

North Eastern Regional Power Committee

MINUTES OF 16th Metering Committee meeting

Date : 05/05/2016 (Thursday)
Time : 14:00 hrs
Venue : "Hotel Nandan", Guwahati.

The List of Participants in the Meeting is attached at **Annexure - I**

Sh. P.K. Mishra, Member Secretary, requested Shri B. Lyngkhoi, Director/SE(O) to take up the agenda item of metering Meeting.

1. Repair/rectification of large time drifted L&T SEMs:

POWERGRID NERTS has completed following jobs:

BNC HVDC Substation: (2 Nos. of Meters):

- 1.0 New Installation at Tie Bay of Pole 1
- 2.0 Replacement of Pavoi end Meter of BNC 132kV Line -2 (due to mismatch of S/N. in database)

Salakati Substation: (2 Nos. of Meters):

- 1.0 Replacement of Meter S.No. NP-5305 Birpara 1 Feeder
- 2.0 Replacement of Meter S.No. NP-5304 Gelephu Feeder

OTPC, Palatana: (6 Nos. of Meters):

Replacement of the Following Meters (Meters handed over to OTPC):-

- 1.0 NP-7585 at GT-1
- 2.0 NP-7582 at STG-1
- 3.0 NP-8313 at S M Nagar Feeder
- 4.0 NP-7584 at STF-2
- 5.0 NP-7602 at STF-1
- 6.0 NP-7581 at Silchar-2

NERTS representative was requested to intimate the status of sending next batch of drifted meters to L&T works for which target was end of April, 2016.

Deliberation in the meeting:

POWERGRID, NERTS representative informed that next batch of SEMs would be sent to L&T works by third week of May, 2016. NERTS was requested to stick to the target date as the Region was running short of meters.

The Sub-committee noted as above.

Action: NERTS.

2. Procurement of 100 USB cords:

Status as per last meeting:

Revised date for NIT: 12/04/2016:

Revised date of BID opening: 27/04/2016

Tentative date of LOA: 10-05-2016.

Deliberation in the meeting:

POWERGRID, NERTS representative informed that they would stick to the target LOA date of 10.05.2016.

The Sub-committee noted as above.

Action: NERTS.

3. Procurement of additional 70 Laptops:

POWERGRID, NERTS representative informed that Demonstration of SEM downloading is being planned by 27-04-2016. After completion of field demo, decision of procurement would be taken.

Deliberation in the meeting:

POWERGRID, NERTS representative stated that the issue was still pending as field testing of SEMs was yet to be completed.

The Sub-committee noted as above.

Action: NERTS.

4. Procurement of 250 SEMs & 60 Laptops/DCDs:

POWERGRID, NERTS representative informed that Field Demonstration of SEM was being planned tentatively by 27th April 2016.

Deliberation in the meeting:

POWERGRID, NERTS representative stated that the field testing of EDMI was complete and it would be over for other two manufacturers by 3rd week of June, 2016.

The Sub-committee noted as above.

Action: NERTS.

4. Installation, operation and maintenance of SEMs and accessories:

The names & contact numbers of meters coordinators are as below:

| SL No. | Organization | Name & Designation | Contact Details |
|--------|-------------------|--------------------------------|-----------------|
| 1 | Ar. Pradesh | Nangkong Perme, EE, SLDC | 09436288643 |
| 2 | Assam | J. K. Baishya, AGM, SLDC | 09435041494 |
| 3 | Manipur | N. Romeo Singh, Dy Mgr, SLDC | 09612657280 |
| 4 | Meghalaya | T. Gidon, EE, SLDC | 09774479956 |
| 5 | Mizoram | Vanlalrema, SE, SLDC | 09436140353 |
| 6 | Nagaland | A. Jakhalu, EE (Trans) | 09436002996 |
| 7 | Tripura | D. Pal, Sr. Mgr | 09436500244 |
| 8 | NEEPCO | B. Majumdar, DM, RHEP | 09612079362 |
| | | Sudip Das, DM, Kopili HEP | 09401237613 |
| | | Ashim Sharma, DM, Khandong HEP | 09435078860 |
| | | Bendang, Mgr. Doyang HEP | 09862769848 |
| | | D. Goswami, Sr. Mgr. AGBPP | 09435577655 |
| | | Prasenjit Sen, Sr. Mgr, AGTPP | 09436167999 |
| 9 | NHPC (Loktak) | Md. Sajid Akhtar, Mgr | 09436678603 |
| 10 | OTPC (Palatana) | N. Gupta, Mgr | 09774233426 |
| 11 | NTPC (Bongaigaon) | J. Bhattacharya, AGM | 09435720036 |
| 12 | NERLDC | Babul Roy, Mgr | 09436335377 |
| 13 | NERTS, PGCIL | Supriyo Paul, Mgr | 09436302995 |
| | | S.K. Singh, Mgr | 09435706099 |
| | | Ravi Sarma, Sr. Engr. | 09435560889 |

The nodal officers were advised to submit the DCD status report at the earliest before next metering committee meeting. Report may be submitted by e-mail to NERPC/NERLDC.

Status as per 15th Metering meeting:

POWERGRID, NERTS representative informed as below:

Status at POWERGRID S/S:

Total DCDs are available at S/S: 28 Nos.

DCDs in working Condition: 23 Nos.

DCD lying defective at S/S: 5

New DCD available in Store: 03 Nos.

DCDs sent for repairing: 19 Nos.

Other utilities were advised to furnish status at the earliest. All Utilities agreed.

Deliberation in the meeting:

Meghalaya representative submitted list of DCDs in their jurisdiction as below:

| SL NO | NAME OF LINE | METER NO | STATUS |
|-------|--|-----------|--|
| 1 | 132 KV KHLT (PG) - KHLT - 1 | NP-6881-A | WORKING. NO DCD OR LAPTOP |
| 2 | 132 KV KHLT (PG) - KHLT - 2 | NP-6880-A | WORKING. NO DCD OR LAPTOP |
| 3 | 220 KV BYRNIHAT- MISA -I (PG) | NP-5301-A | DEFECTIVE (REPORT SENT) |
| 4 | 220 KV BYRNIHAT- MISA -II (PG) | NP-5302-A | WORKING BUT NO DCD OR LAPTOP SUPPLIED |
| 5 | 400 KV BYRNIHAT - SILCHAR | NP-8371-A | |
| 6 | 400 KV BYRNIHAT - BONGAIGAON | NP-8370-A | |
| 7 | 132 KV UMTRU-KAHILIPARA LINE I | NP-8474-A | |
| 8 | 132KV UMTRU-KAHILIPARA LINE II | NP-8475-A | |
| 9 | 132KV LUMSHNONG-PANCHGRAM | NP-6924-A | |
| 10 | 132 KV UMIAM STAGE-4 (MEG) - SARUSAJAI Line I | NP-8473-A | |
| 11 | 132 KV UMIAM STAGE-4 (MEG) - SARUSAJAI Line II | NP-8491-A | |
| 12 | 132 KV NANGALBIBRA (MEG) - AGIA S/C LINE | NP-8487-A | STATUS NOT KNOWN (NO DCD OR LAPTOP WITH ACCESSORIES) |

Other constituents were requested to furnish the status. All agreed.

The Sub-committee noted as above.

Action: NER Constituents.

5. Time Drift in Meters & action required:

The Sub-committee decided that Metering nodal officers should furnish the status of time drift of meters to NERPC/NERLDC on monthly basis for proper monitoring of the meters.

POWERGRID, NERTS representative state that Status of POWERGRID time drifted meters of POWERGRID S/S end earlier furnished. Regarding other end data, checking of the time drifted meters if any under progress.

Meghalaya submitted time drift status of SEMs within their jurisdiction and it has been observed that SEMs installed at Killing against 400 KV Bongaigaon and 400 KV Silchar lines were drifted by more than 5 minutes. These being main meters would have to be replaced at the earliest.

Other utilities were advised to furnish the report immediately which would be for their own benefit. All utilities agreed to do the same.

As there are spare meters available in stock, all utilities are requested to give time correction command in drifted SEMs as and when required to prevent further drifting.

Deliberation in the meeting:

Assam representative submitted time drift list of SEMs in their jurisdiction. It was noticed that many SEMs were drifted and some by more than 10-15 minutes. Such drift had taken place because there was no timely action in providing time advance/retard command to the meters.

As spare meters were limited, drifted meters would have to be replaced in phased manner.

Following meters would be replaced / installed at the earliest from existing spares:

1. Two SEMs to be handed over to NTPC to be used for computation of start-up power of Unit-2.
2. Defective SEM to be replaced at Byrnihat end of Misa -1 (Meter no. NP-5301-A)
3. Replace SEM NP-5797-A at Samaguri end of Misa-1
4. Replace SEM NP-5796-A at Samaguri end of Misa-2
5. Replace SEM NP-7594-A at Panchgram end of Silchar.
6. Replace SEM NP-6034-A at Gohpur end of Nirjuli

OTPC has replaced six SEMs given to them. As intimated by OTPC 3 healthy SEMs are available with them and may be used by POWERGRID/NERTS in above installations.

The Sub-committee noted as above.

Action: NERTS.

Testing of SEMs: On an enquiry from OTPC, it was clarified that; there were no provisions of calibration of meters. As per CEA metering regulations, meters are to be tested at accredited lab every five meters. NERTS intimated that such testing would be planned after receipt of 250 SEMs being procured. NERTS-NERLDC would prepare a list of SEMs with date of installation/supply which would help in the activity.

Time drift of KHEP SEMs: NEEPCO representative intimated there was some time drift in KHEP SEMs and requested visit of Misa personnel to set right the same. It was agreed that POWERGRID-NERTS would do the needful.

The Sub-committee noted as above.

Action: NERTS & NEEPCO.

6. AMR scheme in NER.

It was informed by NERLDC in 15th Metering meeting that a meeting was being organized between POWERGRID, NERLDC and TCS regarding technical details of AMR scheme. According POWERGRID will go ahead accordingly.

Deliberation in the meeting:

POWERGRID-NERTS representative stated that Tech Specs and QR have been mailed to all Metering Committee members and requested submission of views / comments on the same. Specs and QR as circulated by NERTS is attached at **Annexure - 6.**

The Sub-committee noted as above.

Action: NER Constituents.

7. Replacement of SEMs at Doyang

In the last meeting, POWERGRID, NERTS representative stated as below:

“The L&T software is not compatible with the existing Windows/PC Hardware available at Doyang end. Matter taken up with M/s L&T who will provide technical support online in next week for installation of Microsoft SQL Server software suitable for windows 8 platform. Once the suitable H/W /Software is made available the VINPLUS/SEM software will be installed and SEM Meters will be fitted thereafter accordingly.”

NERTS representative was advised to settle the issue before next Commercial Committee meeting.

