CHAPTER 30: TECHNICAL SPECIFICATION FOR SAMAST METER

Interface Energy Meters Technical Specification

30.1 Basic Features of Interface Energy Meters

The energy metering system specified herein shall be used for tariff metering for bulk, inter-utility power flows, in different States of India. Static composite meter shall be installed at interface points as a self-contained device for measurement of Voltage (V), Frequency (f), Active (Wh) and Reactive (VArh) energy exchanged in each successive 5 min time block. All meters shall be compliant to IS 15959 and its latest amendments.

Each meter shall have a unique identification code, which shall be marked permanently on its front, as well as in its memory. All meters supplied to as per this specification shall have their identification code starting with “IEM”, which shall not be used for any other supplies. “IEM” shall be an eight digit running serial number, further followed by “A” and “B” for the use with CT secondary of 1A and 5A respectively. This shall be mutually agreed between the buyer and the vendor. Note: The secondaries of all the CT cores will be 1A.

The meters shall be suitable for communication with external device like modem, DCU, etc. which shall be able to communicate with CDCS for local/remote data transfer. The meter shall compulsorily have at least 1 optical port for taking reading through Hand Held Unit (HHU).

Auxiliary Supply to IEM- The meters shall normally operate with the power drawn from DC auxiliary power supply (Range 110V to 220V DC)to reduce the Voltage Transformer (VT) burden. In addition, there shall be provision to operate the meter from the Voltage Transformer (VT) secondary circuit having a rated secondary line-to-line voltage of 110V, and current transformers (CTs) having a rated secondary current of 1 A or 5A. Any further transformers/ transactions/ transducers required for their functioning shall be in-built in the meters. Necessary isolation and/or suppression shall also be built-in, for protecting the meters from surges and voltage spikes that occur in the VT and CT circuits of extra high voltage switchyards. The reference frequency shall be 50Hz. Also, the meter shall have suitable tolerance (up to 15% either side) for DC supply.

The meters shall safely withstand the usual fluctuations arising during faults etc. In particular, VT secondary voltages 115% of Vref applied continuously and 190% of Vref for 3.0 seconds, and CT secondary current 150% of Iref applied continuously and 30 times of Iref applied for 0.5 seconds shall not cause any damage to or maloperation of the meters.

The meters shall continue to function for the remaining healthy phase(s), in case one or two phases of VT supply fails. In case of a complete VT supply failure, the computation of average frequency shall be done only for the period during which the VT supply was available in the 5-minute block. Any time block contraction or elongation for clock correction shall also be duly accounted for.

The total burden imposed by a meter for measurement and operation shall be defined as per IS 14697. An automatic backup for continued operation of the meter’s calendar-clock, and for retaining all data stored in its memory, shall be provided through a long-life battery, which shall be capable of supplying the required power for at least 2 years. The meters shall be supplied duly fitted with the batteries, which shall not require to be changed for at least 10 years, as long as total VT supply interruption does not exceed two years. The battery mounting shall be designed to facilitate easy battery replacement without affecting PCB of the meter.

The meters shall fully comply with all stipulations in IS 14697 except those specifically modified by this specification. The reference ambient temperature shall be 27 ■C.

Each meter shall have a test output device (visual), as per clause 6.11 of IS 14697.1999, for checking the accuracy of active energy (Wh) measurement. The preferred pulsing rate is twenty (20) per Wh for CT sec-1A and four (4) per Wh for CT sec –5A. It shall be possible to couple this device to suitable testing equipment also.

Exception Management- The three line-to-neutral voltage shall be continuously monitored and in case any of these falls below defined threshold (70% of Vref), meter shall have suitable indication on LED/ LCD. The meter shall also have provision for low voltage event logging in meter memory in case of any phase voltage going below a defined threshold. The time blocks in which such a voltage failure occurs/persists shall also be recorded in the meter’s memory with a symbol“*” if 3 Phase RMS voltage applied to the IEM is in between 5% to 70% of Vref and if Voltage is less than 5% of Vref, meter should record Zero voltage symbol "Z".

Time Accuracy - Each meter shall have a built-in calendar and clock, having an accuracy of 10 seconds per month or better. The calendar and clock shall be correctly set at the manufacturer’s works. The date (year-month-day) and time (hour-min.-sec.) shall be displayed on the meter front on demand. Meter shall have the intelligence to synchronize the time with GPS (Local GPS/CDCS GPS/ NAVIC) signal and from PC using software. Limited time synchronization through meter communication port shall be possible at site. When an advance or retard command is given, twelve subsequent time blocks shall be contracted or elongated by five seconds each. All clock corrections shall be registered in the meter’s memory and suitably shown on print out of collected data.

A touch key or push button shall be provided on the meter front for switching on the display and for changing from one indication to the next. The display shall switch off automatically about one minute after the last operation of touch key/push button. When the display is switched on, the parameter last displayed shall be displayed again, duly updated.

The whole system shall be such as to provide a print out (both from the local PC, and from remote central computer) of the following format:

Figure 1: Standard Raw Data Format for IEM

There are 4 values in one 5 min time block. The first row shall contain the meter data for 2 hours, i.e. 24 time blocks, 00 hrs to 02:00 hrs. Similarly the 2nd row shall contain the data for the next 2 hours and henceforth.

The above data shall be available in text file format (file extension as per IEEE standard/.txt) exportable to Excel. Indication of time retard or advance to be provided without disturbing the proposed format. Each 5-min block data consists of Frequency (in HZ), Active energy (in Wh), Reactive energy (in VARh) and Voltage (in V). All 5 minute Wh and VARh figures in .NPC/output report shall be rounded off upto third decimal.

The portable hand held unit (HHU)/ Common meter reading instrument (CMRI)/ Data Collecting Device (DCD) shall be having IS-15959:2011 compatibility for standardized parameters. The optical coupler for tapping data stored in the SEMs memory shall be compatible universally across different make of SEMs.

30.2 Constructional Features

The meters shall be supplied housed in compact and sturdy, metallic or moulded cases of non-rusting construction and/or finish. The cases shall be designed for simple mounting on a plane, vertical surface such as a control/relay panel front. All terminals for CT and VT connections shall be arranged in a row along the meter's lower side. Terminals shall have a suitable construction with barriers and cover, to provide a secure and safe connection of CTs and VTs leads through stranded copper conductors of 2.5 sq. mm. size.

All meters of the same model shall be totally identical in all respects except for their unique identification codes. They shall also be properly sealed and tamper evident, with no possibility of any adjustment at site, except for transactions allowed in IS 15959.

The meters shall safely withstand, without any damage or mal operation, reasonable mechanical shocks, earthquake forces, ambient temperature variations, relative humidity etc. in accordance with IS-14697. They shall have an IP-51 category dust-tight construction, and shall be capable of satisfactory operation in an indoor, non-air conditioned installation.

Either the meters shall have built-in facility (e.g. test links in their terminals) for in-situ testing, or a separate test block shall be provided for each meter.

30.3 Measurement

The active energy (Wh) measurement shall be carried out on 3-phase, 4-wire principle, with an accuracy as per class 0.2S (IS 14697).

The meter shall compute the net active energy (Wh) sent out from the substation bus bars during each successive 5 min block, and store it in its memory up to fourth decimal with plus sign if there is net Wh export and with a minus sign if there is net Wh import. Further Wh data in .NPC/output report shall be rounded upto third decimal.

The meter shall count the number of cycles in VT output during each successive 5 min block, and divide the same by 300 (60 sec/min x 5min) to arrive at the average frequency. The frequency data shall be stored in the meter's memory in Hertz up to third decimal. Further Frequency data in .NPC/output report shall be rounded off upto second decimal.

The meter shall continuously compute the average of the RMS values of the three line-to-neutral VT secondary voltages as a percentage of 63.51 V, and display the same on demand. The accuracy of the voltage measurement/computation shall be at least 0.5%, a better accuracy such as 0.2% in the 95-105% range being desirable. The voltage data shall be stored in the meter's memory in volts up to third decimal. Further voltage data in .NPC/output report shall be rounded off upto second decimal.

The Reactive energy (VARh) measurement shall be carried out on 3-phase, 4-wire principle, with an accuracy of 0.5S as specified in IS 14697. The meter shall compute the net Reactive energy (VARh) sent out from the substation bus bars during each successive 5 min block, and store it in its memory up to fourth decimal with plus sign if there is net VARh export and with a minus sign if there is net VARh import. It shall also display on demand the net VARh sent out during the previous 5 min block. Further VARh data in .NPC/output report shall be rounded off upto third decimal.

The meter shall also integrate the reactive energy (VARh) algebraically into two separate registers, one for the period for which the average RMS voltage is above 103.0%, and the other for the period for which the average RMS voltage is below 97.0 %. The current reactive power (VAR), with a minus sign if negative, and cumulative reactive energy (VARh) readings of the two registers (>103% and <97%) shall be displayed on demand. The readings of the two registers at each midnight shall also be stored in the meter's memory. When reactive power is being sent out from substation bus bars, VAR display shall have a plus sign or no sign and VARh registers shall move forward. When reactive power flow is in the reverse direction, VAR display shall have negative sign and VARh registers shall move backwards. Generally, the standard PT ratios are 33kV/110V, 132kV/110V, 220 kV /110 V, 400 kV /110 V and 765 kV / 110 V. However, at the time of commissioning the vendor may confirm the same from site and configure the meter accordingly to ensure correct recording of reactive energy.

For CT secondary rating of 5A, all computations, displays and memory storage shall be similar except that all figures shall be one fifth of the actual, worked out from CT and VT secondary quantities.

