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

दिनांक: 21.07.2025

सेवा में/ To,

संलग्न सूची के अनुसार/As per list attached

विषय: दूरसंचार, स्काडा और टेलीमेटरी उपसमिति की 28 वीं बैठक।
Subject: 28th meeting of Telecommunication, SCADA& Telemetry Sub Committee

उत्तर क्षेत्रीय विद्युत समिति की दूरसंचार, स्काडा और टेलीमेटरी (टेस्ट) उप-समिति की **28 वीं बैठक दिनांक 23.07.2025 को 11:00 बजे सम्मेलन कक्ष, एन.आर.पी.सी, नई दिल्ली** में आयोजित की जाएगी। बैठक की **अतिरिक्त** कार्यसूची आपकी सूचना एवं आवश्यक कार्यवाही हेतु संलग्न है।

The 28th meeting of Telecommunication, SCADA & Telemetry (TeST) Sub-committee of NRPC will be **held at conference room in NRPC, New Delhi on 23.07.2025 at 11:00 AM**. The additional agenda for the meeting is enclosed herewith for your information and necessary action.

अनुलग्नक– यथोपरि।

भवदीय,

Signed by Anzum Parwej
Date: 21-07-2025 16:30:48

(अंजुम परवेज)
अधीक्षण अभियंता

18-ए,शहीद जीत सिंह मार्ग, कटवारिया सराय, नई दिल्ली- 110016 फोन:011-011-265530235 ई-मेल:sec-nrpc@nic.in वेबसाईट:http://www.nrpc.gov.in
18-A, S. Jeet Singh Marg, Katwaria Sarai, New Delhi-110016 Phone: 011-26553023 e- mail: sec-nrpc@nic.in Website:http://www.nrpc.gov.in

Contents

AA1 Fiber Sharing on JKPTCL network to provide redundant communication for Alusteng, Drass, Kargil, Khalasti, Leh (Agenda by CTUIL)

1. Presently Alusteng, Drass, Kargil, Khalasti, Leh stations are connected on radial path with ISTS Communication Network. The agenda for redundant communication for these stations was discussed in the **23rd TeST Meeting** held on 23.10.2023 and **26th TeST Meeting** held on dtd. 19.11.2024. In the meeting it was concluded that redundant communication for Alusteng, Drass Kargil, Khalasti and Leh can be established through fiber sharing (3 pairs) on the following JKPTCL links:

   a) Alusteng (PG) - Zainakote (JKPTCL)

   b) Zainakote (JKPTCL) - Wagoora (PG) (ISTS Node)

2. After deliberations, the Forum requested CTU to write a letter to JKPTCL to share 3 pair of fibers for ISTS Communication purpose. In this regard a letter was sent to JKPTCL by CTU dtd. 08.11.2023. (Attached at **Annexure-I**). It was also decided that **two nos. of STM16 FOTE will be required at Alusteng and Zainakote JKPTCL sub-stations** and both FOTE will be connected to POWERGRID sub-stations at both directions. Forum approved 2 nos. of STM16 FOTE along with associated SFPs for Alusteng and Ziankote stations and requested POWERGRID to take up with JKPTCL for establishment of connectivity by taking 3 pairs of fibers for ULDC purpose.

3. In **72nd NRPC held on 19.04.2024**, agenda was again deliberated where Forum suggested that as CEA is preparing Guidelines for Fiber Sharing Policy therefore this matter may be brought after issuance of Guidelines on fiber sharing policy by CEA. Later, CEA has published "**Comprehensive guidelines for the usage and sharing of fiber cores of Optical Ground Wire (OPGW)/ Under Ground Fiber Optic (UGFO) Cable for power system applications**" in March'25.

4. After the issuance of CEA Fiber sharing guidelines, this agenda was again deliberated in **78th NRPC meeting held on 17.03.2025** and in **Special TeST Meeting held on 24.03.2025.** In the meetings forum suggested that CTU to again write letter to JKPTCL for sharing of fibers. CTU has sent a letter dtd. 09.04.2025 to JKPTCL in this regard (attached at **Annexure-II).**

5. JKPTCL response is awaited regarding sharing of fibers on JKPTCL links.

Members may deliberate.

AA2 Fiber Sharing on PTCUL network to provide redundant communication for Pithoragarh (PG) and Sitarganj (PG) stations (Agenda by CTUIL)

1. Presently Pithoragarh (PG) and Sitarganj (PG) stations are connected on radial path with ISTS Communication Network. The agenda for redundant communication for these stations was discussed in the **23rd TeST meeting** held on 23.10.2023 and **26th TeST Meeting** held on 19.11.2024. In the meeting it was concluded that redundant communication link for Pithoragarh (PG) and Sitarganj (PG) stations can be established through **fiber sharing (3 pairs)** on the following PTCUL link:

A. Links/Paths where fibre Sharing is required for Pithoragarh (PG):

a. Pithoragarh (PG) – Pithoragarh (PTCUL)
b. Pithoragarh (PTCUL) – Almora (PTCUL)
c. Almora (PTCUL) -Bhawoli (PTCUL)
d. Bhawoli (PTCUL) -Haldwani (PTCUL)
e. Haldwani (220kV) (PTCUL) Kamalwaganj (PTCUL)
f. 220kV Kamalwaganj (PTCUL) - Pantnagar (PTCUL)
g. Pantnagar (400kV) (PTCUL) - Kashipur (PTCUL)

2. At Kashipur (PTCUL), ISTS FOTE is available which is further connected with Bareilly(PG) through ISTS link.

B. Links/Paths where fibre Sharing is required for Sitarganj (PG):

a. Sitarganj(PG) - Sitarganj(PTCUL)
b. Sitarganj(PTCUL) - Kiccha(PTCUL)
c. Kiccha(PTCUL) - Rudrapur(PTCUL)
d. Rudrapur (PTCUL) - Pantnagar (PTCUL)
e. Pantnagar (PTCUL) – Kashipur (PTCUL)

3. At Kashipur (PTCUL), ISTS FOTE is available which is further connected with Bareilly(PG) through ISTS link.

4. PTCUL informed that the tender for OPGW is going to be floated, and technical approval is in process. However, they will confirm availability after confirmation from higher management and request a letter may be written to PTCUL Management. Forum requested CTU to send a letter to PTCUL for **sharing 3 pair of fibers for ULDC purpose.** In this regard a letter was given to PTCUL by CTU dtd. 08.11.2023. (attached at **Annexure-III**).

5. In **72nd NRPC held on 19.04.2024**, agenda was again deliberated where Forum suggested that as CEA is preparing Guidelines for Fiber Sharing Policy therefore this matter may be brought after issuance of Guidelines on fiber sharing policy by CEA. Later, CEA has published “Comprehensive guidelines for the usage and sharing of fiber cores of Optical Ground Wire (OPGW)/ Under Ground Fiber Optic (UGFO) Cable for power system applications” in March’25.

6. After the issuance of CEA Fiber sharing guidelines, this agenda was again deliberated in 78th NRPC meeting held on 17.03.2025 and in Special TeST Meeting held on 24.03.2025. In the meetings forum suggested that CTU to again write letter to PTCUL for sharing of fibers. CTU has sent a letter dtd. 09.04.2025 to PTCUL in this regard (attached at **Annexure-IV**).

7. PTCUL response is still awaited regarding sharing of fibers on PTCUL links.

Members may deliberate.

AA3 Inputs from TSPs regarding fiber database (Agenda by CTUIL)

1. CEA has published "Comprehensive guidelines for the usage and sharing of fiber cores of Optical Ground Wire (OPGW)/ Under Ground Fiber Optic (UGFO) Cable for power system applications" in March'25. As per Para 7. Of this guideline -

CTU for ISTS/ STUs for InSTS shall be responsible for monitoring the utilization of OPGW fibers and ensuring compliance with the established conditions. The CTU/STU shall maintain a comprehensive database that clearly segregates:

1) **Total number of OPGW fiber cores:** The total number of fiber cores available on the OPGW of the transmission lines.
2) **Number of cores utilized for grid applications:** The number of fiber cores currently being used for essential grid operations
3) **Spare cores reserved for grid applications:** The number of fiber cores specifically retained for future grid applications.
4) **Number of fiber cores already being shared for grid applications:** The number of fiber cores shared with other grid entities (e.g., other TSPs, STUs, DISCOMs) for grid-related purposes. This should include details of the entities involved in each sharing arrangement.
5) **Number of cores leased on a commercial basis:** The number of fiber cores leased to entities for non-grid applications (e.g., telecom providers, internet service providers). This should include details of the lease agreements, including the lessee, lease period, and terms of termination.

2. Therefore, to prepare this comprehensive database TSPs e.g. POWERGRID, ADANI, INDIGRID, STERLITE, TATA-POWERLINK, etc. need to furnish details pertaining to fiber database as per attached **Annexure – V.**

Members may deliberate.

AA4 Inputs for existing PMU Database (Agenda by CTUIL)

1. CEA has issued Guidelines on Unified Philosophy for Placement of Phasor Measurement Unit (PMU) in Indian Grid w.e.f 19.03.2025 attached as **Annexure-VI**. As per these guidelines Placement Annexure-I, Sr. No. 1, 8, 10, 11 & 12, PMUs are to placed at one end of the transmission lines.

2. As per MoM of meeting held dtd. 13.03.2025 (part of this Unified Philosophy for Placement of Phasor Measurement Unit (PMU) in Indian Grid) para 10. Stated:

"CTUIL shall clearly mention the requirement of PMUs at a Substation in line with these Guidelines by duly factoring in the availability of the PMUs at the existing

stations and that under bidding transmission schemes & under-construction transmission schemes."

3. Therefore, to provide these inputs related to PMU in the RFP documents and reply to bidders queries it is requested that database for All India PMU placement details to be provided by RLDC/NLDC to CTUIL so that RFP documents may be furnished accordingly.

Members may deliberate

AA5 Nomination of nodal officers for coordination with NMT of UNMS (Agenda by CTUIL)

1. U-NMS project has been implemented by POWERGRID in the Northern Region through M/s Sterlite, has been in place for over a year since its commissioning.
2. During the **27th TeST meeting held on 21.04.2025,** Forum requested all constituents to nominate a nodal officer.
3. Nomination of nodal officers from all the constituents is still awaited.

Members may deliberate

AA6 Status of schemes approved in various NCT (Agenda by CTUIL)

1. In the **26th NRPC TeST Meeting**, Status of various ISTS communication schemes approved in NCT were deliberated. Forum suggested that this monitoring could be held under the NRPC level.
2. In the **27th TeST meeting**, POWERGRID was requested to provide the status of links commissioned under different projects other than NCT approved Category – B schemes e.g. Reliable schemes / Expansion Schemes etc. as agenda in the TeST meeting henceforth.
3. Details of the schemes approved in the NCT are attached at **Annexure-VII**, Respective Implementing Agency/TSP is requested to provide current status of these schemes.

Members may deliberate.

AA7 Unified Real Time Dynamic State Measurement (URTDSM) project phase-II (Agenda by POWERGRID)

1. POWERGRID has been assigned responsibility for **preparation of DPR for URTDSM Phase-II in the 13th NPC** meeting which will include additional PMUs required as per Sub-Committee Report and replacement of existing Control Centers at SLDCs/RLDCs/NLDC

2. The DPR with cost estimate was presented in the **14th NPC meeting**. The scope covered the replacement of **32 control centers, 2 new control centers at NLDC/ RLDCs/ SLDCs and providing 4000 new PMUs** as per the PMU placement philosophy of the Subcommittee Report. The cost estimate of the project was **Rs. 3922 crores.** This

was made based on **70:30 funding where 70 % is to be funded by PSDF and 30% from POWERGRID Equity, as it was done for URTDSM Phase-I project.**

3. Subsequently it was **conveyed by PSDF in April 2024 that the funding would not be available from PSDF** hence it was decided to optimize the cost by exploring various options such as centralized control center at RLDC, reduction in PMUs, reduction in storage retention etc.
4. URTDSM Phase-II proposal was deliberated in 73rd NRPC dated 21st May and technically agreed. However, the funding for the project was requested from PSDF.
5. In the 15th NPC meeting it was decided to implement the URTDSM Phase-II project only for the ISTS portion (i.e., NLDCs & RLDCs and PMUs only for Central sector stations) as the system is necessary for Grid management.
6. Accordingly, **the cost estimate of Rs.1122 Crores for ISTS portion comprising of control centers (7nos.) of NLDC and RLDCs and PMUs at central sector stations (1070 nos.)** based on Uniform philosophy of PMU placement was presented in the **16th NPC Meeting in July 2025.**
7. In the 16th NPC it was directed that the proposal be shared with all RPCs/Grid-India. Hence a brief of the project, BOQ, and cost estimate for the project is enclosed as **Annexure-VIII** for deliberations by the RPCs.
8. Considering that the Phase 1 system is going to complete its 7 years AMC on January 2027 and the hardware/Software are more than 9 years old, the decision to implement the URTDSM phase -2 system is to be taken up on priority.
9. In view of the above, it is requested that URTDSM Phase-II project for ISTS portion may be deliberated in the meeting.
10. The cost of the Project shall be shared by all the constituents as per the ISTS sharing agreement.

Members may deliberate and concur the proposal

AA8 Communication Audit checklist points may be deliberated by the sub-committee (Agenda by POWERGRID)

1. Standard Operating Procedure (SOP) for Communication Audit of Substations was finalized by NPC in accordance with the Central Electricity Regulatory Commission (Communication System for Inter-State Transmission of Electricity) Regulations, 2017.
2. In this regard, following provisions of audit checklist need further deliberation :

Communication Audit Checklist

a) Whether OPGW is terminated properly. Down lead shall be fixed property in sufficient locations. Metallic part shall be connected to earth mat riser

b) Distinct approach cable shall be laid for Protection, Communication and commercial applications

c) *Whether separate room for communication is available*
d) *Two sets of 48 V (Positive Earthed) DC System shall be available with 1 Common DC Distribution board/ Panels with incoming MCB, coupler MCB, out doing MCBs, etc*
e) *Battery Charger alarms /measurements shall be made available to SAS (if available). It can be achieved through MODBUS or connecting analogue/digital signals to Common BCU of SAS. If such system is not available major alarms shall be alarmed in common substation annunciator.*
f) *Kindly assure proper protection is available for AC Distribution (ELCB, MCB, Backup fuse)*
g) *Aux Transformer neutral Earthing shall be connected to Stations earth mat (Aux Transformers shall be installed in yard earth mat area only)*
h) *Whether DG sets with AMF panels are provided for Aux AC Supply*
i) *Whether 2 nos 11 kV (or 33kV) supplies are available for Each station aux Transformer.*

Members may deliberate

AA9 Review the requirement of NGFW in various Substation packages as per CTU standard technical specifications (Agenda by POWERGRID)

1. There is a requirement of providing NGFW in the substations as per the technical specifications of CTU. These requirements are part of the technical specification issued by the BPC for the various TBCB packages. Accordingly, these provisions have been included in the technical specification of POWERGRID Substation engineering both for RTM as well as TBCB projects.

2. POWERGRID is facing certain challenges in the deployment of NGFW for substation related. There is only one make presently which is being offered primarily due to no. of ports requirement and the requirement of ethernet ports. Also the NGFW, which includes IPS, requires connectivity with the Internet for updates or connection to a Centralized management server. POWERGRID is also taking up with CEA regarding the challenges of providing connectivity of the OT firewall with Internet. Some other provisions in the Tech spec of NGFW which need to be reviewed.

Members may review the requirement and deliberate on the issue

AA10 Operational Issues in OPGW Network – Longer outages in UPPTCL owned OPGW links (outage in Muzaffarnagar 400kV – Nara 220KV and Modipuram – Charla link) (Agenda by POWERGRID)

1. Subject agenda was raised by POWERGRID in 28th TEST sub-committee meeting and UPPTCL has committed to restore the communication links within 1 month, however both the links are still out, resulting impact on UP state sub-stations data and affecting Inter-Regional connectivity for reporting of data to Backup NRLDC at Kolkata and vice-versa.

2. Out of above OPGW connectivity, two (02) OPGW links i.e. **Muzaffarnagar 400kV – Nara 220KV and Modipuram – Charla links** were out of service/ Intermittent for more than 2 years, resulting Backup SLDC, Modipuram is working on single route and center sector connectivity for Inter-Reginal links are disturbed since then.

3. Based on the approval of NCT/NRPC, POWERGRID has commissioned redundant communication equipment at all SLDCs, however without restoration of optical links, we could not achieve the actual redundancy of communication network.

4. UPPTCL is once again requested to take up with concern wing to get these OPGW network restored. 4 fibers has to be provided to ULDC as earlier since 2012-13 and 2 fibers have to keep as spare.

Members may deliberate

AA11 Issues being faced by NMT Team at UNMS Control Centre (Agenda by POWERGRID)

1. During the **27th TEST meeting**, NMT team raised the issue of integration of pending nodes (15-20%), however integration of many Network Elements are still pending. States/IPPs/ISTS owners are either not providing or not able to take up with OEMs to integrate these pending nodes in UNMS system. NMT team is repeatedly raising the issue via mails/telephonically but due to inadequate support from stakeholders, we are not able to integration these pending NEs in UNMS.

2. One more challenge, NMT team is facing that they are not able to get update network details i.e. total numbers of nodes/equipment in particular state and total equipment V/s integrated, vis-à-vis balance integration in UNMS. This requires support from respective state utilities. During project implementation in 2022-23, POWERGRID have some figures and we are monitoring on that, however it is understood that after award of new packages by respective utilities, numbers of equipment/Node have got changed but no input is available with NMT team.

3. **During last meeting, it was concluded that one nodal officer from each State/IPPS/ISTS licensees may be nominated who will coordinate with centralized NTM team for day-to-day integration and operational issues.**

4. All states may update latest available data of equipment v/s total integration in UNMS, so that next course of action may be taken up.

5. One more challenge is being faced during upgradation of software version in existing NMS / individual nodes, sometimes equipment got faulty and we need spares but states don't have spare available for the particular equipment. To meet operational requirement, sufficient spares may be kept by all States constituents.

6. Power supply issue at Kashipur is still persists, resulting power off of UNMS System. PTCUL is again requested kindly to work out solution for powering up UNMS system at their control center.

7. Integration of JKPTCL communication system with UNMS. Earlier some temporary arrangements (local laptop with NMS software) were done to integrate JKPTCL network but some times it got out of service/ powered off.

8. NMT team may also requires Escalation matrix for ISTS node for intimation and resolution of outage issues – CTU/NRLDC may provide the details of concerned officials, so that time intimation may be issued to concerned ISTS/IPPs.

9. System Improvement: As per Bandwidth utilization report, some of the routes are facing bandwidth choking specially in STM-4 routes. System generated report from UNMS system is attached for further deliberation and consideration for upgradation.

10. Following sections have B.W. Utilization over 75%, may be proposed for upgradation to next higher capacity:

Sr. No.	Source Node	Source Port	Destination Node	Destination Port	Layer Rate	Utilization (%)
1	Sohawal	STM4-1-2-3	Ballia_400	STM4-1-4-3	STM-4	92.06
2	PG_KURUKSHETRA	STM4-1-3-1	Abdullapur PG	STM4-1-3-1	STM-4	90.08
3	Ballabhgarh03	STM16-1-4-3	BHIWADI_SDH-02	STM16-1-2-3	STM-16	92.26
4	KOTPUTLI	STM16-1-2-3	BHIWADI_SDH-02	STM16-1-2-4	STM-16	78.97
5	BAREILLY	XS A:SAMQ o Port 2	SHAHJAHANPUR	XS B:SAMQ oPort 2	STM-4	99.6
6	Jallandhar-PG	STM4-1-2-3	Ludhiana_PG	STM4-1-3-1	STM-4	94.84
7	Kunihar LDC_HP	STM4-1-1-1	Gagal	STM4-1-2-3	STM-4	75
8	Abdullapur PG	STM4-1-1-1	Dehradun PG	STM4-1-3-1	STM-4	90.87
9	BAREILLY_400	STM4-1-1-1	SHAHJAHANPUR	STM4-1-1-1	STM-4	96.03

Members may deliberate

AA12 Frequent 48V DC Power Supply issues at State Nodes (Agenda by POWERGRID)

1. ULDC communication network has been established in integrated manner which is passing through Centre Sector as well as State Constituent's transmission lines/sub-stations, however ULDC team is facing challenges in maintaining the communication network due to frequent failure of input power supply/48V DC Power Supply at critical nodes, resulting untimely outages in communication network which affects data availability at NRLDC/ SLDCs. Some of the nodes are mentioned as below:

Sr. No.	Sub-station Name	Services/Links affected
1	220kV Okhla DTL	NRLDC/NLDC Network (2 directions affected)
2	220kV Vasant Kunj DTL	NRLDC/NLDC Network (2 directions affected)
3	220kV Mehrauli DTL	NRLDC/NLDC Network (4 directions affected)
4	400kv Muzaffarpur UPPTCL	Presently linear due to OPGW outage, however affects Roorkee/ Intra-Regional links
5	220kV Manimajra UT	Three directions affected, impacting HP, BBMB and Punjab data
6	220kV Chittorgarh RVPN	Impacting Rajasthan and CS sector data of RE pockets (affecting 3 OPGW links)
7	Chamera-I NHPC	Affecting Chamera pocket data and 2 OPGW links
8	Heeranagar JKPTCL	Affecting SEWA-II data and Gladani link

9	400kV Ajmer RRVPNL	Linear node (affecting protection of lines)
10	400kV Bhadla RRVPNL (Kiosk)	Linear node (affecting protection of lines)

Members may deliberate

AA13 Establishment of new SLDC for Chandigarh UT (Agenda by Chandigarh UT)

1. The **formal notification for the establishment of SLDC Chandigarh** was issued on **31st January 2025, under Section 31 of the Electricity Act, 2003.**
2. During 50th Forum of Load Dispatchers (FOLD) meeting held on 23.05.2025, SLDC Chandigarh was asked to coordinate with POWERGRID in SCADA data integration and related infrastructure enhancements. Chandigarh UT is asked to initiate rooftop solar monitoring also.
3. Accordingly, Chandigarh UT approached POWERGRID vide letter dated 29.05.2025 & 09.06.2025 to take up the implementation of new SLDC for Chandigarh UT.
4. POWERGRID team visited Chandigarh UT Engineering office on 13.06.2025 and submitted a tentative Cost Estimate, BOQ and options for mode of implementation of the new SLDC for Chandigarh UT (either in RTM route or through consultancy route).
5. It is apprised that in line with recommendations of **49th and 58th NRPC**, POWERGRID is implementing **ULDC Phase-III project for the SLDCs of Northern Region and NRLDC (Grid-India) in** unified manner. POWERGRID is implementing **ULDC-III under RTM route for 8 SLDCs of Northern Region and under consultancy route for NRLDC and HPSLDC.** The award for this NR ULDC-III has already been placed on GE and the project is currently under execution.
6. In response to POWERGRID's options, **Chandigarh UT opted to implement the new SLDC project under RTM route in line with other 8 SLDCs of NR.**
7. The tentative cost of the **new SLDC for Chandigarh UT (submitted by POWERGRID) is Rs. 29.08 Crores (for Supply and Services excluding AMC)** based on the ongoing NR ULDC-III awarded cost.
8. Chandigarh UT proposes to implement the establishment of new SLDC under Regulated Tariff Mechanism (RTM) route through POWERGRID, as being done under ongoing NR ULDC-III Project.

Members may deliberate and concur the above proposal.

AA14 Frequent outage of AGC links for TANDA NTPC (Agenda by NTPC)

1. AGC of Tanda NTPC is facing frequent outage due to intermittent communication links. AGC data is presently reported to NLDC via UPPTCL network and outage in the links is very frequent and to the tune of 2-3 days. At present also link is down from 17th July' 25

and we are facing commercial implication on account of the outage. Following transmission lines are available for creating redundant OPGW communication route.