Deliberation in the meeting:

It was informed that POWERGRID Dimapur would take-up with Doyang to install required software in their Computer and resolve the issue within May, 2016.

The Sub-committee noted as above.

Action: NERTS.

8. SEMs at NTPC, BgTPP

In 15th Metering Meeting, POWERGRID, NERTS representative stated that they had issued 8 Nos. of SEM Meters and One DCD to NTPC, Salakati on 11-09-2015.

Status of same has been furnished by NTPC as below:

| SI No | Area | SI Nos. |
|-------|--------------------|-----------|
| 1 | 400KV Line 1 | NP-8568-A |
| 2 | 400KV Line 2 | NP-8566-A |
| 3 | GT 1 | NP-9057-A |
| 4 | ICT 2 (400KV Side) | NP-9055-A |
| 5 | Tie 1 | NP-9056-A |
| 6 | Tie 2 | NP-9054-A |
| 7 | 11KV Sec A | NP-9073-A |
| 8 | 11KV Sec B | NP-9058-A |

Based on discussion with NTPC, NERLDC advised POWERGRID NERTS to install 4 nos. SEMs in BgTPP as below:

- | | |
|---|-------|
| 1. NTPC end of 400 kV NTPC-Bongaigaon(PG) feeder-1----- | 1 SEM |
| 2. NTPC end of 400 kV NTPC-Bongaigaon(PG) feeder-2----- | 1 SEM |
| 3. NTPC end of 400/220 kV ICT-2 LV SIDE ----- | 2 SEM |

This would suffice the requirement at BgTPP to account for the following:

1. Injection by U-1
2. Drawal of start-up power by U-2
3. Drawal of construction power by U-3

Deliberation in the meeting:

NTPC representative informed that two more SEMs would be required to compute start-up power drawal by U-2. Schematic submitted by NTPC is enclosed at

Annexure - 8. It was agreed to provide two more SEMs to NTPC (recorded in Item no. 5). POWERGRID-NERTS would accordingly hand over two more SEMs to NTPC.

The Sub-committee noted as above.

Action: NERTS.

9. Metering issues:

a) Meghalaya representative informed that they had not received DCD for Mendipathar. NERTS representative was advised to hand over one DCD to them immediately.

Regarding Deomali, POWERGRID informed that they had requested Deomali S/S to come to Misa Substation for training and collection of DCD and software but Deomali has not responded.

b) NERTS representative stated that Shifting of Samaguri end meter to Sonabil by POWERGRID was done on 02-02-2016. NERTS was requested to transmit downloaded data to NERLDC.

Deliberation in the meeting:

POWERGRID-NERTS intimated that they had handed over DCD to Mendipathar on 19/12/2015 to Shri B. Hajong of MeECL. Meghalaya representative stated that they would check and revert back.

Non-receipt of Umrangsoo meter readings: NERLDC requested AEGCL to send reading of SEMs installed at Umrangsoo against 132 Khandong-Umrangsoo and 132 Umrangsoo-Haflong feeders.

Regarding Sonabil reading, it was confirmed that the reading had been received.

The Sub-committee noted as above.

Action: AEGCL & MePTCL.

Date and venue of next meeting

It is proposed to hold the 17th Metering meeting of NERPC on second week of June, 2016. However, the exact date and venue will be intimated in due course.

The meeting ended with thanks to the Chair.

List of Participants in the 16th Metering Meeting held on 05.05.2016

| SN | Name & Designation | Organization | Contact No. |
|-----|---|-----------------|-------------|
| 1. | Sh. N. Perme, EE, SLDC | Ar. Pradesh | 09436288643 |
| 2. | Sh. T.N. Sarma, DGM, SLDC | Assam | 09435007369 |
| 3. | Sh. J.K. Baishya, AGM | Assam | 09435041494 |
| 4. | Sh. B.C. Borah, AGM,SLDC | Assam | 09435119248 |
| 5. | Ms. Roseleena Parveen, AM (TRC) | Assam | 08011842597 |
| 6. | Sh. G.K. Bhuyan, AGM (Commercial) | Assam | 09854015601 |
| 7. | Sh. Themcham Woleng, Manager | Manipur | 08731000143 |
| 8. | Sh. Leivon Nilemthang, Asst. Manager | Manipur | 08131032269 |
| 9. | Sh. F.E Kharshiing, SE (SLDC) | Meghalaya | 09863066960 |
| 10. | Sh. A. Kharpan, ACE (Com) | Meghalaya | 09436117802 |
| 11. | Sh. R. Majaw, SE (E/M) | Meghalaya | 09436110871 |
| 12. | Sh. B. Wankhar, EE (MO), SLDC | Meghalaya | 09436105914 |
| | No Representative | Mizoram | - |
| | No Representative | Nagaland | - |
| 13. | Sh. Debabrata Pal, Sr. Manager | Tripura | 09436500244 |
| 14. | Sh. P. Kanungo, DGM (AM) | | PGCIL |
| 15. | Sh. Bishwajit Medhi, Manager (SO-I) | NERLDC | 09436335376 |
| 16. | Sh. R. Sutradhar, DGM (MO) | NERLDC | - |
| 17. | Sh. N.R. Paul, DGM | NERLDC | 09436302723 |
| 18. | Sh. Mintu Mandal, Sr. Engineer (SO-I) | NERLDC | 09436335243 |
| 19. | Sh. Rahul Chakrabarti, Sr. Engr (SO-II) | NERLDC | 09402507543 |
| 20. | Sh. Joypal Roy. Sr. Mgr (C/M) | NEEPCO | 09435577726 |
| 21. | Sh. B.K. Chakraborty, DGM(E) | NEEPCO | 09436309730 |
| 22. | Sh. D. Baishya, Sr. Manager (E/M) | NEEPCO | 09435339966 |
| 23. | Sh. Prasenjit Phooban, DGM (E/M) | NEEPCO | 09435380415 |
| 24. | Sh. Rakesh Kumar, GM (OS), ER.II,HQ | NTPC | 09431011344 |
| 25. | Sh. J. Bhattacharyya, AGM (EMD) | NTPC | 09435720036 |
| 26. | Sh. S.K. Dutta, Manager | NTPC | 09435026764 |

| | | | |
|-----|-----------------------------------|--------------|-------------|
| | No Representative | ENICL | - |
| | No Representative | NHPC | - |
| 27. | Sh. Arup Ch. Sarmah, DGM (Comml.) | OTPC | 09871839502 |
| 28. | Sh. Tapash Karmakar, AM (Elect.) | OTPC | 09435239313 |
| 29. | Sh. P.K. Mishra, MS | NERPC | |
| 30. | Sh. B. Lyngkhai, Director/S.E (O) | NERPC | 09436163419 |
| 31. | Sh. S. Mukherjee, AD-I/AEE | NERPC | 08794277306 |

Annexure-6

Qualifying requirement for AMR Scheme in NER:

1. The average annual turnover of bidder for last 3 financial year should not be less than 12 crores.
2. The bidder should be in business of Meter data acquisition for last 3 years.
3. Development & Customization of software, Commissioning of AMR & Data logging system, Meter reading instrument for last 3 years. Necessary LOA/PO as proof to be submitted.
4. The bidder should be ISO 9001:2000, ISO 20000, SEICMM Level 5 Certificate company.
5. The bidder should have implemented AMR Solution in 50 S/s in last 5 years (01 customer certificate to be provided).
6. Bidder should have certificate in Meter Data Management (MDM) solution in India for 1000 metering points in last 5 years in India.
7. The system should be successfully in operation for last 6 months from the date of commissioning.
8. The bidder should have a delivery center in NER (Resident Engineer/Outsource service agencies) should not be qualified.
9. JV/Consortium shall not be allowed.

TECHNICAL SPECIFICATIONS

**AUTOMATED METER READING
AND METER DATA MANAGEMENT
OF -SEMs IN NERLDC**

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1 INTRODUCTION

POWERGRID, a Government of India Enterprise and Central Transmission Utility is entrusted with the establishment, maintenance and operation of National Grid. POWERGRID is responsible for establishment of inter-state EHV transmission lines, substations and modernisation of load dispatch centres, communication facilities in a coordinated and efficient manner and installation of interface meters (SEMs). The inter-state transmission system moves large blocks of power from the generating stations to the load centers within and across all regions with reliability, security and economy. POWERGRID's role includes the operation of National Load Despatch Center (NLDC) and Regional Load Despatch Centers (RLDCs) besides inter-state transmission system (ISTS).

The power system in country is organized in five electrical regions for operation purpose system namely North, South, East, West and North-east. North Eastern Region consists of seven states i.e. Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura. Regional Load Dispatch Centers are responsible for scheduling and measuring power within and across the regions. Measurement of electric energy is being carried out by interface meters called Special Energy Meters (SEMs) installed at the peripheries of states and regions according to Metering regulation notified by CEA. POWERGRID being Central Transmission Utility (CTU) is responsible for installation of SEMs throughout the region and North Eastern Regional Load Dispatch Center (NERLDC) is responsible for collection and processing the metered data.

1.1 Existing system of Meter-data Reading

Presently, manual system is being used for reading meter data. For reading meter data, each meter has been provided with optical port (as per IEC 1107). Meter data is being collected from the meter through a hand held device called Data Collecting Device (DCD) provided by the meter manufacturers. The data from DCD is dumped in a local PC through software provided by the meter manufacturer. From PC, data in the form of encrypted binary files are sent to NERLDC as E-mail attachment for further processing at NERLDC end. These encrypted files collected from all the locations are converted to text files (format specified by Powergrid) by using manufacturer provided software. After conversion, the data is validated, processed by ~~using in-house developed software (RESEM)~~ MDP Software and sent to NERPC (North Eastern Regional Power

Committee) for preparing weekly [UI Deviation](#) and reactive energy accounts.

1.2 Purpose of this Document

POWERGRID intends to automate manual process, as detailed in para 1.1, of meter-data reading, collection and Validation. This document provides functional and performance requirement of Automated Meter-data Reading (AMR) System for North Eastern Region. AMR system once deployed will be utilized for collection of meter data ~~form~~[from](#) Special Energy Meters deployed by POWERGRID in various locations in North Eastern Region. These locations are owned by POWERGRID or State Electricity Boards (SEBs) or Inter State Generating Stations (ISGS) or IPP's (Independent Power Producers).

