

Amendment-3

Ref.GEM BID NUMBER : GEM/2022/B/2101629- "Appointment of Advanced Metering Infrastructure (AMI)-Service Provider for providing Smart Meter and Head End System for 60,000 End-points in UT of Ladakh on DBFOOT Basis and Spot Reading, Spot Billing & Collection for areas with No/Intermittent Network"

Background:

For reaping maximum benefit from the AMI Solution being deployed under the present RfP, it has been considered prudent to include Meter Data Management System (MDMS) thus ensuring end-to-end solution of the AMI implementation for 60,000 endpoints in UT of Ladakh.

In view of the above, relevant Amendments & Addendums to different sections is enclosed herewith and to be considered by bidder during submission of RFP:

1. Section – 2: Eligibility and Qualification Requirements
Addendum to Clause 8.2

C. Meter Data Management System (MDMS) solution provider – Technical Requirements	
C1	<p>The proposed MDM solution should have been successfully integrated with at least 2 (two) nos. of different HES solutions in Indian/ Global Utility(ies) (power/ water/ natural gas/ telecom) in last 7 (seven) years which are in operation for at least 1(one) year.</p>
C2	<p>The proposed MDM solution should have been successfully integrated with at least 2 (two) nos. of different Billing Systems in Indian/ Global Utility(ies) (power/ water/ natural gas/ telecom) or with Billing/ Other IT systems of 2 (two) different Indian/ Global Utility(ies) in last 7 (seven) years which are in operation for at least 1(one) year.</p>
C3	<p>Should have CMMi (Capability Maturity Model Integration) Level 3 or IEC/ISO 27001 Certification (Software Development & Customization), as the requirement</p>
	<p>a) References along with requisite contract/ Purchase Order (PO)/ Work Order (WO). The references should indicate client name, scope of work, Project start date (as per the format prescribed in Form 13 given in Section 4);</p> <p>b) Documentary evidence of completion of the Project or completion of Go-live status (i.e., Go-live certificate, UAT testing certificate etc.) of the respective project as per the definition of Go-Live/ UAT specified therein or other documentary evidence indicating completion (e.g., proof of payment received/ proof of asset capitalized in books of accounts (as applicable) and client certificate for supply of material or similar proofs) along with contact details of the client</p> <p>c) Certificate / report issued by Client / HES OEM/ solution provider. <i>In case the MDMS solution provider, has integrated with their own HES, then a self-certification shall be provided.</i></p> <p>d) Client certificate and other documentation for implementation performance/ operation.</p>
	<p>Copy of valid certificate</p>

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**2. Section 3: Instructions to Bidders and Bid Data Sheet
Addendum to Clause B: Bid Data Sheet**

16	<p>For Meter Data Management System (MDMS) solution provider Eligibility [Refer Clause 8.2 C1-C3 in Section 2]:</p> <ul style="list-style-type: none"> a) References along with requisite contract/ Purchase Order (PO)/ Work Order (WO). The references should indicate client name, scope of work, Project start date (as per the format prescribed in Form 13 given in Section 4); b) Documentary evidence of completion of the Project or completion of Go-live status (i.e., Go-live certificate, UAT testing certificate etc.) of the respective project as per the definition of Go-Live/ UAT specified therein or other documentary evidence indicating completion (e.g., proof of payment received/ proof of asset capitalized in books of accounts (as applicable) and client certificate for supply of material or similar proofs) along with contact details of the client c) Client certificate and other documentation for implementation performance/ operation. d) A valid ISO certificate or CMMi certificate on or before the date of submission. e) A MAF signed on the letterhead of the MDMS Solution provider, addressed to the Sole/ Lead Bidder (as per the format prescribed in Form 22). 	4
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**3. Section 4: Bidding Forms- Technical Proposal
Addendum to Clause: Checklist of Required Forms**

Sr.	Document	Attached?(Yes/ No)	For Official Use
16	<p>For Meter Data Management System (MDMS) solution provider Eligibility [Refer Clause 8.2 C1-C3 in Section 2]:</p> <ul style="list-style-type: none"> a) References along with requisite contract/ Purchase Order (PO)/ Work Order (WO). The references should indicate client name, scope of work, Project start date (as per the format prescribed in Form 13 given in Section 4); b) Documentary evidence of completion of the Project or completion of Go-live status (i.e., 		

	<p>Go-live certificate, UAT testing certificate etc.) of the respective project as per the definition of Go-Live/ UAT specified therein or other documentary evidence indicating completion (e.g., proof of payment received/ proof of asset capitalized in books of accounts (as applicable) and client certificate for supply of material or similar proofs) along with contact details of the client</p> <p>c) Client certificate and other documentation for implementation performance/ operation.</p> <p>d) A valid ISO certificate or CMMi certificate on or before the date of submission.</p> <p>e) A MAF signed on the letterhead of the MDMS Solution provider, addressed to the Sole/ Lead Bidder (as per the format prescribed in Form 22).</p>		
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4. Section 4. Bidding Forms- Technical Proposal
Form 1: List of Consortium Members/ Sub-Contractor(s)

Amended Table.