Main OPGW Route: Tanda Power Plant to New Tanda sub-station having 3 nos of 400kV lines (approx. 21.7 kms) then New Tanda to POWERGRID Sohawal line 116 kms.

Redundant OPGW Route: Tanda Power Plant to 400kV Sultanpur line (69.5 Kms) then Sultanpur to Sohawal line (77.80 Kms).

2. Forum is requested to plan redundant communication link for Tanda NTPC plant to NLDC for AGC operations.

Members may deliberate

AA15 Request for 2 No. Ethernet ports on existing Firewall installed under URTDSM project (Agenda by PTCUL)

1. PTCUL requests PGCIL to provide two copper Ethernet ports on existing Firewall, installed under UTRDSM project for DC and Scheduling Metering Data. PTCUL shall use the above-mentioned ports as connecting node between SAMAST Server & SCADA Server.
2. Further, in the **27th TeST Meeting**, PTCUL requested the forum to explore the possibilities of installation of MFT/MFM/Transducer like device at each generating plants. The installed MFT/MFM/Transducer like device must have minimum two pointers & shall have 100 plus registers. These registers must have capacity to take data manually. Each generating plants shall feed the data manually & the pointer register shall point to current Scheduled Generation Register and shall increment to next Scheduled Generation Register after each 15 minutes.

Members may deliberate

AA16 Installation of old Tejas Make FOT Equipment in the newly supplied Tejas Make FOTE Panel at Back-Up SLDC, Kashipur (Agenda by PTCUL)

1. POWERGRID installed a new FOTE Rack along with new M/s Tejas make (again) FOTE at Back-Up control center. Now, PTCUL has three Tejas make FOTE PANEL, Two SDH & One PDH, installed at the same location. The PDH is lying idle since long.
2. Therefore, POWERGRID is requested to take back the idle PDH Panel. It is also requested to install Old M/s Tejas FOTE Equipment in the new M/s Tejas FOTE Panel.

Members may deliberate

AA17 Sharing of IPs List for all the field SAS/RTU equipment for integration in the upcoming SCADA/EMS System (Agenda by PTCUL)

1. PTCUL requests POWERGRID to share the IP Series for field SAS/RTU or for the Front-End Server and Terminal-Servers. PTCUL is in the process to create two separate path & two ports for data reporting to Main & Control Centre.

Members may deliberate

AA18 Non-displaying of Dynamic Values on SLDC Haryana Website (ULDC Phase-II) (Agenda by HVPNL)

1. Any newly created data points in the SCADA system (analog values) either do not reflect on the website or display random/incorrect values. This issue has been highlighted to M/s Siemens multiple times. However, no solution has been provided so far, nor has the cause of the issue been provided by M/s Siemens.
2. Therefore, M/s Siemens may kindly be requested to look into this issue sincerely and provide a proper resolution at the earliest.

Members may deliberate

AA19 SLOW Progress of Database creation (Agenda by HVPNL)

1. The ULDC Phase-III SCADA system station database is currently under preparation by M/s GE as per the terms and conditions of the contract. Out of approximately 350 HVPNL stations, the database (RTU Sub-top and SLD) for only 140 stations has been created so far. As per the L2 schedule, the activity was to be completed by March 2025; however, it is already delayed by four months.
2. In view of the scheduled commissioning of the project, M/s PowerGrid is requested to ensure that M/s GE allocates additional resources for database creation to expedite the process and complete the activity at the earliest.
3. Furthermore, all types of FAT (Factory Acceptance Tests) may also be completed in a timely manner.

Members may deliberate

AA20 Issuance of MoM regarding IP confliction in ULDC Phase-III and IP detail for CFE server for BCC – HVPNL (Agenda by HVPNL)

1. Under ULDC Phase-III, HPSLDC and Haryana are establishing their own dedicated Backup Control Centres (BCCs). Due to the shared BCC setup in ULDC Phase-II, the CFE (Communication Front End) server IPs of both states are conflicting in the current Phase-III implementation.
2. A VC meeting was held on 21.05.2025 in which a common consensus was reached. It was decided that M/s PowerGrid would issue the Minutes of Meeting (MoM) and share the finalized CFE IP details for configuration in the upcoming RTU/SAS systems.
3. M/s PowerGrid is therefore requested to issue the MoM along with the CFE server IP details for BCCs at the earliest, so that the matter may be apprised to senior officers of HVPNL.

Members may deliberate

Annexure-I

सेंट्रल ट्रांसमिशन यूटिलिटी ऑफ इंडिया लिमिटेड
(पावर ग्रिड कॉर्पोरेशन ऑफ इंडिया लिमिटेड के स्वामित्व में)
(भारत सरकार का उद्यम)
CENTRAL TRANSMISSION UTILITY OF INDIA LTD.
(A wholly owned subsidiary of Power Grid Corporation of India Limited)
(A Government of India Enterprise)

Ref: C/CTU/Comm/J&K/01 08.11.2023

To,
Managing Director,
J&K Power Transmission Corporation Limited,
Janipur, Jammu- 180001

Sub: Regarding Fibre Sharing on JKPTCL links for ULDC purpose for redundant communication of Alusteng, Drass, Kargil, Khalasti, Leh ISTS Nodes

Sir,

This is with reference to 23rd meeting of Telecommunication, SCADA & Telemetry Sub Committee (TeST) of NRPC held on 21.09.23 in virtual mode. The Minutes of Meetings (MoM) were issued on 23.10.2023 and are attached with this letter. In the meeting redundant communication of Alusteng, Drass, Kargil, Khalasti, Leh was deliberated which was deliberated at para 5 of MoM.

Further, with reference to MoM clause 5.2, MS, NRPC requested CTUIL to write a letter to JKPTCL for fibre sharing on their OPGW links to provide redundant communication links as under:

Fibre Sharing requirement for Alusteng, Drass, Kargil, Khalasti, Leh.

Alusteng, Drass, Kargil, Khalasti, Leh are presently connected with RLDC using PowerTel and J&K links upto Wagoora(ISTS node). To provide redundant path to these stations other pairs of fibre of existing OPGW shall be used with existing ISTS FOTE established under substation packages. JKPTCL to share atleast 6 nos. of fibers for ULDC purpose on the following links:

1. Alusteng - Zainakote
2. Zainakote - Wagoora

It was deliberated during the meeting that two nos. of STM-16 FOTE shall be planned one each at Zainakote and Wagoora in ISTS project alongwith the sharing of fibers mentioned above.

It is to be mentioned that fibres required on JKPTCL links are solely used for ULDC & Grid Management purpose.

After receiving the confirmation of fibre sharing from JKPTCL, scheme shall be prepared by CTUIL and put up for approval in NCT after getting views of NRPC.

It is requested that JKPTCL may provide their consent to CTUIL with copy to NRPC so that scheme shall be finalised at earliest.

Thanking you,

Yours faithfully,

(H S Kaushal)
Sr. GM (CTUIL)

CC:

1. Member Secretary Northern Regional Power Committee 18A, Shaheed Jeet Singh Sansanwal Marg, Katwaria Sarai, New Delhi – 110 016	**2.Chief Engineer,** Transmission – Kashmir, J&K Power Transmission Corporation Limited, Bemina, Srinagar, J&K

सेंट्रल ट्रांसमिशन यूटिलिटी ऑफ इंडिया लिमिटेड
(पावर ग्रिड कॉर्पोरेशन ऑफ इंडिया लिमिटेड के स्वामित्व में)
(भारत सरकार का उद्यम)
CENTRAL TRANSMISSION UTILITY OF INDIA LTD.
(A wholly owned subsidiary of Power Grid Corporation of India Limited)
(A Government of India Enterprise)

Ref: C/CTU/Comm/J&K/02 09.04.2025

To,
Managing Director,
J&K Power Transmission Corporation Limited,
Janipur, Jammu- 180001

Sub: Regarding Fibre Sharing on JKPTCL links for ULDC purpose for redundant communication of Alusteng, Drass, Kargil, Khalasti, Leh ISTS Nodes

Sir,

This is with reference to our earlier letter dtd. 08.11.2023 (attached at Annexure-I) regarding sharing of fibers from JKPTCL links for providing redundant communication to Alusteng, Drass, Kargil, Khalasti, Leh ISTS Nodes.

Presently Alusteng, Drass, Kargil, Khalasti, Leh are connected with RLDC using PowerTel and J&K links upto Wagoora (ISTS node). To provide redundant path to these stations, JKPTCL to share 6 nos. of fibers for ULDC purpose on the following links:

1. Alusteng - Zainakote
2. Zainakote - Wagoora

It is to mention that CEA has issued guidelines "*Comprehensive guidelines for the usage and sharing of fiber cores of Optical Ground Wire (OPGW)/ Under Ground Fiber Optic (UGFO) Cable for power system applications*" by letter dtd 03.03.2025 (attached at Annexure-II). The matter was explained by CEA during the 78th NRPC Meeting.

Further, in the Special TeST Meeting held on 24.03.2025 (MOM attached at Annexure-III) under the chairmanship of MS NRPC, it was decided that CTU shall write a follow up letter to JKPTCL in this regard.

It is requested that JKPTCL shall give their consent as per the above said guidelines in order to finalize the scheme to provide redundant communication to above said links.

Thanking you,

Yours faithfully,

(H S Kaushal)
Sr. GM (CTUIL)

CC:

1. Member Secretary Northern Regional Power Committee 18A, Shaheed Jeet Singh Sansanwal Marg, Katwaria Sarai, New Delhi – 110 016	**2.Chief Engineer,** Transmission – Kashmir, J&K Power Transmission Corporation Limited, Bemina, Srinagar, J&K

Annexure-I

सेंट्रल ट्रांसमिशन यूटिलिटी ऑफ इंडिया लिमिटेड
(पावर ग्रिड कॉर्पोरेशन ऑफ इंडिया लिमिटेड के स्वामित्व में)
(भारत सरकार का उद्यम)
CENTRAL TRANSMISSION UTILITY OF INDIA LTD.
(A wholly owned subsidiary of Power Grid Corporation of India Limited)
(A Government of India Enterprise)

Ref: C/CTU/Comm/J&K/01 08.11.2023

To,
Managing Director,
J&K Power Transmission Corporation Limited,
Janipur, Jammu- 180001

Sub: Regarding Fibre Sharing on JKPTCL links for ULDC purpose for redundant communication of Alusteng, Drass, Kargil, Khalasti, Leh ISTS Nodes

Sir,

This is with reference to 23rd meeting of Telecommunication, SCADA & Telemetry Sub Committee (TeST) of NRPC held on 21.09.23 in virtual mode. The Minutes of Meetings (MoM) were issued on 23.10.2023 and are attached with this letter. In the meeting redundant communication of Alusteng, Drass, Kargil, Khalasti, Leh was deliberated which was deliberated at para 5 of MoM.

Further, with reference to MoM clause 5.2, MS, NRPC requested CTUIL to write a letter to JKPTCL for fibre sharing on their OPGW links to provide redundant communication links as under:

Fibre Sharing requirement for Alusteng, Drass, Kargil, Khalasti, Leh.

Alusteng, Drass, Kargil, Khalasti, Leh are presently connected with RLDC using PowerTel and J&K links upto Wagoora(ISTS node). To provide redundant path to these stations other pairs of fibre of existing OPGW shall be used with existing ISTS FOTE established under substation packages. JKPTCL to share atleast 6 nos. of fibers for ULDC purpose on the following links:

1. Alusteng - Zainakote
2. Zainakote - Wagoora

It was deliberated during the meeting that two nos. of STM-16 FOTE shall be planned one each at Zainakote and Wagoora in ISTS project alongwith the sharing of fibers mentioned above.

It is to be mentioned that fibres required on JKPTCL links are solely used for ULDC & Grid Management purpose.

After receiving the confirmation of fibre sharing from JKPTCL, scheme shall be prepared by CTUIL and put up for approval in NCT after getting views of NRPC.

It is requested that JKPTCL may provide their consent to CTUIL with copy to NRPC so that scheme shall be finalised at earliest.

Thanking you,

Yours faithfully,

(H S Kaushal)
Sr. GM (CTUIL)

CC:

1. Member Secretary Northern Regional Power Committee 18A, Shaheed Jeet Singh Sansanwal Marg, Katwaria Sarai, New Delhi – 110 016	**2.Chief Engineer,** Transmission – Kashmir, J&K Power Transmission Corporation Limited, Bemina, Srinagar, J&K

Annexure-II

सत्यमेव जयते

भारत सरकार
Government of India
विद्युत मंत्रालय
Ministry of Power
केन्द्रीय विद्युत प्राधिकरण
Central Electricity Authority
विद्युत संचार विकास प्रभाग
Power System Communication Development Division
****

Subject: Comprehensive guidelines for the usage and sharing of optical fibers of OPGW/UGFO cables for power system applications - reg

महोदय / Sir,

The rapid expansion and modernization of the power sector necessitate a robust, secure and efficient communication infrastructure. Optical Ground Wire (OPGW)/Underground Fiber Optic Cable (UGFO) plays a crucial role in ensuring seamless data exchange, real-time monitoring, and reliable operation of power systems. However, with increasing demands and multiple stakeholders involved in fiber usage, it became essential to establish a structured framework governing the sharing and utilization of fiber cores of OPGW/UGFO cable.

A Committee was constituted under the chairmanship of Member (Power System), CEA tasked with formulating comprehensive guidelines for the usage and sharing of fiber cores of Optical Ground Wire (OPGW)/ Under Ground Fiber Optic (UGFO) Cable for power system applications.

With the collective efforts of the Committee, CEA has formulated Comprehensive guidelines for the usage and sharing of fiber cores of Optical Ground Wire (OPGW)/ Under Ground Fiber Optic (UGFO) Cable for power system applications. The list of nominated members and the Terms of Reference of the Committee are attached as Annexure to the guidelines.

It is requested that all utilities/TSPs, power system stakeholders, and users to adopt and adhere to these guidelines.

भवदीय,
Signed by Suman Kumar Maharana
Date: 03-03-2025 13:13:55
(S K Maharana)
Chief Engineer,
Power System Communication Development Division,
Central Electricity Authority

Comprehensive guidelines for the usage and sharing of fiber cores of Optical Ground Wire (OPGW)/ Under Ground Fiber Optic (UGFO) Cable for power system applications

भारत सरकार
Government of India

केन्द्रीय विद्युत प्राधिकरण
Central Electricity Authority

विद्युत मंत्रालय
Ministry of Power

February 2025

Acknowledgement

The rapid expansion and modernization of the power sector necessitate a robust, secure and efficient communication infrastructure. Optical Ground Wire (OPGW)/Underground Fiber Optic Cable (UGFO) plays a crucial role in ensuring seamless data exchange, real-time monitoring, and reliable operation of power systems. However, with increasing demands and multiple stakeholders involved in fiber usage, it became essential to establish a structured framework governing the sharing and utilization of OPGW fibers.

The formulated guidelines establish a structured approach to fiber allocation, safeguarding power system communication needs and mitigating future conflicts. These guidelines also ensure that commercial leasing of fiber cores is managed in a way that does not hinder the grid's operational efficiency and reliability.

A committee was constituted with the approval of the Chairperson, CEA, to formulate comprehensive guidelines for the usage and sharing of fiber cores of OPGW/UGFO cable for power system applications. The complete list of the nominated members of the Committee as well as Terms of Reference of the Committee has been annexed with the guidelines.

As the Convenor of the Committee, I express my deepest gratitude to all committee members for their invaluable contributions in shaping these guidelines. Their collective efforts have resulted in a standardized framework that will ensure transparency and efficiency in the usage and sharing of OPGW fiber infrastructure. The technical insights and dedication of all Committee members have played a crucial role in developing these comprehensive guidelines, which will significantly mitigate conflicts and enhance the reliability of grid communications.

I extend special thanks to Shri Ghanshyam Prasad, Chairperson, CEA, for his vision and leadership in constituting this Committee. I am also grateful to Shri A K Rajput, Member (Power Systems), CEA, for chairing the Committee and steering discussions towards a balanced and effective outcome.

Furthermore, I would like to acknowledge the specific contribution made by the officers of Power System Communication Development Division, CEA namely Ms. Priyam Srivastava, Deputy Director; Shri Akshay Dubey, Deputy Director and Shri Arjun Agarwal, Assistant Director. The guidelines have been brought out by the dedicated and sincere efforts of these officers.

Shri S K Maharana,
Chief Engineer, PSCD Division & Convenor of the Committee

Table of Contents

Abbreviations:

1.	AGC - Automatic Generation Control
2.	CERC - Central Electricity Regulatory Commission
3.	CTU - Central Transmission Utility
4.	FOTE - Fiber Optic Terminal Equipment
5.	GSS - Grid Substation
6.	IEEE - Institute of Electrical and Electronics Engineers
7.	IEC - International Electrotechnical Commission
8.	InSTS - Intra-State Transmission System
9.	IPPs - Independent Power Producers
10.	ISGS - Inter-State Generating Station
11.	ISTS - Inter-State Transmission System
12.	LILO - Loop-in-Loop-Out
13.	NLDC - National Load Dispatch Center
14.	NoC - No Objection Certificate
15.	OPGW - Optical Ground Wire
16.	PMU - Phasor Measurement Unit
17.	PSCD - Power System Communication and Development
18.	RLDC - Regional Load Dispatch Center
19.	RoW - Right of Way
20.	SCADA - Supervisory Control and Data Acquisition
21.	SERC - State Electricity Regulatory Commission
22.	SLDC - State Load Dispatch Center
23.	STU - State Transmission Utility
24.	TSP - Transmission Service Provider
25.	UGFO – Under Ground Fiber Optic Cable
26.	VoIP - Voice over Internet Protocol

Comprehensive guidelines for the usage and sharing of fiber cores of Optical Ground Wire (OPGW)/ Under Ground Fiber Optic (UGFO) Cable for power system applications

---

1. Introduction

1.1. These guidelines have been formulated to establish a uniform procedure for the sharing of fiber cores of Optical Ground Wire (OPGW)/ Under Ground Fiber Optic (UGFO) Cable deployed across the power transmission network, ensuring reliable, secure, and continuous monitoring and operation of the grid. They provide a comprehensive framework for fiber allocation, addressing the diverse needs of grid operations, system protection, as well as authorized commercial use. It establishes principles for effective resource allocation, maintaining sufficient redundancy to support future requirements, such as Loop-in-Loop-Out (LILO) expansions, network reconfiguration and scalability to accommodate evolving operational demands.

1.2. In alignment with the *Central Electricity Authority (Technical Standards for Communication System in Power System Operations) Regulations, 2020*, and the *Central Electricity Authority (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations, 2022*, these guidelines have been formulated to support seamless communication needs for power system at national level, regional level, inter-state and intra-state level. By fostering a consistent approach to fiber sharing and allocation, these guidelines intends to promote interoperability and efficiency across multiple entities and users within the power system, ensuring reliable and uninterrupted communication system, which is critical for grid stability and operations.

2. Allocation Requirements

2.1. On any transmission line, minimum of 6 fibers are always in use for critical grid communication, supporting Supervisory Control and Data Acquisition (SCADA), Phasor Measurement Unit (PMU), Voice over Internet Protocol (VoIP), Automatic Generation Control (AGC), and other real-time operations (2 Main, 2 Hot Standby, 2 Spares).

Additionally, for transmission lines requiring line differential protection:

- **4 fibers** are used for reliable differential protection of single feeder (S/c line).
- **8 fibers** are used for reliable differential protection of a double circuit (D/c) line.

2.2. Over and above these fibers which are already in use, the fibers that shall be spared for future grid communication requirements, based on need, is tabulated below:

Type of Future Grid Communication Requirements	**Fiber Allocation**	**Remarks**
Alternate Communication Path/Future expansion/Reconfiguration/LILO requirement/Inter-Utility Communication etc.	Upto 6 Fibers	Shall be spared as and when required for future grid communication requirements of ISTS/In-STS/ISGS/Radial feeders etc.

Type of Future Grid Communication Requirements	Fiber Allocation	Remarks
Line Differential Protection with future reconfiguration, if applicable.	Upto 4 Fibers per circuit	Shall be spared in case new differential protection schemes are required due to system expansion, reconfiguration or LILO additions.
Technology Migration/Centralised Asset Management & Control.	Upto 4 Fibers	Shall be spared for simultaneous transition to next-generation communication networks (e.g., packet-based systems).

Additional Considerations:

1. The actual number of healthy fiber cores to be spared free of cost for future grid telemetry requirements, within the limits stipulated in table above, shall be decided as and when the need arises.
2. **Commercial Utilisation of Fiber cores** –

   - While leasing excess fibers for **non-grid applications**, utilities/Transmission Service Providers (TSPs) must **reserve the right to intervene, seek withdrawal, or cease utilization of leased fibers** to address any emerging grid requirements. The contract to include flexibility for renewal or termination based on evolving needs.

   - The **number of fiber cores to be leased** and the **duration of leasing** must be planned in a rational way, such that, whenever the need arises to spare fibers for grid applications, their availability cannot be denied on the premise that the spare fibers are already leased out for commercial purpose. Additionally, under no circumstances should the routing of grid application data to the SLDC/RLDC (State/Regional Load Dispatch Centers) be adversely affected.

3. Commercial Utilization of OPGW Fibers for other purposes

3.1. While Optical Ground Wire (OPGW) is primarily implemented on transmission assets for telemetering power system parameters and ensuring reliable grid communication, spare fiber cores may be commercially utilized under the following conditions:

3.1.1. **Grid Applications Take Priority** – Spare fibers can be leased for commercial purposes, provided that whenever the need arises for grid applications, the number of cores within the limits stipulated in the Allocation Requirements, is made available without exception.

3.1.2. **Assessment of Future Grid Communication Needs –** Before leasing fiber cores, STUs/TSPs must conduct an assessment of impending grid communication requirements for atleast next five years. This assessment shall be holistic considering state/regional/national level requirements for routing of the data to SLDCs/RLDCs. STUs/TSPs intending to lease fiber cores to collaborate with CTU to discuss:

- Upcoming **grid expansion plans** and their communication requirements.
- Possible dependencies where **ISTS/STU networks need mutual data routing support**.
- The spare fiber capacity that should be **retained for future grid needs** before considering commercial leasing.

Based on this assessment, entities must determine **how many cores can be leased** and the **duration of leasing**, without affecting the availability for future grid applications.

3.1.3. **Termination Clause in Leasing Contracts** – All leasing contracts must include a termination clause, mandating at max 18 month notice period for making the fiber cores available for grid applications whenever required. This ensures that grid operator can reclaim the necessary fibers for critical grid operations with adequate notice. However, it is always advisable to retain some spare fibers for emergency or future grid communication needs in advance, rather than having to invoke the termination clause of the contract when the need arises.

3.1.4. **Regulatory Compliance** – Any commercial utilization of spare fibers must adhere to applicable CERC/SERC regulations pertaining to the 'Sharing of Revenue Derived from Utilization of Transmission Assets for Other Business.'

3.1.5. **Intimation to RPCs for ISTS Fiber Leasing** –

Any ISTS licensee/TSPs proposing to lease fiber cores on a commercial basis must provide prior intimation to the concerned Regional Power Committees (RPCs) regarding:

i. The number of fiber cores proposed for commercial utilization.
ii. The duration of the lease.
iii. The mechanism incorporated in the contract to ensure fiber availability in case of future grid requirements.

3.2. It must be emphasized that the primary purpose of fibers in OPGW/UGFO implemented as part of a transmission scheme is reliable telemetering of power system parameters. Commercial utilization of these transmission assets can only be done after a prudent evaluation of future grid communication needs, ensuring that grid operations are never compromised.

3.3. Proper planning and foresight are necessary to ensure that the commercial use of spare fibers does not jeopardize the security, reliability, and expansion needs of the power system communication network.

4. Sharing Scenarios

The table below outlines fiber-sharing arrangements across different transmission line ownership scenarios, ensuring that:

- Fibers essential for grid operations are spared free of cost, irrespective of whether they are required for Intra-State (InSTS) or Inter-State (ISTS) communication needs.
- Entities to spare healthy fibers, within the limits stipulated in the Allocation Requirements, whenever grid needs arise.

