	Grey Scale8 bit (256 shades) Colour24 bit (16,777,216 colors)
	Supported Paper Weight (ADF)	60 to 105 GSM or better
	Connectivity	USB 2.0
6	Fax	
	Fax Speed	33.6 kbps (3 sec per page)
	Faxing	Yes
	Auto Redialing	Yes

7. System Software Requirements

This section describes the characteristics of system software such as operating system, database and support software (compilers, DBMS, display development, network utilities, report generation, diagnostics and backup utilities) provided by contractor and the original software manufacturer as necessary to support the functioning of AMI Applications systems. All the system software to be used for present scope of work shall have authentic license valid for life time. This section also describes the standards to be followed for all supplied software.

7.1   Software Standards

All software provided by the contractor under this AMI RFP, including the operating system, database and support software, shall comply with the industry-accepted software standards. In areas where these organizations have not yet set standards, the software shall comply with those widely accepted de-facto open standards put forth by industry consortiums, such as OSF and X/Open. The Contractor shall commit to meet the "open systems" objective promoted by industry standards groups.

7.1.1   Design and Coding Standards for AMI Applications and Utilities

These provisions are applicable for both software applications and operating systems and would address program features that must be contained in software for the product to meet the standards. Standard products offered should meet the requirements of the project. The licenses for infra should be genuine.

a. When software is designed to run on a system that has a keyboard, product functions shall be executable from a keyboard where the function itself or the result of performing a function can be distinguished textually.
b. A well-defined on-screen indication of the present focus shall be provided that moves among interactive interface elements as the input focus changes.
c. Applications shall not override user selected contrast and color selections and other individual display attributes.
d. When animation is displayed, the information shall be displayable in at least one non-animated presentation mode at the option of the user.
e. Software shall not use flashing or blinking text, objects, or other elements having a flash or blink frequency greater than 2 Hz and lower than 55 Hz.

7.1.2   Applications

All components of AMI application system shall be maintainable by owner using the supplied software utilities and documentation. The software design and coding standards of the system shall address the followings:

a. **Expansion**: Software shall be dimensioned to accommodate the size of AMI application system as given in BOQ and Appendix-G.(Separate sheet for Sizing)
b. **Modularity**: Software shall be modular i.e. functionally partitioned into discrete, scalable, reusable modules consisting of isolated self-contained functional elements & designed for ease of change. The system shall make maximum use of common industry standards for interfaces.

c. **User-Directed Termination**: Functions taking long execution times shall recognize and process user requests to abort the processing.

d. **Portability & Interoperabilit**y: The system shall be designed for hardware independence and operation in a network environment that facilitates interoperability and integration of third party applications. AMI applications should support multiple RDBMS systems including Oracle, Microsoft SQL Server and MySQL. The Software provided by the Bidder has to ensure Seamless Integration of IT System with the existing system of WESCO and to facilitate or provide full support for any new future/ new application/ equipment integration requirement of WESCO by providing whatever data required by WESCO at that time by/ through the development of Web Services or any other Services. Development and monitoring of Web Services and any other services shall be in the scope of the bidder.

e. **Programming Languages**: The software shall be written using high level ISO or ANSI standard programming languages.

All applications shall be designed with sufficient background logs which capture various level of errors encountered (warning, fatal, informational) while executing, so that the same can be reviewed and attended to.

7.1.3   Operating System

The operating system of all the equipment of AMI application system including network equipment shall be latest version released up to six months prior to FAT. The operating system shall be hardened to provide robust security. The operating system and data file shall be placed in different disk partitions.

In order to facilitate cyber security requirements including patch management, common operating system is preferable to be used by all server nodes within AMI application including MDM/HES servers. This is also to minimize maintenance. All licenses for Operating System & other application software shall be supplied by the contractor and shall be valid throughout the operating life.

7.1.4   Time and Calendar Feature

The AMI application & other servers shall maintain time and calendar for use by various software applications. The internal clocks of all servers and workstation consoles shall be automatically synchronized on NTP protocol. The calendar shall be customizable for working hours, holidays, weekends etc. The holidays, including type of days, shall be entered for each year at the beginning of the year and shall be recognized by all applications.

The user shall be able to alter the date and time. The alteration shall not adversely affect programs running at the beginning of the hour.

7.1.5   Remote Diagnostic

Remote Diagnostic facility with necessary hardware as required shall be provided for communication between the AMI application system at control center and the Contractor's & WESCO's support office for the diagnosis of hardware & software problems. The login shall be protected by a user name & password entry. An automatic intimation shall be provided to inform authorized person from utility on such events of remote access and diagnosis.

7.1.6   Development System as a Test Bench

A Development system independent of production environment shall be defined which shall provide testing facility for integration of changes/modifications of AMI application and new field devices before putting it online with Real-time system. This Development system shall be on LAN separated from the production LAN and shall be self-sufficient to carryout testing of changes/ modifications.

7.2   Network Software

The network software system shall include software for network communication, network security, security management, patch management and network services. Network software shall include the user node software that provides the connection of that node to the network. The network node software shall be provided for each type of network node connection supplied with the initial system and shall be licensed for the quantities and types of nodes defined in the system configuration. Network software shall have scalability feature as envisaged.

7.2.1   Network Communication

Users and various applications shall be able to communicate within local area network and operate as described in this Specification. The network communications software shall use a standard network protocol such as TCP/IP, UDP etc. and shall support both IPv4 and IPv6. The software shall link dissimilar hardware nodes such as local and remote workstations, servers and peripheral devices into common data communication network allowing communications among these devices.

7.2.2   Network Services

The following network services shall be provided for the users within the LAN:
   a. Network file management and transfer of files containing text, data, and graphics information
   b. Network printing management
   c. Network time synchronization
   d. Backup over LAN (Storage Area Network)
   e. Task-to-task communications to external computers
   f. LAN global naming facilities
   g. Remote procedure call
   h. Remote terminal session

7.2.3   Network Management System (NMS)

The proposed network management system shall facilitate following activities:
   a. Security Management to protect systems and network from unauthorized access, manage user access, authorizing rights and privileges.
   b. Viewing of all network elements deployed and administer configuration changes of the network devices and nodes through toolkits to automate the following tasks :
      i. Capture running configuration, Capture startup configuration, Upload configuration
      ii. Compare configuration
      iii. Real-time or scheduled capture of device configurations

iv. Store historical device configurations captured and enable comparison of current device configuration against a previously captured configuration

c. Security patch management shall be encrypted and signed.

d. Inventory Management to collect information about computers in the system such as processors, memory, peripherals and processes running on computers.

e. Performance Management to monitor system and network performance as specified.

f. Fault Management to recognize, isolate, log and identify fault on network and connected machines, nodes, devices.

The network management software shall be based on the latest secured version of Simple Network Management Protocol ver. 3.0 (SNMPv3). The NMS system shall have a simple browser based user interface to provide all the pertinent information about the system. The NMS shall not impact the availability and performance of AMI applications and shall load not more than 3% of any host CPU, 1% of network bandwidth and shall have secure communication.

The network management system shall monitor the performance, resource usages and error statistics of all the servers, workstations, routers and LAN devices including for proposed Utility networks extension (up to 25 number of nodes) including the following:-

a. Utilization (CPU and/or channel time being used as applicable) for
   i. Servers, Workstations, Storage Devices (SAN, HDD etc.)
   ii. LAN, Firewalls(internal & External), Router, Switches
   iii. Data Links

b. Memory utilization, auxiliary memory I/O utilization, of
   i. Servers and Other Machines
   ii. Mass Storage Devices

c. Bandwidth utilization for Routers/Switches
   i. Various interface statistics shall be connected from network devices to measure the performance level

The Network Management Software shall have following functionality:

a. It shall maintain performance, resource usage & error statistics and present this information via displays, periodic reports and on-demand reports.

b. Apart from real-time monitoring of critical network devices, the above information shall be collected and stored at user configurable periodicities i.e. 5 minutes to 60 minutes. The Network Management System (NMS) shall be capable of storing the above data for a period of one (1) year at an interval of 5 minutes.

c. It shall maintain a graphical display for connectivity and status of servers and peripheral devices in local area network. The monitored devices shall be configured to send SNMP notifications, and the graphical element representing the device shall change to a different colour depending on the severity of the notification received.

d. It shall issue alarms when error conditions or resource usage problems occur.

e. The period over which the statistics are gathered shall be adjustable by the user and the accumulated statistics shall be reset at the start of each period.

f. The statistics shall be available for printout and display after each period and on demand during the period.

g. In case more than one technology of AMI (example PLC and RF between Smart Meter & DCU) deployed in the field. It shall maintain statistics on the performance and availability of data being delivered per AMI technology.

7.2.4 System Protection & Security

Identity and access management system should be installed to control and log the access control for all users. The access management system shall be role based. Independent security management system shall be established to protect system and network from unauthorized access, manage user access, authorizing rights and privileges.

As the computer system in control centre has access to external environment, the Contractor shall document and implement Cyber Security Policy/Plan in association with the PFCCL/ WESCO to secure the system. The overall policy and implementation shall account for:

a. Network partition and DMZ through use of firewall as required to maximize the security of AMI application system while facilitating access for data and information to all stake holders.
b. Implement trusted, un-trusted and DMZ with clear perimeter to safeguard the HES/MDM production environment and minimise direct hits from external domain access
c. Prevent unauthorized users from reading or writing data or files, executing programs or performing operations without appropriate privileges.
d. Document all user sign on procedure
e. Record all network traffic for detecting unauthorized activity, unusual activity and attempts to defeat system security (Contractor to propose and document what constitutes normal activity/traffic)
f. A user authentication scheme consisting of at least a user identification and password shall be required for the user to request a connection to any network node.
g. GUI to provide role-based access based on user identity and user role. Shall have following types of users:
    i. Administrator
    ii. Operator
    iii. Field staff
    iv. Viewer/Guest

7.3 Database

7.3.1 Initial Database Generation

The Contractor shall be responsible for the initial database generation using data available at control centre in association with the employer.

7.3.2 Management

The database manager shall locate order, retrieve, update, insert, and delete data; ensure database integrity; and provide backup and recovery of database files. The database manager shall generate and modify all AMI application data by interfacing with all database structures. In systems with a distributed database, the database manager shall have access to all portions of the database

wherever stored. The location of database items shall be transparent to the user performing database maintenance.

Execution of the database manager in any server of the system shall not interfere with the on-line functions of AMI applications including the normal updating of each server's real-time database. In a primary server, database editing shall be limited to viewing functions, database documentation functions and functions that change the contents but not the structure of the database. Editing the on-line database shall not affect the operation of the primary/backup configuration.

The database manager shall include the mechanisms, in both interactive and batch processing modes, to perform the following functions:
  a. Add, modify and delete database items and data sources such as data links, and local I/O.
  b. Add, modify and delete application program data
  c. Create a new database attribute or new database object
  d. Resize the entire database or a subset of the database
  e. Redefine the structure of any portion of the database.

The contractor shall require to provide whether they require or impose any particular hardware and database management techniques to achieve above functionality.

7.3.3   Tracking Changes

The database manager utility shall maintain Audit trail files for all changes made by all users (both online/off-line). The audit trails shall identify each change including date and time stamp for each change and identify the user making the change. An audit trail of last 10,000 edit operations shall be maintained.

7.3.4   Integration

The System should support exchange of data from utility's computerized billing & collection, consumer indexing and asset mapping systems residing at different servers.

7.4   Display Generation, Management and Integration (Display Management and Reporting)

The Contractor shall provide necessary software tools preferably browser based for the generation, management and Integration of AMI application displays.

Displays shall be generated and edited interactively using this display generation software delivered with the system. All displays, symbols, segments, and user interaction fields shall be maintained in libraries. The size of any library and the number of libraries shall not be constrained by software. The display generator shall support the creation, editing, and deletion of libraries, including copying of elements within a library and copying of similar elements across libraries. Execution of the display generator functions shall not interfere with the on-line AMI application functions.

Displays shall be generated in an interactive mode. The user shall be able to interactively:
  a. Develop display elements
  b. Link display elements to the database via symbolic point names
  c. Establish display element dynamics via database linkages

d. Define linkages to other displays and programs
e. Combine elements and linkages into display layers
f. Combine display layers into single displays.

All workstation features and all user interface features defined in this specification shall be supported by the display generator software.

The display generator shall support the addition, deletion and modification of segments, including the merging of one segment with another to create a new segment.

Displays shall not be limited by the size of the viewable area of the screen.

The displays shall be constructed from the display elements library. The display definition shall allow displays to be sized to meet the requirements of the AMI application for which they are used. The display generation software shall allow unbroken viewing of the display image being built as the user extends the size of the display beyond the screen size limits.

The display generator shall support the integration of new and edited displays into the active display library. During an edit session, the display generation software shall allow the user to store and recall a partial display. To protect against loss of display work when a server fails, the current work shall be automatically saved every five minutes (user adjustable) to an auxiliary memory file.

The display generator shall verify that the display is complete and error-free before integrating the display into the active display library. It shall not be necessary to regenerate any display following a complete or partial system or database generation unless the database points linked to the display have been modified or deleted.

The system shall generate reports for all the modules in user-defined formats. The system will have a graphical user interface with a capability for generating customized reports, apart from the regular ones mentioned above, as per the requirement of management and operations staff. Display of statistical data shall be presented additionally in graphical formats such as bar- graph/pie diagram etc. for convenience of analysis.

7.5 Software Utilities

Contractor shall supply all software utilities used to develop and maintain these software, whether or not specifically described by this Specification. The software utilities shall operate on-line (in background mode) without jeopardizing other application functions running concurrently. Utility software shall be accessible from workstations, processor terminals and servers.

7.5.1 Auxiliary Memory Backup Utility

Software utility, to take back-up of auxiliary memory files of server and workstation onto a user-selected archival device such as SAN, shall be installed. Backup shall be maintained for a period of 7 years. The backup utility shall allow for user selection of the files to be saved based on:
a. Server and workstation
b. File names (including directory and wildcard designations)
c. File creation or modification date and time
d. Whether or not the file was modified since the last backup.

Further a utility for taking image backup of auxiliary memory files of the Servers and workstations shall be provided. The utility shall allow restoration of the servers/workstation from this image backup without requiring any other software. An image backup of the built system of each of the Servers and workstations shall be provided on a user-selected archival device such as SAN, which shall be used to restore the system. Automatic full or incremental back up capability of selected systems at user defined intervals shall be provided. It should be possible to restore or recover any software/system at a selected time form backup.

7.5.2   On-Line Monitoring Diagnostics Utility

On-Line monitoring diagnostic programs shall be provided for verifying the availability of the backup equipment and for limited testing of devices without interfering with on-line operations of AMI application system or the failover capability of the devices.

Redundant communication line interface equipment shall be tested by periodically retrieving data over these lines & checking for the ability to communicate with the redundant channel for any errors.

Designated backup server(s) and associated auxiliary memories shall be automatically tested for proper operation to ensure they are ready if needed for a fail over contingency. Any failure to perform diagnostic functions correctly shall cause an alarm to be issued.

7.5.3   Data Exchange Utilities

Facility of data export and import between this system and external systems shall be provided through web services.

7.5.4   Other Utility Services

AMI Application management shall include the following utility services:
 a. Loading and storage of information from labelled portable media storage units as dictated by the requirements of this specification.
 b. Preparation of .pdf output for the displays/reports available in the AMI Application system. It should also be possible to export all the reports to any MS-Office format.
 c. Displays and Reports for Web server -The Contractor shall provide utilities for preparing displays and reports suitable for Web publishing. These utilities shall be used to generate, all required displays and reports from the system displays and reports, automatically (without requiring rebuilding).
 d. On line access to user & system manuals for all software products (e.g., Operating System and Relational Database Software) and AMI applications shall be provided with computer system
 e. Antivirus Software - All computers and firewalls shall be provided with the latest antivirus software as on date of supply. The antivirus software shall have the capability of having its virus definitions updated from time to time. The Contractor shall be responsible for the maintenance & update of the antivirus software during AMC period.
 f. Software Upgrade-The Contractor shall be responsible for the maintenance & update of the patches and signatures of operating system, applications (AMI Applications) system and Web based System up to AMC period.

g. Automated patch management and anti-virus tools shall be provided to expedite the distributions of patches and virus definitions to the system using an orchestration facility.

These tools should consider the possibility to use standardized configurations for IT resources.

7.6 Cyber Security

The following guidelines/strategies shall be taken care of by the Contractor for making the entire Control Centre immune to Cyber Attacks.

a. All the Hardware, OS and application software shall be hardened.
b. Application scanning and hardware scanning tools shall be provided to identify vulnerability & security threats.
c. Data shall be encrypted at system/device/technology level.
d. Network Zoning shall be implemented as per the proposed architecture. However, the Contractor may suggest other methods of network architecture without compromising the security of the System.
e. Internal user shall be allowed to access all adjacent zones. However they will not have access to remote network zone.
f. While procuring cyber security items testing must be done & system must be secure by design.
g. Residual information risk shall be calculated by contractor and same shall be submitted to WESCO for approval through a risk management procedure.
h. All default user id & passwords shall be changed.
i. All log in/out and cable plugs in/ out shall also be logged in Central Syslog server.
j. Penetration & Vulnerability assessment test from certified auditors during FAT, SAT & AMC.
k. Auditing by third party during FAT, SAT and annually during AMC period shall be in the scope of contractor.
l. As the computer system in control center has access to external environment the Contractor shall document and implement Cyber Security Policy/Plan, procedures and controls in association with WESCO to secure the system.
m. Latest Cyber Security Guidelines of CERT-In specified at http://www.cert-in.org.in / NCIIPC/ Ministry of Power or any other competent authority shall be followed.
n. All the Hardware, software & applications shall be obtained ISO 27001:2013 certification.
o. The contractor shall document all the assets and based on that shall provide authenticated Crisis Management Plan for the Control Center approved by WESCO.
p. Perform regular backups of all critical information. Backup data should be kept on a separate device, and backups should be stored offline or in the cloud.
q. Maintain up-to-date antivirus signatures and engines.
r. Application whitelisting/Strict implementation of Software Restriction Policies (SRP) to block binaries running from %APPDATA% and %TEMP% paths.
s. The contractor shall ensure the 7 layer of application security for Control Center.

8. Tests and Inspections

8.1 In-Process Inspection

8.1.1 Type Testing

Type Tests shall be defined as those tests which are to be carried out to prove the design, process of manufacture and general conformity of the materials to this Specification. Type Testing shall comply with the following:

The contractor shall submit, within scheduled period as per project plan, copies of test reports and certificates for all of the Type Tests that are specified in the specifications and that have previously been performed. These certificates may be accepted by WESCO only if they apply to materials and equipment that are essentially identical to those due to be delivered under the Contract and only if test procedures and parameter values are identical to those specified in this specifications carried out at nationally/Internationally accredited labs and witnessed by third party / customer's representatives.

Type Tests shall be performed for all equipment types for which certification is not provided as required above, or if it is determined by WESCO that the certification provided is not acceptable. If any of the type tests are required to be carried out, the same shall be carried out by the contractor. The contractor shall quote testing charges for each type test individually.

Type Tests shall be certified or performed by nationally/internationally reputed laboratories (i.e. NABL-accredited laboratory) using material and equipment data sheets and test procedures that have been approved by WESCO. The test procedures shall be formatted as in the specifications and shall include a complete list of the applicable reference standards and submitted for WESCO approval at least four (4) weeks before commencement of test(s). The contractor shall provide WESCO at least 30 days written notice of the planned commencement of each type test. At least 15 days before the scheduled date of supply, SGIA shall offer for inspection of each lot, 10 random samples for every 10000 numbers of meter to be selected for type testing.

The contractor shall provide a detailed schedule for performing all specified type tests. These tests shall be performed in the presence of a representative of WESCO.

Testing charges for all type tests listed in the specifications shall be indicated separately for each item (excluding expenses of Inspector/ WESCO's representative) in prescribed schedule of the bidding document. The total amount of these charges will be considered in the bid evaluation process.

The contractor shall ensure that all type tests can be completed within the time schedule offered in its Technical Proposal.

In case of failure during any type test, the contractor is either required to manufacture a fresh sample lot and repeat all type tests successfully or repeat that particular type tests at least three times successfully on the samples selected from the already manufactured lot at its own expenses. In case a fresh lot is manufactured for testing then the lot already manufactured shall be rejected.

Documentation for all factory, field, and availability tests that apply to WESCO system shall be provided in accordance with the requirements defined in this section of specification.

8.1.2   Quality Assurance and Quality Control Program

The contractor shall maintain a Quality Assurance/Quality Control (QA/QC) program that provides that equipment, materials and services under this specification whether manufactured, designed or performed within the contractor's plant, in the field, or at any sub-contractor's source shall be controlled at all points necessary to assure conformance to contractual requirements.

The Quality Plan shall be mutually discussed and approved by WESCO after incorporating necessary corrections by the contractor as may be required.

The program shall provide for prevention and ready detection of discrepancies and for timely and positive corrective action. The contractor shall make objective evidence of quality conformance readily available to WESCO.

Instructions and records for quality assurance shall be controlled and maintained at the system levels. The contractor shall describe its QA/QC program in the Technical Proposal, (along with samples from its QA/QC manual) and shall submit its QA/QC Manual for review and acceptance by WESCO.