The Bidder shall identify below the Consortium Members/ Sub-contractor(s) for major Project items. For sub-contractor a Letter of Intent must be provided

Major Project Item	Proposed Consortium Member / Sub-Contractor(s)	Nationality
Meter Manufacturer		
Communication Provider		
System Integrator		
MDM Provider		
HES Provider		
Cloud Service Provider / Managed Service Provider		
RF Solution Provider (if any)		
[Other] (if any)		

5. Section 4. Bidding Forms- Technical Proposal
Form 14: List of materials & Services

Addendum to Table 2: Bill of Materials and Services for Hardware & Software

AMI IT (Hardware, Software) at DC & DR Centers and Integration Services

6. Section 6: Project Requirements

Addendum to Clause 1.4: Brief scope of work

Meter Data Management system (MDM) with prepaid functionality and deployment on cloud as per Clause 2.4 of this Section.

7. Section 6: Project Requirements

Clause 2.2 Communication Infrastructure

Amendment to Sub-Clause 2.2.1: General Requirements

The redundancy mechanism of HES and MDM and their disaster recovery plan shall also be highlighted by the AMISP. AMISP shall satisfy itself through the operational testing of network as a whole and its element for reliability before starting operations and billing.

8. Section 6: Project Requirements

Addendum to Clause 2.4: Meter Data Management system (MDM) and all its related sub-clauses

The Meter Data Management system (MDM) shall support storage, archiving, retrieval & analysis of meter data and various other MIS along with validation & verification algorithms. The MDM shall be a scalable and COTS product. It shall act as a central data repository with interactive dashboard. MDM 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.

MDM should support the future requirement of utility by way integration with other smart grid functionalities as and when implemented by Utility. In this effort, the methodology as outlined in the approach paper shall be followed.

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.	Collection of Daily Meter Profile			
1.1	At scheduled frequency HES should pull the Daily Meter Data from Smart Meter over communication Channel	HES	Meter	Meter Number, reading date & time, kW, kVA, kWh, kVAh, PF, Non-critical Event Code / Date
1.2	Meter should send the data to HES. Provision for retrial	Meter	HES	Meter Number, reading date & time, kW, kVA,

Sr.	Use Case Activity Description	Source	Destination	Info Exchanged
	should be there if Meter data is not collected within time. Consumption details including non-critical events will be in 30 min block data, and data could be incremental to what was sent by meter in preceding instance			kWh, kVAh, PF, Non-critical Event Code / Date
1.3	HES should send the data to MDM	HES	MDM	Meter Number, reading date & time, kW, kVA, kWh, kVAh, PF
1.4	MDM should send the required parameter to Prepaid system for daily charge calculation at least once on daily basis	MDM	Prepaid Engine	Meter Number, reading date & time, kW, kVA, kWh, kVAh, PF, Non-critical Event Code / Date
2.	Monthly Billing profile collection			
2.1	Command from Billing system triggered and send to MDM / HES for collection of Monthly billing Data	Billing System	MDM / HES	Meter Number, reading date & time, kW, kVA, kWh, kVAh, PF, Non-critical Event Code / Date
2.2	At scheduled frequency HES should pull the monthly meter data from Smart Meter over the communication channel	HES	Meter	Meter Number, reading date & time, kW, kVA, kWh, kVAh, PF, Non-critical Event Code / Date
2.3	Meter should send the data to HES. Provision for retrial should be there if Meter data is not collected within time.	Meter	HES	Meter Number, reading date & time, kW, kVA, kWh, kVAh, PF, Non-critical Event Code / Date
2.4	HES should decrypt and validate the data collected and send to MDM	HES	MDM	Meter Number, reading date & time, kW, kVA, kWh, kVAh, PF, Non-critical Event Code / Date
2.5	MDM should send the required parameter to Billing system for Monthly Bill calculation	MDM	Billing Engine	Meter Number, reading date & time, kW, kVA, kWh, kVAh, PF, Non-critical Event Code / Date
3.	Remote Meter disconnection			
3.1	Meter disconnect operation command after wallet balance calculation	Prepaid Engine/ Billing system	MDM	Meter Number, group of meters, instruction to close switch

Sr.	Use Case Activity Description	Source	Destination	Info Exchanged
3.2	Disconnection alert sent to consumer	MDM	Billing System	Meter Number, group of meters, instruction to close switch
3.3	Meter disconnection operator command	MDM	HES	Meter number, action (disconnect)
3.4	Consumer meter disconnection	HES	Meter	Meter Number, switch status
3.5	Disconnection Status Update	Meter	HES	Meter Number, switch status
3.6	Disconnection Status Update	HES	MDM	Meter Number, switch status
4.	Remote Meter Reconnection			
4.1	Meter re-connect operation command after wallet recharge Billing	Billing system	MDM	Meter Number, group of meters, instruction to close switch
4.2	Meter re-connect operation command	MDM	HES	Meter Number, group of meters, instruction to close switch
4.3	Consumer meter reconnection	HES	Meter	Meter number, action (reconnect)
4.4	Reconnection Status Update	Meter	HES	Meter number, action (reconnect)
4.5	Reconnection Status Update	HES	MDM	Meter number, action (reconnect)
5.	Utility detects tampering at consumer site			
5.1	High priority events captured by Meter sent to HES as and when occurred	Meter	HES	Meter Number, event date& time, event Code /description
5.2	High priority events reach MDM for further action.	HES	MDM	Meter Number, event date& time, event Code /description
5.3	Share with WFM to Notify utility personnel for site inspection	MDM	WFM	Consumer number, Meter Number, Tamper code, address
5.4	On analysis and detection of valid tamper event or malfunction, the tamper event must be sent / pushed by the meter to the HES /MDM	Meter	HES/ MDM	Consumer number, meter number, action to be triggered (disconnect), action date & time
5.5	HES sends disconnect command to meter	HES	Meter	Meter Number, action (disconnect)
5.6	Tamper event shared with CIS/CRM. Billing determinants are updated for tamper invoicing	MDM	CIS / CRM	Meter Number, event date & time, event Code /description
5.7	Meter re-connection order	MDM	HES	Meter number, action