Scenario	**Entity to manage the allocation for grid operation purposes.**	**Fiber Sharing**
i) OPGW Laid Under ULDC Scheme on ISTS Lines	Owned and maintained by POWERGRID. Allocation to be managed by CTU.	Fibers to be **spared free of cost** as per Allocation Requirements outlined in Clause 2, whenever required by **STUs, ISTS Licensees/TSPs** for any type of future grid communication requirements.
ii) OPGW Laid Under ULDC Scheme on Intra-State Lines (InSTS)	Owned and maintained by POWERGRID. Allocation to be managed by STU with CTU coordination.	Fibers to be **spared free of cost** as per Allocation Requirements outlined in Clause 2, whenever required by **STUs, ISTS Licensees/TSPs** for any type of future grid communication requirements.
iii) OPGW Laid by STUs on Intra-State Lines	Owned and maintained by STU. Allocation to be managed by STU.	Fibers to be **spared free of cost** as per Allocation Requirements outlined in Clause 2, whenever required by **STUs, ISTS Licensees/TSPs** for any future grid communication requirements.
iv) OPGW Laid by CTU/POWERGRID on Intra-State Lines	Owned and maintained by POWERGRID. Allocation to be managed by CTU with STU coordination.	50% fibers allocated for **ISTS operations**, 50% for **Intra-State operations**. If more than 50% is required by either, fibers to be **spared free of cost**, for any type of future grid communication requirements.
v) OPGW Laid by TSPs on ISTS Lines under TBCB/RTM Projects	Owned and maintained by TSP. Allocation to be managed by CTU	Fibers to be **spared free of cost** as per Allocation Requirements outlined in Clause 2, whenever required by **STUs, ISTS Licensees/TSPs** for any type of

Scenario	Entity to manage the allocation for grid operation purposes.	Fiber Sharing
		future grid communication requirements.
vi) OPGW Laid by TSPs on Intra-State Lines through TBCB	Owned and maintained by TSP. Allocation to be managed by STU	Fibers to be **spared free of cost** as per Allocation Requirements outlined in Clause 2, whenever required by **STUs, ISTS Licensees/TSPs** for any type of future grid communication requirements.
vi) OPGW Laid by POWERGRID/STU's on Deemed ISTS Lines	Owned and maintained by POWERGRID/STU. Allocation to be managed by CTU with STU coordination.	50% fibers allocated for **ISTS operations**, 50% for **Intra-State operations**. If more than 50% is required by either, fibers to be **spared free of cost** for any type of future grid communication requirements.
vi) OPGW Laid by TSPs at their own cost, utilizing the ISTS asset/RoW, with necessary approvals from CERC.	Owned and maintained by TSP. Allocation to be managed by CTU, as the OPGW now, is forming integral part of backbone ISTS Communication network. It is assumed that: • No OPGW was included in the originally approved scheme for the transmission line. • The TSP obtained necessary approvals from the competent authority prior to laying the OPGW.	Fibers to be **spared free of cost** as per Allocation Requirements outlined in Clause 2, whenever required by **STUs, ISTS Licensees/TSPs** for any type of future grid communication requirements.

5. Integration of FOTE for Differential Protection

5.1. Differential teleprotection is a vital component of power system protection, ensuring rapid and selective fault clearance. The choice of communication medium, whether IEEE C37.94 (herein after referred as C37.94) protocol over a shared fiber or separate optical fibers, significantly impacts the reliability and performance of this protection scheme.

5.2. The choice between C37.94 compliant FOTE and separate fiber cores for differential teleprotection depends on a variety of factors, including line length, voltage level, criticality, and network conditions. While C37.94 can be a cost-effective solution for certain applications, separate fibers offer superior reliability and faster fault clearance, making them the preferred choice for critical transmission lines, especially at higher voltage levels.

5.3. The Regional Power Committees (RPCs) generally prioritize a **reliable and dedicated communication link for line differential protection** to ensure the integrity and security of protection signals, especially given the criticality of fast and accurate fault detection for power system stability.

5.4. While specific practices may vary depending on the line's voltage level, length, and criticality, however, in order to guarantee reliable communication for line differential protection systems, the Committee recommends the following provisions:

Condition	**Recommendation**	**Reason**
High-Criticality and High-Voltage Lines (220 kV and above) requiring line differential protection	Preference to dedicated or separate fiber cores for line differential protection rather than shared fibers.	As per IEC 60834, which governs teleprotection equipment, the RPCs lean towards using communication setups that meet high reliability and availability standards, favoring separate fibers to reduce signal attenuation and improve reliability for critical protection.
Lower-Criticality or lines with Voltage below 220 kV requiring line differential protection	Line differential protection may be allowed on shared fibers via Fiber Optic Terminal Equipment (FOTE) using the C37.94 protocol	Multiplexing protection signals over a shared fiber can be a cost-effective solution, particularly when the risk of latency and interference is lower due to shorter transmission distances and moderate fault current levels.
High-Criticality and High-Voltage Lines (220 kV and Above) requiring line differential protection. However, having constraint in availability of dedicated Optical fibers.	Line differential Protection using C37.94-compliant FOTE over shared fiber may be allowed with the following condition: • The setup must meet the provisions of IEC 60834 regarding speed, security, and dependability standards under real-time conditions.	By ensuring reliable and timely communication, C37.94-compliant FOTEs can contribute to meeting the requirements of IEC 60834.

6. Routing of OPGW Fibers during LILO

6.1. In case of Loop-In-Loop-Out (LILO) of transmission lines, routing OPGW fibers must be done in a way that preserves the operational integrity of the grid's communication infrastructure. Key recommendations are elucidated in table below:

Main Line and LILO Configuration	**LILO Tower Type**	**OPGW Installation Requirement**	**Fiber Routing/Splicing in New Substation**	**Configuration Adjustments in Existing Substations**
Main Line: D/c, 24-Fiber OPGW; S/c LILO	M/c Or D/c Tower (Single Tower for Loop In and Out) with two Earth wire peaks	Install 24 F OPGW on both earthwire peaks i.e same Nos. of OPGW as that of main line on both earth wire peaks.	Route required no. of fibers only through the new substation. Splice the required number of fibers for the LILO section at the appropriate point.	Configure protection schemes and data transfer systems to accommodate the new line and substation Ensure fiber continuity for main line traffic.
Main Line: D/c, 24-Fiber OPGW; D/c LILO	Two Separate D/c Towers (Separate Loop In and Out)	Install 24F OPGW i.e same Nos. of fiber cores as that of main line on one earthwire peak per tower.	Route all fibers of OPGW from the main line through the new substation. Splice the required number of fibers for the LILO line at the new substation, if the new S/stn is of different entity.	Configure protection schemes and data transfer systems to accommodate the new line and substation Ensure fiber continuity for main line's traffic through the new S/stn
Main Line: D/C, 24-Fiber OPGW; D/c LILO	Multi-Circuit Tower	Install 24 F OPGW on both earthwire peaks i.e same Nos. of OPGW as that of main line on both earth wire peaks.	Route all fibers of OPGW from the main line through the new substation. Splice the required number of fibers for the LILO line at the new substation, if the new S/stn is of different entity.	Configure protection schemes and data transfer systems to accommodate the new line and substation Ensure fiber continuity for main line's traffic through the new S/stn

Main Line and LILO Configuration	LILO Tower Type	OPGW Installation Requirement	Fiber Routing/Splicing in New Substation	Configuration Adjustments in Existing Substations
Main Line: D/c (220 kV/132 kV), 24-Fiber OPGW; S/c LILO	Tower with Singe Earth wire peak	Install 48F OPGW i.e., double the number of fiber cores as that of main line on single peak available in LILO portion	Route half number of fibers (12F) of OPGW from the main line through the new substation Splice the required number of fibers for the LILO section at the appropriate point.	Configure protection schemes and data transfer systems to accommodate the new line and substation. Ensure fiber continuity for main line traffic.
Main Line: S/C (220kV/132 kV), 24-Fiber OPGW; S/c LILO	Tower with Singe Earth wire peak	Install 48F OPGW i.e., double the number of fiber cores as that of main line on single peak available in LILO portion	Route all fibers (24F) of main line OPGW through the new substation to maintain continuity between the existing stations. Splicing of all the fibers at the new S/stn to be done to integrate LILO traffic.	Configure protection schemes and data transfer systems to accommodate the new line and substation. Ensure fiber continuity for main line's traffic through the new S/stn.

6.2. Whenever a Transmission Licensee implements a Loop-In-Loop-Out (LILO) arrangement on an existing transmission line, adjustments must be made in the **existing Substations**, including **Fiber Optic Terminal Equipment (FOTE)**, **relays**, and **other protection equipment** to ensure seamless integration and reliable protection.

Table summarizing LILO adjustments in existing Substations

Equipment	Adjustments Required	Details
Fiber Optic Terminal Equipment (FOTE)	Signal reconfiguration, routing modifications, capacity upgrades, synchronization, integration with new FOTE, supply of necessary optical	Ensure compatibility with new LILO traffic, enhance capacity if required, and synchronization with relays.

Equipment	Adjustments Required	Details
	interfaces to meet link budget requirement.	
Relays	Reconfiguration of protection schemes, distance zone adjustments, differential protection tuning.	Modify relay settings for fault detection across LILO, adjust impedance settings, and back-up coordination.
SCADA and Telemetry	Data routing, alarm configuration, SCADA system updates.	Integrate new LILO substation data into SCADA, configure additional alarms for LILO events.
Amplifiers/Signal Boosters	Installation if required, signal quality testing.	Ensure strong signal levels across LILO paths, perform attenuation checks.
Protection Redundancy	Ensure redundancy, perform testing and commissioning.	Verify that no single point of failure exists, conduct fault simulations, and document updated settings.

6.3. The entity undertaking the LILO installation and commissioning of the new substation shall ensure that all necessary adjustments, interfaces, and configuration support are implemented to maintain seamless data communication and reliable operation of protection schemes without signal degradation or loss. It is incumbent upon this entity to provide comprehensive support to the owner of the existing substation, facilitating integration and ensuring that all configuration and interoperability requirements are met to uphold continuous, high-integrity signal transmission and effective protection functionality across the network.

6.4. When the LILO is performed at the substation, the leased fiber cores, if any, by the main line owner must be routed continuously through the LILO section. Entity undertaking LILO cannot commercialize fibers routed for main line owner's use to prevent potential disputes.

7. Maintenance of Database:

7.1. CTU for ISTS/ STUs for InSTS shall be responsible for monitoring the utilization of OPGW fibers and ensuring compliance with the established conditions. The CTU/STU shall maintain a comprehensive database that clearly segregates:

1. **Total number of OPGW fiber cores:** The total number of fiber cores available on the OPGW of the transmission lines.
2. **Number of cores utilized for grid applications:** The number of fiber cores currently being used for essential grid operations
3. **Spare cores reserved for grid applications:** The number of fiber cores specifically retained for future grid applications.

4. **Number of fiber cores already being shared for grid applications:** The number of fiber cores shared with other grid entities (e.g., other TSPs, STUs, DISCOMs) for grid-related purposes. This should include details of the entities involved in each sharing arrangement.
5. **Number of cores leased on a commercial basis:** The number of fiber cores leased to entities for non-grid applications (e.g., telecom providers, internet service providers). This should include details of the lease agreements, including the lessee, lease period, and terms of termination.

7.2. CTU/STU shall prepare a standardized format/procedure for the TSPs/Licensees to furnish the above data pertaining to OPGW fibers. CTU/STU shall display the data on its website.

8. OPGW Implementation in New Transmission Projects and Upgradation Schemes

8.1. In all the new transmission projects and upgradation schemes, the Planning agency should ensure that any decision regarding deployment of fiber cores considers both present needs and future expansions, balancing the infrastructure's capability with associated costs.

8.2. Planning of OPGW with a minimum of 48 fiber cores to be done, as per feasibility and requirement. For installations within city limits, OPGW may be equipped with 96 fiber cores to also facilitate usage by DISCOMs, SLDCs, RLDCs, and NLDC for last-mile connectivity, contingent upon the load-bearing capacity of the line. This approach will accommodate any additional future requirements, including Loop-In-Loop-Out (LILO) configurations or increased capacity utilizing the same Right of Way (ROW).

8.3. Additionally, since OPGW fibers can also support long-distance telecommunications network across India, the planning exercise should also take into account the dynamics of the telecom industry while determining the number of fibers to be deployed.

8.4. This strategy will facilitate the establishment of a robust, scalable communication network while maintaining efficiency and responsiveness to evolving operational needs across all areas.

9. Implementation Strategy for Existing ISTS/ InSTS Lines

9.1. Any ISTS TSP/In-STS utility/entity planning to lease out spare fiber cores of its OPGW on existing lines on commercial basis shall adhere to all the provisions and framework for fiber sharing and usage, as outlined in these guidelines.

9.2. For TSPs/utilities that have already leased out fiber cores before the issuance of these guidelines, it is expected that, as and when the need arises to spare fibers for grid applications, they will explore all possible means to make available the minimum no. spare fibers that can serve the purpose, free of cost. In cases where conflicts or stalemate arises regarding the availability of requisite number of fibers, a resolution committee shall be formed. This committee will include representatives from the RPCs, PSCD Division of CEA, CTU, concerned STUs /TSPs , with the goal of resolving the issue in a fair and balanced manner.

10. Conclusion

10.1. These guidelines aim to establish a standardized approach to the allocation and sharing of Optical Ground Wire (OPGW) fibers across power sector, ensuring secure, reliable, and scalable communication infrastructure that meets both present and future grid requirements. By implementing uniform principles for fiber allocation and usage, entities across the power sector—including CTU, STU, TSPs, DISCOMs, SLDCs, RLDCs, and NLDCs—can achieve consistent and efficient communication system for grid operations, protection, and commercial applications. These guidelines provide a clear and standardized framework for the allocation and sharing of Optical Ground Wire (OPGW) fibers, balancing the commercial prospects of fiber usage with the imperative of maintaining secure, reliable, and scalable grid operations.

11. Brief of Recommendations for Adoption

11.1. Uniform Fiber Allocation

Entities should adhere to this fiber allocation guidelines/framework for grid operations, ensuring designated fibers for essential communication and protection. Excess fibers may be designated for commercial use, subject to periodic review and regulatory oversight, thereby maximizing resource utilization without compromising the grid stability.

11.2. Compliance with CEA Regulations

All implementations should align with the CEA (Technical Standards for Communication System in Power System Operations) Regulations, 2020 , CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations, 2022, CERC Interface Requirements and CEA Cyber Security Guidelines, to promote standardized, high-quality communication infrastructures across the power transmission networks.

11.3. Scalability for Future Needs

In areas with high potential for future growth or within city limits, entities are encouraged to install OPGW with 48/96 fiber cores to provide sufficient capacity for last-mile connectivity, future expansions, and LILO requirements, leveraging the Right of Way (ROW) effectively.

11.4. Commercial Usage Protocol

Any commercial usage should adhere to the applicable CERC/SERC Regulations. All leasing contracts must include a termination clause, mandating at max of 18-month notice period for making the fiber cores available for grid applications whenever required. This ensures that grid operator can reclaim the necessary fibers for critical grid operations with adequate notice. However, it is always advisable to retain spare fibers for emergency or future grid communication needs in advance, rather than having to invoke the termination clause of the contract when the need arises.

11.5. **Coordination and Monitoring**

For LILO implementations and OPGW installations in new and upgraded transmission schemes, the entity responsible for installation of the same must provide continuous support to existing substations, facilitating configuration adjustments and ensuring reliable data transfer. Continuous monitoring by CTU is recommended to assess the impact of commercial use and maintain high standards of operational reliability.

These recommendations will ensure that all stakeholders in power system communication can operate within a unified framework, promoting efficiency, compliance, and grid security.

----------x----------

Composition of the Committee constituted under the chairmanship of Member (Power System), CEA tasked with formulating comprehensive guidelines for the usage and sharing of optical fibers (OPGW) for power system applications:

S.no	Members	Organisation/Association
1.	Member (Power System) (Chair)	CEA
2.	Chief Engineer, PCD	CEA
3.	Chief Engineer, NPC	CEA
4.	Chief Engineer, ET & I	CEA
5.	Member Secretary, RPCs	RPCs
6.	Executive Director, CTU	CTU
7.	Executive Director, Grid India	GridIndia
8.	Executive Director, Powergrid	Powergrid
9.	Representative of Electric Power Transmission Association – 2 TSPs	EPTA
10.	Representative from STUs (at the level of Chief Engineer or equivalent)	• Northern Region: UPPCL, RRVPNL • Western Region: GETCO, MPPTCL •Southern Region: KSEBL,TANTRANSCO • Eastern Region: WBSETCL, OPTCL • North Eastern Region: AEGC

The Terms of Reference (ToR) of the Committee is as follows:

1) **Scope and Purpose:** Define the need to develop guidelines that address the unique requirements and challenges associated with the sharing of OPGW fibers among CTU, STUs, and Private Transmission Licensees.

2) **Allocation Requirements:** Define/determine the number of fibers required for catering to varied applications/services for grid management such as data, speech, protection etc., including minimum spare fibres to be earmarked for grid applications/requirements.

3) **Sharing Scenarios**: Analyse the scenarios wherein the spare fibers in the OPGW laid by an entity is to be shared amongst several entities (CTU, STU, TSPs) to facilitate real time grid monitoring. Formulating the uniform mechanism governing the access, usage, or other aspects of the shared fibers in following scenarios:

(i) Sharing of OPGW laid under ULDC scheme on the ISTS lines.
(ii) Sharing of OPGW laid under ULDC scheme on the Intra-State lines.
(iii)Sharing of OPGW laid by STUs on the Intra State lines.
(iv)Sharing of OPGW laid by CTU/Powergrid on the Intra State lines.
(v) Sharing of OPGW on the ISTS lines laid by TSPs under TBCB and RTM projects.

Identify and define the role and responsibilities of Centre, State, and Private Transmission Licensees in the sharing of OPGW fibers.

4) Investigate the integration of Fiber Optic Terminal Equipment (FOTE) for differential protection in accordance with the C37.94 protocol and bring out recommendations.

5) Define the uniform mechanism of routing of OPGW fibers in case of LILO taken up on any transmission line.

6) Recommend the scenarios/limit of OPGW fibers beyond which it can be utilized for other commercial purposes.

7) Formulate recommendations for seamless adoption of these guidelines.

Nominated Members of the Committee

S. No.	Nominated Member's Name	Designation	Division & Organisation
1.	Shri A K Rajput	Member (Power Systems)	Central Electricity Authority
2.	Shri V K Singh	Member Secretary	NRPC, CEA
3.	Shri Asit Singh	Member Secretary	SRPC, CEA
4.	Shri N S Mondal	Member Secretary	ERPC, CEA
5.	Shri Deepak Kumar	Member Secretary	WRPC, CEA
6.	Shri K B Jagtap	Member Secretary	NERPC, CEA
7.	Smt Rishika Sharan	Chief Engineer	NPC, CEA
8.	Shri Surata Ram	Chief Engineer	ET&I, CEA
9.	Shri S K Maharana	Chief Engineer	PSCD, CEA
10.	Shri J B Len	SE	SRPC, CEA
11.	Shri Shiv K Gupta	Sr. DGM	Comm, CTUIL
12.	Shri Ankur Gulati	DGM	GRID-INDIA
13.	Shri. Doman Yadav	Executive Director	Grid Automation & Communication (GA&C), Powergrid
14.	Smt S.Kannika Parameswari	Chief Engineer	P&C, TANTRANSCO
15.	Shri. Viju Rajan John	Chief Engineer	Transmission System Operation, KSEBL
16.	Shri Binaya Ku Mallick	DGM(Telecom)	E & Q, OPTCL,HQRS
17.	Shri N. K Patel	SE (Telecom)	TR Department, Corporate Office, GETCO, Vadodara
18.	Shri R. B Kathiria	EE (Telecom),	Telecom Unit, 220kV S/s, GETCO, Gondal
19.	Shri Jayesh A Mehta	DE (Telecom)	Telecom Unit, 220kV S/s, GETCO, Ranasan
20.	Shri Arup Sarmah	AGM	LA Communication Division, Kahilipara, AEGCL
21.	Smt. Punam Biswakarma	AGM	CA Communication Division, Samaguri, AEGCL
22.	Shri Ashutosh Bhattacharjee	GM	(T&C and Comm.)
23.	Shri Rajesh Gupta	SE (SLDC)	MPPTCL
24.	Shri Sudhir Nema	SE (Planning)	MPPTCL

S. No.	Nominated Member's Name	Designation	Division & Organisation
25.	Smt. Kshama Shukla	EE (P&D)	MPPTCL
26.	Shri Debasis Sarkar	Chief Engineer	Communication Department, WBSETCL
27.	Shri Vivek Dixit	Chief Engineer	Sanchar and Niyantran, UPPTCL
28.	Shri Sanjay Johari	VP	Business Development & Adani Energy Solutions Ltd.
29.	Shri Tarun Tayal	Head- Govt. Alliances and Partnerships	Sterlite Power

Special Invitee - Power System Technology Development Division, CEA

Annexure-III

सत्यमेव जयते

भारतसरकार
Government of India
विद्युतमंत्रालय
Ministry of Power
उत्तरक्षेत्रीयविद्युतसमिति
Northern Regional Power Committee

Date: 02.04.2025

To,

1. Chief Engineer, HPSLDC
2. Chief Engineer, BBMB
3. Chief Engineer, SLDC, PSTCL
4. Chief Engineer, SLDC, RVPN
5. Chief Engineer, UPSLDC
6. Chief Engineer, JKSLDC
7. Chief Engineer, SLDC, HVPNL
8. General Manager, SLDC, DTL
9. ED, NRLDC
10. Dy. COO, CTUIL
11. ED, GA&C, POWERGRID
12. CGM, POWERGRID- NR1
13. Business Unit Head (Grid Software), Siemens

विषय: Minutes of Special Telemetry, SCADA and Telecommunication (TeST) Sub-Committee Meeting held on 24.03.2025 -reg.

महोदय,

A Special Telemetry, SCADA and Telecommunication (TeST) Sub-Committee Meeting was held on 24.03.2025 in NRPC conference room. The minutes of meeting is enclosed herewith for your kind perusal.

भवदीय

Signed by Praveen Jangra
Date: 02-04-2025 16:58:16
प्रवीण जाँगड़ा

कार्यपालक अभियंता (संचार)

18-ए, शहीदजीतसिंहमार्ग, कटवारियासराय, नईदिल्ली- 110016 फोन:011-26513265 ई-मेल: sec -nrpc@nic.in वेबसाईट: http://164.100.60.165
18-A, Shaheed Jeet Singh Marg, Katwaria Sarai, New Delhi-110016 Phone: 011-26513265e- mail: sec-nrpc@nic.in Websitehttp://164.100.60.165

Minutes of Special TeST Meeting held on 24.03.2025

MS, NRPC welcomed all the participants for the special TeST meeting.

1 AMC extension of SCADA/EMS system in SLDCs of NR states (Agenda by RVPN)

EE, NRPC apprised the agenda before the members. Representative from SIEMENS was asked to give the presentation on the agenda.

SIEMENS explained that the new AMC proposal includes comprehensive coverage, extending to hardware. SIEMENS cited the system's aging infrastructure and limited OEM support as reasons for the price escalation. Additionally, SIEMENS informed that as suggested by POWERGRID, centralized hardware storage is proposed to optimize costs rather than maintaining hardware at individuals control centres.

POWERGRID stated that ULDC Phase-III is expected to be completed by December 2025, followed by a three-month parallel operation. SIEMENS stated that in the present AMC proposal, that there are two AMC options: a 12-month term with option of quarterly extension at same T&C or an 18-month commitment at a discounted rate.

After discussion, NR constituents agreed upon 12-month AMC period, considering that present AMC expiries varied across constituents and also considering the implementation status of ULDC Phase-III. It was also decided that further AMC extensions would be considered as per individual utility's requirement.