Such QA/QC program shall be outlined by the contractor and shall be finally accepted by WESCO after discussions before the award of Contract. A Quality Assurance Program of the contractor shall cover but not be limited to the following:

a. The organization structure for the management and implementation of the proposed Quality Assurance Program.
b. Documentation control system.
c. Qualification data for key personnel.
d. The procedure for purchase of materials, parts/components and selection of Sub-contractor's services including vendor analysis, source inspection, incoming raw material inspection, verification of material purchases, etc.
e. System for shop manufacturing including process controls.
f. Control of non-conforming items and system for corrective action.
g. Control of calibration and testing of measuring and testing equipment.
h. Inspection and test procedure for manufacture.
i. System for indication and appraisal of inspection status.
j. System for quality audits.
k. System for authorizing release of manufactured product.
l. System for maintenance of records.
m. System for handling, storage and delivery.
n. A Quality Plan detailing out the specific quality control procedure adopted for controlling the quality characteristics of the product.

Neither the enforcement of QA/QC procedures nor the correction of work mandated by those procedures shall be cause for an excusable delay. An effective Quality Assurance and Quality Control organization shall be maintained by the contractor for at least the duration of this Contract.

The personnel performing QA/QC functions shall have well-defined responsibility, authority, and organizational freedom to identify and evaluate quality problems and to initiate, recommend, or provide solutions during all phases of the Contract.

The QA/QC organization of the contractor shall be an independent administrative and functional structure reporting via its manager to the contractor's top management. The QA/QC manager(s) shall have the authority within the delegated areas of responsibility to resolve all matters pertaining to quality to the satisfaction of WESCO when actual quality deviates from that stated in the Work Statement.

The contractor shall be required to submit all the Quality Assurance Documents as stipulated in the Quality Plan at the time of WESCO's inspection of equipment/materials.

8.1.3   Scope of Employer for QA/QC Program

WESCO or its duly authorized representative reserves the right to carry out Quality Audit and Quality Surveillance of the systems and procedures of the contractor's/his vendor's Quality Management and Control Activities.

The scope of the duties of WESCO, pursuant to the Contract, will include but not be limited to the following:
   a. Review of all the contractor's drawings, engineering data etc.
   b. Witness or authorize its representative to witness tests at the manufacturer's works or at site, or at any place where work is performed under the Contract.
   c. Inspect, accept or reject any equipment, material and work under the Contract in accordance with the specifications.
   d. Issue certificate of acceptance and/or progressive payment and final payment certificate
   e. Review and suggest modification and improvement in completion schedules from time to time; and
   f. Monitor the Quality Assurance program implementation at all stages of the works.

8.1.4   Inspection Certificate

The contractor shall give WESCO or their designated representatives two weeks in case of domestic supplies and six weeks in case of foreign supplies written notice of any material being ready for testing. Such tests shall be to the contractor's account except for the expenses of the Inspector.

WESCO or their designated representatives, unless witnessing of the tests is waived, will attend such tests on the scheduled date for which WESCO or their designated representatives has been so notified or on a mutually agreed alternative date. If WESCO or their designated representatives fails to attend the testing on the mutually agreed date, contractor may proceed with the test which shall be deemed to have been made in the Inspector's presence and contractor shall forthwith forward to the Inspector, duly certified copies of the test results in triplicate.

WESCO shall, within fourteen (14) days from the date of inspection as defined herein, give notice in writing to the contractor of any objection to any drawings and all or any equipment and workmanship which in its opinion is not in accordance with the Contract. The contractor shall give due consideration to such objections and shall make the modifications that may be necessary to meet said objections.

When the factory tests have been completed successfully at the contractor's or Sub-contractor's works, WESCO shall issue a certificate to this effect within fourteen (14) days after completion of tests but if the tests are not witnessed by WESCO or their designated representatives, the certificate shall be issued within fourteen (14) days of receipt of the contractor's Test Certificate by WESCO.

The completion of these tests or issue of the certificates shall not bind WESCO to accept the equipment should it, on further tests after erection, be found not to comply with the Contract.

In cases where the Contract provides for tests, whether at the premises or works of the contractor or of any Sub-contractor, the contractor except where otherwise specified shall provide free of charge items such as labour, materials, electricity, fuel, water stores, apparatus and instruments, as may be reasonably demanded by WESCO or its authorized representative to carry out effectively such tests of the equipment in accordance with the Contract and shall provide facilities to WESCO or its authorized representative to accomplish testing.

The inspection by WESCO and issue of Inspection Certificate thereon, shall in no way limit the liabilities and responsibilities of the contractor in respect of the agreed Quality Assurance Program forming a part of the Contract.

The contractor shall keep WESCO or their designated representatives informed in advance of the time of starting of the progress of manufacture of material in its various stages so that arrangements can be made for inspection.

Record of routine test reports shall be maintained by the contractor at its works for periodic inspection by WESCO's representative.

Certificates of manufacturing tests shall be maintained by the contractor and produced for verification as and when desired by WESCO or their designated representatives. No material shall be dispatched from its point of manufacture until it has been satisfactorily inspected and tested. Testing shall always be carried out while the inspection may be waived off by WESCO in writing only.

However, such inspection by WESCO's representative(s) shall not relieve the contractor from the responsibility for furnishing material, software, and equipment to conform to the requirements of the Contract; nor invalidate any claim which WESCO may make because of defective or unsatisfactory material, software or equipment.

8.1.5 Inspection and Test

All materials furnished and all work performed under this Specification shall be inspected and tested. Deliverables shall not be shipped until all required inspections and tests have been

completed, all deficiencies have been corrected to WESCO's satisfaction, and the equipment has been approved for shipment by WESCO.

Should any inspections or tests indicate that specific hardware, software or documentation does not meet the Specification requirements, the appropriate items shall be replaced, upgraded, or added by the contractor as necessary to correct the noted deficiencies. After correction of a deficiency, all necessary retests shall be performed to verify the effectiveness of the corrective action.

The test shall be considered complete when (a) all variances have been resolved (b) all test records have been submitted (c) WESCO acknowledges in writing successful completion of the test.

8.1.5.1 Inspection

Access to the contractor's facilities while manufacturing and testing are taking place, and to any facility where hardware/software is being produced for WESCO shall be available to WESCO representatives. The contractor shall provide to PFCCL/ WESCO representatives sufficient facilities, equipment, and documentation necessary to complete all inspections and to verify that the equipment is being fabricated and maintained in accordance with the Specification. Inspection rights shall apply to the contractor's facilities and to Sub contractor's facilities where equipment is being manufactured.

Inspections will be performed by WESCO or their designated representatives, which will include visual examination of hardware, enclosure cable dressings, and equipment and cable labeling. Contractor documentation will also be examined to verify that it adequately identifies and describes all wiring, hardware and spare parts. Access to inspect the contractor's hardware quality assurance standards, procedures, and records that are applicable to the facilities shall be provided to WESCO or their designated representatives.

WESCO representatives shall be allowed access to the contractor's facilities during system manufacturing and testing and to any facility where hardware or software is being produced.

WESCO representatives shall be allowed to inspect the contractor's hardware and software quality assurance standards, procedures, and records. Documents identified in the approved software quality assurance plan will be inspected to verify that the contractor has performed the required quality assurance activities.

The inspection rights described above shall not apply to sub vendors supplying standard computer hardware, peripheral equipment, and third-party software products. The inspection rights shall apply to sub vendors developing new software for inclusion in the AMI system and to sub-system suppliers.

8.1.5.2 Test Plans & Procedures

Test plans and test procedures shall be provided by the contractor, for all tests to ensure that each factory and field test is comprehensive and verifies all the features of the equipment are tested.

The contractor shall prepare detail testing procedure in line to specification and submit for WESCO's approval. The procedure shall be modular to the extent possible, which shall facilitate the completion of the testing in the least possible time.

During the development of test plans and test procedures for the system, emphasis shall be placed on testing each conditional logic statement, checking error conditions, and documenting the simulation techniques used. The test plans and test procedures shall be modular to allow individual test segments to be repeated as necessary. They shall be subject to WESCO approval.

8.1.5.2.1 Test Plans

The test plans shall describe the overall test process, including the responsibilities of individuals and the documentation of the test results. The following shall be included in the test plans:
   a. Test schedule on a day-by-day basis
   b. Responsibilities of contractor and WESCO personnel
   c. Record-keeping assignments, procedures, and forms
   d. Procedures for monitoring, correcting, and retesting variances
   e. Procedures for controlling and documenting all changes made to the hardware and software after the start of testing
   f. Block diagrams of the hardware test configuration, the external communication channels, and any test or simulation hardware.

8.1.5.2.2 Test Procedures

The test procedures shall describe the individual tests segments and the steps comprising each segment, particularly the methods and processes to be followed. The test procedures shall include the following items:
   a. Name of function to be tested
   b. References to the functional, design, user, and any other documents describing the function
   c. List of test segments to be performed and the purpose of each test segment
   d. Set-up conditions for each test segment, including descriptions of the test equipment
   e. Descriptions, listings, and instructions for test software tools and displays if any.
   f. Step-by-step descriptions of each test segment, including user actions for each test step
   g. Expected results for each test segment, including pass/fail criteria
   h. Descriptions of the techniques and scenarios to be used to simulate system field inputs and controlled equipment
   i. Copies of any certified test data to be used in lieu of testing.

8.1.5.2.3 Test Records

The complete record of all factory and field acceptance tests results shall be maintained by the contractor. The records shall be maintained in a logical form and shall contain all the relevant information. The test reports shall be signed by the testing engineer and the engineer witnessing the tests. The records shall be keyed to the test procedures. The following items shall be included in the test records:
   a. Reference to appropriate test procedure
   b. Date of test
   c. Description of any test conditions, input data, or user actions differing from that described in the test procedure

d. Test results for each test segment including a pass/fail indication
e. Identification of contractor's test engineer and WESCO's representative if any.
f. Provision for comments by WESCO's representative
g. Copies of any variance reports generated
h. Copies of reports, display copies, and any other hardcopy generated as part of the test.

8.1.5.2.4 Reporting of variances

Starting from the dry run test period, a variance report shall be prepared by contractor personnel each time a deviation from the requirements of this Specification is detected in areas such as system functions, design parameters, performance, documentation, test plans, and test procedures. All such variances shall be closed in mutually agreed manner.

However, at any stage if WESCO feels that quality of variances calls for suspension of the testing the testing shall be halted till satisfactory resolution of variances, which may involve retesting also.

The report shall include a complete description of the variance, including:
a. Sequential identifying number assigned to the variance
b. Date and time the variance was detected
c. Appropriate references to the test procedures and this Specification
d. Description of test conditions at the time the variance was detected
e. Identification of contractor and WESCO representatives
f. Estimated date and time when variance is expected to be fixed
g. Description of the corrective actions taken (to be completed as part of the variance resolution process
h. Dated signature lines for WESCO and contractor representatives to signify reporting and correction of the variance.

Each variance shall be assigned to one of three classes defining the action to be taken to resolve the variance:
a. Class 1: Testing will immediately stop and the contractor will evaluate and correct the variance before testing is resumed
b. Class 2: Testing will continue and the variance will be evaluated and corrected by the contractor at the end of the current session but prior to further testing
c. Class 3: Testing will continue and the variance will be evaluated and corrected at a mutually agreed upon time.

The class shall be assigned by the contractor with WESCO approval.

Variance reports shall be available to WESCO or their designated representatives for review and comment at all times and shall be submitted by the contractor to WESCO or their designated representatives at the start of the availability test. The contractor shall maintain and periodically distribute a variance summary that lists for each variance the report number, a brief description of the variance, its class, and its current status (open or resolved). A variance summary shall also be submitted with the progress report.

All actions taken to correct variances shall be documented on the variance report by the contractor. Sufficient information shall be provided to enable a WESCO representative to determine the need

for and extent of retesting, the need for testing interactions of the correction with any previously tested hardware or software, and the need for updating appropriate documentation. A variance shall be deemed resolved after retesting has been performed to the satisfaction of WESCO and the contractor and WESCO representatives have acknowledged correction of the variance on the variance report.

8.1.5.3   Test Initiation

The following conditions must be satisfied before starting any test

a. All test plans and procedures for the test shall be approved by WESCO.
b. All hardware and software engineering design change orders shall be incorporated into the system under test.
c. All relevant documentation including drawings, lists of deliverables, and software functional and design documents, and user manuals shall be approved by WESCO.
d. A complete regeneration of the software under test shall be performed immediately prior to the start of factory testing.
e. All operating system parameters, files, and configuration information shall be saved to archive media so that the AMI systems operating environment can be recreated starting with an un-initialized system. The existence and completeness of this data shall be demonstrated to WESCO or their designated representatives.
f. All database, display, and report definitions shall be saved to archive media so that the databases, displays, and reports can be recreated if necessary.
g. The image backup of all applications of AMI Systems shall be taken on the archive media so that AMI systems software can be regenerated if necessary.
h. A complete dry run of each factory test (excluding the integrated system test) shall be conducted by the contractor using the approved test plans and test procedures.
i. Written certification that the dry run has been successfully completed shall be provided to WESCO or their designated representatives at least one week prior to the start of each factory test. At WESCO option, WESCO representatives will witness and participate in the dry run of any test.

8.1.5.4   Test Completion

A test shall be deemed to be successfully completed only when:

a. All variances have been resolved to the satisfaction of WESCO
b. All test records have been transmitted to WESCO
c. WESCO acknowledges, in writing, successful completion of the test.

8.1.5.5   Test Suspension

Any time WESCO representatives believe that the quantity or severity of variances warrants suspension of any or all testing, the test shall be halted, remedial work shall be performed, and the complete test shall be repeated. The repeat of the test shall be scheduled for a date and time agreed upon by both the contractor and WESCO.

8.1.5.6   Factory Acceptance Test

The factory tests shall be conducted on all the equipment and shall include, but not be limited to the following, appropriate to the equipment being tested:

    a. Verification of all functional characteristics and requirements specified.
    b. Inspection and verification of all construction, wiring, labeling, documentation and completeness of the hardware

Arrangements shall be made to carry out the tests for pluggable NIC modules integrated into three different meter makes, including the make(s) of meter being supplied by the SGIA. The slot for plugging the NIC modules in the meter shall conform to this specification. The FAT shall be carried out on the meter and/or DCU integrated with the NIC modules. If any on-line communication failover has been agreed between WESCO and the SGIA, tests shall be carried out to check a seamless failover of communication. The three makes of meters shall be checked with NIC modules for all type of communication technologies selected for the project.

Before the start of factory testing, the contractor shall verify that all changes applicable to the equipment have been implemented. As a part of the factory tests, unstructured testing shall be performed to allow WESCO representatives to verify proper operation of the equipment under conditions not specifically tested in the above structured performance test. The contractor's test representative shall be present and the contractor's technical staff members shall be available for consultation with WESCO personnel during unstructured test periods. All special test facilities used during the structured performance test shall be made available for WESCO's use during unstructured testing.

Factory Test Requirements:

The database, displays and the report formats developed by the contractor shall be demonstrated and verified by WESCO or their designated representatives before factory testing.

All Field Device, AMI functions, communication & networking systems as well as performance shall be tested and demonstrated. WESCO or their designated representatives will participate in and witness these tests.

The contractor shall also carry out testing of the standard protocol implementation for successful integration by interfacing with existing Systems before the FAT starts. The database, displays and the report formats developed by the contractor for Central System shall be verified by WESCO or their designated representatives before factory testing.

All hardware and software associated with AMI Systems shall be staged and completely tested with simulated data at the contractor's facility.

The contractor is responsible for conducting all factory tests. WESCO or their designated representatives will witness all tests and will perform selected test procedures. Knowledgeable contractor personnel shall be present at all times to assist WESCO representatives with factory testing as needed. WESCO or their designated representatives will not accept un-witnessed test results of any hardware or software without previous written authorization.

Each of factory tests described below (i.e. the hardware integration test, the functional performance test, and the integrated system test, unstructured tests) shall be carried out under factory test.

8.1.6.1 Hardware Integration Test

The hardware integration test shall confirm that the computer hardware conforms to this Specification and the contractor-supplied hardware documentation. The hardware integration test shall be performed when the computer hardware has been installed in the contractor's factory. The operation of each item shall be verified as an integral part of the system. Applicable hardware diagnostics shall be used to verify that each hardware component is completely operational and assembled into a configuration capable of supporting software integration and factory testing of the system. Equipment expansion capability shall also be verified during the hardware integration test.

8.1.6.2 Functional Performance Test

The functional performance test shall completely verify all features of the AMI Systems hardware and software. As a minimum, the following items shall be included in the functional performance test:

a. Inspection of all equipment for conformance to drawings/document and satisfactory construction and appearance
b. Testing of the proper functioning of all software, including test cases with normal and exception user-entered inputs and responses
c. Simulation of local error and failure conditions
d. Verification that ultimate expansion requirements are met.
e. Verification of data link interfaces with other Central systems
f. Verification of Field Device communication interfaces and data link interfaces with other central systems.
g. Simulation of Field Device and data link communication errors and channel failures, including incorrect check codes and random channel noise bursts
h. Testing of all user interface functions, including random tests to verify correct database linkages
i. Simulation of hardware failures and input power failures to verify the reaction of the system to server and device failure
j. Demonstration of all features of the database, display, and report generators and all other software maintenance features
k. Demonstration of the software utilities, libraries, and development tools.
l. Verification that the computer system meets or exceeds WESCO's performance requirements
m. Verification of the accuracy of hardware and software documentation via random tests
n. Testing of spare parts

8.1.6.3 Integrated System Test

The integrated system test shall verify the stability of the system hardware and software after the functional performance test has been successfully completed. During the integrated system test, all functions shall run concurrently and all contractor-supplied equipment shall operate for a continuous 100-hour period. This minimum level of activity may be augmented, at the discretion of WESCO, by other activities that represent normal day-to-day operation of the system as long as these activities are conducted in accordance with the training and documentation provided with the system. These other activities may include, but shall not be limited to, database, display, and report modifications,

software development activities, configuration changes (including user-commanded server and device failovers), and the execution of any function described in this Specification.

The integrated system test shall assure WESCO that the computer system is free of improper interactions between software and hardware while the system is operating as an integrated unit. In case during the 100 hour period testing uncommanded functional restart or server or device fail occurs the test shall be extended by 24 hours each time such a fail over occurs. Further the test shall not be conducted with the failed device.

8.1.6.4 Unstructured Testing

Periods of unstructured testing shall be allocated to allow WESCO representatives to verify proper operation of the systems under conditions not specifically included in the approved test procedures. Unstructured testing shall be conducted in compliance with the following conditions:
   a. A minimum of 25 percent of the actual test period shall be reserved for unstructured test of the system by WESCO representatives
   b. The contractor's test representative shall be present and the contractor's other technical staff members shall be available for consultation with WESCO personnel during unstructured test periods
   c. All simulation software, test cases, and other test facilities used during the structured portions of the factory tests shall be made available for WESCO's use during unstructured testing
   d. Unstructured testing shall not begin prior to the start of the functional performance test
   e. Unstructured testing shall be allowed at WESCO's discretion both at the end of a structured test segment and after completion of the functional performance test.

The MICC for all hardware shall be issued only after successful completion of FAT as per specification. At least 10 Field Devices for each protocol shall be connected with each central system and the remaining Field devices shall be simulated in the factory test environment. The data exchange between central systems shall also be simulated in the factory test environment.

8.2   Field Installation and Integration Test

It is expected the deliveries to site will happen in lots of meters/DCUs etc. as per schedule of the FAT. The delivery of the production hardware for the data centre (that is servers, Work Stations, LAN/Routers, Firewall, etc.) shall happen with the delivery of the first lot of meters/DCUs. In this phase of testing, the delivered equipment per lot shall be inspected for integration with data centre hardware.

The field installation test shall provide verification that computer system is operationally equivalent to the system that successfully completed factory testing. The responsibility for conduct of field installation test shall rest with the contractor. WESCO or their designated representatives will witness all tests and will perform selected test procedures. Knowledgeable contractor representatives shall be present at all times to assist WESCO representatives with the testing.

The field installation test shall consist of the functional performance test to confirm operation of basic functions such as data acquisition, user interface, and the support and WESCO functions. All hardware shall be tested by running diagnostics. The exact content of the field installation test shall be determined jointly by the contractor and WESCO or their designated representatives.

8.3   Site Acceptance Test

SAT shall be carried out with Smart Meters/DCUs in lots as these are delivered and passes through the Field Installation and Integration tests. The first lot to be subjected to SAT shall consist of the complete cloud data centre and its hardware and software components along with supply, installation & integration of a minimum of 5% Smart Meters/ DCUs (along with its related hardware and software equipment). The SAT for remaining meter population shall be staged on monthly basis based on the total supply, installation and integration of Smart Meters (along with its related hardware and software equipment).

After all lots of equipment has been installed, the contractor shall start up and check the performance of the equipment of field locations. All hardware shall be aligned and adjusted, interfaces to all inputs and outputs installed, operation verified, and all test readings recorded in accordance with the contractor's recommended procedures. The field performance test shall exhibit generally all functions of the equipment and duplicate factory test. All variances must be corrected prior to the start of the field performance test. The list of final tests to be carried out in the field shall be listed in the site-testing document by the contractor.

8.4   Guaranteed Performance Test

Post installation, commissioning and integration of all AMI Hardware, Software, field material in project area and completion of site acceptance test, a 3 month guaranteed performance test shall be undertaken. A designated team/ person from WESCO will review the performance of AMI system after every 30 days against the SLAs defined in this document in section 4. Should AMI system fall short of meeting the defined SLAs, the contractor may continue the test by moving the starting time of the test forward and continuing the test until the consecutive 90 days AMI SLAs has been achieved.

8.5   Operational Acceptance

Contractor's obligations for Operational acceptance of system by WESCO shall be deemed to be met when the following milestones are achieved:

   a. Successful completion of Guaranteed Performance Tests
   b. Completion of training obligations as defined in this RFP
   c. Handing over of all training, engineering and software license documents
   d. Handing over of recommended spares for warranty period and
   e. Successful completion of system availability test

As part of the operation acceptance the AMI system has to undergo a 1000-hour system availability test. This shall be conducted on supplied systems under normal day-to-day operating conditions. The test shall verify the reliability and integrity of the Field devices, Central Systems, Communication & networking systems, database, displays, report and all communication interfaces.