Further, the meter shall continuously integrate and display on demand the net cumulative active energy sent out from the substation bus bars up to that time. The cumulative Wh reading at each midnight shall be stored in the meter's memory. The register shall move backwards when active power flows back to substation bus bars.

Errors for different power factors shall be as defined in IS14697.

For reactive power (VAR) and reactive energy (VARh) measurements, IS14697 shall be complied with. The accuracy of measurement of reactive energy shall be as per class 0.5S.

The harmonics shall be filtered out while measuring Wh, V and VARh, and only fundamental frequency quantities shall be measured/computed.

Data security shall be ensured as per IS 15959 (three layers of security).

30.4 Memory/ Storage

Each meter shall have a non-volatile memory in which the following shall be automatically stored:

Average frequency for each successive 5 min block, in Hertz up to third decimals.

Net Wh transmittal during each successive 5 min block, up to fourth decimal, with plus sign if there is net Wh export and with a minus sign if there is net Wh import.

Net VARh transmittal during each successive 5 min block, up to fourth decimal, with plus sign if there is net VARh export and with a minus sign if there is net MVARh import.

Cumulative Wh transmittal at each midnight, in eight digits including one decimal.

Cumulative VARh transmittal for voltage high condition, at each midnight in eight digits including one decimal.

Cumulative VARh transmittal for voltage low condition, at each midnight, in eight digits including one decimal.

Average RMS voltage for each successive 5min block.

Date and time blocks of failure of VT supply on any phase, as a star (*)/ (Z) mark.

The meters shall store all the above listed data in their memories for a period of fifteen (15) days. The data older than fifteen (15) days shall be erased automatically

The software provided at CDCS, i.e. SLDC, will manage all functionalities of collection of data through DCUs, validate the data, store the data in a database, and manage the complete system. Software will also have a scheduler for scheduling the task of collection of data periodically. The periodicity of data collection shall be user defined.

30.5 Display

Each meter shall have digital display for indication of the following (one at a time), on demand:

Meter serial no. and model : IEM12345678A or IEM12345678B

Date (year month day /yyyy mm dd) : 20160311 d

Time (hour min sec /hh mm ss) : 195527 t

Cumulative Wh reading : 1234567.8 C

Average frequency of the previous block : 49.89 F

Net Wh transmittal during the previous block: - 28.75 E

Net VARh transmittal during the previous block: - 18.75 R

Average % Voltage : 99.2 U

Reactive power (VAR) : 106.5 r

Voltage - high VARh register reading : 1234567.5 H

Voltage - low VARh register reading : 1234567.4 L

Low battery indication

The three line-to-neutral voltages shall be continuously monitored and in case any of these falls below 70 %, a preferably flashing three LEDs (one LED/phase) provided on meter's front shall become steady. They shall go off if all three voltages fall below 70 %. The LED shall automatically resume flashing when all VT secondary voltages are healthy again.

The two VARh registers (xv and xvi) shall remain stay-put while VT supply is unhealthy.

Any other better or more informative mechanism to display the above shall be preferred. The above shall be mutually agreed between the meter buyer and vendor.

Navigation keys to be provided at the meter front plate to navigate the display menu.

30.6 Communication

Each meter must have an optical port on its front for tapping all data stored in its memory through HHU. In addition to the above each meter shall also be provided with a RS-485, Ethernet and USB port on one of its sides, from where all the data stored in the meter's memory can also be transferred to CDCS (through DCU), local computer and external storage. The overall intention is to tap the data stored in the meter's memories at a scheduled time from any of the above mentioned ports or any other means and transmit the same to a remote central computer using suitable means of communication. It shall be possible to securely download the IEM data through an USB port via external storage thereby removing the requirement of a MRI (Meter Reading Instrument). It shall be ensured that data transfer through USB shall be unidirectional only i.e. from Meter to external storage device in an authentication process. Meter data shall be tamper-proof.

All meters shall be compatible with Optical port, RS-485 port, Ethernet port and USB / RS-232 port all together at a time and communicate independently. It shall also be possible to obtain a print out (hard copy) of all data collected from the meters, using the local PC. Data collection from any local laptop/PC shall be possible by installing data collection software. Entire project has to be based on Optic Fibre/GSM/4G/3G.

The Tenderer may design appropriate architecture for providing end to end metering solution. He is free to decide upon the best solution out of all the available options to ensure that data from all IEMs in ASSAM are available at State Load Despatch Centre by the scheduled time. However, the entire responsibility of fully functional end to end metering system shall rest with the Tenderer in order to meet the performance levels as given in this document. The communication provider may adopt Optical Fibre/GSM/3G/4G communication technology or a combination of these technologies as per the site requirement adopting best available technology in the proposed area of implementation. The successful Tenderer shall be responsible for proper data exchange among IEM, DCU, CDCS, MDP and other operational/requisite software as part of fully functional metering system.

The operational testing of all the network elements has to be demonstrated by the Tenderer to the satisfaction of the utility.

The Tenderer shall provide the necessary software which would enable a local PC/ CDCS to:

Accept the data from the Optical/Ethernet/WAN and store it in its memory in user defined formats (text, csv, xls, etc.) in a user-defined file name (file name format must be ddmmyy substation name-utility name).

Polling feature along with a task scheduler to run the data downloading software at a pre-designated date and time repeatedly or by manually selecting a meter. File naming for such downloaded data should also be in user-defined format. A detailed activity log shall also be available for each downloading operation.

Upload/Import meter data (binary files) in the software for further processing. While uploading, there shall be provision to upload all selected files with single key-stroke.

Convert the binary file(s) to text file(s).There should be provision to select multiple files based on filename, convert all selected files with single key-stroke and store the text files in the same location where binary files are stored.

Display the collected data on PC's screen in text format, with forward/backward rolling

Print out in text format the data collected from one or more meters, starting from a certain date and time, as per operator's instructions

Transmit the collected data, in binary format, through an appropriate communication link to the central computer, starting from a certain date and time, as per operator's instructions.

Store the collected data in binary format, on a CD/Pen Drive. In addition to above, in general the software shall be able to convert IEMs data to existing format as well as in tabular (.csv) format as applicable.

The above software shall further ensure that absolutely no tampering (except erasing of complete data with password protection) of the collected metering data is possible during its handling by the PC. The software shall be suitable for the commonly available PCs, (Windows) and shall be supplied to Owner in a compatible form to enable its easy loading into the PCs available (or to be installed by the Owner/others) at the various substations.

The Tenderer shall ensure data integrity checks on all metered data received from data collection systems.

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 Metering system shall be provided free of cost by the respective owners of the premises.

Climatic Condition

The meters to be supplied against this specification shall be required to operate satisfactorily and continuously under the following tropical conditions of hot, humid, dusty, rust and fungus prone environment.

Maximum ambient air temperature (°C)	**55**
Minimum ambient air temperature (°C)	(-) 5
Average Daily ambient air temperature (°C)	32
Maximum Relative Humidity (%)	95
Minimum Relative Humidity (%)	10
Maximum altitude above sea level (m)	1000
Average Annual Rainfall (mm)	1200
Maximum Wind Pressure (Kg/sq.m)	195
Isoceraunic Level (days per year)	50
Seismic Level (Horizontal Accn. In g)	0.3

Quality Assurance

The quality control procedure to be adopted during manufacturing of the specified equipment shall be mutually discussed and finalized in due course, generally based on the established and proven practices of the manufacturer. The software shall be user friendly which can be easily installed in any PC/Laptop irrespective of operating system of the PC/Laptop, and shall be certified for ensuring data handling capabilities. The same shall be demonstrated by the party during technical evaluation. During demonstration party shall bring standard meter. Thereafter software shall be offered for technical compatibility before taking up further necessary action in the procurement process.

Testing

All equipment, after final assembly and before dispatch from manufacturer’s works, shall be duly tested to verify that is suitable for supply to the Owner. Routine and acceptance tests shall be carried out on the meters in line with IS 14697.

Any meter which fails to fully comply with the specification requirements shall be liable to be rejected by the Owner. However, the Owner may purchase such meters at a reduced price in case of marginal non-compliance, at his sole discretion.

Acceptance Tests for PC Software and data down loading using meter communication ports- All IEMs after final assembly and before despatch from Tenderer’s/Manufacturer’s works shall be duly tested to verify that they are suitable for downloading data using meter communication ports shall be subjected to the following acceptance test.

Downloading Meter Data from the Meter(s) to PC via optical port.

Downloading meter data through USB port and RS 232.

Downloading meter data to DCU/CDCS through Ethernet as well as RS 485 port.

Compatibility with PC Software.

Functioning of Time synchronisation, advance and retard time commands.

Per meter downloading time verification.

Copy of Certificate shall be submitted.

30.7 Type Tests

One (1) meter in a batch shall be subjected to the complete range of type tests as per IS14697 and IS15959, after final assembly. In case of any failure to pass all specified tests, the Tenderer shall arrange to carry out the requisite modifications/replacements in the entire lot of meters at his own cost. After any such modifications and final assembly, two (2) meters selected out of the lot by the Owner’s representative shall be subjected to the full range of type tests. The lot shall be accepted by the Owner only after successful type testing.

The meters used for type testing shall be separately identified, duly marked, and supplied to the Owner in case they are fully functional and as good as other (new) meters, after necessary touching up/refurbishing. In case this is not possible, the Tenderer shall provide their replacements at no extra cost to Owner.

The Tenderer shall arrange all type testing specified above, and bear all expenses for the same.