SIEMENS explained the AMC cost break-up, covering manpower, project management, hardware components etc. SIEMENS also mentioned that software license fee and royalty charges is also a major component of proposed AMC cost. Constituents requested a more detailed cost break-up for management justification, SIEMENS agreed to provide by 31.03.2025.

Also, SIEMENS stated that since present AMC of some NR constituents is expiring on 31.03.2025, constituents need to intimate POWERGRID/SIEMENS for continuation of AMC before 31.03.2025, so that existing AMC team is not withdrawn from sites.

After detailed discussion following was concluded:

1. SIEMENS to provide a detailed justification in terms of price break up before 31.03.2025
2. Since, the project is a single package, a common **12-month AMC with a provision for quarterly extensions** was opted by SLDCs/BBMB.
3. SLDCs/BBMB to inform POWERGRID/SIEMENS about AMC continuation before **31.03.2025**

2 Fiber sharing on STU links for redundant communication (Agenda by NRPC)

EE, NRPC apprised the forum about the requirement for STU links to enhance redundant communication. Matter has been discussed previously in several TeST meetings and sharing is required from following: in UP, Uttarakhand and J&K for the specific links mentioned in the agenda.

He further stated that since the guidelines for fiber sharing have been issued and are now available with states, they may take further action accordingly. UPSLDC stated that since guidelines were recently issued, they are still in the discussion phase.

MS, NRPC suggested that states may take up to **two months** to review the guidelines and communicate for further course of action for fibre sharing and checking healthiness of fibres.

MS, NRPC requested CTU to send a follow-up letter in view of the newly issued guidelines.

3 OPGW installation on existing 400 kV Sikar (PG) – Agra (PG) D/c line (owned by PG) which is proposed to be LILOed at 400 kV GSS Kumher (RVPN) (Agenda by CTUIL)

EE, NRPC introduced the agenda and discussions held in 78th NRPC meeting held on 16th-17th March 2025 where '*CTU apprised that data, voice & protection requirements of* Agra and Sikar S/s are *being met through other routes from their respective nodes whereas the same for Kumher S/s of RVPN is being explored yet.'*

Rajasthan SLDC apprised *data, voice & protection requirements of* Kumher S/s is envisaged to be met through Agra end or Sikar end.

On enquiry of MS, NRPC whether fiber connectivity from Kumher S/s could be provided from either end, i.e. Agra or end, CTU stated that OPGW should be laid on whole section of **400kV Sikar (PG) – Agra (PG) D/c line** citing CEA (Technical Standards for Construction of Electric Plants and Lines), 2022, under Chapter IV, PART-A "SUBSTATIONS AND SWITCHYARDS (66 kV AND ABOVE)" Clause 48 , sub clause (5), which states that:

"

Optical Ground Wire and Power Line Carrier Communication. —

(a) Optical Ground Wire along with necessary terminal equipment shall be provided on transmission lines of voltage rating of 110 kV and above for speech transmission, line protection, and data channels.

(b) The primary path for tele-protection shall be on point-to-point Optical Ground Wire and alternative path shall be either on Power Line Carrier Communication or predefined physically diversified Optical Ground Wire paths.

"

CTU also mentioned CEA letter dated 22.05.2024 regarding "Compliance with CEA (Technical Standards for Construction of Electric Plants and Lines), 2022 - Installation of Optical Ground Wire on Transmission Lines – reg", which requires all upcoming lines of STU and ISTS should envisage OPGW installation.

Members agreed with CTU's proposed scheme of Installation of 48 Fiber OPGW on existing 400 kV Sikar (PG) – Agra (PG) D/c line (owned by PG) (386 Km) including Repeater which is proposed to be LILOed at 400 kV GSS Kumher (RVPN) including FOTE at Sikar S/s (PG) & Agra S/s (PG).

Meeting ended with vote of thanks

*****

List of participants: -

NRPC Sectt.

1. Sh. V. K. Singh, Member Secretary
2. Sh. Anzum Parwej, Superintending Engineer
3. Sh. Praveen Jangra, Executive Engineer
4. Smt. Priyanka Patel, Manager, POWERGRID

NRLDC

5. Sh. M. M. Hassan, Chief General Manager (SL)
6. Sh. Paritosh Patnak, Manager

UPSLDC

7. Sh. Amit Narain, Superintending Engineer

Grid-India

8. Sh. Mahesh Kumar, General Manager
9. Sh. Ashok Kumar, General Manager

CTUIL

10. Sh. Tej Prakash Verma, Deputy General Manager
11. Sh. Prakhar Pathak, Engineer
12. Sh. Anshul Mahawar, ET

HVPN

13. Sh. Er. Sushil Kumar, Superintending Engineer
14. Sh. Er. A. P. Singh, Executive Engineer
15. Sh. Er. Anshu Jain, Assistant Engineer

RVPN

16. Sh. Sudhir Jain, Chief Engineer
17. Sh. Manish Athaiya, Superintending Engineer

POWERGRID

18. Sh. Doman Yadav, Executive Director (GA&C)
19. Sh. Arun Kumar Singh, Sr. General Manager
20. Sh. Narendra Kumar Meena, Deputy General Manager

HPSLDC

21. Sh. Rakesh C. Negi, Superintending Engineer
22. Sh. Er. Sanjay Raneet, Sr. Executive Engineer

SIEMNS LTD.

23. Sh. Namit Kumar, Head SOL Business
24. Sh. Sumit Bhatnagar, Senior Manager GSW SOL
25. Sh. Rahul Murada, SIEMNS

DTL, SLDC

26. Sh. Vinay Kumar Jaiswal, Assistant General Manager

PSTCL

27. Sh. Sunder, Deputy Chief Engineer/ SLDC (OA)
28. Sh. Ankit Bedi, Sr. Executive Engineer/ SLDC (OA)
29. Sh. Mandeep Micky, Sr. Executive Engineer

JKPTCL, Jammu

30. Sh. Vikas Anand, Chief Engineer

BBMB

31. Smt. Ruchi Sharma, Director/ PR
32. Sh. Gurpreet Singh, Deputy. Director / LD-2
33. Sh.Ansh Jain, Assistant Director

सेंट्रल ट्रांसमिशन यूटिलिटी ऑफ इंडिया लिमिटेड
(पावर ग्रिड कॉर्पोरेशन ऑफ इंडिया लिमिटेड के स्वामित्व में)
(भारत सरकार का उद्यम)
CENTRAL TRANSMISSION UTILITY OF INDIA LTD.
(A wholly owned subsidiary of Power Grid Corporation of India Limited)
(A Government of India Enterprise)

Ref: C/CTU/Comm/PTCUL/01 08.11.2023

Er. Anupam Singh,
Chief Engineer (SCADA & SLDC)
Power Transmission Corporation of Uttarakhand Ltd.
Dehradun-24800,
Uttarakhand

Sub: Regarding Fibre Sharing on PTCUL lines for ULDC purpose for redundant communication of Pithoragarh (PG) and Sitarganj (PG) stations

Sir,

This is with reference to 23rd meeting of Telecommunication, SCADA & Telemetry Sub Committee (TeST) of NRPC held on 21.09.23 in virtual mode. The Minutes of Meetings (MoM) were issued on 23.10.2023 and are attached with this letter. In the meeting redundant communication of Pithoragarh(PG) and Sitarganj(PG) was deliberated at para 22.1(Sr. No. 8) of MoM.

Further, in the meeting it was deliberated that CTUIL shall write a letter to PTCUL for fibre sharing on their OPGW links to provide redundant communication links as under:

A. Fibre Sharing requirement for Pithoragarh (PG)

Pithoragarh (PG) is presently connected to RLDC with radial path via Jauljivi(ISTS), redundant path of Pithoragarh(PG) can be created via PTCUL OPGW network, PTCUL to share atleast 6 nos. of fibers for ULDC purpose on the following links:

1. Pithoragarh (PG) – Pithoragarh (PTCUL)
2. Pithoragarh (PTCUL) – Almora
3. Almora -bhawoli
4. bhawoli -Haldwani
5. Haldwani -220kv Kamalwaganj
6. 220kv Kamalwaganj - pantnagar
7. Pantnagar - 400kv Kashipur (PTCUL)

At Kashipur (PTCUL), ISTS FOTE is available which is further connected with Bareiley(PG) through ISTS link.

It is understood that links mentioned at 1 & 2 above are in the process of implementation, same may be expedited at your end in order to establish the said redundant path at the earliest.

B. Fibre Sharing requirement for Sitarganj(PG)

Sitarganj (PG) is presently connected to RLDC with radial path via CB Ganj (UP Network), redundant path of Sitarganj (PG) can be created via PTCUL OPGW network, PTCUL to share atleast 6 nos. of fibers for ULDC purpose on the following links:

1. Sitarganj(PG) - Sitarganj(PTCUL)
2. Sitarganj(PTCUL) - Kiccha
3. Kiccha - Rudrapur
4. Rudrapur - Pantnagar
5. Pantnagar – Kashipur (PTCUL)

At Kashipur (PTCUL), ISTS FOTE is available which is further connected with Bareiley(PG) through ISTS link.

It is to be mentioned that fibre required on PTCUL links shall be solely used for ULDC & Grid Management purpose.

After receiving the confirmation of fibre sharing from PTCUL, scheme shall be prepared by CTUIL and put up for approval in NCT after getting views of NRPC.

It is requested that PTCUL may provide their consent to CTUIL with copy to NRPC so that scheme shall be finalised at earliest.

Thanking you,

Yours faithfully,

(H S Kaushal)
Sr. GM (CTUIL)

CC:

1. Member Secretary Northern Regional Power Committee 18A, Shaheed Jeet Singh Sansanwal Marg, Katwaria Sarai, New Delhi – 110 016	**2. Er. D.P. Singh,** Superintendent Engineer (SCADA), Power Transmission Corporation of Uttarakhand Ltd. Haldwani-263139, Uttarakhand

सेंट्रल ट्रांसमिशन यूटिलिटी ऑफ इंडिया लिमिटेड
(पावर ग्रिड कॉर्पोरेशन ऑफ इंडिया लिमिटेड के स्वामित्व में)
(भारत सरकार का उद्यम)
CENTRAL TRANSMISSION UTILITY OF INDIA LTD.
(A wholly owned subsidiary of Power Grid Corporation of India Limited)
(A Government of India Enterprise)

Ref: C/CTU/Comm/PTCUL/02 09.04.2025

Er. Anupam Singh,
Chief Engineer (SCADA & SLDC)
Power Transmission Corporation of Uttarakhand Ltd.
Dehradun-24800,
Uttarakhand

Sub: Regarding Fibre Sharing on PTCUL links for providing redundant communication to Pithoragarh (PG) and Sitarganj (PG) stations

Sir,

This is with reference to our earlier letter dtd. 08.11.2023 (attached at Annexure-I) regarding sharing of fibers from PTCUL links for providing redundant communication to Pithoragarh (PG) & Sitarganj (PG) ISTS Nodes.

A. Fibre Sharing requirement for Pithoragarh (PG)

Pithoragarh (PG) is presently connected to RLDC with radial path via Jauljivi (ISTS), redundant path of Pithoragarh (PG) can be created via PTCUL OPGW network, PTCUL to share 6 nos. of fibers for ISTS communication purpose on the following links:

1. Pithoragarh (PG) – Pithoragarh (PTCUL)
2. Pithoragarh (PTCUL) – Almora
3. Almora -bhawoli
4. bhawoli -Haldwani
5. Haldwani -220kv Kamalwaganj
6. 220kv Kamalwaganj - pantnagar
7. Pantnagar - 400kv Kashipur (PTCUL)

B. Fibre Sharing requirement for Sitarganj (PG)

Sitarganj (PG) is presently connected to RLDC with radial path via CB Ganj (UP Network), redundant path of Sitarganj (PG) can be created via PTCUL OPGW network, PTCUL to share 6 nos. of fibers for ISTS communication purpose on the following links:

1. Sitarganj (PG) - Sitarganj (PTCUL)
2. Sitarganj (PTCUL) - Kiccha
3. Kiccha - Rudrapur
4. Rudrapur - Pantnagar
5. Pantnagar – Kashipur (PTCUL)

It is to mention that CEA has issued guidelines "*Comprehensive guidelines for the usage and sharing of fiber cores of Optical Ground Wire (OPGW)/ Under Ground Fiber Optic (UGFO) Cable for power system applications*" by letter dtd 03.03.2025 (attached at Annexure-II). The matter was explained by CEA during the 78th NRPC Meeting.

Further, in the Special TeST Meeting held on 24.03.2025 (MOM attached at Annexure-III) under the chairmanship of MS NRPC, it was decided that CTU shall write a follow up letter to PTCUL in this regard.

It is requested that PTCUL shall give their consent as per the above said in order to finalize the scheme to provide redundant communication to above said stations.

Thanking you,

Yours faithfully,

(H S Kaushal)
Sr. GM (CTUIL)

CC:

1. Member Secretary Northern Regional Power Committee 18A, Shaheed Jeet Singh Sansanwal Marg, Katwaria Sarai, New Delhi – 110 016	**2. Er. D.P. Singh,** Superintendent Engineer (SCADA), Power Transmission Corporation of Uttarakhand Ltd. Haldwani-263139, Uttarakhand

Annexure-I

सेंट्रल ट्रांसमिशन यूटिलिटी ऑफ इंडिया लिमिटेड
(पावर ग्रिड कॉर्पोरेशन ऑफ इंडिया लिमिटेड के स्वामित्व में)
(भारत सरकार का उद्यम)
CENTRAL TRANSMISSION UTILITY OF INDIA LTD.
(A wholly owned subsidiary of Power Grid Corporation of India Limited)
(A Government of India Enterprise)

Ref: C/CTU/Comm/PTCUL/01 08.11.2023

Er. Anupam Singh,
Chief Engineer (SCADA & SLDC)
Power Transmission Corporation of Uttarakhand Ltd.
Dehradun-24800,
Uttarakhand

Sub: Regarding Fibre Sharing on PTCUL lines for ULDC purpose for redundant communication of Pithoragarh (PG) and Sitarganj (PG) stations

Sir,

This is with reference to 23rd meeting of Telecommunication, SCADA & Telemetry Sub Committee (TeST) of NRPC held on 21.09.23 in virtual mode. The Minutes of Meetings (MoM) were issued on 23.10.2023 and are attached with this letter. In the meeting redundant communication of Pithoragarh(PG) and Sitarganj(PG) was deliberated at para 22.1(Sr. No. 8) of MoM.

Further, in the meeting it was deliberated that CTUIL shall write a letter to PTCUL for fibre sharing on their OPGW links to provide redundant communication links as under:

A. Fibre Sharing requirement for Pithoragarh (PG)

Pithoragarh (PG) is presently connected to RLDC with radial path via Jauljivi(ISTS), redundant path of Pithoragarh(PG) can be created via PTCUL OPGW network, PTCUL to share atleast 6 nos. of fibers for ULDC purpose on the following links:

1. Pithoragarh (PG) – Pithoragarh (PTCUL)
2. Pithoragarh (PTCUL) – Almora
3. Almora -bhawoli
4. bhawoli -Haldwani
5. Haldwani -220kv Kamalwaganj
6. 220kv Kamalwaganj - pantnagar
7. Pantnagar - 400kv Kashipur (PTCUL)

At Kashipur (PTCUL), ISTS FOTE is available which is further connected with Bareiley(PG) through ISTS link.

It is understood that links mentioned at 1 & 2 above are in the process of implementation, same may be expedited at your end in order to establish the said redundant path at the earliest.

B. Fibre Sharing requirement for Sitarganj(PG)

Sitarganj (PG) is presently connected to RLDC with radial path via CB Ganj (UP Network), redundant path of Sitarganj (PG) can be created via PTCUL OPGW network, PTCUL to share atleast 6 nos. of fibers for ULDC purpose on the following links:

1. Sitarganj(PG) - Sitarganj(PTCUL)
2. Sitarganj(PTCUL) - Kiccha
3. Kiccha - Rudrapur
4. Rudrapur - Pantnagar
5. Pantnagar – Kashipur (PTCUL)

At Kashipur (PTCUL), ISTS FOTE is available which is further connected with Bareiley(PG) through ISTS link.

It is to be mentioned that fibre required on PTCUL links shall be solely used for ULDC & Grid Management purpose.

After receiving the confirmation of fibre sharing from PTCUL, scheme shall be prepared by CTUIL and put up for approval in NCT after getting views of NRPC.

It is requested that PTCUL may provide their consent to CTUIL with copy to NRPC so that scheme shall be finalised at earliest.

Thanking you,

Yours faithfully,

(H S Kaushal)
Sr. GM (CTUIL)

CC:

1. Member Secretary Northern Regional Power Committee 18A, Shaheed Jeet Singh Sansanwal Marg, Katwaria Sarai, New Delhi – 110 016	**2. Er. D.P. Singh,** Superintendent Engineer (SCADA), Power Transmission Corporation of Uttarakhand Ltd. Haldwani-263139, Uttarakhand

Annexure-II

सत्यमेव जयते

भारत सरकार
Government of India
विद्युत मंत्रालय
Ministry of Power
केन्द्रीय विद्युत प्राधिकरण
Central Electricity Authority
विद्युत संचार विकास प्रभाग
Power System Communication Development Division
****

Subject: Comprehensive guidelines for the usage and sharing of optical fibers of OPGW/UGFO cables for power system applications - reg

महोदय / Sir,

The rapid expansion and modernization of the power sector necessitate a robust, secure and efficient communication infrastructure. Optical Ground Wire (OPGW)/Underground Fiber Optic Cable (UGFO) plays a crucial role in ensuring seamless data exchange, real-time monitoring, and reliable operation of power systems. However, with increasing demands and multiple stakeholders involved in fiber usage, it became essential to establish a structured framework governing the sharing and utilization of fiber cores of OPGW/UGFO cable.

A Committee was constituted under the chairmanship of Member (Power System), CEA tasked with formulating comprehensive guidelines for the usage and sharing of fiber cores of Optical Ground Wire (OPGW)/ Under Ground Fiber Optic (UGFO) Cable for power system applications.

With the collective efforts of the Committee, CEA has formulated Comprehensive guidelines for the usage and sharing of fiber cores of Optical Ground Wire (OPGW)/ Under Ground Fiber Optic (UGFO) Cable for power system applications. The list of nominated members and the Terms of Reference of the Committee are attached as Annexure to the guidelines.

It is requested that all utilities/TSPs, power system stakeholders, and users to adopt and adhere to these guidelines.

भवदीय,
Signed by Suman Kumar Maharana
Date: 03-03-2025 13:13:55
(S K Maharana)
Chief Engineer,
Power System Communication Development Division,
Central Electricity Authority

Comprehensive guidelines for the usage and sharing of fiber cores of Optical Ground Wire (OPGW)/ Under Ground Fiber Optic (UGFO) Cable for power system applications

भारत सरकार
Government of India

केन्द्रीय विद्युत प्राधिकरण
Central Electricity Authority

विद्युत मंत्रालय
Ministry of Power

February 2025

Acknowledgement

The rapid expansion and modernization of the power sector necessitate a robust, secure and efficient communication infrastructure. Optical Ground Wire (OPGW)/Underground Fiber Optic Cable (UGFO) plays a crucial role in ensuring seamless data exchange, real-time monitoring, and reliable operation of power systems. However, with increasing demands and multiple stakeholders involved in fiber usage, it became essential to establish a structured framework governing the sharing and utilization of OPGW fibers.

The formulated guidelines establish a structured approach to fiber allocation, safeguarding power system communication needs and mitigating future conflicts. These guidelines also ensure that commercial leasing of fiber cores is managed in a way that does not hinder the grid's operational efficiency and reliability.

A committee was constituted with the approval of the Chairperson, CEA, to formulate comprehensive guidelines for the usage and sharing of fiber cores of OPGW/UGFO cable for power system applications. The complete list of the nominated members of the Committee as well as Terms of Reference of the Committee has been annexed with the guidelines.

As the Convenor of the Committee, I express my deepest gratitude to all committee members for their invaluable contributions in shaping these guidelines. Their collective efforts have resulted in a standardized framework that will ensure transparency and efficiency in the usage and sharing of OPGW fiber infrastructure. The technical insights and dedication of all Committee members have played a crucial role in developing these comprehensive guidelines, which will significantly mitigate conflicts and enhance the reliability of grid communications.

I extend special thanks to Shri Ghanshyam Prasad, Chairperson, CEA, for his vision and leadership in constituting this Committee. I am also grateful to Shri A K Rajput, Member (Power Systems), CEA, for chairing the Committee and steering discussions towards a balanced and effective outcome.

Furthermore, I would like to acknowledge the specific contribution made by the officers of Power System Communication Development Division, CEA namely Ms. Priyam Srivastava, Deputy Director; Shri Akshay Dubey, Deputy Director and Shri Arjun Agarwal, Assistant Director. The guidelines have been brought out by the dedicated and sincere efforts of these officers.

Shri S K Maharana,
Chief Engineer, PSCD Division & Convenor of the Committee

Table of Contents

Abbreviations:

1.	AGC - Automatic Generation Control
2.	CERC - Central Electricity Regulatory Commission
3.	CTU - Central Transmission Utility
4.	FOTE - Fiber Optic Terminal Equipment
5.	GSS - Grid Substation
6.	IEEE - Institute of Electrical and Electronics Engineers
7.	IEC - International Electrotechnical Commission
8.	InSTS - Intra-State Transmission System
9.	IPPs - Independent Power Producers
10.	ISGS - Inter-State Generating Station
11.	ISTS - Inter-State Transmission System
12.	LILO - Loop-in-Loop-Out
13.	NLDC - National Load Dispatch Center
14.	NoC - No Objection Certificate
15.	OPGW - Optical Ground Wire
16.	PMU - Phasor Measurement Unit
17.	PSCD - Power System Communication and Development
18.	RLDC - Regional Load Dispatch Center
19.	RoW - Right of Way
20.	SCADA - Supervisory Control and Data Acquisition
21.	SERC - State Electricity Regulatory Commission
22.	SLDC - State Load Dispatch Center
23.	STU - State Transmission Utility
24.	TSP - Transmission Service Provider
25.	UGFO – Under Ground Fiber Optic Cable
26.	VoIP - Voice over Internet Protocol

Comprehensive guidelines for the usage and sharing of fiber cores of Optical Ground Wire (OPGW)/ Under Ground Fiber Optic (UGFO) Cable for power system applications

---

1. Introduction

1.1. These guidelines have been formulated to establish a uniform procedure for the sharing of fiber cores of Optical Ground Wire (OPGW)/ Under Ground Fiber Optic (UGFO) Cable deployed across the power transmission network, ensuring reliable, secure, and continuous monitoring and operation of the grid. They provide a comprehensive framework for fiber allocation, addressing the diverse needs of grid operations, system protection, as well as authorized commercial use. It establishes principles for effective resource allocation, maintaining sufficient redundancy to support future requirements, such as Loop-in-Loop-Out (LILO) expansions, network reconfiguration and scalability to accommodate evolving operational demands.

1.2. In alignment with the *Central Electricity Authority (Technical Standards for Communication System in Power System Operations) Regulations, 2020*, and the *Central Electricity Authority (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations, 2022*, these guidelines have been formulated to support seamless communication needs for power system at national level, regional level, inter-state and intra-state level. By fostering a consistent approach to fiber sharing and allocation, these guidelines intends to promote interoperability and efficiency across multiple entities and users within the power system, ensuring reliable and uninterrupted communication system, which is critical for grid stability and operations.

2. Allocation Requirements

2.1. On any transmission line, minimum of 6 fibers are always in use for critical grid communication, supporting Supervisory Control and Data Acquisition (SCADA), Phasor Measurement Unit (PMU), Voice over Internet Protocol (VoIP), Automatic Generation Control (AGC), and other real-time operations (2 Main, 2 Hot Standby, 2 Spares).

