भारत सरकार
Government of India
विद्युत मंत्रालय
Ministry of Power
उत्तर क्षेत्रीय विद्युत समिति
Northern Regional Power Committee

सं. उक्षेविस/ प्रचालन/108/04/2022/3686-3720   दिनांक : 20.05.2022

सेवा में / To,

संलग्न सूची के अनुसार/As per list attached

विषय: टेस्ट उप-समिति की 19वीं बैठक का कार्यवृत्त ।
Subject: 19th meeting of TeST Sub-Committee – Minutes.

उत्तर क्षेत्रीय विद्युत समिति की टेस्ट उप-समिति की 19वीं बैठक दिनांक 07 मार्च 2022 को वेब-एक्स विडियो कॉंफ्रेंसिंग के माध्यम से आयोजित की गई । इस बैठक के कार्यवृत्त की प्रति आपकी सूचना व आवश्यक कार्यवाही हेतु संलग्न है।

19th TeST Sub-Committee meeting of NRPC was held on 07th March 2022 via WebEx video conferencing. Copy of the minutes of the meeting is enclosed herewith for favour of information and necessary action.

(सौमित्र मजूमदार)
अधीक्षण अभियंता

<u>**Minutes of 19th Meeting of Telecommunication, SCADA & Telemetry (TeST) Sub- Committee**</u>

Date: 07.03.2022 via video conferencing

List of participants is attached at Annexure-I.

<table>
<tr><td>**I.   Confirmation of Minute**</td></tr>
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1. Confirmation of Minutes

Representative of NRPC Sectt. informed that the minutes of 18th meeting of TeST sub-committee held on 10.08.2021 were issued on 25.08.2021. No comments have been received on the MoM. He requested members to confirm the minutes.

The sub-committee confirmed the minutes of the meeting.

<table>
<tr><td>**II.   Telecommunication and Telemetry issues**</td></tr>
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2. Issues in OPGW laying in HPSEBL (Agenda by PGCIL)

2.1.   Representative of NRPC informed that this agenda was also discussed in 15th, 16th, 17th & 18thTeST Sub- committee of NRPC.

2.2.   Representative of PGCIL stated that strengthening and reconductoring is still pending on some lines at HPSEBL end. He also informed that PGCIL is not getting timely and continuous shutdown on some lines, due to which OPGW laying work is getting delayed.

2.3.   Representative of HPSEBL informed that strengthening works are pending on certain lines only and has been completed on most of the lines. Regarding shutdown issues, he informed that the same was not allowed due to load pattern. In the Jeori-Nogli line, shutdown could not be provided due to non-availability of alternate source. He assured that shut down will be facilitated by mid-April as alternate generation will be available by then. He also informed that continuous shutdown cannot given on Gumma-Jutog line. A joint inspection is being done by PGCIL and HPSEBL to explore alternate ways to lay OPGW on this line.

2.4.   NRLDC requested HPSEB and PGCIL to share the timeline and schedule of strengthening OPGW work.

2.5.   The sub-committee urged HPSEBL and PGCIL to complete the work before monsoon.

3. Establishment of additional fiber connectivity for NRLDC/NLDC communication network (Agenda by NRLDC)

3.1. Representative of PGCIL informed that for reporting of Telemetry data at NLDC, NRLDC for SCADA, WAMS, REMC and backup RLDCs Systems installed at New Delhi, new OPGW (48F) was planned on overhead transmission line between 220kV Tughlakabad – R.K.Puram (approved in NRPC meeting). However due to various issues, this overhead line was turned down and underground XLPE cable is being laid by DTL, along with this XLPE cable laying, 96 Fiber (48F x 2 Nos.) optical fiber cable is also being laid by DTL for sub-station connectivity. This OFC cable / XLPE cable is being laid through NRLDC / IIT Delhi main gate. PGCIL requested DTL to spare 48F from Tughlakabad 220 to NRLDC (main gate) and NRLDC to R K Puram – Vasant Kunj 220kV for grid operation / ULDC purpose.

3.2. Representative of DTL stated that providing 48F may not possible as they may use these fibers for their internal network connectivity along with station protection system and requested PGCIL to update plan for fiber connectivity.

3.3. Representative of PGCIL stated that NLDC and NRLDC connectivity is very critical for real time monitoring, voice connectivity and grid operation point of view. After this connectivity, following robust fiber connectivity shall be established along with existing optical paths for NLDC, RLDC and all their back up RLDCs System for grid operation.

1) Ballabhgarh – Badarpur – Mehrauli – Vasant kunj 66kV - NRLDC (**existing ULDC**)

2) Maharanibagh – NRLDC – underground (**existing Telecom**)

3) Jhatikara – Bamnauli - Mehrauli -Vasant Kunj 220 – R K Puram – NRLDC (**Partially Commissioned**)

4) Ballabhgarh – Tughlakabad PG – Tughlakabad (DTL) – NRLDC - **Proposed**

5) NRLDC - R K Puram - Vasant – Kunj 220 – Mehrauli (existing ULDC network) – **Proposed**

3.4. Representative of NRLDC informed that they have already surveyed NRLDC connectivity through this OFC cable and one manhole is also planned at NRLDC main gate for this connectivity.

3.5. Representative of DTL confirmed that they will provide 12 fiber (6 pair) in each cable from Tughalakabad 220 to R K Puram via NRLDC (in new OFC cable) and R K Puram to Vasant Kunj 220kV (in old OFC cable). After installation and commissioning of these OFC cables, DTL will demark 24 Fibers for PGCIL for NLDC/RLDC connectivity.

4. OPGW installation on main lines which are to be LILOed at new Substations in TBCB projects (Agenda by CTUIL)

4.1. Representative of CTU informed a new sub-station, 765/400kV Dausa is proposed to be established by LILOing the following two existing transmission lines;

    i)   765kV (2×765 S/C) Jaipur (Phagi) RVPNL – Gwalior lines (312 kms.)

    ii)   400kV D/C Agra – Jaipur (South)(PG) line (254 kms.)

Both of the lines are owned by PGCIL. Further, he mentioned that OPGW on the LILO portion is envisaged along with the construction of the proposed lines. Since there is no OPGW on the existing main lines and redundancy of data communication of the new Dausa substation to RLDC cannot be maintained without OPGW availability on these main lines, OPGW needs to be provided by replacing one earth wire on both the main existing lines and integrating it with OPGW of the upcoming LILO section.

4.2. MS, NRPC mentioned that it may not be advisable to lay OPGW on the whole old transmission lines. He enquired whether Agra, Gwalior and Phagi are connected with redundant routes,

4.3. Representative of PGCIL informed that Agra is connected in 5 directions. Gwalior is also connected with multiple routes.

4.4. Representative of NRLDC mentioned that Gwalior is part of WR region and may not impact Northern Region connectivity as we have sufficient WR-NR Inter-Regional OPGW connectivity.

4.5. Representative of PGCIL mentioned that 765kV Phagi is a critical station and is presently only connected with PGCIL Ajmer and Heerapura in RRVPNL Network, so redundant routes are required for Phagi.

4.6. Representatives of NRLDC and RRVPNL opined that though redundant routes are required, laying of 300 kMs OPGW is not justified against LILO line of small length (25-30kms).

4.7. Representative of CTU further stated as per present philosophy, if a new LILO envisaged with OPGW, OPGW is being laid on the entire existing transmission line, if not available. This fulfills the purpose redundancy and can also be utilized for protection system (DTPC) in transmission system.

4.8. MS (NRPC) stated that all cases need to be discussed on a case to case basis and blanket approval for OPGW laying is not optimum as it involves additional financial implications and may increase tariff. He suggested that other options, including OPGW connectivity with nearer sub-station, may be explored.

4.9. Representative of PGCIL stated that to establish additional redundancy for 765kV Phagi Sub-station, RRVPNL may provide 4 fibres to PGCIL from Phagi to Heerapura on 400kV line for ULDC purpose.

4.10. Representative of RRVPNL agreed to provide the fibers to PGCIL from Phagi to Heerapura. He requested PGCIL to provide Telemetry data channels for RRVPNL Sub-LDCs (Bhilwara and Kota) over PGCIL's OPGW links, so that sub-LDC data can be reported through following alternate optical route:

"Kota Sub LDC – Bhilwara Sub LDC - 400kV Chittorgarh - 765 Chittorgarh - Ajmer 765 – Phagi 765 – Heerapura 400 –Heerapura SLDC".

4.11. PGCIL agreed to provide Ethernet/E1 channels on their OPGW route for grid operation connectivity.

4.12. The sub-committee decided that new OPGW may be laid only from 765kV S/C Dausa to Phagi new transmission lines on both the circuits. Further, OPGW may be replaced after 15 years as per CERC guidelines.

5. Package-I(a) being implemented in PSTCL by PGCIL for expansion of Fiber Optic Communication System (Agenda by PSTCL)

5.1. Representative of PSTCL stated that despite PGCIL's assurance, only 44 out of 66 links have been commissioned as part of Package-I(a). 22 links are yet to be commissioned. He requested PGCIL to complete the commissioning of remaining links. He further informed that PSTCL has already sent a report mentioning links that have not been commissioned yet. Further, when Fibcom engineer visited their stations for connecting optical fiber, he reported optical breakdown at several places.

5.2. Representative of PGCIL informed that they have put their best efforts and commissioning of OPGW links on various transmission lines of PSTCL under Package-1(a) has almost completed. 44 links have already been commissioned which needs to be capitalized and rest of the links will be commissioned by 31st March 2022. As per procedure, PGCIL applied for commissioning certificate to NRLDC. They need confirmation from respective state constituents for state sector lines. In this case confirmation from PSTCL is pending and PGCIL is not able to declare DOCO for the said links (pending for 6-7 months). He requested PSTCL to take the links which have been commissioned under AMC

5.3. Representative of NRLDC requested PGCIL to ensure that data is flowing before giving confirmation of commissioned links.

5.4. The sub-committee urged PGCIL to complete the commissioning of remaining lines by 31st March, 2022. The sub-committee also urged PSTCL to give confirmation as soon as the lines are commissioned.

6. Leasing out dark fibers from PSTCL links under Package-I(a) (Agenda by PSTCL)

6.1. Representative of PSTCL informed that they intend to lease out dark fibers from their links under Package-I(a). He requested PGCIL to apprise the

details of dark fibers from central sector OPGW links which can be allotted to PSTCL for this purposes.

6.2. Representative of PGCIL informed that they do not give dark fibers to any utility. PGCIL's stand on dark fibere has already been recorded on earlier TeST meetings. They can only provide bandwidth/ optical bypass for grid operation/ULDC purpose through our ULDC communication equipment.

6.3. The sub-committee urged PGCIL and PSTCL to take up this matter bilaterally.

7. Status of OPGW connectivity at NHPC Power Stations under Central Sector scheme (Agenda by NHPC)

7.1. Representative of NHPC stated that in the 18th TeST meeting held on 10.08.2021, PGCIL had informed that they are planning to complete the remaining work of OPGW by November 2021. However, the same is yet to be completed. He stated that OPGW is required for reliable data telemetry, as well as AGC implementation at Parbati-III Power Station, He requested PGCIL to update the status of OPGW commissioning at Parbati-II and Parbati-III Power Station.

7.2. The subcommittee urged PGCIL that the OPGW connectivity at NHPC power stations may be completed on priority.

8. Issue regarding Dismantled scrap Earth wire under Reliable Communication Scheme (Agenda by PGCIL)

8.1. Representative of PGCIL that PGCIL is establishing OPGW network for center sector communication system by replacing existing earth wire / old 12F OPGW with 24F OPGW cable under Reliable Communication Scheme. Approximately 2100 kms of OPGW cable has been installed in Northern Region-II out of 2532 Kms. Most of the balance works are pending in Hilly terrain area specially in 400kV S/C Parbati Pooling (Banala) – Koldam, 400kV S/C Parbati II (HEP) - Parbati III & 400 kV Kurukshetra-Malerkotla lines due to non-availability of consent by their owners and 220 kV Budhil-Chamera & 220 kV ADHEP- Nalagarh line due to non-availability of non-auto mode.

8.2. Representative of ADHEP informed that there was some communication gap and the same has been resolved. They have agreed that PGCIL may take scrape earth wire.

8.3. Representative of PGCIL informed there were some issues regarding dismantled scrap earth wire with PKTCL. A meeting was held on 05.03.2019 at NRPC regarding laying of OPGW on PKTCL lines under reliable communication for central sector. As per the minutes of the meeting, PGCIL had informed that cost of OPGW has been discounted considering scrap Earth wire would be taken back by the installing agency. Hence benefit on account of dismantled earth wire has already been considered shared among

beneficiaries which is in line with the spirit of CERC sharing regulation. Hence, no earth wire shall be returned to PKTCL.

8.4. Representative of INDIGRID informed that this issues was initially discussed in the 181st OCC meeting when PGCIL requested shutdown on Parbati – Koldam line. They have sent multiple communications to PGCIL to have a meeting on this matter. They have informed PGCIL that they want to carry out the work of OPGW installation on their lines. There is a provision in the implementation agreement that they can lay OPGW on their lines. They have requested PGCIL to grant approval for the same. He further stated that, as per CERC Tariff Regulation 2019 benefit arising out of scrap earth wire shall be shared between licensee and beneficiary in the ratio of 50:50.

8.5. Representative of Sekura informed that CTU has approached Hon'ble CERC by filing the Petition no. 94/MP/2021 for seeking directions from Hon'ble Commission for installation of OPGW on the 400 kV Kurukshetra-Malerkotla Transmission Line, owned & operated by NRSS XXXI (B) Transmission Ltd. (Sekura). He also informed that Hon'ble Commission has directed CTU to implead all the transmission licensees implementing transmission projects under the TBCB route as respondents.

8.6. The sub-committee opined that since the matter is sub-judice, no decision can be taken on this matter.

9. PTCUL Telemetry Issues- Non-availability of Real-Time data from PTCUL (Agenda by NRLDC)

9.1. Representative from NRLDC requested PTCUL to update the status of installation of RTUs and replacement of faulty transducers.

9.2. Representative from PTCUL informed that RTU installation project is in tendering process and he will not be able to inform exact timelines for RTU installation work.

9.3. Member Secretary NRPC stated this is a long pending issue and PTCUL has not shown any progress till date. They keep repeating that the project is in tendering stage. He expressed serious concern regarding delay in installation of RTUs and requested SLDC for integration of telemetry at the earliest.

9.4. Sub-committee decided that this agenda may also be taken up in RPC meeting to be held in the month of March 2022.

10. Non-availability of Reliable/ Redundant Communication System for PTCUL, SLDC (Agenda by NRLDC)

10.1. Representative of NRLDC informed that SLDC Uttarakhand is connected to NRLDC through radial network from Roorkee-Dehradun and all services like ICCP, PMU/PDC and VOIP are working on this. Any issue in this link leads to outage of Voice and Data communication between SLDC Uttarakhand and

NRLDC. He requested PTCUL to update the status of installation of redundant OPGW link between Dehradun to NRLDC.

10.2. Representative from PTCUL informed that there is delay in tendering process and it will take at least 2 years for them to establish OPGW on Majra (Dehradun SLDC) to Dehradun PG line.

10.3. Representative from PGCIL informed that after completion of OPGW works by PTCUL on Majra (Dehradun SLDC) to Dehradun PG line, PGCIL will immediately integrate the communication equipment and establish redundant communication route for Dehradun SLDC.

10.4. Representative of NRLDC mentioned that in previous meetings as well this timeline was provided but no progress seen on the ground. Every time, SLDC link was out and they have no connectivity for 5-7 days. They mentioned that PGCIL was ready to carry out this work subject to PTCUL consent.

10.5. Representative of PTCUL submitted that if NRPC agrees with the proposal, they would take up with their management for deletion of these two lines from their scheme, so that the work may be carried-out by PGCIL to establish redundant path between SLDC and RLDC establishing OPGW on the following lines:

1) Dehradun (PG) – Jhajra (approx.16 Km)

2) Jhajra – Majra (approx. 5 Km)

10.6. PGCIL agreed to carry out these works in running OPGW package i.e. NROSS Project, subject to the approval in the NRPC forum.

10.7. Subcommittee decided that this agenda may also be taken up in NRPC meeting to be held in the month of March 2022.

11. J&K Telemetry Issues (Agenda by NRLDC)

11.1. Representative of NRLDC informed that Real-Time data availability from Jammu and Kashmir is very poor. There is zero visibility of data in J&K stations. The matter has been discussed in various TCC and TeST meetings, but there is no improvement of the same.

11.2. He stated that this matter was also discussed in Special Meeting with J&K on 28.07.2020 where in representative of J&K informed that they have given consultancy work to PGCIL for installation of OPGW in J&K. However, due to funding issue OPGW work has been stalled by PGCIL.

11.3. During in 47th TCC-49th NRPC meeting, J&K confirmed that they will resolve the issues mutually with PGCIL so that data starts reporting to SLDC/ NRLDC.

11.4. Representative from J&K informed that they are in process of OPGW commissioning and RTU integration. Various meeting has been held between J&K, PGCIL and Siemens and priority list and work segregation has been finalized. He further informed that around 6-8 RTUs will be integrated by 31st

March 2022 and all 70 RTUs will be integrated with SLDC by 31st December 2022.

11.5. The sub-committee urged J&K PDD to expedite RTU integration.

12. Communication plan for channel redundancy to NRLDC (Agenda by NRLDC)

12.1. Representative of NRLDC informed that the reliability of communication channel to NRLDC was discussed in various TeST Meetings. Still 18 RTUs are reporting to NRLDC on single channel. He requested that redundant channel for the remaining 18 locations may be provided at the earliest.

12.2. Following timelines was submitted by various utilities

S.No.	Name of RTU	Comments	Timeline
1	KISHANGANGA	NHPC	31st march 2022
2	PARBATI-2	NHPC	31st March 2022
3	SALAL	NHPC	31st march 2022
4	KalaAmb	PGCIL	31st march 2022
5	BUDHIL	IPP	-
6	KARCHAM WANGTOO	IPP	-
7	SHREE CEMENT	IPP	-
8	URI-2*	NHPC	Completed
9	MEERUT	PGCIL	31st March 2022
10	NEEMRANA	PGCIL	31st march 2022
11	AMARGARH	STERLITE	31st March 2022
12	PARBATI-3	NHPC	--
13	AD Hydro	AD Hydro	31st march 2022
14	Bhiwadi HVDC	PGCIL	31st March 2022
15	DRASS	PGCIL	31st March 2022
16	KARGIL	PGCIL	31st march 2022
17	LEH	PGCIL	31st march 2022
18	KHALSTI	PGCIL	31st march 2022

12.3. Representatives from Karcham Wangtoo, Budhil and Shree Cement were not present in the meeting. It was decided that matter will be taken up with them in OCC meeting.

12.4. The sub-committee urged utilities to ensure availability of redundant channel at the earliest.

13. Integration of PMU data from Gumma Sub-Station (Agenda by NRLDC)

13.1. Representative of NRLDC informed that integration of PMU from Gumma Sub-station is still pending. During 18th TeST Meeting, representative from HPPTCL had informed that PMU procurement is in tender stage and PMUs at

Gumma Sub-station will be installed at the earliest. He requested HPPTCL to update the status of PMU Integration at Gumma Sub-Station.

13.2. Representative from HPSLDC informed that tendering process for installation of PMUs at Gumma, Wangtu and Lahal is being taken up together and installation work will be completed at the earliest.

13.3. The sub-committee urged HPPTCL to expedite the PMU Integration at Gumma Sub-Station.

14. Operation of PMUs installed under various sub-station of Utilities (Agenda by PGCIL)

14.1. Representative of PGCIL informed it has been observed that that several times GPS cable and Antenna have been used for sub-station purpose by local sub-station officials, resulting in PMUs data reporting disturbed in SLDCs. He highlighted Moradabad station (UPPTCL) where this issue happens frequently, due to which vendors have now denied going there for multiple visits.

14.2. He further stated that in Obra power house, cable was burnt 2 years back and UPPTCL had confirmed that they will provide all required cables (CT/PT and DI) and OFC cable, so that M/s GE (AMC vendor) can integrate PMU data reporting with SLDC Lucknow. But the issue is still pending. He requested UPPTCL to take up the matter with Obra power house for restoration of PMU data.

14.3. The sub-committee urged SLDCs to issue necessary instructions so that these devices are not disturbed. UPPTCL was further requested to ensure restoration of PMU data.

15. Telemetry Issues from PGCIL Stations (Agenda by NRLDC)

15.1. Representative from NRLDC informed that proper telemetry is not available from many PGCIL substations. A letter regarding Telecommunication, SCADA & Telemetry issues from PGCIL Sub-stations has already been written to PGCIL. He stated that issues in most of the location have been rectified. However, issues of Balia and Bhiwadi HVDC is still pending,

15.2. Representative from PGCIL informed that they are in process of award for integration works at Balia and Bhiwadi HVDC and informed that the work will be completed within 1-2 months.

15.3. The sub-committee urged PGCIL to resolve the issues of Balia and Bhiwadi HVDC at the earliest.

16. Reliable Telemetry from State Sub-Stations (Agenda by NRLDC)

16.1. Representative from NRLDC informed the utilities about issues regarding non-availability of data from various sub-stations of state and requested them to expedite the RTU installation work.

16.2. Representative from PSTCL informed that RTU installation work is in process and it is likely to be completed by 31st March 2022.

16.3. Representative from Haryana informed that they are in process of RTU installation and same would be completed at the earliest.

16.4. Representative from HPPTCL informed that RTU installation work is in progress; however, it could not be completed due to supply of L3 switch and confirmed that RTU work would be completed by 15th April 2022.

16.5. The sub-committee urged all the constituents/utilities to expedite the RTU installation work.

III. Issues related to Unified Load Dispatch & Communication scheme of NR

17. Issues being faced by UP SLDC in ULDC Phase-II

17.1. Representative of PGCIL informed that a meeting was held recently. In the meeting, Siemens has agreed that certain issues were to be resolved but are still pending. They assured that all the issues will be resolved soon.

17.2. Representative of M/S Siemens informed that they have consolidated all the issues faced by the states. He assured that all the issues will be resolved by 31st March 2022.

17.3. It was decided that another meeting will be held in 2nd week of April between States and Siemens to review the progress. Further review meeting may be held every month.

17.4. The sub-committee urged M/s Siemens to resolve all the issues within the agreed timelines.

18. Issues being faced by PSTCL in ULDC Phase-II

18.1. Covered in agenda 17.

19. Issues being faced by HVPNL in ULDC Phase-II

19.1. Covered in agenda 17.

20. Issues being faced by BBMB in ULDC Phase-II

20.1. Covered in agenda 17.

21. **Establishment of dedicated backup Control Centers for SLDC under ULDC Phase-III (Agenda by NRLDC)**

21.1. Representative of NRLDC informed that the concept of backup control centers was there during ULDC Phase-II as well. However, only NRLDC /UPPTCL/Jammu and Kashmir have dedicated backup control centers. Other SLDCs opted to have backup control centers in some other state's SLDC. However, this led to several issues.

21.2. He stated that it is essential that separate dedicated backup control centers should be established by States so that periodic testing and monitoring of backup control centers could be done by respective SLDC representative.

21.3. MS, NRPC agreed with the opinion expressed by representative of NRLDC. He stated that backup control center would be helpful in case of disasters, as grid operations can be shifted to the backup. However, location of backup control center should be judiciously decided considering necessary disaster guidelines.