1.1 Acronyms and definitions

The acronyms and definitions used in this document are listed in the following table:

| | Definition |
|--------------------------------|---|
| SLDC | State Load Dispatch Center |
| ISGS | Inter State Generating Station. |
| SEBs / DISCOMs | State Electricity Boards / Distribution Comapnies |
| SEM | Special Energy Meter |
| IPv4 | Internet Protocol version 4 |
| IPv6 | Internet Protocol version 6 |
| LAN | Local Area Network |
| UDP | User Datagram Protocol |
| WAN | Wide Area Network |
| AMR | Automated Meter-data Reading |
| DCD | Data Collection Device |
| HES | Head End System |

| | |
|---------------------|---------------------------------------|
| | |
| DCU | Data Concentrator Unit. |
| MDM | Meter Data Management |
| CDCS | Central Data Collection System. |
| TOC | Taking Over Certificate. |
| GSM | Global System of Mobile |
| GPRS | General Packet Radio Service |
| ICU | Interface Converter Unit. |
| SRS | Software Requirement Specifications |
| SOA | Service Oriented Architecture |
| RDBMS | Relational Database Management System |
| SAN | Storage Area Network |

2 AMR ARCHITECTURE

Architecture is broadly divided into three parts, (i) Remote End Metering subsystem, (ii) Communication/ Connectivity subsystem & (iii) Centralized Data Collection subsystem

2.1 Intent of AMR

The intent of AMR scheme proposed in this document is to automate the task of data collection from each meter/location periodically and storing the same in a **COTS Relational** database (RDBMS like Oracle, MS SQL Server, ~~etc., My SQL~~ etc). Data from the [Head End AMR System database](#) will be used by enterprise application software such as ABT energy accounting software directly [through a standard Data format](#) or via a file in desired format ([NPC](#)) and further processing. Preliminary validation [such as standard communication error checks \(such as CRC/BCH\)](#) is to be inbuilt in central data collection system (CDCS) envisaged in this scope. Concept diagram of the indented AMR is given below :-

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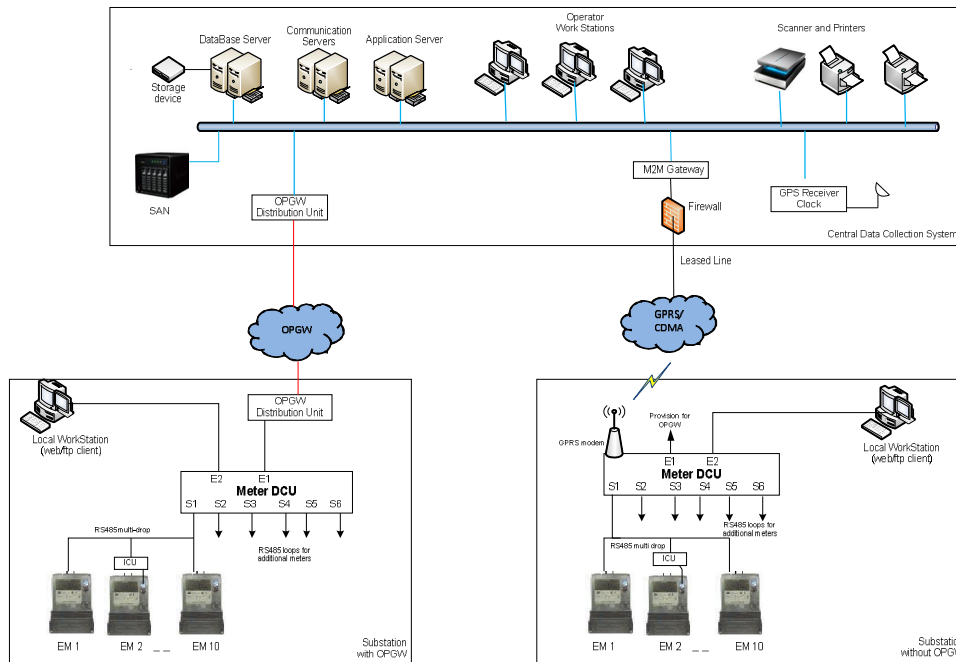


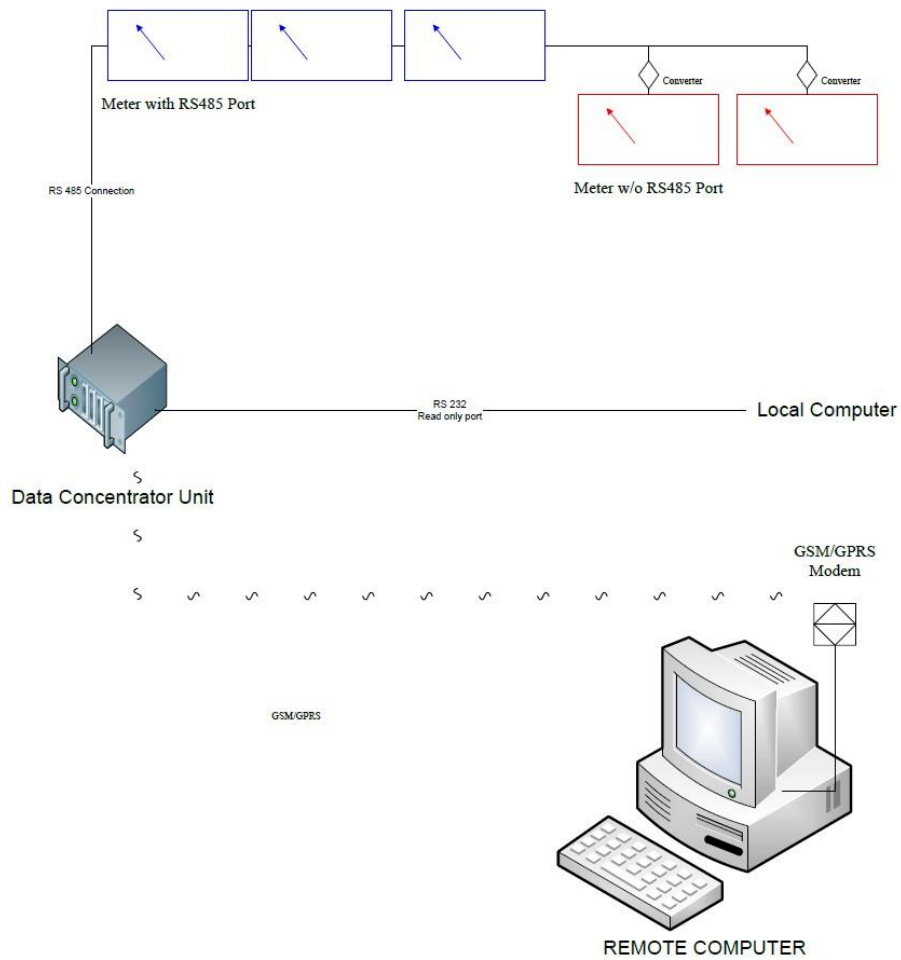
Figure 1: AMR System Architecture for Grid Metering

2.2 Energy Meters Deployed Presently

Energy Meters to be covered under proposed AMR system are L&T, Elster manufactured as per Technical Specification of NERLDC/POWERGRID. At present about ~~<add number of meters here>~~ 350 meters are installed at about ~~<give number of meter location>~~ 80 locations geographically dispersed across the North Eastern Region. Each location may have variable numbers of meters ranging from 1 to 25nos. Each SEM has been provided with an optical port or RS-485 port.

2.3 Data Concentrator Unit (DCU)

A Data Concentrator Unit (DCU) installed at each location will act as interface between central data collection system and SEMs installed at that location. DCU shall collect data from all the energy meters installed at one location and sent the same to CDCS. DCU shall also report diagnostic information of the energy meters to CDCS.



2.4 Central Data Collection System (CDCS)

A Central Data collecting system(CDCS) shall be provided at NERDELDC (or any **Location identified by NERLDC**). This system will manage all functionalities of collection of data through DCUs, process validate the meter data, store the data in a RDBMS, and manage the complete AMR system including the remote devices in the field. The DCU's shall push data at specified intervals with a provision of on-demand poll from the central location (CDCS). Software will also have a scheduler for scheduling the task of collection of data

~~periodically~~. Provision of extracting data from the application database in standard file formats such as the XML, -text files as per existing format for all or selected meters for further processing by existing software applications is also to be build in data collection software. At the same time, the new software shall have a provision for integration with the new processing application via direct database integration or a middleware. CDCS shall have the following hardware

1. M2M Gateway/communication server

Machine to machine (M2M) Gateway connects the CDCS LAN to public service provider network radio networks like GPRS/CDMA without compromising on the security of data transfer. the network. The M2M Gateway creates a trusted network (VPN) with all DCUs connected to the AMR system over the GPRS/CDMA network. M2M gateway should offer security guaranteed by VPN, a virtual private—network, by creating a secure semi-permanent encrypted tunnel between each DCU and the CDCS LAN by assignment of dynamic/virtual IP's to the individual remote devices from the M2M Gateway/Communication Server. networks to pass non-protocol specific traffic between sites using SSL/TLS /IPSec. M2M Gateway will also house the device configuration files and maintain their versions. has a fixed static IP which is known to the device gateways fixed at various distributed locations. DCUs with dynamic IP shall connect to M2M server, M2M server shall intern do the IP translations for the AMR servers in the CDCS to access the DCU over GPRS/CDMA network.

2. Communication server

Communication server shall host all meter reading protocol drivers to fetch data from each meter. The AMR software shall be SOA based and the communication shall deliver the data fetched from the meters to the database server and as well as to the other applications in the SOA.

3.2. Application Server

Application server shall host all the middleware services, and AMR specific applications such as reporting modules, user interface services, data delivery services etc. The application server should also host the network management functions, patch management, antivirus services.

4.3. Database server

The data collected by the AMR system should be stored in RDBMS which shall be hosted in the database server. The database server should also perform data archival functions and should be provided with attached storage devices to backup data at configurable intervals.

5.4. Work stations

Work stations shall provide as user interface to the AMR system, all user interface functionalities—needed for viewing data, configuration, engineering,—IT system management, network management, backup management etc should be possible from these

Comment [PC1]: There is no separate communication server required as the M2M Gateway will act as the communication server.

work stations.

Other components needed are listed below

- 6-5. SAN storage
- 7-6. Network Switches
- 8-7. Router and Firewall
- 9-8. GPS receiver with NTP/SNTP output
- 10-9. Printers
- 11-10. Scanner
- 12-11. 19" Server racks for servers
- 13-12. 2 Mbps Leased Line for connectivity to GPRS cloud
- 14-13. Furniture for Workstations

2.5 Communication System

Communication system to be used for transfer of data from DCU to CDCS is OPGW for substations that support OPGW and GPRS/CDMA for locations without OPGW interface. If the OPGW/GPRS/CDMA service is not available at any location, Bidder is free to suggest alternative communication media if it is more efficient and cost effective. Commissioning of the AMR through integration with the communication media is entirely in the scope of the bidder.