Additionally, for transmission lines requiring line differential protection:

- **4 fibers** are used for reliable differential protection of single feeder (S/c line).
- **8 fibers** are used for reliable differential protection of a double circuit (D/c) line.

2.2. Over and above these fibers which are already in use, the fibers that shall be spared for future grid communication requirements, based on need, is tabulated below:

Type of Future Grid Communication Requirements	**Fiber Allocation**	**Remarks**
Alternate Communication Path/Future expansion/Reconfiguration/LILO requirement/Inter-Utility Communication etc.	Upto 6 Fibers	Shall be spared as and when required for future grid communication requirements of ISTS/In-STS/ISGS/Radial feeders etc.

Type of Future Grid Communication Requirements	Fiber Allocation	Remarks
Line Differential Protection with future reconfiguration, if applicable.	Upto 4 Fibers per circuit	Shall be spared in case new differential protection schemes are required due to system expansion, reconfiguration or LILO additions.
Technology Migration/Centralised Asset Management & Control.	Upto 4 Fibers	Shall be spared for simultaneous transition to next-generation communication networks (e.g., packet-based systems).

Additional Considerations:

1. The actual number of healthy fiber cores to be spared free of cost for future grid telemetry requirements, within the limits stipulated in table above, shall be decided as and when the need arises.
2. **Commercial Utilisation of Fiber cores** –

   - While leasing excess fibers for **non-grid applications**, utilities/Transmission Service Providers (TSPs) must **reserve the right to intervene, seek withdrawal, or cease utilization of leased fibers** to address any emerging grid requirements. The contract to include flexibility for renewal or termination based on evolving needs.

   - The **number of fiber cores to be leased** and the **duration of leasing** must be planned in a rational way, such that, whenever the need arises to spare fibers for grid applications, their availability cannot be denied on the premise that the spare fibers are already leased out for commercial purpose. Additionally, under no circumstances should the routing of grid application data to the SLDC/RLDC (State/Regional Load Dispatch Centers) be adversely affected.

3. Commercial Utilization of OPGW Fibers for other purposes

3.1. While Optical Ground Wire (OPGW) is primarily implemented on transmission assets for telemetering power system parameters and ensuring reliable grid communication, spare fiber cores may be commercially utilized under the following conditions:

3.1.1. **Grid Applications Take Priority** – Spare fibers can be leased for commercial purposes, provided that whenever the need arises for grid applications, the number of cores within the limits stipulated in the Allocation Requirements, is made available without exception.

3.1.2. **Assessment of Future Grid Communication Needs –** Before leasing fiber cores, STUs/TSPs must conduct an assessment of impending grid communication requirements for atleast next five years. This assessment shall be holistic considering state/regional/national level requirements for routing of the data to SLDCs/RLDCs. STUs/TSPs intending to lease fiber cores to collaborate with CTU to discuss:

- Upcoming **grid expansion plans** and their communication requirements.
- Possible dependencies where **ISTS/STU networks need mutual data routing support**.
- The spare fiber capacity that should be **retained for future grid needs** before considering commercial leasing.

Based on this assessment, entities must determine **how many cores can be leased** and the **duration of leasing**, without affecting the availability for future grid applications.

3.1.3. **Termination Clause in Leasing Contracts** – All leasing contracts must include a termination clause, mandating at max 18 month notice period for making the fiber cores available for grid applications whenever required. This ensures that grid operator can reclaim the necessary fibers for critical grid operations with adequate notice. However, it is always advisable to retain some spare fibers for emergency or future grid communication needs in advance, rather than having to invoke the termination clause of the contract when the need arises.

3.1.4. **Regulatory Compliance** – Any commercial utilization of spare fibers must adhere to applicable CERC/SERC regulations pertaining to the 'Sharing of Revenue Derived from Utilization of Transmission Assets for Other Business.'

3.1.5. **Intimation to RPCs for ISTS Fiber Leasing** –

Any ISTS licensee/TSPs proposing to lease fiber cores on a commercial basis must provide prior intimation to the concerned Regional Power Committees (RPCs) regarding:

i. The number of fiber cores proposed for commercial utilization.
ii. The duration of the lease.
iii. The mechanism incorporated in the contract to ensure fiber availability in case of future grid requirements.

3.2. It must be emphasized that the primary purpose of fibers in OPGW/UGFO implemented as part of a transmission scheme is reliable telemetering of power system parameters. Commercial utilization of these transmission assets can only be done after a prudent evaluation of future grid communication needs, ensuring that grid operations are never compromised.

3.3. Proper planning and foresight are necessary to ensure that the commercial use of spare fibers does not jeopardize the security, reliability, and expansion needs of the power system communication network.

4. Sharing Scenarios

The table below outlines fiber-sharing arrangements across different transmission line ownership scenarios, ensuring that:

- Fibers essential for grid operations are spared free of cost, irrespective of whether they are required for Intra-State (InSTS) or Inter-State (ISTS) communication needs.
- Entities to spare healthy fibers, within the limits stipulated in the Allocation Requirements, whenever grid needs arise.

Scenario	**Entity to manage the allocation for grid operation purposes.**	**Fiber Sharing**
i) OPGW Laid Under ULDC Scheme on ISTS Lines	Owned and maintained by POWERGRID. Allocation to be managed by CTU.	Fibers to be **spared free of cost** as per Allocation Requirements outlined in Clause 2, whenever required by **STUs, ISTS Licensees/TSPs** for any type of future grid communication requirements.
ii) OPGW Laid Under ULDC Scheme on Intra-State Lines (InSTS)	Owned and maintained by POWERGRID. Allocation to be managed by STU with CTU coordination.	Fibers to be **spared free of cost** as per Allocation Requirements outlined in Clause 2, whenever required by **STUs, ISTS Licensees/TSPs** for any type of future grid communication requirements.
iii) OPGW Laid by STUs on Intra-State Lines	Owned and maintained by STU. Allocation to be managed by STU.	Fibers to be **spared free of cost** as per Allocation Requirements outlined in Clause 2, whenever required by **STUs, ISTS Licensees/TSPs** for any future grid communication requirements.
iv) OPGW Laid by CTU/POWERGRID on Intra-State Lines	Owned and maintained by POWERGRID. Allocation to be managed by CTU with STU coordination.	50% fibers allocated for **ISTS operations**, 50% for **Intra-State operations**. If more than 50% is required by either, fibers to be **spared free of cost**, for any type of future grid communication requirements.
v) OPGW Laid by TSPs on ISTS Lines under TBCB/RTM Projects	Owned and maintained by TSP. Allocation to be managed by CTU	Fibers to be **spared free of cost** as per Allocation Requirements outlined in Clause 2, whenever required by **STUs, ISTS Licensees/TSPs** for any type of

Scenario	Entity to manage the allocation for grid operation purposes.	Fiber Sharing
		future grid communication requirements.
vi) OPGW Laid by TSPs on Intra-State Lines through TBCB	Owned and maintained by TSP. Allocation to be managed by STU	Fibers to be **spared free of cost** as per Allocation Requirements outlined in Clause 2, whenever required by **STUs, ISTS Licensees/TSPs** for any type of future grid communication requirements.
vi) OPGW Laid by POWERGRID/STU's on Deemed ISTS Lines	Owned and maintained by POWERGRID/STU. Allocation to be managed by CTU with STU coordination.	50% fibers allocated for **ISTS operations**, 50% for **Intra-State operations**. If more than 50% is required by either, fibers to be **spared free of cost** for any type of future grid communication requirements.
vi) OPGW Laid by TSPs at their own cost, utilizing the ISTS asset/RoW, with necessary approvals from CERC.	Owned and maintained by TSP. Allocation to be managed by CTU, as the OPGW now, is forming integral part of backbone ISTS Communication network. It is assumed that: • No OPGW was included in the originally approved scheme for the transmission line. • The TSP obtained necessary approvals from the competent authority prior to laying the OPGW.	Fibers to be **spared free of cost** as per Allocation Requirements outlined in Clause 2, whenever required by **STUs, ISTS Licensees/TSPs** for any type of future grid communication requirements.

5. Integration of FOTE for Differential Protection

5.1. Differential teleprotection is a vital component of power system protection, ensuring rapid and selective fault clearance. The choice of communication medium, whether IEEE C37.94 (herein after referred as C37.94) protocol over a shared fiber or separate optical fibers, significantly impacts the reliability and performance of this protection scheme.

5.2. The choice between C37.94 compliant FOTE and separate fiber cores for differential teleprotection depends on a variety of factors, including line length, voltage level, criticality, and network conditions. While C37.94 can be a cost-effective solution for certain applications, separate fibers offer superior reliability and faster fault clearance, making them the preferred choice for critical transmission lines, especially at higher voltage levels.

5.3. The Regional Power Committees (RPCs) generally prioritize a **reliable and dedicated communication link for line differential protection** to ensure the integrity and security of protection signals, especially given the criticality of fast and accurate fault detection for power system stability.

5.4. While specific practices may vary depending on the line's voltage level, length, and criticality, however, in order to guarantee reliable communication for line differential protection systems, the Committee recommends the following provisions:

Condition	**Recommendation**	**Reason**
High-Criticality and High-Voltage Lines (220 kV and above) requiring line differential protection	Preference to dedicated or separate fiber cores for line differential protection rather than shared fibers.	As per IEC 60834, which governs teleprotection equipment, the RPCs lean towards using communication setups that meet high reliability and availability standards, favoring separate fibers to reduce signal attenuation and improve reliability for critical protection.
Lower-Criticality or lines with Voltage below 220 kV requiring line differential protection	Line differential protection may be allowed on shared fibers via Fiber Optic Terminal Equipment (FOTE) using the C37.94 protocol	Multiplexing protection signals over a shared fiber can be a cost-effective solution, particularly when the risk of latency and interference is lower due to shorter transmission distances and moderate fault current levels.
High-Criticality and High-Voltage Lines (220 kV and Above) requiring line differential protection. However, having constraint in availability of dedicated Optical fibers.	Line differential Protection using C37.94-compliant FOTE over shared fiber may be allowed with the following condition: • The setup must meet the provisions of IEC 60834 regarding speed, security, and dependability standards under real-time conditions.	By ensuring reliable and timely communication, C37.94-compliant FOTEs can contribute to meeting the requirements of IEC 60834.

6. Routing of OPGW Fibers during LILO

6.1. In case of Loop-In-Loop-Out (LILO) of transmission lines, routing OPGW fibers must be done in a way that preserves the operational integrity of the grid's communication infrastructure. Key recommendations are elucidated in table below:

Main Line and LILO Configuration	**LILO Tower Type**	**OPGW Installation Requirement**	**Fiber Routing/Splicing in New Substation**	**Configuration Adjustments in Existing Substations**
Main Line: D/c, 24-Fiber OPGW; S/c LILO	M/c Or D/c Tower (Single Tower for Loop In and Out) with two Earth wire peaks	Install 24 F OPGW on both earthwire peaks i.e same Nos. of OPGW as that of main line on both earth wire peaks.	Route required no. of fibers only through the new substation. Splice the required number of fibers for the LILO section at the appropriate point.	Configure protection schemes and data transfer systems to accommodate the new line and substation Ensure fiber continuity for main line traffic.
Main Line: D/c, 24-Fiber OPGW; D/c LILO	Two Separate D/c Towers (Separate Loop In and Out)	Install 24F OPGW i.e same Nos. of fiber cores as that of main line on one earthwire peak per tower.	Route all fibers of OPGW from the main line through the new substation. Splice the required number of fibers for the LILO line at the new substation, if the new S/stn is of different entity.	Configure protection schemes and data transfer systems to accommodate the new line and substation Ensure fiber continuity for main line's traffic through the new S/stn
Main Line: D/C, 24-Fiber OPGW; D/c LILO	Multi-Circuit Tower	Install 24 F OPGW on both earthwire peaks i.e same Nos. of OPGW as that of main line on both earth wire peaks.	Route all fibers of OPGW from the main line through the new substation. Splice the required number of fibers for the LILO line at the new substation, if the new S/stn is of different entity.	Configure protection schemes and data transfer systems to accommodate the new line and substation Ensure fiber continuity for main line's traffic through the new S/stn

Main Line and LILO Configuration	LILO Tower Type	OPGW Installation Requirement	Fiber Routing/Splicing in New Substation	Configuration Adjustments in Existing Substations
Main Line: D/c (220 kV/132 kV), 24-Fiber OPGW; S/c LILO	Tower with Singe Earth wire peak	Install 48F OPGW i.e., double the number of fiber cores as that of main line on single peak available in LILO portion	Route half number of fibers (12F) of OPGW from the main line through the new substation Splice the required number of fibers for the LILO section at the appropriate point.	Configure protection schemes and data transfer systems to accommodate the new line and substation. Ensure fiber continuity for main line traffic.
Main Line: S/C (220kV/132 kV), 24-Fiber OPGW; S/c LILO	Tower with Singe Earth wire peak	Install 48F OPGW i.e., double the number of fiber cores as that of main line on single peak available in LILO portion	Route all fibers (24F) of main line OPGW through the new substation to maintain continuity between the existing stations. Splicing of all the fibers at the new S/stn to be done to integrate LILO traffic.	Configure protection schemes and data transfer systems to accommodate the new line and substation. Ensure fiber continuity for main line's traffic through the new S/stn.

6.2. Whenever a Transmission Licensee implements a Loop-In-Loop-Out (LILO) arrangement on an existing transmission line, adjustments must be made in the **existing Substations**, including **Fiber Optic Terminal Equipment (FOTE)**, **relays**, and **other protection equipment** to ensure seamless integration and reliable protection.

Table summarizing LILO adjustments in existing Substations

Equipment	Adjustments Required	Details
Fiber Optic Terminal Equipment (FOTE)	Signal reconfiguration, routing modifications, capacity upgrades, synchronization, integration with new FOTE, supply of necessary optical	Ensure compatibility with new LILO traffic, enhance capacity if required, and synchronization with relays.

Equipment	Adjustments Required	Details
	interfaces to meet link budget requirement.	
Relays	Reconfiguration of protection schemes, distance zone adjustments, differential protection tuning.	Modify relay settings for fault detection across LILO, adjust impedance settings, and back-up coordination.
SCADA and Telemetry	Data routing, alarm configuration, SCADA system updates.	Integrate new LILO substation data into SCADA, configure additional alarms for LILO events.
Amplifiers/Signal Boosters	Installation if required, signal quality testing.	Ensure strong signal levels across LILO paths, perform attenuation checks.
Protection Redundancy	Ensure redundancy, perform testing and commissioning.	Verify that no single point of failure exists, conduct fault simulations, and document updated settings.

6.3. The entity undertaking the LILO installation and commissioning of the new substation shall ensure that all necessary adjustments, interfaces, and configuration support are implemented to maintain seamless data communication and reliable operation of protection schemes without signal degradation or loss. It is incumbent upon this entity to provide comprehensive support to the owner of the existing substation, facilitating integration and ensuring that all configuration and interoperability requirements are met to uphold continuous, high-integrity signal transmission and effective protection functionality across the network.

6.4. When the LILO is performed at the substation, the leased fiber cores, if any, by the main line owner must be routed continuously through the LILO section. Entity undertaking LILO cannot commercialize fibers routed for main line owner's use to prevent potential disputes.

7. Maintenance of Database:

7.1. CTU for ISTS/ STUs for InSTS shall be responsible for monitoring the utilization of OPGW fibers and ensuring compliance with the established conditions. The CTU/STU shall maintain a comprehensive database that clearly segregates:

1. **Total number of OPGW fiber cores:** The total number of fiber cores available on the OPGW of the transmission lines.
2. **Number of cores utilized for grid applications:** The number of fiber cores currently being used for essential grid operations
3. **Spare cores reserved for grid applications:** The number of fiber cores specifically retained for future grid applications.

4. **Number of fiber cores already being shared for grid applications:** The number of fiber cores shared with other grid entities (e.g., other TSPs, STUs, DISCOMs) for grid-related purposes. This should include details of the entities involved in each sharing arrangement.
5. **Number of cores leased on a commercial basis:** The number of fiber cores leased to entities for non-grid applications (e.g., telecom providers, internet service providers). This should include details of the lease agreements, including the lessee, lease period, and terms of termination.

7.2. CTU/STU shall prepare a standardized format/procedure for the TSPs/Licensees to furnish the above data pertaining to OPGW fibers. CTU/STU shall display the data on its website.

8. OPGW Implementation in New Transmission Projects and Upgradation Schemes

8.1. In all the new transmission projects and upgradation schemes, the Planning agency should ensure that any decision regarding deployment of fiber cores considers both present needs and future expansions, balancing the infrastructure's capability with associated costs.

8.2. Planning of OPGW with a minimum of 48 fiber cores to be done, as per feasibility and requirement. For installations within city limits, OPGW may be equipped with 96 fiber cores to also facilitate usage by DISCOMs, SLDCs, RLDCs, and NLDC for last-mile connectivity, contingent upon the load-bearing capacity of the line. This approach will accommodate any additional future requirements, including Loop-In-Loop-Out (LILO) configurations or increased capacity utilizing the same Right of Way (ROW).

8.3. Additionally, since OPGW fibers can also support long-distance telecommunications network across India, the planning exercise should also take into account the dynamics of the telecom industry while determining the number of fibers to be deployed.

8.4. This strategy will facilitate the establishment of a robust, scalable communication network while maintaining efficiency and responsiveness to evolving operational needs across all areas.

9. Implementation Strategy for Existing ISTS/ InSTS Lines

9.1. Any ISTS TSP/In-STS utility/entity planning to lease out spare fiber cores of its OPGW on existing lines on commercial basis shall adhere to all the provisions and framework for fiber sharing and usage, as outlined in these guidelines.

9.2. For TSPs/utilities that have already leased out fiber cores before the issuance of these guidelines, it is expected that, as and when the need arises to spare fibers for grid applications, they will explore all possible means to make available the minimum no. spare fibers that can serve the purpose, free of cost. In cases where conflicts or stalemate arises regarding the availability of requisite number of fibers, a resolution committee shall be formed. This committee will include representatives from the RPCs, PSCD Division of CEA, CTU, concerned STUs /TSPs , with the goal of resolving the issue in a fair and balanced manner.

10. Conclusion

10.1. These guidelines aim to establish a standardized approach to the allocation and sharing of Optical Ground Wire (OPGW) fibers across power sector, ensuring secure, reliable, and scalable communication infrastructure that meets both present and future grid requirements. By implementing uniform principles for fiber allocation and usage, entities across the power sector—including CTU, STU, TSPs, DISCOMs, SLDCs, RLDCs, and NLDCs—can achieve consistent and efficient communication system for grid operations, protection, and commercial applications. These guidelines provide a clear and standardized framework for the allocation and sharing of Optical Ground Wire (OPGW) fibers, balancing the commercial prospects of fiber usage with the imperative of maintaining secure, reliable, and scalable grid operations.

11. Brief of Recommendations for Adoption

11.1. Uniform Fiber Allocation

Entities should adhere to this fiber allocation guidelines/framework for grid operations, ensuring designated fibers for essential communication and protection. Excess fibers may be designated for commercial use, subject to periodic review and regulatory oversight, thereby maximizing resource utilization without compromising the grid stability.

11.2. Compliance with CEA Regulations

All implementations should align with the CEA (Technical Standards for Communication System in Power System Operations) Regulations, 2020 , CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations, 2022, CERC Interface Requirements and CEA Cyber Security Guidelines, to promote standardized, high-quality communication infrastructures across the power transmission networks.

11.3. Scalability for Future Needs

In areas with high potential for future growth or within city limits, entities are encouraged to install OPGW with 48/96 fiber cores to provide sufficient capacity for last-mile connectivity, future expansions, and LILO requirements, leveraging the Right of Way (ROW) effectively.

11.4. Commercial Usage Protocol

Any commercial usage should adhere to the applicable CERC/SERC Regulations. All leasing contracts must include a termination clause, mandating at max of 18-month notice period for making the fiber cores available for grid applications whenever required. This ensures that grid operator can reclaim the necessary fibers for critical grid operations with adequate notice. However, it is always advisable to retain spare fibers for emergency or future grid communication needs in advance, rather than having to invoke the termination clause of the contract when the need arises.

11.5. **Coordination and Monitoring**

For LILO implementations and OPGW installations in new and upgraded transmission schemes, the entity responsible for installation of the same must provide continuous support to existing substations, facilitating configuration adjustments and ensuring reliable data transfer. Continuous monitoring by CTU is recommended to assess the impact of commercial use and maintain high standards of operational reliability.

These recommendations will ensure that all stakeholders in power system communication can operate within a unified framework, promoting efficiency, compliance, and grid security.

----------x----------

Composition of the Committee constituted under the chairmanship of Member (Power System), CEA tasked with formulating comprehensive guidelines for the usage and sharing of optical fibers (OPGW) for power system applications:

S.no	Members	Organisation/Association
1.	Member (Power System) (Chair)	CEA
2.	Chief Engineer, PCD	CEA
3.	Chief Engineer, NPC	CEA
4.	Chief Engineer, ET & I	CEA
5.	Member Secretary, RPCs	RPCs
6.	Executive Director, CTU	CTU
7.	Executive Director, Grid India	GridIndia
8.	Executive Director, Powergrid	Powergrid
9.	Representative of Electric Power Transmission Association – 2 TSPs	EPTA
10.	Representative from STUs (at the level of Chief Engineer or equivalent)	• Northern Region: UPPCL, RRVPNL • Western Region: GETCO, MPPTCL •Southern Region: KSEBL,TANTRANSCO • Eastern Region: WBSETCL, OPTCL • North Eastern Region: AEGC

The Terms of Reference (ToR) of the Committee is as follows:

1) **Scope and Purpose:** Define the need to develop guidelines that address the unique requirements and challenges associated with the sharing of OPGW fibers among CTU, STUs, and Private Transmission Licensees.

2) **Allocation Requirements:** Define/determine the number of fibers required for catering to varied applications/services for grid management such as data, speech, protection etc., including minimum spare fibres to be earmarked for grid applications/requirements.

3) **Sharing Scenarios**: Analyse the scenarios wherein the spare fibers in the OPGW laid by an entity is to be shared amongst several entities (CTU, STU, TSPs) to facilitate real time grid monitoring. Formulating the uniform mechanism governing the access, usage, or other aspects of the shared fibers in following scenarios:

(i) Sharing of OPGW laid under ULDC scheme on the ISTS lines.
(ii) Sharing of OPGW laid under ULDC scheme on the Intra-State lines.
(iii)Sharing of OPGW laid by STUs on the Intra State lines.
(iv)Sharing of OPGW laid by CTU/Powergrid on the Intra State lines.
(v) Sharing of OPGW on the ISTS lines laid by TSPs under TBCB and RTM projects.

Identify and define the role and responsibilities of Centre, State, and Private Transmission Licensees in the sharing of OPGW fibers.

4) Investigate the integration of Fiber Optic Terminal Equipment (FOTE) for differential protection in accordance with the C37.94 protocol and bring out recommendations.

5) Define the uniform mechanism of routing of OPGW fibers in case of LILO taken up on any transmission line.

6) Recommend the scenarios/limit of OPGW fibers beyond which it can be utilized for other commercial purposes.

7) Formulate recommendations for seamless adoption of these guidelines.