21.4. The sub-committee opined that as in other regions, dedicated backup Control center may also be established by all states during SCADA upgradation. Location of backup control center may be decided in a separate meeting, considering necessary disaster guidelines.

22. **Data Integration between Main and Backup Control Centre (CC) of SLDC BBMB with Main and Backup CC of NRLDC at SLDC (Agenda by BBMB)**

22.1. Representative of BBMB requested that specific clauses may be incorporated as a part of the contract agreement to ensure that integration on ICCP shall be in the scope of the vendor implementing SCADA System at NRLDC (at NRLDC end).

22.2. Representative of NRLDC and PGCIL informed that it is already covered in the scope of the vendor implementing SCADA System.

23. **Rollover to IPv6 for External World Connectivity under ULDC Phase-III scheme (Agenda by BBMB)**

23.1. Representative of BBMB requested that specific clauses may be incorporated under ULDC Phase-III scheme to ensure that necessary equipment have dual stack feature so that the website and other external world connectivity for SCADA system can operate on both on IPv4 and IPv6 technologies.

23.2. Representative of NRLDC and PGCIL informed that this provision is already covered.

24. Dismantling of Nokia Equipment at NRLDC (Agenda by NRLDC)

24.1. Representative of NRLDC informed that Nokia Communication equipment were installed at NRLDC under ULDC package. Four (4) number of racks for Nokia were installed. Now almost all the data from Nokia has been shifted and these racks are idle for more than a year. There is severe space constraint in NRLDC communication room and space for installation of new equipment is not available.

24.2. He requested PGCIL to take necessary action for dismantling of Nokia equipment at NRLDC so that space can be vacated for installation of new Equipment.

24.3. Representative of PGCIL informed that dismantling work has already been started and shall be completed within 5-7 days.

24.4. The sub-committee urged PGCIL to complete the dismantling work at the earliest.

25. Upgradation of DC Power Supply supplied under ULDC (Agenda by NRLDC)

25.1. Representative of NRLDC informed that presently 60A DCPS is installed at NRLDC. DCPS was installed under ULDC Phase-I and is working at full load. Being obsolete, spare parts of DCPS are difficult to arrange. Any issue in DCPS may lead to failure of DC Supply to communication equipment. He requested PGCIL/CTU to take necessary action for replacement /upgradation of DC power supply at the earliest.

25.2. Representative of PGCIL informed that these 48V DCPS were installed in ULDC Phase-I scheme and inadvertently missed out in replacement of ULDC phase-I wherein OPGW and communication equipment were replaced under reliable communication scheme. Since works under reliable communication scheme are almost verge of completion, so we may consider the replacement of 48V DCPS in ongoing NROSS scheme through amendment in existing contract/ fresh tender.

25.3. Representative of NRLDC stated that existing DCPS are of capacity of 60A (2 nos.) and both are running on almost full load, so replacement may be considered for at least 100A (2 nos.).

25.4. Representative of PGCIL agreed for the same under NROSS project for NRLDC and NLDC with a capacity of 100A (2 nos. at each location). He further requested that if any other state constituent requires 48V DCPS for ULDC communication system at their SLDC, they may provide their requirements within a months' time, so that same may be considered in one contract/tender.

25.5. The sub-committee urged PGCIL/CTU to take necessary action for replacement /upgradation of DC power supply at the earliest.

IV. OTHER AGENDA

26. Telemetry of real time active power (MW) data to SLDCs.

26.1. Representative of NRPC informed that several meetings were held at NPC level wherein the issue of providing real time active power (MW) data to SLDCs was discussed.

26.2. Based on the same, Technical Specifications have been prepared by NPC. Part-I of Technical Specifications deal with IEM, DCU and other accessories for automatic data downloading from meter at Substation level. Part-II of Technical Specification deal with CDCS (Central Data Collecting System) comprising AMR for receiving data automatically and MDP for the Meter Data Management analytics.

26.3. He requested sub-committee members to send their comments, if any, on the technical specifications to NRPC, for further transmission to NPC division.

Draft Technical Specification has been attached at Annexure II.

27. Permission to work for Installation of DCPS & Battery and Maintenance activity of existing communication equipment at Manimajra UT sub-station under ULDC scheme (Agenda by PGCIL)

27.1. Representative of PGCIL informed that they are not being given entry permission from UT Chandigarh for DCPS, OPGW installation and maintenance works at Manimajra UT sub-station. Since this is very critical issue for ULDC connectivity at Manimajra, he requested NRPC to convene separate meeting with UT, Chandigarh to resolve the entry permission and work permit issues.

27.2. Representative of UT Chandigarh was not present in the meeting.

27.3. The sub-committee requested PGCIL to resolve this issue bilaterally with UT Chandigarh. If the issue remains unresolved then a meeting may be held with UT Chandigarh.

28. Non-availability of space for UNMS project at State constituents (Agenda by PGCIL)

28.1. Representative of PGCIL informed that for monitoring and operation of state sector communication network for UNMS project some equipment and furniture needs to be installed at all SLDCs. For installation of these equipment, space is required at all SLDCs for 42 U rack (800x1000x2000mm) and furniture. In addition, uninterrupted AC power supply is required at all SLDCs from existing UPS system for powering up of these equipment.

28.2. Representative of PGCIL further informed that project execution has been delayed due to non-availability of space and power supply.

28.3. MS, NRPC raised serious concern and mentioned that this project was approved by all constituents. All states are part of the scheme and they will use this NMS system for monitoring and operation of their communication network which would result in better grid operation. He urged all utilities to explore the possibility of providing space and power supply as requested by PGCIL.

28.4. Representative of RRVPNL urged PGCIL to provide complete set of LOA and relevant documents, so that they may take up with their management for space and other approvals.

28.5. Representative of HPSEBL agreed to provide space and power supply.

28.6. Representative of BBMB informed that they will further review space requirement and confirm at the earliest.

28.7. Representative of J&K PDD informed that they will inform PGCIL after two days.

28.8. Representative of UPSLDC agreed to provide required space.

28.9. Representative of PSTCL informed that they will inform PGCIL at the earliest.

28.10. The sub-committee urged all participants of states to provide logistic support at all control centers, so that project can be completed in time frame.

29. Input for database development system for UNMS Project (Agenda by PGCIL)

29.1. Representative of PGCIL informed that for commissioning of UNMS Project, basic database development is required, for which details of existing NMS of centre sector / state sector/ IPPs / Solar developer/ other transmission licensee and independent nodes which are reporting data for grid operation would be required. He stated that delay in providing data will impact project schedules. He further stated that States have implemented their own communication network and OEM viz. GE, ABB and Fibcom are working for states network, but data is not being shared till date by OEMs even after repeated reminders.

29.2. Representative of PGCIL also requested NRLDC and SLDCs to provide data for all centre sector / state sector/ IPPs / Solar developer/ other transmission licensee and independent nodes which are reporting or connected with Northern Region Power system grid, so that we may take up the matter with them and collect data for their communication equipment.

29.3. The sub-committee requested all the constituents to share this information with PGCIL.

30. Delay in Payment (Agenda by PGCIL)

30.1. Representative of PGCIL informed that some constituents have not made payments for consultancy services on RTU / APS / Wideband / OPGW maintenance. He further stated that even when constituents have made payment, payment details are not shared by constituents in most of the cases. He requested all constituents to deposit payment and share details for main payment and TDS immediately.

30.2. Representative of Rajasthan and HVPNL informed that they have already made payment and have shared the information to PGCIL representative.

30.3. Representative of NRLDC suggested that PGCIL may reconcile the payments with the constituents mutually.

30.4. The sub-committee urged PGCIL to share details regarding the payments received with all constituents and requested all constituents reconcile the same.

31. Settlement of issue of MW tower (Asset of HVPNL) installed at 400KV S/S, Bawana (Agenda by HVPNL)

31.1. Representative of HVPNL requested DTL to expedite the Settlement of issue of MW tower (Asset of HVPNL) installed at 400KV S/S, Bawana.

31.2. Representative of DTL informed that NoC given by HVPNL is under the consideration of DTL management. He also informed that issue will be resolved by next month.

31.3. The sub-committee urged DTL to settle the issue at the earliest.

AA-4 Implementation of ULDC Phase-III

AA 4.1 Representative of PGCIL informed that they have shared the draft BOQ of ULDC Phase-III with all states. However, confirmation regarding the same is pending from them. He requested all states to send their comments regarding the draft BOQ for further necessary action.

AA 4.2 Representative of NRLDC informed that they have also finalized BOQ and it has also been approved by Himachal Pradesh. They will also share final BOQ after approval of management. Tendering process is expected to start by the first week of April.

AA 4.3 Member Secretary opined that PGCIL and NRLDC should ensure that that BOQ prepared by them should be alignment to avoid issues in the future.

Sl. No.	Name (as per WebeX)	Organization	Attendee Email
1	BBMB	BBMB	adld1@bbmb.nic.in
2	Rahul	BBMB	ddld2@bbmb.nic.in
3	bbmb ad	BBMB	adplc@bbmb.nic.in
4	Kaushal-CTU	CTU	hsk@pgcil.in
5	Vinay Kumar Jaiswal	DTL	vinayjaiswaldtl@gmail.com
6	Leena Arya	DTL	leenascada.dtl@gmail.com
7	Abhijeet DTL	DTL	abhi.kr502@gmail.com
8	Abhijeet DTL	DTL	abhi.kr502@gmail.com
9	Pritam Chauhan SE HPSEBL	HPSEB	er.pritamchauhan@gmail.com
10	Sumit Garg	HPSEB	sumitgarg@lnjbhilwara.com
11	CE System Operation, HPSEBL	HPSEB	cesyshpsebl@gmail.com
12	K R Sharma HPSEBL	HPSEBL	krsharma2008@gmail.com
13	Pritam Chauhan SE HPSEBL	HPSEBL	er.pritamchauhan@gmail.com
14	Sr. XEN HPSEBL	HPSEBL	srxen.scada@gmaqil.com
15	HPSLDC	HPSLDC	sldc.scadaxen@gmail.com
16	Ruchika	HVPNL	xen.hvpn@gmail.com
17	R S Dahiya	HVPNL	xensldcrtumtc@hvpn.org.in
18	Prateek Mohan Rai	Indigrid	prateek.rai@indigrid.com
19	Indigrid Lokendra Ranawat	Indigrid	lokendra.ranawat@indigrid.com
20	Vishal Chowhan JKSLDC	J&K PDD	chowhan.pdd@gmail.com
21	Rahul Ranjan NHPC	NHPC	rahulranjan@nhpc.nic.in
22	NRLDCSO	NRLDC	nrldcso2@posoco.in
23	NRLDC Admin	NRLDC	shailesh@posoco.in
24	MM Hassan	NRLDC	mm.hassan@posoco.in
25	Paritosh NRLDC	NRLDC	paritosh@posoco.in
26	Saumitra Mazumdar	NRPC	seo-nrpc@nic.in
27	Praveen, XEN, NRPC	NRPC	praveen.cea@gov.in
28	MS, NRPC	NRPC	ms-nrpc@nic.in
29	AK BEHERA	PGCIL	akbehera@PGCIL.in
30	Naveen PG	PGCIL	naveenkc173@PGCIL.in
31	Narendra Kumar Meena ULDC	PGCIL	nkmeena@PGCIL.in
32	LDNC	PGCIL	priya.jumnani@PGCIL.in
33	Furkan Siddiqui	PGCIL	fa.siddiqui@PGCILindia.com
34	Prateek srivastava	PGCIL	prateek.sri@gov.in
35	Sunita chohan	PGCIL	chohan@PGCIL.in
36	Furkan Siddiqui	PGCIL	fa.siddiqui@PGCIL.in
37	Er. HS Bindra PSTCL	PSTCL	se-comm-ldh@pstcl.org
38	srxen pb	PSTCL	srxen-sldc2@pstcl.org
39	Addl SE T&C Cell	PSTCL	srxen-pm-tc-jld@pstcl.org
40	Kamal kumar	PSTCL	srxen-sldc2@pstcl.org
41	sr xen sldc punjab	PSTCL	srxen-sldc2@pstcl.org
42	Addl. SE T&C Cell	PSTCL	srxen-pm-tc-jld@pstcl.org
43	Er AJITPAL Singh Multani. Addl SE	PSTCL	srxen-pm-tc-jld@pstcl.org

Sl. No.	Name (as per WebeX)	Organization	Attendee Email
	PSTCL		
44	Hare Ram	PTCUL	ae1_scada_ksp@ptcul.org
45	Vinayak Shaily	PTCUL	ee1_sldc@ptcul.org
46	Asim Baig PTCUL	PTCUL	asimisonet@gmail.com
47	Jagbir Singh	PTCUL	ee_tandc_hld@ptcul.org
48	UTTAM KUMAR SE SCADA PTCUL	PTCUL	se_scada@ptcul.org
49	SESSDA-SLDC RVPN	RVPNL	se.ssda@rvpn.co.in
50	RAMINDER SINGH	Sekura	raminder.singh@sekura.in
51	neeraj verma	Sekura	neeraj.verma@sekura.in
52	satishskkumar	Siemens	satishskkumar@siemens.com
53	Sumit Bhatnagar	Siemens	sumit.bhatnagar@siemens.com
54	Rajarshi Singha Roy	Siemens	rajarshi.singharoy@siemens.com
55	Pratap Ganjoo	Siemens	pratap.ganjoo@siemens.com
56	SE SCADA UPSLDC	UPSLDC	sescadait@upsldc.org
57	EE SCADA IT UPSLDC	UPSLDC	ee1scadait@gmail.com
58	UPSLDC	UPSLDC	ae5scadait@gmail.com
59	Sateesh maurya UPSLDC	UPSLDC	ae5scadait@gmail.com
60	Ravinder		xen.plccsnr@gmail.com
61	Pankaj Kapoor		pankaj.kapoor@lnjbhilwara.com
62	Ehtisham Andrabi		eandrabi@gmail.com
63	Sobti		sameer.sobti@lnjbhilwara.com
64	Anshu Jain		anshujain.nitsrinagar@gmail.com
65	Deepak Gupta		deepakgupta075@gmail.com
66	XEN SLDC		xensldcpnp@gmail.com
67	Sumit Kumar		sumitchaudhary70@yahoo.com
68	EE1		ee1scadait@gmail.com
69	Namit		namit.kumar1@gmail.com
70	Vipin Chander Negi		srxeneskotla@gmail.com
71	ak		emtclko@gmail.com
72	H K Chawla		hk.chawla12@gmail.com

Technical Specification (TS) for ISTS Metering System

Part-I (Section 1) :

Interface Energy Meter (IEM)

Part-I (Section 2):

Automated Meter Reading (AMR) System

Part-II :

Meter Data Processing (MDP) System

TS finalized by the committee -January 2022

Table of Content

BACKGROUND

Power system operation in India is under control of hierarchical regulatory system. Commercial settlements of energy generation and consumption are being computed through Availability Based Tariff (ABT) and Deviation Settlement Mechanism (DSM) which are in vogue for energy accounting. Availability Based Tariff was implemented in India in 2002/2003 considering the settlement period as 15-min. The Special Energy Meters (SEM) for Interface points i.e. Interface Energy Meters (IEM) are deployed throughout all the regions of India at identified locations which store electrical parameters having significance in Regional Energy Accounting (REA) and DSM. Suitable storage capacity was provided in meters keeping in view meagre data communication facilities which were available in the country about two decades ago. Block wise Energy data as recorded by the SEMs are down loaded offline weekly and forwarded (in encrypted format) by email to respective RLDCs for verification/validation. The processed meter data is forwarded by RLDCs to RPC secretariats for preparation of weekly/monthly energy accounts.

Government of India (GoI) has set a Renewable Energy (RE) target of 450GW by 2030. The need for implementing a 5-minute scheduling, accounting and settlement at the Inter State level is being felt considering the variability of load and renewables especially considering RE penetration in the coming years.

This issue was discussed in CCM (Commercial Coordination Meeting) and TCC/RPC meetings at regional level and it was suggested to replace the entire fleet of existing SEMs (15-min Block) with Interface Energy Meters (5-min Block) and implementation of CDCS comprising Automated Meter Reading (AMR) and Meter Data Processing (MDP) system was also discussed. The above is also in line with the recommendations of the Report on Scheduling, Accounting, Metering and Settlement of Transactions in Electricity (SAMAST) that was endorsed by the Forum of Regulators on 15th July 2016.

Moreover, in view of the new DSM regulation and its amendments, which are more stringent, there is a need expressed by States to get streaming online instantaneous MW data at a user configurable rate (minimum 1 min) at SLDCs via AMR system. This instantaneous MW data is only for the purpose of taking actions/decisions in real time for grid monitoring & discipline.

INTRODUCTION

This specification describes the technical specifications of IEM & AMR system and MDP system. The description includes requirements in respect of IEMs (new as well as replacement of old meters), DCUs & accessories at substation level and hardware, software & functionalities of AMR system at RLDC/RPC level and hardware, software & functionalities of MDP system at RLDC level.

A conceptual architecture of ISTS Metering Scheme is shown in Fig.1
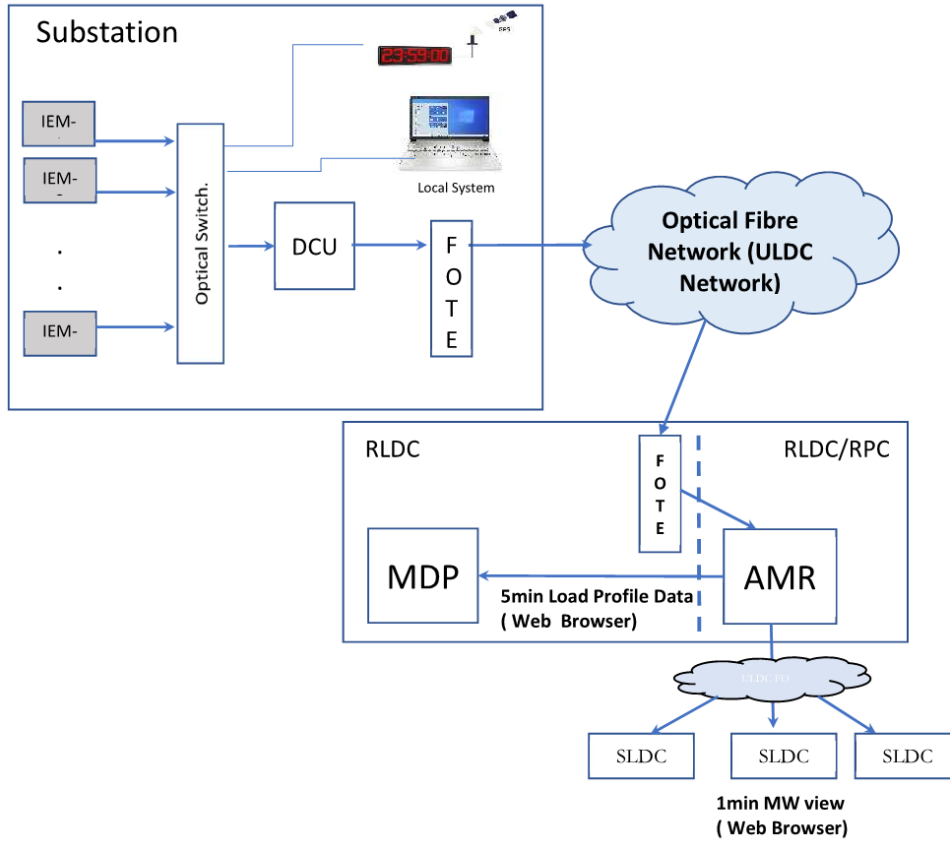
Fig.1

- All IEM through Ethernet port shall be connected to DCU in a LAN with network switch and thereafter meter data (both 5 min Load Survey data and 1 min Instantaneous MW data) shall be communicated to AMR system at RLDC/RPC via FO network & existing FOTE equipment at RLDC.
- An application software along with required hardware for Meter Data Acquisition and online monitoring of IEMs i.e. AMR system, shall be installed at RLDC/RPC and shall get the meter data in an automated manner from each interfacing points.
- Application in AMR system shall convert 5 min raw meter data into .npc format and share the same with MDP system through Web browser or through LAN port.
- Existing GPS clock, Laptop/Desktop, FOTE at station level shall be used for respective functionalities.

The technical specifications are broadly prepared in Two parts.

Part-I Section-1 :Interface Energy Meters

The first section of the specifications covers Interface Energy Meter (IEM) along with suitable switches for connection in between and thereafter connection with DCU.

Part-I Section-2 :Automatic Meter Reading System

The second section covers DCU at substation level and AMR system comprising all associated hardware & software at Control Centre level i.e. RLDC.

Part-II: Meter Data Processing System

The third part covers MDP system comprising all associated hardware & software for MDP functionality.

The execution of the project shall be planned in such a manner that there is no interruption in the prevailing regional energy accounting system. The IEMs shall record data at user configurable 5 min time block. This data shall be collected by DCU as per user defined schedule and communicated to AMR system at control center i.e. RLDC/RPC. Thereafter the settlement period for data processing and energy accounting shall be performed in MDP system by RLDC as per the prevailing CERC regulations.

All the new IEMs shall be factory manufactured as 5 min Time Block and the AMR system shall collect 5 min Load Survey data from all interface points and share the same with MDP system.   In case the MDP application chooses the settlement period to be 15 min, then the collected data of 5 min interval shall be converted to 15 min interval in MDP application software before processing and energy accounting for all interface points and further share the data to RPC. The format of the 5-min processed data reports shall be exactly same as that of the existing 15-min processed data reports in text files for compatibility at RPC end.

The installation of the IEM at the interface points may involve shutdown of transmission elements in certain cases at Generation stations. This shall be coordinated through the existing outage coordination procedure approved by the Regional OCC forum. The Employer/RLDC shall coordinate the shutdown as per the OCC approved list subject to real time grid conditions.The Interface Energy Meters shall be accommodated in existing C&R panel in door closed condition. If required before bidding, bidder may collect necessary details by visiting the site.