Copy of Test certificate shall be submitted to SLDC.

30.8 ANOMALY DETECTION FEATURES

The meter shall have features to detect and log the occurrence and restoration of following anamolies, along with date and time of event: 6.1.1. Phase wise Missing Potential – The meter shall detect missing potential (1 or 2 phases) provided the line current is above a specified threshold. The voltage at that stage would be below a specified threshold.

Phase wise Current Circuit Reversal – The meter shall detect reversal of polarity provided the current terminals are reversed. This shall be recorded for 1 or 2 phase CT reversal.

Voltage Unbalance – The meter shall detect voltage unbalance if there is unbalance in voltages.

Current Unbalance – The meter shall detect current unbalance if there is unbalance in load conditions. Meter should ensure true system conditions before going for current unbalance checks.

CT Miss – The meter shall detect current miss if the current is below a defined threshold, provided the phase voltage is above a specified threshold. Snapshots of phase wise voltage, phase wise active current and phase wise power factor shall be provided with above specified anomaly events. Further, each meter module shall record the following events along with total duration:

Power On/Off – The meter shall detect power off if both the auxiliary supplies fail. The event shall be recorded on the next power up. At the same time power on event shall be recorded. No snapshot shall be logged with this event.

Feeder Supply Fail -This event shall be logged when feeder supply, i.e. all the voltages goes below certain threshold. No snapshot shall be logged with this event.

Last three hundred & fifty (350) events (occurrence + restoration), in total, shall be stored in the meter memory on first in first out basis.

There shall be five separate compartments for logging of different type of anomalies :

Compartment No. 1	**100 events of missing potential**
Compartment No. 2	100 events of CT reversal
Compartment No. 3	100 events of power failure/ Power on-off
Compartment No. 4	50 events of transaction related changes as per ICS Category B

Once one or more compartments have become full, the last anomaly event pertaining to the same compartment shall be entered and the earliest (first one) anomaly event should disappear. Thus, in this manner each succeeding anomaly event shall replace the earliest recorded event, compartment wise. Events of one compartment/ category should overwrite the events of their own compartment/ category only. In general persistence time of 5 min. for occurrence and restoration respectively need to be supported in meter.

Anomaly count should increase as per occurrence (not restoration) of anomaly events. Total no. of counts shall be provided on BCS.

30.9 Installation and Commissioning

The Tenderer shall be responsible for total installation and commissioning of the meters (along with test blocks, if supplied separately) as per Owner’s advice, including unpacking and inspection on receipt at site, mounting the meters on control and relay panels at an appropriate viewing height, connection of CT and VT circuits including any required rewiring, functional testing, commissioning and handing over. The Tenderer’s personnel shall procure/carry the necessary tools, equipment, materials and consumables (including insulated wires, lugs, ferrules, hardware etc.)

As part of commissioning of DCDs the Tenderer shall load the software specified in clause 5(d) into the PCs at the respective substations, and fully commission the total meter reading scheme. He shall also impart the necessary instructions to substation engineers. At least 2-hour training session shall be arranged for substation staff and SLDCs. Also, an operating manual (pdf as well as hard copy) of the meter containing all details of the meter, various data downloading features, etc. shall be made available at site and SLDC.

At the time of commissioning, the meters lying in stores shall be time synchronized through GPS signal before installation in the panel to avoid the large time mismatch.

General

The meter shall be supplied with latest/compatible software (shall be compatible with old & new meters data download handling). Any new software as required to be installed within warranty period are to be done by party or through remote support to client.

The total arrangement shall be such that one (1) operation (click on “data down load from meter” button on software) can carry out the whole operation in about five (5) minutes per meter or preferably faster.

The layout of software front end/user interface has to be approved by RLDC during technical evaluation/demonstration. However, a standard template sheet will be provided along with TENDER for reference.

Software for windows/office/antivirus to be supplied. Antivirus should not slow down processes and same will be demonstrated during technical demonstration.

Above specification is minimum only, any higher standard required for the purpose intended (meter data handling) would be assessed by vendor and would be supplied accordingly. The detailed architecture shall be approved during drawing approval stage.

Meter shall be accommodated in existing C&R panel of standard size (Alstom/ ER/ABB/Siemens) in kiosk or C&R panel with door closed. If required before TENDERding, Tenderer may collect necessary data or else the scope is deemed to be included.

Step by Step procedure (on screen shot type and desktop video capture) shall be provided for

Installation/Re-installation of Database handling software in to Laptop / PC

Meter maintenance/site-testing procedure as per relevant IS/IEC standard

Procedure for data downloading from Meter by HHU/Laptop/Desktop PC.

As on date of delivery, the supplied meters shall comply with all statutory regulation as required under CERC/CEA/IEGC as applicable and the same should be declared by the vendor during delivery along with warranty certificate.

Warranty

The IEM shall be under warranty as per OEM standard Warranty Policy. The Tenderer shall be responsible for meter testing as per CEA metering regulations.

The warranty would include repair, replacement, part material replacement cost and one way (return) transportation cost (including insurance of transit)

Meter software, if upgraded by OEM should be supplied free of cost with initiation taken from party. Remote service person name to be indicated during TENDERding

Meters which are found defective/inoperative at the time of installation or become inoperative/defective within the warranty period, these defective/inoperative meters shall be replaced within one week of receipt of report for such defective/inoperative meters

Copy of warranty certificate shall be submitted to owner

STANDARDS TO BE COMPLIED WITH

Standards to be complied

S.No	Reference	Reference Title
	Detail	
1	IS-15959:2011	Data Exchange for Electricity Meter Reading Tariff &
		Load Control – Companion Specification
2	IS-14697:1999	Specifications for AC Static Transformer operated Watt
		Hour & VAR-Hour meters, class of 0.2S and 0.5S
3	IEEE 830-1998	IEEE Recommended Practice for Software
		Requirements Specifications

AMR System

Overview

AUTOMATED METER READING or AMR, as the name suggests is a system used for automating the Meter data collection process. AMR to retrieve data from Energy Meters installed in the substation/ Switchyards has to be primarily based on GPRS/4G/3G network and fibre optic communication, where ever available. However in case GPRS/4G/3G network is not available at any location, then any reliable communication service like Broadband & Satellite Communication may be used for communication with CDCS.

Meters with RS 485/Ethernet port shall be interfaced with Data Concentrator unit to be installed at the substation. Each DCU shall collect and communicate meter data to CDCS server i.e. MDAS(Meter Data Acquisition Software) installed at the central data center located in each SLDC.

The intent of AMR scheme proposed in this document is to automate the task of data collection from each meter/location to the Central Data Collection System (CDCS) followed by validation, processing and generation of customized reports. The data shall be stored in RDBMS database located at respective CDCS server(SLDC).

The communication system for data transfer from IEM to SLDC shall be in the scope of the Tenderer. Concept diagram of the envisaged AMR system is given in Figure

Figure 2: Concept Diagram of Envisaged AMR System

AMR Software Features

AMR shall be provided for collection and processing of data from ABT(IEM) meters (as specified by SAMAST committee) installed at remote Substations. AMR architecture may include the following 4 parts:

Data Concentrator Unit (DCU)

Communication System

GPS clock

Centralized Data Collection subsystem (CDCS) (including CDCS server and MDAS software).

Data Centre Communication Server (CDCS) software shall perform following functions:-

Communication with DCUs

Collection of energy meter data

Collection of status data from DCU

Remote Configuration of DCU

Processing of energy data

Storing of data

Reporting functions for network and communication

Monitoring and Alarming

Audit trail and logging.

Data Concentrator Unit

A Data Concentrator Unit (DCU) installed at each location will act as interface between Central Data Collection System (CDCS) at SLDC and IEMs installed at that location.

DCU shall collect data from energy meters and sent the same to CDCS at SLDC.

DCU shall also report diagnostic information of the energy meters to CDCS. DCU shall have following functions: -

Acquiring energy data and status from energy meters.

Providing energy data and status to CDCS

Providing energy data and status to local computer.

Intelligence to synchronize IEMs clock with GPS clock located at CDCS.

Each meter has a unique identification number and each meter location has unique Identification code. DCU shall collect data from a single or group of meters based on meter number and meter location code. DCUs shall collect data from energy meters and transfer the same to CDCS. DCUs should provide a RS-485/Ethernet/USB port for Communication with local personal computer or terminal.

Central Data Collection System

A Central Data Collecting System provided at SLDC will manage all functionalities of collection of data through DCUs, validation and verification of the data, storage of the data in a database with RAC and with HA (High availability provided by remote mirroring of database storage) and management of the complete AMR system. CDCS shall have a scheduler for scheduling the task of collection of data periodically up to the last time block. Provision of extracting data from the database in the text files as per existing format for all or selected meters for further processing by Energy Accounting software is also to be built in data collection software. The responsibility of providing data up to CDCS (including all the hardware in between) shall be the responsibility of the Tenderer.

The Supplier shall supply, install and commission the CDCS server including the MDAS software on the CDCS server. The awardee under the tender "Supply, Installation, Testing and Commissioning of IT solution as part of Scheduling, Accounting Metering and Settlement of Transaction (SAMAST) system at State Load Dispatch Centre in the North Eastern States of Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland and Tripura" shall install the housing/rack for CDCS server and associated equipments in the SLDC premises and make the same available to the Tenderer under this tender as per the project milestone of the former tender.