Nominated Members of the Committee

S. No.	Nominated Member's Name	Designation	Division & Organisation
1.	Shri A K Rajput	Member (Power Systems)	Central Electricity Authority
2.	Shri V K Singh	Member Secretary	NRPC, CEA
3.	Shri Asit Singh	Member Secretary	SRPC, CEA
4.	Shri N S Mondal	Member Secretary	ERPC, CEA
5.	Shri Deepak Kumar	Member Secretary	WRPC, CEA
6.	Shri K B Jagtap	Member Secretary	NERPC, CEA
7.	Smt Rishika Sharan	Chief Engineer	NPC, CEA
8.	Shri Surata Ram	Chief Engineer	ET&I, CEA
9.	Shri S K Maharana	Chief Engineer	PSCD, CEA
10.	Shri J B Len	SE	SRPC, CEA
11.	Shri Shiv K Gupta	Sr. DGM	Comm, CTUIL
12.	Shri Ankur Gulati	DGM	GRID-INDIA
13.	Shri. Doman Yadav	Executive Director	Grid Automation & Communication (GA&C), Powergrid
14.	Smt S.Kannika Parameswari	Chief Engineer	P&C, TANTRANSCO
15.	Shri. Viju Rajan John	Chief Engineer	Transmission System Operation, KSEBL
16.	Shri Binaya Ku Mallick	DGM(Telecom)	E & Q, OPTCL,HQRS
17.	Shri N. K Patel	SE (Telecom)	TR Department, Corporate Office, GETCO, Vadodara
18.	Shri R. B Kathiria	EE (Telecom),	Telecom Unit, 220kV S/s, GETCO, Gondal
19.	Shri Jayesh A Mehta	DE (Telecom)	Telecom Unit, 220kV S/s, GETCO, Ranasan
20.	Shri Arup Sarmah	AGM	LA Communication Division, Kahilipara, AEGCL
21.	Smt. Punam Biswakarma	AGM	CA Communication Division, Samaguri, AEGCL
22.	Shri Ashutosh Bhattacharjee	GM	(T&C and Comm.)
23.	Shri Rajesh Gupta	SE (SLDC)	MPPTCL
24.	Shri Sudhir Nema	SE (Planning)	MPPTCL

S. No.	Nominated Member's Name	Designation	Division & Organisation
25.	Smt. Kshama Shukla	EE (P&D)	MPPTCL
26.	Shri Debasis Sarkar	Chief Engineer	Communication Department, WBSETCL
27.	Shri Vivek Dixit	Chief Engineer	Sanchar and Niyantran, UPPTCL
28.	Shri Sanjay Johari	VP	Business Development & Adani Energy Solutions Ltd.
29.	Shri Tarun Tayal	Head- Govt. Alliances and Partnerships	Sterlite Power

Special Invitee - Power System Technology Development Division, CEA

Annexure-III

सत्यमेव जयते

भारतसरकार
Government of India
विद्युतमंत्रालय
Ministry of Power
उत्तरक्षेत्रीयविद्युतसमिति
Northern Regional Power Committee

Date: 02.04.2025

To,

1. Chief Engineer, HPSLDC
2. Chief Engineer, BBMB
3. Chief Engineer, SLDC, PSTCL
4. Chief Engineer, SLDC, RVPN
5. Chief Engineer, UPSLDC
6. Chief Engineer, JKSLDC
7. Chief Engineer, SLDC, HVPNL
8. General Manager, SLDC, DTL
9. ED, NRLDC
10. Dy. COO, CTUIL
11. ED, GA&C, POWERGRID
12. CGM, POWERGRID- NR1
13. Business Unit Head (Grid Software), Siemens

विषय: Minutes of Special Telemetry, SCADA and Telecommunication (TeST) Sub-Committee Meeting held on 24.03.2025 -reg.

महोदय,

A Special Telemetry, SCADA and Telecommunication (TeST) Sub-Committee Meeting was held on 24.03.2025 in NRPC conference room. The minutes of meeting is enclosed herewith for your kind perusal.

भवदीय

Signed by Praveen Jangra
Date: 02-04-2025 16:58:16
प्रवीण जाँगड़ा

कार्यपालक अभियंता (संचार)

18-ए, शहीदजीतसिंहमार्ग, कटवारियासराय, नईदिल्ली- 110016 फोन:011-26513265 ई-मेल: sec -nrpc@nic.in वेबसाईट: http://164.100.60.165
18-A, Shaheed Jeet Singh Marg, Katwaria Sarai, New Delhi-110016 Phone: 011-26513265e- mail: sec-nrpc@nic.in Websitehttp://164.100.60.165

Minutes of Special TeST Meeting held on 24.03.2025

MS, NRPC welcomed all the participants for the special TeST meeting.

1 AMC extension of SCADA/EMS system in SLDCs of NR states (Agenda by RVPN)

EE, NRPC apprised the agenda before the members. Representative from SIEMENS was asked to give the presentation on the agenda.

SIEMENS explained that the new AMC proposal includes comprehensive coverage, extending to hardware. SIEMENS cited the system's aging infrastructure and limited OEM support as reasons for the price escalation. Additionally, SIEMENS informed that as suggested by POWERGRID, centralized hardware storage is proposed to optimize costs rather than maintaining hardware at individuals control centres.

POWERGRID stated that ULDC Phase-III is expected to be completed by December 2025, followed by a three-month parallel operation. SIEMENS stated that in the present AMC proposal, that there are two AMC options: a 12-month term with option of quarterly extension at same T&C or an 18-month commitment at a discounted rate.

After discussion, NR constituents agreed upon 12-month AMC period, considering that present AMC expiries varied across constituents and also considering the implementation status of ULDC Phase-III. It was also decided that further AMC extensions would be considered as per individual utility's requirement.

SIEMENS explained the AMC cost break-up, covering manpower, project management, hardware components etc. SIEMENS also mentioned that software license fee and royalty charges is also a major component of proposed AMC cost. Constituents requested a more detailed cost break-up for management justification, SIEMENS agreed to provide by 31.03.2025.

Also, SIEMENS stated that since present AMC of some NR constituents is expiring on 31.03.2025, constituents need to intimate POWERGRID/SIEMENS for continuation of AMC before 31.03.2025, so that existing AMC team is not withdrawn from sites.

After detailed discussion following was concluded:

1. SIEMENS to provide a detailed justification in terms of price break up before 31.03.2025
2. Since, the project is a single package, a common **12-month AMC with a provision for quarterly extensions** was opted by SLDCs/BBMB.
3. SLDCs/BBMB to inform POWERGRID/SIEMENS about AMC continuation before **31.03.2025**

2 Fiber sharing on STU links for redundant communication (Agenda by NRPC)

EE, NRPC apprised the forum about the requirement for STU links to enhance redundant communication. Matter has been discussed previously in several TeST meetings and sharing is required from following: in UP, Uttarakhand and J&K for the specific links mentioned in the agenda.

He further stated that since the guidelines for fiber sharing have been issued and are now available with states, they may take further action accordingly. UPSLDC stated that since guidelines were recently issued, they are still in the discussion phase.

MS, NRPC suggested that states may take up to **two months** to review the guidelines and communicate for further course of action for fibre sharing and checking healthiness of fibres.

MS, NRPC requested CTU to send a follow-up letter in view of the newly issued guidelines.

3 OPGW installation on existing 400 kV Sikar (PG) – Agra (PG) D/c line (owned by PG) which is proposed to be LILOed at 400 kV GSS Kumher (RVPN) (Agenda by CTUIL)

EE, NRPC introduced the agenda and discussions held in 78th NRPC meeting held on 16th-17th March 2025 where '*CTU apprised that data, voice & protection requirements of* Agra and Sikar S/s are *being met through other routes from their respective nodes whereas the same for Kumher S/s of RVPN is being explored yet.'*

Rajasthan SLDC apprised *data, voice & protection requirements of* Kumher S/s is envisaged to be met through Agra end or Sikar end.

On enquiry of MS, NRPC whether fiber connectivity from Kumher S/s could be provided from either end, i.e. Agra or end, CTU stated that OPGW should be laid on whole section of **400kV Sikar (PG) – Agra (PG) D/c line** citing CEA (Technical Standards for Construction of Electric Plants and Lines), 2022, under Chapter IV, PART-A "SUBSTATIONS AND SWITCHYARDS (66 kV AND ABOVE)" Clause 48 , sub clause (5), which states that:

"

Optical Ground Wire and Power Line Carrier Communication. —

(a) Optical Ground Wire along with necessary terminal equipment shall be provided on transmission lines of voltage rating of 110 kV and above for speech transmission, line protection, and data channels.

(b) The primary path for tele-protection shall be on point-to-point Optical Ground Wire and alternative path shall be either on Power Line Carrier Communication or predefined physically diversified Optical Ground Wire paths.

"

CTU also mentioned CEA letter dated 22.05.2024 regarding "Compliance with CEA (Technical Standards for Construction of Electric Plants and Lines), 2022 - Installation of Optical Ground Wire on Transmission Lines – reg", which requires all upcoming lines of STU and ISTS should envisage OPGW installation.

Members agreed with CTU's proposed scheme of Installation of 48 Fiber OPGW on existing 400 kV Sikar (PG) – Agra (PG) D/c line (owned by PG) (386 Km) including Repeater which is proposed to be LILOed at 400 kV GSS Kumher (RVPN) including FOTE at Sikar S/s (PG) & Agra S/s (PG).

Meeting ended with vote of thanks

*****

List of participants: -

NRPC Sectt.

1. Sh. V. K. Singh, Member Secretary
2. Sh. Anzum Parwej, Superintending Engineer
3. Sh. Praveen Jangra, Executive Engineer
4. Smt. Priyanka Patel, Manager, POWERGRID

NRLDC

5. Sh. M. M. Hassan, Chief General Manager (SL)
6. Sh. Paritosh Patnak, Manager

UPSLDC

7. Sh. Amit Narain, Superintending Engineer

Grid-India

8. Sh. Mahesh Kumar, General Manager
9. Sh. Ashok Kumar, General Manager

CTUIL

10. Sh. Tej Prakash Verma, Deputy General Manager
11. Sh. Prakhar Pathak, Engineer
12. Sh. Anshul Mahawar, ET

HVPN

13. Sh. Er. Sushil Kumar, Superintending Engineer
14. Sh. Er. A. P. Singh, Executive Engineer
15. Sh. Er. Anshu Jain, Assistant Engineer

RVPN

16. Sh. Sudhir Jain, Chief Engineer
17. Sh. Manish Athaiya, Superintending Engineer

POWERGRID

18. Sh. Doman Yadav, Executive Director (GA&C)
19. Sh. Arun Kumar Singh, Sr. General Manager
20. Sh. Narendra Kumar Meena, Deputy General Manager

HPSLDC

21. Sh. Rakesh C. Negi, Superintending Engineer
22. Sh. Er. Sanjay Raneet, Sr. Executive Engineer

SIEMNS LTD.

23. Sh. Namit Kumar, Head SOL Business
24. Sh. Sumit Bhatnagar, Senior Manager GSW SOL
25. Sh. Rahul Murada, SIEMNS

DTL, SLDC

26. Sh. Vinay Kumar Jaiswal, Assistant General Manager

PSTCL

27. Sh. Sunder, Deputy Chief Engineer/ SLDC (OA)
28. Sh. Ankit Bedi, Sr. Executive Engineer/ SLDC (OA)
29. Sh. Mandeep Micky, Sr. Executive Engineer

JKPTCL, Jammu

30. Sh. Vikas Anand, Chief Engineer

BBMB

31. Smt. Ruchi Sharma, Director/ PR
32. Sh. Gurpreet Singh, Deputy. Director / LD-2
33. Sh.Ansh Jain, Assistant Director

Sr. No	OPGW line & circuit name	Name of TBCB/RTM Owner of OPGW	Region	Year of Commissioning	Total number of OPGW fiber cores (24/48/96 etc) (a)	Number of cores utilized for grid applications (b)	Spare cores reserved for grid applications (c)	Number of fiber cores already being sharedwith other entity for grid application.(d)	Name of the grid entity to which fibers shared for grid applications i.e. (d).	Lease period for sharing of fibers i.e.(d) for grid applications	Number of cores leased on a commercial basis (e)	Name of entity to which fibers shared for non-grid applications i.e. (e) on commercial basis	Lease period for sharing of fibers on commercial basis	Out of order/Damaged fibers(f)	Remaining/ unallocated ((A-(B+C+D+E+F))

सत्यमेव जयते

भारत सरकार/ Government of India

विद्युत मंत्रालय/ Ministry of Power

केन्द्रीय विद्युत प्राधिकरण/ Central Electricity Authority

विद्युत प्रणाली अभियांत्रिकी एवं प्रौद्योगिकी विकास प्रभाग

Power System Engineering & Technology Development Division

सेवा में,

<as per attached list>

विषय: Minutes of the Meeting held on 13.03.2025 to discuss the way forward on the Draft "Guidelines on Unified Philosophy for Placement of Phasor Measurement Unit (PMU) in Indian Grid" - reg.

महोदया/महोदय,

A Meeting was held on 13.03.2025 at 09:45 hrs at Chintan Conference Hall of CEA under the chairmanship of Chairman, CEA to discuss the way forward on the Draft "Guidelines on Unified Philosophy for Placement of Phasor Measurement Unit (PMU) in Indian Grid".

2. The Minutes of the Meeting including the Final Report of the Committee on "**Guidelines on Unified Philosophy for Placement of Phasor Measurement Unit (PMU) in Indian Grid"** are enclosed for kind information and necessary action please.

This issues with the approval of Chairperson, CEA.

Encl: as above

भवदीय,

NRLK 19/3/2025

(एन.आर.एल.के. प्रसाद/ N.R.L.K. Prasad)

मुख्य अभियंता (का.प्र.)/ Chief Engineer(I/C)

Copy to:

1. Chief Engineer, NPC, CEA
2. Chief Engineer, PCD Division, CEA
3. SA to Chairperson, CEA
4. SA to Member (PS), CEA

तीसरी मंजिल,सेवा भवन, आर. के. पुरम-I, नई दिल्ली-110066 टेलीफैक्स: 011-26732307 ईमेल: ce-psetd@nic.in वैबसाइट:www.cea.nic.in
3rd Floor, Sewa Bhawan, R.K Puram-I, New Delhi-110066 Telefax: 011-26732435 Email: ce-psetd@nic.in Website: www.cea.nic.in

ADDRESS LIST

To

Secretary, Central Electricity Regulatory Commission, 6th, 7th & 8th Floors, Tower B, World Trade Centre, Nauroji Nagar, New Delhi- 110029	secy@cercind.gov.in Cc: chiefengg@cercind.gov, awdhesh@nic.in
M/s CTUIL, 2nd Floor, Corporate Centre, Plot No:2, "Saudamini",Sec-29, Near IFFCO Chowk, Gurgaon	tanay@powergrid.in rshakya@powergrid.in Cc: ashok@powergrid.in
M/s Grid Controller of India limited-9 (1st Floor), Qutab Institutional Area, Katwaria Sarai, New Delhi-110016	amangautam@gridindia.in Cc: cmd@grid-india.in
CMD, Powergrid Corporation of India Ltd. Saudamini, Plot No. 2, Sector – 29, Gurgaon – 122001 (Haryana)	awanish.kumar@powergrid.in mohan.kishor@powergrid.in Cc: cmd@powergrid.in tyagir@powergrid.in
Electric Power Transmission Association	sumeet.sharma@adani.com Cc: epta.dg@gmail.com, shadique.afgal@apraava.com anurag.patel@sterlite.com Sunnykumar.singh@adani.com
CMD, NTPC Limited, NTPC Bhawan, SCOPE Complex, Institutional Area, Lodhi Road, New Delhi-110003	cmd@ntpc.co.in Sachingarg01@ntpc.co.in ankurtripathy@ntpc.co.in
CMD, NHPC Limited, NHPC office complex, Sector-33, Faridabad - 121003	surendramishra@nhpc.nic.in Cc: cmd@nhpc.nic.in
Independent Power Producers Association of India (IPPAI), Diamond House, 2nd Floor, 11, Primrose Road, Bengaluru-560025	dharun@ippaimail.org gulrez@ippaimail.org divya@ippaimail.org
Director General, Central Power Research Institute, Prof. Sir C.V. Raman Road, Post Box No: 8066, Bengaluru	kaliappan@cpri.in Cc: dgcpri@cpri.in
Director, CSIR-National Physical Laboratory, Dr. K.S. Krishnan Marg, New Delhi - 110012	avni.khatkar@nplindia.org Cc: director@nplindia.org
President, Sustainable Projects Developers Association (SPDA), 910, 9th floor Surya Kiran Building, 19, KG Marg, New Delhi - 110001	upendra.kumar@avaada.com ankit.gupta@avaada.com Cc: spda@solarpda.com spda@spdaonline.com
Indian Wind Power Association Door – E, 6th Floor, Shakti Towers-1 766, Anna Salai, Chennai – 600002	kmn@windplus.in Cc: secretary.general@windpro.org jwpahq@windpro.org

Power System Engineering & Technology Development Division
New Delhi

Minutes of the Meeting held on 13.03.2025 to discuss the Way Forward on the Draft "Guidelines on Unified Philosophy for Placement of Phasor Measurement Unit (PMU) in Indian Grid"

1. A meeting was held on 13.03.2025 in the Chintan Conference Hall of CEA under the Chairmanship of Chairperson, CEA to discuss the Way Forward on the implementation of Draft "Guidelines on Unified Philosophy for Placement of Phasor Measurement Unit (PMU) in Indian Grid". List of participants is at **Annexure-A**.

2. At the outset of the meeting, Chairperson, CEA welcomed all the participants and stated that the discussions around suitable locations for PMU have been happening for some time. In this connection, a Committee formed under the Chairmanship of Member (Power System), CEA (PMU Committee) dealt with the matter in detail, and finalized a set of Guidelines for implementation in all upcoming projects. This meeting was being held to discuss the way-forward on the same. Thereafter, he requested Chief Engineer I/C (PSE&TD) to present the details.

3. Chief Engineer I/C (PSE&TD) gave a brief Presentation (**Annexure-B**). The salient points of the Presentation are as follows.
   a) The different Guidelines/ Standards dealing with the requirements of placement of PMUs in the Indian Electric Grid are noted as follows:
      (i) Regulation 48 (6) of Central Electricity Authority (Technical Standards for Construction of Electric Plants and Electric Lines) Regulations, 2022. *The regulation specifies the Locations of PMUs in general.* (**Annexure-C)**.
      (ii) Report of the Sub-Committee on PMU Placement and Analytics under URDTSM Phase-II brought out in 2023. *The report extensively deals with various possible Locations of PMUs.* (**Annexure-C)**.
      (iii) Guidelines on Interface Requirements brought out under the Central Electricity Regulatory Commission (Communication System for inter-State transmission of electricity) Regulations, 2017 and issued vide CERC Order dated 19.01.2024. *The Guidelines primarily deal with various Parameters to be telemetered from PMUs placed on various equipment (power system elements) in various Stations* (**Annexure-D**).

   b) In this connection, a meeting was held on 20.06.2024 to bring clarity about the locations of Phasor Measurement Units (PMUs) in the Grid and the Parameters to be telemetered from them. As per the decision taken in the Meeting, a Committee under the Chairmanship of Member (Power System), CEA with representatives from CEA, CTUIL, POWERGRID, GRID INDIA, NTPC, NHPC, Electric Power Transmission Association (EPTA), Independent Power Producers Association of India (IPPAI), CPRI, National Physical Laboratory (NPL), Sustainable Project Developer Association (SPDA), Indian Wind Power Association (IWPA) was constituted vide CEA letter dated 04.10.2025 to suggest ways to harmonize various requirements for PMU installation into one single Guideline.

   c) This PMU Committee held two Meetings on 05.12.2024 and 27.01.2025 to deliberate & finalize draft "Guidelines for Unified Philosophy for placement of Phasor Measurement Units (PMUs) in Indian Grid". In the second meeting of the Committee held on 27.01.2025, Analytics Tool Developers, viz., M/s Electric Power Group (EPG) and M/s GE were also invited for taking their opinion regarding the placement of PMUs.

   d) Based on the extensive deliberations held during the meetings and recommendations of the Committee, Draft "Guidelines on Unified Philosophy for placement of PMUs in Indian Grid" have been finalized. *These Guidelines (**Annexure-E**) primarily specify both the optimized locations &*

the elements on which PMUs are required and the optimized list of signals/ data to be telemetered from those PMUs.

e) In this regard, a Comparative Statement on PMU Locations between PMU Committee Guidelines and URTDSM Sub-Committee Guidelines (**Annexure-F**) is presented. A Comparative Statement on PMU Parameters to be telemetered between PMU Committee Guidelines and CERC Guidelines on Interfacing Requirements (**Annexure-G**) is also presented.

f) W.r.t. PMU Locations, the following is noted:
- PMU Locations as per PMU Committee Guidelines are basically an optimized list of that present in URTSM Sub-Committee Report, and sufficient to obtain required levels of observability.
- ***Accordingly, for Uniformity in approach w.r.t Placement of PMUs in the Indian Grid, above finalized PMU Committee Guidelines, 2025 shall be adopted for implementation.***

g) W.r.t. Parameters to be telemetered from PMU's, the following is noted:
- W.r.t. Analog and Digital Parameters, the Items present in PMU Committee Guidelines are basically an optimized list of that present in CERC Interfacing Guidelines, and sufficient to obtain required observability levels
- W.r.t. Protection Parameters, the Items not present in CERC Interfacing Guidelines, but present in PMU Committee Guidelines, are general in nature, and not mandatory; PMU Committee Guidelines, 2025 are in general agreement with CERC Guidelines on Interfacing Requirements, 2024 w.r.t. PMU Parameters to be telemetered; as such, there is no need to bring any Amendment in CERC Guidelines on Interfacing Requirements, 2024.
- ***Therefore for Uniformity in approach w.r.t PMU Parameters to be telemetered in the Indian Grid, above finalized PMU Committee Guidelines, 2025 shall be adopted for implementation.***

4. Chairperson, CEA raised the concern that CERC should not issue the Guidelines on Technical matters in power sector, as CEA is primarily responsible for that. ***He requested Chief Engineer (NPC) to issue address a letter to Secretary, CERC in this regard so that duplication of efforts and attendant confusion arising from multiple guidelines/ Standards on same technical matter may be avoided***. However, CERC may give the reference of relevant Technical Standards issued by CEA in their regulations.

5. Chairperson, CEA enquired whether PMUs are being manufactured in India. Representative from National Physical Laboratory (NPL) and POWERGRID stated that there are two manufacturers viz M/s Valiant Communications Ltd and M/s Hitachi Energy who are manufacturing PMUs in India.

6. Representative from NPL stated that PMUs are being tested at NPL. NPL is also supporting an indigenous PMU manufacturer by providing technical services. However, none of the PMUs installed in Phase-1 of URTDSM were tested at CSIR-NPL. In addition to NPL and CPRI, testing facility for PMUs is also available with Powergrid Advanced Research and Technology Centre (PARTeC) at Manesar. Testing facility at POWERGRID is traceable to the National Standards of India. In this connection, it was noted that no testing facility is available in India for Synchro-Phasor Data Transfer. So, if testing facility for PMU Data Transfer as per Standard IEEE C37.118.2 is required, CSIR-NPL, being the National Measurement Institute of the country, will extend its facilities in this area if requirement for the same is received.

7. CPRI through email informed that for PMU communication/ data transfer, compliance w.r.t. Standard, IEC 61850-10, may be ensured. In CPRI, its compliance for IEDs is being done using a tool. However, the required tool is not available in CPRI for testing of PMU Communication compliance as per IEEE C37.118.2:2011. CPRI also informed that so far no requirement has been received from PMU manufacturers like Hitachi, GE Vernova and Siemens for testing as per IEEE C37.118.2:2011.

8. Chairperson, CEA enquired about the requirements of PMUs, especially in view of the above PMU Committee Guidelines 2025. Representative from POWERGRID stated that earlier there is a requirement of 4000 PMUs under the URTDSM Phase-II, which may come down to 2000-2500 as per these Guidelines. ***Chairperson, CEA requested to carry out the assessment of the PMUs in view of increase in sudden demand due to these Guidelines, and requested that PMU manufacturers may also be consulted regarding their manufacturing capacity.***

9. Grid-India also confirmed the sufficiency of PMU locations and PMU Parameters as brought out in the PMU Committee Guidelines, 2025, and requested for their early implementation.