ABBREVIATIONS

S.No	Acronym	Definition
1	AMR	Automated Meter Reading
2	ATP	Acceptance Test Plan
4	CMRI	Common Meter Reading Instrument
5	C&R	Control & Relay
6	CTU	Central Transmission Utility
7	DCD	Data Collection Device
8	DCU	Data Concentrator Unit
9	DSM	Deviation Settlement Mechanism
10	EA	Energy Accounting
11	EHV	Extra High Voltage
12	FAT	Factory Acceptance Test
13	FTE	Full Time Equivalent
14	GPRS	General Packet Radio Service
15	GSM	Global System of Mobile
16	HHU	Hand Held Unit
17	IEC	International Electro-technical Commission
18	IEEE	Institute of Electrical and Electronics Engineers
19	IEM	Interface Energy Meter
20	IP	Ingress Protection
21	IS	Indian Standard
22	ISTS	Inter State Transmission System
23	LAN	Local Area Network
24	MDP	Meter Data Processing
25	NMS	Network Management System
26	OEM	Original Equipment Manufacturer
27	PCB	Printed Circuit Board
28	RDBMS	Relational Database Management System
29	RMS	Root Mean Square
30	SAT	Site Acceptance Test
31	SEM	Special Energy Meter
32	SRS	Software Requirements Specification
33	TOC	Taking Over Certificate
34	VPN	Virtual Private Network
35	WAN	Wide Area Network
36	RLDC	Regional Load Dispatch Centre
37	RPC	Regional Power Committee

Part-I (Section 1) :
Interface Energy Meter (IEM)

INTERFACE ENERGY METERS

1. Basic Features of Interface Energy Meters

i.   The energy metering system specified herein shall be used for tariff metering for bulk, inter-utility power flows, in different States of India. Projection mounted type, Static composite AC 3-ph 4 wire meter shall be installed at interface points as a self-contained device for measurement of Voltage (V), Frequency (f), Active (Wh) and Reactive (VArh) energy exchanged in each successive user defined (5 min/15 min) time block. Meter time block shall be re-configurable at site for change of time block as specified by the Central Commission. All meters shall be compliant to CEA (Installation and Operation of meters) Regulations 2006 and its amendments & IS 15959 and its amendments.

ii. Each meter shall have a unique identification code, which shall be marked permanently on its front, as well as in its memory. All meters supplied to as per this specification shall have their identification code starting with "IEM", which shall not be used for any other supplies. "IEM" shall be followed by an eight digit running serial number, further followed by a "A" "B" for the use with CT secondary of 1A and 5A respectively. This shall be mutually agreed between the buyer and the vendor.
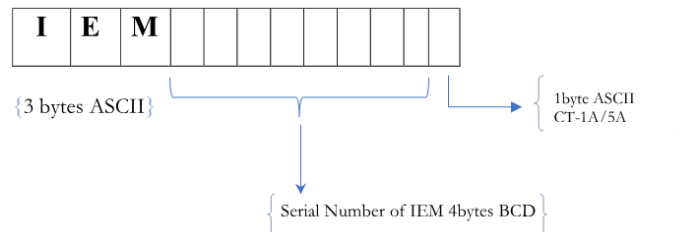
iii. The meters shall be DLMS protocol compliant and shall be suitable for communication with external device like modem, DCU, etc. which shall be able to communicate with AMR system for remote data transfer.

iv. Auxiliary Supply to IEM- The meters shall normally operate with the power drawn from the VT secondary circuit (line-to line voltage of 110V); provided that there shall be provision to operate the meters from AC (240V AC) and DC (110V/ 220V DC) auxiliary power supply.. Necessary isolation and/or suppression shall also be built-in as per IS 14697 and its amendments, for protecting the meters from surges and voltage spikes from extra high voltage switchyards. The reference frequency shall be 50Hz. Also, the meter shall be suitable of ±15% tolerance for DC supply.

v.   Variation in CT/PT The meters shall safely withstand the usual fluctuations arising during faults etc. In particular, VT secondary voltages 115% of Vref applied continuously and 190% of Vref for 3.0 seconds, and CT secondary current 150% of Iref applied

continuously and 30 times of Iref applied for 0.5 seconds shall not cause any damage to or maloperation of the meters.

vi. The meters shall continue to function for the remaining healthy phase(s), in case one or two phases of VT supply fails. In case of a complete VT supply failure, the computation of average values shall be calculated and recorded along with the time only for the period during which the VT supply was available in configured time block. However, the integrated parameters (active/reactive energy) shall not be affected and recorded as actuals

vii. The total burden imposed by a meter for measurement and operation shall be defined as per IS 14697 and its amendments. An automatic backup for continued operation of the meter's calendar- clock, and for retaining all data stored in its memory, shall be provided through a long- life battery, which shall be capable of supplying the required power for at least 2 years. The meters shall be supplied duly fitted with the batteries, which shall not require to be changed for at least 10 years, as long as total VT supply interruption does not exceed two years.

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

ix. Each meter shall be provided with optical test output device (visual), as per IS 14697 and its amendments for checking the accuracy of active energy (Wh) measurement. The preferred pulsing rate is twenty (20) per Wh for CT sec-1A and four (4) per Wh for CT sec –5A.

x. **Exception Management**- The three line-to-neutral voltage shall be continuously monitored and in case any of these falls below defined threshold (80% of Vref), meter shall have suitable indication on LED/ LCD. The meter shall also have provision for low voltage event logging in meter memory in case of any phase voltage going below a defined threshold. The time blocks in which such a voltage failure occurs/persists shall also be recorded in the meter's memory with a symbol"*" if 3 Phase RMS voltage applied to the IEM is in between 25% to 80% of Vref and if Voltage is less than 25% of Vref, meter should record Zero voltage symbol "Z".

xi. **Time Accuracy** - Each meter shall have a built-in calendar and clock, having an accuracy of 10 seconds per month or better. The calendar and clock shall be correctly set at the manufacturer's works. The date (year-month-day) and time (hour-min.-sec.) shall be displayed on the meter front on demand. Meter shall have the intelligence to synchronize the time locally from station control room or remotely from AMR system through software. All clock corrections shall be registered in the meter's memory and suitably shown in the meter data report.

xii. The IEMs shall be supplied with version of Firmware. A touch key or push button shall be provided on the meter front for switching on the display and for changing from one indication to the next
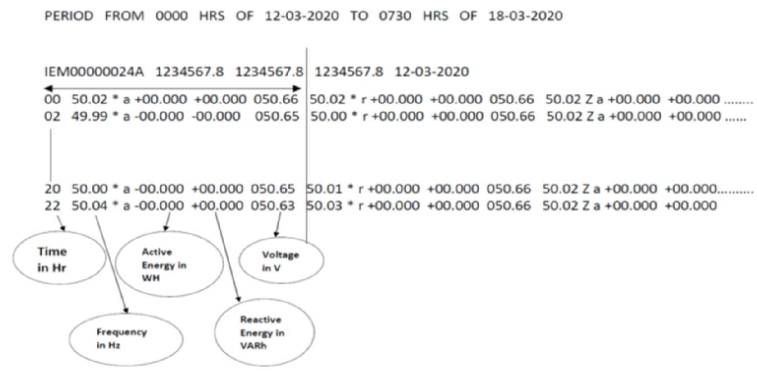
Fig 2 – Standard raw data format of IEM

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

xiii. Accuracy of IEMs under transients, frequency variations, voltage variations, unbalance, harmonics. Electromechanical influence and reverse phase rotation etc. shall be maintained as per IS 14697 and its amendments

xiv. **Self-Diagnostic Feature**: The IEMs shall be capable of performing complete self-diagnostic check to monitor all circuits for any malfunctioning to ensure proper functioning of the meter all the time. The meter shall have indications for unsatisfactory/ malfunctioning of the following-

    a. Non volatile memory
    b. RTC battery

The said malfunctioning should be flagged as LED indication on the front of the IEMs and at station PC through DCU as alarm/indication and also at AMR system at RLDCs/RPCs

xv. **Constructional Features**

    (a) The meters shall be supplied with compact and sturdy, metallic or moulded cases of non-rusting construction and/or finish. The cases shall be designed for simple mounting on a plane, vertical surface such as a control/relay panel front. Terminals shall have a suitable construction with barriers and cover, to provide a secure and safe connection of CTs and VTs leads through stranded copper conductors of 2.5 sq. mm. size.

    (b) All meters of the same model shall be totally identical in all respects except for their unique identification codes. They shall also be properly sealed and tamper evident, with no possibility of any adjustment at site as per IS 15959 (and its amendments) & CEA (Installation and Operation of meters) Regulations 2006 (and its amendments).

(c) The meters shall safely withstand, without any damage or mal operation, reasonable mechanical shocks, earthquake forces, ambient temperature variations, relative humidity, other external factors etc. in accordance with IS-14697(and its amendments) & CEA (Installation and Operation of meters) Regulations 2006 (and its amendments).

(d) They shall have at least IP51 category dust tight construction, and shall be capable of satisfactory operation in an indoor, non-air conditioned installation & outdoor installation in a panel

(e) The meters shall have built-in facility (e.g. test links in their terminals) for in-site testing.

(f) The meter shall be immune to external influences like magnetic induction, vibration, electrostatic discharge, switching transients, surge voltages, oblique suspension and harmonics and necessary tests shall be carried out in accordance with relevant standard.

xvi. **Data Security:** Data security shall be as per

a. IS 15959 (three layers of security) and its amendments,
b. Cyber Security guidelines issued by the Central Government, time to time &
c. The technical standards for communication system in Power Sector laid down by the Authority (CEA).

2. Measurement

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

b. The meter shall compute the instantaneous active power (W) sent out from the substation busbars in each successive 1 min block, and store it in its memory up to two decimal place.

c. The meter shall compute the net active energy (Wh) sent out from the substation bus bars during each successive time block, and store it in its memory up to two decimal place.-Further Wh data in .NPC/output report shall be rounded upto two decimal.

d. The meter shall count the number of cycles in VT output during each successive time block, and divide the same by time (in sec)to arrive at the average frequency. The least count of the frequency data shall be 0.01 Hz. The frequency data shall be stored in the meter's memory in Hertz up to two decimal. Further Wh data in .NPC/output report shall be rounded upto two decimal.

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

f. The Reactive energy (VARh) measurement shall be carried out on 3-phase, 4-wire principle, with an accuracy of **0.2S** similar to Wh measurement. The meter shall compute the net Reactive energy (Net VARh=(VARh Export- VARh Import)) sent out from the substation bus bars during each successive time block, and store it in its memory up to

second decimal. It shall also display on demand the net VARh sent out during the previous time block. Further Wh data in .NPC/output report shall be rounded up to second decimal.

g. The meter shall also integrate the reactive energy (VARh) algebraically into two separate registers, one for the period for which the average RMS voltage is above 103.0%, and the other for the period for which the average RMS voltage is below 97.0%. The current reactive power (VAR), and cumulative reactive energy (VARh) readings of the two registers (>103% and <97%) shall be displayed on demand. The voltage range of +/-3% (i.e 97 to 103) shall be configurable as and when required in future.The readings of the two registers at each midnight shall also be stored in the meter's memory. When reactive power is being sent out from substation bus bars, VAR display shall have a plus sign or no sign and VARh registers shall move forward. When reactive power flow is in the reverse direction, VAR display shall have negative sign and VARh registers shall move backwards. Generally, the standard PT ratios are 132 kV/110 V, 220 kV /110 V, 400 kV /110 V and 765 kV / 110 V. However, at the time of commissioning the vendor may confirm the same from site (authorized sign) and configure the meter accordingly to ensure correct recording of reactive energy.

h. For reactive power (VAR) and reactive energy (VARh) measurements, IS14697 shall be complied with. The accuracy of measurement of reactive energy shall be as per the standard.

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

j. Errors for different power factors shall be as defined in IS14697 and its amendments.

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

3. Memory / Storage

i. Each meter shall have a non-volatile memory in which the following shall be automatically stored:
   a. Average frequency for each successive time block, in Hertz up to second decimals.
   b. Net Wh transmittal during each successive time block, up to second decimal, with plus sign for active power sent out from station busbars and minus sign for active power received into the busbars
   c. Net VARh transmittal during each successive time block, up to second decimal with plus sign for reactive power sent out from station busbars and minus sign for reactive power received into the busbars.
   d. Cumulative Wh transmittal at each midnight, in eight digits including one decimal.
   e. Cumulative VARh transmittal for voltage high condition, at each midnight in eight digits including one decimal.
   f. Cumulative VARh transmittal for voltage low condition, at each midnight, in eight digits including one decimal.
   g. Average RMS voltage for each successive time block.

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

ii.   The meters shall store all the above listed data in their memories for a period of minimum fifteen (15) days.

iii. 1min instantaneous MW data shall be sent to AMR system without storing data in meter memory.

4. Display

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

i)   Meter serial no.: IEM12345678A or IEM12345678B

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

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

iv)   Cumulative Wh reading : 1234567.8 C

v)   Average frequency of the previous block : 49.89 F

vi)   Net Wh transmittal during the previous block with +/- sign: - 28.75 E

vii) Net VARh transmittal during the previous block with +/- sign : - 18.75 R

viii) Average % Voltage : 99.2 U

ix)   Reactive power (VAR) : 106.5 r

x)   Voltage - high VARh register reading : 1234567.5 H

xi)   Voltage - low VARh register reading : 1234567.4 L

xii) Low battery indication

xiii) The three line-to-neutral voltages shall be continuously monitored and in case any of these falls below 80 %, then preferably, the corresponding flashing LED provided on meter's front shall become steady. They all shall go off if all three voltages fall below 80 %. The LED shall automatically resume flashing when all VT secondary voltages are healthy again.

xiv) The two VARh registers (x and xi) shall remain stay-put while VT supply is unhealthy.

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

5. Communication Port

i)   All the meters shall have at least three ports. . One of these ports shall be compatible for Ethernet traffic through which all the data stored in the meter's memory shall be transferred to DCU. The data between Meter and DCU is exchanged using Ethernet standard frame structures defined in IS15959.

The second port shall be front Optical port suitable for admin access / meter configuration/ local data downloading. The admin port is password protected for

access and the meter configuration is to be done through admin port using Laptop and optical to USB convertor. Optical to USB convertor cable of suitable length to be supplied at every location. (Third port shall be Rs485 as spare and shall be used for meter data access in case of any eventuality. One number RS485 to USB convertor cable of suitable length to be supplied at every location.

ii) All the three ports shall be able to transmit data simultaneously.

iii) The galvanic isolation of these ports is such that no external electrical induction on cable degrades the performance of the meter. Meter data shall be tamper-proof.

iv) Data collection on any local laptop/PC shall be possible by installing data collection software. It shall be ensured that data transfer through Optical to USB interface shall be unidirectional only i.e. from Meter to external storage device in an authentication process.

6. Meter Reading Software at Station PC

Software based on Windows-10 & its higher version Operating System for Local communication with meters shall be supplied for viewing/ downloading the meter data, status, alarms etc without any extra cost and shall be considered as integral part of the metering equipment.
The software shall be capable to do the following tasks primarily-

i. Downloading of 5 min load survey data in case failure of data reading through AMR

ii. Clock adjustment of meters

7. Quality Assurance

The successful bidder shall have a comprehensive quality assurance program at all stages of manufacturing for ensuring products giving reliable, trouble free performance. Details of the bidder's quality assurance and set up shall be furnished during engineering. A detailed quality assurance program shall be outlined by the Contractor and shall be finally accepted by Employer/owner after discussions. A Quality Assurance Program of the Contractor shall generally cover but not be limited to the following:

i. Organization structure of the manufacturer and his main sub-suppliers (PCBs, Cards) with details of QA' setup, overall workflow,
ii. Documentation control system
iii. Qualification data for key personnel
iv. The procedure for purchase of materials, Critical components (Memory register chip, real time clock, optical ports) with their suppliers
v. Procedure of stage inspection of product before final testing
vi. Procedure adopted for 'In-site' testing of PCBs, parametric tolerance variation by self and sub-contractor
vii. Testing and calibration facility
viii. Sample copies of test certificate of bought out components

8. Acceptance Tests

All equipment, after final assembly and before dispatch from manufacturer's works, shall be duly tested to verify suitability for supply to the Owner. Testing of meters shall be carried out in line with CEA (Installation and Operation of meters) Regulations 2006 (and its amendments) and relevant standards.

i. Type Test & Routine Test for IEM-

a. The meters shall be subjected to the complete range of type tests & routine tests as per IS14697 and IS15959 and their amendments and other applicable standards, after final assembly

b. Type test conducted once shall be valid for 5 years for the same model. Copy of Test certificate shall be submitted to Employer/OWNER.

c. The type tested meters shall not be supplied/installed. The Bidder shall arrange all type testing specified above, and bear all expenses for the same.

d. Type tests shall be certified or performed by NABL accredited laboratories as per CEA (Installation and Operation of meters) Regulations 2006 (and its amendments) and relevant standards using data sheets and test procedures that have been approved by the Employer.

ii. Factory Acceptance Test (FAT)-

The FAT shall be conducted according to the FAT Test Plan and Test Procedure approved by Employer/OWNER and shall cover the following Tests as per IS 14697 as a minimum-

1. Test of Starting Condition

2. Test of No-Load Condition

3. Test of Meter Constant

4. Insulation Resistance Test

5. AC High voltage test

6. Test of Power Consumption

7. Test of Limits of Error

8. Test of Repeatability of Error

9. Functional Test i.e. i) Voltage Variations, Frequency Variations, c) Phase Sequence Reversal

10. ABT features verification i.e. a) Test for reactive high register when V> 103% Vref & for reactive low register when V<97% Vref.

11. Communication Test through Ethernet port, RS 485 and Optical admin port

12. Downloading of Meter data using communication –

    i) Downloading Meter Data from the Meter(s) to PC via admin Optical port.

    ii) Downloading meter data to DCU through Ethernet port. IEMs along with convertor, Optical Switch, DCU shall be integrated with the PC for demonstration.

    iii) Downloading Meter Data from the Meter(s) to PC via RS 485 port

13. Testing of Time Synchronization

14. 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 labelled.

A procedure/schedule for the above demonstrations shall be submitted to the employer for approval. Copy of Test certificate shall be submitted to Employer/OWNER

9. Guarantee

i. The IEM shall be guaranteed for 10 years from the date of supply.
ii. The guarantee would include repair, replacement, part material replacement cost and both way transportation cost (including insurance of transit).
iii. All India service center details along with contact number and mail ID of each centers shall be provided during bidding.
iv. Meter software, if upgraded by OEM should be supplied free of cost with initiation taken from party.
v. Meters which are found defective/inoperative at the time of installation or become inoperative/defective within the guarantee period, the same shall be attended by service engineer from bidder's regional service center within one week of receipt of report (from Generation/Transmission licensee in whose premises the meters are installed). Service engineer shall repair the defective meter, upon unable to rectify, the same shall be replaced with spare meter borrowing from employer/owner. The spare meter shall be replenished with new meter by OEM in another one week time without any cost implication.
vi. Copy of warranty certificate shall be submitted to employer.

10. Training

Hands on training program for Employer/Owner personnel shall cover the following:

- Features of IEM & Communication Interface.
- Extension of Auxiliary Supply, CT/PT connection.
- Time synchronization through station GPS, Time correction through software.
- Data downloading from IEM.
- Data uploading through web interface.
- Installation of software in local PC/Laptop.

System Diagnostics Minimum duration of training program is Two Hours. A comprehensive documentation including product manual, Installation manual, O&M manual should be provided to all participants. Procedure for data downloading from Meter to Local PC and video tutorials to attend minor issues shall also be provided to each site.

11. Demonstration of IEMs

It is mandatory to demonstrate the capability of meter to capture 5 min Load survey data and 1 min instantaneous data along with compatibility with DCU in DLMS protocol before mass fabrication . For this purpose, successful bidder shall bring with them the required switch and demo version of Meter reading software during demonstration. The successful bidder shall also co-ordinate with AMR system developer for demonstration/seamless integration with AMR system (envisaged in Part-I Section-2 of TS) through employer/implementing agency.

12. Dismantling / Buy-Back of Existing IEM *(applicable only for replacement of old meters)

Bidder is responsible for dismantling of old special energy meters and to purchase on buy back basis on successful installation of new IEMs in case of replacement of existing old meters.

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Part-I (Section 2):

Automated Meter Reading
(AMR) System

II. TECHNICAL SPECIFICATION – PART 1-SECTION 2

Automatic Meter Reading (AMR) System

2.1. Intent of AMR System

AMR system is the bridge between IEMs at Substations and the data processor system (MDP) at RLDC .The intent of AMR system proposed in this document is collection of meter load survey data at a user configurable rate (5min) and 1 minute instantaneous MW data from each meter through DCU to AMR control centre for further sharing with RLDC for validation, processing and generation of customized reports by MDP system and sharing of 1 min Instantaneous MW data to SLDCs for viewing purpose.

2.2. Scope of Work

This section provides detailed scope of work included in the bidder's scope, and also the facilities to be provided by station owner/employer.

2.2.1. 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, support and maintenance including, but not limited to, the followings:

a. Provide a working system that meets or exceeds the functional and performance requirements of this specification.
b. Design Document for complete AMR System including software specifications.
c. All hardware including Application Servers, Database Servers and RDBMS, HMI, DCU, LAN Switches etc .
d. All cabling, wiring, terminations and interconnections of the equipment at AMR control center as well as at substation level.
e. Database development, Displays and Reports.
f. Archival and retrieval of data through Standard RDBMS such as SQL/ORACLE database
g. The complete system shall be in line with established cyber security standards.
h. Training of Owner/Employer personnel.
i. Engineering and technical assistance during the guarantee and AMC period

2.2.2. Exclusion of Bidder's Scope of Work

Followings are not included in the scope of the bidder and shall be provided by local station

and RLDC/RPC without any extra cost to bidder:-

    a.   Space for AMR system at RLDCs/RPCs

    b.   Auxiliary AC Power Supply to servers, HMIs and other hardware components of AMR system at RLDCs/RPCs.

    c.   Provision of static IP (to be provided by RLDC/NLDC) and internet/intranet connection available at RLDC/RPC

    d.   Building, air conditioning systems and other infrastructures.

    e.   Hardware/Software at RLDCs for receiving meter data in .npc format from AMR system through Web Browser or LAN.

    f.   Hardware/Software at SLDCs for viewing 1 min instantaneous MW data from AMR system using Web Browser

    g.   Integration of AMR system data into Existing/future Meter Data Processing software of POSOCO

Any other work which is not identified above (2.2.1 & 2.2.2) or in the specification but is required for completion of the project within the intent of this specification shall also be in the scope of the Bidder without any extra cost.

2.3. Components of AMR System

    i.   Data Concentrator Unit (DCU) at Substation level (ISTS Interface point) and associated FO cable connection between IEM to LAN switches, ethernet connection between switches and DCU upto FOTE and also with Local computer.

    ii.   AMR System at AMR Control Centre i.e. RLDC/RPC and connection of AMR system with existing FOTE at RLDC.

2.3.1. Data Concentrator Unit (DCU)

A Data Concentrator Unit (DCU) installed at each station will act as interface between IEMs and AMR system at RLDCs/RPCs. DCU shall collect data from energy meters (upto 30 IEMs/DCU) and send the same to AMR system at RLDCs/RPCs. DCU shall also report diagnostic information of the energy meters to AMR System. The DCU shall be multi-vendor interoperable to support communication of different make IEMs with Centralized AMR system.

2.3.1.1. Basic Functions of DCU

DCU shall have following major functions-

    i.   **Acquiring 5 min load survey data and 1 min instantaneous MW data from IEMs.** DCUs shall be connected with energy meters through Ethernet to Optical convertors & Optical Switches in between. Connection to the IEMs shall be firm and secure from any unintended disconnection.

ii.   **Providing meter data to AMR central server at RLDC/RPC**
DCUs shall query meter data from IEMs and transfer the same to AMR system based on the command received from AMR control centre. Command may be for one time demand of data or it may be on cyclic basis as defined in Task Scheduler application (to be finalized in design document during engineering phase).

AMR system takes the updated Database from these DCUs and create suitable Database in its memory at Control Centre. DCU shall be able to query data from all or selected energy meters for the selected period based on the command from AMR system. DCUs shall be able to read meter data from all make of energy meters supplied as per this Technical Specification (Part-I Section-1).

Each meter has a unique identification number and each meter location has unique identification code. DCUs shall collect data from IEMs and transfer the same to AMR system. As DCU shall function on read and forward philosophy for IEM data, no storage is envisaged in the DCUs for meter data.

iii.   **Acquiring status and alarm from energy meters**
DCUs shall acquire connected IEM details like meter identification number, make etc. whenever it's powered on. Any meter change activity like meter number etc. shall be reported to AMR system immediately.

DCUs shall be self-monitoring for alarm like power failure, communication disconnection, and disconnection from energy meters and report the same to AMR system immediately and also to local computer.