Sr.	Use Case Activity Description	Source	Destination	Info Exchanged
	once tamper issue is resolved			(re-connect)
5.8	HES sends re-connect command to meter	HES	Meter	Meter Number, action (re-connect)
6.	Missed interval readings			
6.1	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)
6.2	On receiving data request command, meter will send data to HES	Meter	HES	Meter Number, reading date & time, kW, kVA, kWh, kVAh
6.3	Missed Interval and Reads Data acquired by MDM	HES	MDM	Meter Number, readings with date & time
7.	Consumer connection outage/restoration event			
7.1	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
7.2	Outage / Restoration Notification	HES	MDM	Meter Number, Outage / restoration Date / Time, Power On or Off count
7.3	Sharing Outage / Restoration Notification	MDM	OMS/CIS-CRM	Meter Number, Outage / restoration Date / Time, Power On or Off count
7.4	Meter read request from OMS to identify service outage / restoration	OMS	MDM → HES	Meter Number,
7.5	Meter responds to event poll from HES	Meter	HES	Meter number, Status (live/dead)
8.	Remote firmware upgrades/ meter configuration changes			
8.1	Remote firmware upgrade	HES	Meter	Firmware
8.2	Configuration Commands: Change tariff parameters, Synchronize clock, Registers reset (status, max, tampering)	HES	Meter	Meter number, tariff parameters, registers status, event type and priority
8.3	Status update of Firmware / Configuration	Meter	HES	
9.	Load monitoring at demand side			
9.1	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

Sr.	Use Case Activity Description	Source	Destination	Info Exchanged
10.	Time synchronization			
10.1	Synchronizing RTCs of meters / DCUs/ACP	HES	DCU/Meter	Time Setting
11.	Metering network changes			
11.1	Change / new installation in Meter / DCU Network Hierarchy	Meter / DCU	HES	Network identification info including DCUs
11.2	Change / new installation in Meter / DCU Network Hierarchy	HES	MDM	Network identification info including DCU
12.	New consumer connection			
12.1	Receive verified pre & post-paid new consumer requests	CIS-CRM/ Billing	MDM	Consumer name, address. Connection request etc.
12.2	Generate meter installation order	MDM	/WFM	Consumer ID & details
12.3	Receive meter installation report	WFM	MDM	Meter number, DT no, Feeder & reading
12.4	Requesting instant, interval & events data from meters	MDM	HES → Meter	Meter Number, Reading date & time, reading params (kWh, kVAh, kW etc.)
12.5	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.)
12.6	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.
13.	Migrate post-paid consumer to prepaid mode			
13.1	Receive migration request	CIS-CRM/ Billing	MDM	Migration request for post-paid consumer with profile
13.2	Setup prepaid consumer profile in prepaid engine. If no change in meter is required, skip next two steps	MDM	Prepaid Engine	Prepaid consumer profile
13.3	Generate prepaid meter installation order if required	MDM	WFM	Consumer ID & details
13.4	Receive meter installation report	WFM	MDM	Meter number, DT no, Feeder & reading
13.5	Enable prepaid mode in meter	Prepaid engine	HES → Meter	Engineering token
13.6	Receive activation confirmation	HES	MDM	Activation status
13.7	Request instant, interval &	MDM	HES → Meter	Meter Number, Reading

Sr.	Use Case Activity Description	Source	Destination	Info Exchanged
	events data from meter			date & time, reading params (kWh, kVAh, kW etc.)
13.8	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.)
13.9	Once meter remote read verification is over, share migration request completion detail with other modules	MDM	Billing / CIS-CRM	Prepaid consumer profile
14.	Migrate prepaid consumer to post-paid mode			
14.1	Receive migration request	CIS-CRM	MDM	Migration request for prepaid consumer with profile
14.2	Request meter data	MDM	HES → Meter	Meter Number, Consumer ID
14.3	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
14.4	Send meter disconnect command	MDM	HES → Meter	
14.5	Receive connection status	HES	MDM	Disconnect status
14.6	Enable post-paid mode in meter	MDM	HES → Meter	Engineering token
14.7	Receive activation of post-paid mode	HES	MDM	Activation Status
14.8	Request instant, interval & events data from meter	MDM	HES → Meter	Meter Number, Consumer ID
14.9	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.)
14.10	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
15.	Consumer Registration in Consumer Portal/ App			
15.1	Consumer clicks on new user on consumer portal/	Portal/ App	CIS/CRM	Request for registration with RMN/email ID