8.5.1   Test Responsibilities

WESCO will be responsible for conducting the availability test. The test shall consist of normal AMI Systems operations without special test equipment or procedures.

Test records defined in the availability test plan and procedures will be maintained by WESCO personnel. WESCO will operate and maintain the system according to procedures described in the approved contractor documentation. WESCO shall also raise incident reports for every incident that is encountered and closed with response time, resolution time and hold times.

AMI systems maintenance on an on-call basis shall be provided by the contractor during the availability test period. When on-site maintenance support is needed, qualified contractor personnel shall arrive at the site within maximum four (4) hours of notification and shall keep WESCO fully informed of the progress in problem resolution. For availability purposes, this service response time and the associated on-site maintenance time shall be taken into account as defined in Sections of "Downtime" and "Hold time".

The contractor shall maintain an inventory of spare parts, which may be required to achieve the specified availability. These spares shall be in addition to the mandatory spares. All spare parts used during the availability test shall be drawn from contractor's inventory.

During the availability test period, WESCO reserves the right to modify the displays and reports. Such modifications will be described to the contractor at least 48 hours in advance of implementation to allow their impact on the availability test to be assessed, except where such changes are necessary to maintain control of the power system.

8.5.2 Downtime

Downtime occurs whenever the criteria for successful operation defined in Section 8.1.15 are not satisfied. Downtime shall be measured from the start of diagnostic procedures until full service is restored. In the event of multiple failures, the total elapsed time for repair of all problems (regardless of the number of maintenance personnel available) shall be counted as downtime. For onsite response the delay in response time (more than four hours) shall be added to downtime.

8.5.3 Hold time

During the availability test, certain contingencies may occur that are beyond the control of either WESCO or the contractor. These contingencies may prevent successful operation of the system, but are not necessarily valid for the purpose of measuring AMI systems availability. Such periods of unsuccessful operation may be declared "hold time" by mutual agreement of WESCO and the contractor. Specific instances of hold time contingencies are:

   a. **Scheduled Shutdown**: During scheduled shutdowns, or if an equipment failure occurs while its backup device is scheduled out-of-service, the resulting system outage shall be hold time, provided that service can be restored according to contractor-specified procedures within 30 minutes.
   b. **Power Interruption and Environmental Excursion**: Loss of power or manual shutdown in the event of loss of environmental control shall be considered hold time. If the system is operated during periods of power or environmental conditions beyond those specified, any resultant downtime shall also be considered hold time.
   c. **Intermittent Failure**: Periods during which an intermittent, recurring software or hardware failure is experienced will be considered hold time, provided that the contractor is engaged in remedial action and normal functions can be restored by contractor-defined procedures

whenever the failure occurs. Instead of accounting for the actual intermittent downtime, one hour of downtime shall be counted for each 120 hours of otherwise successful operation while the problem persists.

d. **Failure of WESCO's Software**: Time during which the system is down due to failure of software written and independently produced by WESCO shall be considered hold time. If a failure in such software cannot be overcome by contractor- defined procedures, execution of the failed program will be suspended. Programs developed by WESCO personnel under contractor supervision are specifically excluded from this provision.

e. **Service Response Time:** A maximum four (4) hours of hold time will be allowed for the contractor to respond to each call for maintenance support. The time between detection of a failure and the start of diagnostic procedures shall also be considered hold time when performed by WESCO's personnel.

f. **Corrected Design Defect**: Hold time may be declared by mutual agreement to ensure against similar future occurrences if a failure occurs due to a defect in system design for which the contractor defines and implements corrective measures. In such a case, hold time shall be allowed in increments of 120 hours to allow verification of the corrective action.

8.5.4 Test Duration and Criteria for Acceptance

After the elapse of 1000 hours of cumulative test time, the availability shall be calculated. Should availability falls short of specified percentage, the contractor may either (a) Continue the test by moving the starting time of the test forward and continuing the test until the consecutive hours have been accumulated and the specified availability has been achieved subject to maximum of 75 days, Or (b) the contractor may restart the test for 1000 hours, however, more than two such restarts shall not be allowed.

To establish that all failures have been satisfactorily repaired prior to the end of the availability test, no downtime, intermittent (hold time) failures, or more than one uncommanded fail over shall have occurred within 240 hours of the test's conclusion.

Criteria for successful operation

The AMI system shall be designed to meet the system availability as the SLA

The total operational time shall not include the hold time. The system shall be considered available as long as all the requirements defined under section-3 are available.

The successful completion of the availability test and completion of milestones as stated above will lead to Operational Acceptance of the system. WESCO shall issue the acceptance certificate within 30 days of notice served by the contractor.

9. Maintenance

9.1   General

The scope of work under maintenance & support services shall include a comprehensive maintenance of all the software (including licensing and annual technical support cost) and hardware along with field devices provided by the contractor under this project. The contractor shall also provide future integration and support services for meeting the future expansion requirement envisaged under this project. The maintenance practices to be followed shall be as per ISO 20000 Standard. The essence of the maintenance and support services is to provide maintenance support for the designated hardware, software and field devices, with the goal of meeting the availability as set forth herein. The contractor is to hand hold the WESCO's team to take over maintenance and support services after completion of contractor's FMS period. The project/ system devices should allow their functionalities to be upgraded without disruption to the existing functionalities by downloading new software and configuration information.

9.2   Contractor's Maintenance Responsibility

During entire contract period, contractor shall make available resident Project Manager, hardware & software specialists, who shall be available upon notification by WESCO about any problem(s) that may exist. The contractor's specialists shall be required to respond to WESCO notification in line with provisions of Technical Specifications. The contractor shall replace or repair all defective parts and shall have prime responsibility for keeping the system operational.

9.3   Maintenance Support

Period of maintenance support shall be eight (8) years from Operational Acceptance by WESCO. The period of maintenance support shall include five (5) years Warranty (Defect Liability) period commencing from Operational Acceptance and eight (8) years thereafter. During above period, commencing from Site Acceptance, support for operation of entire system is under scope of contractor.

System availability requirements during the maintenance period shall be as per the SLA.

For all third party equipment (Hardware & Software) Contractor shall have back to back support along with supply of spare with appropriate response time from OEM/OEM Authorized representatives. Contractor shall be responsible for coordination with the OEM for all matter related to that equipment. But the Contractor shall be responsible for meeting the overall response times and availability requirements specified in the Specification.

The maintenance of the System shall be comprehensive and shall comprise of the following category of works which is further elaborated for each of the different subsystems:
  a. Preventive Maintenance Activity (performance monitoring, system backup, hardware & software maintenance and update, field & network devices firmware update, emergency response and troubleshooting etc.)
  b. Integration of new devices (Meters/nodes, networking devices, NIC, integration with existing system etc.)
  c. Maintaining adequate spares for maintenance.

9.4 Preventative Maintenance Activity

The preventive maintenance activities shall be performed by the Contractor to keep the system running at optimum level by diagnosis and rectification of all hardware and software failures and would broadly include:

a. Repair / replacement of defective equipment: The Contractor shall be responsible for repair/replacement of all the hardware including consumables required for the various systems. Only replacement of printer cartridge and paper rim shall be excluded from the scope of the Contractor.

b. Configuration of the replaced hardware and software, periodic routine checking as part of a preventive maintenance program (as described in further detail in this document) which would include checking of functionality of hardware and software,

c. Monitoring of the performance of the system and doing necessary tuning for optimum performance to accommodate any changes such as addition of new components.

d. Providing all necessary assistance to WESCO for addition and modification of database and user interface & consumer portal displays and Database sizing activities.

e. Take Backup of the system at regular interval

f. Restoration of the systems upon its failure and to restore the functioning of the various systems at the Control Centre.

Routine works like database works, and other such day-to-day operational activity would primarily be the responsibility of WESCO and in case of any difficulty in this regard the same shall be referred to the contractor for support.

9.4.1 Hours of Cover

The Contractor shall provide at least one engineer at Rourkela who has an experience and skill to maintain the system to the desired level of availability. The contractor's on-site support for Control Centre shall be on all days from 9:00 am to 5:30 pm local time (IST), excluding public and Utility Company holidays, throughout the contract period. At least one Engineer having expertise in relevant field shall be available on all days at Control Centre. The timings for Emergency Support would be 24 hours a day, 7 days a week throughout the year.

The support personnel so deployed shall be qualified personnel having at least one year of experience in the relevant field. The contractor shall submit the CVs and recommendation letter from customer's for all support personnel(s) to WESCO for approval before deployment at site. WESCO can ask the Contractor to replace the personnel deployed for FMS if its performance is not found to be satisfactory.

9.4.2 Service Response Requirements

The severity levels are defined in coming sections and the requirement of response time for various severity levels is defined below:

Emergency Support for Severity 1 issues are to be provided 24 hours a day, seven days a week. The on-call support team shall include all key technical competencies so that any aspect of a system failure can be attended. Severity 1 problems shall be reported by telephone for rapid

response; target response times are defined in section below for severity 1 problems, the key objective is to restore the system to an operational state as quickly as possible, including by a temporary workaround. Resolution of the defect may be completed during standard hours.

Severity 2, 3, and 4 problems shall be reported by WESCO through a call tracking system to be provided by the contractor. Resolution of problems may also be provided by an individual fix that will be installed by the contractor at no extra cost to Owner.

9.5   Monitoring

The operation and performance of the various systems under AMC shall be monitored on a fortnightly basis, the contractor shall review the following, analyse the results and submit report to Employer. The contractor shall conduct at least the following monitoring at control centre:

9.5.1   Log Monitoring

   a. System logs for a selected day
   b. System history log
   c. Aggregate data collection
   d. Field & Network Device failure
   e. Events collection
   f. Availability of communication link

During monitoring if any defect/ abnormality are found, the contractor shall undertake corrective maintenance for the same. All coordination for failure & poor performance of ISP/ GPRS service provider shall be the responsibility of contractor during AMC period.

9.5.2   Resource Monitoring

Resource Monitoring services comprise checking the system's major node resources, gather log data, analyze results, and advise WESCO on the appropriate actions to be taken and undertake any agreed upon actions. The NMS system shall be able to continuously collect the following information:
   a. CPU loading (Peak and Average)
   b. Memory utilization (Peak and Average)
   c. Disk utilization (Peak and Average)
   d. LAN utilization (Peak and Average)
   e. Operating system resource utilization reports
   f. System error log

The bidder shall submit the procedures details to meet the above along with the offer.

9.5.3   Cyber Security System Monitoring

The Contractor shall also be responsible for monitoring of the cyber security system. The logs of the system shall be analyzed for exceptions and the possible incident of intrusion/trespass shall be informed to WESCO. The monitoring shall encompass the various cyber security devices installed at Control Centre and Substations such as firewalls, Intrusion prevention system (both network

based and host based), routers etc. The Centralized Monitoring Console (CMC) shall monitor and continuously collect the above logs.

The Cyber security system shall also be subjected to Annual Security Audit from CERT-In listed auditors at the cost of the Contractor during AMC period. Contractor shall implement the recommendations/remedial actions suggested by the Auditor after audit.

9.6 Patch Management

The contractor shall also be responsible for providing updates/patches for the software products supplied under the project. All other patches of third party product like Operating System and Anti-virus shall be tested by the Contractor prior to installing in the Utility's network. Other products like Firewalls shall also be provided with secure patch management. A secure patch management and deployment system is to be established which shall be provided with single point of Internet connectivity. All the patches shall be downloaded through this single point of connection. Internet connection shall be provided by utility.

The Contractor shall provide a mechanism for patch management so that it is known that what patches have been applied, what all patches are pending but available with us and what is the recent release of patches for the various products. Any patch shall be applied only with express permission of the utility's representative.

9.7 Physical Maintenance

The contractor shall undertake physical maintenance of all equipment/modules under scope of this contract, in accordance with this section once in 3 months. The physical maintenance shall include cleaning, dusting, inspection of equipment for loose connections, damage to insulation, pest infections etc.

Equipment shutdown during preventive maintenance shall be deemed as available.

9.8 Spares inventory

The Contractor shall maintain a sufficient spares inventory at its own cost to meet the spare availability requirements of the system. The spares shall be used as and when required and no separate charges are payable except the maintenance charges.

9.9 Integration of Equipment

All future services, protocol emulations & configuration support for integration of smart meters/ nodes, routers, access points, network devices, web services, integration with other offline applications etc. shall be responsibility of contractor and shall be part of the maintenance charges.

9.10   Problem/Defect Reporting

The bidder shall submit an appropriate problem/ defect reporting procedure to meet the requirement of all severity levels to get the approval of the same from WESCO. The problems will be categorized as defined in Table below.

Category	Definition
Severity 1 – Urgent	Complete system failure, severe system instability, loss or failure of any major subsystem or system component such as to cause a significant adverse impact to system availability, performance, or operational capability (as described at 11.9.1-Severity-1)
Severity 2 – Serious	Degradation of services or critical functions such as to negatively impact system operation. Failure of any redundant system component such that the normal redundancy is lost (as described at 11.9.2-Severity-2) Non-availability of Man-power at Control Centre during working hours, non-availability of spares
Severity 3 – Minor	Any other system defect, failure, or unexpected operation (as described at 11.9.3-Serverity-3)
Severity 4 – General/Technical Help	Request for information, technical configuration assistance, "how to" guidance, and enhancement requests. (As described at 11.9.4-Severity-4)

9.11   Severity Levels

The detail of the systems under different severity levels is as below:

9.11.1 Severity-1(Urgent Support)

This support is required when there is a complete system failure, severe system instability, the loss/ failure of any major sub-system / system or its components, which may significantly impact the system availability, performance, or operational capability at Control centre. Following outages/disruptions will be considered under Serverity-1:

   a. Loss of data due to any problem in software /hardware.
   b. Loss of data due to any problem in communication network
   c. Outages of any application software.
   d. Cyber Security issues.
   e. Outage of both Routers and LAN Switches.
   f. Loss of data exchange with other computer systems of utility.

The failure of field devices shall be considered as Severity-1 level, however a maximum time of Organization and travelling time of 4/6 working hrs shall be provided to rectify field defects.

Upon receiving intimation, the representative of the contractor would immediately attend to the problem and restore all functionalities at the earliest.

9.11.2 Severity-2

The support services not defined under Severity-1 are included under this category. Coverage under this severity would be outages that do not immediately cause on line data loss but

subsequently could result into Severity-1 category outage, loss of an important subsystem that may affect the day-to-day works and loss of archived data.

    a. Failure of Storage System, stoppage of data collections for archiving and outage of other applications not covered under severity-1 are included in this category.

    b. Failure of any redundant system component affecting the critical redundancy like loss of any one Application Processor, Router.

    c. Non-availability of designated contractor's Man-power at control centre as well as required inventory of spares specified here.

    d. Failure of one UPS system, Failure of Battery System and failure of any other system of Auxiliary

    e. Power supply not covered under Severity-1 are included in this category.

9.11.3 Severity-3 (Standard Support)

The support services included under this category are when the outage or loss of functionality is neither of an emergency nor priority functionalities as indicated in severity level 1 or 2 above. Problems like database reworking, failure of any one workstation, printers etc. would be covered under this category.

9.11.4 Severity-4 (General Technical Help)

Request for information, technical configuration assistance, "how to" guidance, and enhancement requests are included under this category.

9.12 Response & Resolution Time

This section describes target times within which contractor should respond to support requests for each category of severity. The initial response time is defined as the period from initial receipt of the support request (through approved communications channels) and acknowledgment of the contractor subject to maximum time defined in Table below. The Action Resolution Time is the period from the acknowledgement of support request to the contractor delivering a solution subject to the Maximum time defined in Table below. This period includes investigation time and consideration of alternative courses of action to remedy the situation. The Action is defined as a direct solution or a workaround.

Except for Severity Level 1 all response/resolution times (hours and days) specified below are working hours only.

Severity	Initial Response Time (Working Hours)	Initial Response Time (Non-Working Hours)	Action Resolution Time	Action
1	5 minutes	30 minutes	2 hours	An urgent or emergency situation requiring continuous attention from necessary support staff until system operation is restored – may be by workaround.
2	5 minutes	2 Hours	24 Hours	Attempt to find a solution

Severity	Initial Response Time (Working Hours)	Initial Response Time (Non-Working Hours)	Action Resolution Time	Action
				acceptable to WESCO (dependent on reproducibility), as quickly as practical.
3	2 hours	1 day	2 days	Evaluation and action plan. Resolution time is dependent on reproducibility, ability to gather data, and WESCO's prioritization. Resolution may be by workaround.
4	2 hours	1 day	2 days	Report on the problem/query is to be furnished.

9.13 Availability and FMS Charges

The contractor shall provide guaranteed availability for various types of Systems as specified in Table below. Availability calculation methodology for Control centre hardware / software and data availability of field devices at control centre shall be as below:

9.13.1 Availability of System

The non-availability hours for availability calculation shall be counted from the end of the allowed Action Resolution time. A standardized preferably web based online ticket register shall be maintained at site containing full details of each outages, actions taken by WESCO to correct the problem, applicable Severity level, time of reporting to the contractor support engineer/support, allowed Response time as per the Response times defined in above section, actual Resolution time, and review of Engineer-in-charge as well as the contractor's support engineer of the site.

In the event of multiple failures at a site, due to a common cause, the first FPR (Field Problem, Report) logged shall be used for the purpose of availability calculation. However, simultaneous multiple outages due to unrelated cause would be counted separately.

Availability computation shall be done on per quarter yearly basis per site. The formula to be used for availability computation shall be as under:

Availability per quarter (per site) = $\frac{\text{THQ- (S1 x 1+S2 x0.8+S3 x 0.5)}}{\text{THQ}}$ x 100%

    a. Where THQ is total hours in the quarter
    b. S1 is the total non-available hours in Severity Level-1
    c. S2 is the total non-available hours in Severity Level-2
    d. S3 is the total non-available hours in Severity Level -3

9.13.2 Payment of FMS Charges

In the event of availability below a certain level, the FMS charges would be proportionately reduced as follows:

Availability of AMI System per Month	% Deduction
> 97%	NIL
Less than 97%	Penalty will be 1% of the FMS component of the Meter Rent per month for every 1% or part there of decrease in availability under 97%). Penalty will be calculated separately for Hardware and Software Availability. The maximum deduction shall be limited to FMS component of the Meter Rent per month paid for that particular period.

The computation of Availability / Non-availability would be rounded up to 2 decimal on quarterly basis and any deduction in the FMS charges thereof would be calculated on pro-rata basis.

For Data Performance:
The following data read performance should be met by the contractor during the FMS period. If the desired performance requirements are not met, the FMS charges would be proportionately reduced as described below.

Data Type	Performance Requirement
1. Scheduled daily meter readings (as per IS 16444/15959)	
Daily collection of the previous day's interval energy data and total accumulated energy	From 95% of meters within 8 hours after midnight; and
	From 99.5% of meters within 24 hours after midnight. Average availability for the month will be computed
Penalty will be 1% of the FMS component of the Meter Rent per month for every 1% or part there of decrease in availability under 99.5%). Penalty will be calculated separately for Hardware and Software Availability. The maximum deduction shall be limited to FMS component of the Meter Rent paid for that particular period.	

9.14   Contractor's Obligations and Responsibility

The contractor shall guarantee continuous availability of the system as indicated in section 9.12. In order to optimize and improve the response of the system, the contractor may re- install the program modules after making the WESCO engineer aware of the consequence (like data loss, database rebuild etc.).

Any modification of software/operating system required to restore functionality due to hardware upgrades/replacement, patches, or arising out of a necessity to fix FPRs (Field problem reports), would be done by the contractor at no extra cost to Employer.

The contractor will submit FSR (Field Service Report) and the steps taken to solve the problem, along with details of code changes.
Assistance in periodic bill generation as per requirement of Utility.

9.15   Responsibilities of WESCO

The responsibilities of WESCO during the maintenance period are as follows:

a) WESCO shall ensure that proper environmental conditions are maintained for the system.

b) WESCO shall ensure that system is kept and operated in a proper and prudent manner as described in the system documentation provided by the Contractor and only trained WESCO representatives (or persons under their supervision) are allowed to operate the system.

c) WESCO shall provide access to the sites of installation for purposes of providing Support Services.

d) WESCO shall provide the contractor with Space for storage for spares.

9.16   Responsibility Matrix

The table in this section provides a summary definition of the roles and responsibilities of the contractor and WESCO.