DCUs shall have non-volatile memory for storing details of IEMs duly time stamped, details of connected meters like make, meter number, status change. Non-volatile memory should be able to store such details for at least one month in round FIFO buffer.

iv.   **Providing IEM data to local computer at substation**
Software based on Windows-10 & its higher version Operating System at existing local computer at substation shall be supplied for viewing/ downloading the meter data, status, alarms etc. DCU shall be connected to the existing PC having the software for viewing/ downloading the meter data, status, alarms etc. Local PC shall be able to query meter data from selected or all IEMs. All communication between local computer and DCU/IEM shall be password protected.

The software shall be capable to do the following tasks primarily-

i.   Downloading of 5 min load survey data through DCU

ii.   Clock adjustment of meters from local station GPS

iii.   Receiving of all alarms & events from DCU

iv.   Generation of Log sheet/incident report

Station PC shall be arranged by respective site/ utility.

v. **Time synchronization of IEMs, either from GPS installed at site or from control center AMR Software (MDAS)**

DCU shall have the intelligence to synchronize the IEM clock time. Input signal to DCU shall be from AMR system GPS clock. If AMR system clock synch signal is not available to DCU, DCU will get GPS clock reference from station GPS. DCU shall function as SNTP servers to the IEMs and SNTP clients to AMR system SNTP servers.

vi. **Display**

Each DCU shall be provided with indicative LEDs for monitoring of Power supply status, Healthiness of DCU.

vii. DCU shall support remote configuration from AMR control centre. DCU shall accept only digitally signed files for Configuration updates, Firmware updates, package updates, License updates & Patch updates. Only root user shall have the rights to modify/delete DCU logs.

viii. Each DCU shall be capable to connect 30 IEMs for polling on ethernet port over DLMS protocol without any delay in Data Collection process. Accordingly, additional DCU shall be provided in case the number of IEMs becomes more than thirty at any particular substation.

ix. The data exchange & encryption shall be as per the IS 15959 :2011 standard and its amendments.

2.3.1.2. Constructional Features of DCU

i. DCU shall be a self-contained, stand-alone, tamper proof sealed box with necessary ports for external connection.

ii. DCU shall not have any removable parts such as a hard disk, to ensure smooth and reliable operation for long term.

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

iv. The DCU shall be powered from the station battery supply rated at 220V/110V DC supply. Implementing Agency shall confirm exact DC voltage at each station during engineering stage. Contractor shall provide DCUs accordingly.

v. DCU shall be able to operate in environment with temperature up to 50ºC and humidity up to 90% without any significant effect on its performance.

vi. 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.

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

2.3.1.3. Communication Ports of DCU

- Two Ethernet ports & Two RJ 45 ports

- DCU shall be capable of sending 5 min load profile data as well as 1 min instantaneous MW data simultaneously to AMR system through separate physical FO channels.

2.3.2. Ethernet Switch to connect IEMs to DCU

- 16 ports Industrial grade layer 2 Ethernet Switch, 12 number 10/100/1000 MBPS RJ 45 ports & 4 numbers 1/10G FO Port at Substation Control room.

- Industrial grade layer 2 Ethernet Switch with required RJ 45 ports and FO ports at Switchyard location to convert electrical data to optical.

- Dual inbuilt AC (240V) and DC (110V/220V) power supply with rack mountable hardware

Note- Number of ethernet switch at each station shall be as per requirement during detailed engineering.

2.3.3. AMR Software

AMR System provided at AMR Control Centre (RLDC/RPC) will manage all functionalities of collection of load profile data along with 1 min instantaneous MW data through DCUs, conversion of data to .npc format for further use by MDP system and synchronization of IEMs through DCU.

2.3.3.1. Basic functions of AMR System

AMR system shall support the following functions:

i) Task scheduler function for 5 min load survey data acquisition at desired interval & 1 min instantaneous MW data acquisition in real time

j) Functionality for re-polling of missing data if any.

k) Raw data to [.npc] conversion.

l) Web application to share [.npc] files to RLDC.

m) Web application for viewing of 1min MW data by SLDCs.

n) 15 days storage of Raw/Binary data of 5 min load survey data at AMR control centre.

o) Time synchronization of IEMs from Remote AMR system

The detailed technical requirements for various functions of AMR system are described in subsequent sections. The Bidders are required to offer their standard products that meets or exceeds the specification requirements.

2.3.3.1.1. Functional Requirements

Main functionality of AMR system is to acquire data from different meters installed at Interface points. AMR system shall perform at least the following functions:

i. Communication with DCUs for polling of IEM data

AMR system shall communicate with DCUs mainly using FO network. AMR system shall ensure data integrity checks, for example, checksum, time check etc. AMR system shall have polling feature to run the data downloading software at a pre-designated date and time repeatedly or by manually selecting meter. A detailed activity log shall also be available for each downloading operation.

ii. Task scheduler application for collection of load profile data & 1 min instantaneous MW data

AMR system shall poll DCUs to fetch 5min load survey data and 1 min instantaneous MW data from each meter automatically through task scheduler functionality at a user defined interval. It shall fetch meter data from all metering points and process the same in its server in user defined formats (text, csv, xls etc.) in a user defined file name (file name format must be dd-mm-yy substation name-utility name-meter serial no). There should be provision to select multiple meter data file based on filename, and convert all selected files with single key-stroke. The system shall display meter data (for individual meter or Station wise or Utility wise) on PC's screen in text format, with forward/backward rolling.

AMR system shall automatically retry for missed data; the number of retry attempts and the time interval between each attempts shall be configurable (max 3 attempts with configurable time gap between each attempt). After maximum attempts, the system shall generate event and alarm showing details of missing data both at Substation PC as well as in AMR server at RLDC. An automatic mail or SMS shall be generated by the system for uploading missing data through Web application.

iii. Uploading missing data through Web application

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

➢ The web application link shall be made accessible to all stations through website.
➢ Only encrypted data shall be uploaded
➢ Each station shall be given User name and Password for login the web application.
➢ Browser shall have the list of all Utilities and its station names.
➢ Each station shall upload the encrypted data by selecting their Utility name and Station name.
➢ Web Application shall generate the confirmation message to the station on successful uploading of data.

- ➢ Web application shall generate the popup message at AMR system with Utility name and Station name on receipt of data and the same shall be recorded as alarm/event in AMR system.
- ➢ All the encrypted data received at AMR system via web application shall be stored in predefined path.
- ➢ AMR system shall have the provision to store the data in the database for the further processing.

Uploading meter data files manually to the AMR system by an authenticated user shall also be supported and shall be done by the operator within stipulated time to achieve availability of 5 min load survey data at AMR control centre.

iv. Collection of status/alarm data from DCUs

AMR software shall have feature to monitor each DCU for its status, parameters and any alarm, events. The status data shall be collected periodically or on demand at any time from all or selected DCUs. Upon failure of communication of DCU with AMR centre, alarm/event shall be generated by AMR system and an automatic mail shall be sent to respective stations. AMR operating personal shall co-ordinate the same with concerned person \ location as well.

v. Integration/configuration of DCUs & IEMs from remote

AMR software shall have feature for remote integration of New IEMs and DCUs without any interruption to existing process. It shall also have the functionality to configuration of selected or batch of DCUs & IEMs.

It shall be able to configure below mentioned parameters of DCU individually or in batch mode.

- Configuration of DCU for integration of New IEMs.
- Modification of database in case of replacement of IEM.
- Configuration of scheduler time for collection of energy data/Status/Alarm etc.
- Changes in meter protocol driver

It shall also be able to configure some meter parameters through DCU such as Time Block, setting reactive power band as per the changes suggested by appropriate commission in future.
Only root user shall have the rights to configure DCU/IEM parameters from AMR software.

vi. Time synchronization of DCUs/IEMs

The AMR system shall maintain time synchronization across all devices to ensure accuracy of data. The AMR system shall check and send time synchronization to all meters once in a day, which shall be user configurable and can be modified by root user as per the future requirement.

vii. Storage of Raw/Binary data in AMR system Database

AMR system shall support storage of 5min load survey raw meter data and alarms & events for maximum 15 days

viii. **Data sharing with RLDCs and SLDCs**

Two type of web browser application shall be designed for data sharing purpose to RLDC and SLDC.

- **For RLDC**

AMR system shall convert 5 min raw meter data in .npc format and share the same with MDP system in [.npc] format through Web browser through authenticated login on Web Portal. Also provision shall be built to share data from AMR database to MDP database through secured LAN Port as both the systems are co-located at RLDC/RPC. Provision should be made available for downloading meter data in suitable batches/state wise/location wise/meter wise.

- **For SLDC**

AMR system shall also provide access to SLDCs to view 1 min instantaneous MW data through Web browser for viewing purpose. The application shall be designed to sum-up the 1 min instantaneous MW data for the pre-defined meters for each SLDC. This application shall have the provision for addition/ deletion the meters as per SLDC requirement. Implementing agency shall collect the details of ISTS meters from each SLDC during detailed engineering for this purpose.

ix. **Reporting functions**

AMR system shall have data reporting capability implemented through a separate module. Reporting module shall give report output on screen in pdf or in .xls/,csv form at user configurable format & periodicity.

Some of the required reports are as below

1. Meter Master file, Utility wise, Station wise (As and when required)
2. Meter details; Utility wise, Station wise, month wise, year wise, or as per customized period (As and when required)
3. Missing Meter Data report (after completion of each polling cycle)
4. DCU disconnection report (Daily/Weekly/Monthly)
5. Time Synchronization Report (Daily)
6. Meter Database change report (Monthly)
7. Software/Patch updation Report (As and when required)

Report formats shall be finalized during detailed engineering in association with Employer/Owner. System shall process print out of any report as per operator's instruction.

x. **Monitoring and alarm generation**

AMR system shall generate alarm and event log whenever "data not received" occurs for each polling cycle from one or more DCUs/IEMs. The alarm shall indicate which location/DCU/IEM has the problem.

xi. Audit trail and logging

AMR system shall have security features to prevent unauthorized access to IEMs and meter data to ensure authentication for all AMR components. The system shall have audit and logging function for each and every activities either completed successfully or failed.

The system shall provide audit trail of user and system activities that enables data changes to be tracked and reported, including changes made by the system administrator.

For editing of energy meter data, the system shall record the following information in a log and store it for a minimum of 12 months:

- User ID
- Date and Time of Change

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

Changes to configuration data by users shall be logged by date, time, and user ID and such logs shall be stored for a minimum of 12 months. Critical changes relating to measuring parameters (pulse multipliers, transformer ratios, etc.) and formulae change shall be stored indefinitely as a previous version. The database for these is to be maintained in AMR system.

It should have provision of full data and system audit ability such as version controls and data retrieval according to the date and time.

The functionalities other than specified here to meet the intent of AMR shall also be considered by the contractor as part of AMR without any extra cost.

2.3.3.2. AMR System Sizing

The sizing requirement specified in this document is only for initial sizing. The delivered system shall be expandable as per future requirements upto 50%. Vendor is required to demonstrate their system's expandability in FAT (Factory Acceptance Test)

i. Population of Energy Meters

AMR system shall be capable to receive data from a minimum 500$ DCUs and each DCU shall be capable of connecting atleast 30 IEMs . Further, AMR system shall have provision to collect and handle data from 10000$ energy meters without any significant degradation of performance.

$ These are tentative numbers. Exact no of IEMs & DCUs shall be as per concurrence of respective RPCs at the time of finalization of implementing agency.

ii. Data Storage

AMR system shall support storage of raw meter data, alarms, and events for 15 days beyond which the data shall be removed from database in FIFO mode. The storage shall be calculated considering 50% space availability as spare all time with maximum Meters connected (i.e. 10000 numbers of IEMs).

2.3.3.3. Performance Requirements of AMR System

The AMR system shall receive the load survey data from all meters in the region including missing data on same day as per schedule agreed in the detailed engineering. AMR system shall poll DCUs/IEMs in batches; each batch shall consist minimum 1000 meters; and receive complete data from all concerned DCUs/meters within 1 hour including re-polling of missing data (if any).

AMR system shall continue to operate without interruption under any single point of failure condition. That means there shall be no hardware or software element whose failure renders the AMR system unavailability.

2.3.3.4. Hardware requirement for AMR System

Server : (Minimum Requirement)

- ➢ **2** X Intel Xeon E5-2667 v4 3.2 GHz,25M Cache,9.6GT/s QPI,8C/16T (135W) Max Mem 2400MHz Cache 8MB.
- ➢ 128GB RDIMM,2400MT/s
- ➢ 1TB hot pluggable, RAID 5 for Server Internal HDD
- ➢ Remote Management- Shall be able to manage through dedicated 1G remote management port with Remote Access Controller with KVM redirection. Any licenses required for KVM redirection should be included with support for 5 years.
- ➢ DVD+/-RW SATA Internal
- ➢ Power Supply and Fans-Dual, Hot-plug, Redundant Power Supply(1+1). Redundant hot swap fans.
- ➢ USB 3.0 ports-4 nos.(minimum)
- ➢ Supported OS as per the requirements and latest technology
- ➢ Form Factor -1U Rack with rack mounting kit
- ➢ Management Software - Server management software with power management features and 5 years support should be included
- ➢ NIC Port - 4 X 1Gbps NIC card
- ➢ Office 2019 Business (64 bit) or latest.
- ➢ Operation System: latest
- ➢ 23" Wide TFT Monitor
- ➢ Makes: HP/DELL/Lenovo /equivalent
- ➢ CPU should be latest model fully compatible with the application.

HMI specification (Minimum Requirement)

- ➢ Processor – 1 x Intel i5 -7300U (3M cache, 2 Cores, 4 Threads 2.60 GHz) CPU
- ➢ Memory- 1 x 16GB Dual Rank x8 DDR4-2666 SODIMM (expandable up to 32 GB)
- ➢ Hard Drive - Configured with 1 x 1TB SATA 6G Read Intensive M.2 Drive
- ➢ Graphics: Intel Integrated Graphics or Higher
- ➢ Ports- One SD Card slot,1 GbE management Port, 2 1GbE port,2 USB 2.0 port, 2 USB 3.0 and 1 HDMI Port
- ➢ Integrated sound controller; Gigabit Ethernet controller; DVD writer dual layer ; 104 Keys OEM Keyboard and OEM Optical Mouse; all necessary Plug-ins/utilities and driver software, bundled in CD/DVD Media
- ➢ 4 USB Port
- ➢ 23 " TFT Monitor
- ➢ Windows 10 Professional or latest, MS office 2019 or latest

LAN Switch specification (Minimum Requirement)

- ➢ ISO8802 or IEEE 802 Series Standards
- ➢ LAN switch shall be a rack-mountable with 1U form factor.
- ➢ The switch should have hot-swappable and field-replaceable internal redundant power supply and fan from day one.
- ➢ Layer-3 switching & VLAN
- ➢ Minimum 8- 1 Gbps Ethernet ports (However, the no. of ports in a LAN switch shall be as per the network architecture. Vendor has to provide required no. of switch as per the requirement of technical specification)
- ➢ The switch should have 1x USB Console Port, 1x OOB management port, and 1x serial console port.
- ➢ Flash Memory- 128 MB or more and DRAM 512MB or more.
- ➢ Cat 6 or higher bandwidth cable
- ➢ The switch should support hardware-based ACL with support for VLAN, Port, MAC, and IP based ACLs.
- ➢ The switch should support SNMPv1, SNMPv2c, and SNMPv3.
- ➢ The Switch should be manageable through SSHv2, SSL, and/or SNMPv3 etc.
- ➢ All Functionalities of Switch shall be IPv6 compliant and it should work on IPv6 Platform without any additional hardware/software.

GPS based Time facility (Minimum Requirement)

> Minimum 2ppm time stability of internal time base
> Feature of Propagation delay compensation .
> Feature includes an offset to permit correction to local time
> Feature of reverting to internal time base upon loss of signal from UTC source
> Resynchronization delay should not be more than 5 minutes
> Accuracy of synchronization must be less than 1.5 micro Sec
> Minimum port details: 2 no Ethernet ports, 2 IGIG-B port

The above-mentioned hardware specification is minimum requirement, if the vendor AMR application requires higher configuration then vendor shall include the same while bidding. No cost implication shall be sought during detailed engineering for system configuration. After supply of material during commissioning or during observation period if any server hardware/software up gradation required, the same shall be in vendor scope without any extra cost.

The contractor shall ensure that at the time of final approval all the hardware must be as per latest technology and industry standard.

2.3.3.5. Software requirement of AMR System

AMR system shall be developed on open platform based on distributed architecture for scalability without degradation of the performance using additional hardware in future (if required).

AMR System shall meet the following general software requirements.

i.   **Upgradability-**

Operating System, application programs supplied in AMR system shall be fully upgradable by firmware upgrade or other software upgrade methods. The same shall be logged in the system.

ii.   **Cyber Security-**

Third Party security audit by CERT-in certified auditor is to be done prior to commissioning or Go Live whichever is earlier. Compliance with CERT-in standard for all software modules has to be ensured by suppliers prior to handing over. Supplier/Contractor shall document and implement a Cyber Security Policy in line with CERT-in latest guidelines (https://www.cert-in.org.in) to secure the system and the Contractor shall keep updating the Security settings as per the revised guidelines of CERT-In at time to time.

Minimum requirements to be followed by the contractor for making the entire AMR system immune to Cyber-attacks are as follow-

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

- Network partitioning and DMZ by use of firewall as required while facilitating access for data to RLDC and SLDCs

- All default user id & password shall be changed after first time Log in.

- All log in / log out and cable plug in/plug out shall be logged in the system

- Authorization control shall allow only to use or access functions for which they have been given authorization. The access privileges for each user can only be assigned by system administrator of AMR system as the case may be.

- System and application sessions must automatically lock after 30 minutes(configurable) of inactivity.

- Record all network traffic for detecting unauthorized activity, unusual activity and attempts to defeat system security.

- Vendor must identify and list the entire network and other protocols that is used for AMR system and limit what is not required.

- All unused USB ports of all servers/workstations shall be disabled at AMR control center.

2.4. Documentation requirements of AMR system

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

i. **Design Documents**

Before manufacturing of the AMR system components, a design document shall be submitted. The design document must essentially (but not limited to) include following-

- System Overview & complete network schematics

- Functional/ Flow chart diagram

- Functions/ Technical Details of major component

- System configurations & Design Documents

- Testing Procedure (Type/Routine Test ,FAT, SAT)

- Cyber Security policy as per CERT-in guideline

ii. **User Manuals**

A list and brief description of all user documents that will be provided along with the software package to be supplied during system handover. This must include the following minimum documents:

- System configuration manuals

- Technical support handbook

- User Manuals for complete AMR system including DCU

- Operation & Maintenance Manuals of AMR system including DCU.

User manual for central site location where AMR system 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 itself contain complete document required for operation of complete AMR system including each and every component of the metering system.

A comprehensive documentation including product manual, Installation manual, O&M manual for DCU along with video tutorials to attend minor issues shall be uploaded and made available at AMR server. The same shall be accessible from all connected substations through web application link.

2.5. Testing requirements of AMR system

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 for the delivered and installed system.

2.5.1. Acceptance Test Plan and Procedures

The Vendor 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. The final Test Procedures and Test Plans shall be subject to review and approval prior to 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 complete system.

2.5.2. Factory Acceptance Test (FAT)

The Vendor 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 Vendor to detect and correct most design, integration, database, display, and performance problems prior to the FAT. The representatives of Employer shall have the right to witness all or parts of pre-FAT for which vendor shall intimate the schedule to Employer sufficiently in advance.

Test results (including documentations and certifications) for tests conducted by Vendor or third parties that are not included in the FAT test plan and procedures shall be furnished to Employer prior to FAT for review and verification. Vendor and/or third parties conducted

tests deemed inadequate shall be repeated for acceptance of Employer.

Vendor's project manager shall sign off each test of Pre-FAT. The completed test results shall be sent to Employer for review before their representative's visit to the Vendor facilities for the FAT. All tests shall be conducted using the contract-specified databases unless Employer authorizes the Vendor to use a test database.

The FAT shall be conducted according to the FAT Test Plan and Test Procedure documents approved by Employer 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 labelled

- 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 Vendor.

- 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 between IEM and DCU and DCU to AMR system
  ❖ User Interface function response time

  This performance requirement shall be met under the maximum number of input DCUs and maximum number of IEMs as specified during detailed engineering.

- Security Testing – Verify that the software meets security requirements at delivery 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 Employer's representative, who shall be able to schedule unstructured testing at any time, including during structured tests.

2.5.3. Site Acceptance Test (SAT)

The SAT will be conducted by the contractor with support from employer after the system has been installed. 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. Any other tests shall be included, as necessary, to verify overall system operation under field conditions. Any defects or design errors discovered during the SAT shall be corrected by the Vendor. The SAT includes the commissioning test, the functional and performance test, and the cyber security audit after the installation of the delivered system.

2.6. Training requirements of AMR system

Training program for system users shall include but not restricted to the following:

- 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.
- Minimum training including hands-on for a group of system users shall be 12 hours (6 hours x 2 days).

2.7. Guarantee

i. The AMR system shall be under guarantee for a period of 10 years from the date of successful commissioning.
ii. The guarantee shall include repair, replacement, part material replacement and both way transportation cost (including transit insurance) of all the hardware items of the AMR system.
iii. The software developed shall be kept under guarantee for a period of 10 years from issuance of TOC. The necessary support towards un-interrupted operation of the software shall be ensured by the contractor.

2.8. Annual Maintenance Contract (Operation, Maintenance & Support Service)

The scope of AMC shall include operation, maintenance & support services for the offered AMR system. There should be round the clock availability of skilled persons at AMR Control Centre for Operation & Maintenance of AMR system. In case of any problem at substation location, service engineer shall be deputed to site from vendor regional establishment.

The period of AMC support shall be 10 years commencing from Operational Acceptance.

2.8.1. Operation-

The contractor shall deploy skilled operating personnel for 24x7 operation at AMR control center. Minimum two persons in each shift shall be provided to monitor the task scheduler process for data collection, to ensure 100% availability of 5 min load survey data by Tuesday of each week to RLDC & to ensure 1 min instantaneous MW data to SLDCs through web browser and also to monitor healthiness of each component of AMR system.

Reporting of failure events (such as. Meter data non availability, DCU disconnection, communication problem, software/Hardware problems) shall be done automatically by sending mail or sms to the concerned personnel through computer application. There shall be provision to report breakdown manually with a complaint no. and time. Any defect found by the vendor itself while monitoring shall also be recorded and communicated to the respective Substation in-charge and Employer/Owner.

In case of complete AMR system failure due to server/any other reasons, the contractor shall get 5 minute meter load survey data through mail from all ISTS meter locations in time and manually update the database for further share with RLDC.

2.8.2. Maintenance-

A comprehensive maintenance shall be ensured for all DCUs, Switches and AMR Equipment at station level as well as AMR control center along with related software and hardware provided by the vendor for AMR System.