2.6 Interface Converter Unit (ICU)

Where ever SEMs have not been provided with the RS-485 port and meters having RS-485 port, an interface converter shall be installed for converting optical interface to RS-485 interface. The design of ICU should be such that it provides both interface i.e. RS-485 as well as optical. Tentative numbers of ICU is given in **BOQ**.

3 SCOPE OF WORK

This section provides detailed scope of work included in the bidder's scope, excluded from the bidder's scope, facilities to be arranged by bidder and facilities to be provided by **NERLDC/POWERGRID**

3.1 Bidder's Scope of Work

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

- Design Document for complete AMR System.
- Software Requirements Specifications for CDCS and DCU.
- Server System and Central Data Collection System (CDCS)
- Data Concentrator Unit (DCU) with Built-in GPRS/~~CDMA~~ modem
- Connection and interfacing of meters with DCU.
- Interface Converter Unit wherever required.
- Communication channels between each DCU and CDCS for non OPGW locations.
- All cabling, wiring, terminations and interconnections of the equipments
- Database development, Displays and Reports as per requirement of NERLDC.
- Standard database (RDMS) for storage of data.
- Normalized structure of database.
- Meter data processing and configuration of energy accounting reports as per requirement of NERLDC.
- Training of NERLDC & POWERGRID personnel
- Warranty for one year after issue of TOC by NERLDC & POWERGRID .
- Support and Maintenance (comprehensive i.e. including supply/repair of materials) during 4 years extended period under AMC after expiry of warranty period.
- Tie up with meter manufacturers as required for AMR scheme implementation & during warranty period on behalf of POWERGRID/NERLDC

3.2 Exclusions from Bidder's Scope of Work

Followings are not included in the scope of the bidder and shall be provided by NERLDC without any extra cost to bidder:-

- Auxiliary Power Supply for DCU at each location and for server system/CDCS at single point at each location. Further distribution system from this single point is to be provided by bidder.
- Provision of GPRS SIM's, Bandwidth and OPGW connectivity.
- Provision of static IP and internet connection at NERLDC
- Building, air conditioning systems and other infrastructures.
- PC required for data downloading at each location with connector against local requirement by site. Local site shall arrange for the same.

3.3 Facilities to be provided by POWERGRID/NERLDC for Project Implementation

NERLDC & POWERGRID will be responsible for providing the following facilities as may be reasonably required for project implementation:

- Arranging necessary shutdowns and work permits at **all locations**.
- Obtaining requisite statutory clearances and/or approvals as required to be taken for scope of work of AMR.
- Providing power supply outlets for construction work.
- Providing storage space at sites free of cost wherever is available.
- Manufacturer specific Protocol Details for meter communication. However, Supplier shall have to sign agreement for ~~not~~ sharing the protocol / code of the meter required for AMR.

4 FUNCTIONAL REQUIREMENTS

Major components of the AMR System to be implemented under the scope of this specification document are Data Collection Unit, Central Data Collection System, Interface Converter Unit and communication channel. This section enumerates the functional requirements of each component.

4.1 Data Collection Unit

Data Collection Unit (DCU) is to function as gateway between central data collection system (CDCS) and energy meters installed at DCU location. DCU shall have following functions:-

- Providing energy data and status to CDCS.
- Acquiring energy data and status from energy meters.
- Providing energy data and status to local computer at site.

Status means data of healthiness status of DCU & Communication channel and any status given by meter. [The DCU should be compatible with two SIM's and should have provision for Ethernet connectivity with fall back option between them](#)

4.1.1 Providing Energy Data and Status to CDCS (Connectivity to CDCS)

Every DCU should have at least two LAN port for connecting the DCU to the OPGW and substation local operator work station. OPGW network provided in various substations is connected to the station LAN to provide remote connectivity to CDCS.

For locations that are presently without OPGW interface DCUs shall be provided with built-in modems in order to have connectivity over GPRS/~~CDMA~~ with CDCS. The DCU's should have option for two SIM's to ensure reliability of communication.

All communication between DCU and CDCS should be on secure VPN, ~~and it should be encrypted.~~ DCU must support interoperable communication protocol IEC 62056-46, 47, 53,61,62 (DLMS/COSEM) to exchange ~~with the Meters. data with Data Acquisition Software at CDCS.~~ DCU shall push data over specified intervals to the CDCS. The interval of Data transfer should be set remotely. act as DLMS server to supply data to CDCS as per the object models defined in IEC 62056-61. Vendor specific data object should be mapped using C group OBIS codes

DCU shall accept following commands from CDCS and should function as per the command:

- On demand Energy data collection from energy meters.
- Acquiring status and alarm form energy meters.
- Modification of DCU Configuration.

4.1.1.1 Energy Data Collection.

DCUs shall collect energy data, store and transfer/push the same to CDCS as per schedule and provide data to CDCS on demand. DCU should be able to collect data from all or selected energy meters for the selected period and transfer the same to CDCS.

DCUs should ~~have option to~~ implement the protocols of existing meters at various locations included in the scope of this AMR system. In future, all new meters will be compatible with DLMS/COSEM protocol, therefore to ensure interoperability with, the DCUs supplied should support DLMS/COSEM client, ~~driver~~. The vendor shall demonstrate the DLMS/COSEM interoperability during technical evaluation.

~~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 or meter location code.~~

In Case of failure in communication with DCU at meter end or between DCU & CDCS suitable diagnostic tools to identify the reason of communication failure such as outage, GPRS Service availability etc. and accordingly send alarm / signal to the DCU / CDCS shall be provided. The ~~DCU tool~~ shall be capable of detecting such failures and initiate action for ~~collection~~ / transfer of data as & when communication is restored automatically. DCU must also have data storage for storing meter data for ~~107~~ 30 days. This memory shall be over and above the memory required for proper functioning of AMR.

Comment [PC2]: This is not required as 30 days load survey data is already in the meter. So provision for network connectivity outage need only be provisioned

4.1.1.2 Status Data Collection.

DCUs shall collect 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, CT/PT ratio if any etc periodically as well as whenever it is powered on (Meter or DCU). Any modification activity like change in meter number, CT ratio etc should be reported to CDCS.

DCUs shall be self monitoring for events such as, communication disconnection, and disconnection from energy meters and report the same to CDCS immediately.

DCUs should 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 ~~10 7 days (+) one month~~ in round FIFO buffer.

Whenever communication is restored, DCU should send the Data to CDCS in incremental manner to avoid overlap of Data.

4.1.1.3 Time Synchronization of Meters.

~~DCU clock shall be synchronized to the CDCS using NTP Protocol. The CDCS Software should generate a report of the drift between the Meter time and DCU time for the purpose of reconciliation. GPS clock using GPS receivers. DCU shall support SNTP/NTP protocol for receiving clock signal from the station GPS receiver(if available) or from GPS receiver at CDCS. DCUs 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 15 60 seconds) with reference to GPS time, the DCU shall initiate clock synchronization in incremental manner with pre-configured offset interval(say 10 seconds). Bidders can propose alternate mechanisms with the objective keep all the meter clocks within 15 60 seconds drift with reference to the GPS clock. Any meter time change command initiated by the AMR system~~

~~should be logged as part of audit trail.~~

~~DCUs shall also support time synchronization as per DLMS protocol as specified in IS 15959 to support synchronization of time for future SEMs that comply to IS 15959.~~

4.1.1.4 -DCU Configurations change.

Each DCU should have a unique identification number normally not required to alter at site.

DCUs should accept and respond command for making configuration changes in DCU like periodicity of energy data/status data collection. For each configuration change, DCU should respond with task successful or failure message to CDCS. Configuration commands from CDCS may be in the form of single command or multiple commands from the [DCU configuration tool](#). DCU should accept and make changes in configuration through [the configuration tool for DCU's from the Head End Meter Data Acquisition application](#). ~~SMS from CDCS as well as data on GPRS.~~ DCU should receive the configuration command from CDCS on same channel used for transfer of data to CDCS.

DCUs should store all configuration data locally in a non-volatile memory. All change to configuration should be saved in the local memory and only after receiving a specific update 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. [All Configuration change versions for the DCUs should log history of configuration changes upto 30 days for audit purpose, all history should be centrally be also](#) maintained in CDCS.

4.1.2 Acquiring energy and status data from energy meters (Connectivity to SEM)

DCUs are to be connected with local energy meters in multi drop/[daisy chain](#) connection to RS-485 port or to optical port with interface converter unit if required. Connection to the local energy meters should be firm and secure from any unintended disconnection. DCU should implement SEM protocols. [Meter communication protocol details for the energy meters will provided by NERLDC / POWERGRID / Meter manufacturer.](#) Additional details as required will be collected by the bidder from [meter OEM with the knowledge of Power grid. OEM meter](#). It should be possible to change/update the DCU driver configuration from CDCS. DCUs should not send any command other than the command to read the energy data and status data. DCU shall have provision to be able to collect data from DLMS compliant energy meters in future via change in the firmware/application.

4.1.3 Providing energy data to local computer.

DCUs should provide LAN port for communication directly with local personal computer. PC should be able to [display query](#) energy data from selected or all energy meter by using web browser [and intuitive](#) user interface [through the DCU](#). No special software should be required to be installed at local computer for this communication. All communication with local computer should be password protected. PC for data downloading at each DCU location shall be available at respective site. [In addition, web interface](#) (If clients , minimum 10nos. clients should be considered to be provided with system supply i.e. without any additional cost) [should be provided to identified remote stations \(as mentioned in BoQ\) for their individual use. These users should have password controlled access.](#)

4.2 Central Data Collection System

A central data collection system (CDCS) shall be provided at NERLDC 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 [DCU health](#) status data ~~form DCUs~~
- Remote Configuration of DCUs
- Processing of energy data.
- Storing of data.
- Providing data to energy accounting software.
- Reporting functions.
- Monitoring and Alarming.
- Audit trail and logging.
- Meter [Data](#) management [functions](#).

Parties are advised to get information of the existing data collection system before bidding.

4.2.1 Communication with DCUs

The CDCS shall have a dedicated Communication Server/[M2M Gateway](#) – This shall manage the VPN Connections, DCU Communication, Alarm management, Logging as well as DCU Configurations. The Interface of the Communication Server, shall be standards based, such that, upgrade of either Communication System or Application Server hardware will not need a commensurate replacement of the other. The CDCS shall have a [Device Network](#) Management Interface that provides a Dash Board of the DCU's and their status / Alarms and Meter's that are not communicating.

4.2.2 Collection of energy data from DCUs

CDCS shall collect data from energy meters through DCU for selected/configured meter location periodically or on demand. ~~CDCS should have scheduler software which shall issue command to concerned DCU and shall collect the required energy meter data.~~

4.2.3 Collection of DCU Health status data ~~form DCUs~~

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

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4.2.4.2.3 Remote Configuration of DCUs

CDCS should be provided with software module for remote configuration of selected or batch of DCUs. Remote DCU configuration module should be able to configure each and every 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:

- ~~Push~~ interval eyele for sending meter data to CDCS. ~~collection of energy data.~~
- ~~Fixed public IP of CDCS server of the Control Centre~~
- Changes in meter protocol driver configuration paramters.