Sr.	Use Case Activity Description	Source	Destination	Info Exchanged
	App, provides RMN or email ID and submits data			
15.2	Utility receives request for registration and sends OTP after verification	CIS/CRM	Email/Messag e Gateway	OTP
15.3	Consumer submits OTP	Portal/ App	CIS/CRM	
15.4	Consumer receives registration detail	CIS/CRM	Email Gateway	Login ID and default password
15.5	Consumer submits first login request	Portal/ App	CIS/CRM	
15.6	System seeks password change	CIS/CRM	Portal/ App	
15.7	Consumer changes default password	Portal/ App	CIS/CRM	
16.	Consumer Access to Consumption, Billing& Profile Data			
16.1	Consumer logs in to Portal/ App	Portal/ App	MDM	
16.2	Consumer Profile for Portal/ App	CIS-CRM	MDM →Portal/ App	Name, Account, Address, Service Points, K Number
16.3	Consumption Data	MDM	Portal/ App →UI	Consumption profile
16.4	Billing (post-paid) / Credit Balance (prepaid)	Billing → MDM	Portal/ App	Post-paid Billing history/ Current Bill, Prepaid Recharge history
17.	Prepaid Consumer Recharge			
17.1	Consumer logs into Portal / Mobile App	Mob App / Portal	UI	Login
17.2	Consumer fills-in required detail in UI and requests recharge	UI→ Prepaid App	Payment Gateway	Consumer ID, Recharge amount
17.3	Consumer selects payment method	Payment Gateway	Net banking /Credit Card / Wallet etc.	
17.4	Consumer receives payment acknowledgement	Payment Gateway	Prepaid App→Portal→ UI	
17.5	Calculate credit balance for prepaid consumer & update prepaid meter	Prepaid App	HES→Meter	Consumer credit balance (virtual token)
17.6	Notify credit balance to consumer	Prepaid App	Email/SMS Gateway	Credit Balance
18.	Post-Paid Consumer Bill Payment			
18.1	Consumer logs into Portal / Mobile App	Mob App / Portal	UI	Login

Sr.	Use Case Activity Description	Source	Destination	Info Exchanged
18.2	Consumer is presented with Billing history and current outstanding Bill	Billing → MDM	Portal/ App→UI	Outstanding Bill
18.3	Consumer requests bill payment. Option to download bill	UI→Billing	Payment Gateway	
18.4	Consumer selects payment method	Payment Gateway	Net banking /Credit Card / Wallet etc.	
18.5	Consumer receives payment acknowledgement	Payment Gateway	Billing→ Portal/ App→UI	
18.6	Payment acknowledgement through email/SMS	Billing	Email/SMS Gateway	Payment acknowledgement
19.	Consumer Service Request			
19.1	Consumer logs in to Portal/ App	Portal/ App	CIS/CRM	
19.2	Consumer requests for service	UI	CIS/CRM	Service request
19.3	System assigns SRN & sends acknowledgement	CIS/CRM	Portal/ App→UI, Email/SMS Gateway	
19.4	System resolves request & updates consumer records	CIS/CRM	Portal/ App→UI, CIS/CRM	
19.5	System closes SRN	CIS/CRM	Email/SMS Gateway	
20.	Consumer Complaints			
20.1	Consumer logs into Portal/ App	Portal/ App	CIS/CRM	
20.2	Consumer registers complaint	UI	CIS/CRM	Specific complaint
20.3	System assigns CRN & sends acknowledgement	CIS/CRM	Portal/ App→UI, Email/SMS Gateway	
20.4	System assigns resolution based on nature of complaint	CIS/CRM	CIS / OMS / WFM	
20.5	Target system reports completion of complaint	OMS / WFM	CIS/CRM	
20.6	System updates records and closes CRN	CIS/CRM	CIS, Email/SMS Gateway	
21.	Demand read of meters from consumer premises			

Sr.	Use Case Activity Description	Source	Destination	Info Exchanged
21.1	Requesting instantaneous, interval, load profile & events data from meters	MDM	HES→Meter	Meter Number, Reading date & time, reading params (kWh, kVAh, kW etc.)
21.2	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.)
22.	Staff User Access to Utility Portal			
22.1	User logs in to Portal	Portal	MDM	Login with appropriate credentials
22.2	User selects available functions	MDM	Portal → UI	
22.3	User logs out	Portal → UI	MDM	

The AMISP shall specify and deliver an initial system that supports the collection and storage of data for meeting the performance level for 60,000 no of consumers/ Smart Meters with facility of future expansion.

The MDM shall have the ability to selectively choose which data to be maintained and which to be purged or archived as per requirement of Utility (user selectable).

2.4.1 Asset Management

- a) The MDM shall maintain information and relationships between the 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.) etc.
- b) 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.
- c) Ability to report and log any damage / deterioration in the meter attributable to consumer /utility.

2.4.2 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.