Brief outline of maintenance-

a.   **Monitoring healthiness of AMR system/components-**

This should be done by analyzing the report from AMR system for any discrepancy/disconnection. In case the problem is with main AMR system components, the same is to be addressed by the contractor and for other site related issues the same is to be informed to the station in-charge of respective generating company or the transmission licensee, in whose premises the meter has been installed.

b.   **Rectification/replacement of defective hardware of AMR system including DCU and switches at station level-**

In case defect of any hardware is identified, the same should be immediately replaced by the contractor without any extra cost.

c.   **Collection of meter data**

In case of unavailability of any meter data in AMR control center due to any reason, operator at AMR control center shall ensure that concerned station in-charge shall collect missing data and upload data through web application.

d.   **Incorporation change of CT/PT ratio, if any, in AMR software at RLDC/RPC**

In case of any change in CT or PT ratio in any feeder due to replacement/ augmentation, the same should be incorporated in AMR software for proper registration based on the input from Generator Company/ Transmission Licensee & confirmation from RLDC .

e.   **Monitoring software performance and correction if required-**

Regular monitoring of software for its smooth function, data availability for other application should be done with generation of monitoring report.

f.   **Maintenance of hardware of AMR system**

Regular monitoring of hardware of AMR system and maintenance thereof after noticing/ being reported of any mal function/ defect. Defect should be attended as per severity schedule. In case replacement of hardware is required, the same should be immediately replaced by the contractor without any extra cost.

If any of the server is required to be replaced, a server shall be arranged by the contractor so as to keep the system healthy until the original server is rectified and reinstalled, as per guarantee terms.

g.   **Maintenance of software for AMR system**

Software license shall be ensured to maintain desired availability of the system. Contractor shall provide support for all AMR applications on all days of the week. In case site visit is necessary for the software system/upgradation, all such required visits shall be without any additional financial implication. Also upgradation of software including cyber security to meet the desired performance shall be done by the contractor without any additional cost implication.

In case any addition or modification is required in settings, formulae or any other parameters in the AMR system to meet the procedure laid by the Appropriate Commission, the same shall be ensured by the contractor as a part of AMC.

2.8.3.   Support Services-

Apart from maintenance work described above, the contractor shall be responsible for commissioning of IEMs/ DCUs, replacement of faulty IEMs/DCUs & future IEMs/DCUs (which are not envisaged under this project) with AMR system with the goal of meeting the availability as set forth herein. Any training programme at substation and control room, if required, shall also be imparted by the contractor. Payment for all this work shall be done at the prevailing rate for such work under this NIT.

2.9. Availability requirements & Penalty charges during AMC period-

AMR system availability shall be computed on monthly basis. The vendor shall submit weekly report to the employer regarding availability of the AMR system. Weekly Availability Report shall be put up to Employer/Owner by the Contractor with reasons for data non-availability through AMR along with the calculated penalty as per the penalty rate provided in Severity Table . The Employer/Owner shall review the same and levy the deduction on monthly basis.

System	Requirements	Deduction/Penalty charges
AMR system availability	As per severity level tabulated below	As per severity level tabulated below
Availability of 5 min Load survey data at AMR control center on weekly basis	100% (By AMR or Manual upload)	25% of monthly AMC shall be deducted on each occasion

Severity level:

Following are the severity levels in terms of breakdown maintenance work and associated penalty to be imposed against non-compliance within stipulated time:

Severity Level	Description	Resolution time allowed		Penalty for if not resolved within allowed time on each occasion. (in INR)
		When site visit not required	When site visit required	
Emergency (Severity Level-1)	When both the server are down / not working	≤24 hours	3 days	Penalty= (X* No of days beyond permissible) / 30 X=0.25% of contract price OR 25% of AMC charges for the month whichever is higher .
Critical (Severity Level-2)	When one server is down/ not working.	≤24 hours	3 days	Penalty= (X* No of days beyond permissible) / 30 X=0.125% of contract price OR 12.5% of AMC charges for the month whichever is higher .
Critical (Severity Level-3)	When DCUs are faulty or Problem in Ethernet Switch etc.	2 days	7 days	1% of monthly AMC charges for each DCU / Ethernet Switch failure during the month.
Spare Non-Availability	Non availability of 15% spare of required hardware components of AMR system.			5% of monthly AMC charges
Note- i) In case the contractor do not meet the AMR system performance requirements consecutively for 3 months due to outage of AMR servers/system without valid reason, the Contract shall be terminated and the Contract Performance Guarantee shall be forfeited.				

| ii) | Delay due to any reason not attributable to the contractor shall not be charged and consequent waiver of penalty is subject to discretion of the owner. |
| iii) | Site visit means visit of experts from service center of contractor/OEM representatives to AMR control center or stations (as applicable). |

The bill for AMC after every month of service shall be accompanied by the following certificates;

1. System availability certificate by Employer.
2. Work report containing routine and break down maintenance
3. Spare material transaction report
4. Commissioning work report (if applicable)
5. Any other document as may be required in future.

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Part-II :

Meter Data Processing (MDP) System

METER DATA PROCESSING AND REPORTING

This section describes the envisaged system architecture of Meter Data Processing (MDP) and Reporting in Host Region.

Intent of MDP and Reporting

The intent is to provide the requirement details of Standard RDBMS such as SQL/ORACLE Database (with latest upgraded version available) oriented Meter Data Processing Software having compatibility to exchange and share data / information with similar Database systems that may be used by other RLDC / NLDC with a view to meet requirements of Data Warehousing and Business Intelligence systems etc. The Client Interface shall be Browser/console based and report formats shall be in user defined multiple formats like PDF, Standard Spreadsheet, CSV, Text file etc. The software is intended to meet the deviation settlement accounting as well as regional energy accounting requirements for the commercial mechanism adopted in respect of bulk power supplies and inter-State exchanges within and across the Region. The software shall also have a module for importing the interchange schedule of regional entities from an external system and computing the deviation by any regional entity from its interchange schedule. Further the software shall have a module to compute the deviation charges as per the prevailing DSM mechanism approved by CERC. MDP would be implemented by implementing agency as per then prevailing CERC regulations. This document describes the details of various functions like meter data - collection, formatting /conversion and facilities of Standard RDBMS such as SQL/ORACLE database oriented software and proposed solution for meter data processing.

1.   General Requirements:

- RLDCs/NLDC shall be able to access all meter related data through authenticated and secure login through web based platform with the facility of downloading the data in standard formats such as csv, xlsx etc.

- The MDP software should provide standard API features (preferably RESTful APIs such JSON etc) to enable data exchange between AMR servers and meter data processing application software at RLDCs/NLDC. Facility shall be provided for the RLDCs/NLDC to be able to receive raw data from the AMR using secure mode of communication.

- Database creation in MDP software shall be done by designing a suitable interface between MDP and AMR.

- Since RLDCs are responsible for meter data processing, the objective is to ensure 99.99% availability of Energy meter data at RLDCs/NLDC end. MDP software would be located on hardware provided by RLDCs/NLDC.

- RLDC after receiving the meter data from different locations in encrypted form convert the same into readable format through suitable software. The source code/encryption

key for conversion of encrypted raw data into readable format from the meter vendors would be provided to implementing agency and POSOCO.

IEMs Details (Master file) in MDP:

o MDP shall keep database (Meter No., Location ID, Utility Name, Station Name, Description, Meter Type, HV Voltage, LV Voltage, HV Current, LV Current etc.) of all IEMs used in accounting.

o One of the inputs required for computation of energy from raw data is a Master file containing details (CT/PT ratio, location, etc.) of all the available IEM's in the region.

o There shall be provision for updation of existing IEMs database and to add new IEMs to MDP database

o Whenever master file shall be modified, the old version of the master file shall be stored in database with date stamping. When computation of raw data for old dates is required, the S/W shall fetch the meter details (Meter ID, HV Voltage, LV Voltage, HV Current, LV Current etc.), for the mentioned period, from the required version of the Master file.

o Meter associated with a particular location ID during particular period may need to have be associated with another location ID. MDP shall be able to handle this relocation.

o The MDP Master File format shall be as mentioned below.

Utility Name	Station Name	Location	Description	Element Type	Meter No	Local Meter	HV Voltage	LV Voltage	HV current	LV current
						ID	(kV)	(V)	(A)	(A)

Table V-1 - Master file format

- Activities to be carried out by the software can be broadly classified as follows:

  a. Uploading Meter Data in database

  b. Validation of Meter Data

  c. Computation of net injection, drawal and transmission loss

  d. Accounting

  e. Reporting

After receipt of energy meter data from all metering locations, RLDCs are responsible for meter data processing, validation and computation.

a. Uploading Meter data in Database:

The process shall be through 'Database Interface Menu driven'. The Menu shall enable creation, uploading, validation, processing, modification, computation and retrieval of Meter data from Database.

File Upload Menu: The user shall be asked to enter / select from a calendar the "Start Date" and the "End Date" for the period for which the Meter data file shall be uploaded to the system. On entry the user shall be able to upload the file by browsing the computer or directly from database.

On successful upload, same shall be mentioned on the screen along with "Error Description" if any.

Data Availability Menu The availability of all data (i.e. data received /not received/partially received) w.r.t. individual meters can be checked through this menu. The user is required to select the dates (start date / end date) pertaining to the period concerned and select the location code against which the availability of data is required to be checked. The Menu shall also display a description of the location in brief.

On selection of the appropriate location(s), the status of availability shall be mentioned and in case of availability, the date-wise availability of data w.r.t. the concerned meter(s), for the subject location(s), shall be displayed under each location through an expandable drop down menu. The time-block-wise details regarding Frequency, WH data, Raw Data, Date of Receipt etc. shall also be displayed as shown below:

	Location	Location Description.	Date	Availability		
+	AB–01	ABC END OF XYZ–1 FDR	DD/MM/YYYY	YES / NO		
	In case of YES:					
	Time	Meter	Frequency	WH Data	Raw Data**	Received On
	00:00	NP–0001–A	50.01	14.66	50.01 + 14.66	DD/MM/YYYY
	00:05	NP–0001–A	49.99	13.92	49.99 + 13.92	DD/MM/YYYY
	―――					
	23:55	NP–0001–A	49	13.65	49 + 13.65	DD/MM/YYYY

** Raw Data is the combination of the frequency (Hz) and WH data.

Table V-2 - Data Availability Report

Further, the data regarding availability/ partial availability shall also be downloadable in consolidated format in a text file format (file extension as per IEEE standard/.txt) exportable to ISO/IEC 26300:2006/Amd 1:2012 or ISO/IEC-29500:2012 compatible Spreadsheet format. For partial availability of data for particular time blocks only, the same shall also be displayed/ reported.

All Checks Menu: Through the All Checks Menu the User shall be able to check the existence of any problems related to the various measurable parameters recorded by the meters viz. Voltage, Time Correction, Frequency, Watt Hr, any Algebraic sum problems etc. The user shall be able to select the start date and the end date, station type (Generator/ Inter Regional/ State/ Transmission Utility) and Location(s) for which the information is required. The same shall also be downloadable as "Details File" & "Summary File". The various checks to be performed

along with sample format of reports are defined as follows:

(i) **Voltage Check**: If during any time block, voltage in any of the phases fall below 80% of rated voltage, this would be flagged and reported.

Location	Date	Time	Meter	Problem	WH Data	Raw Data
NG-13	03/03/2018	00:30	NP-6889-A	Voltage Supply Failure	-4.54	50 * -04.54
NG-13	03/03/2018	02:30	NP-6889-A	Voltage Supply Failure	-3.37	48 * -03.37
NG-13	03/03/2018	05:15	NP-6889-A	Voltage Supply Failure	-3.15	49 * -03.15
NG-13	03/03/2018	07:15	NP-6889-A	Voltage Supply Failure	-11.71	50 * -11.71

Table V-3 – Voltage Check Report

(ii) **Time Correction Check**: The log of meters requiring time correction would be provided In case of time drift in the meter, time correction command can be provided through DCU; which would be logged and stamped in meter data file. This check would list out such time correction commands.

Location	Date	Time	Meter	Problem	WH Data	Raw Data
AG-01	01/03/2018	13:45	NP-9081-A	Time Correction Retard	6.16	49 rr+06.16
AG-01	01/03/2018	14:00	NP-9081-A	Time Correction Retard	6.32	46 rr+06.32
AG-01	01/03/2018	14:15	NP-9081-A	Time Correction Retard	6.26	40 rr+06.26
AG-01	01/03/2018	14:30	NP-9081-A	Time Correction Retard	6.19	45 rr+06.19

Table V-4 – Time Correction Check Report

(iii) **Frequency Check**: A meter is defined in Meter database as Master frequency meter and frequency as recorded by Master frequency meter is used for all computations. This check lists all meters with frequency difference of more than a set tolerance value with reference to Master Frequency Meter. User shall be allowed to select the Master Frequency Meter from a list of defined Master Frequency Meters.

Location	Date	Time	Meter	Frequency	Master Frequency	Variance	Number of continuous time-blocks for which this variance was observed
ZZ-07	01/01/2018	00:00	NP-5285-A	51	48	3	
ZZ-07	01/01/2018	00:15	NP-5285-A	47	50	3	
ZZ-07	01/01/2018	00:45	NP-5285-A	51	47	4	
ZZ-07	01/01/2018	01:00	NP-5285-A	48	50	2	
ZZ-07	01/01/2018	01:45	NP-5285-A	51	55	4	

Table V-5 – Frequency Check Report

(iv) **Watt Hr. Check**: This check is used to lists out any 'zero value' Wh reading (i.e. if the flow is '0') or any Wh reading which is greater than 2 digit (99.99) value i.e. beyond permitted range in any time block; and it is reported as 'no flow' and 'invalid reading' respectively. If there is a no flow condition, it is to be checked for non-availability or open/ floating condition of line/ ICT/ Generator or any

other reason.

Location	Date	Time	Meter	Problem	WH Data	Raw Data
AG-01	05/02/2018	00:00	NP-9081-A	No Flow	0	00 * +00.00
AG-01	05/02/2018	00:15	NP-9081-A	No Flow	0	00 * +00.00
AG-01	05/02/2018	00:30	NP-9081-A	No Flow	0	00 * +00.00
AG-01	05/02/2018	00:45	NP-9081-A	No Flow	0	00 * +00.00
AG-01	05/02/2018	01:00	NP-9081-A	No Flow	0	00 * +00.00

Table V-6 – Frequency Check Report

(v) **Algebraic Problem:** In a meter, sum of Wh readings of all time blocks in a day should be equal to the Wh reading of whole day (difference between cumulative reading of 0000 Hrs and 2345 Hrs). This check flags if there is any discrepancy in this algebraic sum during the period.

ocation	Date	Problem	Cumulative Diff.	Algebraic Sum	Error
AX-02	01/01/2018	Algebraic sum	1,196.050000	1,196.100000	-0.050000
AX-03	01/01/2018	Algebraic sum	979.600000	979.560000	0.040000
AX-04	01/01/2018	Algebraic sum	1,346.900000	1,346.890000	0.010000
AX-05	01/01/2018	Algebraic sum	1,331.600000	1,331.580000	0.020000

Table V-7 – Algebraic Problem Report

View Menu: The View Menu shall enable the users to view and download all data pertaining to the following:

    i. (M)WH Data

    ii. (M)WH Daily Data

i.   (**M)WH Data**: The following details shall be displayed on selection of start date, end date and location(s) / utility / station etc., for the selected locations for all available time blocks:

Time	Meter	CTR	PTR	WH Data	MWH Data*	Received On
00:00	NP-0001-A	800	1200	6.77	6.4992	DD/MM/YYYY
00:05	NP-0001-A	800	1200	7.08	6.7968	DD/MM/YYYY

23:55	NP-0001-A	800	1200	7.04	6.7584	DD/MM/YYYY

*$MWH = WH \times CTR \times PTR$

Table V-8 – Algebraic Problem Report

The detailed files shall also be downloadable in pre-approved formats as shown in **Annexure-B**.

ii.   (**M)WH Daily Data**: This option shall enable the user to view & download the details regarding

daily total energy flow for all the selected locations for the selected period, for all the dates. The following shall be displayed and shall be downloadable in pre-approved format as shown in **Annexure-C.**

Location	Location Desc	Date	Total Energy
XY-01	ABC END OF XYZ-1 FDR	DD/MM/YYYY	532.7904
XY-02	ABC END OF XYZ-2 FDR	DD/MM/YYYY	399.4368
XY-03	ABC END OF XYZ-3 FDR	DD/MM/YYYY	399.4368

Table V-9 – (M)WH Daily Data

- The Computation (Multiplication of raw data with CT/PT Ratios to arrive at actual values) of meter data in MDP shall be done automatically after activating the import option for data fetching from AMR SERVER.

b.   Validation of Meter Data:

Real and Virtual/Fictitous Meters can be classified into three types viz., Main Meters, Check Meters and Standby Meters. For accuracy of Energy Accounting it is essential to carry out validation of meter data. Validation of Main Meters (both real and virtual meters) is done by pair checking of Main Meter readings with that of Check and Standby Meters (real and virtual/fictitous meters) data for every block. The pairs shall be configurable as per change of network configuration under Configuration Menu as mentioned in subsequent paragraphs.

Provision of "High Correlation Comparison" facility shall also be made available.

Validation Menu: The validation menu shall have two options:

A.Pair Check: The mismatch (difference) between the readings of the real or virtual meters of identified pairs is checked and listed as shown below:
The pair check menu shall display a list showing the following:
(i)   meter pairs: Meter IDs for End-1 and End-2,
(ii)   Station Names for End-1 & End-2,
(iii)   pair relation (M – C, M – S, C – S),
(iv)   the mismatch tolerance limit in MWH (the limit is set as 0.5/1/1.5 MWH for 132/220/400kV voltage level respectively),
(v)   Name of Feeder/ Element Details
(vi)   And there shall also be an option to "include Meter Replace Value Tolerance %"; which can be entered by the user; and which shall overrule the set tolerance limits and display the readings against those meters only and for those time blocks for which the value is beyond this user-specified limit.
(vii) Option to select the time period (i.e. Start & End dates)
The following list shall be displayed and upon selection of the required pair(s), the time block wise details and total mismatch for each day for the selected period will be displayed and can be downloaded.

End–1 Station Name	End–2 Station Name	MAIN Meter No./ ID	CHECK/ ST.BY Meter No./ ID	Pair Relation	MWH limit X	MWH limit Y	Element Name
ABC	XYZ	AG–01	TR–01	M – S	0.5	0.5	400KV ABC – XYZ–1
ABC	XYZ	AG–02	TR–02	M – S	0.5	0.5	400KV ABC – XYZ–2
ABC	PQR	AM–01	AM–02	M – S	1.5	1.5	400KV ABC – PQR–1
ABC	PQR	AM–03	ME–14	M – S	1.5	1.5	400KV ABC – PQR–2

Table V-10 – Validation (Pair-check) Report-1

detailed meter reading mismatch values shall be displayed for the whole day and for those blocks for which the value exceeds the tolerance limits:

Date	End-1	End-2	End-1 MWH	End-2 MWH	Diff MWH	% Diff.
05/03/2018	AM–19	AS–45	3371.7090	–3437.5272	–65.8181	1.95
		Time	End-1 MWH	End-2 MWH	Difference	% Diff.
		00:00	31.2727	–38.3272	–7.0545	22.56
		00:05	30.2545	–33.9636	–3.7090	12.26
06/03/2018	AM–19	AS–45	2822.6909	–2846.0727	–23.3818	0.83
		Time	End-1 MWH	End-2 MWH	Difference	% Diff.
		01:30	25.7454	–22.4727	3.2727	12.71
		01:45	30.4727	–23.6727	6.8000	22.32
		17:00	38.1090	–29.7090	8.4000	22.04

Table V-11 – Validation (Pair-check) Report-2

The results of the above pair checking shall be downloadable in .xlsx file formats; samples of which are given under **Annexures-D (I) & D (II).**

For calculation of MWH & percentage differences, the following shall be the consideration:
1. The polarity of Main & Check shall be same and that of Main & Standby meters shall be opposite.
2. For working out the percentage differences, the reference energy value shall be the Main Meter energy data.

Further, there shall be a provision for Graphical representation of Pair Checks in Excel as per samples shown below:
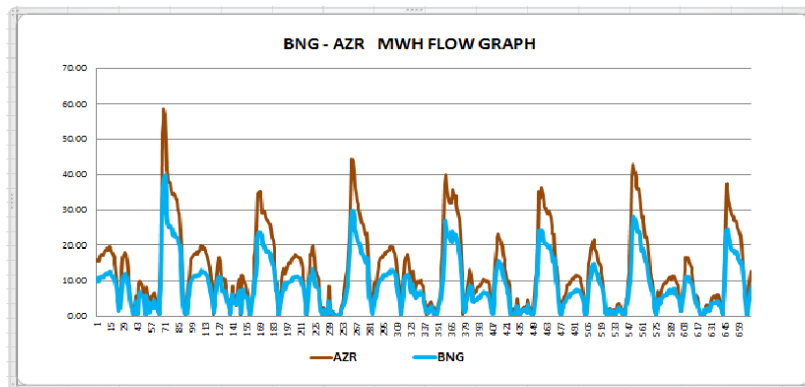
Fig:1 BNG-AZR MWH graph
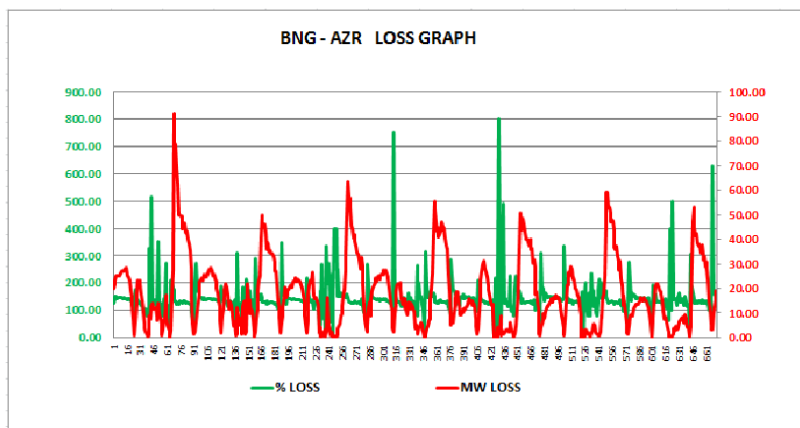
Fig:2 BNG-AZR loss graph

Further, the software shall provide other facilities like loss analysis trends and measurements of other statistical parameters like standard deviations etc. wherever possible.

B.Net Bus Check: In any bus bar of substation or generating station, total energy incoming in any time block should be equal to total outgoing energy. This is checked in all identified buses and the result is listed. Mismatch beyond tolerance is flagged.

The net bus check menu shall display a list of "Net Bus Virtual Meters" and there shall also be an option for applying a Tolerance % limit. On selection of the desired meters and the range of dates for which the net bus checking is required to be carried out, the MDP software shall generate a list of the values for every time block for all the selected dates and the same shall be displayed as shown below. On entering the tolerance limit, only those time blocks for which the values of the net bus % mismatch is exceeding the set limit shall be displayed.

For example:

The Net Bus Virtual/Fictitious Meter for a generating station is the difference between the combinations of all the outgoing Main Meters at the outgoing feeders and the sum of the Standby Meters at HT of the Generator and the station transformer.

For calculating the % Mismatch, the difference is divided by that virtual meter value which is

calculated out of the main meter readings.