Communication System

For the purpose of this project communication media i.e. Fiber Optic/GPRS shall be provided by the respective utility. However for the Pilot Supplier will have responsibility to establish the same. Communication system to be used for transfer of data from DCU to CDCS may be through Optic fibre /GSM-2G/ 3G/ 4G. Tenderer is free to suggest alternative reliable communication media if it is more efficient and cost effective. The Tenderer may conduct field survey for the same prior to submission of tender.

Scope of Work

This section provides detailed scope of work included in the Tenderer's scope, excluded from the Tenderer's scope, facilities to be arranged by Tenderer and facilities to be provided by station owner.

Tenderer's Scope of Work

The scope of work in complete conformity with subsequent sections of the specification shall include site survey(prior to tendering and during execution), planning, design, engineering, manufacturing/integration, FAT test , supply, transportation & insurance, delivery at site, storage, installation, commissioning, demonstration for site acceptance, training and documentation of AMR system including:

Design Document for complete AMR System.

Software Requirements Specifications for CDCS/MDAS and DCU.

MDAS output format shall include exposing APIs (in Json format).

Application Server Database System and Central Data Collection System (CDCS) at SLDCs.

CDCS server along with Router for installation of MDAS (Meter Data Acquisition System) at SLDC.

Making data available up to CDCS system at SLDC.

Data Collection Unit (DCU)

Connection and interfacing of meters with DCU.

Supply and laying of optical fiber at the stations for connection of IEM to DCU wherever the Ethernet/serial communication not feasible

GSM/GPRS/ Modems, Media converter, Switch

Communication channels between each DCU and CDCS.

All cabling, wiring, terminations and interconnections of the equipment.

Database development, Displays and Reports.

Archival and retrieval of data through database with RAC and with HA (High availability provided by remote mirroring of database storage) database at SLDC.

Decoded text files in existing format at SLDC.

Periphery segregation shall be in line with established cyber security standards.

Training of personnel (Substation, SLDC and other divisions of the respective state utility)

Warranty for 1 years. The intent of the project is that the Tenderer shall ensure 100% data availability at SLDC within the stipulated time as per IEGC within the warranty period.

To maintain extra 20% quantity of AMR equipment as backup and future requirement.

Functional Requirements:

30.9.7.9.1 Major components of the AMR System to be implemented under the scope of this specification document are

Data Concentrator Unit

GPS clock

Central Data Collection System (CDCS) or Meter Data Acquisition System (MDAS).

Communication channel

This section enumerates the functional requirements of each component.

30.9.7.9.1.1 Data Concentrator Unit (DCU)

DCU is to function as a gateway between Central Data Collection System (CDCS) and energy meters installed at DCU location. DCU shall have following functions: -

Acquiring energy data and status from energy meters.

Providing energy data and status to CDCS.

Providing energy data and status to local computer.

Time synchronization of IEM's, either through GPS installed at site or through CDCS

Provision for Interface between DCUs

Application Requirement: Data Concentrator Unit (DCU) along with the suitable enclosure shall be placed in the control room in the Substation/ Generating Plant. DCU is functionally requires to acquire the IEM data and transferring the same to Data Control Center (SLDC) using communication system and AMR software.

30.9.7.9.1.1.1 General Construction

DCU shall be a self-contained, stand-alone box with minimum 1 serial (RS485) port for meter connection and with one RJ45 Ethernet 10/100/1000mbps port. DCU shall have in built modem or external modem facility. DCU shall have MODBUS port in addition to DLMS.

DCU should be flush mounted or surface mounted and to be supplied with suitable enclosure for installation in the control room. The enclosure shall be complete with the internal wining and have all the necessary arrangement for the termination of various communication and power cables in the enclosure.

DCU should be of reputed make and should be field tested in similar application for central govt /state govt./PSU etc. DRS/data sheet approval will be taken during drawing approval stage

The DCU shall be normally powered from the station battery backup supply rated at 110/220 VDC/ 230VAC.

DCU should have protection against entry of dust.

Substantial EMI (Electro Magnetic Interference) and ESD (Electro Static Discharge) will be present at DCU site, effect of which shall be duly considered while designing the system. Performance of the overall system shall not be hampered by such interference. EMI/ESD tolerance shall comply with IEC61850-3 guidelines.

DCU should be able to operate in environment with temp up to 45°C and humidity up to 90% without any significant effect on its performance.

The mechanical design and construction of each unit sub-assembly shall be inherently robust and rigid under various conditions of operation, adjustment, replacement, storage and transport.

DCUs shall also withstand without any damage or mal-operation reasonable mechanical shocks, earthquake forces, ambient temperature variations, relative humidity etc. They shall have an IP-54 or better category dust-tight construction, and shall be capable of satisfactory operation in an indoor, non-air-conditioned installation.

Local Display and LEDs for status like power on, communication activity etc should be provided on the face of DCU.

30.9.7.9.1.1.2 Acquiring energy and status data from energy meters

DCUs shall be connected with local energy meters through Ethernet/Serial/USB optical fiber with suitable media converter/ switches in between. All communication between meters and CDCS via DCU should be firm and secure from any unintended disconnection. DCU should implement IEM protocols (IS 15959- Data Exchange for Electricity Meter Reading Tariff & Load Control – Companion Specification). It shall be possible to change/update the energy meter protocol driver from CDCS. DCU shall store the energy data from the meters for at least 15 days in its memory. DCUs shall not send any command other than the command to read the energy data, status data and GPS clock synchronization of IEM clock.

DCU shall be capable of synchronizing with GPS locally/Remote and transfer the synchronizing signal to all the IEMs connected to it. The necessary ports for time synchronization shall be made available. Status means data healthiness check of DCU & Communication channel and any status given by meter.

Providing Energy Data and Status to CDCS

DCUs shall be provided with suitable SIM/modem etc. in order to have connectivity over Optic Fibre /GSM/ 3G/ 4G with SLDC. All communication between DCU and CDCS shall be on secure VPN with two IP address. DCU shall accept following commands from CDCS/GPS Clock and shall function as per the command:

Energy data collection from energy meters.

Acquiring status and alarm from energy meters.

Modification of DCU Configuration through remote access from CDCS.

IEM clock synchronization with GPS clock from CDCS.

The DCU should be compatible with two SIM’s and should have provision for Ethernet connectivity with fall back option between them. Tenderer may supply separate modem with DCU as per technical specifications specified herein.

Transfer of data from DCU to MDAS should be on physical Ethernet and secured VPN form. The DCU should be able to run the meter protocol drivers to read each type of meter and transfer them to the Control Centre. The DCU must support DLMS/COSEM (HDLC & TCP) as well as MODBUS to communicate with meters.

30.9.7.9.1.1.3 Energy Data Collection

DCUs shall query energy data and transfer the same to CDCS based on the command received from CDCS. Command may be for one time demand of data or it may be on cyclic basis. DCU shall be able to query data from all or selected energy meters for the selected period based on the command from CDCS. DCUs shall be able to read energy data from all make of energy meters available in the market like L&T, Secure and Genus etc.

Each meter has a unique identification number and location identification code. DCU shall collect data from a single or group of meters based on meter number or meter location code.

DCU shall receive complete data from energy meters and send the same to CDCS within specified time guaranteed by the vendor. This performance requirement shall be met under the maximum number of IEMs as specified for the delivered as-build or expanded system.

30.9.7.9.1.1.4 Providing energy data to local computer

DCUs shall provide RS-485/Ethernet/USB port for communication with local personal computer or terminal. DCU shall provide meter status, alarm etc. and energy data to local personal computer, if required. Local PC shall be able to query energy data from selected or all energy meter by using web browser and intuitive user interface. The web browser shall be same as CDCS web browser to access the IEMs installed at local station. No special software should be required to be installed at local computer for this communication. All communication with local computer shall be password protected. PC for data downloading at each DCU location shall be arranged by respective site.

30.9.7.9.1.1.5 Status Data Collection

DCUs shall query periodically all energy meters connected to it for status or any alarm etc. Any change in status or alarm shall be reported to CDCS immediately.

DCUs shall acquire connected energy meter details like meter identification number, make, Low Voltage flag etc. periodically as well as whenever it’s powered on. Any meter change activity like meter number, Low Voltage flag etc. shall be reported to CDCS immediately. DCUs shall be self-monitoring for alarm like power failure, communication disconnection, and disconnection from energy meters and report the same to CDCS immediately. DCUs shall have non-volatile memory for storing status data of energy meters duly time stamped, details of connected meters like make, meter number, status change. Non-volatile memory should be able to store such data for at least one month in round FIFO buffer.

30.9.7.9.1.1.6 Time Synchronization of Meters

DCU shall have the intelligence to synchronize the IEM clock time with updated RTC clock time. DCU will get GPS clock reference from its respective CDCS (at SLDC) / local GPS clock and synchronize RTC clock time in DCU. The RTC of DCU should retain its synchronized clock signal without any drift for at least 12 hrs.

The CDCS/MDAS Software should generate a report of the drift between the Meter time and DCU time for the purpose of reconciliation.

30.9.7.9.1.1.7 DCU Configurations change

Each DCU shall have a unique identification number normally not required to alter at site. DCUs shall accept and respond command for making configuration changes in DCU like periodicity of energy data/status data collection/GPS clock signal for IEM clock synchronization. For each configuration change, DCU shall respond with task successful or failure message to CDCS. Configuration commands from CDCS may be in the form of single command or multiple commands in a command file.

DCU shall accept and make changes in configuration through data command on Optical fibre /GSM-2G/ 3G/ 4G. DCU shall receive the configuration command from CDCS on same channel used for transfer of data to CDCS. DCUs shall store all configuration data locally in a separate non-volatile memory. All changes to configuration shall take place first to this memory. Only after receiving a specific command from CDCS, the saved configurations should come into effect. However, any other functionality should not get affected during accepting and responding to configuration commands from CDCS. DCUs are not required to store history of configuration changes as all history shall be maintained in CDCS.