2.4.3 Meter Data

- a) The MDM shall accept input, process, store, and analyse Meter data from HES and meter data collected through handheld meter reading instruments and manual meter reads. In case of manual reads, provision should be there to insert associated notes such as assessed energy, etc. It would responsibility of AMISP for manual meter reading in case of any communication failure, etc. with seven (7) days of such failure.
- b) The MDM should accept input, process, store, and analyse non-billing meter data such voltage and power quality data (such as under/over voltage, out of band frequency, etc.) as they are available from HES. The MDM should also support schedule and on-demand meter reads and pinging of meter energized states by authorized users and by other utility systems.
- c) The MDM shall provide storage and retrieval of all collected Meter Data, events and alarm. It shall have capacity of storing 10 years data (as required by the utility based on regulatory provisions) via archiving
- d) The archiving of data should be done at a frequency of 7 days and all data older than 30 days should be archived. AMISP'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 such as net metering/pre-paid metering/multiple meters at same premises.
- i) The MDM shall have the ability to manage at a minimum 5-minute interval data.
- j) The AMISP shall ensure data integrity checks on all metered data received from data collection systems.

2.4.4 Data Validation, Estimation, and Editing (VEE)

- a) The validation and estimation of metered data shall be based on standard estimation methods (such as max/avg. of past three days, max/avg. of past X number of similar weekdays, max/avg. of similar blocks of past X numbers of similar weekdays, etc.). The MDM should also support and maintain following data-
 - i. Registered Read Data including register reads, daily billing cycle, as well as derived billing determinants such as TOU

- ii. Interval Data channels with variable intervals and variable units of measure
 - iii. Calculated Data that is derived or computed such as billing determinants and aggregated loads.
 - iv. Event data storage of all collected event and alarm data from meters, network equipment, and MDM itself
- b) 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
- i. CUM decrements within a billing cycle (except net-metering)
 - ii. CUM reads increments more than configurable threshold
 - iii. Future or old read dates
 - iv. Number of digits exceeds number of meter dials
- c) 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
- i. Register decrements (except net-metering)
 - ii. Resets (to zero) (except net-metering)
 - iii. CUM reads increments more than configurable threshold
 - iv. Future or old read dates
 - v. Erratic compared to CUM read (sum of TOU reads minus CUM read)
- d) MDM shall detect, flag, alarm and trigger an estimating process including but not limited to when the following anomalies occur in Demand register reads
- i. Do not reset on cycle
 - ii. Do not reset coincident with consumer move-out or move-in
 - iii. Reset off cycle inappropriately
 - iv. Too high
- e) All data shall be transferred to billing system after meter data validation and estimation including transformer / feeder station wise energy audit.
- f) MDM shall estimate usage for non-metered service points such as streetlights, farm lights, traffic signals, etc.
- g) The MDM shall maintain both the original received raw data in a non-manipulated state, in addition to VEE data.
- h) 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.

- i) 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.

2.4.5 Billing Determinants Calculations

The MDM-

- a) Shall allow configuring multiple TOU options (e.g., the number and duration of TOU rate periods) by consumer type, tariffs and day type (weekend, weekdays, and holidays) and by season.
- b) Shall support the processing of interval data into billing determinants to include the following at a minimum:
 - i. Total Consumption
 - ii. Consumption in different time blocks for ToU billing
 - iii. Maximum Demand (in kW and kVA)
 - iv. Number of tamper counts
 - v. Average power factor
 - vi. Net-Metering data
- c) Shall process interval data and frame it into the appropriate TOU periods for consumption and demand; for example, roll up 30-minute data intervals into hourly data.
- d) Shall have the ability to properly account for special metering situations such as check metering, sub metering, prepaid metering and net metering when calculating billing determinants and sending them to billing and other systems.
- e) 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 H) when calculating billing determinants and sending them to billing software.
- f) Shall have the ability to facilitate implementation of automatic compensation payments by Utility to consumers for sustained outages when requested. Compensation calculations would require cross checking with billing and consumer balance information to ensure that disconnection is not construed as a no supply event.

2.4.6 Prepaid functionality

The MDM with the help of the corresponding HES, should be able to switch the Smart Meter between prepaid and post-paid modes by a simple change in configuration of the Smart Meter firmware remotely. The following prepaid functionality shall apply

- a) MDM shall use consumer attributes from Consumer Care System (CCS) and/or Utility Billing system to,
 - i. enrol and setup new prepaid/ post-paid consumers