NetBus tolerance value:				
Location	Location Desc.	Station Name	NetBus*	Date
AG-91	NET BUS AT AGTPP	RC NAGAR (RCN)	-834.372600	01/12/2017
Time	Formula	Expression	NetBus	% Mismatch
00:00	+(AG-81) -(AG-71)	' +(9.0522) -(17.964)'	-8.911800	49.61%
00:05	+(AG-81) -(AG-71)	' +(8.5272) -(17.3664)'	-8.839200	50.90%
00:10	+(AG-81) -(AG-71)	' +(8.4768) -(17.064)'	-8.587200	50.32%

23:50	+(AG-81) -(AG-71)	' +(8.4168) -(16.9416)'	-8.524800	50.32%
23:55	+(AG-81) -(AG-71)	' +(8.3706) -(16.9272)'	-8.556600	50.55%

Table V-12 – Validation (Net Bus) Report

c. Computation of Injection/Drawal Of Utilities:

- The user shall have the option to convert any 15 min meter reading data into 5 min data and vice versa. For conversion of 15 min block length data into 5 min blocks, the MWH readings of each 15 min blocks shall be equally divided against three 5 min blocks, the total remaining same; and the frequency for each 5 min block being same as that of the 15 min block. Similarly, for conversion of 5 min reading to 15 min, the MWH value shall be the algebraic sum of three consecutive 5 min block readings and frequency shall be the average of the three 5 min readings.

- Energy data of IEMs shall be used for Computation of Injection/Drawal of utilities, which shall include application of algebraic functions on a set of predefined IEMs. Such injection/drawal of utilities may itself be treated as a fictitious meter data, which can be calculated through application of algebraic functions on real meter data.

- Addition and deletion of new utility shall be user defined. There shall also be provision to update the file with date stamp.

- There shall be two types of database for Fictitious IEMs. One for Fictitious ID details with description and other is for formulae set. All the data formats shall be user configurable.

- The format of Fictitious IEMs shall be as below:

FICTITIOUS ID	FICTITIOUS ID TYPE	DESCRIPTION
KO-901	Main	Korba Stage-1 Injection
KO-902	Check	Korba Stage-1 Injection
KO-902	Standby	Korba Stage-1 Injection
LK-901	Main	Lanco Stage-1 Injection
LK-902	Check	Lanco Stage-1 Injection
LK-902	Standby	Lanco Stage-1 Injection

Table V-13 Fictitious meter Description file format

FICTITIOUS ID	FICTITIOUS ID TYPE	FORMULA
KO-901	Main	(KO-01)+(KO-02)-(KO-03)*98/100
KO-902	Check	(KO-04)+(KO-05)-(KO-06)*98/100
KO-902	Standby	(KO-05)+(KO-06)+(KO-07)
LK-901	Main	(LK-01)+(LK-02)-(LK-03)
LK-902	Check	(LK-04)+(LK-05)-(LK-06)
LK-902	Standby	(LK-05)+(LK-06)+(LK-07)
IN-901	Main	(KO-901)+(LK-901)

Table V-14 Fictitious meter Formulae File Format

- Computation formula of a fictitious meter may involve other fictitious meters in its formula. Therefore, the software shall have the capability to compute the same. The fictitious meters used in the formula have to be computed first before they are used in other formulae.

- S/W shall have the capability to replace any meter used in fictitious formulae with its Check/Standby meter with application of transmission loss in case of non-availability/discrepancy of main meter data. The replacement can be for a block/day/week. The percentage of loss to be applied shall be defined by user in configuration file base on the type and voltage rating. The configuration file format shall be as below.

Type of Element	Voltage Level KV	% of Loss to be applied
Line	765	1.5
Line	765	2
Line	220 and Below	4
ICT	-	0

Table V-15 – Loss configuration file

- All changes in fictitious meter in block wise shall be stored in database for future requirements.

- MDP shall be able to store the formula of Fictious meters with time stamp. During the computation of Fictious meter data, MDP shall fetch the formula as per the time stamp and compute the result.

- MDP shall be capable of fetching computed IEM data and fictitious meter data of required date and time block through query.

- MDP shall also store name associated with Location IDs with time stamp, to handle change in names after LILO of lines.

- If, while computing fictitious formula, any meter data is found missing/invalid, the same shall be shown in an error dialogue box with an option to bypass the same or not.

- MDP shall compute Injection/Drawal of Utilities while incorporating all the changes made in fictitious meter configuration files viz. replacement of main meters with Check/Standby meters due to non-availability/ discrepancy of main meter data.

- Report of all replacements and adjustments done shall be provided/available and downloadable.

- Meter associated with a particular location ID during particular period may need to have be associated with another location ID. MDP shall be able to handle this relocation.

- After uploading meter data into the database and validating the data, the user shall be able to carry out computation of the various parameters such as net injection, drawal and

transmission loss etc.

On clicking the "Compute" option, computation shall be carried out by the software and the following data shall be generated and stored in the database

a)Virtual/Fictitious Meter Data

b)Out MWH Data

c)Out MVAR Data

d)Loss Computation

e)Pair check results.

After executing the above computations, the following information shall be viewable under the 'View Menu':

(i)   Virtual/Fictitious Meter Data

(ii) Virtual/Fictitious Meter Daily Data

(iii) Reverse Flow Virtua/Fictitious Meter Data

(iv) Reverse Flow Virtual/fictitious Meter Data Summary

(i)   **Virtual/Fictitious Meter MWH Data**: The user shall be required to select the date range and the Virtual meter(s) against which the MWH details are to be viewed. On selection, the following details shall be displayed showing the date-wise total MWH against each Virtual meter, expandable on the same screen to display the time-block-wise details (for the entire 96 or 288 blocks, as applicable), as shown below:

	Virtual Meter No.	Description	Station / State Name	MWH	Date	
⊟	AB–71	INJECTION BY ABC GEN. STN. (LINES)	ABC	---- (upto 2 decimal places)	01/01/2018	
Date	**Time**	**Formula$**	**Expression$**	**MWH**	**MW**	**Error$$**
01/01/2018	00:00	+(AB–01) +(AB–02) +(AB–03)	+(0) +(11.28) +(8.2224)	19.5024	78.0096	
	00:05	+(AB–01) +(AB–02) +(AB–03)	+(0) +(11.0304) +(8.2872)	19.3176	77.2704	
	--- *upto*					
	23:55	+(AB–01) +(AB–02) +(AB–03)	+(0) +(13.5648) +(6.7968)	20.3616	81.4464	

Table V-16– Virtual/Fictitious Meter MWH Data

$ *Formula refers to the various meters combining to form the Virtual /Fictitious- meter and Expression refers to the MWH flow for each meter.*

$$ *Error – an error message shall be displayed in case of non–availability of data of any of the meters, from the combination of meters, as per the formula; or any other problem with meter data.*

The above details shall be downloadable in .xlsx file format as shown in the sample placed at **Annexure-F (I).**

(ii) **Virtual/Fictitious Meter MWH Daily Data:** This menu shall enable the user to view and download (in .xlsx format) the overall total daily MWH energy flow for every Virtual meter for each day for the range to dates selected by the user and for the selected Virtual meter(s) as shown below:

Virtual/Fictitious Meter No.	Description	Station / State Name	Total MWH	Date
AG-71	INJECTION BY RC NAGAR (LINES)	RC NAGAR (RCN)	1526.9808	05/03/2018
AG-71	INJECTION BY RC NAGAR (LINES)	RC NAGAR (RCN)	1229.7696	06/03/2018
AG-91	NET BUS AT AGTPP	RC NAGAR (RCN)	-511.8900	05/03/2018
AG-91	NET BUS AT AGTPP	RC NAGAR (RCN)	-415.6944	06/03/2018
AS-51	TOTAL DRAWAL OF ASEB	ASSAM	18783.4893	05/03/2018
AS-51	TOTAL DRAWAL OF ASEB	ASSAM	17049.7198	06/03/2018

Table V-17 --Virtual Meter MWH Daily Data

The sample downloadable format is also attached in **Annexure–F (II).**

(iii) **Reverse Flow Virtual/Fictitious Meter Daily Data**: The user shall be able to download and view the details regarding reverse flow (drawal by a generator and injection by a drawing entity is treated as reverse flow) of energy for the selected Virtual/Fictitious meter(s) for the selected days for all the time blocks for which reverse energy flow has occurred.

For the selected virtual/fictitious meter(s), the "formula" of meter combination and the "expression" showing the individual meter readings shall also be displayed. The following details shall be displayed and downloadable in .xlsx files for each selected meter as shown below (format placed at **Annexure-G (I)):**

Date	Time	Location	Station Name	Formula	Expression	MWH
DD/MM/YYYY	00:00	XY-71	XXYYZZ (XYZ)	+(XY-01) +(XY-02) - (XY-03) +(XY-04)	'+(0.6444) +(0.6444) -(-1.0584) +(-2.4156)'	-0.068400
01/01/2018	00:05	DY-71	DOYANG (DOY)	+(DY-01) +(DY-02) – (DY-03) +(DY-04)	'+(0.63) +(0.6408) -(-1.0332) +(-2.3616)'	-0.057600
01/01/2018	00:15	DY-71	DOYANG (DOY)	+(DY-01) +(DY-02) – (DY-03) +(DY-04)	'+(0.6624) +(0.6624) -(-1.0044) +(-2.394)'	-0.064800

01/01/2018	02:00	DY-71	DOYANG (DOY)	+(DY-01) +(DY-02) – (DY-03) +(DY-04)	'+(0.6948) +(0.702) -(-0.9792) +(-2.412)'	-0.036000

<p style="text-align:center">**Table V-18 --Reverse Flow Virtual/Fictitious Meter MWH Data**</p>

(iv) **Reverse Flow Virtual/Fictitious Meter Data Summary**: The summary of the details regarding reverse flow of energy w.r.t. the selected meters for the selected days i.e. the total number of time blocks for which reverse flow has occurred and the total reverse flow MWh for the selected dates shall be viewable and downloadable as shown below (format at **Annexure-G(II))**:

Virtual/Fictitious Meter No.	Station Name	Date	Total Blocks	Energy MWh
XY-71	XXYYZZ (XYZ)	DD/MM/YYYY	73	-6.894000
DY-71	DOYANG (DOY)	01/01/2018	70	-5.130000
DY-71	DOYANG (DOY)	02/01/2018	68	-5.691600
DY-71	DOYANG (DOY)	03/01/2018	72	-6.048000
DY-71	DOYANG (DOY)	04/01/2018	73	-6.451200

<p style="text-align:center">**Table V-19 Reverse Flow Virtual/Fictitious Meter MWH Data Summary**</p>

d. **Accounting:**

Account/accounting Menu: After computation. The account Menu enables a user to retrieve the energy accounting records of the IEM (both in 5 minutes and 15 minutes) pertaining to the following:

(i) MWH output
(ii) MVAR output
(iii) Load Curve
(iv) Lord Duration Curve
(v) Loss Computation

(i) **MWH output:** Through this option the user can compute the drawal / export by every entity, injection by the generators, MWH loss in the lines and Net Bus Check for Bus at the Substation End.

Time	Freq.	Line–1	Line–2	---Line–N	Total (MWH)
00:00	45	+0.401000	−0.471600	---	+154.436853
00:05	46	+0.390000	−0.612000	---	+151.328018

23:55	44	+0.382200	−0.748800		+139.487827
TOTAL		+38.732400	−34.53000		+16957.979817

The above details shall be downloadable in .xlsx / .txt file formats as shown in the examples below:
Examples:

(1) MWH Drawal Accounting for the State of A:

TIME	FREQ	PLP-JMB	SALK-BTP5-1	AZAR-SIL	AZAR-BONG	UNR-HAF		TOTAL
00:00	46	+0.009600	+16.560000	+29.600000	+6.545455	-1.262400	---	+149.682458
00:15	45	+0.004800	+16.080000	+30.181818	+5.527273	-0.912000	---	+147.842449
00:30	42	+0.004800	+15.936000	+29.963636	+5.163636	-0.864000		+145.915986
00:45	44	+0.009600	+15.712000	+30.545455	+4.654545	-0.835200		+145.025969
01:00	44	+0.004800	+16.192000	+31.927273	+7.200000	-0.763200		+150.995061
01:15	38	+0.004800	+16.016000	+32.436364	+6.018182	-0.648000		+151.223852
01:30	34	+0.009600	+15.856000	+33.090909	+8.254545	-0.604800		+150.108879
01:45	41	+0.004800	+15.776000	+33.090909	+5.818182	-0.528000		+149.109535
02:00	41	+0.004800	+14.896000	+34.472727	+2.400000	-0.556800		+145.824008
02:15	39	+0.004800	+14.928000	+34.690909	+2.400000	-0.662400		+147.436690
02:30	42	+0.004800	+14.768000	+34.763636	+1.890909	-0.710400		+146.381126
02:45	47	+0.000000	+14.528000	+34.981818	+1.454545	-0.696000		+144.886325
03:00	48	+0.004800	+14.448000	+34.909091	+1.672727	-0.672000		+144.281536
03:15	46	+0.000000	+14.224000	+35.418182	+1.309091	-0.643200		+143.612691
03:30	47	+0.000000	+14.144000	+35.272727	+1.309091	-0.628800		+143.322499
03:45	46	+0.000000	+14.176000	+35.418182	+1.600000	-0.619200		+144.351751
04:00	49	+0.000000	+14.224000	+35.490909	+1.672727	-0.648000		+144.721613
04:15	49	+0.000000	+14.464000	+35.054545	+2.254545	-0.633600		+145.459718
04:30	47	+0.000000	+14.800000	+34.763636	+2.909091	-0.681600		+147.319507
04:45	46	+0.000000	+15.248000	+34.836364	+3.709091	-0.628800		+149.426664
05:00	41	+0.000000	+15.584000	+34.254545	+4.800000	-0.571200		+154.337198
05:15	39	+0.000000	+16.352000	+33.454545	+6.909091	-0.696000		+158.811180
05:30	43	+0.000000	+17.040000	+32.145455	+9.527273	-0.811200		+163.910137
05:45	44	+0.000000	+18.688000	+29.236364	-14.545455	-0.955200		+172.501497
06:00	47	+0.000000	+20.576000	+26.545455	-19.272727	-1.224000		+183.756274
06:15	44	+0.000000	+21.952000	+26.400000	-22.327273	-1.488000		+195.608129

Table V-20: MWH drawal Accounting

(2) Net Bus Check for 'M' S/S (at 220kV bus):

| | | | | | NET BUS CHECK | FOR MTSA USING SPECIAL ENERGY METERS | | | | |
TIME	FREQ	K'GURI	SMG-1	SMG-2	ICT	DMR-1^	DMR-2^	BYR-1	BYR-2	NET220KV
00:00	46	-5.968000	+8.950000	+8.810000	-11.064000	-1.235000	-1.395000	-2.880000	-2.976000	+6.364000
00:15	47	-5.904000	+8.560000	+8.510000	-10.848000	-1.240000	-1.420000	-2.560000	-2.576000	+5.594000
00:30	42	-5.936000	+8.340000	+8.320000	-10.872000	-1.295000	-1.425000	-2.896000	-2.896000	+5.586000
00:45	44	-6.064000	+8.250000	+8.190000	-10.728000	-1.370000	-1.375000	-3.152000	-3.152000	+5.693000
01:00	44	-6.160000	+9.020000	+9.010000	-10.992000	-1.480000	-1.330000	-2.848000	-2.880000	+6.238000
01:15	38	-6.304000	+9.190000	+9.150000	-10.752000	-1.600000	-1.295000	-2.848000	-2.848000	+6.449000
01:30	34	-6.448000	+9.240000	+9.200000	-10.536000	-1.800000	-1.260000	-2.944000	-2.960000	+6.590000
01:45	41	-6.384000	+9.310000	+9.260000	-10.848000	-2.040000	-1.255000	-2.992000	-2.960000	+6.817000
02:00	41	-7.120000	+9.560000	+9.530000	-12.048000	-2.490000	-1.195000	-4.864000	-4.848000	+9.203000
02:15	39	-7.072000	+9.560000	+9.520000	-12.000000	-2.840000	-1.210000	-4.800000	-4.816000	+9.444000
02:30	42	-7.216000	+9.580000	+9.570000	-11.808000	-3.215000	-1.180000	-4.928000	-4.960000	+9.889000
02:45	47	-7.296000	+9.490000	+9.410000	-11.544000	-3.350000	-1.135000	-4.960000	-4.944000	+9.853000
03:00	48	-7.312000	+9.350000	+9.290000	-11.448000	-3.355000	-1.145000	-4.976000	-4.992000	+9.772000
03:15	46	-7.296000	+9.400000	+9.350000	-11.400000	-3.280000	-1.145000	-4.960000	-4.976000	+9.615000
03:30	47	-7.200000	+9.360000	+9.360000	-11.496000	-3.200000	-1.165000	-4.944000	-4.976000	+9.507000
03:45	46	-7.136000	+9.440000	+9.360000	-11.616000	-3.060000	-1.200000	-4.912000	-4.912000	+9.420000
04:00	49	-7.008000	+9.370000	+9.330000	-11.568000	-2.995000	-1.235000	-4.592000	-4.608000	+8.954000
04:15	49	7.008000	19.410000	19.380000	11.856000	2.840000	1.265000	4.800000	4.816000	19.057000
04:30	47	6.960000	19.360000	19.310000	12.240000	2.665000	1.305000	4.704000	4.752000	18.958000
04:45	46	6.816000	19.450000	19.420000	12.456000	2.545000	1.280000	4.560000	4.576000	19.237000
05:00	41	6.736000	19.650000	19.600000	12.792000	2.390000	1.190000	4.544000	4.544000	19.978000
05:15	43	5.920000	19.550000	19.500000	13.728000	2.470000	1.525000	3.616000	3.712000	19.631000
05:30	43	4.720000	19.420000	19.370000	15.192000	2.345000	2.015000	2.032000	2.064000	18.254000
05:45	44	-3.632000	+8.990000	+8.930000	-17.544000	-2.355000	-2.490000	-1.584000	-1.616000	+8.243000
06:00	47	-2.208000	+8.800000	+8.780000	-19.680000	-2.255000	-2.915000	-0.480000	-0.544000	+8.018000
06:15	44	-1.392000	+9.180000	+9.210000	-20.832000	-2.160000	-3.065000	-0.432000	-0.400000	+8.235000
06:30	42	-0.976000	+9.990000	+9.940000	-21.192000	-2.075000	-3.100000	-1.728000	-1.680000	+8.487000
06:45	47	-0.512000	+10.220000	-10.210000	-23.160000	-2.010000	-3.190000	-1.648000	-1.632000	+9.790000
07:00	49	-0.576000	+10.700000	-10.670000	-22.896000	-1.925000	-3.145000	-2.656000	-2.592000	+10.004000
07:15	52	-0.960000	+10.960000	-10.940000	-22.584000	-1.915000	-2.950000	-2.496000	-2.528000	+10.437000
07:30	48	-1.392000	+11.480000	-11.460000	-22.272000	-1.855000	-2.750000	-1.856000	-1.856000	+11.329000

Table V-20: MWH drawal Accounting

3: _Net Bus Check for 'M' S/S (at 220kV bus):_

| | | | | | NET BUS CHECK | FOR MTSA USING SPECIAL ENERGY METERS | | | | |
TIME	FREQ	K'GURI	SMG-1	SMG-2	ICT	DMR-1^	DMR-2^	BYR-1	BYR-2	NET220KV
00:00	46	5.968000	18.950000	18.810000	11.064000	1.235000	1.395000	12.880000	12.976000	6.364000
00:15	45	5.904000	18.560000	18.510000	10.848000	1.240000	1.420000	12.560000	12.576000	5.594000
00:30	42	5.936000	18.340000	18.320000	10.872000	1.295000	1.425000	12.896000	12.896000	5.586000
00:45	44	6.064000	18.250000	18.190000	10.728000	1.370000	1.375000	13.152000	13.152000	5.693000
01:00	44	6.160000	19.020000	19.010000	10.992000	1.480000	1.330000	12.848000	12.880000	6.238000
01:15	38	6.304000	19.190000	19.150000	10.752000	1.600000	1.295000	12.848000	12.848000	6.449000
01:30	34	-6.448000	+9.240000	+9.200000	-10.536000	-1.800000	-1.260000	+2.944000	+2.960000	-6.590000
01:45	41	-6.384000	+9.310000	+9.260000	-10.848000	+2.040000	-1.255000	+2.992000	+2.960000	-6.817000
02:00	41	-7.120000	+9.560000	+9.530000	-12.048000	+2.490000	-1.195000	+1.864000	+4.848000	-9.203000
02:15	39	-7.072000	+9.560000	+9.520000	-12.000000	+2.840000	-1.210000	+1.800000	+4.816000	-9.444000
02:30	42	-7.216000	+9.580000	+9.570000	-11.808000	+3.215000	-1.180000	+1.928000	+4.960000	-9.889000
02:45	47	-7.296000	+9.490000	+9.410000	-11.544000	+3.350000	-1.135000	+1.960000	+4.944000	-9.853000
03:00	48	-7.312000	+9.350000	+9.290000	-11.448000	+3.355000	-1.145000	+1.976000	+4.992000	-9.772000
03:15	46	-7.296000	+9.400000	+9.350000	-11.400000	+3.280000	-1.145000	+4.960000	+4.976000	-9.615000
03:30	47	-7.200000	+9.360000	+9.360000	-11.496000	+3.200000	-1.165000	+4.944000	+4.976000	-9.507000
03:45	46	-7.136000	+9.440000	+9.360000	-11.616000	+3.060000	-1.200000	+4.912000	+4.912000	-9.420000
04:00	49	-7.008000	+9.370000	+9.330000	-11.568000	+2.995000	-1.235000	+4.592000	+4.608000	-8.954000
04:15	49	-7.008000	+9.410000	+9.380000	-11.856000	+2.840000	-1.265000	+4.800000	+4.816000	-9.057000
04:30	47	-6.960000	+9.360000	+9.310000	-12.240000	+2.665000	-1.305000	+4.704000	+4.752000	-8.958000
04:45	46	-6.816000	+9.450000	+9.420000	-12.456000	+2.545000	-1.280000	+4.560000	+4.576000	-9.237000
05:00	41	-6.736000	+9.650000	+9.600000	-12.792000	+2.390000	-1.190000	+4.544000	+4.544000	-9.978000
05:15	39	-5.920000	+9.350000	+9.500000	-13.728000	+2.470000	-1.525000	+3.616000	+3.712000	-9.631000
05:30	43	-4.720000	+9.420000	+9.370000	-15.192000	+2.345000	-2.015000	+2.032000	+2.064000	-8.254000
05:45	44	-3.632000	+8.990000	+8.910000	-17.544000	+2.355000	-2.490000	+1.584000	+1.616000	-8.243000
06:00	47	-2.208000	+8.800000	+8.780000	-18.680000	+2.255000	-2.915000	+0.480000	+0.544000	-8.018000
06:15	44	-1.392000	+9.180000	+9.210000	-20.832000	+2.160000	-3.065000	-0.432000	-0.400000	-8.235000
06:30	42	-0.976000	+9.990000	+9.940000	-21.192000	+2.075000	-3.100000	-1.728000	-1.680000	-8.487000
06:45	47	-0.512000	-10.220000	+10.210000	-23.160000	+2.010000	-3.190000	-1.648000	-1.632000	-9.790000
07:00	51	-0.576000	-10.700000	+10.670000	-22.896000	+1.925000	-3.145000	-2.656000	-2.592000	+10.004000
07:15	52	0.960000	10.960000	110.940000	22.584000	1.915000	2.950000	2.496000	2.528000	110.437000
07:30	48	1.392000	11.480000	111.460000	22.272000	1.855000	2.750000	1.856000	1.856000	111.329000