Similarly, it shall be possible to upgrade the DCU firmware remotely from CDCS based single or multiple commands from CDCS. The firmware upgrade shall come into effect only after receiving the specific command from CDCS. The DCU shall immediately send the status of firmware upgrade to the CDCS and shall provide the old as well as new firmware versions.

It shall also be possible to roll back the firmware upgrade if required.

30.9.7.9.1.1.8 Type Test Requirements of DCU (Tenderer should provide valid type test certificates along with the bi document)

List of Type Tests for DCU

Type Test Requirements of DCU	
Conducted Emission	CISPR 22: 2008-09, Ed 6.0 EN55022:2006/A1:2007 on power lines and signal ports
Radiated Emission	CISPR 22: 2008-09, Ed 6.0 EN 55022:2006+A 1:2007 Class A 30Mhz to 1000Mhz

Type Test Requirements of DCU	
Electrostatic Discharge	IEC 61000-4-2:2001 - ±8 kV Contact Discharge, ± 15 kV Air Discharge
Radiated Susceptibility	IEC 61000-4-3: 2006 -80 - 1000 MHz : 10V/m 80% AM, 1 kHz sine wave
Electrical Fast Transient	IEC 61000-4-4:2004 - ±4 kV serial ports, Ethernet port, DC Power Ports
Surge Protection	IEC61000-4-5:- 2011 Serial port ± 4kV, 1.2/50 μs for common mode, Ethernet port ± 2kV, 1.2/50 μs for common mode DC Power port ± 2kV, 1.2/50 μs for common mode, ± 1kV, 1.2/50 μs for differential mode AC Power port ± 4kV, 1.2/50 μs for common mode, ± 4kV, 1.2/50 μs for differential mode
Induced (Conducted) RFI	IEC 61000-4-6: 2004 - 0.15 - 80 MHz : 10 Vrms 1 kHz, 80%AM for DC power, serial and Ethernet port
Power Frequency Magnetic Field	IEC 61000-4-8: 2001 -40 A/m & 1000 A/m
Damped Oscillatory Magnetic fields immunity test	IEC 61000-4-10 T rise: 75 ±- 20% Oscillation frequency 1MHz: ±- 10% Repetition rate: 400 /s for 1 MHz ± 10%, Burst duration: Not less than 2s Continuous magnetic field strength: 30 A/m
Voltage AC Dips & Interruption	IEC 61000-4-11 - AC Power port 0% short Interruption for 250 cycles, 0% of AC mains voltage for 0.5 cycles and 1 cycle, 40% dips for 10 cycles, 70% dips for 25 cycles, 80% dips for 250 cycles
Damped Oscillatory Wave	IEC 61000-4-12 Damped Oscillatory Frequency: 1 MHz Common Mode: up to ± 2.5 kV Differential Mode: up to ±1.0 kV for power port 1 MHz Common Mode: up to ± 2.5 kV for serial port 1 MHz Common Mode: up to ± 2.5 kV for Ethernet port
Immunity to Conducted Common mode disturbances	IEC 61000-4-16 Ed 1.1 frequency range 0-150kHz
Ripple on DC power line immunity test	IEC 61000-4-17 10% of the Nominal DC voltage AC line frequency 50Hz on DC power port
Voltage Dips & Interrupts	IEC 61000-4-29: 2000 - 0% short interruption for 0.03 sec, 40% and 70% dips for 0.3 sec, 80% & 120% variation for 3 sec
Impulse voltage Immunity	IEC60255-5 2000-12, Ed2.0 ±5kV for power port and earth
Barometric Pressure test	IEC 60870-2-2 Ed 1.0 Test range 0 (101.3 kPa) to 3000m (70.0 kPa)
AC Voltage Range and Tolerance test	IEC 60870-2-1 Ed 2.0 176 Vac (-20 %) to 253 Vac (+15%)
Cold Temperature test	IEC60870-2-2 tested at -40 oC
Hot temperature test	IEC60870-2-2 tested at 70 oC
Humidity test	IEC60870-2-2 95% RH 55oC and 55oC
Vibration and Shock test	As per IECC60870-2-2, Class Am, 5Hz to 500Hz on X,Y, Z axis, 10g in X,Y, Z axis
Green Product	RoHS

30.9.7.9.1.1.9 Central Data Collection System (CDCS)

A central data collection system (CDCS) shall be provided at SLDC for collection and processing of data from DCUs installed at remote locations. CDCS shall perform following functions: -

Communication with DCUs

Collection of energy data from DCUs

Collection of status data form DCUs

Remote Configuration of DCUs

GPS clock signal to DCU

Processing of energy data.

Storing of data.

Providing data to energy accounting software.

Reporting functions.

Monitoring and Alarming.

Audit trail and logging.

Meter management.

Shall have user Interface for Data/Report uploading on website.Data/Report access for predefine list of meters to SLDCs with secure user name and password for intrastate energy accounting.

In case of AMR communication system failure due to any reasons manual provision should be made for uploading IEM data to the MDP software for energy calculation.

CDCS shall include a web-based application for utilities/stations to manually upload the data in case of AMR communication system failure due to any reasons. The following shall be taken care of in this regard:

The web application link shall be made accessible to all stations through SLDC website.

The downloaded data shall be in encrypted format.

Each utility shall be given User name and Password for login the web application.

Browser shall have the list of all Utilities and its station names.

Each station shall upload the encrypted data by selecting their Utility name and Station name.

Web Application shall generate the confirmation message to the station on successful uploading of data.

Web application shall generate the popup message at CDCS with Utility name and Station name on receipt of data.

All the encrypted data received at CDCS via web application shall be stored in predefined path.

CDCS shall have the provision to decrypt the data and store in the database for the further processing.

Communication with DCUs

The CDCS shall have a dedicated Communication Server – This shall manage the VPN Connections, DCU Communication, Alarm management, Logging, DCU Configurations as well as GPS clock signal to DCU. The Interface of the Communication Server shall be standards based such that, up gradation of either Communication System or Application Server will not need a commensurate replacement of the other. The CDCS shall have a Network Management Interface that provides a Dash Board of the DCU's and their status / Alarms and Meter's that are not communicating.

Collection of energy data from DCUs

CDCS shall collect data from energy meters through DCU for selected/configured meter location periodically or on demand at any time. CDCS shall have a scheduler software, which shall issue command to the concerned DCU and collect the required energy meter data. It shall be possible to schedule data downloading on hourly basis.

Collection of status data form DCUs

CDCS shall have a DCU monitoring module. This module shall monitor each DCU for its working status, parameters and any alarm etc. The monitoring data shall be collected periodically or on demand at any time from all or selected DCUs.

Remote Configuration of DCUs

CDCS shall be provided with software module for remote configuration of selected or batch of DCUs. Remote DCU configuration module should be able to configure each parameter of DCU individually or in batch mode. It shall be possible to download the following changes to the remote device in addition to other required changes:

Poll cycle for collection of energy data.

Fixed public IP of CDCS server of the Control Centre

Changes in meter protocol driver

GPS clock signal to DCU

CDCS shall send time sync signal to DCU to time synchronize the IEMs connected to that DCU. CDCS shall check the time in each meter on a pre-configured interval (say once a day) and if the drift in meter clock is more than maximum allowed drift (say 60 seconds) with reference to GPS time, the DCU shall initiate clock synchronization in incremental manner with pre-configured offset interval(say 10 seconds). Tenderers can propose alternate mechanisms with the objective keep all the meter clocks within 60 seconds drift with reference. Any meter time change command initiated by the AMR system should be logged as part of audit trail.

Processing of energy data

Collected energy meter data (5-min) shall be provided to the data processing module. The time block period of the raw output from CDCS shall be user defined (5 min). This module shall check the data for completeness, error etc. and if any error is found, the same shall be displayed as an alarm.

Storing of data

If collected data is error free, it shall be provided to a data storage module. Data storage module shall load the collected energy data in to the database as per its structure. Archival of data shall be through RDBMS data base. CDCS shall provide online storage for storing a minimum of 10 years of collected, processed and output data.

CDCS event archive data storage historian shall provide a minimum data storage of 10 years, assuming event will not be more than 20% of the total time.

Providing data to energy accounting software

CDCS should have software module for providing energy meter data from the database to the energy accounting software. The data output shall be in the form of text file (as per IEMs standard text file format) or as query-based output.

Reporting

CDCS shall have data reporting capability implemented through a separate dedicated module. Reporting module should be able to give report output on screen, in pdf or in xls/csv form. Reports may be based on pre-configured criteria or based on adhoc query.

Monitoring and Alarm

CDCS at SLDC shall provide DCU monitoring and self-monitoring functions to monitor the operating conditions and the performance of the system.

A suitable network management system (NMS) shall be provided at CDCS 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.

Any detected problems shall be reported through local display, built-in event logging and to remote console or printer. Severe problems, such as loss of communication, shall generate alarms locally and e-mail notifications to configured e-mail address. User shall be able to enable and disable alarms individually.

CDCS shall generate an alarm whenever “data not received” occurs for one or more times for one or more DCU/IEM data. The alarm shall indicate which DCU/IEM has the problem. All Alarms (such as loss of supply to IEM, DCU failure, Communication failure, AMR failure etc.) to be generated in CDCS within 5 min. of the event.