Legend:
- This indicates who has primary responsibility to perform this function.
- A This indicates who will provide assistance.
- F Feedback

Item	Task	WESCO	Contractor
1.0	PROBLEM IDENTIFICATION		
1.1	Root cause analysis to determine whether the fault is attributable to Hardware or Software.	F	•
1.2	Resolution of problems involving third party maintainer where there is uncertainty whether the root cause is hardware or software.	----	•
2.0	SOFTWARE PROBLEM RESOLUTION		
2.1	Report problem and assist with problem identification	----	•
2.2	Provide or recommend corrections, temporary patches, workarounds or other fixes to system problems	----	•
2.3	Install and test corrections, temporary patches, workarounds or other fixes to system problems	----	•
3.0	ROUTINE SOFTWARE SUPPORT		
3.1	Build and maintain database, displays and reports	F	•
3.2	Perform system back-ups	----	•
3.3	Restore or reinstall software from back-ups	----	•
3.4	Monitor system logs (part of remote monitoring service)	----	•
3.5	Maintain system logs	----	•
3.6	Maintain user accounts	•	A
4.0	HARDWARE PROBLEM RESOLUTION		
4.1	Report problem and assist with defining problem	•	A
4.2	Troubleshoot problem to diagnose if it is software- related or		

Item	Task	WESCO	Contractor
	hardware-related	----	●
4.3	Identify failed component, Replace failed components in the system using parts from spares inventory	----	●
4.4	Restore operation of repaired/replaced equipment	----	●
5.0	HARDWARE SPARE PARTS		
5.1	Manage local spares inventory	----	●
5.2	Replenish local spares inventory	----	●
6.0	INTEGRATION AND DATABASE WORK AT CONTROL CENTRE END		
6.1	Field Device Integration	----	●
6.2	Other System Integration	----	●
7.0	CYBER SECURITY MONITORING		
7.1	Patch Updates	----	●
7.2	Cyber Security Monitoring	A	●
7.3	Annual Audits	----	●
7.4	Implementation of Recommendations during Audit	----	●
7.5	Maintenance of Spares		●
8.	Manual Meter Read through HHU in case of non-communication of Smart Meters	----	●

10. Project Management

10.1   Project Management

The Contractor shall assign a project manager with the authority to make commitments and decisions that are binding on the Contractor. WESCO will designate a Nodal officer to coordinate all project activities. All communications between WESCO and the Contractor shall be coordinated through the project managers/ nodal officer. The project managers shall also be responsible for all communications between other members of the project staffs including sub- contractor, if any.

10.2   Project Schedule

The bidder shall submit a preliminary project implementation schedule along with the bid. The detail project implementation schedule shall be submitted by the Contractor after award for WESCO's approval, which shall include at least the following activities:
  a.   Site Survey
  b.   Documents, Data Requirement Sheet, Drawing submission and approval
  c.   Type Testing Schedule
  d.   Hardware purchases, development/manufacturing and integration
  e.   Dispatch Schedule
   f.   Receipt, Storage, Installation & Field update schedule
  g.   Factory & Site Testing Schedule
  h.   Training schedule
   i.   Field trial run schedule

The project implementation schedule shall include the estimated period for completion and its linkage with other activities. The Project implementation schedule shall also contain WESCO activities as required by the Contractor to complete the project.

10.3   Progress Report

A progress report shall be prepared by the Contractor for each month against the activities listed in the project schedule. The report shall be made available to PFCCL/ WESCO on a monthly basis, e.g., the 10th day of each month. The progress report shall include all the completed, ongoing and scheduled activities and transmittals issued and received for the month.

10.4   Transmittals

Every document, letter, progress report, change order, and any other written transmissions exchanged between the Contractor and WESCO shall be assigned a unique transmittal number. The Contractor shall maintain a correspondence index and assign transmittal numbers consecutively for all Contractor documents. WESCO will maintain a similar correspondence numbering scheme identifying documents and correspondence that WESCO initiates.

10.5   Review Meeting

Progress meetings shall be scheduled by WESCO and attended by the Contractor each reporting period to review progress of project. Progress meetings shall be used to review the progress report, written correspondence exchanged since the last meeting, and open action items.

Contractor shall also attend technical meetings as and when required by WESCO to discuss technical aspects of the project and to review WESCO comments on documents. When appropriate, these technical meetings shall be conducted as extensions to the progress meetings.

10.6   Document Review and Approval Rights

To ensure that the proposed systems conform to the specific provisions and general intent of the Specification, the Contractor shall submit documentation describing the systems to WESCO for review and approval.

WESCO will respond with written comments to the Contractor within thirty (30) calendar days after receipt of the documents. Documents requiring correction must be resubmitted by the Contractor to WESCO within thirty (30) calendar days. WESCO will respond to resubmitted documents within thirty (30) calendar days after receipt of the document. No implementation schedule relief is to be implied for documents requiring correction and resubmission to WESCO.

WESCO shall have right to require the Contractor to make any necessary documentation changes at no additional cost to WESCO to achieve conformance with the Specification.

Any purchasing, manufacturing, or programming implementation initiated prior to written WESCO approval of relevant documents or drawings shall be performed at Contractor risk. Review and approval by WESCO shall not relieve the Contractor of its overall responsibilities to satisfy system functions and performance requirements in accordance with the Specification.

To help WESCO manage review and approval of documents during any given period, Contractor shall stagger release of documents over the time allocated in the project schedule. The number and size of documents shall be factored into the document release schedule. At any time, no more than five (5) documents shall be submitted to the WESCO for review and approval.

11. Document Requirements

11.1 General

To ensure that the proposed systems conform to the specific provisions and general intent of the Specification, the Contractor shall submit documentation to WESCO describing the systems for review and approval. Further the Contractor shall also submit the drawings / documents for all the hardware & software required for site installation, testing and commissioning and thereafter operation of the system. The Contractor shall obtain approval of WESCO for the relevant document at each stage before proceeding for purchase, manufacturing, system deployment, factory testing, erection, site testing, training etc.

11.2 Instructions

Documents shall have unique identification No. and every revision shall be mentioned. The Contractor shall submit three (3) hard copies of each document/ drawing for WESCO's review and approval along with soft copy with each submission. After approval two (2) sets of all the documents shall be submitted as final documentation. Any changes observed during field implementation shall be incorporated in the as-built drawing and two copies of same shall be submitted to WESCO on electronic media in pdf format.

The Contractor shall also supply two (2) sets of Technical User manuals/ guides/ O&M manuals/ manufacturers catalogues for all the hardware & software supplied under the contract. The user manual shall at minimum include the principle of operation, block diagrams, troubleshooting and diagnostic and maintenance procedures. Considering all the components of the system the following documents/drawings shall be required under the system.

11.3 Hardware Documentation Requirements

The following document shall be submitted as applicable for the subsystem.
  a. System description documents (Overview)
  b. Data requirement sheets for all items
  c. Functional description document
  d. Database documents
  e. Drawings/Documents for manufacturing/assembly of the equipment/system
  f. Drawings/Documents for installation of the equipment/system at site
  g. Installation Progress Document: Including documentation of date of installation, make and meter ID of existing replaced meter, meter ID of new meter, consumer account number, GPS coordinates, unmetered connection, existing meter status (OK, failed, meter tampering), line theft, etc. Where applicable contractor may, for recordkeeping, take photographs/ videos of installation site on approval from WESCO
  h. Software description/design documents for each module
  i. Factory test procedure and report
  j. Manuals for each equipment
  k. System configuration parameter
  l. Site testing procedure and report
  m. Training documents

n. System administrator documents
o. User guide
p. Software licenses
q. Type test reports
r. Cable sizing calculations
s. Inventory of the hardware
t. General & internal arrangement drawing of panels indicating modules, components location etc.
u. Installation drawing
v. Schematic drawing

11.4   Software Documentation Requirements

The documents to be submitted shall include the following information:

11.4.1 Software Inventory

An inventory of all software shall be maintained by the Contractor. The Contractor shall submit the following inventory lists: the preliminary inventory list at the time of the Functional Description document approval, an updated inventory list immediately prior to the start of the FAT, and the final inventory list at the time of system commissioning. The inventory shall include the name of each program, a cross reference to pertinent Contractor documents, language and libraries used, and an indication of whether the program is to be standard, modified, or custom.

11.4.2 Functional Description

Functional description documentation shall be provided for each function described in this specification. It shall include the following information for each function:
   a. Introduction describing the purpose of the function with references to other documentation to aid the reader's understanding of the functions performed.
   b. Performance requirements that describe the execution periodicity and the tuning parameters that control or limit the capabilities of the software.
   c. Complete description of the operation, data and logic interfaces with other functions.
   d. Sample displays where applicable.

11.4.3 Software Design

Software design documentation shall be provided for each function before the Factory Acceptance Test. It shall include detailed descriptions of the following items:
   a. The overall organization and architecture of the software logic such as a breakout of the software into software modules.
   b. Mathematical algorithms and formulae.
   c. Complete description of algorithms, operation and data and logic interfaces with other functions.
   d. Data dictionary in which following (as applicable) information for each data item in tables, file, and array is provided: (1) Name (2) Purpose, (3) Location, (4) Length of data item, and (5) Initialization.

e. Databases internal and external to the software, along with a description of all inputs required and the output produced by the software modules.

f. Interfaces with other software modules.

g. Design limitations such as field length and the maximum quantity of data items that can be processed.

11.4.4 Database Documentation

Database documentation shall describe the structure of the database. The documentation shall define the individual elements (files, records, fields, and tables) and their interrelationships. Portions of the database developed specifically for Owner's systems shall be identified.

Documentation shall also be provided that instructs the user in the preparation of data to be used for the databases, including:

a. The overall organization of input records

b. The format of each data record

c. Each data field and the valid entries pertaining to the fields.

Sufficient database documentation shall be provided to enable database to be updated or regenerated when inputs are changed & added, programs are modified, and new programs are added.

11.4.5 User Documentation

User documentation shall contain detailed operating instructions and procedures. Instructions and procedures shall be explained step-by-step with an explanation of how each step is performed, which parameters can be adjusted, and the effects obtained by varying each parameter. Additionally, the user documentation shall describe:

a. All user guidance and error messages, along with the steps necessary to recover from errors

b. The user interface including displays and keyboard operations used to control, review the input and output produced by the function. All displays relevant to the function shall be included along with a description of each dynamic display field.

c. Alarms & messages issued by the function and the conditions under which they are generated

d. Procedures to be followed for computer system restarts, failures, and failovers.

11.4.6 System Administration Documentation

System administration documentation shall be provided to guide WESCO personnel in the operation and procedures required to generate and update the systems, including system software, database, application software and other elements of the systems. System administration documents shall be provided for the following items:

a. Network communications management

b. Processor configuration

c. System performance monitoring

d. System restart/failover management and diagnostic procedures

e. System generation and management

f. Database generation and management

g. Display generation and management
h. Report generation and management
i. Diagnostic programs
j. Software utilities
k. Software maintenance
l. Application software parameters and tuning guides
m. Web administration
n. Other Contractor supplied system software not included above.

11.4.7 Test Documentation

Documentation for all factory, field and availability tests shall be provided.

11.4.8 Training Documentation

Training documentation shall be provided for all courses in accordance with the requirements.

12. Annexures

Annexure A   **Whole Current A.C. Single Phase Two Wire Smart Energy Meter Of Accuracy Class 1.0 (with/ without net-metering)**

A.1   General Standards Applicable for Meter

Unless otherwise specified elsewhere in this specification, the performance and testing of the meters shall conform to the following standards and amendments/revisions thereof.

S. No.	Standard No.	Title
1	IS 13779 with latest amendments	AC Static Watt-hour Meter class 1& 2
2	IS 16444 with latest amendments	A.C. Static Direct Connected Watt Hour Smart Meter Class 1 and 2- Specification
3	IS 15884 with latest amendments	Alternating Current Direct Connected Static Prepayment Meters for Active Energy (Class 1 and 2)- Specification
4	IS 15959 Part 1 & Part 2 with latest amendments	Data Exchange for Electricity Meter Reading, Tariff and Load Control- Companion Standards

A.2   Communication

Meter shall have ability to communicate with DCU/Access Point/HES on any one of the technologies mentioned in IS16444 in a secure manner, as per site conditions and as per design requirement of contractor. In case of GPRS/3G/4G based meter, meter shall accommodate SIM card of any service provider. In case of Plug in type communication module, meter shall log communication module removal /non responsive event with snapshot.

A.3   Other Specifications

Particulars	Specification
Applicable Standards	The meters shall comply with IS 16444 for all requirements. Those parameters which are not covered in IS 16444 have been specifically mentioned in this specification.
Reference Voltage	As per relevant IS
Current Rating	5-30A
Starting Current	As per IS 16444
Accuracy	Class 1.0 as per IS 16444
Limits of error	As per IS 16444
Operating Temperature range	As per IS 16444
Humidity	As per IS 16444

Particulars	Specification
Frequency	As per IS 16444
Influence Quantities	As per IS 16444
Power Consumption of meter	As per IS 16444
Current and Voltage Circuit	As per IS 16444
Running at No Load	As per IS 16444
Test output device	As per IS 16444
Meter Display	As per IS 16444
Name Plate & marking Meter Display	As per IS 16444
Parameters to be measured. In case of net-meter both export & import parameters to be measured	As per IS 16444 / As per IS 15959 Part-2
Maximum Demand resetting	As per IS 15959 Part 2
Time of Use registers	As per IS 15959 part 2
Power Quality Information	As per IS 15959 part 2
LED/LCD Indicators	As per IS 16444
Load Survey/Interval Data	As per IS 15959 part 2
Tamper/ Event Recording	As per IS 15959 part 2
Measuring Elements	As per IS 16444
Alarm	As per IS 16444/ 15959 Part 2
Load Control	As per IS 16444
Connect/Disconnect and status of load switch	As per IS 16444
Programmability	As per IS 16444
Communication	As per IS 16444.
Communication Protocol	As per IS 16444
Remote Firmware upgrade	As per IS 15959 part 2
Real Time Clock(RTC)	As per IS 16444/ IS 15884 The clock day/date setting and synchronization shall only be possible through password/Key code command from one of the following: • From remote server through suitable communication network. • Hand Held Unit (HHU) or Meter testing work bench and this shall need password enabling for meter; The methodology for the synchronization would be as per requirement of Utility
Data Retention	As per CEA regulations

Particulars	Specification
Battery Backup	Meter shall be supplied with separate battery backup for RTC.
Guarantee	Contractor shall undertake a guarantee to replace meter up to a period of 60 months from the date of supply. The meter which are found defective/inoperative within the guarantee period, these defective/inoperative meters shall be replaced within one month of receipt of report for such defective/inoperative meters
First Breath(power on) and Last gasp (power off) condition detection and communication to HES	As per IS 16444
Data Display Facility (Manual/ Automatic)	Data Display shall be in three modes- • Auto Scroll • Scroll with Push Button • High Resolution (Shall display energy values with resolution of 2 digits before decimal and 3 digits after decimal in push button mode) The display order shall be: Auto Scroll • Cumulative Active Energy kWh along with legend. • Current calendar month MD in kW with legend. • Instantaneous voltage • Instantaneous current These parameters should be displayed on the LCD/LED continuously for a period of 15 seconds on Auto scroll. In case of power failure, the meter should display above parameters with push button. Scroll with Push-button • Internal diagnostics • Cumulative kWh • Date • Real Time • Voltage in (V) • Current (I) • Power (kW) • Current month MD in kW • Last month cumulative kWh • Last month MD in kW • Last month MD occurrence Date • Last month MD occurrence Time • Meter Serial Number The meter's display should return to default display mode

Particulars	Specification
	(continues auto scroll) if push button is not operated for more than 10 seconds.
Anti-Tamper Features	The meter shall continue recording energy under any tamper condition and would log the event and send alarm at Head End System after detection of the defined theft features as per IS 15959 Part 2.

Optional test as per requirement of utility: The Meter shall be immune under external magnetic influences as per CBIP 325. Meter shall be tested for high voltage discharge (Spark) up to 35 KV as per CBIP 325. |

In case of any discrepancy or any issue related to interpretation of any technical aspects with respect to Smart Meters, the requirements as per relevant IS will prevail.

Annexure B   Whole Current A.C. Three Phase Four Wire Smart Energy Meter Of Accuracy Class 1.0 (with/ without net-metering)

B.1   General Standards Applicable for Meter

Unless otherwise specified elsewhere in this specification, the performance and testing of the meters shall conform to the following standards and amendments/revisions thereof.

S. No.	Standard No.	Title
1	IS 13779 with latest amendments	AC Static Watt-hour Meter class 1& 2
2	IS 16444 with latest amendments	A.C. Static Direct Connected Watt Hour Smart Meter Class 1 and 2- Specification
3	IS 15884 with latest amendments	Alternating Current Direct Connected Static Prepayment Meters for Active Energy (Class 1 and 2)- Specification
4	IS 15959 Part 1 & Part 2 with latest amendments	Data Exchange for Electricity Meter Reading, Tariff and Load Control- Companion Standards

B.2   Communication

Meter shall have ability to communicate with DCU/Access Point/HES on any one of the technologies mentioned in IS16444 in a secure manner, as per the site conditions and as per design requirement of the contractor. In case of GPRS/3G/4G based meter, the meter shall accommodate SIM card of any service provider. In case of Plug in type communication module, the meter shall log communication module removal /non responsive event with snapshot.

B.3   Other Specifications

Particulars	Specification
Applicable Standards	The meters shall comply with IS 16444 for all requirements. Those parameters which are not covered in IS 16444 have been specifically mentioned in this specification.
Reference Voltage	As per relevant IS
Current Rating	20-100 A
Starting Current	As per IS 16444
Accuracy	Class 1.0 as per IS 16444
Limits of error	As per IS 16444
Operating Temperature range	As per IS 16444
Humidity	As per IS 16444
Frequency	As per IS 16444
Influence Quantities	As per IS 16444
Power Consumption of meter	As per IS 16444

Particulars	Specification
Current and Voltage Circuit	As per IS 16444
Running at No Load	As per IS 16444
Test output device	As per IS 16444
Meter Display	As per IS 16444
Name Plate & marking Meter Display	As per IS 16444
Parameters to be measured In case of net-meter both export & import parameters to be measured	As per IS 16444 / As per IS 15959 Part-2
Maximum Demand resetting	As per IS 15959 Part 2
Time of Use registers	As per IS 15959 part 2
Power Quality Information	As per IS 15959 part 2
LED/LCD Indicators	As per IS 16444
Load Survey/Interval Data	As per IS 15959 part 2
Tamper/ Event Recording	As per IS 15959 part 2
Measuring Elements	As per IS 16444
Alarm	As per IS 16444/ 15959 Part 2
Load Control	As per IS 16444
Connect/Disconnect and status of load switch	As per IS 16444
Programmability	As per IS 16444
Communication	As per IS 16444.
Communication Protocol	As per IS 16444
Remote Firmware upgrade	As per IS 15959 part 2
Real Time Clock(RTC)	As per IS 16444/ IS 15884 The clock day/date setting and synchronization shall only be possible through password/Key code command from one of the following: • From remote server through suitable communication network. • Hand Held Unit (HHU) or Meter testing work bench and this shall need password enabling for meter; The methodology for the synchronization would be as per requirement of utility
Data Retention	As per CEA regulations
Battery Backup	Meter shall be supplied with separate battery backup for RTC.
Guarantee	Contractor shall undertake a guarantee to replace meter up to a period of 60 months from the date of supply. The meter which are found defective/inoperative within the guarantee period,

Particulars	Specification
	these defective/inoperative meters shall be replaced within one month of receipt of report for such defective/inoperative meters
First Breath(power on) and Last gasp (power off) condition detection and communication to HES	As per IS 16444
Data Display Facility (Manual/ Automatic)	Data Display shall be in three modes- • Auto Scroll • Scroll with Push Button • High Resolution (Shall display energy values with resolution of 2 digits before decimal and 3 digits after decimal in push button mode) The display order shall be: Auto Scroll • Cumulative Active Energy kWh along with legend. • Current calendar month MD in kW with legend. • Instantaneous voltage V_{RN} • Instantaneous voltage V_{YN} • Instantaneous voltage V_{BN} • Instantaneous current I_R • Instantaneous current I_Y • Instantaneous current I_B These parameters should be displayed on the LCD/LED continuously for a period of 15 seconds on Auto scroll. In case of power failure, the meter should display above parameters with push button. Scroll with Push-button • Internal diagnostics • Cumulative kWh • Date • Real Time • Voltage V_{RN} (V) • Voltage V_{YN} (V) • Voltage V_{BN} (V) • Current I_R (I) • Current I_Y (I) • Current I_B (I) • Power (kW) • Power (kVA)

Particulars	Specification
	- Current month MD in kW - Current month MD in kVA - Last month cumulative kWh - Last month cumulative kVAh - Last month MD in kW & occurrence Date - Last month MD in kVA & occurrence Date - Meter Serial Number The meter's display should return to default display mode (continues auto scroll) if push button is not operated for more than 10 seconds.
Anti-Tamper Features	The meter shall continue recording energy under any tamper condition and would log the event and send alarm at Head End System after detection of the defined theft features as per IS 15959 Part 2. Optional test as per requirement of utility: The Meter shall be immune under external magnetic influences as per CBIP 325. Meter shall be tested for high voltage discharge (Spark) up to 35 KV as per CBIP 325.

In case of any discrepancy or any issue related to interpretation of any technical aspects with respect to Smart Meters, the requirements as per relevant IS will prevail.

Annexure C   **Three phase CT operated alternating current smart meter Of Accuracy Class 0.5S (with/ without net-metering)**

C.1   **General Standards Applicable for Meter**

Unless otherwise specified elsewhere in this specification, the performance and testing of the meters shall conform to the following standards and amendments/revisions thereof.

Sl. No.	Standard No.	Title
1	IS 16444: Part 2 with latest amendments	AC Static Transformer Operated Watt-hour and VAR-Hour Smart Meters, class 0.2S, 0.5S and 1S
2	CBIP- Publication 325 with latest amendments	Standardization of AC Static Electrical Energy Meters
3	CBIP Technical report no. 111 with latest amendments	Specification for Common Meter Reading Instrument
4	IEC-62052-11 with latest amendments	Electricity metering equipment (AC) - General Requirements & test conditions Part 11. metering equipment
5	IS:9000 with latest amendments	Basic Environmental Testing Procedures for Electronic & Electrical Items.
6	ANSI/IPC-A- 610 with latest amendments	Workmanship standard for Acceptability of Electronic Assemblies (A standard developed by Institute for Interconnecting and packaging Circuits)
7	IS 12063 with latest amendments	Degrees of protection provided by enclosures of electrical equipment.
8	IS 14451, Part-2: 1999 with latest amendments	Telemetering for consumption and demand. Direct digital transfer of meter values.
9	IS 4905: 1999 with latest amendments	Methods for Random sampling.
10	IS 12346 with latest amendments	Specifications for Testing Equipment for AC Energy meter.
11	IEC-61000-4-5 with latest amendments	Electromagnetic capability, Testing and measurement techniques - Surge immunity test
12	IEC 60687 with latest amendments	AC Static Transformer Operated Watt-hour and VAR-Hour Meters, class 0.2S and 0.5S
13	IS 15959 Part 3 with latest amendments	Data exchange for electricity meter reading, tariff and load control: Companion specification

The specifications of this Annexure shall also be applicable for Three phase CT-PT operated alternating current smart meter Of Accuracy Class 0.5S .