4: _MWH Loss in the Lines:_

```
------------------------------------------------------------------------------   --------------------------------
                    MWH LOSS IN THE LINES  USING SPECIAL ENERGY METERS
  TIME  FREQ   DIM(PG)-DIM(S)-1 DIM(PG)-KOH(S)    KOH-KAR   AGAR-AGTPP-1   K`GHAT-PKBRI        D`NGR-D`CHERA  PAL-UDAI-1
  00:00  46    +0.284400       +3.661200        +0.000000   -0.355200     +0.141600           +0.000000      -2.044800
  00:15  45    +0.237600       +3.078000        +0.000000   -0.067200     +0.031200     ----  +0.000000      -2.400000    ---
  00:30  42    +0.216000       +3.549800        +0.000000   -0.028800     +0.057600     ----  +0.000000      -2.678400    ---
  00:45  41    +0.187200       +3.513600        +0.000000   -0.009600     +0.036000     ----  +0.000000      -2.707200    ---
  01:00  44    +0.194400       +2.944800        +0.000000   -0.057600     +0.091200           +0.000000      -2.928000
  01:15  38    +0.165600       +2.944800        +0.000000   -0.048000     +0.052800           +0.000000      -3.244800
  01:30  31    +0.169200       +2.782800        +0.000000   -0.048000     -0.048000           +0.000000      -3.340800
  01:45  41    +0.166200       +2.761200        +0.000000   -0.096000     +0.014400           +0.000000      -3.398400
  02:00  41    +0.165600       +2.757600        +0.000000   -0.009600     +0.079200           +0.000000      -3.446400
  02:15  39    +0.194400       +2.707200        +0.000000   -0.038400     +0.014400           +0.000000      -3.542400
  02:30  42    +0.208800       +2.592000        +0.000000   -0.000000     +0.086400           +0.000000      -3.561600
  02:45  47    +0.194400       +2.613600        +0.000000   -0.076800     +0.050400           +0.000000      -3.648000
  03:00  48    +0.183600       +2.620800        +0.000000   +0.000000     +0.052800           +0.000000       3.763200
  03:15  46    +0.237600       +2.631600        +0.000000   +0.067200     +0.004800           +0.000000       3.811200
  03:30  47    +0.248400       +2.671200        +0.000000   +0.028800     +0.021600           +0.000000       3.792000
  03:45  46    +0.273600       +2.710800        +0.000000   +0.067200     +0.067200           +0.000000       3.936000
  04:00  49    +0.345600       +2.804400        +0.000000   +0.028800     +0.007200           +0.000000       3.907200
  04:15  49    +0.304000       +2.659200        +0.000000   +0.009600     +0.144000           +0.000000       3.907200
  04:30  47    +0.622800       +3.142000        +0.000000   +0.076800     +0.055200           +0.000000       3.907200
  04:45  46    +0.817200       +3.369600        +0.000000   +0.048000     +0.004800           +0.000000       3.897600
  05:00  41    +1.065600       +2.156100        +0.000000   +0.057600     +0.158400           +0.000000       3.792000
  05:15  39    +1.443600       +1.148100        +0.000000   +0.067200     +0.448800           +0.000000       3.715200
  05:30  43    +2.008800       +2.311200        +0.000000   +0.201600     +0.067200           +0.000000       3.628800
  05:45  44    +2.473200       +3.916800        +0.000000   +0.028800     +0.228000           +0.000000       3.657600
  06:00  47    +2.674800       +5.018100        +0.000000   +0.076800     +0.091200           +0.000000       3.283200
  06:15  44    +2.588400       +5.569200        +0.000000   +0.085400     +0.295200           +0.000000       2.860800
  06:30  42    +2.494800       +5.652000        +0.000000   -0.009600     +0.033600           +0.000000      -2.524800
         --    --              --               --          --            --             --    --             --
         --    --              --               --          --            --             --    --             --
         --    --              --               --          --            --             --    --             --
  23:15  40    +0.432000       -3.924000        +0.000000   -0.028800     +0.074400      --   +0.000000      +0.000000
  23:30  37    +0.370800       -3.826800        +0.000000   -0.249600     +0.086400      --   +0.000000      +0.000000
  23:45  44    +0.357200       -3.718800        +0.000000   -0.144000     -0.091200      --   +0.000000      +0.000000
------------------------------------------------------------------------------
  TOTAL        +107.611200     +394.207200      +0.000000   -2.380800     +1.303200           +0.000000     -159.964800
------------------------------------------------------------------------------
```

(ii) **MVARH output:** This option enables a user to compute the reactive energy accounting of all States.

(iii) **Load Curve:** Through this option , the user can be obtain a graphical representation of the power flow, frequency and percentage loss pertaining to all the locations for the selected time periods .

Sample Load curve for 01/01/2018 for location 'X'
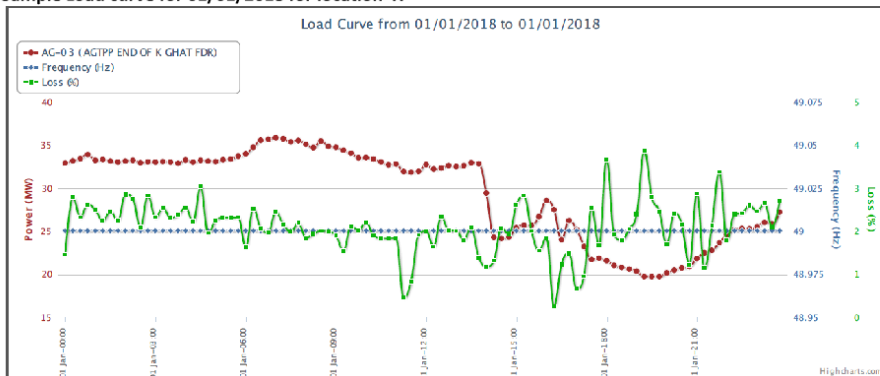
The above graph shall be downloadable in .pdf file format.

(iv) **Load Duration Curve:** This option enables the user to view and download a graphical representation of the MW load flow vs time duration (in percentage) for which the load flow was below/above a particular maximum or minimum load.

Sample Load Duration Curve for 'A'

LOAD DURATION CURVE of AS-51 FLOW FROM (01/01/2018-01/01/2018)
Max.Flow=1121.966536MW Min.Flow=549.602724MW
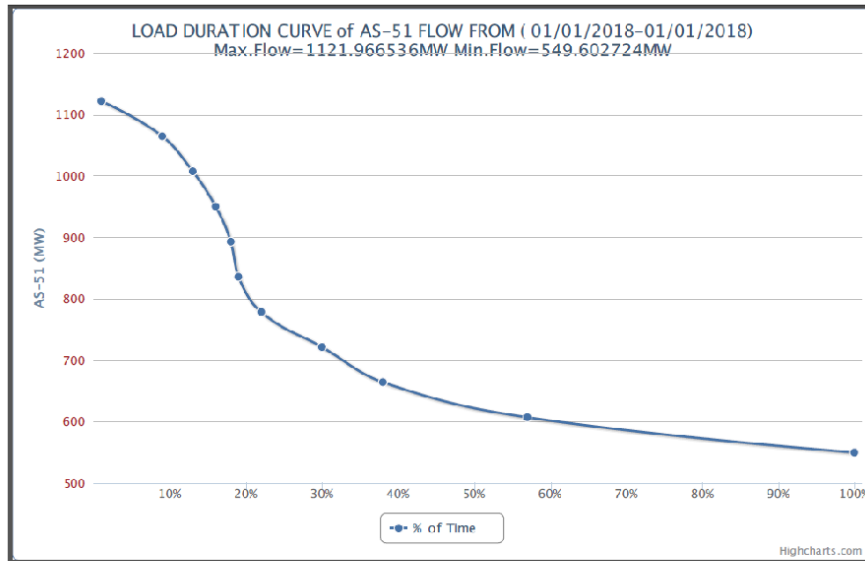
The above curve shall be downloadable in .pdf, .jpeg, .png & SVG Vector Image file format.

(v) Loss Computation:

Regional pool loss for each time block for a selected time period must be computed and also represented graphically in MDP software.

Actual Regional transmission loss is computed as below:

Actual Transmission losses (in MWh) in Regional ISTS, L =
(ΣInjection of Regional Entities, G + ΣInterregional injection, I) - (ΣRegional Entity drawals + Σ Inter-regional drawals)

Actual Percentage Regional losses, LPA = L / (G+I) *100

Total injection or drawal by any Regional entity in a time block is considered to arrive at Regional injection or drawal.

Hon'ble CERC has notified CERC (Sharing of Inter State Transmission Charges and Losses) Regulations, 2020 on 04th May,2020; w.e.f. 1st November,2020. As per clause (10) of these regulations, transmission losses for ISTS shall be calculated on all India average basis for each week, from Monday to Sunday.

All India transmission loss would be based upon the average loss computed from the SEM data of previous week. Transmission losses for ISTS calculated on all India basis for each time block

for a selected time period can be computed and also represented and also represented graphically. The respective RLDC has to provide data to NLDC for calculation of all India transmission loss as per the format of NLDC which has to be generated automatically from the MDP software.

Transmission losses for ISTS shall be calculated on all India average basis by NLDC for each week, from Monday to Sunday, as under:

[(In – Dr) / (Ir)] X 100

Where:
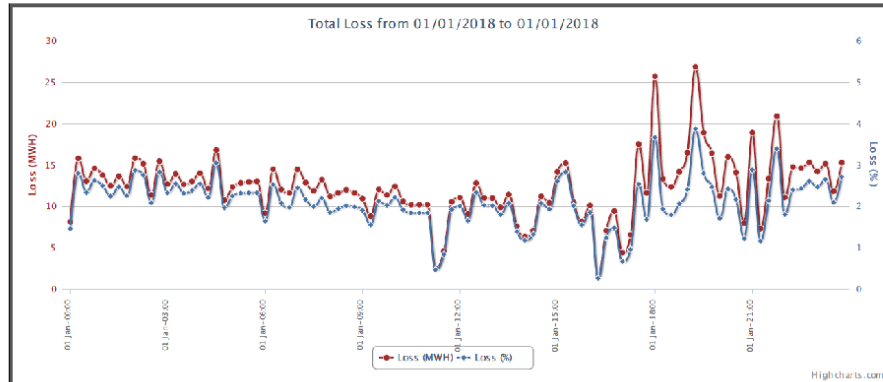'In' denotes sum of injection into the ISTS at regional nodes for the week;
'Dr' denotes sum of drawal from the ISTS at regional nodes for the week;
'Ir' denotes sum of injection into the ISTS at regional nodes less injection from generation based on solar or wind power resources for the week as per CERC Sharing Regulations and subsequent amendments thereof

Entity wise Loss Computation of the Region

Dates	Inj:	Drawal:	Loss:	Loss %:		TOTAL									
01/01/2018	47,678.711503	45,924.749298	1,164.001005	2.47	7,926.889393	0.000000	7,926.889393	3,694.108500	19,557.869917	16,963.560117	13,744.132762	113.157600	13,630.976102	0.000000
Time	Inj	Drawal	Loss	Loss%	BTPS (DTP) [NT-71] (Inj)	BTPS (BTP) [NT-71] (Drawal)	BTPS (DTP) (Net)	ASSAM [AS-511] (Inj)	ASSAM [AS-511 (Drawal)	ASSAM (Net)	ER-NER [CR-511] (Inj)	ER-NER [CR-511] (Drawal)	ER-NER (Net)	NR NER[NR 511](Inj)
00:00	456.123634	-448.044129	8.078929	1.77	76.885527	0.000000	76.885527	31.549311	188.419904	-164.276903	111.002836	0.000000	111.002836	0.000000
00:15	457.548473	-441.789400	15.759400	3.44	81.043110	0.000000	81.043110	32.501838	183.682064	-151.180213	140.468837	0.000000	140.468837	0.000000
00:30	449.297139	-436.291875	13.005263	2.89	81.652000	0.000000	81.652000	33.204460	180.665055	-146.250567	132.960145	0.000000	132.960145	0.000000
00:45	436.249629	-421.720072	14.529557	3.31	81.219437	0.000000	81.219437	34.313673	176.721118	-141.280540	122.785366	0.000000	122.785366	0.000000
01:00	435.232145	421.536342	13.725803	3.15	81.215236	0.000000	81.215236	35.531313	179.350691	143.450373	119.464509	0.000000	119.464509	0.000000
01:15	430.393162	-423.906810	12.486384	2.90	80.122828	0.000000	80.122828	35.735417	181.792203	-146.016849	121.483746	0.000000	121.483746	0.000000
01:30	431.765483	418.189946	13.575537	3.14	81.577373	0.000000	81.577373	36.332720	180.305155	143.022435	115.667128	0.000000	115.667128	0.000000
01:45	428.519653	-416.171929	12.347571	2.88	81.722227	0.000000	81.722227	36.636935	180.293009	-143.626074	113.533345	0.000000	113.533345	0.000000
02:00	430.926163	-411.148287	19.778169	3.56	81.791066	0.000000	81.791066	37.604383	178.583963	-140.949577	114.841273	0.000000	114.841273	0.000000
02:15	426.772617	411.535063	15.137564	3.54	73.140100	0.000000	73.140100	36.158312	177.018326	138.258016	118.563708	0.000000	118.563708	0.000000
--	--	--			--		--	--			--			
--	--	--			--		--	--			--			
23:00	482.719429	-468.541961	14.177431	2.94	53.615730	0.000000	53.615730	32.713431	188.540937	-155.833503	191.810292	0.000000	191.810292	0.000000
23:15	473.749650	458.543861	15.105732	3.19	54.414036	0.000000	54.414036	34.256623	183.168610	148.232087	150.542181	0.000000	150.542181	0.000000
23:30	462.842950	-451.070989	11.771200	2.54	54.001900	0.000000	54.001900	35.108993	176.893630	-141.784643	142.510182	0.000000	142.510182	0.000000
23:45	458.434710	443.189267	15.245503	3.33	53.904346	0.000000	53.904346	36.845500	176.383127	139.537627	135.471700	0.000000	135.471700	0.000000
Total loss for 01/01/2018 to 01/01/2018	Inj: 47,678.741503	Drawal: -45.924.740298	Loss: 1,164.001005	Average Loss %: 2.47										

Sample Total Loss Graph

Total Loss from 01/01/2018 to 01/01/2018

Loss (MWH) — Loss (%)

Highcharts.com

The Loss Graph shall be downloadable in .pdf, .jpeg, .png & SVG Vector Image file format.

Format of loss output file shall be as below:

Name	Date	Time Blk	Injection(A)	Drawl(B)	Loss(A-B) (MWH)	Loss (MW)	Region Loss (%)
	27-03-2017	1	6084.85	5837.30	247.54	990.16	4.07
	27-03-2017	2	6071.78	5845.74	226.03	904.12	3.72
	27-03-2017	3	6075.19	5837.96	237.24	948.96	3.91
	-	-	-	-	-	-	-
	02-04-2017	96	5669.85	5449.95	219.90	879.6	3.88
	02-04-2017	97	5748.77	5520.88	227.90	911.6	3.96
	02-04-2017	96	5780.30	5560.22	220.08	880.32	3.81
			$\sum$ (A)	$\sum$ (B)	$\sum$ (loss MWH)	$\sum$ (loss MW)	

<center>**Table V-22 – Loss output file**</center>

S/W shall have the feature to generate loss output files for required period (From "Date and Time block" & To "Date and Time block") through user query.

- **Line Wise Transmission Loss Computation:** Configuration file for line wise transmission computation shall be as below:

Meter ID (A)	Meter ID (B)	Loss (MWH) (C)	Loss (%)
KO-001	KO-005	If A is +ve "A-B" or else "B-A"	If A if +ve "(C/A)*100" or else "(C/B)*100"
KO-007	KO-009	"	"
-	-	"	"
-	-	"	"
TR-001	TR-005	"	"
BL-007	BL-009	"	"

<center>**Table V-23 – Line wise Transmission loss configuration file**</center>

o Format of line wise transmission loss output file shall be as below:

Date	Time Blk	"KO-001"-"KO-005"		-	-	-	"LA-001"-"LA-005"	
		Loss (MWH)	Loss (%)	-	-	-	Loss(MWH)	Loss (%)

27-03-2017	1	-1.12	-3.18	-	-	-	-2.12	-3.18
27-03-2017	2	-0.27	-1.16	-	-	-	-3.27	-1.16
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
02-04-2017	95	-0.27	-1.00	-	-	-	-1.27	-3.00
02-04-2017	96	-0.40	-1.56	-	-	-	-3.40	-3.56

Table V-24- Line wise transmission loss output file

- o S/W shall have the feature of browsing the line wise loss configuration files with respect to utility/Station/Voltage level etc. so that the required pair can be easily computed.
- o Software shall also have the provision to compute loss for a user specified no. of time blocks for any entity.

- **ICT loss computation** configuration file and their output file formats shall be same as that of the line wise loss formats.

- **Bus loss Computation:** The bus loss configuration shall be user defined.

Configuration file for bus loss computation shall be as below:

BUS ID	Bus Description	Bus Section Formulae (L)	Bus Section Loss (MWH)	Bus Section Loss (%)
KO-025	KSTPS-400KV	L=(KO-001)+(KO-002) - (KO-003)	L	{L/sum of injection into the bus (negative energy recordings)}
-	-	-	-	-

Table V-25- Bus loss configuration file format

Format of bus wise transmission loss output file shall be as below:

Bus ID	Bus Description	Bus Section Loss (MWH)	Bus Section Loss (%)
KO-025	KSTPS-400KV	10.2	1.2
-	-	-	-
-	-	-	-

Table V-26 – Bus loss output file format

e. **Configuration Management:** This menu enables the user to configure the following information in the System or database:

(i) **Location/ Meter data**: Through this option a user shall be able to create, enter, update,

delete or modify details pertaining to Real Meters or Virtual/Fictitious Meters, into the system database, as per requirement from time to time.

Utility Name	Station Name	Location	Description	Meter No	Meter Type	Voltage Label	HV Current	LV Current	EHV Voltage	LV Voltage
		AB-01	AB END OF AB-CD-1 FDR	NP-9081-A	Main	132	600	1	132	110
		AB-04	ABC GT-1	NP-6857-A	Stand by	132	250	1	132	110
		XY-05	X END OF XY FDR	NP-6887-A	Line meter	132	400	1	132	110
		EF-24	EF END OF EFGH-1 FDR (CHECK METER)	NP-9458-A	Check	220	500	1	220	110

Table V-27 – Location Data

(ii) Find & Replace: This option enables a user to find real meters or Virtual/Fictitious meters and replace them with their compatible pairs or otherwise modify the formula as applicable.

This option can be used in case the data pertaining to a meter is missing due to any reason.

Once location id of the meter to be replaced is entered in "Find", software will suggest other end meter from "Pairs" or net-bus of other end as probable replacement. User can accept suggestion or use own meter location-id / formula and specify from - to date and time for replacement in all formulae (except validation checks).

Against every transmission line and the replaceable meter pairs, the software shall maintain records of previous 2 (two) months loss history in the form of "Export Loss" & "Import Loss". Thus, in case of replacement of any end meter with its pair, a multiplying factor shall be applied by the software in order to account for the line loss; for which the software shall check the direction of flow of energy and follow proper sign convention as defined in the preceding paragraphs under validation menu and apply the multiplying factor accordingly considering either import loss or export loss as applicable for that time block. The following shall be the consideration for applying the multiplying factor:

(1) In case of (+)ve reading in the available end meter, the applicable multiplying factor for replacing the missing meter reading shall be (1 - % previous 2 mths. Avg. Import Loss)
(2) In case of (-)ve reading in the available end meter, the applicable multiplying factor shall be 1/(1 - %previous 2 mths. Avg. Export Loss)

(a) **OUT MWH Configuration**: This function is used to configure the formulae for obtaining the desired active MWH power output of an entity. The MWH output is calculated based on real meter MWH output and Virtual meter MWH output, which can be modified as required. The software should be able to handle computation of virtual meter within a Virtual meter.

(b) **OUT MVAR Configuration**: This function is used to configure the formulae for obtaining the desired reactive MVARH power output of the States. The reactive MVARH

output is calculated based on real meter reactive MVARH power output and Virtual/Fictitious meter reactive MVARH power output. This is similar to OUT MWH.

(c) <u>Master Frequency:</u> Master frequency meter is a IEM whose recorded frequency code is considered as standard freq. code by all synchronously inter-connected electrical regions, viz., NR, ER, WR, SR and NER for any calculation such as DSM etc. within the above mentioned Region.

Through this option, Master frequency meters can be defined. There shall be option to define multiple Master Frequency Meters in order to enable validation check with reference to any frequency.

(d) <u>Pair Configuration:</u> Through this menu the user shall be able to define and edit the pairs of real meters and also enter new pairs or delete obsolete ones. The list of pairs and their details such as errors, feeder name etc. are displayed; and the pairs can be selected from a scrolling menu for changing them, if required; and each of the other details can also be modified once the option to 'edit' is clicked against a selected pair.

(e) <u>User Information:</u> It is list of authorized users who can access the Meter data processing software.

(f) <u>Location/ Meter Master Data:</u> Through this menu, a user shall be able to update the list of various Utilities – Generation/ Transmission Utilities, States, Regions, Regional Boundaries etc. involved in the Regional / State power flow.

f. Historical Record: The History of each connected real meter right from the beginning of operation of the meter, changes in CT or PT ratio, meter no., replacement of the meter etc. shall be maintained in the database for viewing or downloading as stated below:

(i)   Location/ Real Meter Data History
(ii)   Change in CTR, PTR, Meter No & Replacement

(i)   **<u>Location/ Real Meter Data History</u>**: This option shall enable the user to view and download the details regarding history of the meter(s); which includes start date & time and end date & time of the meters, installation date, testing date, Make etc.. A sample downloadable file is placed at **Annexure-H(I)**.

(ii)   **<u>Change in CTR, PTR, Meter No. & Replacement during the period:</u>** Through this menu, <u>**the user can view and download the details regarding the changes in CT & PT Ratios of the**</u> meters, change in meter number, as well as details regarding the history of the meter such as start date & time and end date & time and details regarding replacement of the meter by another meter, if any. The following details are mentioned

Utility Name	Station Name	Loc	Meter Name	Start Date	Start Time	End Date	End Time	HV Current	LV Current	EHV Voltage	LV Voltage	Nature of Change
ABC	XYZ	XY–01	NP–1001–A	05/06/2017	00:00	12/11/2017	23:45	400	1	132	110	
ABC	XYZ	XY–01	NP–1001–A	13/11/2017	00:00			300	1	132	110	CT ratio/ PT ratio

Table V-28 – Table of Historical Records (Change in CTR/PTR/Meter no.

Meter Replacements:

Further, the following record is downloadable regarding meter replacements history

Utility Name	Station Name	Location	Meter No	Start Date	Start Time	End Date	End Time	Meter Replaced With
ABC	XYZ	XY–01	XY–1001–A	01/01/2016	00:00	01/01/2018	23:55	–(XY–11)

Table V-29 – Table of Historical Records -Meter Replacement Menu

g. Reports:

MDP software shall provide options to generate reports in configurable 5-minute/15-minute/hourly/daily etc. depending upon the user requirement as per the prevailing CERC Regulations. The reports shall be in pre-defined Text file, PDF, ISO/IEC 26300:2006/Amd 1:2012 or ISO/IEC-29500:2012 compatible Spreadsheet and CSV formats. The format of the 5-min processed data reports shall be exactly same as that of the existing 15-min processed data reports for compatibility with the existing system.