Performance levels for AMR and CDCS

Data from all the installed IEMs shall be received at CDCS within 8 hours after the scheduled hour (as per user defined). Report for missing data if any shall be generated instantly on demand.

Issues observed in data collection, processing, report generation etc. shall be flagged by SLDC to the vendor for speedy redressal.

Audit trail and logging

CDCS should have audit and logging function for each and every activities either completed successfully or failed should be logged. The system shall provide audit trail of user and system activities that enables data changes to be tracked and reported, including changes made by the system administrator. For editing of energy meter data, the system shall record the following information in a log and store it for a minimum of 12 months:

User ID

Date and Time of Change

User shall be prompted to input a reason for editing using either a standard reason code or a freeform text field. In addition to data stored in the edit log, each interval containing edited data shall be marked with a status to indicate that the data has been edited. The pre-edited value shall be stored in the database as a previous version, which can be retrieved using “as-off” date functionality.

Changes to configuration data by users shall be logged by Date, time, and user ID and such logs shall be stored for a minimum of 12 months. Critical changes relating to measuring parameters (pulse multipliers, transformer ratios, etc.) and formulae change shall be stored indefinitely as a previous version. The database for these is to be maintained in CDCS. For regular system tasks, such as meter communication, task processing, validation, etc. the information will be kept for minimum one month. Full data and system audit ability such as version controls and data retrieval according to the date and time. Additionally, all versions of meter data shall be stored such that they may be retrieved by “as-off” date for user to inspect.

Email & SMS Alerts

CDCS Application software shall have the option to send alerts and notifications via SMS and email to authorized users (operators or maintenance personnel). This shall be used to configure alerts for critical events such as communication device failure, IEM failure, DCU failure, Power supply failure, data collection error reports etc. The software should have option to email reports generated in the system as email attachments.

Data collection, Validation of Data & Reporting

The intent is to provide the requirement details of database-oriented software having capability to exchange and share data/ information with similar database systems that may be used by SLDCs with a view to meet requirements of Data Warehousing and BI systems. The client interface should be browser or console based and report formats should be in user defined multiple formats like PDF, MS Excel, CSV, Text etc.

Collection, Processing and Computation of Meter Data

While importing data from CDCS to software, any discrepancy or missing of data in any particular block or wrong raw data format shall be displayed and downloaded in the form of a report. The output format shall be station-wise, Utility wise and period wise

Software shall have the option to generate the list of meter IDs whose data is not available, List of meter IDs whose data is available for day wise for the required period.

The computation of meter data from IEMs shall be done automatically after activating the import option for data fetching from CDCS

All meter data computation (Active Energy, Reactive Energy, Voltage etc.) shall follow configured Time Blocks region wise Software shall have the provision to access and correct the IEMs raw data in database, if required. The corrected raw data shall replace the old data. It may be noted that multiplication factors are accounted in the meter itself and the practice of applying multiplication factors of CT/PT needed to be dispensed with to reduce computational effort on servers.

Validation of IEM and Fictitious Meter

IEMs and fictitious meters are classified in 3 categories

Main Meters

Check Meters

Standby Meters

Prior to energy accounting, validation and IEMs and fictitious meters data is essential for accurate energy accounting

Validation of main meters data is done by pair-checking and that with Check and stand-by meters data by block wise (5/15 minutes)

The validation of data, software shall have a pair configuration file where all set of pairs can be defined.

Pair check file shall be user configurable for addition/ deletion/ modification of pairs in accordance with the change in network configuration.

When pair check option is activated, Software shall compute the difference between the selected pairs and shall generate the output file which shall consist of actual difference and percentage of difference.

Generally, the polarity of Main and Check meters is same as whereas polarity of main and stand-by meters is reverse. The software shall compute accordingly.

For calculating percentage difference, the reference energy value shall be the sending energy value for Main-Standby meter (M-S set). Since polarity of main and check meters is same, the main meter energy data shall be considered as reference for pair check of Main- Check meter (M-C) Set.

Sending end can be decided based on the polarity of the meter data (Sending end polarity is +ve , while receiving end polarity in –ve).

Software shall generate the pair check output file which contains block wise difference and percentage difference values of all pairs whose %age difference is greater than tolerance value).

Tolerance %age value shall be user defined and it may vary from element to element. The tolerance value shall be user give in pair check configuration file for each pair.

Data Exchange Facility for integration with SAMAST Software

The proposed AMR solution will have facility to integrate with proposed SAMAST software. The AMR Vendor needs to share data in format desired by SLDC through Application Programming Interfaces (APIs) / web service model with proposed SAMAST software.

Reports

Software shall have the feature to prepare reports (5/15/ minutes) in user defined Text, PDF, Excel and CSV format

Active Energy Reports

Software shall have the capability to prepare day wise active energy reports of utilities. The report shall be prepared for each utility. The formats shall be user configurable

Voltage Reports

Software shall have the option for preparation of voltage reports (5/ 15 minutes) for required meters. The files should be user configurable

The format for 5/ 15 minutes block wise Voltage reports should be same as that of active energy reports

Software shall have the option for preparation of low voltage logging reports (5/ 15 minutes) (as per user defined limits)

Software shall fetch the details of the meter ID which have recorded low voltage.

Frequency Report

Frequency data of reference IEM shall be used for DSM accounting. If main reference meter data is not available, first standby meter data frequency data shall be used for accounting. If both main and first stand by meters data are not available for a particular period, second stand by meter frequency data should be used for these periods. The software shall have a user frequency configuration file for selection of any of the reference IEMs.

The finalized frequency by as per user of SLDC to be exported to proposed SAMAST software and Website and others as per SLDC requirements.

S/W shall have the module to compare the frequency data recorded by all IEMs with reference IEM frequency data and to generate the report/trend for any required period (Date and Time through query. The module shall also have the option to define frequency tolerance value. If difference in the frequency data is greater than the tolerance then report shall show the same.

Issues to be addressed during Data Validation

As the input raw data is in 5-min blocks all computations in new data processing software shall be done in 5-min only

While Reports generation, Data Processing Software shall provide two options two generate processed data reports in 15/5-min depending upon the user requirement.

The format of the 15-min processed data reports shall be exactly same as that of the existing 15--min processed data reports in text tiles

Graphs/ Trends

Software shall have the option to display the graphs/ trends in user defined standard chart type such as line, scatter plot, bar chart etc. of different electrical quantities (energy, voltage, frequency etc.) already stored in database for the required period (date and time) through query.

There shall be provision to download the graphs/ trends in required formats (JPEG, PDF etc.)

The X and Y axis parameters of the graphs are user definable

Data Exchange

The solution will have facility to integrate with proposed SAMAST software. The AMR Vendor needs to share data in format desired by SLDC through Application Programming Interfaces (APIs) / web service model with proposed SAMAST software.

30.9.7.9.1.2 GPS CLOCK

The GPS clock will be installed at each SLDC. The GPS clock must have the intelligence to synchronize with NAVIC signal/ NTP/SNTP output.

The Time synchronization equipment to be installed on one of the existing panel at site, shall receive the Coordinated Universal Time (UTC) transmitted through Geo Positioning Satellite System (GPS) and synchronizes equipment to the Indian standard time in a SLDC. Equipment shall have real time digital display in Hour, Minutes and Seconds (24 Hours mode). Standard will be relevant IEC & IS (15959) in line with this document.

Time synchronization equipment shall include antenna, all special cables and processing equipment etc. The length of the Cable for antenna shall generally be Max. 30 Mtrs. However depending on the special requirement, additional length of cable shall be supplied wherever required, without any extra cost

It shall be compatible for synchronization of CDCS.

Equipment shall be able to operate up to the ambient temperature of 50 degree centigrade and 95% humidity.

The synchronization equipment (TSE) shall have 2 microsecond accuracy equipment shall able to meet real time corresponding to IST (taking in to consideration all factors like voltage & temperature variation, propagation & processing delay etc)

Equipment shall meet the requirement of IEC 60255 for storage & operation

The system shall be able to track the satellites to ensure no interruption of synchronization signal.

The output signal from each port shall be programmable at site for either one hour, half hour, minute or second pulse as per requirement.

The equipment offered shall have Minimum seven (7) output ports. Combination of output ports shall be following: -

Potential free contact (Minimum pulse duration of 50 milli seconds): 01 No.

IRIG-B: 02 Nos.

RS232C: 01 Nos.

SNTP port: 02 No.

Unmodulated/modulated : 02

Ethernet

The equipment shall have a periodic time correction facility of one second periodically.

Time synchronization equipment shall be suitable to operate from 220V DC (or) 110V DC as available at Substation.

GENERAL: Tenderer has to supply the suitable connectors of all seven Outputs of the TSE. In case of IRIG-B, T type connectors will be supplied for Looping.

General Requirements

Components of AMR system shall meet following requirements:

Data Concentrator Unit (DCU)

DCU shall be a self-contained, stand-alone, tamper proof sealed box with necessary ports for external connection. It shall be flush mounted or surface mounted without requirement of a separate panel

DCU should be of reputed make and should be field tested in similar application for central govt /state govt./PSU etc. DRS/data sheet approval will be taken by drawing during drawing approval stage

All components inside DCU shall be easily accessible for testing. The plug-in units, whose removal or insertion, when in operation might endanger the reliability or performance of the unit, shall have suitable protection

Each sub-assembly inside DCU shall be clearly marked to show its function, schematic reference so that they are identifiable from the component layout diagram in the handbook

All external connections to DCU should be secure so as to avoid accidental disconnection.