10. In this connection, since the Guidelines require PMUs to be provided at only one end of the line, the need to clearly specify the PMU requirements on various lines at station (s) of a project as part of its RfP document was discussed. On this, Chairperson, CEA requested CTUIL to bring the proposal of the Transmission Scheme to NCT with clear requirement of PMUs in line with these guidelines. ***That is CTUIL shall clearly mention the requirement of PMUs at a Substation in line with these Guidelines by duly factoring in the availability of the PMUs at the existing stations and that under bidding transmission schemes & under-construction transmission schemes.***

11. Chairperson, CEA stated that as these Guidelines are in alignment with CERC Guidelines on Interfacing Requirements, 2024, there is no contradiction observed between these two; therefore the PMU Committee Guidelines which optimally specify the PMU Locations and PMU Parameters to be telemetered shall be adopted for implementation for URTDSM (Phase-II) project and all upcoming schemes with applicability as under:
    - These Guidelines shall be applicable to all the upcoming Tariff-based Competitive Bidding (TBCB)/ Regulated Tariff Mechanism (RTM) based Projects. Additionally, these guidelines shall also be applicable to Projects (through TBCB or RTM route) for which the tender has been published before the date of issue of these guidelines for which the price bids are yet to be submitted.
    - For the Transmission Scheme for which bidding was submitted on or after 27.12.2022 (the date of notification of CEA Construction Standards, 2022) but before 19.01.2024 (the date of notification of CERC Guidelines on Interfacing requirements, 2024), PMUs shall be installed as per RfP document.
    - For the transmission Scheme for which bid was submitted on or after 19.01.2024, PMUs shall be installed as per RFP duly factoring in CERC Interface Guidelines.
    - The PMU Committee Guidelines, viz., "Guidelines on Unified Philosophy for Placement of Phasor Measurement Unit (PMU) in Indian Grid" shall be effective from the date of issue of the Guidelines.

12. The finalized "Guidelines on Unified Philosophy for Placement of Phasor Measurement Unit (PMU) in Indian Grid" are given at **Annexure-H** for kind reference and necessary action by all concerned.

13. The meeting ended with thanks to chair.

*****

Annexure-A

List of Participants

CEA

1. Sh. Ghanshyam Prasad, Chairperson, CEA – in Chair
2. Ms. Rishika Sharan, Chief Engineer (NPC)
3. Sh. N.R.L.K. Prasad, Chief Engineer I/C (PSE&TD)
4. Sh. Bhanwar Singh Meena, Director (PSE&TD)
5. Sh. Pankaj Kumar Verma, Deputy Director (PSE&TD)

CTUIL

1. Sh. T.N. Pauan Kalyan Kumar, E.T.

GRID-INDIA

1. Sh. Manas Ranjan Chand, DGM
2. Sh. Aman Gautam, Manager

POWERGRID

1. Sh. Mohan Kishor. N. DGM
2. Sh. Awanish Kumar, Chief Manager

NTPC LTD.

Sh. Abhishek Khanna, Sr. Manager

NHPC LTD

Sh. Jaganath Pani, Sr. Manager

CSIR-NPL

Dr. Avni Khattar, Scientist

ADANI

Sh. Sumeet Sharma, Vice President

RESONIA LTD. (Erstwhile STERLITE POWER)

Sh. Anurag Patel, Chief Manager

ACME

Sh. Nitish Kumar, AGM

WELSPUN

Sh. Akash Bhatnagar, Dy. Manager

FPEL

Sh. Karan, B.D.

Annexure-B

Meeting on Way Forward for Implementation of the Draft "Guidelines on Unified Philosophy for Placement of Phasor Measurement Units (PMUs) in Indian Grid"

PMUs in Indian Grid

- PMU is a Device that produces synchronized phasor, frequency, and rate of change of frequency (ROCOF) estimates from voltage and/or current signals and a time synchronizing signal. PMUs are essential components (building blocks) of Wide Area Monitoring System (WAMS).

- Given the increasing penetration of renewable energy (RE) leading to increasing Variability and Unpredictability in power generation, the role of PMUs becomes crucial **to enhance visualization of power system dynamics in real-time** and they are also being utilized extensively in post-dispatch analysis.

- PMU's Deployment: The deployment of PMUs in India began as a pilot project in 2008-2010; and this soon blossomed into a large-scale PMU based Wide Area Monitoring System (WAMS) called, **Unified Real-Time Dynamic State Measurement (URTDSM)**, which was proposed to be implemented in Two Phases.

Unified Real Time Dynamic State Measurement (URTDSM) Project

- Under URTDSM Phase-I Project, which was executed during 2014 - 2021, locations for PMU placement in the Indian Grid were selected based on the Philosophy decided in the Joint Meeting of all Five Reginal Standing Committee on Power System Planning held on 05.03.2012 and availability of wide-band communication at the sub-stations.

  --- *[Annexure-I (URTDSM1-Criteria)]*

- Based on the experience of installation of PMUs under URTDSM Phase-I, and feedback provided by Grid-India (erstwhile POSOCO) to CEA/ CERC and all Stakeholders, requirement for New Locations for PMUs & Additional Analytics on PMU Data came up.

- Accordingly, a Committee, set up by NPC Division of CEA in September, 2021, came up with a "Report on PMU Placement and Analytics under URTDSM Phase II", and the same was approved by NPC in its 13th Meeting held on 05.07.2023.

Different Guidelines in force for PMU Installation in Indian Grid

- It has been observed that the following three Guidelines/ Standards are prevalent with specified criteria for placement of PMUs in the Indian Electric Grid:

1) Regulation 48 (6) of Central Electricity Authority (Technical Standards for Construction of Electric Plants and Electric Lines) Regulations, 2022 – [**specifies the Locations of PMUs in general**] ---***[Annexure-I (CEA-CSR Criteria)]***

2) Report of the Sub-Committee on PMU Placement and Analytics under URDTSM Phase II brought out in 2023 – [**extensively deals with <u>various possible Locations of PMUs</u>**] ---***[Annexure-I (URTDSM Sub-Committee Criteria)]***

3) Guidelines on Interface Requirements brought out under the Central Electricity Regulatory Commission (Communication System for inter-State transmission of electricity) Regulations, 2017 and issued vide CERC Order dated 19.01.2024 [**primarily deal with <u>various Parameters to be telemetered from PMUs</u> placed on various equipment (power system elements) in various Stations**]

---***[Annexure-II (CERC-GIR Criteria)]***

PMU Committee Guidelines, 2025

- In this connection, a meeting was held on 20.06.2024 to bring clarity about the **locations of Phasor Measurement Units (PMUs)** in the Grid **and the Parameters to be telemetered** from them.

- As per the decision taken in the Meeting, a Committee - *under the Chairmanship of Member (Power System), CEA with Members from CEA, CTUIL, POWERGRID, GRID INDIA, NTPC, NHPC, Electric Power Transmission Association (EPTA), Independent Power Producers Association of India (IPPAI), CPRI, National Physical Laboratory, Sustainable Project Developer Association (SPDA), Indian Wind Power Association (IWPA)* - was constituted vide CEA letter dated **04.10.2024** to suggest ways to harmonize various requirements for PMU installation into one single Guideline.

PMU Committee Guidelines, 2025 [contd…]

- This PMU Committee held TWO Meetings on **05.12.2024** and **27.01.2025** to deliberate & finalize draft "Guidelines for Unified Philosophy for Placement of Phasor Measurement Units (PMUs) in Indian Grid".

- In the second meeting of the Committee held on 27.01.2025, Analytics Tool Developers, viz., M/s Electric Power Group (EPG) and M/s GE were also invited for taking their opinion regarding the placement of PMUs.

- Based on the extensive deliberations held during the meetings and recommendations of the Committee, Draft "Guidelines on Unified Philosophy for placement of PMUs in Indian Grid" have been finalized.
- **These Guidelines primarily specify the optmised locations & the elements on which PMUs are required as well as the optimized signals/ data to be telemetered from those PMUs.** ***--[Annexure-III (PMU Committee Criteria)]***

Way Forward

- CEA Construction Standards, 2022 specifies **Locations of PMUs placement in general**

- URTDSM Sub-Committee Report, 2023 specifies **extensive list of possible locations** for PMUs placement

- CERC Guidelines on Interfacing Requirements, 2024 specify **list of parameters to be telemetered from PMUs** placed on various equipment in various sub-stations and generating stations

- PMU Committee Guidelines, 2025 specify **both optimized locations for PMUs placement and optimized list of Signals to be telemetered from PMU's**

Way Forward [contd...]

Annexure-B

- A Comparative Statement on **PMU locations** between PMU Committee Guidelines and URTDSM Sub-Committee Guidelines is given at **Annexure-IV**
- A Comparative Statement on **PMU Parameters** between PMU Committee Guidelines and CERC Guidelines on Interfacing Requirements is given at **Annexure-V**
- ***W.r.t. PMU Locations, the following is noted:***
  - **PMU Locations as per PMU Committee Guidelines are basically an optimized list of that present in URTSM Sub-Committee Report, and sufficient to obtain required levels of observability.**
  - **Accordingly, for Uniformity in approach w.r.t Placement of PMUs in the Indian Grid, *above finalized PMU Committee Guidelines, 2025 shall be adopted for implementation*.**
- ***W.r.t. Parameters to be telemetered from PMU's, the following is noted:***
  - ***W.r.t. Analog and Digital Parameters, the Items present PMU Committee Guidelines are basically an optimized list of that present in CERC Interfacing Guidelines, and sufficient to obtain required observability levels***
  - ***W.r.t. Protection Parameters, the Items not present in CERC Interfacing Guidelines, but present in PMU Committee Guidelines, are general in nature, and not manadatory; PMU Committee Guidelines, 2025 are in general agreement with CERC Guidelines on Interfacing Requirements, 2024 w.r.t. PMU Parameters to be telemetered; as such, there is no need to bring any Amendment in CERC Guidelines on Interfacing Requirements, 2024.***
  - **Therefore for Uniformity in approach w.r.t PMU Parameters to be telemetered in the Indian Grid, *above finalized PMU Committee Guidelines, 2025 shall be adopted for implementation*.**

THANK YOU

Annexure-C

URTDSM1-Criteria

Criteria for PMU Locations under URTDSM Phase-I:

During the Joint Meeting of all the five Regional Standing Committees on Power system Planning held on 05.03.2012, following PMU placement philosophy was decided:

a) All 400 kV Stations in State and ISTS Grids
b) All Generating Stations at 220 kV and above
c) HVDC Terminals and inter-regional and inter-national Tie- lines
d) Both ends of all the transmission lines at 400 kV and above: State and ISTS Sector

CEA-CSR-Criteria

As per Regulation 48(6) of Central Electricity Authority (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations, 2022:

48 (6) PMU Requirements:

(a) *Synchrophasor measurement using Phasor Measurement Units along with fibre optic connectivity, Global Positioning System Receiver and communication equipment shall be provided for monitoring the entire interconnected grid on real time basis* ***at substations of 400 kV and above voltage level, switchyard of generating stations at 220 kV and above voltage level, Alternating Current side of converter bays of High Voltage Direct Current stations and Pooling Point of renewable energy generating stations of fifty mega watt and more and Battery Energy Storage System of fifty mega watt and more****.*

(b) *Phasor Measurement Units shall comply with IS 60255-118-1-2018.*

(c) *The dispersedly located Phasor Measurement Units shall communicate with Phasor Data Concentrators installed at certain strategic locations at State, Regional and National level*

Annexure-C

URTDSM Sub-Committee-Criteria

The "Report of the Sub-Committee on PMU Placement and Analytics under URTDSM Phase II" suggested, inter alia, the following minimum criteria for placement of PMUs for URTDSM Phase-II:

1) At one end of all 400 kV and above transmission lines.
2) At the HV side of all ICTs connected to 220 kV and above.
3) On HV side of coupling transformer of SVC/STATCOM for measurement of HV Bus voltage and current of coupling transformer
4) At one end of line wherever FSC/ TCSC are installed.
5) On HV side of converter transformers for measuring HVAC bus voltage and current of converter transformer on each converter station.
6) On both ends of Inter-regional and trans-national tie lines and on boundary buses for such lines.
7) At the Generating Transformers (GTs) at LV side (having HV side of 220 kV and above) of the Generating units with capacity above 200 MW for Thermal units, 50 MW for Hydro units and 100 MW for Gas units.
8) On all 220 kV substations for measuring voltage of 220 kV bus and current of two lines/transformer catering to load centers.
9) All 132 kV and above ISTS lines in NER & Sikkim and important load centers.
10) At RE developer end of the evacuating line connecting the Renewable Energy Pooling Stations (PS) to point of interconnection with the grid of 50 MW and above.
11) Islanding, Separating & Restoration Points- At one end of line which is connected to black start stations along with circuit breaker status via synchro phasors.
12) Fiber Optic should be covered under Phase – II for all the above locations of the URTDSM project.
13) At all ICTs, Bus reactors, Switchable line reactors of critical substations.

*****

Annexure-D

CERC Guidelines on Interface Requirements

B. PMU Signal List

Sl. No	Description	Analog Points	Digital Points	Protection Signal
1	Line	**VOLTAGE** {VRM, VYM, VBM, VPM, VRA, VYA, VBA, VPA} **CURRENT** {IRM, IYM, IBM, IPM, IRA, IYA, IBA, IPA} MW, MVAR, F, DF/DT	-Main Breaker status -Tie Breaker status -Isolators	Main1/Main2 protection,
2	Bays		- Breaker -Isolators	
3	Main Buses, Transfer Buses	- **VOLTAGE** {VRM, VYM, VBM, VPM, VRA, VYA, VBA, VPA} F, DF/DT	Bus Sectionalizer, Bus Coupler Breaker	
4	Transformer/Coupling Transformer/Converter Transformer	- **VOLTAGE** {VRM, VYM, VBM, VPM, VRA, VYA, VBA, VPA} **CURRENT** {IRM, IYM, IBM, IPM, IRA, IYA, IBA, IPA} MW/MVAR for HV& LV Side	-Breaker -Isolators	Main1/Main2 protection
5	Reactor	**VOLTAGE** {VRM, VYM, VBM, VPM, VRA, VYA, VBA, VPA} **CURRENT** {IRM, IYM, IBM, IPM, IRA, IYA, IBA, IPA} MVAR	-Breaker -Isolators	
6	FSC/TCSC	**VOLTAGE** {VRM, VYM, VBM, VPM, VRA, VYA, VBA, VPA} **CURRENT** {IRM, IYM, IBM, IPM, IRA, IYA, IBA, IPA} MVAR	-Bypass Breaker - -FSC ON/OFF Status	

7	SVC	**VOLTAGE** {VRM, VYM, VBM, VPM, VRA, VYA, VBA, VPA} **CURRENT** {IRM, IYM, IBM, IPM, IRA, IYA, IBA, IPA} MVAR	Breaker	
8	Generator	**VOLTAGE** {VRM, VYM, VBM, VPM, VRA, VYA, VBA, VPA} **CURRENT** {IRM, IYM, IBM, IPM, IRA, IYA, IBA, IPA} MW, MVAR, F, DF/DT for HV& LV Side	-RGMO/FGMO ON/OFF Status Breaker Status -Isolators	V
9	STATCOM	**VOLTAGE** {VRM, VYM, VBM, VPM, VRA, VYA, VBA, VPA} **CURRENT** {IRM, IYM, IBM, IPM, IRA, IYA, IBA, IPA} MW, MVAR, F, DF/DT	- CB OF EACH MODULE MSR, MSC	
10	Phase Shifter	**VOLTAGE** {VRM, VYM, VBM, VPM, VRA, VYA, VBA, VPA} **CURRENT** {IRM, IYM, IBM, IPM, IRA, IYA, IBA, IPA} HV & LV MW / MVAR F, DF/DT	- CB	

Annexure-E

Criteria for Placement of PMUs (Location, Elements) and Signals to be Measured and Reported by PMUs

SN	Locations for Placement of PMU	Elements to be considered	Signals to be measured and reported by PMUs		
			Analog Points	Digital Points	General List of Protection Signals $
1.	Substations of 400 kV and above Voltage Level	At one end of all Transmission Line Bays of 400 kV and above. Note: Of the two ends of the line, PMU needs to be provided at only ONE end	• Voltage and Current • MW and MVAR	Circuit Breaker (CB) Status	• Distance protection relay (21-1/21-2) • Over Voltage Protection (59) • Main1+Main2 Protection (Combined) And any other as per requirement
		Bus bars of 400 kV and above	Bus voltage and frequency and DF/DT	Bus Sectionalizer/ Bus Coupler wherever applicable	Bus Bar Protection operated • Bus bar differential protection (87B) • Local breaker back up protection (50LBB) And any other signal as per requirement

2.	Switchyard of 220 kV and above voltage level of Generating Stations (200 MW and above for Thermal, 50 MW and above for Hydro (including Pump Storage plants), 100 MW and above for Gas, 200 MW and above for Nuclear and 100 MVA and above for SYNCON)	At the LV side of the GT of the Generating Units/ Step-Up Transformer of the SYNCON connected with 220 kV and above Bus	• Voltage and Current • MW, MVAR	RGMO/FGMO status, GT HV side CB status	Generator Protection Trip (unit wise) • And any other as per requirement
		Bus bars of 220 kV and above at Generating Stations	Bus Voltage and Frequency and DF/DT	Bus Sectionalizer/ Bus Coupler wherever applicable	Bus Bar Protection operated • Bus bar differential protection (87B) • Local breaker backup protection (50LBB) And any other as per requirement
3.	Substations of 220 kV and above voltage level RE Generating stations with renewable/ Hybrid plants of 50 MW and more.	All Transmission Line Bays of 220 kV and above	• Voltage and Current • MW and MVAR	CB Status	• Distance protection relay (21-1/21-2) • Over Voltage Protection (59) • Main1+Main2 Protection (Combined) And any other as per requirement
		Bus bars of 220 kV and above	Bus Voltage and Frequency and DF/DT	Bus Sectionalizer/ Bus Coupler wherever applicable	Bus Bar Protection operated • Bus bar differential protection (87B)

					• Local breaker backup protection (50lbb) And any other as per requirement
4.	Renewable Energy (RE) Pooling Stations of 220 kV and above voltage level connecting 50 MW and more	All Transmission Line Bays of 220 kV and above emanating from RE Pooling station to other non-generating sub-station.	• Voltage and Current • MW and MVAR	CB Status	• Distance protection relay (21-1/21-2) • Over Voltage Protection (59) • Main1+Main2 Protection (Combined) And any other as per requirement
		Bus bars of 220 kV and above	Bus Voltage and Frequency and DF/DT	Bus Sectionalizer/ Bus Coupler wherever applicable	Bus Bar Protection operated • Bus bar differential protection (87B) • Local breaker backup protection (50LBB) And any other as per requirement
		HV side of 765/400 kV ICTs and in the absence of 765 kV Bus, on the HV side of 400/220 kV ICT.	• Voltage and Current • MW and MVAR	CB Status	Protection Trip operated • Transformer differential protection (87T) • Non direction IDMT

					O/C & E/F protection (51,51N) And any other as per requirement
5.	High Voltage Direct Current stations (HVDC)	On HV side of Converter Transformers in HVDC Stations	• Voltage and Current • MW and MVAR	CB Status	Protection Trip operated • Transformer differential protection (87T) • Non direction IDMT O/C & E/F protection (51,51N) And any other as per requirement
6.	Stations with STATCOM/ FSC/ TCSC/ SVC/ Phase Shifter	On HV side of STATCOM/ FSC/ TCSC/ SVC On both Primary & Secondary sides of Phase Shifter	• Voltage and Current • MW and MVAR	CB Status of each Module (FSC, MSR, MSC as applicable)	Protection Trip operated • Over current protection • Differential And any other as per requirement

7.	Battery Energy Storage Stations (BESS) of 50 MW and more	At Line bay of 132 kV and above of Battery Energy Storage Systems	• Voltage and Current • MW and MVAR	CB Status, Controller Status, RGMO/ FGMO Status, Modes (Energy Storage, Frequency Regulation etc.,)	Protection Trip operated LVRT, HVRT And any other as per requirement
8.	All ISTS Lines in NER and Sikkim of 132 kV and above	At one end of all Transmission Line Bays of 132 kV and above in NER and Sikkim. Note: Of the two ends of the line, PMU needs to be provided at only ONE end	• Voltage and Current • MW and MVAR	CB Status	• Distance protection relay (21-1/21-2) • Over Voltage Protection (59) • Main1+Main2 Protection (Combined) And any other as per requirement
9.	Inter-Regional/Trans-national Tie lines at 132 kV and above	At both ends of Line Bays of all Inter-Regional and Trans-National tie lines	• Voltage and Current • MW and MVAR	CB Status	• Distance protection relay (21-1/21-2) • Over Voltage Protection (59) • Main1+Main2 Protection (Combined) And any other as per requirement
10	220 kV Substations: only Stations catering to	At one end of all Transmission Line Bays of 220 kV and above	• Voltage and Current • MW and MVAR	CB Status	• Distance protection relay (21-1/21-2)

	Metropolitan cities.	Note: Of the two ends of the line, PMU needs to be provided at only ONE end			• Over Voltage Protection (59) • Main1+Main2 Protection (Combined) And any other as per requirement
		Bus bars of 220 kV	Bus voltage and frequency and DF/DT	Bus Sectionalizer/ Bus Coupler wherever applicable	Bus Bar Protection operated • Bus bar differential protection (87B) • Local breaker backup protection (50LBB) And any other as per requirement
11	Bulk consumers at 132 kV and above	At the one end of 132 kV and above	• Voltage and Current • MW and MVAR	CB Status	• Distance protection relay (21-1/21-2) • Over Voltage Protection (59) • Main1+Main2 Protection (Combined) And any other as per requirement
		Bus bars of 132 kV and above	Bus voltage and frequency and DF/DT	Bus Sectionalizer/	Bus Bar Protection operated

				Bus Coupler wherever applicable	• Bus bar differential protection (87B) • Local breaker backup protection (50LBB) • And any other as per requirement
12	Islanding, Separating and Restoration Points-	At one end of line which is connected to black start stations, islanding & restoration points	• Voltage and Current • MW and MVAR	CB Status	• Distance protection relay (21-1/21-2) • Over Voltage Protection (59) • Main1+Main2 Protection (Combined) And any other as per requirement

$ The list of protection signals are general in nature. The actual protection signals shall be decided during the execution stage of the Projects in consultation with the GRID INDIA. The actual signals shall be provided based on the availability of the spare ports in the PMUs. In any case, no additional PMUs shall be installed just for the capturing the protection signals.