4.3 Meter Data Management

The Meter Data Management module would function as the meter data repository for NERLDC. This will form the base for meter data analysis and act as the gateway to the settlement and billing process. The Meter Data Management module should be a commercial off the shelf enterprise level product having been globally deployed for a large meter base of more than 100000 metering points. The Meter Data management module should have the following built in functions:

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4.2.54.3.1 Data Validation, Estimation and Editing (VEE) :

The software shall have validation/assessment module to detect ~~Detect Phase voltage loss,~~ Energy Counter Roll over, Missing—interval data etc. Incase invalid data is obtained, the module should replace missing data from ~~check meters/~~ or through automated estimation routine as per details below.

Comment [PC4]: Check meters may be taken as a reference for the Estimation Routine Run

4.2.5.14.3.1.1 Validations

Validation of Meter Details

Before metering is approved for billing purposes under the settlement system (and following changes to such metering such as a meter change or CT ratio change) the meter details are validated. This involves verification:

- That the meter data correctly pertains to the registered metering installation and the date/time stamps of the data interrogation are correct;
- That the date and time held by the meter are correct;

Validation of Metered Load Profile Data

On receipt of the load profile data collected from an ABT meter the following checks are completed:

Time Intervals

For each interrogation, the number of expected time intervals between the start and stop times of the load profile data is calculated and compared with the actual number of time intervals found in the load profile data file. Any difference in the number of time intervals is investigated and resolved.

Spike Check

Each time a meter is interrogated the highest and third highest peaks of the data file returned are compared. If the difference between these two peaks is greater than 300% (configurable) then the data is investigated to verify the validity of the data.

Cumulative/Total Consumption Comparison

When the device is interrogated, if the device provides an electronic cumulative reading of the prime register equivalent to the total consumption of the meter, then the difference between successive cumulative readings is compared to the total of the meter period data for the same period of time.

Previous Peak Tolerance

The peak value for each interrogation is compared with the peak value for the previous data file. If the difference exceeds 100% this is flagged and investigated to ensure the validity of this data.

Zero Interval Tolerance

On each interrogation, the total number of zero intervals retrieved (on customer import kW channel) is counted. If more than 20 zero quarter hourly intervals are contained in the data file this is flagged and the cause investigated.

4.2.5.2 Data Estimation & Substitution This section is not required, it is taken care of in MDP software.

Requirement for Data Estimation and Substitution

~~Data estimation is required to be undertaken in situations where meter data is incomplete, has been irretrievably lost or cannot be obtained within the time frames required.~~

~~Data substitution is required where the data obtained is erroneous.~~

Data Estimation & Substitution Rules

~~Data will be estimated/ substituted when required using one of the following methods in the order specified below:~~

~~1 Where a **check meter is installed** and functional, data requiring estimation/substitution will be taken directly from the check meter;~~

~~2 **If the gap in data is 2 hours or less** point to point linear interpolation will be used to estimate/substitute the data. Intervals containing a power outage are not used as end points for interpolation:~~

~~a) If the data gap occurs in the middle of the data, the first point is the last valid interval before the gap and the second point is the first valid interval after the gap.~~

~~b) If the gap occurs at the beginning of the span the last interval from the historical data is used as the first point if the historical data is available and valid. Otherwise the second point (the first valid interval after the section) is used as the first point.~~

e) If the gap occurs at the end of the span the first point (the last valid interval before the section) is used as the second point.

3 If the **gap in data is greater than 2 hours** then the interval data is constructed using the average load shape based on the three most recent “similar” days with valid data (i.e. data that has not been estimated). A “similar” day means the same day of week and can be chosen from the previous 90 days. If the day needing estimation is a holiday, then the “similar days” should be holidays rather than the same day of week. If adequate data is not available to perform this then one of the methods outlined below will be employed in the order given. Where actual meter readings are available an adjustment factor shall be calculated and applied to the data to ensure that the total estimated consumption is equal to the total actual consumption.

a) If only two “similar” days are available within 90 days, the average is calculated of these two. Similarly, if only one “similar” day is available the data for this day is used for estimation.

b) If no “similar” days are available in the previous 90 days, the three “like” days that are closest chronologically prior to the day requiring estimation are used. A “like” day means a weekday or weekend/holiday.

e) If no “similar” days are available and three “like” days are not available then the average of the two “like” days that are closest chronologically prior to the day requiring estimation is used.

d) If no “similar” days are available and two “like” days are not available then the data for the “like” day that is closest chronologically prior to the day requiring estimation is used.

e) If there is no historical data that can be used, the data should be estimated manually and the process and assumptions documented fully.

1. — Data backup and recovery provision shall be available
2. — DB shall be tuned for better performance
3. — Data storage time period shall be configurable by the user. (CERC specifies 18 months)

Data VEE Reports

1. Meter Data Receipt – Day wise Report
This report contains data reception details for a day.
2. List of Erroneous Data – Day wise Report
This report contains error data list for a day
3. List of Verified Meter Data – Day wise Report
This report contains meter data that are verified for a day
4. List of Estimated Meter Data – Day wise Report
This report contains estimated meter data for a day
5. List of Edited Meter Data – Day wise Report
This report contains edited meter data for a day
6. List of Frequent Failure Meters – Non receipt Report – Monthly
This report contains details of meters that fails frequently for a month
7. Meter Status Indication Report – Daily
This report contains details of indication of meter status for a day
8. Meter Status Indication report - Weekly
This report contains details of indication of meter status for a week
9. Meter status Indication report - Monthly
This report contains details of indication of meter status for a month

The software should have provision to calculate net energy consumption based on multiple boundary meters for various DISCOMs by using the function of aggregation. The software should allow user to easily change the calculation of the consolidated energy consumption reports. The details of the reports to be generated and the calculations that needs to be done from raw meter data for generating reports shall be shared with the successful bidder by NERLDC.

4.2.64.3.2 Meter data Processing at HES

Collected energy meter data should be processed by the CDCS HES software for making it usable for report generation. The data processed at the HES end is passed onto the Meter Data Management Module in a standard format for further validation and analysis.

~~processing module shall check the data for its completeness, any error etc. If data collected is not found usable, data should be collected again.~~

~~The software should have provision to calculate net energy consumption based on multiple boundary meters for various DISCOMs. The software should allow user to easily change the calculation of the consolidated energy consumption reports. The details of the reports to be generated and the calculations that needs to be done from raw meter data for generating reports shall be shared with the successful bidder by NERLDC.~~

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Comment [PC5]: This should be property/feature of the MDM

4.2.74.3.3 Storing of data.

~~The raw meter data is stored in the HES RDBMS. If collected data found usable, it should be provided to data storage module. Data storage module perform the loading the collected energy data to database as per its structure. MS SQL Server or other equivalent COTS RDBMS such as Oracle should be used., MySQL (including vendor support) should be permissible.~~

4.2.84.3.4 Providing data to 3rd Party Enterprise application softwares

CDCS HES should have ~~interfaces software module~~ for providing energy meter data from the database to the ~~MDM 3rd party Enterprise application~~ software using IEC61970 CIM/XML interface.

The CDCS should also act as an OPC server and be compliant to IEC 60870-5-104 for Data Exchange with NERLDC SCADA systems.

4.2.94.3.5 Reporting

It is expected that the MDM Software housed at CDCS should 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. Some of the reporting requirements are as follows:

- Energy Consumption **Weekly**/Monthly statements/Trends
- ~~Executive Summary~~
- DISCOM wise Energy consumption **weekly**/monthly statement/Trends
- Energy Dashboard consisting of mainly
 - Energy balance Statements
 - Reactive Energy release statements to Licensees
- Daily import export flow
- Midnight reactive report

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Reports in HES AMR

In this category various types of Query based report can be generated. 1. NPC report 2. Device Diagnostic report 3. Load Curve 4. Maximum and minimum flow report 5. Reactive energy flow report 6. Time deviation report 7. Daily export/import flow report etc

3.4.1 NPC Report

NPC file can be downloaded directly on the PC or it can be mailed by assigning e mail id. NPC file can be generated by using search type i.e meter serial no, Feeder name, substation name, all substations. NPC file can be generated by selecting any date range. The same has been shown below.

Diagnostic report

In diagnostic report, communication status, Modem Hostname, Service provider details report, of all SEMs along with substation wise is generated. It also gives the reason for not reporting the data through AMR which helps us in analysing the problem. It also gives the primary and secondary SIM numbers along with last load survey polling and last midnight polling.

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Load Curve

By selecting the desired date range and by selecting the feeder Load Curve can be generated as below. The graph plot can be downloaded and e-mailed in jpg or pdf.

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Maximum and Minimum flow report

By selecting the date range and feeder, Maximum and minimum flow can be determined along with the Time at which maximum and minimum occurred.

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Time Deviation report

Time deviation report is generated by selecting the Substation name. List of all SEMs having drift, along with drift time is generated. AMR system compares Meter RTC with GPS matched DCU and drift is reported as +ve or -ve in the report as mentioned below. The same can be downloaded in PDF or excel and can be sent to each substation for time correction of respective SEM.

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Daily Export/Import report

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~~In this, feeder wise daily export and import report for each day is generated by selecting the desired date. By selecting substation in the menu, import and export for each element of that substation can be determined in report format.~~

Comment [PC6]: Should be shifted to MDM

4.2.104.3.6 Monitoring and Alarming.

CDCS HES Application Software shall provide DCU monitoring and self-monitoring functions to monitor the operating conditions and the performance of the system.

~~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, ~~and E-mail notifications to configured e-mail address~~ should also be possible from the central location.

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/SEM data. The alarm shall indicate which DCU/SEM has the problem.

CDCS shall generate an alarm when “data not received in time” occurred to a DCU/SEM data for more than a preset number of times during a specified period.

4.2.114.3.7 Audit trail and logging

CDCS should have audit and logging function 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.

Any user activity in the system shall be recorded as following information in a log and stored 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.

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 retrieving data according to the date and time. Additionally, all versions of meter data shall be stored and retrievable by “as-off” date so that users may inspect data

4.2.124.3.8 Time Synchronization of Meters

CDCS shall be provided with a GPS receiver to synchronize the System clock of all nodes in the network. The GPS clock should have NTP/SNTP output. CDCS servers and DCUs shall be synchronized using [the NTP reference](#). ~~his reference clock~~. DCUs 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). Bidders can propose alternate mechanisms with the objective keep all the meter clocks within ~~60~~ 30 seconds drift with reference to ~~NTP~~ the GPS clock. Any meter time change command initiated by the AMR system should be logged as part of audit trail.