- ii. migrate existing post-paid consumers to prepaid mode and vice versa
- b) An appropriate pre-payment application engine shall support the pre-payment metering capability through the delivered system.
- c) The prepayment system shall ensure that payment and connection parameters are stored centrally, and the details are updated to CIS-CRM/MDM through consumer portal/ app as per Clause 2.5 of this Section. Information required by consumer's Mobile App and web portal are shared in near real time.
- d) Prepaid consumers shall be provided facility to recharge their account by logging on to the consumer portal/app as per Clause 2.5 of this Section.
 - i. The user interface shall be integrated with the present online payment gateway of the utility. Additional payment gateways shall be implemented if required
 - ii. The payment gateways shall facilitate payments through on-line banking, credit cards and payment wallets
- e) A prepaid mobile application functionality shall be provided as a recharge option for android OS and iOS. The consumer portal/ app, shall enable consumers to recharge as well as view recharge history, existing balance, daily usage etc.
- f) In addition to billing determinants, the MDM shall share, consumer recharge and credit updates with the utility Billing system. Any reconciliation shall be carried out in the Billing System and the same shall be shared with the MDM for use by the prepayment application.
- g) The system shall periodically monitor the energy consumption of prepaid consumer and decrease the available credit based on consumption. For this purpose, the MDM shall fetch billing data (kWh/kVAh consumption and MD) at configured intervals¹ from the prepaid meter. The raw billing data shall be subjected to standard VEE rules before being used to update recharge balance with the help of applicable tariff slabs. The credit balance is updated into meter at re-charge time.
- h) The prepayment application shall use determinants such as minimum fixed charges, TOU tariffs, slab rates, duties & surcharge while calculating consumer credit/balance. Fixed charge shall be deducted on daily basis irrespective of the consumption, even after disconnection of supply and adjusted in the next transaction.
- i) The prepayment application should be able to automatically apply different TOU tariffs for future date lines, while calculating consumer credits.
- j) The system should send connect/disconnect command based on available credit as per notified rules & regulations.

¹The frequency of pre-configured intervals shall be at least every hour in addition to that at re-charge time

- k) The system should send low-credit notifications to the consumer when their balance approaches a pre-configured threshold. Alerts shall initiate on every recharge, low credit and load connection/disconnection. The alerts shall be posted on the consumer web Portal/ App in real time and sent through SMS and email. Consumer should also be alerted through other mechanisms such as one-time alarm / beep from the meter, LED blinking, message, etc.
- l) It shall be possible to configure an “emergency” credit limit in INR as well as day terms. This emergency credit shall be used as reserved amount that is consumed when consumer credit is exhausted. The credit amount shall be adjusted in next recharge transaction.
- m) It shall be possible to configure certain prepaid consumers where auto-disconnections shall not happen due to negative credit. The conditions/protocols for auto-disconnections are detailed in Annexure I.
- n) The pre-payment function as part of MDM shall also have a facility to configure arrear recovery mechanism to recover arrears from a consumer. Some of the indicative mechanism to recover the same can be recovery of [X]% from every recharge amount while the rest goes as charging amount till all the arrears are recovered. Alternately the arrears may be settled in next [X] instalments as decided by utility such that not more than 50% of any instalment shall be adjusted towards arrear.

2.4.7 Net Metering

MDM shall flag, alarm and trigger an estimating process including but not limited to when the following events 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 in any given day by any net-metering consumer more than the programmable threshold value

Like billing for post-paid meters, the billing for net-meters shall take place in the utility Billing server.

2.4.8 Exception Management

- a) 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.
- b) Ability to group, prioritize, filter and send system generated alarms and events to predetermined email addresses, cellular text messages to phone numbers/SMS/consumer care etc. Alternatively, these alarms/alerts may be routed to utility’s WFMS.
- c) Exception Generation - MDM shall generate exceptions based on configurable business rules including but not limited to the following:

- i. Meter tamper alerts
- ii. Communication module health alerts for meter/DCU
- iii. If the consumption is less/more than pre-defined average consumption
- iv. Negative Consumption (not for net-metering)
- v. Power outage indications received from the Smart Meter

2.4.9 Service Orders

- a) 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.
- b) 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.
- c) 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.

2.4.10 Revenue Protection Support

- a) Ability to analyse meter tampering flags, power outages, usage trends and usage profiles to identify potential energy diversion situations, and produce daily reports, monthly reports and service order requests for investigation.
- b) The business rules for revenue protection alerts shall be configurable via a user-friendly interface.
- c) The MDM shall filter out revenue protection alerts that may be caused by field activities if the field activity information is provided to the MDM.
- d) The MDM shall support the analytics/investigation (i.e., view current and historical usage patterns) to validate suspected revenue protection issues.

Clause 2.6 AMISP shall establish connectivity between the workstations located at the NOMC with that of the cloud-based MDM-HES system. In addition, the AMISP shall establish connectivity between the cloud-based MDM system with utility's existing Billing system.

Clause 2.7.1.3 In order to facilitate cyber security requirements including patch management, common operating system is preferable to be used by all server nodes within the AMI application including MDM/HES servers.

The AMISP's core deliverables are the MDM, the HES, the NMS and the smart field devices (DCUs/Routers and Smart Meters). Hence the system integrations shall comprise of the following,

- i. HES with field devices (DCUs/Routers and smart Meters)
- ii. MDM with
 - a. HES
 - b. Billing and CIS
 - c. Other legacy IT/OT systems as required by the utility
 - d. National level Reporting Platform to come up in future
 - e. National Feeder Monitoring System

9. Section 6: Project Requirements

Addendum to Clause 3: AMI System Integrations

Sub-clause 3.1 MDM Integrations with Utility IT/OT Systems

The MDM will act as the bridge to integrate the AMI system with other utility IT/OT systems. These IT/OT systems may be already existing or those which the Utility have planned. The IT/OT systems may include but not be limited to the following:

- a) Billing, CIS, IVRS, CRM systems
- b) Legacy Data Collection Systems
- c) HHU/CMRI or manual reading system etc.
- d) Consumer Portal/ App
- e) GIS
- f) SCADA, OMS
- g) PLM, DRMS
- h) Asset Management System
- i) Work Force Management System
- j) DT Monitoring System
- k) EVSE

The details of the existing integration infrastructure, including specificity in implementation, interface and services available for each of the existing enterprise applications which the AMISP has to integrate with the AMI system, has been provided in Annexure L of this Section.