CT-PT operated meter (HT Meters at consumer end)

Reference Voltage - /110V phase to phase
Current Rating - /5A

For CT-PT operated meter (HT Meters at Feeder Level – 33 KV and 11 KV)

Reference Voltage - /110V phase to phase
Current Rating - /1A and /5A
Meters shall be programmable in primary values at the time of installation

CT operated meter (at Consumer end)

Reference Voltage – 3x240V phase to phase
Current Rating - /5A

CT operated meter (at DT level)

Reference Voltage – 3x240V phase to phase
Current Rating – /5A

All CT operated meters have to be supplied by the Bidder. CT for meters at consumer end as well as for HT meters would be provided by WESCO. However, CT for meters at DT level is to be supplied by the Bidder. The CT ratios for meters at DT level have been mentioned in Annexure-17 to the RfP. Further, the Bidder has to supply boxes for all types of CT operated meters of polycarbonate material.

For HT Meters, the specifications of Meter Box for Three Phase Meters may be used.

For LT CT meters, the Bidder has to supply Meter Box of polycarbonate material as per its own specifications ensuring proper communication from the meters. However, the specifications of the boxes have to be submitted to WESCO after award of the project to the selected Bidder and before supply of meters.

C.2 Communication

Meter shall have ability to communicate with DCU/Access Point/HES on any one of the technologies mentioned in IS 16444: Part 2 in a secure manner, as per site conditions and as per design requirement of contractor. In case of GPRS/3G/4G based meter, meter shall accommodate SIM card of any service provider. In case of Plug in type communication module, meter shall log communication module removal /non responsive event with snapshot.

C.3 Other Specifications

Particulars	Specifications
Applicable Standards	The meters shall comply with IS 16444: Part2 for all requirements except for those parameters which have been specifically mentioned to be otherwise in this specification.
Reference Voltage	As per relevant IS
Current Rating	To be assessed by Contractor as per Utility requirement
Starting Current	As per IS 16444: Part2
Accuracy	Class 0.5S as per IS 16444: Part2
Limits of error	As per IS 16444: Part2

Particulars	Specifications
Operating Temperature range	As per IS 16444: Part2
Humidity	As per IS 16444: Part2
Frequency	As per IS 16444: Part2
Influence Quantities	As per IS 16444: Part2
Power Consumption of meter excluding communication module	As per IS 16444: Part2
Current and pressure Coil	As per IS 16444: Part2
Running at No Load	As per IS 16444: Part2
Test output device	As per IS 16444: Part2
Meter Display	Minimum 7 digit backlit white light LCD Display of minimum 10 mm height with legends to identify parameters on meter. For testing purpose, high resolution display having at least 5 decimals digits shall be provided.
Time of Use (In case of net-meter both export & import parameters to be measured)	Should support at least eight (8) Time of day tariff registers with programmable time zones and storage of billing parameters (kW, kVA, kWh & kVAh)
Parameters With net-metering)	Instantaneous parameters: As per category D3 meters according to IS 15959: Part-3: 2017 Billing parameters: As per category D3 meters according to IS 15959: Part-3: 2017 Load survey / Interval data parameters: As per category D3 meters according to IS 15959: Part-3: 2017. 35 (Power ON) days data to be recorded with 15 minutes integration period. The register shall automatically rollover the data after 35 days based on first in first out (FIFO). Instantaneous Voltage, Instantaneous Current and Instantaneous Power Factor have to read for every 15 minutes as part of Interval data. The billing parameters shall be retained in the meter for 6 months and should automatically rollover.
Power Quality Information	Logging of quality of supply events like power on/off, over/under voltage, over current (50 events) Setting of Under/ Over Voltage and Over current shall be configurable. OBIS codes provided by the Bidder will be accepted.
Maximum Demand	Should have Maximum Demand registers kW and kVA with integration period 30/15 minutes. Resets should be auto-monthly or through communication command.
Load Survey/Interval Data	35 (Power ON) days data to be recorded with 15 minutes integration period with date & time stamping for Active Energy (kWh), Apparent Energy (kVAh), Reactive Energy (kVARh), Average Voltage, Average Current, Average Power Factor and Average Demand in kW & kVA. In addition cumulative mid night kWh, kVAh, kVARh (lag/lead) (00.00 Hrs) with date & time stamp shall also be recorded for 35 (Power ON) days. The register shall automatically rollover the data after 35 days based on first in first out (FIFO). Instantaneous Voltage, Instantaneous Current and Instantaneous Power Factor have to read for every 15 minutes as part of Interval data.
LED/LCD	LED indicator for pulse/kWh. LED/LCD indicator for tamper,

Particulars	Specifications
Indicators	current reversal (not for net-metering).
Tamper/Event recording	As per IS 15959 Part-3. 200 events shall be stored in local memory of meters.
Alarm	Alarm for power on/off (on restoration of power), Under Voltage, Over Voltage, Over Current, malfunctioning of events shall be generated and communicated to the HES immediately
Measuring Elements	Meter should have four measuring elements - three in phases and one in neutral path for sensing.
Anti-Tamper features	The meter shall continue recording energy under any tamper condition and would log the event and send alarm at Head End System after detection of the defined theft features as per IS 15959 Part 3. Optional test as per requirement of utility: The Meter shall be immune under external magnetic influences as per CBIP 325. Meter shall be tested for high voltage discharge (Spark) up to 35 KV as per CBIP 325.
Programmability	It should be possible to program the parameters limits /values from remote through adequate security mechanism. Once programmed it will be possible for the programmed parameters to come into effect from a certain date & time. Meteorology under such condition must remain intact and shall not be upgradable from remote.
Communication	The port for local communication and baud rate shall be as per IS 15959. In addition to this the meter will have a provision for an Integral modular plug & play type for NAN (Neighbourhood Area Network) i.e. from Meter to router / access points/ data collector or directly for WAN (Wide Area Network).
Communication Protocol	As per IS 15959/DLMS-COSEM
RTC & time synchronization	Meter shall have RTC with 20 years calendar programmed in the memory and provision for time synchronization, The maximum drift shall not exceed +/- 300 Seconds per year. The clock day/date setting and synchronization shall only be possible through password/Key code command from one of the following: • Hand Held Unit (HHU) or Meter testing work bench and this shall need password enabling for meter • From remote server through suitable communication network. Contractor shall submit the methodology for the synchronization of RTC.
Data Retention	Non Volatile Memory (non-battery backed up) with 10 years data retention in absence of power.
Battery Backup	Meter shall be supplied with separate battery backup for RTC and for display in case of power failure. The battery shall have a guaranteed life of 10 years from the date of installation of meters.
Data display facility (manual/Auto)	Data Display shall have following features: • High Resolution (Shall display energy values with resolution of 2 digits before decimal and 5 digits after decimal.

Particulars	Specifications
	• The Push button for manual scrolling in addition to auto scrolling with a persistence time of 10 seconds for each parameter shall be provided. Display of data as per **Annexure-H**
Guarantee	Manufacturer shall undertake a guarantee to replace meter up to a period of 5 year from the date of operation. The meter which are found defective/inoperative at the time installation or become inoperative/defective within the guarantee period, these defective/inoperative meters shall be replaced within one month of receipt of report for such defective/inoperative meters
Remote Firmware Upgrade	The meter shall support remote firmware upgrades as well remote configuration in order to remotely add new features and functions to meters without having to send person to field in secure manner.

In case of any discrepancy or any issue related to interpretation of any technical aspects with respect to Smart Meters, the requirements as per relevant IS will prevail.

Annexure D   Table of Compliance

The Bidder shall annotate the Table of Contents of each section and appendix of Volume – II (Technical Specifications) to provide a high-level summary of compliance status. In all cases, the following symbols, and no others shall be used:

C - Bid complies with all requirements in the adjacent paragraph.

A - Bid is not compliant with the requirements in the adjacent paragraph, but a functional alternative is proposed.

X - Bid takes exception to the requirements of the adjacent paragraph and no functional alternative is proposed.

Only one symbol shall be assigned to paragraph and shall indicate the worst case level of compliance for that paragraph. This annotation may be hand written.

The Bidder shall also underline, on the compliance copy, all requirements to which exceptions have been taken (X) or to which alternatives have been proposed (A).

Each alternative shall be clearly and explicitly described. Such descriptions shall use the same paragraph numbering as the bid document sections addressed by the alternatives. All alternative descriptions shall be in one contiguous section of the bidder's proposal, preferably in the same volume, and titled "Alternatives." A separate section titled "Exceptions" should be provided containing any discussion or explanation chooses to provide concerning exceptions taken. Alternatives which do not substantially comply with the intent of the bid documents will be considered exceptions.

Any clause which is not included in this compliance table shall be treated as "fully complied" or C

WESCO will assess the merits of each alternative and exception and will be the sole judge as to their acceptance.

Annexure E   Bill of Quantities

Please refer Annexure 10 of this RfP

Annexure F   Data Requirement Sheet

F.1   Single Phase Whole Current Smart Meter

S. No	Description of the Features	Minimum Requirement of Features	As per Bidder Offering
	Applicable Standards	The meters shall comply with IS 16444 for all requirements. Those parameters which are not covered in IS 16444 have been specifically mentioned in this specification.	
	Reference Voltage	As per relevant IS	
	Current Rating	5-30 A	
	Starting Current	As per IS 16444	
	Accuracy	Class 1.0 as per IS 16444	
	Limits of error	As per IS 16444	
	Operating Temperature range	As per IS 16444	
	Humidity	As per IS 16444	
	Frequency	As per IS 16444	
	Influence Quantities	As per IS 16444	
	Power Consumption of meter	As per IS 16444	
	Current and Voltage Circuit	As per IS 16444	
	Running at No Load	As per IS 16444	
	Test output device	As per IS 16444	
	Meter Display	As per IS 16444	
	Name Plate & marking Meter Display	As per IS 16444	
	Parameters to be measured (In case of net-meter both export & import parameters to be measured)	As per IS 16444 / As per IS 15959 Part-2	
	Maximum Demand resetting	As per IS 15959 Part 2	
	Time of Use registers	As per IS 15959 part 2	
	Power Quality Information	As per IS 15959 part 2	
	LED/LCD Indicators	As per IS 16444	
	Load Survey/Interval Data	As per IS 15959 part 2	
	Tamper/ Event Recording	As per IS 15959 part 2	
	Measuring Elements	As per IS 16444	
	Alarm	As per IS 16444/ 15959 Part 2	
	Load Control	As per IS 16444	
	Connect/Disconnect and status of load switch	As per IS 16444	
	Programmability	As per IS 16444	
	Communication	As per IS 16444.	
	Communication Protocol	As per IS 16444	
	Remote Firmware upgrade	As per IS 15959 part 2	

S. No	Description of the Features	Minimum Requirement of Features	As per Bidder Offering
	Real Time Clock(RTC)	As per IS 16444/ IS 15884 The clock day/date setting and synchronization shall only be possible through password/Key code command from one of the following: • From remote server through suitable communication network. • Hand Held Unit (HHU) or Meter testing work bench and this shall need password enabling for meter; The methodology for the synchronization would be as per requirement of utility	
	Data Retention	As per CEA regulations	
	Battery Backup	Meter shall be supplied with separate battery backup for RTC.	
	Guarantee	Contractor shall undertake a guarantee to replace meter up to a period of 60 months from the date of supply. The meter which are found defective/inoperative within the guarantee period, these defective/inoperative meters shall be replaced within one month of receipt of report for such defective/inoperative meters	
	First Breath(power on) and Last gasp (power off) condition detection and communication to HES	As per IS 16444	
	Data Display Facility (Manual/ Automatic)	Data Display shall be in three modes- • Auto Scroll • Scroll with Push Button • High Resolution (Shall display energy values with resolution of 2 digits before decimal and 3 digits after decimal in push button mode) The display order shall be: Auto Scroll • Cumulative Active Energy kWh along with legend. • Current calendar month MD in kW with legend. • Instantaneous voltage • Instantaneous current These parameters should be displayed on the LCD/LED continuously for a period of 15 seconds on Auto scroll. In case of power failure, the meter should display above parameters with push button. Scroll with Push-button • Internal diagnostics	

S. No	Description of the Features	Minimum Requirement of Features	As per Bidder Offering
		• Cumulative kWh • Date • Real Time • Voltage in (V) • Current (I) • Power (kW) • Current month MD in kW • Last month cumulative kWh • Last month MD in kW • Last month MD occurrence Date • Last month MD occurrence Time • Meter Serial Number The meter's display should return to default display mode (continues auto scroll) if push button is not operated for more than 10 seconds.	
	Anti-Tamper Features	The meter shall continue recording energy under any tamper condition and would log the event and send alarm at Head End System after detection of the defined theft features as per IS 15959 Part 2. Optional test as per requirement of utility: The Meter shall be immune under external magnetic influences as per CBIP 325. Meter shall be tested for high voltage discharge (Spark) up to 35 KV as per CBIP 325.	

F.2   Three Phase Whole Current Smart Meter

S. No.	Description of the Features	Minimum Requirement of Features	As per Bidder Offering
	Applicable Standards	The meters shall comply with IS 16444 for all requirements. Those parameters which are not covered in IS 16444 have been specifically mentioned in this specification.	
	Reference Voltage	As per relevant IS	
	Current Rating	20-100 A	
	Starting Current	As per IS 16444	
	Accuracy	Class 1.0 as per IS 16444	
	Limits of error	As per IS 16444	
	Operating Temperature range	As per IS 16444	
	Humidity	As per IS 16444	
	Frequency	As per IS 16444	
	Influence Quantities	As per IS 16444	
	Power Consumption of meter	As per IS 16444	

S. No.	Description of the Features	Minimum Requirement of Features	As per Bidder Offering
	Current and Voltage Circuit	As per IS 16444	
	Running at No Load	As per IS 16444	
	Test output device	As per IS 16444	
	Meter Display	As per IS 16444	
	Name Plate & marking Meter Display	As per IS 16444	
	Parameters to be measured In case of net-meter both export & import parameters to be measured	As per IS 16444 / As per IS 15959 Part-2	
	Maximum Demand resetting	As per IS 15959 Part 2	
	Time of Use registers	As per IS 15959 part 2	
	Power Quality Information	As per IS 15959 part 2	
	LED/LCD Indicators	As per IS 16444	
	Load Survey/Interval Data	As per IS 15959 part 2	
	Tamper/ Event Recording	As per IS 15959 part 2	
	Measuring Elements	As per IS 16444	
	Alarm	As per IS 16444/ 15959 Part 2	
	Load Control	As per IS 16444	
	Connect/Disconnect and status of load switch	As per IS 16444	
	Programmability	As per IS 16444	
	Communication	As per IS 16444.	
	Communication Protocol	As per IS 16444	
	Remote Firmware upgrade	As per IS 15959 part 2	
	Real Time Clock(RTC)	As per IS 16444/ IS 15884 The clock day/date setting and synchronization shall only be possible through password/Key code command from one of the following: • From remote server through suitable communication network. • Hand Held Unit (HHU) or Meter testing work bench and this shall need password enabling for meter; The methodology for the synchronization would be as per requirement of utility	
	Data Retention	As per CEA regulations	
	Battery Backup	Meter shall be supplied with separate battery backup for RTC.	

S. No.	Description of the Features	Minimum Requirement of Features	As per Bidder Offering
	Guarantee	Contractor shall undertake a guarantee to replace meter up to a period of 60 months from the date of supply. The meter which are found defective/inoperative within the guarantee period, these defective/inoperative meters shall be replaced within one month of receipt of report for such defective/inoperative meters	
	First Breath(power on) and Last gasp (power off) condition detection and communication to HES	As per IS 16444	
	Data Display Facility (Manual/ Automatic)	Data Display shall be in three modes- • Auto Scroll • Scroll with Push Button • High Resolution (Shall display energy values with resolution of 2 digits before decimal and 3 digits after decimal in push button mode) The display order shall be: Auto Scroll • Cumulative Active Energy kWh along with legend. • Current calendar month MD in kW with legend. • Instantaneous voltage V_{RN} • Instantaneous voltage V_{YN} • Instantaneous voltage V_{BN} • Instantaneous current I_R • Instantaneous current I_Y • Instantaneous current I_B These parameters should be displayed on the LCD/LED continuously for a period of 15 seconds on Auto scroll. In case of power failure, the meter should display above parameters with push button.	
S. No.	Description of the Features	Minimum Requirement of Features	As per Bidder Offering

S. No.	Description of the Features	Minimum Requirement of Features	As per Bidder Offering
		Scroll with Push-button • Internal diagnostics • Cumulative kWh • Date • Real Time • Voltage V_{RN} (V) • Voltage V_{YN} (V) • Voltage V_{BN} (V) • Current I_R (I) • Current I_Y (I) • Current I_B (I) • Power (kW) • Power (kVA) • Current month MD in kW • Current month MD in kVA • Last month cumulative kWh • Last month cumulative kVAh • Last month MD in kW & occurrence Date • Last month MD in kVA & occurrence Date • Meter Serial Number The meter's display should return to default display mode (continues auto scroll) if push button is not operated for more than 10 seconds.	
	Anti-Tamper Features	The meter shall continue recording energy under any tamper condition and would log the event and send alarm at Head End System after detection of the defined theft features as per IS 15959 Part 2. Optional test as per requirement of utility: The Meter shall be immune under external magnetic influences as per CBIP 325. Meter shall be tested for high voltage discharge (Spark) up to 35 KV as per CBIP 325.	

F.3 Three Phase CT Operated Smart Meter

S. No	Description of the Features	Minimum Requirement of Features	As per Bidder Offering
	Applicable Standards	The meters shall comply with IS 16444: Part2 for all requirements except for those parameters which have been specifically mentioned to be otherwise in this specification.	
	Reference Voltage	As per relevant IS	
	Current Rating	To be assessed by Contractor as per Utility Requirement	
	Starting Current	As per IS 16444: Part2	
	Accuracy	Class 0.5S as per IS 16444: Part2	
	Limits of error	As per IS 16444: Part2	
	Operating Temperature range	As per IS 16444: Part2	
	Humidity	As per IS 16444: Part2	
	Frequency	As per IS 16444: Part2	
	Influence Quantities	As per IS 16444: Part2	
	Power Consumption of meter excluding communication module	As per IS 16444: Part2	
	Current and pressure Coil	As per IS 16444: Part2	
	Running at No Load	As per IS 16444: Part2	
	Test output device	As per IS 16444: Part2	
	Meter Display	Minimum 7 digit backlit white light LCD Display of minimum 10 mm height with legends to identify parameters on meter. For testing purpose, high resolution display having at least 5 decimals digits shall be provided.	
	Time of Use (In case of net-meter both export & import parameters to be measured)	Should support at least eight (8) Time of day tariff registers with programmable time zones and storage of billing parameters (kW, kVA, kWh & kVAh)	
	Parameters With net-metering)	Instantaneous parameters: As per category D3 meters according to IS 15959: Part-3: 2017 Billing parameters: As per category D3 meters according to IS 15959: Part-3: 2017 Load survey / Interval data parameters: As per category D3 meters according to IS 15959: Part-3: 2017. 35 (Power ON) days data to be recorded with 15 minutes integration period. The register shall automatically rollover the data after 35 days based on first in first out (FIFO). Instantaneous Voltage, Instantaneous Current and Instantaneous Power Factor have to read for every 15 minutes as part of	

S. No	Description of the Features	Minimum Requirement of Features	As per Bidder Offering
		Interval data. The billing parameters shall be retained in the meter for 6 months and should automatically rollover.	
	Power Quality Information	Logging of quality of supply events like power on/off, over/under voltage, over current (50 events) Setting of Under/ Over Voltage and Over Current shall be configurable. OBIS codes provided by the Bidder shall be accepted.	
	Maximum Demand	Should have Maximum Demand registers kW and kVA with integration period 30/15 minutes. Resets should be auto-monthly or through communication command.	
	Load Survey/Interval Data	35 (Power ON) days data to be recorded with 15 minutes integration period with date & time stamping for Active Energy (kWh), Apparent Energy (kVAh), Reactive Energy (kVARh), Average Voltage, Average Current, Average Power Factor and Average Demand in kW & kVA. In addition cumulative mid night kWh, kVAh, kVARh (lag/lead) (00.00 Hrs) with date & time stamp shall also be recorded for 35 (Power ON) days. The register shall automatically rollover the data after 35 days based on first in first out (FIFO). Instantaneous Voltage, Instantaneous Current and Instantaneous Power Factor have to read for every 15 minutes as part of Interval data.	
	LED/LCD Indicators	LED indicator for pulse/kWh. LED/LCD indicator for tamper, current reversal (not for net-metering).	
	Tamper/Event recording	As per IS 15959 Part-3. 200 events shall be stored in local memory of meters.	
	Alarm	Alarm for power on/off (on restoration of power), Under Voltage, Over Voltage, Over Current, malfunctioning of diagnostic events shall be generated and communicated to the HES immediately	
	Measuring Elements	Meter should have four measuring elements - three in phases and one in neutral path.	
	Anti-Tamper features	The meter shall continue recording energy under any tamper condition and would log the event and send alarm at Head End System after detection of the defined theft features as per IS 15959 Part 3. Optional test as per requirement of utility: The Meter shall be immune under external magnetic influences as per CBIP 325. Meter shall be tested for high voltage discharge (Spark) up to 35 KV as per CBIP 325.	
	Programmability	It should be possible to program the parameters limits /values from remote through adequate security mechanism. Once programmed it will be possible for the programmed parameters to come	

S. No	Description of the Features	Minimum Requirement of Features	As per Bidder Offering
		into effect from a certain date & time. Meteorology under such condition must remain intact and shall not be upgradable from remote.	
	Communication	The port for local communication and baud rate shall be as per IS 15959. In addition to this the meter will have a provision for an Integral modular plug in type OR built in type Communication Module for NAN (Neighbourhood Area Network) i.e. from Meter to router / access points/ data collector or directly for WAN (Wide Area Network).	
	Communication Protocol	As per IS 15959/DLMS-COSEM	
	RTC & time synchronization	Meter shall have RTC with 20 years calendar programmed in the memory and provision for time synchronization, The maximum drift shall not exceed +/- 300 Seconds per year. The clock day/date setting and synchronization shall only be possible through password/Key code command from one of the following: • Hand Held Unit (HHU) or Meter testing work bench and this shall need password enabling for meter • From remote server through suitable communication network. Contractor shall submit the methodology for the synchronization of RTC.	
	Data Retention	Non Volatile Memory (non-battery backed up) with 10 years data retention in absence of power.	
	Battery Backup	Meter shall be supplied with separate battery backup for RTC and for display in case of power failure. The battery shall have a guaranteed life of 10 years from the date of installation of meters.	
	Data display facility (manual/Auto)	Data Display shall have following features: • High Resolution (Shall display energy values with resolution of 2 digits before decimal and 5 digits after decimal. • The Push button for manual scrolling in addition to auto scrolling with a persistence time of 10 seconds for each parameter shall be provided. Display of data as per **Annexure-H**	
	Guarantee	Manufacturer shall undertake a guarantee to replace meter up to a period of 5 year from the date of operation. The meter which are found defective/inoperative at the time installation or become inoperative/defective within the guarantee period, these defective/inoperative meters shall be replaced within one month of receipt of report for such defective/inoperative meters	
	Remote Firmware Upgrade	The meter shall support remote firmware upgrades as well remote configuration in order to	

S. No	Description of the Features	Minimum Requirement of Features	As per Bidder Offering
		remotely add new features and functions to meters without having to send person to field in secure manner.	