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4.2.134.3.9 Email & SMS Alerts

CDCS [HES 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 or data collection error reports. The software should have option to email reports generated in the system as email attachments.

[These alerts should be sent to the MDM module for further reporting and analysis](#)

4.34.4 Interface Converter Unit

Energy meters to be included in AMR system have optical interface (as per IEC1107) for downloading data and giving time correction command through a handheld device called data collection device (DCD) / **through meter software installed in Laptop**. However, some of the energy meters have also been provided RS-485 port in addition to optical port. Wherever RS-485/~~RS422~~ port is available and functional, it should be used for connectivity to local DCU and transfer of data from meter to DCU/CDCS. **In case energy meter does not have RS-485 port (~~or RS422~~) or the port is not functional at the time of implementation of the AMR system**, an Interface Converter Unit (ICU) should be used for conversion of communication signals from optical port to RS-485 port. Each ICU should meet following requirements:-

- ICU should be firmly mountable on optical port of energy meter so as it should get loosen or come out by unintended actions. However, mounting should not put obstacle for normal view of meter display.
- ~~➤ ICU should provide the interface for both RS 485 as well as functionality of optical port. Optical port shall be available for downloading of energy meter data or time corrections of energy meter clock through hand held device / **through meter software installed in Laptop** as being done presently. The ICU should be intelligent enough to generate its own Station ID and thus operate over an RS 485 local substation network.~~
- ICU should be stand alone device and should accept 0-220 V DC and 230 V AC from TB/TTB of meter existing station DC supply. without requiring any external input except connection to communication wire. Power for ICU may be drawn through DCU on the spare pair of same communication cable used for communication between meter and DCU. It must be ensured that optical port on ICU does not require external power supply modules to fetch the data from meter.
- It is preferable to convert optical interface to RS-485 port by the interface converter. However, vendor is free to use any other standard for conversion as long as it meets the requirements of AMR system without affecting performance and intended functions.

4.44.5 **Communication System**

Project has to be based on various communication medium based on availability, priority shall be for OPGW in case OPGW is not available at any location, then any available communication service like GPRS/~~CDMA/DSL~~/PSTN/~~PLCC~~ may be used for communication with CDCS.

Communication system should meet following requirements:-

- All communication between DCUs and CDCS should be through secured Virtual Private Network (VPN) tunnel (~~encrypted data~~) which shall be transparently managed between each DCU and the CDCS by the M2M Gateway/communication Server CDCS.
- Transfer of data from DCU to CDCS should be on TCP/IP over OPGW or using GPRS/~~CDMA/DSL~~ and ~~on serial communication while using PSTN/PLCC.~~ 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 dynamic IP based SIM cards. s should be supported at DCU and static IP at CDCS.
- For communication with CDCS, each DCU should be provided with Ethernet port as well as Serial port option . This is needed even for substation that presently does not have OPGW since OPGW is likely to be added in the future. For locations that does not presently have OPGW, built-in GPRS/~~CDMA~~ modem capable of transferring the data to CDCS data to CDCS using TCP socket communication using DLMS/COSEM as well as SFTP protocols. In both cases there shall be no requirement to assign public static IPs to this GPRS device. DSL, PSTN, PLCC modem interface capability should also be available in DCU.
- For GPRS Mode of communication the DCU should have provision for two SIM's from two different service providers with provision of fall back between the two SIM's in case of failure of communication with one SIM.
- A fixed public IP shall be provided for the internet landing point at CDCS to connect the GPRS cloud to CDCS.
- There shall be no requirement to pull meter data over GPRS network by running meter specific APIs in the Servers at the Control Centre, as it will slow down the process of remote reading with growing number of meters as well as the limited bandwidth available in meter communication ports and that of the GPRS network.
- The DCU should be able to run the meter protocol drivers locally to read each type of meter and transfer them to the Control Centre.
- The inbuilt Modem should be Dual Band capable of operating at 900 and 1800 MHz. Modem should support both Data and SMS transmission. It should have both GSM and GPRS/EDGE features

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- Modem should use standard AT Command set (GSM 07.05, GSM07.07) for settings of the modem. TCP/IP stacks access via AT commands, Internet Services: TCP, UDP, HTTP, FTP, SMTP, Max. Baud Rate: for GSM Operation - 9600 bits/sec.
- DCU should be capable of operating on single phase 230 V, 50 Hz power supply or through y-

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5 GENERAL REQUIREMENTS

Components of AMR system should meet following physical requirements:

5.1 DCU

5.1.1 General Construction

- DCU shall be a self contained, stand alone box with necessary ports for external connection. It should be flush mounted or surface mounted with out requirement of a separate panel.
- DCU should not have any moving parts such as a hard disk, to ensure smooth and reliable operation for long term.
- The DCU shall be normally powered from the station battery backup supply rated at 220 VDC.
- DCU should have protection against entry of dust, lizards 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 should be able to operate in environment with temp upto 50°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 should also withstand without any damage or maloperation reasonable mechanical shocks, earthquake forces, ambient temperature variations, relative humidity etc. They shall have an IP-50 category dust-tight construction, and shall be capable of satisfactory operation in an indoor, non-air conditioned installation.

5.1.2 Local Display and LEDs

LEDs for status like power on, communication activity etc like power failure

communication fault etc should be provided on the face of DCU.

The DCU should have a web server in order to give web based display of DCU dash board displaying all status, logs of activities, logs of alarm etc should be provided which shall be accessible from local PC as well as on CDCS.

5.1.3 DCU Communication Capability

- All communication between DCUs and CDCS should be through secured Virtual Private Network (VPN) tunnel (~~encrypted data~~) which shall be transparently managed between each DCU and the CDCS by [the M2M Gateway/communication Server CDCS](#).
- Transfer of data from DCU to CDCS should be on TCP/IP over OPGW or using GPRS/~~CDMA/DSL~~ and ~~on serial communication while using PSTN/PLCC~~. 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 dynamic IP based SIM cards. s should be supported at DCU and static IP at CDCS.](#)
- For communication with CDCS, each DCU should be provided with Ethernet port as well as Serial port option. This is needed even for substation that presently does not have OPGW since OPGW is likely to be added in the future. For locations that does not presently have OPGW, built-in GPRS/~~CDMA~~ modem capable of transferring the [data to CDCS data to CDCS using TCP socket communication using DLMS/COSEM as well as SFTP protocols. In both cases there shall be no requirement to assign public static IPs to this GPRS device. DSL, PSTN, PLCC modem interface capability should also be available in DCU.](#)
- [For GPRS Mode of communication the DCU should have provision for two SIM's from two different service providers with provision of fall back between the two SIM's in case of failure of communication with one SIM.](#)
- For Substations where OPGW/PSTN is implemented, the GPRS mode of communication should be capable to be configured as back up communication mode.

5.2 CDCS

- DOTNET or equivalent architecture such as Java based technologies should be used for development of CDCS software.
- [Uploading meter data files manually to the MDM-AMR system by an authenticated user should also be supported as part of Edit functionality.](#)

Comment [PC7]: Manual Entry or Edit should be permissible at MDM level only.

- System under this project should be complete in all respect including software, hardware, servers, LAN ~~equipment~~equipment's, cabling, modems, server racks etc.
- The Application servers and M2M Gateway/communication servers~~or computer system~~ should be in redundant mode in main and standby configuration. In case of failure of main standby should take over the work of data collection.
- Data collection system should use multi-tier architecture having separate tier for database, application server and client.
- Application tier should utilize Web based architecture based on Microsoft .NET framework, JAVA framework etc.
- Client tier should be any Internet Explorer like MSIE, Firefox etc.
- The Application shall be secured with password protected access. It should be multi-user with role based security.
- CDCS should be implemented by using server machines. Two ~~servers~~machines shall be used for hosting application software and RDBMSs in main and standby mode. Two servers shall be used as communication front end for all communication with DCUs as well as clients.
- Suggested configuration of application servers may be:-
 - 16 GB main memory
 - 3x300 GB ~~—~~hot pluggable, HDD configured as RAID 5.
 - DVD RW drive
 - 2USB ports
 - 10/100/1000 Mbps dual Ethernet card

The above are minimum requirement and any system with higher parameters shall be accepted.

CDCS Hardware should contain a desktop based Engineering console (minimum 1 CPU, 4 GB RAM) with keyboard, mouse and monitor etc for making changes to the CDCS HES without affecting the running system.

The CDCS should also house the Development environment for the MDM System. The suggested minimum configuration of this is as follows:

- 8 GB main memory
- 3x300 GB hot pluggable, HDD configured as RAID 5.
- DVD RW drive
- 2 USB ports
- 10/100/1000 Mbps dual Ethernet card

The Communication Server/M2M Gateway which also provides the secure VPN channel must be specially designed for large systems (support at least 500 locations in parallel) in terms of hardware reliability by providing dual power supply and hard drives. The following should be the features:

- ✓ Should support at least 200 Nos of remote GPRS units
- ✓ Dual power supply and hard drives for redundant operation

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- ✓ Expands Ethernet over wireless (GPRS/EDGE) network
- ✓ Mobile operator independent static IP addressing for connected GPRS devices enabling two-way communication
- ✓ Easy and quick to install and configure
- ✓ VPN for secure communication
- ✓ Built-in Firewall

The following are the minimum Hardware specifications

1. Processor Environment
 - 2 GHz Quad-Core Xeon
 - Memory - 2 GB RAM
 - 2 x 72 G Bytes SAS hot swap
2. Power
 - Dual power supply (100-240 VAC)
3. Mounting
 - 19" Rack Mountable
4. Operating Environment
 - Operating temperature 0 to +45 °C
 - Storage temperature -20 to +45 °C
 - Humidity 10% to 90% RH non-cond.
 - Network Connection
 - 2 x Ethernet RJ-45 (10/100/1000 Base-T)
5. Approvals
 - CE, FCC

- ✓ Software
 - The communication Front end must include related software which enables VPN connection.
 - Should support VPN protocols like SSH, L2TP and OpenVPN

✓ Configuration and Management

The Communication Front end must be configured and managed by secure https-connection.

The Communication front end can be installed in the Militarized or the Demilitarized Zone (DMZ)

The CDCS should also have an external storage (min 1 TB) for archiving the meter data for 3 years.

A Router at CDCS end is required to channelize the meter data traffic as well as connecting CDCS to the main NERLDC LAN. This router should have an inbuilt firewall.

The following are the router features:

- Support the TCP/IP protocols
- Support 10/100/1000 Mbps LAN interface
- Have inbuilt software firewall
- Shall support G.703 E1 interface for interfacing with communication links and shall support a speed of 64 kbps configurable upto 2Mbps at each port

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Router shall be provided with following minimum specifications.