For those IT/OT systems which the Utility have planned in future, the AMISP shall publish document on available standard interfaces to enable their integration.

It will be necessary to integrate the MDM with the utility IT/OT systems following robust industry standard mechanisms.

MDM shall interface with these IT/OT systems on standard interfaces. The data exchange models and interfaces shall comply with CIM-XML-IEC 61968-9 / IEC 61968-100 / Web Services / MultiSpeak v3.0. MDM solution shall be ESB-SOA enabled.

The aim of the above interface standards is to ensure generic two-way interfacing of the MDM with other applications. This effort shall be guided by the methodology whose details are outlined in the approach paper set out in Project Implementation Plan.

10. Section 6: Project Requirements

Addendum to Clause 3: AMI System Integrations

Sub-clause 3.4 Integration with national level reporting platform

The AMI system put in place should provide a seamless exchange of data with a national level data portal without any manual interface including NFMS. In this regard, the MDM shall have an out-bound interface to facilitate data transfer through API-based model/ service bus to a central platform as and when made available. An indicative data list will be provided by the Utility for sharing with the national level reporting platform during contract period. The technical interface (such as web services, published APIs, DB table schemas etc.) for enabling this integration, will be defined accordingly. However, the AMISP needs to ensure the following:

- a) Any reports / analytics / graphics from system would provide opportunity to anonymize/ remove traceability to individual consumers to maintain privacy
- b) Reports/data made available in the public domain for public consumption should be always sufficiently aggregated/ anonymized so as to protect consumer privacy.

11. Section 6: Project Requirements

Addendum to Clause 6: Analytics and Reporting and all its relevant sub-clauses.

Sub-clause 6.1 Analytics including Energy Audit

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

- a) Energy Audit: Perform DT/Feeder/ Sub-Division/ Division/ Circle wise energy audit for configurable period. These energy audit reports shall clearly bring out the technical and commercial losses through detailed analysis of supply side energy data and corresponding aggregated consumption data of connected consumers. In this analysis it must factor in data of energy export from net-metered consumers. The automated audit should include but not limited to:
 - I. A daily automatic feeder loss (Feeder Head reading minus summation of all DT meters readings)
 - II. Automatic LT Energy loss (DT meter reading minus summation of readings of all those consumer meters served by the selected DT) would be reported
 - III. Billing and collection efficiency
 - IV. Identify the top [X] best as well as worst performing feeders and DTs
- b) 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, consumer type (hospitals, schools, govt. offices, multiplexes,

commercial, residential, industrial etc.), or any user specified collection of meters.

- c) Generate peak & off-peak load patterns by aggregating all loads of consumer group/consumer type/DT/Feeder over configurable period/day type.
- d) Perform load analysis for different groups and categories of consumers in different weather conditions.
- e) Ability to provide the data to load forecasting, load research or demand response applications (based on use cases provided in Annexure H) and perform error management such as 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) Analysing 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 and also support calculation of compensation payments for sustained outages. Five reliability indices shall be calculated,
 - i. System Average Interruption Duration Index (SAIDI), which is sum of all consumer interruption durations in a given period over total number of consumers 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 consumer 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 consumer interruptions less than the defined time (1 or 5 minutes) over the total number of consumers served

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 / first breath messages from DT/Feeder level meters or the power outage/restoration events logged by these meters. These computations shall be independent of similar computations made by any OMS application.

- i) 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.

- j) Identify & visualize poor performing assets such as feeder/DT on multiple criteria such as energy losses, outage duration etc. through appropriate colour coding depending on severity thresholds.
- k) Analyse data of net-metering consumers to identify patterns of energy export to grid on hourly/weekly/monthly/yearly basis.

6.2 Reporting Function

The Report function shall enable the 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 through GUI of Utility user interface (refer to Clause 2.5.1 of this Section for more details). The AMISP 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.

6.2.1 The MDM shall generate following reports (an indicative list only). Utility may request for additional reports as well during the contract period.

- i. Daily data collection report
- ii. Usage exceptions
- iii. VEE validation failures
- iv. Missing interval Read date and times (on hourly, daily, weekly & monthly basis) and their trends
- v. Physical meter events (install, remove, connect, disconnect) & meter reset report
- vi. Meter flags
- vii. Meter inventory
- viii. Defective meters
- ix. AMI performance measurements
- x. Threshold exception
- xi. DT condition monitoring
- xii. MIS reports and analytical reports including but not limited to following:
 - 1) Payment collection summary and details in a day/week/month/year or as per user selectable period and trends
 - 2) Number / list of disconnected consumers due to inadequate prepaid account balance
 - 3) Prepaid consumers running low on account balance
 - 4) Connected consumers

- 5) Critical notifications sent to consumers
- 6) Revenue analytics as per consumption pattern of consumers (in terms of money and energy units). This shall also include automatic compensation payments by Utility to consumers for sustained outages, if implemented
- 7) Data-driven Analytics reports by leveraging AI/ML based technologies

6.2.2 Following high level reports for Utility Management shall be generated automatically at specified frequencies to help management with business decisions.