The report configuration files shall be user configurable. There shall be provision for addition of new columns in the report to incorporate new elements and there shall also be a provision to configure new report to incorporate new utility.

Different types of Reports to be prepared are as below.

a. Active Energy Reports
i. S/W shall have the capability to prepare the day wise active energy reports (in 5/15 min

blocks data) of Utilities for submission to RPC.

ii. These reports shall be prepared for each utility. The formats shall be user configurable.

iii. The Active energy report shall consist of computed data of all elements which shall be used for computation of drawal/injection of utilities and total value.

iv. These configuration files shall be user configurable. There shall be suitable provisions for addition of new columns in the report to incorporate new element and there shall also be provision for configuration of new reports to incorporate new utility.

v. Typical Active energy output file format (5/15 min) shall be as below:

Active Energy(MWH) Accounting of "Utility Name" for 31-03-17								
Date	Time	Time Blk	Meter ID-1	Meter ID-2	-	-	-	Total
31/03/2017	00:00	1	33.163635	33.054546	-	-	-	100.036362
31/03/2017	00:15	2	32.072727	32.072727	-	-	-	100.690903
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
31/03/2017	23:30	95	36.545452	36.436363	-	-	-	100.254555
31/03/2017	23:45	96	36.327271	36.327271	-	-	-	100.254539

Table V-30- Active Energy Output file format

b. **Reactive Energy Reports**

i. Reactive Energy Settlement at ISTS level is being done day wise for Low Voltage (<97% of Rated Voltage) and High Voltage (>103% of Rated Voltage) conditions.

ii. S/W shall have the capability to prepare the weekly reactive energy reports of

iii. Utilities for submission to RPC.

iv. These reports shall be prepared for each utility. The Reactive energy report shall consist of Cumulative reactive data (LV & HV registers) of all elements which shall be used for computation of drawal/injection of utilities. However, there shall be an option to provide reactive energy reports similar to active energy report with block-wise details of reactive energy consumption/injection.

v. Typical block wise Reactive energy output file format shall be as below:

Reactive Energy (MVARh) Accounting of "Utility Name" for 31-03-17								
Date	Time	Time Blk	Meter ID-1	Meter ID-2	-	-	-	Meter ID-n
31/03/2017	00:00	1	11.163635	12.054546	-	-	-	100.036362
31/03/2017	00:15	2	12.072727	12.072727	-	-	-	100.690903
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
31/03/2017	23:30	95	16.545442	16.436347	-	-	-	100.254555
31/03/2017	23:45	96	16.327261	16.327252	-	-	-	100.254539

Table V-31– Reactive energy output file (block wise)

vi. Along with block wise reactive report for High voltage /Low voltage conditions, a report mentioning net VAR exchange in each TB may be added.

vii.　Day wise Reactive energy output file format shall be as below:

Date	Meter ID-1		Meter ID-2		-	-	-	Total Reactive Energy Drawl	
	LV	HV	LV	HV	-	-	-	LV	HV
01/02/2016	2346.20	0.00	2324.70	0.00	-	-	-	6584.25	0.00
02/02/2016	2356.00	0.00	2334.50	0.00	-	-	-	7524.25	125.25
-	-	-	-	-	-	-	-	-	
-	-	-	-	-	-	-	-	-	
06/02/2016	1142.90	0.00	2195.60	0.00	-	-	-	7558.39	25.30
07/02/2016	1718.60	0.00	2339.30	0.00	-	-	-	6548.35	365.20

Reactive Energy(MVArh) Accounting of "Utility Name" for 31-03-17

Table V-32 - Reactive energy output file (day wise)

c. **Voltage Reports:**

 i.　S/W shall have the option for preparation of Voltage reports (5/15 min block wise) for required meters. The configuration files shall be user configurable.

 ii.　The format of 5/15 min block wise Voltage reports are same as that of active energy reports.

 iii.　S/W shall have the option for preparation of Low Voltage Logging report (5/15 min block wise).

 iv.　The S/W shall fetch the details of meter IDs which have recorded the Low Voltage using low voltage logging symbols "*" and "Z".

 v.　The output format of Low Voltage reports shall be as below:

Meter ID	Low Voltage(*) Logging report for the period "31-03-17" to "02-04-17"									
	Total No. of Blocks (LV Logging)	31-03-2017		01-04-2017		-		02-04-2017		
		Blk-1	2	-	-	-	-	-	-	-	96
KO-001	12 5	*	*	-	-	-	-	-	-	-	*
LA-028	18		*	-	-	-	-	-	-	-	
KS-012	7	*		-	-	-	-	-	-	-	*
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-

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Table V-33 – Low voltage Log file

Meter ID	Low Voltage(Z) Logging report for the period "31-03-17" to "02-04-17"										
	Total No. of Blocks(LV Logging)	31-03-2017		01-04-2017			-	02-04-2017			
		Blk-1	2	-	-	-	-	-	-	-	96
KO-001	2	Z	Z	-	-	-	-	-	-	-	Z
LA-028	5		Z	-	-	-	-	-	-	-	
KS-012	6	Z		-	-	-	-	-	-	-	Z
-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-
MB-005	0			-	-	-	-	-	-	-	

Table V-34 – Zero voltage log file

d. Frequency Reports:

i. Frequency data of reference IEM (user defined) shall be used for DSM Accounting. If main reference meter data is not available, first standby meter (user defined) frequency data shall be used for accounting. If both main and first standby meter frequency data are not available for a particular period, second standby meter (user defined) frequency data shall be used for these periods.

ii. The S/W shall have a user frequency configuration file for selection of any of the reference IEMs.

iii. The output file format of reference IEM frequency data to submit to RPC for DSM accounting shall be as below:

Date	Time	Time Block	Frequency of Main IEM	Frequency of First Standby IEM	Frequency of Second Standby IEM
31-03-2017	00:00	1	49.97		
31-03-2017	00:15	2	49.88		
-	-	-	-		
-	-	-	-		
-	-	-	-		
-	-	-	-		
31-03-2017	23:30	95	50.03		
31-03-2017	23:45	96	50.01		

Table V-35 – Frequency report output file format

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

Frequency Comparison Report for the Period "30/03/17" to "31/03/17"							
Date	Time	Blk No	Meter ID-1	Meter ID-2	-	-	Meter ID-n
31-03-2017	00:00	1	0.02	0	-	-	0.02
31-03-2017	00:15	2	0.01	0.01	-	-	0.01
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-

06-04-2017	23:30	95	0.06	0	-	-	0.02
06-04-2017	23:45	96	0.01	0	-	-	0.03

Table V-36 – Frequency Comparison Report

2. Other Requirements:

(i)   The software should be expandable to include databases of up to 7500 Meters in a region without compromising performance and speed. Load test shall be carried out to verify the performance of the software. For computations of any Fictitious meter or creation of any OUT.MWH files maximum time taken should be less than 5 min.

(ii)   In case Regional pool loss in any time block during a day is outside the tolerance range as specified by the user, all such time blocks will be flagged. The software will provide suggested rectification for the flagged time blocks based on Validation checks.

(iii)   The system should facilitate concurrent login of multiple users after proper authentication and verification.

(iv)   The computed Virtual meter data and OUT MWH files shall be stored in the database.

(v)   "High Co-relation comparison" features should be available to evaluate the main meter missing/wrong/zero measurement data.

(vi)   Provision to modify in MDP menu/Report formats/ addition of reports must be possible.

3. Transition Requirements

Presently the time period for Scheduling and Settlement at ISTS level is 15-min. Special Energy Meters data is used for computation of injection/drawal of all entities, which are under the jurisdiction of RLDC. Injection/Drawal computed from SEMs data is used as input data for preparation of following regional accounts.

- Deviation Settlement (Weekly)
- Reactive Energy (Weekly)
- Congestion (Weekly)
- Ancillary Services (Weekly)
- Regional Energy Account (Monthly)
- Transmission Deviation Account (Monthly)

Bidders are encouraged to refer the appropriate regulation to understand the settlement system. They are also encouraged to check the links on RLDC website to understand the format of existing output reports.

Until the amendments for 5-min Settlement in the appropriate regulations come, the settlement at the interstate level shall continue to be done at 15-min interval. Hence, the data of 5-min interval received from the IEMs shall be converted to 15-min interval at AMR SERVER, so that it is compatible with the existing software for energy accounting at RLDC and RPC. After the entire infrastructure envisaged under this project is in place, the output files generated for energy accounting shall be compatible with the existing software. In a nutshell, the execution of work shall be planned in such a manner that there is no interruption in the existing regional energy accounting system.

4. Deviation and Other Reports

This module shall compute deviation of regional entity by comparing the actual injection/drawal with its interchange schedule. It shall also compute the applicable deviation charges and generate the reports that

include time block wise normal deviation charges, additional deviation charges, capped deviation charges, aggregate deviation charges.

The module shall be capable of importing the interchange schedules in .xls/.csv format from the external system. The user shall be able to define the applicable deviation rates (in paisa per unit) in line with the formula notified in the appropriate CERC regulations. There shall be adequate flexibility for the user to configure the methodology for computation of deviation/ deviation charges in line with the prevailing CERC regulations and/or as per the decisions of the regional power committees.

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

The module shall provide interface for generating user defined reports using arithmetic, logical and statistical functions.

5. Graphs/Trends

- S/W shall have the option to display the graphs/trends in user defined standard chart type such as line scatter plot, bar chart etc. of different electrical quantities (Energy, Voltage, Frequency etc.) already stored in database for the required period (Date and Time) through query.

- There shall also be a provision to display the Actual vs Schedule graphs of utilities for user defined period. S/W shall have the provision to upload standard CSV 5/15 min schedule data.

- There shall be provision to download the Graphs/Trends in required formats (JPEG, PDF etc.)

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

6. Performance Requirement

MDP software should fetch (from AMR), process, transmit the output and archive the complete meter data within specified performance parameters as specified in the Service Level Agreement **(Annexure – 1).**

7. Backup of MDP Software and Data

Back-up of MDP software of respective RLDC/NLDC should be at different RLDC/NLDC locations. The processed data is used for Deviation Settlement Mechanism (DSM) calculation has commercial implication. Also, as per the regulation the processed data is required to be archived for last 5 years. The appropriate storage technology and requirement shall be considered by the successful bidder/vendor during installation and commissioning of MDP software.

8.   Documentation Requirements

Details of services to be provided by the successful bidder/vendor during and up to the end of warranty period must be catalogued along with a committed response and resolution time, through Service Level Agreement (SLA). Documentation of MDP shall meet following requirements. All documents shall be supplied in computer readable soft version:-

1.   Design Documents

Before starting the development of MDP software, a design document shall be submitted. The design document must essentially (but not limited to) included:-

- System Overview

- Functional diagram

- Flow diagram

- Functions of each major component

- Overall data interfacing scheme

- System configurations

- Cyber Security Provisions

2. Software Requirement Specifications Document

After approval of Design document 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 IEC/ISO/IEEE 29148: 2018. Software should be designed as per approved SRS.

3. User Manuals

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

3.1 Training Documents

Training document to be used during training of RLDC personnel shall contain major functional details of the overall MDP software, its features and major instructions for understanding the overall working of the MDP software.

3.2 Testing Documents

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

3.3 Documents providing software details

Documentation of all software used in solution providing details of Name of Software Used, Version No (as on date of FAT/SAT), License Type (Third party Commercial/ Proprietary of Solution provider/ Open Source) with validity duration (Perpetual/ Term based) shall be prepared and submitted. All software requiring upgradation/ service support, based on any renewal subscription, should be separately listed.

VIII.   TESTING REQUIREMENTS

MDP software shall be subject to 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.

1. Acceptance Test Plans and Procedures

The Vendor shall develop and document proposed Test Procedures and Test Plans for Site Acceptance Testing (SAT) of the delivered and commissioned system and its components. Vendor shall finalize the proposed 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 respective RLDC to verify the ability of the delivered and commissioned MDP software and its modules to individually and simultaneously fulfil 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 respective RLDC in consultation with stakeholders before any testing.

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

2.   Site Acceptance Test (SAT)

The SAT will be conducted by the OWNER with support as required from the vendor 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 RLDC 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 Vendor. The SAT includes the commissioning test, the functional and performance test, and the cyber security audit after the installation of the delivered system.

3.1 Commissioning Test

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

- Loading of the software and starting the system. At the option of the RLDC, all software shall be recompiled from the source or distribution media.

- Interface of the MDP software for all data sources and other systems that interface with the MDP software.

- Initialization and preliminary tuning of application software as needed.

3.2 Site Cyber Security Audit

The site cyber security audit shall repeat the audit performed during SAT in every year during Annual maintenance.

3.3 Test Approval

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

IX. TRAINING REQUIREMENTS

Comprehensive training programs shall be provided to enable the efficient and effective use and operation of the deployed system by users of the system, and to develop a self-sufficient software support team within RLDCs.

Training shall include, where appropriate, a combination of formal training classes, workshops, as well as continuous (informal) knowledge transfer from the Vendor's technical specialists to the personnel of RLDC during the deployment process and after the commissioning of the MDP software. In-person/virtual training sessions could be offered at the RLDCs or any other locations of choice by both parties.

1. Training programs for system users

Training program for system users shall include but not restricted to the following:

- 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.

- Minimum classroom training for a group of system users shall be 18 hours (6 hours x 3 days). Minimum hands-on training for a team of system users shall be 48 hours (6 hours x 8 days). The group shall comprise of RLDC personnel.

2. Training program for system software support team

Training program for software support team shall include but not restricted to the following:

- System overview including system design and detailed as-built system configuration information

- System software maintenance

- System diagnostics and troubleshooting oriented training

- Minimum training for hardware and software support team shall be 18 hours (6 hours x 3 days). The software support team shall comprise of representatives from RLDC.

The bidder 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 RLDC at the beginning of the deployment, and shall work with the RLDC to schedule, organize and execute the approved training programs.

X. SUPPORT AND MAINTENANCE REQUIREMENTS

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

1. Scope of Warranty/O&M/AMC

The warranty period for MDP system would be as per depreciation schedule as specified in CERC RLDC (Fees & Charges) Regulations, 2019 and subsequent amendments thereof. During warranty/O&M/AMC period, vendor would be responsible for repair/ replacement/ modification/ rectification of software, updation of software used in MDP software all times without any extra charges to RLDC.

2. On-Site Support and Maintenance

Vendor shall maintain a team of skilled personals having sufficient knowledge of the system in order to diagnose and set right any problem in MDP software in minimum time as per Service Level Agreement.

Vendor shall maintain an online web based help desk system on its own website for logging complaints and checking the resolution status round the clock on all days of the year. Web based help desk shall be accessible to the user through browser via Internet.

Vendor shall post one Full Time Equivalent (FTE) resident engineer to RLDC throughout the warranty/O&M/ AMC period in order to diagnose and set right any problem in MDP system in minimum time. He/she shall coordinate with the RLDC personnel and the back end team of the vendor for complaint resolution. Resident engineer shall be provided with mobile phone for communication for escalation of complaint. Vendor shall maintain this mobile phone live and shall maintain same number throughout the contract period.

3. Upgradation and Patches

Vendor shall keep updated all supplied software with all latest patch and upgrade. There shall be no separate liability for License renewable on the system user. The versions of the software licenses like Oracle/MS Office/Windows etc. should be specified (Enterprise, Standard etc.). The time validity and version of the licenses should also be specified. These licenses should be in the name of owner (RLDC) and not in the name of vendor.

4. Charges for support services

All recurring expenditure for support services shall be borne by the vendor.

Service Level Agreement

## 1.	Problem/Defect Escalation Order

The successful bidder/vendor shall submit their organization's escalation order for issue in MDP software application to respective RLDC in the following format:

Vendor Executive Details	Description	Escalation Order
Name Designation Email ID Mobile number	Overall accountability	4th level
Name Designation Email ID Mobile number	Metering Department (Market Operation) head to interact if there is any change in business requirement or some change request need to be implemented within the existing contract or any other issue that need to have a mutual consent to move forward and if the problem/defect in the existing software is not resolved within the specified resolution time.	3rd level
Name Designation Email ID Mobile number	Metering Department (Market Operation) Team Lead to report if any concerns and some items within the scope need to be fixed in priority	2nd level
Name Designation Email ID Mobile number	Interaction with Metering Department (Market Operation) Team, to provide support, resolve the defects and work together for seamless operation.	1st level

Table 1- Escalation Matrix

## 2.	Cyber Security System Monitoring

The successful bidder/vendor shall be responsible for monitoring of the cyber security of the software. The logs of the software shall be analyzed for exceptions and the possible incident of intrusion/trespass shall be informed to the RLDC promptly.

The monitoring shall encompass the various cyber security devices installed at RLDCs such as firewalls, Intrusion prevention system (both network based and host based), routers etc.

The Cyber security system shall also be subjected to six monthly Security Audit from CERT-In listed auditors at the cost of the successful bidder/vendor. The auditors along with auditing firms

need to be changed every 2 years so that different auditors audit the system throughout the maintenance phase. The detailed cyber security audit report must be submitted by successful bidder/vendor to the RLDC.

Successful bidder/vendor shall implement the recommendations/remedial actions suggested by the Auditor after audit for any upgrade (Patches) in existing system excluding any new deliverables required for the software as per mutually agreed schedule.

3.   System Availability and Recovery of Charges

The nature of maintenance support required for systems and components by successful bidder/vendor are described in the Table-2 below:

Sl. no.	System	Scope	System Availability
1	Meter Data Processing and Energy Accounting	Software	99.99 %

Table 2- System availability requirement

The successful bidder/vendor shall be responsible for coordination with the OEM for all matters related to that software. The successful bidder/vendor shall also be responsible for meeting the overall response times and availability requirements as specified in the Service Level Agreement.

The maintenance of the Software shall be comprehensive and shall comprise of the following category of works which is further elaborated for each of the different subsystems:

- Preventive Maintenance Activity (performance monitoring, system backup, patch management, updates, emergency response and troubleshooting)

- Maintaining the backup of software application

- Integration of new module etc.

3.1 Preventive Maintenance Activity

The preventive maintenance activity to be performed by the successful bidder/vendor to keep the software running at optimum level by diagnosis and rectification of all software failures would broadly include:

- Upgradation of database/software/any other application -The bidder shall be responsible for upgradation of database/software/any other application to latest versions having support from OEM and also ensuring cyber security compliance as per Government of India guidelines.

- Monitoring of the performance of the software and doing necessary tuning for optimum performance to accommodate any changes such as addition of new modules.

- Providing all necessary assistance to respective RLDC for addition and modification of database, Database sizing activities including Backup and restoration of the software.

- Restoration of the software upon its failure and to restore the functioning of the various modules.

3.2 Hours of Cover

The vendor shall provide engineers who have an experience and skill to maintain the software system to the desired level of availability. The vendor's on-site support for software shall be standard hours of service i.e. Monday to Friday - 9:00 am to 5:30 pm local time (IST) throughout a year.

One expert Engineer on FTE basis having expertise in metering data processing software shall be available during the standard hours of service at RLDC. The timings for Emergency Support shall be 24 hours a day, 7 days a week throughout the year.

Vendor and its personnel have to follow all rules and regulations of RLDC premises in view of certifications of ISO-9001, ISO-14001, OHSAS-18001 and ISO-27001 including any other future certification.

3.3 Problem/Defect Reporting

The bidder shall submit an appropriate problem/defect reporting procedure to meet the requirement of all severity level cases to get the approval of the same from respective RLDC.

The problems will be categorized as follows:

Severity 4 – Emergency	Complete software failure, severe software instability, loss or failure of any major software module such as to cause a significant adverse impact to software availability, performance, or operational capability. For e.g. software Crash/not working
Severity 3 – Serious	Degradation of services Failure of backup such that the normal redundancy is lost.
Severity 2 – Minor	Any other software defect, failure, or unexpected operation. For e.g. part module is working and other part is not.
Severity 1 – General	Request for information, technical configuration assistance, "how to" guidance, and enhancement requests.

Table 3- Severity Levels

3.4 Response and Resolution Time

This section describes the target times within which the bidder shall respond to support requests for each category of severity. The Initial Response Time is defined as the period from the initial receipt of the support request (email/telephone/fax or any other communication channels) and the acknowledgment of the vendor subject to the Maximum time defined in Table -4. The Action Resolution Time shall be computed after the expiry of the ideal initial response time subject to the Maximum time defined in Table-4.

This period includes investigation time and consideration of alternative courses of action to remedy the situation. The Action is defined as a direct solution or a workaround. Except for Severity Level 4 all response and resolution times (hours and days) specified below are working hours only:

Severity	Ideal Initial Response Time	Action Resolution Time (Max.) (to be commenced after end of ideal initial response time)	Action
4	1 hour	6 hours	An urgent or emergency situation requiring continuous attention from necessary support staff until system operation is restored – may be by workaround.
3	3 Hours	12 Hours	Attempt to find a solution acceptable to Owner (dependent on reproducibility) as quickly as practical.
2	8 hours	18 hours	Evaluation and action plan. Resolution time is dependent on reproducibility, ability to gather data, and Owner's prioritization. Resolution may be by workaround.
1	18 hours	24 hours	Report on the problem/query is to be furnished.

Table 4 - Emergency Support Response/Resolution Time

The bidder shall submit the detailed format and procedure for all the activities such as Reporting time, Resolution time, Downtime etc. along with the bid proposal.

3.5 Availability and Payment charges Calculation

It is the endeavor of both the bidder and owner to maximize system availability to the extent possible. The bidder shall provide guaranteed availability for software as specified in Table 2. The non-availability hours for availability calculation shall be counted from the end of the allowed Action Resolution time. The web-based help desk software application shall have features for complaint reporting, severity level assignment, initial response time stamping, remarks of the resident engineer regarding actions taken, complaint resolution time stamp and statistics for computing duration of system outage under different severity level categories. There shall be separate login for RLDC for certification of the complaint resolution time. The complaint resolution time stamp shall be generated only after endorsement/acknowledgement by RLDC engineer in-charge.

Duration of outages over and above the Action Resolution time, as defined in Table-4 in each of the Severity levels shall be counted for the non- availability computation and shall be clearly brought out

in the web based help desk. The resolution may be accomplished by a work around, and such solution shall mark the end of non-availability.

3.6 Availability computation for AMR/MDP System

System availability is envisaged for overall software availability at RLDC. 99.99% software availability is to be ensured. Availability shall be computed on weekly basis. The formula to be used for availability computation would be as under:

Availability per week = {THQ- (S4 + S3 + S2 + S1)} x 100%

Where THQ is total hours in the week

S1 is the total non-available hours in Severity Level-1 in the week.

S2 is the total non-available hours in Severity Level-2 in the week.

S3 is the total non-available hours in Severity Level -3 in the week.

S4 is the total non-available hours in Severity Level -4 in the week.

The target availability would be 99.99 % or better.

3.7 Payment of maintenance charges (based on the total System availability)

In the event of availability below a certain level, the maintenance charges would be proportionately reduced as follows:

Availability of the system per week	Deduction in the AMC/O&M charges for the week
More than or equal to 99.99%	NIL
Less than 99.99%	Deduction of 1% of the apportioned weekly AMC/O&M charges for every 0.1 % or part there of decrease in data availability from Target Availability subject to maximum deduction of 20%

Table -5: Deduction against less availability

The computation of Availability / Non-availability would be rounded up to 2 decimal places at RLDC on weekly basis and any deduction in the maintenance charges thereof would be calculated as stated above on pro-rata basis.