F.4 Routers for Communication Network (If Applicable)

S. No	Description of the Features	Minimum Requirement of Features	As per Bidder Offering
	General Requirements	• The communication network shall have dynamic & self-healing capability. If one of the communication element like router or access point fails then nodes connecting to that element shall switch to best available element for communication of data to HES. • It shall support IPv4 and IPv6 network addressing. • Each node shall keep a track of best available nearby nodes. • The communication network equipment shall use Unlicensed or Licensed frequency band as permitted by WPC. • All the communication network equipment shall be certified by WPC, Government of India for operation in license free frequency band. • Suitable network management system (NMS) shall be available to monitor the performance of the communication network round the clock. The NMS shall provide viewing of all the networking elements deployed at site and enable configuration, parameterization of the networking devices and the nodes. • It shall support remote firmware upgrading • It shall be secure enough to avoid all cyber threats like DDoS, spoofing, malwares etc. • The communication network shall ensure secure communication of data to HES. • The equipment shall be weatherproof, dustproof and constructed for outdoor installation on poles (minimum rating: IP-55). A suitable mounting provision shall be made for the equipment. • Enclosure: Provision for security sealing shall be provided and in case the gasket of the cover is used for protection against moisture, dust and insects, the gasket shall be made of weather and aging resistant material. • The list of standards followed in all the devices/equipment used in communication network shall be furnished.	

S. No	Description of the Features	Minimum Requirement of Features	As per Bidder Offering
		• Routers / Access Points shall have suitable power supply arrangements. Provision of battery backup for at least 5 hour shall be there to continue operation in case of power supply failure. The life expectancy of battery shall be 5 years or more.	

F.5 Access Points for Communication Networks (if Applicable)

S. No	Description of the Features	Minimum Requirement of Features	As per Bidder Offering

	Configuration Requirement	• It shall be able to configure the communication with underlying nodes/end points.
		• It shall support on demand read and ping of individual/group of meters.
		• It shall push events like tamper, power off etc. to HES immediately on occurrence/receipt from field devices/meters.
		• It shall have Wide Area Network (WAN) connectivity to the HES through suitable means.
		• It shall communicate with routers/nodes/end points on RF mesh (Unlicensed or Licensed frequency band as permitted by WPC).
		• It shall periodically monitor meter reads/downstream commands and shall retry and reconnect in case of failed events/reads.
		• After power Interruption, on restoration of power supply, it shall establish communication with underlying devices as well as upstream application (HES) automatically.
		• Access point shall facilitate recording of:
		   o No of packet failures
		   o Retry attempts
		   o Missed periodic reading
		   o Failure to connect
		   o Tamper events
		• It shall be capable to handle interval data of suitable nos. of any type of smart meter (1ph/3ph). Access point shall be able to acquire and send data to HES for full capacity (No. of meters/field devices it is designed for) within a suitable time period to achieve the performance level. Full capacity of access point is required to be indicated in the offer.
		• Access point shall support remote firmware upgrades as well as remote configuration from the control center.	

F.6 Data Concentrator Unit (DCU) (If Applicable)

S. No	Description of the Features	Minimum Requirement of Features	As per Bidder Offering
	Configuration, Functionality & Interface	• It shall be able to configure the communication with underlying nodes/meters. • It shall pull data from the field devices and push the data at configured intervals to the HES. It should also support the HES in pulling data from the field devises/meters. The data acquisition (Push/Pull) frequency shall be programmable. DCU shall be capable to prioritize control commands. • DCU shall ensure a secure communication to HES and shall have internal memory for storing interval data for at least 5 days. • DCU shall support on demand read and ping of individual/group of meters. • It shall support IPv4 and IPv6 network addressing. • DCU shall push events like tamper, power off etc. to HES immediately on occurrence/receipt from field devices/meters. • The equipment shall be weatherproof, dustproof and constructed for outdoor installation on poles (minimum rating: IP-55). A suitable mounting provision shall be made for the equipment. • Enclosure: Provision for security sealing shall be provided and in case the gasket of the cover is used for protection against moisture, dust and insects, the gasket shall be made of weather and aging resistant material.	
	Communication	• The communication architecture shall be any, as defined under IS 16444. • The DCU shall ensure the appropriate backhaul for secure transfer of data to HES either via Fiber Optic communication. In case of GPRS/3G/4G backhaul, it shall support APN based SIM card from any service provider. It shall have Wide Area Network (WAN) connectivity to the HES through suitable means. • DCU shall be able to communicate with meters either on RF mesh (Unlicensed or Licensed frequency band as permitted by WPC). • DCU shall periodically monitor meter reads/downstream commands and shall retry and reconnect in case of failed events/reads. • It shall push events like tamper, power off etc. to HES immediately on occurrence/receipt from field devices/meters. DCU shall be able to acquire and send data to HES for full capacity (as per designed for no. of meters/field devices) to ensure the performance level. Full capacity of DCU is	

S. No	Description of the Features	Minimum Requirement of Features	As per Bidder Offering

		required to be indicated in the offer.
		• After Power Interruption, on restoration of power supply, DCU shall establish communication with underlying devices as well as upstream application automatically.
		• DCU shall be able to communicate with the nearest meters depending on topographical features. For further communication among the meters, distance of the other meters with the DCU shall not be a constraint as communication of the nearest meters shall be established with other meters through appropriate mesh formation / other formation.
		• Remote Firmware Upgrade: The DCU shall support remote firmware upgrades as well as remote configuration from the control center. Configuration of programmable parameters of smart meters shall be done through HES.
		• All meters falling under one DCU shall be commissioned and checked for proper communication in presence of utility in-charge.
		• DCU shall keep the records of minimum of the following events:
		    o No of packet failures
		    o Retry attempts
		    o Missed periodic readings
		    o Failure to connect
		    o Tamper events	

F.7 Requirements for Cloud Services (Refer section 3.8)

S. No.	Description of the Features	Minimum Requirement of Features	As per Bidder Offering

F.8 Workstation Consoles (Refer section 6.2. Requirements as added in section 6.2 shall be duplicated in the table below)

S. No.	Description of the Features	Minimum Requirement of Features	As per Bidder Offering

F.9 Monitors (Refer section 6.2. Requirements as added in section 6.2 shall be duplicated in the table below)

S. No.	Description of the Features	Minimum Requirement of Features	As per Bidder Offering

S. No.	Description of the Features	Minimum Requirement of Features	As per Bidder Offering

F.10 Firewall (Refer section 6.2. Requirements as added in section 6.2 shall be duplicated in the table below)

S. No.	Description of the Features	Minimum Requirement of Features	As per Bidder Offering

F.11 Router (Refer section 6.2. Requirements as added in section 6.2 shall be duplicated in the table below)

S. No.	Description of the Features	Minimum Requirement of Features	As per Bidder Offering

F.12 Switch (Refer section 6.2. Requirements as added in section 6.2 shall be duplicated in the table below)

S. No.	Description of the Features	Minimum Requirement of Features	As per Bidder Offering

F.13 Storage Area Network (SAN) (Refer section 6.2. Requirements as added in section 6.2 shall be duplicated in the table below)

S. No.	Description of the Features	Minimum Requirement of Features	As per Bidder Offering

F.14 Printer (Refer section 6.2. Requirements as added in section 6.2 shall be duplicated in the table below)

S. No.	Description of the Features	Minimum Requirement of Features	As per Bidder Offering

F.15 Panel Rack (Refer section 6.2. Requirements as added in section 6.2 shall be duplicated in the table below)

S. No.	Description of the Features	Minimum Requirement of Features	As per Bidder Offering

F.16 Local Area Network (Refer section 6.2. Requirements as added in section 6.2 shall be duplicated in the table below)

S. No.	Description of the Features	Minimum Requirement of Features	As per Bidder Offering

F.17 Host based Intrusion Detection System & Intrusion Prevention System (Network Based) (Refer section 6.2. Requirements as added in section 6.2 shall be duplicated in the table below)

S. No.	Description of the Features	Minimum Requirement of Features	As per Bidder Offering

Annexure G   System Sizing Requirement

G.1   Sizing Parameter

The system shall be designed as per the technical parameters defined in this specification and as specified in this Annexure.

The system shall be suitably sized based on data to be captured from the no. of nodes as per Price Bid Format (Annexure 10). However, the bidder has to develop the overall AMI architecture in such a manner that it meets the scaling up requirements of entire area under WESCO in future.

The auxiliary memory utilization of any of the Servers shall not exceed 30% of its delivered capacity at any time even under peak loading conditions like-
- 200 alarms per minutes for 5 minutes.
- 10 display request simultaneously from 5 users.
- Restoration of 100% meter data after system failure.
- System activity alarms.

This memory utilization includes the memory used for storage of data (including expansion requirement defined in above para) for the defined duration as specified in the Technical Specification

The system architecture and the network design shall have the ability to handle the growth with respect to functions, user and geographic sites. Also, applications must evolve to support new business requirements and make use of new technologies.

G.2   Configuration requirement for Hardware & Software

S. No	Description	No of Nodes	Future requirement
1	Head End System (HES)*	As per Annexure 10 of the RfP	Scaling up requirements of entire area under WESCO in future
2	Meter Data Management System (MDM)*	As per Annexure 10 of the RfP	Scaling up requirements of entire area under WESCO in future

*In future, WESCO may use same HES / MDM for entire area. Provision should be there to cover such area through procurement of additional licenses.

Annexure H   Display Parameters for 3-Phase CT Operated Smart Meters

To be provided in the following sequence:

Mode : 1 (Auto Scroll)	Parameters of this mode should display on auto scrolling as well as manually up & down scrolling using push button (as mentioned in manual scrolling i.e. except repeated parameters)	
Sequence	Parameter	Notation
1	Display check	- - - - - - -
2	Sr. No. of Meters	The numeric Meter Serial Number to be provided on Meter Display in line with the number of Display Digit requirement
3	CT Ratio	
4	RTC date & time	
5	R- Phase Voltage	V1
6	Y- Phase Voltage	V2
7	B- Phase Voltage	V3
8	R- Phase Line Current	I1
9	Y- Phase Line Current	I2
10	B- Phase Line Current	I3
11	Inst. Total P.F. (Avg. of 3Ph.)	Pr.PF.
12	Inst. Total active power	Pr.Kw.
13	Rising demand in KW with elapse time	
14	KW-MD of last billing period i.e. billing MD of 24hours recorded between last two resets	BMD ------------Kw
15	MD KW for Present Billing Period (After last reset)	RMD ------ Kw.
16	24hrs. apparent energy derived from Vectorial summation of total (fund+ Harm.) active energy and reactive (lag only) energy	TC Kvah
17	Cumm KWH for (Zone1)	T1C Kwh
18	Cumm. KWH for (Zone2)	T2C Kwh
19	Cumm KWH for (Zone3)	T3C Kwh
20	Cumm KWH for (Zone upto 8)	T8C Kwh
21	MD KW between last two resets – (Zone-1)	T1 BMD
22	MD KW between last two resets – (Zone-2)	T2 BMD

Mode : 1 (Auto Scroll)	Parameters of this mode should display on auto scrolling as well as manually up & down scrolling using push button (as mentioned in manual scrolling i.e. except repeated parameters)	
Sequence	Parameter	Notation
26	MD KW between last two resets – (Zone-3)	T3 BMD
27	MD KW between last two resets – (Zone-upto 8)	T8 BMD
28	MD KW for Present Billing – (Zone -1)	T1RMD ------ Kw
29	MD KW for Present Billing - (Zone -2)	T2RMD ------ Kw
30	MD KW for Present Billing – (Zone -3)	T3RMD ------ Kw
31	MD KW for Present Billing – (Zone –upto 8)	T8RMD ------ Kw
32	MD Reset Count	
33	Voltage failure count phase wise	
34	Current failure count phase wise	
35	Voltage unbalance Count	
36	Current unbalance Count	
37	Current reversal count- phase wise	
38	Magnet tamper count.	
39	Total Tamper Count	

Note :
- Each parameter shall be displayed for 10 seconds.
- The persistent tamper event indication/icon shall be displayed in auto mode.

Mode : 1 (Manual Scroll)	Parameters of this mode should display manually on up & down scrolling using push button	
Sequence	Parameter	Notation
1	Display check	- - - - - - -
2	Sr. No. of Meters	UTP
3	CT Ratio	
4	RTC date & time	
5	R- Phase Voltage	V1
6	Y- Phase Voltage	V2
7	B- Phase Voltage	V3
8	R- Phase Line Current	I1
9	Y- Phase Line Current	I2

Mode : 1 (Manual Scroll)	Parameters of this mode should display manually on up & down scrolling using push button	
Sequence	Parameter	Notation
10	B- Phase Line Current	I3
11	Inst. P.F. (Avg. of 3Ph.)	Pr.PF.
12	Inst. Total active power	Pr.Kw.
13	Rising demand in KW with elapse time	
14	24hrs. total active energy (fundamental+ harmonics)	TC Kwh
15	24hrs. total reactive energy	TC Kvarh lg
16	24hrs. apparent energy derived from Vectorial summation of total (fund+ Harm.) active energy and reactive (lag only) energy	TC Kvah
17	MD KW for Present Billing Period (After last reset)	RMD ------ Kw.
18	KW-MD of last billing period i.e. billing MD of 24hours recorded between last two resets	BMD ------------Kw
19	Cumulative MD	CMD ------------Kw
20	Cumm KWH for (Zone1)	T1C Kwh
21	Cumm. KWH for (Zone2)	T2C Kwh
22	Cumm KWH for (Zone3)	T3C K wh
26	Cumm KWH for (Zone upto 8)	T8C K wh
27	MD KW between last two resets – (Zone-1)	T1 BMD
28	MD KW between last two resets – (Zone-2)	T2 BMD
29	MD KW between last two resets – (Zone-3)	T3 BMD
30	MD KW between last two resets – (Zone-upto 8)	T8 BMD
31	MD KW for Present Billing – (Zone -1)	T1RMD ------ Kw
32	MD KW for Present Billing – (Zone -2)	T2RMD ------ Kw
33	MD KW for Present Billing – (Zone -3)	T3RMD ------ Kw
34	MD KW for Present Billing – (Zone –upto 8)	T8RMD ------ Kw
35	MD Reset Count	
36	Voltage failure count - phase wise	
37	Current failure count - phase wise	
38	Voltage unbalance Count	
39	Current unbalance Count	
40	Current reversal count- phase wise	

Mode : 1 (Manual Scroll)	Parameters of this mode should display manually on up & down scrolling using push button	
Sequence	Parameter	Notation
41	Magnet tamper count.	
42	Total Tamper Count	

Mode : 2	Parameters of this mode should display manually up & down scrolling using push button under Mode-2	
Sequence	Parameter	Notation
1	Inst. P.F.Phase 1	P.F1
2	Inst. P.F.Phase 2	P.F2
3	Inst. P.F.Phase 3	P.F3
4	Inst. Kva	Pr Kva
5	Inst. Kvar.	Pr Kvar
6	Phase Sequence - Voltage	
7	Phase Sequence -Current	
8	Frequency	Hz
S9	Cumm. KVARH (Lead)	
10	MD Kvar after last billing – (24 Hrs)	MD Kvar
11	Cumm. KVARH-lag for (Zone-1)	Kvarh1
12	Cumm KVARH-lag for (Zone-2)	Kvarh2
13	Cumm KVARH-lag for (Zone-3)	Kvarh3
14	Cumm KVARH-lag for (Zone-upto 8)	Kvarh8
15	Cumm. KVAH for (Zone-1)	Kvah1
16	Cumm KVAH for (Zone-2)	Kvah2
17	Cumm KVAH for (Zone-3)	Kvah3
18	Cumm KVAH for (Zone-upto 8)	Kvah8
19	MD KVA after last billing – (24 Hrs)	MD Kva
20	MD KVA after last billing – (Zone-1)	MD Kva1
21	MD KVA after last billing – (Zone-2)	MD Kva2
22	MD KVA after last billing – (Zone-3)	MD Kva3
23	MD KVA after last billing – (Zone- upto 8)	MD Kva8
24	MD KVA between last two resets – (Zone-1)	B Kva1

Mode : 2	Parameters of this mode should display manually up & down scrolling using push button under Mode-2	
Sequence	Parameter	Notation
25	MD KVA between last two resets – (Zone-2)	B Kva2
26	MD KVA between last two resets – (Zone-3)	B Kva3
27	MD KVA between last two resets – (Zone- upto 8)	B Kva8
28	Fundamental Kwh	

Mode : 3	Parameters of this mode should display manually up & down scrolling using push button	
Sequence	Parameter	Notation
1	High Resolution display for Total KWH	
2	High Resolution display for KVARH-Lag	
3	High Resolution display for KVAH	
4	High Resolution display for Fundamental KWH	

Annexure I   Technical Specifications of Meter Box

Technical Specifications for Polycarbonate Meter Box for Single Phase Meter

1. SCOPE:

This specification covers the technical requirements of design, manufacture, testing at manufacturer's works, packing, forwarding, supply and unloading at store/site and performance of single phase meter box intended to contain one number single phase whole current energy meter complete with all accessories for trouble free and efficient operation.

2. APPLICABLE STANDARDS: -

The equipment covered by this specification shall unless otherwise stated, be designed, manufactured and tested in accordance with latest edition of the following Indian/International standards and shall conform to the regulations of the local statutory authorities.

a)	IS: 14772-2000	General requirements for enclosures for accessories for household and similar fixed electrical installations- specifications.
b)	IS: 11731(Part-II) -1992	Methods of test for determination of Flammability of solid electrical insulating material when exposed to an igniting source.
c)	IS 4249-1967	Specification for classification and method of test for non- ignitable and self-extinguishing properties of solid electrical insulating materials.
d)	IS 5133(Part II)-1969	Specification for boxes for the enclosure of electrical accessories.
e)	IS 2500(Part 1)-2000	Sampling procedure for inspection by attributes part-1 sampling schemes indexed by acceptance quality limit (AQL) for lot by lot inspection.
f)	UL 746-C	Polymeric Materials in Electrical equipment.

3. CLIMATIC CONDITIONS OF THE INSTALLATION:

The meter box shall be suitable for following conditions:-
i)   Minimum Ambient temperature: (-) 35°C.
ii)   Maximum Ambient temperature: 55°C.
iii)   Relative humidity: 26%
iv)   Maximum relative humidity: upto 95%
v)   Average Annual Rain fall: 150cm

4. GENERAL TECHNICAL REQUIREMENTS:

S. No	DESCRIPTION	REQUIREMENT
1	Application	Outdoor
2	Degree of protection	IP 55
3	Flammability requirement	FVo
4	Grade of material	Polycarbonate with fire retardant, Self- Extinguishing, UV stabilized and anti-oxidation properties.
5	Material	The meter box (base and Cover) shall be made of

	a) Base: b) Cover:	polycarbonate material which complies following properties; Meter box shall be weather proof, capable to withstanding temperatures of boiling water for 5 minutes continuously without distortion or softening. It shall withstanding Glow wire test at 650^0C as per IS: 14772. Polycarbonate Lexan 943 A or equivalent Grade with dark grey color. Polycarbonate Lexan 943 A or equivalent Grade with Transparent configuration.
6	Material of the gasket	Rubber gasket
7	Material withstand temperature	125 Deg C ± 2 Deg C

5. GENERAL CONSTRUCTIONS:

5.1 The meter box shall be weather proof, tamper proof and shall be made of Injection moulded polycarbonate material with self-extinguishing, UV stabilized, recyclable and Anti oxidation properties. The box shall be of adequate strength, unbreakable and shall be made in two pieces (base and cover).The base shall be dark grey color whereas the cover shall be completely transparent.