Category	Report	Frequency
Energy Audit	<p>Energy Audit Report (DT/ Feeder / Sub-Division/ Division/ Circle wise) in contiguous electrical locations:</p> <ul style="list-style-type: none"> • 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 • Billing and collection efficiency • Identify the top [X] best as well as worst performing feeders and DTs 	Daily, 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 the 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 [X] consumers	Daily, Monthly and User Selectable Time Period with configurable near real time alerts
	Load Management Report (Identify top overloaded DTs) and load rise	Monthly and User Selectable Time Period

Category	Report	Frequency
	trend	
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
	Meter Current Unbalance (DT/ Feeder)	Daily, Monthly and User Selectable Time Period with configurable near real time alerts
Loss Analytics	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 [X] 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>

- 6.2.3 The utility interface should have ability to generate reports on critical and non-critical information received from the HES to the MDM as per Clause 2.3.3 of this Section.
- 6.2.4 The utility interface shall have feature to generate report related to SLAs being mentioned in Clause 7.7 of this Section.
- 6.2.5 Ability to generate various analytics reports as per Clause 6.1 of this Section.
- 6.2.6 AMISP shall submit a detailed report on data being shared as per Clause 2.7.8 on a yearly basis. AMISP shall submit detailed report on any exception in general data sharing on monthly basis. Further, AMISP shall also submit a detailed report for any other time period as requested by utility

12. Section 6: Project Requirements

Amendment to Clause 7: Operation & Maintenance

Sub-Clause 7.1 Scope & Period: Operation & Maintenance

- xiii. Ensuring smooth data traffic between the MDM and utility systems

13. Section 6: Project Requirements

Amendment to Clause 7: Operation & Maintenance

Sub-Clause 7.4 Monitoring

The operation and performance of the various systems shall be monitored on a continuous basis. The AMISP shall conduct at least the following monitoring:

- a) MDM / HES system error history logs or selected day

14. Section 6: Project Requirements

Amendment in Clause 7: Operation & Maintenance

Sub-clause 7.8 –Duties of RECPDCL/LPDD and AMISP during Operations and Maintenance Phase

Amendment in table Serial no. 3.0 Routine Software (including MDM, HES, Utility Interface, Consumer app/portal) Support

15. Section 6: Project Requirements

Amendment in Clause 9: Tests, Inspections and Management of the Quality Assurance / Quality Control Program

Sub-clause Clause 9.3 h) Integration tests with the MDM in line with a use case table to be drawn up by the AMISP. A use case table is provided in Clause 2.4 of this Section for reference purpose

16. Section 6: Project Requirements

Clause 9: System Availability Test

Addendum to Sub-clause 9.5.3.1 Criteria for successful operation

The AMI system shall be designed to meet the system availability as defined below:

S. No.	System	Minimum System Availability Requirements
3.	MDM	99.5%

17. Section 6: Project Requirements

Clause 10: Project Management

Amendment in Sub-clause 10.2 : Key Personnel

The AMISP shall appoint at least the following personnel dedicated for the AMI Project

- a) **Project Manager:** She / he shall have the authority to make commitments and decisions that are binding on the AMISP. Utility will designate a Nodal officer to coordinate all project activities. All communications between the Utility and the AMISP shall be coordinated through the project manager and nodal officer. The project manager should be an expert in AMI Implementation including metering and related aspects, installation and management of Smart Meters, communication network, last mile connectivity, HES and MDM. The project managers shall be responsible for all communications between other members of the project staffs including sub-contractors, if any.

18. Section 6: Project Requirements

Clause 13: Annexures

Annexure A : Technical Specifications for Whole Current A.C. Single Phase Smart Energy Meter – Amendment in Scope : Pre-paid features at MDM end (as per IS 15959 Part 2)

Annexure B : Technical Specifications for Whole Current A.C. Three Phase Smart Energy Meter

Amendment in: Pre-paid features at MDM end (as per IS 15959 Part 2)

The prepaid engine shall be at the billing system end.

19. Section 6: Project Requirements

Clause 13: Annexures

Addendum to Annexure H: Future Demand Response Program Use Cases for Reference
The objective of the Demand Response 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

S. No.	Functional requirement	Description of Functional requirement
4.	Curtailement due to Contract Violation	<p>Utility limits consumer's load due to reasons like exceeding contract load</p> <p>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).</p>
5.	Demand side Management	<p>In every 30-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.</p>
6.	Load Monitoring at Demand side	<p>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</p>
7.	Initiate Direct Load Control Event	<p>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</p>
8.	Energy accounting system	<p>Register and Interval based accounting:</p> <p>Register based 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.</p> <p>Bi-directional MDM should support bi-directional metering by processing the delivered and received channels for a given meter in two separate channels.</p> <p>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.</p> <p>Usage Calculated from Register Reads</p>

S. No.	Functional requirement	Description of Functional requirement
		<p>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.</p> <p>Interval Billing:</p> <p>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.</p> <p>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).</p> <p>For example, if 30 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. 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).</p>