- Functions: High performance routing for data exchange between remote PC's
- Routing Capability: Layer -2 & Layer-3 routing & dynamic discovery of routing
- Processing capacity: Minimum 2Mpps
- IPSec VPN tunnels: Minimum 100
- Features to support: QoS, MPLS, Security, Broadband, Multiservice, Voice, IP to IP Gateway
- Routing protocols: EIGRP, IGRP, IS-IS, OSPF, BGP, ARP, IPCP, IP forwarding, VLAN MPLS etc.
- Network protocols: TCP/IP, IPv6, OSI, Telnet, UDP, DHCP
- Network management: Using SNMP Protocol
- Inbuilt software firewall features: Yes
- Speed configurability at each port: All ports shall be configurable from 64kbps to 2Mbps
- Interface ports: 1000Mbps LAN ports – 2 G.703 Ports as per BOQ.
- Mounting: Rack mountable.

Servers are connected to each other on a local area network (LAN), which allows sharing of resources without requiring any physical disconnections & reconnections of communication cable. Single LAN is envisaged for the CDCS system. LAN shall have the following characteristics:

- Conform to the ISO 8802 or IEEE 802 series standards.
- Allow reconfiguration of the LAN and the attached devices without disrupting operations
- Have minimum of twenty four (24) ports of 10/100/1000Mbps in LAN switch.
- Shall support both IPv4 & IPv6

Workstation is to be provided at CDCS for Engineering/development. Workstation shall be equipped with required software, applications, user license for creation of user displays, data Analysis and reporting output as well as user administration at all locations with user access as defined in the specification.

The minimum hardware configuration of the workstation shall be:

- 4 GB Main memory
- 300 GB minimum Auxiliary memory
- DVD-RW drive
- 21 inch TFT color monitors
- Speakers for audible alarms
- 10/100/1000Mbps dual Ethernet ports
- USB port

The CDCS room including air conditioning will be provided by PGCIL/POSOCO.

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5.3 ICU

- ICU should be designed as self-contained unit easily mountable and un-mountable from energy meters.
- ICU should be robust in design and should not become loose or should not get disconnected with unintended action.
- ICU should have protection against entry of dust, lizards etc.
- Substantial EMI (Electro Magnetic Interference) and ESD (Electro Static Discharge) will be present at ICU site, effect of which shall be duly considered while designing the system. Performance of the overall system shall not be hampered by such interferences.
- ICU should be able to operate in environment with temp upto 50°C and humidity up to 90% without any significant effect on its performance.

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- 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.
- ICUs shall also withstand without any damage or maloperation reasonable mechanical shocks, earthquake forces, ambient temperature variations, relative humidity etc. They shall have an IP-50 category dust-tight construction, and shall be capable of satisfactory operation in an indoor, non-air conditioned installation.

5.4 Communication System

- All modem/SIM should be securely and firmly mounted on DCU itself.
- The DCU with built in modem shall meet the following environmental specifications, IP50 housing, Storage Temperature: -20 degrees to +70 degree Celsius, Operating Temperature: -10 degrees to +60 degree Celsius, Humidity:- 95% RH (Non - Condensing).

6 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 approved test protocols/ schedules to be submitted in advance by the Bidder ahead of factory/site inspection

6.1 System Sizing

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. Supplier is

required to demonstrate their system's expandability in FAT.

6.1.1 CDCS

CDCS should meet following sizing requirements:

6.1.1.1 Population of Energy Meters

CDCS shall receive data from about 100 DCUs at the minimum data collection interval from up to 25 energy meters connected per DCU initially. However, CDCS should be able to handle data collection from up to 500 DCUs and up to 2500 energy meters without any significant degradation of performance.

6.1.1.2 Data Storage

CDCS shall provide online storage for storing, as a minimum, 5 (five) years collected data, processed data and output data.

CDCS event archive data storage historian shall provide, as a minimum, a data storage that is capable of storing 5 (five) years of event data.

6.1.1.3 Clients

CDCS shall be capable of supporting minimum 5 (five) Concurrent Web clients for providing collected data on HES. Each client output shall be individually configurable by users.

6.1.2 DCU

DCU shall be presently connected to all the energy meters as per location list (Annex -X) or as per detailed engineering done by bidder, without any significant degradation of performance. However implementation should be such that each DCU must contain 20% spare channel.

6.2 Data Handling Performance Requirements

CDCS shall meet the following performance requirements for data collection and data processing.

6.2.1 Performance requirements for CDCS

CDCS shall be able to complete all data receiving, data processing, data storing from all DCUs within specified time as guaranteed by the supplier excluding the waiting time for data arrival. This performance requirement shall be met under the maximum number of input DCUs and maximum number of SEMs with the maximum number of data points as specified for the delivered as-build or expanded system.

6.2.2 Performance requirements for DCU

DCU shall be able to complete all data receiving from energy meters and sending the same to CDCS within specified time guaranteed by the supplier. This performance requirement shall be met under the maximum number of SEMs as specified for the delivered as-build or expanded system.

6.3 System Availability Requirements

AMR system and its subsystems and system components shall meet the following availability requirements.

The CDCS [Server environment](#) shall have a measured availability of 99% or better during the availability test. The CDCS software shall be considered available when all of the functions described in this Specification, except as noted are operating as specified, at their scheduled periodicity, and within the execution time parameters, at the same time all hardware is available as specified.

The CDCS shall continue to operate without interruption under any single point of failure condition. That is, there shall be no hardware or software element that, as a result of its failure, renders the CDCS unavailable. This requirement shall specifically include all hardware, the interconnections among hardware, power supplies etc.

6.3.1 System components

Individual system components, such as server hardware, storage devices, shall each exhibit an availability of better than 99%.

7 SOFTWARE GENERAL REQUIREMENTS

AMR System shall meet the following general software requirements.

7.1 Upgradeability

All ~~system~~ software ~~kernel~~/OS and application ~~Software programs~~ supplied shall be fully ~~updated~~ ~~gradable~~ through ~~OEM firmware~~ ~~updates~~ ~~grade~~ and/or other software ~~update~~ ~~grade~~ methods. The firmware/software ~~updates~~ ~~grade~~ may include

- General software upgrade such as kernel/OS upgrade
- Adding new features and functionalities, such as supporting new data format ~~st and~~ ~~communication protocols~~
- Fixing bugs and deficiencies

The Supplier shall keep NERLDC informed of the latest software updates of revisions available after the system is shipped.

Select Authenticated Users shall be able to perform the necessary software ~~update~~ ~~grade~~ in the field. These updates should be made available till the entire contractual period

7.2 Software security requirements at delivery

Software at delivery shall meet following requirements in accordance with general software security assurance practices.

7.2.1 Security Tested and Configuration ~~red~~

All software and associated application software modules shall be the most secure version of the software available at the time of start of the Factory Acceptance Test. The delivered software shall to be tested to ensure the followings:

- Free of computer viruses, worms, Trojan horses, and other software contaminants
- Unused services are disabled/removed, this includes
- Device drivers for devices not included in the hardware
- Unused networking protocols
- Unused administrative utilities, diagnostics, network management, or system management functions
- Administrative ~~_____~~ utilities, diagnostics, network management, or system management functions or workstations unused by administrators
- Backups of files, databases, and programs, used during system installation/upgrade but not needed in the operational system
- Accounts that are not End-User Administrator created shall be removed, this include

- Any guest accounts (with and without passwords) or default administrator or maintenance accounts other than the initial system administrator account for Procurement Entity
- Any guest accounts or default administrator or maintenance accounts for any third party software

7.2.2 Maximum Initial Security Settings

The software shall be shipped with all security settings at their maximum setting. All software shall be delivered with all the latest relevant patches installed.

All security-related parameters and options shall be placed at their most restrictive settings at the delivery, i.e. affording the access and execution privileges to the smallest class of users consistent with meeting the functional specifications, and restricting their rights to the narrowest range of privileges.

7.2.3 No Automatic Downloading and Execution of Executable Code

It shall not be possible to download any executable code into the CDCS or DCU and execute the downloaded software code automatically without system administrator's approval. All software shall be removed that would otherwise make it possible to execute a scripting language (such as ActiveX, Java, Java scripts, etc.), including software in the browser and e-mail processor, where applicable.

7.2.4 File Access Control

The CDCS and DCU software shall support controlled access privileges for files on, including at least access, read, write, execute, and combinations of these. The access privileges for each user can only be assigned by system administrator of CDCS or DCU as the case may be, and shall be assigned on an individual user account basis.

The default access privileges for each new user account shall be no access to any file on the system at all.

No user, including system administrator, shall be given the privilege of modifying operating system files and other files that are never supposed to change while the system is running.

7.2.5 Free of “Electronic Self-Help” Enabled Software

It shall be strictly prohibited for delivered software to contain embedded faults or back-door mechanisms that allow the software manufacturer to remotely disable some or all of the functions of the software, or affect their performance, or in any way degrade its operation (so-called “*electronic self-help*” in the terms of the Uniform Computer Information Transactions Act). The software shall not contain any mechanism that automatically disables some of all of its functions or degrades their operation on a certain date or upon the occurrence of a specific event.

8 GENERAL HARDWARE REQUIREMENTS

AMR System shall meet the following hardware requirements.

8.1 Operating environment

AMR system hardware ([DCU/ICU](#)) shall be supplied that is suitable to operate in environment with temp up to 50°C and humidity up to 90% without any significant effect on its performance.

8.2 Security Requirements

AMR System hardware and packaging design shall meet physical security requirements like measures to prevent unauthorized access to AMR system hardware components.

9 DOCUMENTATION REQUIREMENTS

Documentation of AMR system should meet following requirements. All documents should be supplied in hard copies as well as computer readable soft version:-

9.1 Design Documents

Before starting the manufacturing of the AMR system components a design document should be submitted. The design document must essentially (but not limited to) included:-

- System Overview.
- Functional diagram.
- Flow diagram.
- Functions of each major component.
- Physical details of each major component.
- Overall networking scheme.
- System configurations.

9.2 Software Requirement Specifications Document

After approval of Design document a software requirements specifications (SRS) document for the application software for CDCS and DCU should be prepared and submitted for approval. This SRS should be prepared as per IEEE standard 830 of latest version for recommended practice for software requirements specifications. Software should be designed as per approved SRS.

9.3 User Manuals

Following user manuals should be prepared and supplied for the system:-

9.4 User Manual for central site

User manual for central site i.e location where CDCS shall be installed and where all data collection activities shall be taken up, should contains all user instructions, block diagrams, user screens etc in order to make it self contain complete document required for operation of complete AMR system including each and every component of AMR system.