The meter Box shall have roof tapering down to both sides for easy flow of rainwater.

The thickness of the box shall not be less than 3mm on the load bearing side and other sides, door and roof shall not be less than 2.5 mm.

The box shall be designed in such a way that there should be the following clearances between the meter and the Meter box:

- Between Sides of the meter body and meter box – 30 mm minimum (excluding the flanges on the meter body for sealing screws.)

- Between lower edge of the terminal block and the Meter box – 70 mm Minimum

- Between the back of the meter and the meter box base – 10 mm Minimum

- Between the top of the meter and the meter box cover – 20 mm Minimum

The meter box shall have a taper roof for easy flow of rain water and shall have degree of protection IP 55 for affording protection against dust & water.

5.2 The meter base supports inside the box should have adequate strong enough molded supports within the block to avoid damage during tightening of screws and raised by about 10 mm in the box for ease of wiring. While fixing, the meter screws should not protrude outside.

5.3 The design of the meter box shall be such that it may facilitate easy wiring and access to the meter terminals. Nylon gland of internal diameter of approx. 20 mm shall be provided for I/C and O/G cables of size 2C x 16 sq. mm or as approved by WESCO.

5.4 The box cover shall be fixed to the base through two number hinges (approx length 30 - 60 mm). The arrangement for hinges shall be provided on the side of the base and shall be such that it may avoid unauthorized access to inside of the box. Hinges should be outside

and enclosed by polycarbonate material and once the box is closed and sealed, hinges should not be approachable. Box cover shall be openable by more than 90 degrees.

5.5 For holding and sealing the box, two U-shaped latches shall be provided. The latch shall be GI sheet with minimum thickness 2 mm, to secure it with the base of the box. The latch shall be provided along with suitable clamp assembly in base as well as cover, such that these are fully covered by the latch after closing. The clamp along with the latch shall have a sealing hole such as to provide a through sealing arrangement in the assembly.

5.6 For fixing the box to flat wall or wooden board 4Nos. holes (2Nos.key holes at top) of minimum 6 mm dia. shall be provided at the four corners of the meter box. For fixing of Box on flat wall, 4 Nos. 5mm diameter 40mm long pan head self- taping screws and washers shall be provided by the supplier with every Box. 4 Nos. plastic fixing plugs of 50mm length suitable for self-tapping screws shall also be provided (Fixing clamp and accessories for pole mounting/ wall mounting, shall be in the scope of Agency, who shall be installing the meters in the field based on the actual site conditions & pole sizes. These are not to be supplied with the boxes).

5.7 Push button arrangement shall be required on the cover of the box to operate the meter display push button from outside the meter box to read the meter display parameters without opening the meter box cover.

5.8 A provision in form of depression should be provided on the meter box cover to download the meter data from the meter using the CMRI probe without opening the meter box cover. This shall be provided in such a way that the optical probe of the CMRI cable can be placed on top of the meter box cover in a suitable depression in the meter box cover which is aligned suitably with the meter optical port. Also the meter box cover shall have provision of sealing this depression. The depression so provided should be covered so that there is no physical access to the meter optical port while using this depression.

5.9 Suitable rubber gasket of round shape all around the cover along its periphery shall be provided for protection.

5.10 After closing and sealing the meter box, it should not be possible to allow entry of any sharp object even forcefully inside the box without breaking base/cover. Suitable overlapping (approx 10 mm) shall be provided between base and cover to avoid access to the meter or its accessories inside the meter box by any means after sealing the box.

5.11 The tolerance permissible in overall dimension of MCB shall be +/- 2%.

6. NAME PLATE AND MARKING:

i.   The following should be suitably marked /printed on the meter box indelibly.

"WESCO" should be written on the top of Meter box
Manufacturer Name:
Year of manufacturing:
WESCO's Logo:
Electrical Danger mark as per IE rules (Red in Colour):
P.O. No. :

7. Tests: All routine acceptance & type tests shall be carried out in accordance with the relevant IS/IEC. All routine & acceptance tests shall be witnessed by the WESCO/ PFCCL authorized representative(s). All the components shall also be type tested as per the relevant

standards. Following tests shall be necessarily conducted on the meter box in addition to others as specified in IS/IEC standards.

7.1 Type test:

S. No	Test/Standard	Requirement
1.	Protection against electric shock (IS:14772 -2000)	Enclosure shall be so designed that when it is mounted for normal use, the live parts of any correctly installed accessories or any parts of these accessories which may become live due to a fault shall not be accessible.
2.	Resistance to ageing, humid conditions, Ingress of solid objects and to harmful ingress of water (IS:14772 -2000)	Resistance to Ageing: Enclosure shall be kept in a heating cabinet with temp 70 ±2 C° for 7 days as per IS. After completion of the test, the enclosure shall not show any cracks. **Humid conditions:** Enclosure shall be kept in a cabinet with humidity between 91 to 95 % for 7 days as per IS. After completion of the test, enclosure shall not show any damage. **Resistance against ingress of solid objects and to harmful ingress of water:** Enclosure shall be subjected to test for degree of protection (IP 55) as per IS 12063.
3.	Mechanical strength/Impact Resistance Test (IS:14772 2000)/(UL:746C)	The sample shall be subjected to Impact resistance test as per the respective standards and shall not show occurrence of any of the following: 1.Making uninsulated live parts accessible to contact. 2. Producing a condition that might affect the mechanical performance of the enclosure. 3. Producing a condition that would increase the likelihood of an electric shock.
4.	Resistance to heat /Ball Pressure Test (IS:14772 -2000)	The test shall be made on one sample in a heating cabinet at a temp of 125 ±2°C as per IS. After completion of test , the diameter of the impression caused by the ball shall be measured and should not exceed 2 mm.
5.	Resistance to Abnormal heat and fire/ Glow wire test (IS: 14772-2000)	Parts of insulating materials which might be exposed to thermal stresses due to electric effects shall not be affected by abnormal heat and by fire. The compliance shall be checked by means of the glow wire test performed at 650°C, according to IS 11000 (Part 2/section 1) with no flame and glowing.
6.	Resistance to Tracking (IS 14772-2000)	The sample when tested as per clause no 17 of IS: 14772, shall show no flashover after completion.
7.	Flammability test (IS:.11731(Part II) 1986)/U L:94)	The sample shall comply to flammability requirements of category FVO/ Vo as per respective standards.
8.	Test for self-extinguishing Property (IS:4249-1967)	The sample when tested as per clause 3.5.1 of IS 4249 shall comply to the specified requirements.
9.	Test for water absorption (IS:5133 (Part-II)-1969)	The sample shall be heated to a temperature of 50±3°C for 24 hours, as per IS and after completion, the water content absorbed should not be more than 1%.

10.	UV Light Exposure (UL-746C)	The sample when exposed to UV light as per the defined test method, shall comply to the following a) **Physical Properties:** The average value of physical properties after the UV light exposure shall not be lower than 70% of its initial value (without UV aging) i.e. the variation shall not be more than 30%. b) **Flammability Test:** After the UV light exposure, the flammability requirement of FVO shall remain unchanged. c) **Flexural Strength:** After the UV light exposure, Flexural strength shall not be lower than 70% of its initial value (without UV aging) i.e. the variation shall not be more than 30%.

7.2 **Routine tests:**
1. Marking
2. Visual Examination and Dimensions
3. Protection against electric shock

7.3 **Acceptance tests:**
1. Marking
2. Visual Examination and Dimensions
3. Protection against electric shock
4. Mechanical strength/Impact Resistance Test
5. Resistance to Abnormal heat and fire / Glow wire test
6. Flammability test

8. PACKING:

Bidder shall ensure that all the equipment's covered under this specification shall be prepared for rail/road transport in a manner so as to protect the equipment's from damage in transit.

9. GUARANTEED TECHNICAL PARTICULARS:

No.	Particulars	Unit	Requirement	Bidders to confirm
1	Application		Outdoor	
2	Degree of protection		IP 55	
3	Flammability requirement		FVo	
4	Grade of Material		Polycarbonate with fire retardant, Self-Extinguishing, UV Stabilized and anti-oxidation properties.	
5	Material a) Base b) Cover		a) Base : Polycarbonate Lexan 943 A or equivalent Grade with dark grey colour b) Cover : Polycarbonate Lexan 943 A or equivalent Grade transparent	
6	Thickness of box a) Base & Cover	mm	Base : 3mm Cover 2.5 mm	
7	Material of the gasket		Rubber Gasket	
8	Material withstand temperature	°C	125°C	
10	Construction features of the box			
a)	Clearance from Meter surface			

	: (minimum) Left , Right side : 30 mm Bottom : 70 mm Front & back : 10 mm Top : 20 mm			
b)	Display Push button operating arrangement at cover of the box			
d)	Sealing arrangement (with latch)		2 Nos.	
e)	Hinges		2 Nos.	
f)	Colour of Meter Box (Base & Cover)		Base : Dark Grey Cover : Transparent	
g)	No. of holes for fixing the meter box		4 Nos.	
h)	Total no. of fixing screws to be provided		4 Nos.	
i)	Overlapping length between base & cover	mm	Approx. 10 mm	
j)	Incoming & outgoing cable holes		2 Nos. to be provided	
k)	Weight of complete box in Kg. with +/- tolerance		Please confirm	
l)	Whether recyclable material		Please confirm	

Technical Specifications for Polycarbonate Meter Box for Three Phase Meter

1. **SCOPE:**

This specification covers the technical requirements of design, manufacture, testing at manufacturer's works, packing, forwarding, supply and unloading at store/site and performance of Three phase meter box intended to contain one number Three phase whole current energy meter complete with all accessories for trouble free and efficient operation.

2. **APPLICABLE STANDARDS: -**

The equipment covered by this specification shall unless otherwise stated, be designed, manufactured and tested in accordance with the latest edition of the following Indian/International standards and shall conform to the regulations of the local statutory authorities.

a)	IS: 14772-2000	General requirements for enclosures for accessories fo household and similar fixed electrical installations specifications.
b)	IS: 11731(Part-II) - 1992	Methods of test for determination of Flammability of solid electrical insulating material when exposed to an igniting source.
c)	IS 4249-1967	Specification for classification and method of test for non ignitable and self-extinguishing properties of solid electrica insulating materials.
d)	IS 5133(Part II)-1969	Specification for boxes for the enclosure of electrica accessories.
e)	IS 2500(Part 1)-2000	Sampling procedure for inspection by attributes part-1 sampling schemes indexed by acceptance quality limit (AQL for lot by lot inspection.
f)	UL 746-C	Polymeric Materials in Electrical equipment.

3. **CLIMATIC CONDITIONS OF THE INSTALLATION:**

The meter box shall be suitable for following conditions:-
i)   Minimum Ambient temperature: (-) 35°C.
ii)   Maximum Ambient temperature: 55°C.
iii) Relative humidity : 26%
iv) Maximum relative humidity : upto 95%
v)   Average Annual Rain fall: 150cm

4. **GENERAL TECHNICAL REQUIREMENTS:**

SI.	DESCRIPTION	REQUIREMENT
1	Application	Outdoor
2	Degree of protection	IP 55
3	Flammability requirement	FVo
4	Grade of material	Polycarbonate with fire retardant, Self-Extinguishing, UV stabilized and anti-oxidation properties.

5	Material
	    a) Base:
	    b) Cover:
		The meter box (base and Cover) shall be made of polycarbonate material which complies following properties;
		Meter box shall be weather proof, capable to withstanding temperatures of boiling water for 5 minutes continuously without distortion or softening. It shall withstanding Glow wire test at 650^0C as per IS : 14772.
		Polycarbonate Lexan 943 A or equivalent Grade with dark grey color. Polycarbonate Lexan 943 A or equivalent Grade with Transparent configuration.

6	Material of the gasket	Rubber gasket
7	Material withstand temperature.	125 Deg C ± 2 Deg C

5. GENERAL CONSTRUCTIONS:

5.1 The meter box shall be weather proof, tamper proof and shall be made of Injection moulded polycarbonate material with self-extinguishing, UV stabilized, recyclable and Anti oxidation properties. The box shall be of adequate strength, unbreakable and shall be made in two pieces (base and cover).The base shall be dark grey color whereas the cover shall be completely transparent.

The meter Box shall have roof tapering down to both the sides for easy flow of rainwater.

The thickness of the box shall not be less than 3mm on the load bearing side and other sides, door and roof shall not be less than 2.5 mm.

The box shall be designed in such a way that there should be the following clearances between the meter and the Meter box:

o   Between Sides of the meter body and meter box – 30 mm minimum (excluding the flanges on the meter body for sealing screws.)

o   Between the lower edge of the terminal block and the Meter box – 70 mm Minimum

o   Between the back of the meter and the meter box base – 10 mm Minimum

o   Between the top of the meter and the meter box cover – 30 mm Minimum

The meter box shall have a taper roof for easy flow of rain water and shall have degree of protection IP 55 for affording protection against dust & water.

5.2 The meter base supports inside the box should have adequate strong enough molded supports within the block to avoid damage during tightening of screws and raised by about 10 mm in the box for ease of wiring. While fixing, the meter screws should not protrude outside.

5.3 The design of the meter box shall be such that it may facilitate easy wiring and access to the meter terminals. Nylon gland of internal diameter of approx. 30 mm shall be provided for I/C and O/G cables of size 4C x 35 sq. mm or as approved by the WESCO.

5.4 The box cover shall be fixed to the base through two number hinges (approx. length 30 - 60 mm). The arrangement for hinges shall be provided on the side of the base and shall be such

that it may avoid unauthorized access to inside of the box. Hinges should be outside and enclosed by polycarbonate material and once the box is closed and sealed, hinges should not be approachable. Box cover shall be openable by more than 90 degrees.

5.5 For holding and sealing the box, two U-shaped latches shall be provided. The latch shall be GI sheet with minimum thickness 2 mm, to secure it with the base of the box.. The latch shall be provided along with suitable clamp assembly in base as well as cover, such that these are fully covered by the latch after closing. The clamp along with the latch shall have a sealing hole such as to provide a through sealing arrangement in the assembly.

5.6 For fixing the box to flat wall or wooden board 4Nos. holes (2Nos.key holes at top) of minimum 6 mm dia. shall be provided at the four corners of the meter box. For fixing of Box on flat wall, 4 Nos. 5mm diameter 40mm long pan head self- taping screws and washers shall be provided by the supplier with every Box. 4 Nos. plastic fixing plugs of 50mm length suitable for self-tapping screws shall also be provided (Fixing clamp and accessories for pole mounting/ wall mounting, shall be in the scope of Agency, who shall be installing the meters in the field based on the actual site conditions & pole sizes. These are not to be supplied with the boxes).

5.7 Push button arrangement shall be required on the cover of the box to operate the meter display push button from outside the meter box to read the meter display parameters without opening the meter box cover.

5.8 A provision in form of depression should be provided on the meter box cover to download the meter data from the meter using the CMRI probe without opening the meter box cover. This shall be provided in such a way that the optical probe of the CMRI cable can be placed on top of the meter box cover in a suitable depression in the meter box cover which is aligned suitably with the meter optical port. Also the meter box cover shall have provision of sealing this depression. The depression so provided should be covered so that there is no physical access to the meter optical port while using this depression.

5.9 Suitable rubber gasket of round shape all around the cover along its periphery shall be provided for protection.

5.10 After closing and sealing the meter box, it should not be possible to allow entry of any sharp object even forcefully inside the box without breaking base/cover. Suitable overlapping (approx 10 mm) shall be provided between base and cover to avoid access to the meter or its accessories inside the meter box by any means after sealing the box.

5.11 The tolerance permissible in overall dimension of MCB shall be +/- 2%.

6. NAME PLATE AND MARKING:

The Purchase order No. & Date, Month & Year of manufacture and the word "DANGER" (with red color) shall be engraved/printed or marked on the top cover of the box. The manufacturer's name &"Property of WESCO" shall be engraved/printed or marked on the bottom half of the box such that it shall not be removed easily. Nameplate will be made of Aluminum sheet & fixed through rivets.

7. Tests: All routine acceptance & type tests shall be carried out in accordance with the relevant IS/IEC. All routine & acceptance tests shall be witnessed by the PFCCL/ WESCO authorized representative(s). All the components shall also be type tested as per the relevant standards. Following tests shall be necessarily conducted on the meter box in addition to others as specified in IS/IEC standards.

7.1 Type test:

S. No	Test/Standard	Requirement
1.	Protection against electric shock (IS:14772 -2000)	Enclosure shall be so designed that when it is mounted for normal use, the live parts of any correctly installed accessories or any parts of these accessories which may become live due to a fault shall not be accessible.
2.	Resistance to ageing, humid conditions, Ingress of solid objects and to harmful ingress of water (IS:14772 -2000)	Resistance to Ageing: Enclosure shall be kept in a heating cabinet with temp 70 ±2 C° for 7 days as per IS. After completion of the test, the enclosure shall not show any cracks. **Humid conditions:** Enclosure shall be kept in a cabinet with humidity between 91 to 95 % for 7 days as per IS. After completion of the test, enclosure shall not show any damage. **Resistance against ingress of solid objects and to harmful ingress of water:** Enclosure shall be subjected to test for degree of protection (IP 55) as per IS 12063.
3.	Mechanical strength/Impact Resistance Test (IS:14772 2000)/(UL:746C)	The sample shall be subjected to Impact resistance test as per the respective standards and shall not show occurrence of any of the following: 1. Making uninsulated live parts accessible to contact. 2. Producing a condition that might affect the mechanical performance of the enclosure. 3. Producing a condition that would increase the likelihood of an electric shock.
4.	Resistance to heat /Ball Pressure Test (IS:14772 -2000)	The test shall be made on one sample in a heating cabinet at a temp of 125 ±2°C as per IS. After completion of test , the diameter of the impression caused by the ball shall be measured and should not exceed 2 mm.
5.	Resistance to Abnormal heat and fire/ Glow wire test (IS: 14772-2000)	Parts of insulating materials which might be exposed to thermal stresses due to electric effects shall not be affected by abnormal heat and by fire. The compliance shall be checked by means of the glow wire test performed at 650°C, according to IS 11000 (Part 2/section1) with no flame and glowing.
6.	Resistance to Tracking (IS 14772-2000)	The sample when tested as per clause no 17 of IS: 14772, shall show no flashover after completion.
7.	Flammability test (IS:.11731(Part II) 1986)/U L:94)	The sample shall comply to flammability requirements of category FVO/ Vo as per respective standards.
8.	Test for self-extinguishing Property (IS:4249-1967)	The sample when tested as per clause 3.5.1 of IS 4249 shall comply to the specified requirements.
9.	Test for water absorption (IS:5133 (Part-II)-1969)	The sample shall be heated to a temperature of 50±3°C for 24 hours, as per IS and after completion, the water content absorbed should not be more than 1%.

10.	UV Light Exposure (UL-746C)	The sample when exposed to UV light as per the defined test method, shall comply to the following
		a) **Physical Properties:** The average value of physical properties after the UV light exposure shall not be lower than 70% of its initial value (without UV aging) i.e. the variation shall not be more than 30%.
		b) **Flammability Test:** After the UV light exposure, the flammability requirement of FVO shall remain unchanged.
		c) **Flexural Strength:** After the UV light exposure, Flexural strength shall not be lower than 70% of its initial value (without UV aging) i.e. the variation shall not be more than 30%.

7.2 Routine tests:
1. Marking
2. Visual Examination and Dimensions
3. Protection against electric shock

7.3 Acceptance tests:
1. Marking
2. Visual Examination and Dimensions
3. Protection against electric shock
4. Mechanical strength/Impact Resistance Test
5. Resistance to Abnormal heat and fire / Glow wire test
6. Flammability test

8.0 PACKING:

Bidder shall ensure that all the equipment's covered under this specification shall be prepared for rail/road transport in a manner so as to protect the equipment's from damage in transit.

9.0 GUARANTEED TECHNICAL PARTICULARS:

No.	Particulars	Unit	Requirement	Bidders to confirm
1	Application		Outdoor	
2	Degree of protection		IP 55	
3	Flammability requirement		FVo	
4	Grade of Material		Polycarbonate with fire retardant, Self-Extinguishing, UV Stabilized and anti-oxidation properties.	
5	Material c) Base d) Cover		Base : Polycarbonate Lexan 943 A or equivalent Grade with dark grey colour Cover : Polycarbonate Lexan 943 A or equivalent Grade transparent	
6	Thickness of box a) Base & Cover	mm	Base : 3mm Cover 2.5 mm	
7	Material of the gasket		Rubber Gasket	
8	Material withstand temperature	°C	125°C	
10	Construction features of the box			

No.	Particulars	Unit	Requirement	Bidders to confirm
a)	Clearance from Meter surface : (minimum) Left , Right side : 30 mm Bottom : 70 mm Front & back : 10 mm Top : 30 mm			
b)	Display Push button operating arrangement at cover of the box			
d)	Sealing arrangement (with latch)		2 Nos.	
e)	Hinges		2 Nos.	
f)	Colour of Meter Box (Base & Cover)		Base : Dark Grey Cover: Transparent	
g)	No. of holes for fixing the meter box		4 Nos.	
h)	Total no. of fixing screws to be provided		4 Nos.	
i)	Overlapping length between base & cover	mm	Approx. 10 mm	
j)	Incoming & outgoing cable holes		2 Nos. to be provided	
k)	Weight of complete box in Kg. with +/- tolerance		Please confirm	
l)	Whether recyclable material		Please confirm	

TECHNICAL SPECIFICATION OF METER BOX FOR HT METERS

For HT Meters, the specifications of Meter Box for Three Phase Meters may be used.