The DCU shall be powered from the station battery backup supply rated at 110 V/220V DC supply or UPS supply

DCU shall have protection against entry of dust, lizards, Rats etc.

Substantial EMI (Electro Magnetic Interference) and ESD (Electro Static Discharge) will be present at DCU site, effect of which shall be duly considered while designing the system. Performance of the overall system shall not be hampered by such interferences. EMI / ESD tolerance shall comply with IEC 61850-3 standard.

DCU shall be able to operate in environment with temperature up to 50ºC and humidity up to 95% without any significant effect on its performance.

The mechanical design and construction of each unit sub-assembly shall be inherently robust and rigid under various conditions of operation, adjustment, replacement, storage and transport

DCUs shall also withstand, without any damage or mal-operation, reasonable mechanical shocks, earthquake forces, ambient temperature variations, relative humidity etc. They shall have an IP-51 category dust-tight construction and shall be capable of satisfactory operation in an indoor, non-air-conditioned installation.

A local display for status like power on, communication activity etc. and alarms like power failure communication fault etc. shall be provided on the face of DCU

A web-based display of DCU dashboard displaying all status; logs of activities, logs of alarm etc. shall be provided which shall be accessible from local PC as well as on CDCS

All communication between DCUs and CDCS should be end to end encrypted through secured Virtual Private Network (VPN) tunnel which shall be transparently managed between each DCU and the CDCS by the M2M Gateway/communication Server

Transfer of data from DCU to CDCS should be on TCP/IP over Fibre optic communication or using GPRS.While using GPRS the communication between DCU and the communication server/M2M Gateway should be on dynamic/virtual IP so that the communication is operator independent for all DCU’s communicating simultaneously with different service provider-based SIM cards

For communication with CDCS, each DCU should be provided with Ethernet port, Serial port option for integration with existing Fibre Optics communication media. If any media converter is required for the integration, Tenderer has to supply the same. This is needed even for substation that presently does not have FO communication since FO communication is likely to be added in the future. For locations that do not presently have FO communication, built-in GPRS modem of DCU /external modem must be capable of transferring the data to CDCS

For GPRS Mode of communication the DCU should have provision for two SIMs from two different service providers (best available internet service provider of that particular site) with provision of fall back between the two SIM’s in case of failure of communication with one SIM

For Substations where FO communication /PSTN is implemented, the GPRS mode of communication should be capable to be configured as back up communication mode

All modem/SIM installed shall be securely and firmly mounted on DCU itself

Mounting or un-mounting of modem/SIM shall be accessible from front of DCU

It shall be possible to change modem/SIM without uninstalling DCU

Mounting of modem/SIM shall be sealable

The Modem shall meet the following environmental specifications, IP55 housing, Storage Temperature: -20 degrees to +70 degree Celsius, Operating Temperature: - 10 degrees to +60 degree Celsius, Humidity: - 95% RH (Non - Condensing)

Item	Description
PORTS:	15 Ethernet Port* (for Meter interface),1 RS 485 PORT,1 SERIAL PORT, 2-4 USB, 1 or 2 GPS Clock synchronous port. *Suitable network switch to be considered for interface between meters and DCU in case of Ethernet communication.
SUPPLY:	Station battery backup supply rated at 110V/220V DC supply or UPS supply.
SIM:	DUAL SIM, INBUILT GPRS MODEM
STORAGE:	ATLEAST 15 DAYS OF DATA
OPERATING TEMP:	-10 degrees to +60 degree Celsius:
HUMIDITY:	- 95% RH (Non - Condensing)
DUST	IP-51 CATEGORY
PROTECTION	
COMM.PROTOCOL	TCP/IP while OPGW / GPRS
Max Meters/DCU	15
COMPATIBLITY	DLMS/COSEM STANDARD
COMMUNICATION REQUIREMENT	Should be able to communicate with at least 2 IPs.
Earthing	The DCU, Communication terminal equipment's, HUB and all associated equipment's of AMR at site to be properly grounded at two places through suitable copper strip/bundled wire. The earthing strip will be connected to existing grid strip/flat/ and healthiness of earthiness & any additional requirement (viz. Spike V guard etc.) will be full-filled by Tenderer as required telecom/metering/communication equipment as supplied & installed by Tenderer

Notwithstanding the above, the MODEM should meet the following specifications:

Standard and Convenience

Dual SIM, Dual Module and ACTIVE/ACTIVE mode supported

Support standard RS232 (or RS485/RS422), Ethernet & WiFi port that can connect to Serial,

Ethernet & WiFi devices directly.

Support standard WAN port & PPPoE protocol that can connect to ADSL directly

Enter into communication state automatically when powered

Support several work modes

Convenient configuration and maintenance interface WEB or CLI

Features

Support Master module, Standby module and WAN (PPPOE, ADSL) Optional triple link

backup

Support 2G/3G/4G/Static IP/DHCP/L2TP, PPTP, PPoE WAN access methods

Support VPN client (PPTP, L2TP, OPENVPN, IPSEC and GRE)

Support VPN server (PPTP, L2TP, OPENVPN, IPSEC and GRE)

Support local and remote firmware upgrade, import and export configure file.

Support VLAN, MAC Address clone, PPPoE Server

Support WiFi 802.11 b/g/n, AP Client, Adhoc, Repeater Bridge mode

WiFi support WEP, WPA, WPA2 encryption and MAC address filter

Support multi trigger ways, SMS, ring and data

Support link disconnection when timeout

Support APN/VPDN

Support DHCP server and client, Firewall, NAT, DMZ host, URL block, QoS, Traffic statistics,

Real time link speed statistics etc.

Full protocol support, TCP/IP, UDP, ICMP, HTTP. Optional SMTP, POP3, OICQ, TELNET, FTP, SNMP, SSHD etc.

Cellular Specification

Cellular Module: Industrial Cellular module

Standard and Band:

Main & Standby Module

LTE FDD 2600/2100/1800/900/800MHz, (Band 1/3/7/8/20)

700/1700/2100MHz (Band 2/4/5/13/17/25 optional)

LTE TDD 2600/1900/2300MHz (Band 38/39/40). 800 / 1400 / 1800

MHz. Band27/61/62 Optional

DC-HSPA+/HSPA+/HSDPA/HSUPA/WCDMA /UMTS 2100 / 1900 / 900

/ 850 / 800 MHz (Band 1, 2, 5, 6, 8)

EDGE/GPRS/GSM 900/1800/1900MHz

Bandwidth FDD LTE: DL: 100Mbps, UL: 50Mbps

TDD LTE: DL: 61Mbps, UL: 18Mbps

TX power: <24 dBm

RX sensitivity: < -109 dBm

System Availability Requirements

AMR system, subsystems and system components shall be able to meet the following availability requirements. The CDCS software shall have a measured availability of 99.99 % or better during the availability test.

The CDCS software shall continue to operate without interruption under any single point of failure condition. That is, there shall be no hardware or software element whose failure renders the CDCS unavailable. This requirement shall specifically include all AMR system components like hardware, the interconnections among hardware, power supplies, and all enclosures.

Field Wiring: The Tenderer has to provide the following:

Wire: Single core, 2.5 sq. mm, multistrand copper wire along with items like “U” lugs(copper), sleeves, ferrules, necessary terminal blocks etc for PT wiring.

Wire: Single core, 2.5 sq. mm, multistrand copper wire along with items like “Ring” lugs(copper), sleeves, ferrules, necessary terminal blocks etc for CT wiring.

Uninterrupted Power Supply and cable for Meters.

All required items not specifically mentioned but required for successful commissioning of the project.

Laptop Spec: The laptop with OS & Meter reading software shall have at least specifications as mentioned in Annexure-M-I:

System Sizing and Performance Requirements

AMR System shall meet the following system sizing and performance requirements. The system sizing and performance requirements are specified for main subsystem. Standby subsystem shall have the same sizing and performance requirements. The Acceptance of the product shall be based on the Owner/SLDC approved test protocols/ schedules to be submitted in advance by the Tenderer ahead of factory/site inspection. The system sizing for AMR System is only specified for initial sizing. The delivered system shall be expandable as the input and output requirements grow. Vendor is required to demonstrate their system’s expandability in FAT.

CDCS shall be capable to receive data from a minimum 400 DCUs, which is collecting up to 15 energy meters connected per DCU, at the minimum data collection interval. However, CDCS shall have provision to collect and handle data from up to 1000 DCUs and up to 5000 energy meters without any significant degradation of performance.

GENERAL CONDITION: The Tenderer stands responsible for end to end integration from meter output to CDCS. Field Survey for Availability of GPRS-2G 3G/4G data networks may be made by the Tenderer prior to submission of TENDERs.

DRS approval- Data sheet approval (of all items to be supplied, BOQ-item or Non-BOQ item as required to be supplied under project- Refer Note-4 Annex-L, Annex-M-II) along with scheme drawing approval will be proposed by executing agency at the scheme/design engineering stage and will be approved by the utility.

Location wise as built drawing (showing what are items supplied/connected /installed in one location, wiring schedule if any) will be provided by Tenderer after commissioning.

A SAT/Commissioning format (for all items) will be proposed based on the scheme as finalized and same will be followed.

SYSTEM

Network Communication

Users and MDAS applications shall be able to communicate within the ABT system local area network (please refer to the tender “Supply, Installation, Testing and Commissioning of IT Solutions as a part of Scheduling, Accounting, Metering and Settlement of Transactions System at SLDCs in the North Eastern States”)and operate as described in this Specification. The network communications software shall use a standard network protocol such as TCP/IP. The software shall link dissimilar hardware nodes such as workstations, servers, and peripheral devices into a common data communication network allowing communications among these devices.