9.5 User Manual for DCU site

Separate user manual shall be provided which shall be used by the users located at DCUs site. This user manual should contain details of external connections to DCU, ICU, communication system, block diagram of system at DCU site, instructions of using DCU system, trouble shooting of DCU system etc. This user manual should be self contain and does not require any external reference document in order to use and trouble shoot DCU system.

9.6 Training Documents

Training document to be used during training of site personals should contain major functional details of overall AMR system, its features and major instructions of understanding the overall working of the AMR system.

9.7 Testing Documents

Testing documents shall be prepared and submitted as per Testing Requirements clause of this specification.

10 TESTING REQUIREMENTS

All equipment, materials and software for AMR System shall be subject to both Factory Acceptance Testing (FAT) and Site Acceptance Testing (SAT). The purpose of Acceptance Testing is to determine compliance to this specification in every respect in regard to the delivered and installed system.

10.1 Acceptance Test Plans and Procedures

The Supplier shall develop and document proposed Test Procedures and Test Plans for Factory Acceptance Testing (FAT) and Site Acceptance Testing (SAT) of the delivered and commissioned system and its components. Supplier shall finalize the proposed FAT and SAT acceptance test plans and procedures. The final Test Procedures and Test Plans shall be subject to review and approval prior to testing.

The Acceptance Test Plans (ATP) shall enable NERLDC to verify the ability of the delivered and commissioned system and its components to individually and simultaneously fulfill all functional and performance requirements of the system set forth in the contract through a series of mutually agreed to structured tests.

All system documentations shall be completed, reviewed and approved by the NERLDC & POWERGRID before any testing.

The ATP shall include, but not be limited to, functional tests that demonstrate compliance of the functional, performance, software, hardware, communication, interface, and operational aspects of the delivered and installed system.

10.2 Factory Acceptance Test (FAT)

The Supplier shall perform a preliminary FAT (Pre-FAT) prior to the FAT. The pre-FAT shall be a complete dry run of the FAT, following the test plans and procedures. The intent is for the Supplier to detect and correct most design, integration, database, display, and performance problems prior to the FAT. The NERLDC &/or POWERGRID representative shall have the right to witness all or parts of pre-FAT for which Supplier shall intimate the POWERGRID sufficient advance.

Test results (including documentations and certifications) for tests conducted by Supplier or third parties that are not included in the FAT test plan and procedures shall be furnished to NERLDC prior to FAT for review and evaluation. Supplier and/or third parties conducted tests deemed inadequate shall be repeated until accepted by NERLDC & POWERGRID.

Supplier's project manager shall sign off each test of Pre-FAT. The completed test results shall be sent to POWERGRID for review before POWERGRID's representative travel to the

Supplier's facilities for the FAT. All tests shall be conducted using the contract- specified databases unless the POWERGRID authorizes the Supplier to use a test database.

The FAT shall be conducted according to the FAT Test Plan and Test Procedure documents approved by POWERGRID shall cover, as a minimum:

- Visual Inspection – To verify that the system to be delivered has all required components and is properly configured. Visual inspection shall verify acceptable workmanship and that all equipment, including cables and connectors, are appropriately labeled
- Hardware Diagnostic Test – Individual tests of all system hardware. These tests shall consist of running standard hardware diagnostic programs, plus all special diagnostic programs used by the Supplier
- Communications and Interfacing Test – Verify that all interconnected system components, such as data acquisition, control, monitoring, and data management functions are operating properly when correctly connected
- Software Development Tools – Verify that all required software development tools, utilities, software diagnostics, and debugging tools for the system, including the UI and database, are included in the system and are functioning correctly
- Functionality verification – Verify that all system functions are working normally as set forth in the contract
- Performance Testing – Verify that the system throughput, timing and response time requirements are satisfied. Tests shall include verification of:
 - Data exchange times
 - Local and remote request response times
 - Communication latency
 - UI function response time
- Security Testing – Verify that the system meet the software at delivery security requirements and other aspects of secure operation and system access including:
 - Communication error detection capabilities
 - Correct operation of system configuration, control, maintenance, and management procedures
 - Safe system recovery with no erroneous data or control operation generation after system restarts
 - Protection against unauthorized access to the system and control functions
- Environmental Testing – Verify that
 - All system functions shall operate correctly over the specified temperature range
 - The accuracy of the inputs and outputs remain valid over the specified temperature range.

The test schedule shall allow sufficient time for verification and/or additional

unstructured testing by the POWERGRID's representative, who shall be able to schedule unstructured testing at any time, including during structured tests.

10.3 Site Acceptance Test (SAT)

The SAT will be conducted by the NERLDC & POWERGRID with support as required from the Supplier after the system has been installed and commissioned. The system will be subjected to a subset of the functional and performance tests. The SAT will also include any type of testing that could not be performed in the factory. Unstructured tests will be employed by the POWERGRID's representative, as necessary, to verify overall system operation under field conditions. Any defects or design errors discovered during the SAT shall be corrected by the Supplier.

The SAT includes the commissioning test, the functional and performance test, and the cyber security audit after the installation of the delivered system.

10.3.1 Commissioning Test

The commissioning tests shall be conducted by the Supplier and include:

- The same visual inspection and verification as in FAT
- Loading of the software and starting the system. At the option of the NERLDC & POWERGRID, all software shall be recompiled from the source or distribution media
- Interface of the AMR System to communications facilities for all data sources and other systems that interface with the AMR System
- Initialization and preliminary tuning of application software as needed

10.3.2 Site Functional and Performance Test

The site functional and performance test ("site test") shall be comprised of a subset of the functional and performance tests conducted in FAT. The tests to be performed shall be proposed by the Contractor and approved by the NERLDC/POWERGRID. These tests shall be extended as necessary to test functions simulated during the FAT, such as communications with all field devices and all other systems that interface with the CDCS.

10.3.3 Site Cyber Security Audit

The site cyber security audit shall repeat the audit performed during factory testing.

10.4 Test Approval

The Supplier shall maintain a complete computer record of all test results with variance reporting and processing procedures for approval by NERLDC/POWERGRID. In the event that the AMR System does not successfully pass any portion of the Acceptance Testing, the Supplier shall notify the NERLDC & POWERGRID of the specific deficiency. The Supplier shall promptly correct the specified deficiency, which will then be re-tested until successful.

11 TRAINING REQUIREMENTS

Comprehensive training programs shall be provided to enable the efficient and effective use and operation of the deployed AMR system by users of the system, and to develop a self-sufficient hardware and software support team within the NERLDC. Training charges are deemed to be inclusive in bid and no additional payment shall be made to supplier.

Training shall include, where appropriate, a combination of formal training classes, workshops, as well as continuous (informal) knowledge transfer from the Supplier's technical specialists to the personnel of NERLDC & POWERGRID and its constituents during the deployment process and after the commission of the AMR System. **5 (Five)** Training programme of 1(one) day duration each has to be imparted for a batch size of maximum **10 (ten)** candidates. In additions, a special training of 2 (Two) days duration on CDCS operation has to be imparted to utility Engineers.

In-person training sessions could be offered at Supplier's location or at the NERLDC/POWERGRID's own facilities or any other locations of choice by both parties.

Training programs for system users shall include, but not limited to:

- System overview including system functionalities and features
- System configuration and operations oriented training
- System alarms handling
- Local/Remote configuration procedures
- Engineering oriented training for development/testing

Training programs for system hardware and software support team members shall include:

- System overview including system design and detailed as-built system configuration information
- System software maintenance
- System hardware maintenance
- Engineering oriented training for development/testing
- System diagnose and troubleshooting oriented training for engineers and technicians

The Supplier shall prepare and provide a description of the proposed training programs with course content and technical level of the instruction for review and approval by the Procurement Entity at the beginning of the deployment, and shall work with the NERLDC/POWERGRID to schedule, organize and execute the approved training programs.

12 SUPPORT AND MAINTENANCE REQUIREMENTS

Supplier should provide onsite as well as remote support in order to keep system operational with system functionalities and performance in accordance with the specifications.

12.1 Scope of AMC

During warranty / AMC period(4year beyond warranty), supplier is responsible for repair/ replacement/ modify/ rectify all times i.e. software, hardware either manufactured or bought out, updation of software used in AMR scheme without any extra charges to POWERGRID/NERLDC.

12.2 On-site support and maintenance

Supplier should maintain a team of skilled personals having sufficient knowledge of the system in order to diagnose and set right any problem in AMR system in minimum time. Since, the locations of DCUs under this AMR system is geographically spread across entire ~~NE Region~~Delhi-NCR Region, the supplier should have an office in Guwahati and locate its supporting personals so as any problem may be attended within next working day of reporting.

Supplier should maintain a help desk operated from 0900 hrs to 1800 hrs on all days except Sundays and national holidays. Supplier should maintain a online web based help desk system for logging complaints and checking the resolution status. Help desk should be accessible by the user through browser via Internet. Separate username and password shall be provided with separate privileges for users of central site as well as DCUs site. DCUs site user should be able view logs of –complaints and status logged by that user only. However, user of central site should be able to view of logged complaints and their status irrespective the initiator of compliant. Any complaint shall remain open until and unless approved its closure by the central site user. All logs should be suitably time stamped.

Supplier should post a resident engineer located in central location in Guwahati. Resident engineer should be provided with mobile phone for communication in odd hours or for

escalation of complaint. Supplier should maintain this Mobile phone live and should maintain same number throughout the contract period. All expenditure on this phone shall be borne by the supplier.

For complaints related to sites, the bidder should reach site within 24 hours of filing of complaint and resolve the complaint within 72 hours of filing of system fault complain.

Bidder should keep a record of each complaint attended, duly signed by site coordinator. If a system is not reasonably restored or any components of the system requires repairing, standby equipments (i.e DCU, Modem, cables, conductors etc.) must be provided.

12.3 Up-gradation and patches

Supplier should keep updated all supplied software kernel/OS and application software with all latest patch and upgrade. All updates-gradation will be done free of cost for the entire contractual period, next 7years. Any upgradation/update as required for PC software in line with AMR softwares will be done by party

12.4 Maintenance and support of bought out items

Supplier should take back-to-back support from manufactures of bought out items like servers, printers and like items. However, supplier shall be fully responsible for all coordination work from OEM for all types of support and maintenance for the bought out items.

Supplier should have established office set up in np in northeastern region for prompt service support

12.5 Maintenance and Support for Communication channels

Suppliers should be responsible for all coordination with communication channel service provider like availability of channels, utilisation, data volume certification etc. Billing and payment of monthly and/or yearly bills will also be settled by the supplier to communication services provider. Channel utilisation charges and rental charges of communication channels as billed by communication service provider shall be quarterly reimbursable to the supplier by NERLDC/POWERGRID against original documents. Bidder should estimate the optimum plan of service provider for each location & submit to NERLDC/POWERGRID for approval before taking any connection.

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