TECHNICAL SPECIFICATION OF METER BOX FOR LT CT METERS

For LT CT meters, the Bidder has to supply Meter Box of polycarbonate material as per its own specifications ensuring proper communication from the meters. However, the specifications of the boxes have to be submitted to WESCO after award of the project to the selected Bidder and before supply of meters.

Annexure J   Standard Operating Procedure for replacement of existing/ old meters of WESCO

1. SGIA will contact Nodal Officer, Rourkela Smart Grid Project, WESCO for replacement of existing/ old meters with smart meters.

2. The Nodal Officer shall furnish the list of consumers of Rourkela Smart City area whose meters will be replaced (i.e. soft copy and signed copy) to SGIA with following details:

   a. Name of Division
   b. Name of Section
   c. Name of Binder
   d. Consumer Name
   e. Existing consumer number
   f. Consumer Address details
   g. Tariff category
   h. Date of supply
   i. CD in KW
   j. The list would be prepared @TRF-wise and Feeder-wise, if possible.

3. Upon receipt of the above list, SGIA shall undertake a survey at its own level to assess the quantity of meters and quantity of accessories required Binder wise & Section wise.

4. The officials of SGIA would be issued Identity Cards with the signature of Authorized Officer/ Nodal officer of the project. This would be done at the earliest because SGIA officials would need to carry the same during the time of survey also. The Identity Card would contain the following:

   a. Name of SGIA with Logo
   b. Photograph of person
   c. Name of person
   d. Purpose of assigned work
   e. Valid up to
   f. Signature of Authorized Officer/Nodal Officer, WESCO.

5. At least 15 days before the scheduled date of supply, SGIA shall offer for inspection of each lot, 10 random samples for every 10000 numbers of meter to be selected for type testing.

6. The agency shall finalize the installation schedule in consultation with the Executive Engineers of divisions and submit it to the Project Manager /Nodal Officer, Rourkela Smart Grid Project, WESCO.

7. Once the Work starts, the section officer of the area shall intimate the details of new eligible applicant to the Project Manager /Nodal Officer. He will submit it to the SGIA for new meter installation .The SGIA will fix service connections and meters in their premises and intimate details to the concern section officer for bringing them in to the billing fold.

8. SGIA shall take two clearly visible photographs of the meter and installation before removing the old meter (in the first photograph would be of the meter closely with visible meter serial number and reading and the second photograph would be from a distance to reflect the positioning and connection). Similarly photographs should be taken by SGIA after new meter installation capturing the meter serial number and initial reading. The photos should be submitted to ESO/SDO concern on daily basis.

9. During installation of Smart Meters, manual noting in paper should not be done. An App needs to be provided by the SGIA to WESCO during installation. The bill file shall be loaded in the app. During replacement of existing meters, the Final Reading will be noted by the app and the photograph of the old meter will be taken. The app will take the Initial Reading of the new meter along with the photograph. This app will be integrated with the MDM and would be in synchronisation with existing billing system of WESCO. All the data shall be send by the app to the MDM and automatically 3 print out will also be generated. The data captured by the app shall be stored in the MDM and shall also be sent for approval automatically. This will make the process faster and there will be less chance of mistakes due to less human intervention.

10. In case meter is already fixed on verandah/ outside wall of consumer, then new meter shall be fixed at the same location. In case meter is fixed inside the premises then it is to be shifted to a suitable place on the outside wall/verandah etc. The meter should be installed in such a way that display should not be at more than 6ft height (Human Eye level).

11. After installation of meters, SGIA shall seal it immediately and obtain the signature of consumer or his/her representative. The installation and sealing report will be jointly signed by representative of both the agency and the consumer and shall be submitted to ESO/SDO every day and to keep a record of it.

12. In case any meter is found to be working properly but is mentioned as defective in the list then the SGIA should not replace the same but bring it to the knowledge of area ESO/SDO as well as Project Manager /Nodal Officer Rourkela Smart Grid, WESCO. Similarly, if any meter is found to be defective but not mentioned in the list It should be brought to the knowledge of same officials of WESCO only after approval from Project Manager /Nodal officer in writing the same may be replaced.

13. In case of replacement of service wire, it will be done as per suggestion of SGIA and approval of Project Manager/ Nodal Officer. SGIA shall prepare the list of service wire replacement DTR-wise and submit to both ESO and SDO. The ESO/SDO shall arrange shut-down DTR-wise and work to be taken up accordingly.

14. In case any consumer does not allow replacement of meter/ service wire, the representative of SGIA should move on to the other consumers without completely stopping the process. At the end of the day, SGAI shall submit the list in writing of each resistive consumer to ESO/ SDO. It shall be the responsibility of concerned SDO to resolve the issue and if necessary, FIR has to be lodged by the concern ESO/SDO (on ground of obstructing official work and other clauses). However, in case of manhandling of meter replacement personnel by any consumer or others, the FIR is to be lodged by the affected person.

15. Discom shall ensure availability of power supply in area installation area during installation

period to maintain speed of installation and to avoid idle labour expenses.

16. SGIA shall record all parameters of new meters in the format prescribed by WESCO. These reports are to be submitted to the ESO/SDO twice every week. This should be kept in subdivision for all future reference and regulatory /legal compliance.

17. A smart meter installation is not complete without verification using the meter's multi-function display. After power is applied to the device, every smart meter automatically goes through a verification process to determine if the meter is operating properly. This verification table information can be used to confirm that the meter is operating properly.

18. After the smart meter's display has been inspected to confirm there are no errors or alarms, the Utility can be confident that the smart meter installation has been successfully completed.

19. After meter installation, customer identification no., meter ID, its hardware & software configuration, name plate details, make, type i.e. 1 Phase or 3 Phase, etc. (as per requirement of utility) shall be updated in DCU / HES / MDM. The information would also be updated on the portal/ app for providing information to consumers.

Annexure K   General requirement for common pluggable communication module for Smart Meters

Considering that the new Smart Meters may use different types of communication technologies (RF/PLCC/Cellular, etc.), thus in order to enable different communication modules to be used in the same meter, it is necessary to use a universal interface and a particular size irrespective of the choice of communication technology that defines the dimensions of the communication slot as well as physical placement and location of connectors. The following example recommendations will go a long way in assuring interoperability whilst still complying with the provisions of IS 16444 and IS 15959 standards:

Part I

1. **Recommended Module Placement location**
   In order to improve the Radio Performances of any of the wireless technologies encompassing but not limited to Cellular, RF and / or RF mesh, it is recommended to place the communication module anywhere on the accessible part of the meter. This will also enable an easy approach to improve antennae performances.
2. Meter shall have the means of tamper detection to record the event(s) of the removal of the communication module set from the meter, irrespective of whether the meter is in power on (has supply) or powered off (no supply) condition.
3. The Module shall be hot swappable and shall fit snugly inside the meter box, so that the same IP class of the meter is maintained.
4. A transparent cover may be used for the purpose,

   a. To have a sealing arrangement with the meter body as well as

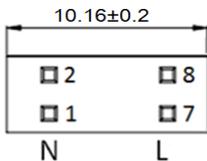   b. For easy viewing of LED indicators and antenna assembly without having to open the cover.

Part II
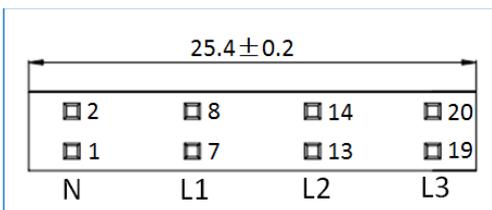
AC power interface:

In the event of PLC communication being chosen as the only or one of the choices, the following arrangement of connector and pinouts need to be provisioned on the communication module.
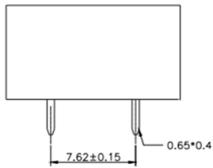
Female connector

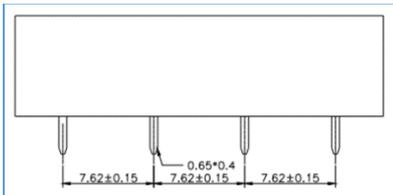1. Front View:
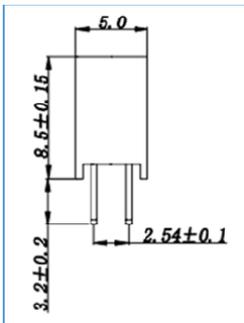

Single phase meter

Poly phase meter

2、Top View:

Single phase meter


Poly phase meter

3、Side View:

 Pin to Pin distance should be: 7.62mm (Standard Pin connector)

Communication interface:

The meter shall have a slot of an appropriate size to allow for the pluggable communication module (such as but not limited to NAN /WAN, dual mode RF, Dual Technology, cellular etc.) to be fit in to the meter. The meter shall provide a 14-pins Female socket connector (2*7pin, 2.54mm). The socket shall be selected and positioned to ensure that the male pins on the communication module can connect reliably and easily connect with the female contactors on the meter.
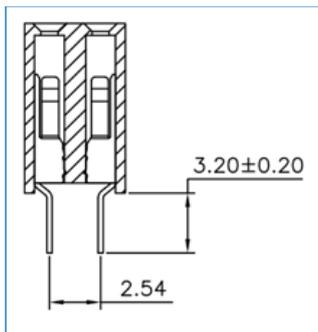
Female connector

1. Front View：

2. Top View:

8.50

2.54   0.64*0.25±0.05

3. Side View:

3.20±0.20

2.54
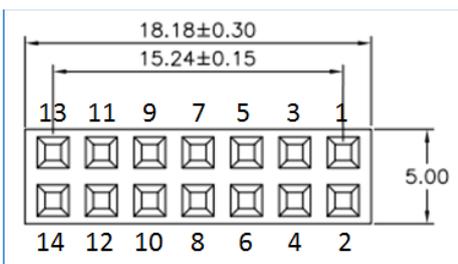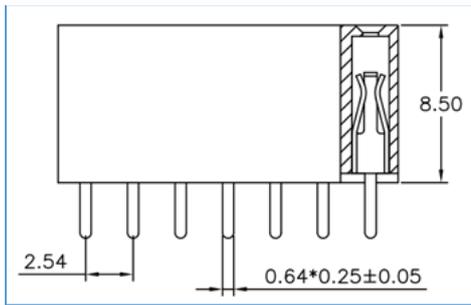
PIN Outs may be provided as per below details

| Pin No	Name	Input/output	Description
1	Reserved	/	/
2	Reserved	/	/
3	Power EN	Output	Control the module's power supply
4	Reserved	/	/
5	Reserved	/	/
6	Meter TXD	Output	To Module UART port RXD, Min.38400
7	Meter RXD	Input	From Module UART port TXD, Min.38400
8	Reserved	/	/
9	RTS	Input	Input digital signal from module
10	RST	Output	Reset signal for module
11	CTS	Output	Output digital signal to module
12	+Vdc	Power	As per IS16444
13	GND	Common	Ground Reference Potential
14	GND	Common	Ground Reference Potential

Part III

The following reference size may be adhered to irrespective of a single or multiple communication options provisioned on the same module. This standard form factor and dimensions will enable physical and functional interoperability with different makes of meters.

A. Module 3-D views (For Representational Purpose Only)

1. Module in meter (Top View)
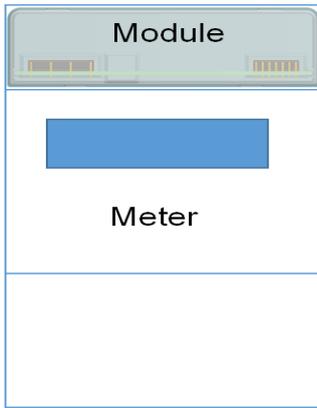
2. 3D View
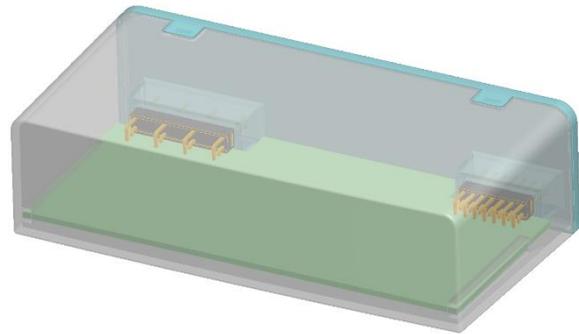
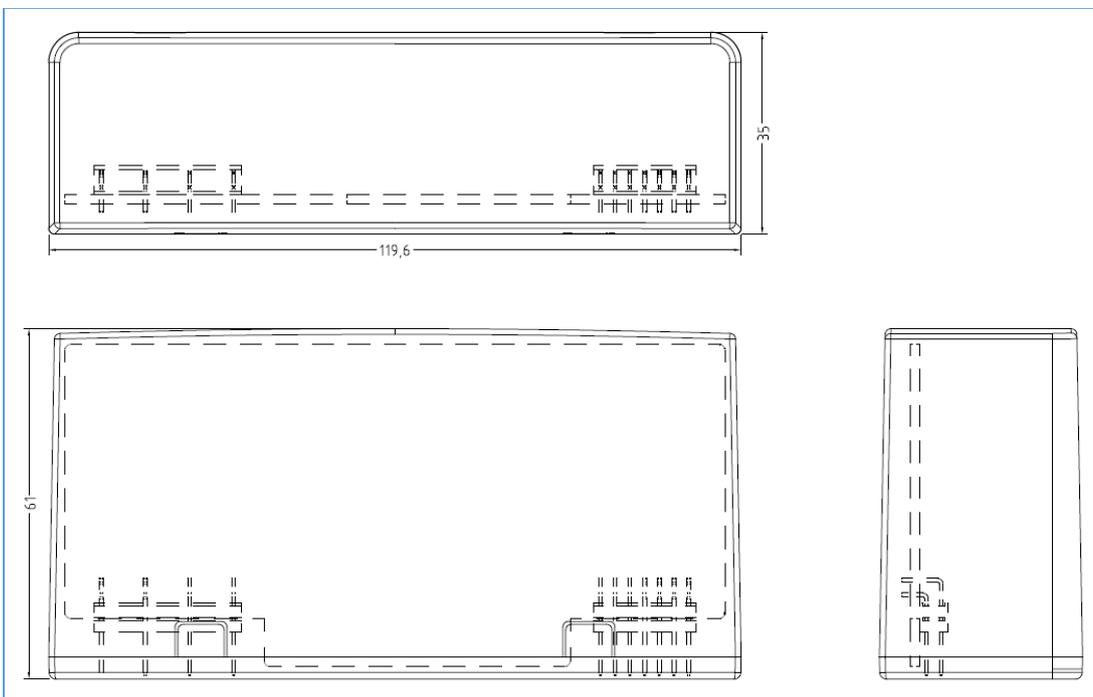
3. Front View

4. Back View

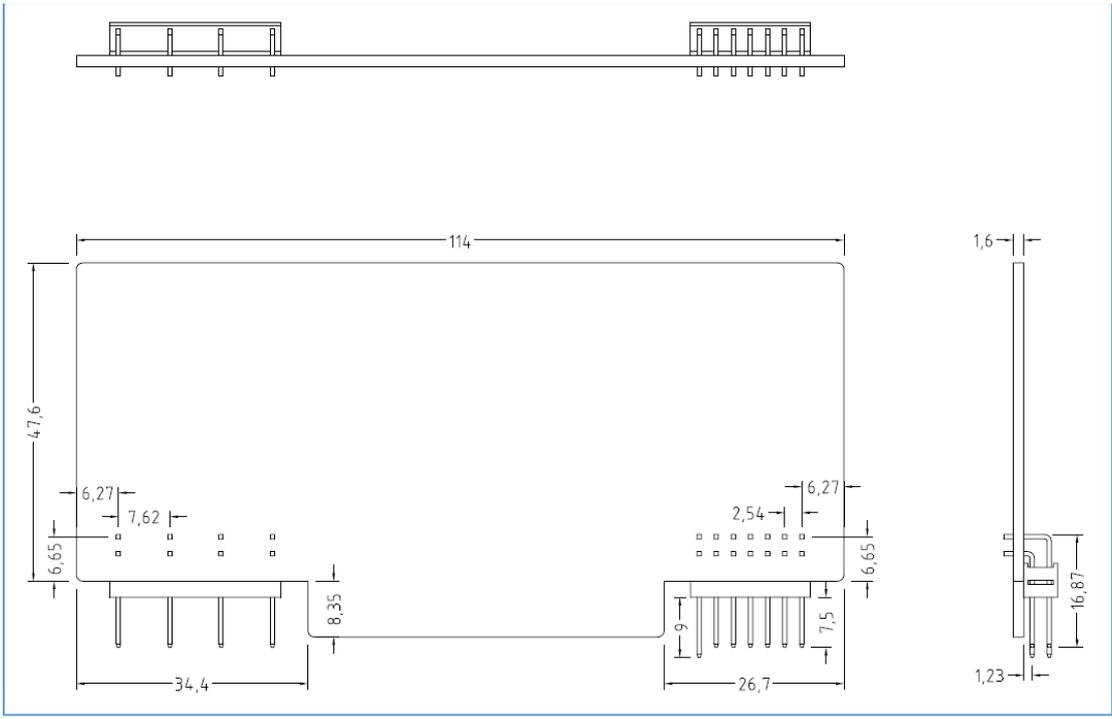5. Side View

6. Top View

7. Bottom View

B. Module Dimensions

Overall view of the module:

Overall view of the module's PCBA:

Notes: Module Reference Sizes: unit mm.

Annexure L   System Use Cases

The objective of the Demand Response iterated in the RFP is to optimal utilization of energy resources by uniform distribution of load across the day, to save additional investment in capacity addition within the utility, improved access of power to rural areas, reduction in technical losses, enhanced consumer satisfaction by load curtailment in place of load shedding.

S.No	Functional requirement	Description of Functional requirement
1.	Load Curtailment event in place of Load Shedding	System will determine based on day ahead schedule for available generation capacity and load forecasting the load curtailment events. Advance notice will be sent to a group of consumers affected by this load curtailment. DR system will send the load curtailment command to the MDM. The MDM will forward this command to the appropriate AMI Head-End.
2.	DR Program Commencement	Once the consumer is set up with all the devices necessary, the consumer details will be sent to DR system. Premium charges for assured power supply with SLA and/or Rebates and incentives can be given to consumers who participate in DR programs.
3.	Real time Pricing	Utility shall be able to send real-time pricing signals to end consumers/ AMI system
4.	Curtailment due to Contract Violation	Utility limits consumer's load due to reasons like exceeding contract load
		Alarms (visual and audio) shall be provided in case of load violation (in home device, Email, SMS etc.). The billing system shall be notified of the load violation, and the corresponding charges shall be applied to consumer (based on tariff rules).
5.	Demand side Management	In every 15-minute interval Meter data should be captured, Confirmation of action taken for demand response should be mentioned as well as monitoring of historical Consumer Load Profile should be done.
6.	Load Monitoring at Demand side	Daily Meter Reading, Status and associated details capturing for records of consumer consumption data, TOU details, real time trends and Load profile Details. Along with this whenever there is a load violation event recorded in the meter, the information is sent to the control center
7.	Initiate Direct Load Control Event	Utility calls a Direct Load Control Event using the Peak Load Management (PLM) Application and executes through head-end by sending a load control signal to Smart Appliances thru HAN/Smart Meter or other means
8.	Energy accounting system	**Register and Interval based accounting:** **Register based**

S.No	Functional requirement	Description of Functional requirement
		Register based accounting supports requirements for prepaid energy accounting based on register reads.
		It includes billing cycle data services that deliver billing determinants via an interface to CIS/Billing on the billing cycle date and on request when special reads are required. A Billing Determinant Calculator provides the flexibility to compute the billing determinant values based on utility defined formulas. Formulas are built around logical and arithmetic operators, and can contain other billing determinants, constants, and consumer functions.
		Bi-directional
		MDM should support bi-directional metering by processing the delivered and received channels for a given meter in two separate channels.
		Net Metering (using Virtual channel)
		MDM should support net metering by processing the delivered and received channels from the meter/recorder and calculating a net amount. The calculated net will be stored onto a virtual channel. MDM should provide full tracking, management, and storage of usage data related to each data channel. This allows summation of usage data separately for each data channel.
		Usage Calculated from Register Reads
		MDM can create usage data from register reads received from AMI systems or gathered manually through HHUs. MDM will calculate the difference between the current bill period register read and the previous bill period register read, applying the ratio required converting to the correct kWh usage. Rollover conditions are also considered when computing usage. The calculated usage is stored in the billing table and accessible to all applications that require the data.
		Interval Billing:
		The Interval Billing should include all of the functionality offered in the Register Billing in addition to support Advanced Billing Determinants (ABD) calculated from interval reads.
		As interval data is retrieved by the AMI systems, the Advanced Billing Determinant (ABD) engine should process the interval reads into daily and billing cycle usage-based billing determinants (as compared to register-based billing).
		For example, if 15 min interval data is retrieved by the system, MDM calculates the proper billing determinant which is based on RTP/ Time-of-Use (TOU) tariff, then ABD engine will make this computation based on tariff configuration data in the database.

S.No	Functional requirement	Description of Functional requirement
		Then it stores this daily data set (RTP/TOU values with usage details for each), along with the interval data in the Metered Usage Data Repository (MUDR). On each billing cycle, the ABD engine will summarize the RTP/TOU and demand data for each period over the requested billing span and deliver these billing determinants to the billing system. By performing the billing determinant summations daily, MDM support end-user presentation of "month-to-date" information as well as spread computational loads over time (including weekends).