Remote Diagnostic

Remote Diagnostic facility with necessary Hardware as required shall be provided for communication between the CDCS system at control center, DCU at Sub-station and the utility’s support office for the diagnosis of Hardware & Software problems. The login shall be protected by a user name & password entry. This facility through separate port shall also be extended to the Owner through a separate secure port for remote maintenance.

Network services

The following network services shall be provided for the users of CDCS system within the LAN(please refer to the tender “Supply, Installation, Testing and Commissioning of IT Solutions as a part of Scheduling, Accounting, Metering and Settlement of Transactions System at SLDCs in the North Eastern States”):

(a) File management and transfer of files containing text, data, and graphics information.

(b) Printing management

(c) Backup over LAN

(d) Task-to-task communications to external computers

(e) Remote procedure call

(f) Remote terminal session

System Security& Cyber Security

The Contractor shall document and implement a Cyber Security Policy in line with CERT-In latest guidelines (http://www.cert-in.org.in) to secure the system and the Contractor shall keep updating the Security settings as per the revised guidelines of CERT-In at time to time. Below listed basic strategies shall be followed by the Contractor for making the entire Control Centre immune to Cyber-attacks.

All the Hardware, OS and application software shall be hardened.

Network partition and DMZ through use of Firewall as required maximizing the security of ABT, OA AND MIS System while facilitating access for data and information to all stake holders.

All default user id & passwords shall be changed.

All log in/log out and cable plug in/plug out shall also be logged in the System.

Prevent unauthorized users from reading or writing data or files, executing programs or performing operations without appropriate privileges

Document all user sign on procedure

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)

Vendor has to identify and list the entire network and other protocols that communicate with physical systems and limit what is not required.

Network Zoning shall be implemented as per the proposed architecture given in Fig.1. However, the Contractor may suggest other methods of network architecture without compromising the security of the System.

No user shall be allowed to access remote network zones other than the adjacent zone.

Latest Cyber Security Guidelines of CERT-In specified at (http://www.cert-in.org.in) shall be followed.

In normal condition all USB ports of all servers/work stations shall be disabled

Database Management

The database manager shall locate order, retrieve, update, insert, and delete data to ensure database integrity and have provision for backup and recovery of database files. The database manager shall generate and modify all meter 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.

All newly defined database pages, elements or data shall be initially presented to the user with default values for all parameters and characteristics where defaults are meaningful. The user shall be guided to enter new data, confirm existing data, and change default values as desired.

All required entries for any database item selected for changes shall be presented to the user. When parameters are entered that require other parameters to be specified, the additional queries, prompts, and display areas required to define the additional parameters shall be presented automatically.

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.

(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.

Database development tools

The Contractor shall provide all necessary software tools for the development and maintenance of the databases at Control Centre. This tool shall be capable of managing the entire system database. The database development software tool delivered with the CDCS/MDAS system shall be used to generate, integrate and test the database. The database development tool shall facilitate IEC 61970 CIM data exchange of both incremental and full power system model.

This tool shall contain database structure (format) definitions and all initialization data to support the generation of all relational and non-relational run-time databases required to implement the system's CDCS/MDAS functions. The tool shall include consistent, coordinated procedures to manage and access the databases. Extensive reasonability, integrity, and referential integrity checks shall be made on user entries to detect errors at the time of entry. Invalid entries, such as entering an invalid data type or attempting to define contradictory characteristics for a database item, shall be detected and reported to the user in an error message. Help displays shall be available to provide additional, detailed information to the user on request.

Tracking Database Changes

The database manager utility shall maintain Audit trail files for all changes made by all users. 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 one-year operations shall be maintained.

Cyber Security

The entire system shall be subjected to cyber security audit every year by CERT-IN certified agencies. The Tenderer shall arrange for cyber security audit.

Reporting System

Data Extraction – The incremental Data is to be extracted from the various data sources including web-forms, data files and loaded into the master data store. The extractors to the source and target data sources must be provided as part of the application. It must be feasible to schedule the data extraction activities and perform them on ad hoc basis and pre-defined trigger. The Solution must be able to check for availability of data to be extracted and present the status on a dashboard

Data Validation - Relevant rules are to be defined on the extracted data to validate the reasonability of the information. These include rules for checking the value range, sign, and null values. The solution must enable to define business rules / validation rules on a data element level. It must also list/highlight pending data inputs for completion of a process.

Data Store - The validated data shall be loaded into a data store using an appropriate tool. The data to be loaded must be transformed, cleansed, and standardized before loading into the data store. The business rules defined by successful Tenderer shall be validated by the utility. The database shall eventually be hosted on the Storage Area Network (SAN) (please refer to the tender “Supply, Installation, Testing and Commissioning of IT Solutions as a part of Scheduling, Accounting, Metering and Settlement of Transactions System at SLDCs in the North Eastern States”)for scalability and ease of archival. The application must be able to

interface with SAN. Tools for DB archival, truncation etc. to be provided as part of the Application

Reporting - The data in the data store shall be used to generate reports that involve arithmetical and statistical operations on the data to arrive at calculated values. The reports to be generated include the current set of reports. Report generation in multiple file formats like XLS, PDF etc. must be supported. The solution must enable drill down, drill across and roll-up for data elements Design and publish new reports on a need-based basis. Create dashboards, charts & reports

User Friendly Graphical user Interface (GUI) for editing report formats, layout field's etc. facility to augment an existing report with copy-create options to incorporate changes from time to time.

The different types of reports to be generated are

Regular reports on trigger after all data is uploaded

Custom report

Freeform nullified query interface (User shall be able to select fields/parameters dynamically and generate the report)

The GUI for making new reports and custom reports must be use friendly with DB field appearing on a pane which could be dragged and dropped at a relevant location on the report. The solution shall also provide a web form for entry of data for creating a log book type report at the end of every shift, outlining brief details of events during the shift-outages in shift, LCs availed etc. the reporting solution shall also be required to output data in csv, xls(x) format for aiding in preparation of weekly, monthly and yearly report. These reports are available in SLDC websites.

Configurability - The reporting requirements are dynamic and new reporting needs arise from time to time. The underlying data for the reports shall still be available in the system but the system shall be configurable to generate administrator defined reports and publish them. The solution shall be future ready to accept newer sources of data through ODBC, XML, CSV, TXT and generate fresh reports applying of varying periodicity.

Dashboards - The reporting needs include generation of reports in easy to use and intuitive graphical format allowing the selection of widgets, chart types, flash objects and features such as tool tips. Data querying shall be enable for all authenticated users from SLDC to the master database at RLDC/NLDC as part of custom report or free from query.

Data Replication - The Schema of the data store at each of the SLDC needs to be replicated at RLDC/NLDCs on real time basis. At the RLDC a separate set of reports need to be published aggregating the data of all the SLDC's own data Suitable solution architecture is also shown below for the application and data base server deployment

Administration - Separate groups of users shall be created to access the systems like System Administrator, SLDC Administrator, SLDC Member, User Member, Public. Different user categories and their functionalities to be decided by respective SLDCs.

Notifications - The solution must support notifications through SMS and e-mail. SMS and email gateways/ API (SMS) shall be provided by SLDC. Notifications to the relevant users upon submission, updating and non-submission of data (beyond threshold time) shall be some of the applicable scenarios.

Solution Access - The Solution must be accessible securely both from within the SLDC Intranet and the Internet. All forms, page for upload of data etc. exposed to Internet for constituents /ISGS data entry has to be password protected.

General Requirement:

Software's shall be Web based application developed in open-source technology; all the additional plugin / server software licensing cost shall be included in scope and taken care by the Tenderer.

The software shall have role base access.

The software shall have authentication and authorization with single sign–on.

The integrated operation software shall be user friendly, scalable etc. Some of the features of the application are as:

All logs should be highlighted with a notification.

Pointer duplicacy should be avoided while making data base.

Uniformity/Standard should be maintained for all data base.

Nomenclature/ Aliases should be decided by the supplier and SLDC/utility.

Common front end for all the modules

Integration of all the modules with each other

Integration of any other related third party application in the common front end.

Upgrading the modules as per extant and amended regulations of CERC/SERC.

Output of all these modules should be configured with the other modules of SAMAST.

The software shall be designed in extensible manner so that it can accommodate future changes and could be easily maintained.

The software shall have facility to add/block/edit users having different levels of rights and authorizations.

The software design shall take care of system performance tuning & other configuration details as may be required.

The software shall prompt alerts and /or confirmation before any major changes like marking for deletion, updating etc.

Software shall have usual GUI and operating aids like Troubleshooting Tips, Keyboard Shortcuts, Tool Tips, Menu and Toolbar, that are not conflicting with the end user browser settings.

The software shall have compatibility with industry standard internet browsers such as Microsoft Internet Explorer, Mozilla Firefox and Google Chrome etc.

There shall be facility for import / export of data through Excel sheet / Open office spread sheet/csv files.

Option for exporting reports to PDF and excel / csv formats.

Suitable scheduling of back-up (application and database) through the application/automatically as per the requirement of data security.

The developed software shall have the facility to register requirement/ modification and bugs reported by various users during operation.

The system developed shall have facility of help by way of FAQs and User Documentation to the users of the system.

The software shall have provision for sending auto-generated e-mails/SMS, as identified by the system administrator.

The software shall maintain the version details and changes carried out in respective version. These details shall be available to all users.

Audit: The system shall provide defined audit trail of various activities performed by the users as required.