Note:

1. *Wherever Line Voltage/Bus Voltage and Line Current are mentioned above, it means 3-phase Voltages and 3-phase Currents.*
2. *In One-and-Half-Breaker Scheme, CB Status means Status of both Main and Tie Breakers.*
3. *For NER: 132 kV and above Voltage level shall be considered in place of 220 kV and above*

Annexure-F

Comparative Statement on PMU Locations between PMU Committee Guidelines and URTDSM Sub-Committee Guidelines

SN	Station	Location for PMU Placement	
		Report of the Sub-Committee on PMU Placement and Analytics under URTDSM Phase II	**PMU Committee Guidelines**
1.	Substations of 220 kV and above Voltage Level	➢ At one end of all 400 kV and above transmission lines ➢ At the HV side of all ICTs connected to 220 kV and above	**Substations of 400 kV and above Voltage Level** ➢ At one end of all Transmission Line Bays of 400 kV and above. ➢ Bus bars of 400 kV and above
2.	Switchyard of 220 kV and above voltage level of Generating Stations	**Generating units with capacity above 200 MW for Thermal units, 50 MW for Hydro units and 50 MW for Gas units** ➢ Generating Transformers (GTs) at LV side (having HV side of 220 kV and above)	**Switchyard of 220 kV and above voltage level of Generating Stations (200 MW and above for Thermal, 50 MW and above for Hydro (including Pump Storage plants), 100 MW and above for Gas, 200 MW and above for Nuclear and 100 MVA and above for SYNCON)** ➢ At the LV side of the GT of the Generating Units/ Step-Up Transformer of the SYNCON connected with 220 kV and above Bus ➢ Bus bars of 220 kV and above at Generating Station
3.	Substations of 220 kV and above voltage level of RE Generating stations	➢ At RE developer end of the evacuating line connecting the Renewable Energy Pooling Stations (PS) to point of interconnection with the grid of 50 MW and above.	➢ All Transmission Lines of 220 kV and above ➢ Bus bars of 220 kV and above

Annexure-F

4.	Renewable Energy (RE) Pooling Stations of 220 kV and above voltage level connecting 50 MW and more	➢ At one end of all 400 kV and above transmission lines ➢ At the HV side of all ICTs connected to 220 kV and above	➢ All Transmission Line Bays of 220 kV and above emanating from RE Pooling station to other non-generating sub-station. ➢ Bus bars of 220 kV and above ➢ HV side of 765/400 kV ICTs and in the absence of 765 kV Bus, on the HV side of 400/220 kV ICT
5.	High Voltage Direct Current stations (HVDC)	➢ On HV side of converter transformers	➢ On HV side of Converter Transformers in HVDC Stations
6.	Stations with STATCOM/ FSC/ TCSC/ SVCC/ Phase Shifter	➢ On HV side of coupling transformer of SVC/STATCOM ➢ At one end of the line wherever FSC/ TCSC are installed.	➢ On HV side of STATCOM/ FSC/ TCSC/ SVC/Phase Shifter
7.	Battery Energy Storage Stations (BESS) of 50 MW and more	Not included	➢ At Line Bays of all 132 kV and above of Battery Energy Storage Systems
8.	All ISTS Lines in NERC Sikkim of 132kV and above	➢ All 132 kV and above ISTS lines in NER and Sikkim and important load centers	➢ At one end of all Transmission Line Bays of 132 kV and above in NER and Sikkim.
9.	Inter-Regional/Trans-national Tie lines	➢ Both ends of Inter-regional and trans-national tie lines ➢ Boundary buses for such lines.	➢ At both ends of Line Bays of all Inter-Regional and Trans-National Tie-lines at 132 kV & above voltage level.
10	All 220 kV substations catering to load centers.	➢ 220 kV Bus bars ➢ Two lines/transformer catering to load centers	**Only Critical 220 kV Substations catering to Metropolitan Cities** ➢ At one end of all Transmission Line Bays of 220 kV and above ➢ Bus bars of 220 kV

Annexure-F

11	Islanding, Separating and Restoration Points	➢ At one end of line which is connected to black start stations	➢ At one end of line which is connected to black start stations, islanding & restoration points
12	Critical substations	➢ ICTs ➢ Bus reactors ➢ Switchable line reactors	Not included
13	Bulk consumers at 132 kV and above	➢ Not included	➢ At the one end of 132 kV and above ➢ Bus bars of 132 kV and above

******

Annexure-G

Comparative Statement on PMU Parameters between Draft PMU Committee Guidelines and CERC Guidelines on Interfacing Requirements

SN	Description	Analog Points		Digital Points		Protection Signal	
		CERC Guidelines	PMU Committee Guidelines	CERC Guidelines	PMU Committee Guidelines	CERC Guidelines	PMU Committee Guidelines
1	Line	• **VOLTAGE** {VRM, VYM, VBM, VPM, VRA, VYA, VBA, VPA} • **CURRENT** {IRM, IYM, IBM, IPM, IRA, IYA, IBA, IPA} • MW, MVAR, F, DF/DT	• Line Voltage and Current	• Main Breaker status • Tie Breaker Status • Isolators	• Circuit Breaker Status • Tie breaker Status, in case of one-and-half-breaker Scheme	• Main1/Main2 protection	• Distance protection relay (21-1/21-2) • Over Voltage Protection (59) • Main1+Main2 Protection (Combined) • And any other as per requirement
2	Bays	—	—	• Breaker • Isolators	—	—	—
3	Main Buses, Transfer Buses	• **VOLTAGE** {VRM, VYM, VBM, VPM, VRA, VYA, VBA, VPA} • F, DF/DT	• Bus Voltage and Frequency	• Bus Sectionalizer • Bus Coupler Breaker	• Bus Sectionalizer/ Bus Coupler wherever applicable		• Bus Bar Protection operated • Bus bar differential protection (87B) • Local breaker backup protection (50LBB) • And any other as per requirement

Annexure-G

4	Transformer/Coupling Transformer/Converter Transformer	• **VOLTAGE** {VRM, VYM, VBM, VPM, VRA, VYA, VBA, VPA} • **CURRENT** {IRM, IYM, IBM, IPM, IRA, IYA, IBA, IPA} • MW/MVAR for HV& LV Side	a) On HV side of 765/400 kV ICTs and in the absence of 765 kV Bus, on the HV side of 400/220 kV ICT in case of Renewable Energy (RE) Pooling Stations of 220 kV and above voltage level connecting 50 MW and more • Voltage and Current b) On HV side of Coupling Transformer of STATCOM • Voltage and Current c) On HV side of Converter Transformers in	• Breaker • Isolators	• Circuit Breaker Status	• Main1/Main2 protection	• Transformer differential protection (87T) • Non direction IDMT O/C & E/F protection (51,51N) • And any other as per requirement

			HVDC Stations • Voltage and Current				

Annexure-G

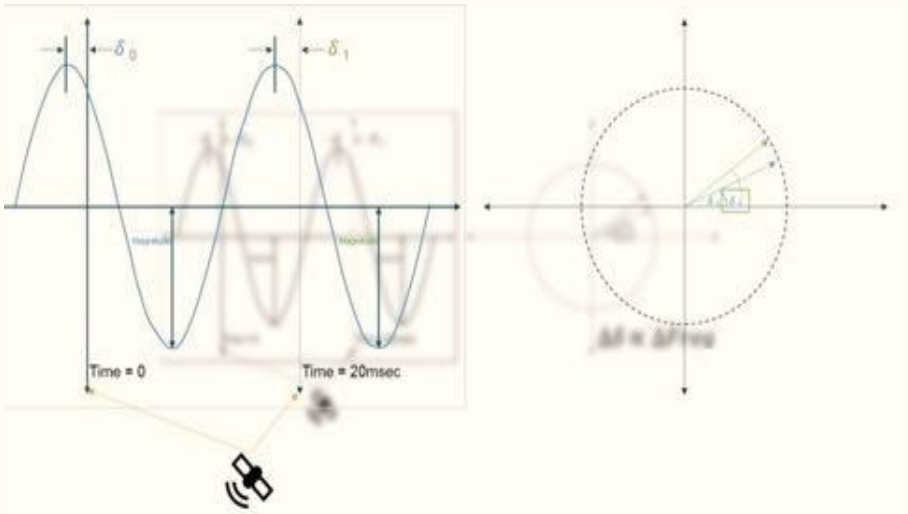
5	Reactor	• **VOLTAGE** {VRM, VYM, VBM, VPM, VRA, VYA, VBA, VPA} • **CURRENT** {IRM, IYM, IBM, IPM, IRA, IYA, IBA, IPA} • MVAR	—	• Breaker • Isolators	—		—
6	FSC/TCSC	• **VOLTAGE** {VRM, VYM, VBM, VPM, VRA, VYA, VBA, VPA} • **CURRENT** {IRM, IYM, IBM, IPM, IRA, IYA, IBA, IPA} • MVAR	• Voltage and Current	• Bypass Breaker • FSC ON/OFF Status	• CB Status of each Module (FSC, MSR, MSC as applicable)		• Over current protection • Differential • And any other as per requirement
7	SVC	• **VOLTAGE** {VRM, VYM, VBM, VPM, VRA, VYA, VBA, VPA} • **CURRENT** {IRM, IYM, IBM, IPM, IRA, IYA, IBA, IPA} • MVAR	• Voltage and Current	• Breaker	• CB Status of each Module		• Over current protection • Differential • And any other as per requirement

8	Generator	• **VOLTAGE** {VRM, VYM, VBM, VPM, VRA, VYA, VBA, VPA} • **CURRENT** {IRM, IYM, IBM, IPM, IRA, IYA, IBA, IPA} • MW, MVAR, F, DF/DT for HV& LV Side	At the LV side of the GT of the Generating Units/ Step-Up Transformer of the SYNCON connected with 220 kV and above Bus: • Voltage and Current	• RGMO/FGMO ON/OFF Status • Breaker Status • Isolators	• RGMO/FGMO status • GT HV side CB status	V	• Generator Protection Trip (unit wise) • And any other as per requirement
9	STATCOM	• **VOLTAGE** {VRM, VYM, VBM, VPM, VRA, VYA, VBA, VPA} • **CURRENT** {IRM, IYM, IBM, IPM, IRA, IYA, IBA, IPA} • MW, MVAR, F, DF/DT	• Voltage and Current	• Circuit Breaker of each Module Module MSR, MSC	• CB Status of each Module	—	• Over current protection • Differential • And any other as per requirement
10	Phase Shifter	• **VOLTAGE** {VRM, VYM, VBM, VPM, VRA, VYA, VBA, VPA} • **CURRENT** {IRM, IYM, IBM, IPM, IRA, IYA, IBA, IPA} • HV & LV MW / MVAR F, DF/DT	• Voltage and Current	• Circuit Breaker	• CB Status		• Over current protection • Differential • And any other as per requirement

*****

सत्यमेव जयते

Guidelines for Unified Philosophy for Placement of Phasor Measurement Units (PMUs) in Indian Grid



GOVERNMENT OF INDIA
MINISTRY OF POWER
CENTRAL ELECTRICITY AUTHORITY

March, 2025

Guidelines on Unified Philosophy for Placement of Phasor Measurement Unit (PMUs) in Indian Grid

March, 2025

Table of Content

1. Introduction

India's power grid is one of the largest in the world, spanning different regions with varying demand profiles, generation sources, and transmission elements. Increasing penetration of renewable energy RE), especially solar and wind, in Indian Grid, introduces variability and unpredictability in power generation. In such a scenario, the requirement of Phasor Measurement Units (PMUs) in the grid becomes crucial. PMUs are critical devices in Wide Area Monitoring Systems (WAMS). Phasor measurement units (PMUs) measure current and voltage by amplitude and phase at selected stations of the transmission system. The high-precision time synchronization (via GPS/ NavIC) allows comparing measured values (synchrophasors) from different substations far apart and drawing conclusions as to the system state and dynamic events such as power swing conditions.

Phasor Measurement Unit captures the Current and Voltage at a high sampling rate which enables estimation of the accurate phasor. The data in each PMU is time-synchronized via Global Positioning System (GPS)/ NavIC receivers and aggregated in the Phasor Data Concentrator (PDC). The phasors measured simultaneously provide snapshots of the conditions at monitored nodes. By comparing these snapshots, the steady state and also the dynamic state of critical nodes can be observed across transmission and sub-transmission networks.

Under URTDSM Phase-I Project, which was executed during 2014 - 2021, locations for PMU placement in the Indian Gird were selected based on the suggestion of Panel of Experts and availability of wide-band communication at the sub-stations. The data from PMUs is presently available at a resolution of 40 ms (25 frames per second). Subsequently, with the expanding Electric grid owing to expansion in Renewable Energy capacity addition, PMUs are being installed at more locations and elements. The objective of these guidelines is to define the criteria for placement of PMUs in Indian Electric Grid.

2. Existing Philosophy for Placement of PMUs

2.1 The following three guidelines/standards are prevalent with specified criterion for placement of PMU in Indian Electric Grid.

(i) Regulation 48 (6) of the Central Electricity Authority (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations, 2022.

(ii) Report of the Sub-Committee on PMU Placement and Analytics under URTDSM Phase II.

(iii) "Interface Requirements" under the Central Electricity Regulatory Commission (Communication System for inter-State transmission of electricity) Regulations, 2017

2.2 <u>As per Sub-Committee Report on PMU Placement and Analytics under URTDSM Phase-II:</u> Based on the experience of installation of PMUs under URTDSM Phase-I, feedback was provided by Grid-India (erstwhile POSOCO) to CEA/ CERC and all stakeholders. Subsequently, National Power Committee, CEA vide letter 20.09.2021 set up a Sub-Committee to provide recommendations of the placement of PMUs in URTDSM phase-II and to suggest applications for deployment. The "Report of the Sub-Committee on PMU Placement and Analytics under URTDSM Phase II" suggested *inter alia* minimum criteria for placement of PMUs for URTDSM Phase-II. As per this report (Page No-68 of the report) following locations should have PMUs (Minimum Criteria):

(i) At one end of all 400 kV and above transmission lines

(ii) At the HV side of all ICTs connected to 220 kV and above

(iii) On HV side of coupling transformer of SVC/STATCOM for measurement of HV Bus voltage and current of coupling transformer

(iv) At one end of line wherever FSC/ TCSC are installed.

(v) On HV side of converter transformers for measuring HVAC bus voltage and current of converter transformer on each converter station.

(vi) On both ends of Inter-regional and trans-national tie lines and on boundary buses for such lines.

(vii) At the Generating Transformers (GTs) at LV side (having HV side of 220 kV and above) of the Generating units with capacity above 200 MW for Thermal units, 50 MW for Hydro units and 100 MW for Gas units.

(viii) On all 220 kV substations for measuring voltage of 220 kV bus and current of two lines/transformer catering to load centers.

(ix) All 132 kV and above ISTS lines in NER & Sikkim and important load centers.

(x) At RE developer end of the evacuating line connecting the Renewable Energy Pooling Stations (PS) to point of interconnection with the grid of 50 MW and above.

(xi) Islanding, Separating & Restoration Points- At one end of line which is connected to black start stations along with circuit breaker status via synchro phasors.

(xii) Fiber Optic should be covered under Phase – II for all the above locations of the URTDSM project.

(xiii) At all ICTs, Bus reactors, Switchable line reactors of critical substations.

2.3 As per Guidelines on "Interfacing Requirements" brought out under the Central Electricity Regulatory Commission (Communication System for inter-State transmission of electricity) Regulations, 2017: Based on the inputs from NLDC and in consultation with all the stakeholders, CERC has notified these Guidelines on Interface Requirements vide Order dated 19.01.2024. These guidelines provide the signals that need to be telemetered from PMUs installed at any location. As per the guidelines the parameters to be telemetered from various sub-stations and generating stations with respect to PMU are as per the table given below:

SN	Description	Analog Points	Digital Points	Protection Signal
1	Line	**VOLTAGE** {VRM, VYM, VBM, VPM, VRA, VYA, VBA, VPA}	–Main Breaker status –Tie Breaker status –Isolators	Main1/Main2 protection,
		CURRENT {IRM, IYM, IBM, IPM, IRA, IYA, IBA, IPA}		
		MW, MVAR, F , DF/DT		
2	Bays		- Breaker –Isolators	
3	Main Buses, Transfer Buses	– **VOLTAGE** {VRM, VYM, VBM, VPM, VRA, VYA, VBA, VPA} F, DF/DT	Bus Sectionalizer, Bus Coupler Breaker	

4	Transformer/Coupling Transformer/Converter Transformer	– **VOLTAGE** {VRM, VYM, VBM, VPM, VRA, VYA, VBA, VPA}	–Breaker –Isolators	Main1/Main2 protection
		CURRENT {IRM, IYM, IBM, IPM, IRA, IYA, IBA, IPA}		
		MW/MVAR		
		for HV& LV Side		
5	Reactor	**VOLTAGE** {VRM, VYM, VBM, VPM, VRA, VYA, VBA, VPA}	–Breaker –Isolators	
		CURRENT {IRM, IYM, IBM, IPM, IRA, IYA, IBA, IPA}		
		MVAR		
6	FSC/TCSC	**VOLTAGE** {VRM, VYM, VBM, VPM, VRA, VYA, VBA, VPA}	–Bypass Breaker - –FSC ON/OFF Status	
		CURRENT {IRM, IYM, IBM, IPM, IRA, IYA, IBA, IPA}		
		MVAR		
7	SVC	VOLTAGE {VRM, VYM, VBM, VPM, VRA, VYA, VBA, VPA} CURRENT {IRM, IYM, IBM, IPM, IRA, IYA, IBA, IPA} MVAR	Breaker	
8	Generator	VOLTAGE {VRM, VYM, VBM, VPM, VRA, VYA, VBA, VPA} CURRENT {IRM, IYM, IBM, IPM, IRA, IYA, IBA, IPA} MW, MVAR, F, DF/DT for HV& LV Side	–RGMO/FGMO ON/OFF Status Breaker Status –Isolators	V
9	STATCOM	VOLTAGE {VRM, VYM, VBM, VPM, VRA, VYA, VBA, VPA} CURRENT {IRM, IYM,	-CB OF EACH MODULE MSR, MSC	

		IBM, IPM, IRA, IYA, IBA, IPA} MW, MVAR, F, DF/DT		
10	Phase Shifter	VOLTAGE {VRM, VYM, VBM, VPM, VRA, VYA, VBA, VPA} CURRENT {IRM, IYM, IBM, IPM, IRA, IYA, IBA, IPA} HV & LV MW / MVAR F, DF/DT	- CB	

2.4 As per Central Electricity Authority (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations, 2022: As per Regulation 48(6) of Central Electricity Authority (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations, 2022, it is mandatory to install PMUs at substations of 400 kV and above voltage level, switchyard of generating stations at 220 kV and above voltage level. The relevant extract of Regulation 48(6) is as under:

48 (6) Phasor Measurement Units:

(a) Synchrophasor measurement using Phasor Measurement Units along with fibre optic connectivity, Global Positioning System Receiver and communication equipment shall be provided for monitoring the entire interconnected grid on real time basis at substations of 400 kV and above voltage level, switchyard of generating stations at 220 kV and above voltage *level, Alternating Current side of converter bays of High Voltage Direct Current stations and pooling point of renewable energy generating stations of fifty mega watt and more and Battery Energy Storage System of fifty mega watt and more.*

(b) Phasor Measurement Units shall comply with IS 60255-118-1-2018.

(c) The dispersedly located Phasor Measurement Units shall communicate with Phasor Data Concentrators installed at certain strategic locations at State, Regional and National level.

2.5 It has been observed that existing criteria/ philosophies as mentioned above for placement of PMUs in the substations are not uniform. The said guidelines are not aligned with each other. Therefore, there is a need to harmonise these varying philosophies.

3. Committee for the Unified Philosophy for Placement of PMUs in Indian Grid:

A committee was constituted vide letter No CEA-PS-14-12/9/2024-PSETD Division dated 04.10.2024 to study the different guidelines for the requirement of PMU installation currently in force in the country and to suggest ways to harmonize the requirements for placement of PMUs into one single document. The draft Guidelines were formulated based on the inputs from the committee members. Subsequently, the first meeting of the Committee was held on 05.12.2024 to discuss the draft "Guidelines for Unified Philosophy for placement of Phasor Measurement Units (PMUs) in Indian Grid". The second meeting of the Committee was held on 27.01.2025 in which Analytics Tool Developers, viz., M/s Electric Power Group (EPG) and M/s GE were invited for taking their opinion regarding the placement of PMUs. Based on the discussion during the meeting and recommendations of the Committee, this Unified Philosophy for placement of PMUs in Indian Grid has been finalised.

4. General Requirements of PMUs

4.1 PMU shall comply with the latest version of IS/IEC/IEEE 60255-118-1 and IEEE C37.118.2 Standards as amended. PMU shall include the supporting components such as fiber optic connectivity, Navigation with Indian Constellation (NavIC) and Global Positioning System (GPS) based time receiver system and associated network Ethernet Switches. The PMU shall support measurement of minimum two feeders or elements (i.e. two sets of three phase voltage and current phasors).

4.2 The PMU shall support data reporting rates of 25 and 50 frames per second for 50 Hz System. For RE generating plants, BESS and other grid connected invertor/ convertor based equipment including the hybrid generation plant, PMU shall support reporting rate of minimum 100 frames per second. PMUs shall communicate with the Phasor Data Concentrators (PDCs) installed at strategic locations at respective State, Regional and National Level.

4.3 The PMUs shall be able to acquire/measure/calculate at least the following signals and report it to the PDCs specified above:

a) 3-phase voltage Phasors, (Magnitude and angle),
b) 3-phase current Phasors, (Magnitude and angle),
c) Positive sequence voltage, (Magnitude and angle),
d) Positive sequence current, (Magnitude and angle),
e) Circuit Breaker Status (ON/OFF)
f) Protection operated status
g) Frequency (Hz)
h) Rate of Change of Frequency (ROCOF)-df/dt
i) Analog Values (MW, MVAR)

5.0 Criteria for placement of PMUs

Criteria for placement of PMUs in the system shall be as per **Annexure-I**. This criteria specifies the locations, the elements on which PMUs are required at specified location and the signals/data to be reported by the PMUs.

*****

Annexure-I

Criteria for Placement of PMUs (Location, Elements) and Signals to be measured and reported by PMUs

SN	Locations for Placement of PMU	Elements to be considered	Signals to be measured and reported by PMUs		
			Analog Points	Digital Points	General List of Protection Signals $
1.	Substations of 400 kV and above Voltage Level	At one end of all Transmission Line Bays of 400 kV and above. Note: Of the two ends of the line, PMU needs to be provided at only ONE end	• Voltage and Current • MW and MVAR	Circuit Breaker (CB) Status	• Distance protection relay (21-1/21-2) • Over Voltage Protection (59) • Main1+Main2 Protection (Combined) And any other as per requirement
		Bus bars of 400 kV and above	Bus voltage and frequency and DF/DT	Bus Sectionalizer/ Bus Coupler wherever applicable	Bus Bar Protection operated • Bus bar differential protection (87B) • Local breaker back up protection (50LBB) And any other signal as per requirement

2.	Switchyard of 220 kV and above voltage level of Generating Stations (200 MW and above for Thermal, 50 MW and above for Hydro (including Pump Storage plants), 100 MW and above for Gas, 200 MW and above for Nuclear and 100 MVA and above for SYNCON)	At the LV side of the GT of the Generating Units/ Step-Up Transformer of the SYNCON connected with 220 kV and above Bus	• Voltage and Current • MW, MVAR	RGMO/FGMO status, GT HV side CB status	Generator Protection Trip (unit wise) • And any other as per requirement
		Bus bars of 220 kV and above at Generating Stations	Bus Voltage and Frequency and DF/DT	Bus Sectionalizer/ Bus Coupler wherever applicable	Bus Bar Protection operated • Bus bar differential protection (87B) • Local breaker backup protection (50LBB) And any other as per requirement
3.	Substations of 220 kV and above voltage level RE Generating stations with renewable/ Hybrid plants of 50 MW and more.	All Transmission Line Bays of 220 kV and above	• Voltage and Current • MW and MVAR	CB Status	• Distance protection relay (21-1/21-2) • Over Voltage Protection (59) • Main1+Main2 Protection (Combined) And any other as per requirement

		Bus bars of 220 kV and above	Bus Voltage and Frequency and DF/DT	Bus Sectionalizer/ Bus Coupler wherever applicable	Bus Bar Protection operated • Bus bar differential protection (87B) • Local breaker backup protection (50lbb) And any other as per requirement
4.	Renewable Energy (RE) Pooling Stations of 220 kV and above voltage level connecting 50 MW and more	All Transmission Line Bays of 220 kV and above emanating from RE Pooling station to other non-generating sub-station.	• Voltage and Current • MW and MVAR	CB Status	• Distance protection relay (21-1/21-2) • Over Voltage Protection (59) • Main1+Main2 Protection (Combined) And any other as per requirement
		Bus bars of 220 kV and above	Bus Voltage and Frequency and DF/DT	Bus Sectionalizer/ Bus Coupler wherever applicable	Bus Bar Protection operated • Bus bar differential protection (87B) • Local breaker backup protection (50LBB) And any other as per requirement

		HV side of 765/400 kV ICTs and in the absence of 765 kV Bus, on the HV side of 400/220 kV ICT.	• Voltage and Current • MW and MVAR	CB Status	Protection Trip operated • Transformer differential protection (87T) • Non direction IDMT O/C & E/F protection (51,51N) And any other as per requirement
5.	High Voltage Direct Current stations (HVDC)	On HV side of Converter Transformers in HVDC Stations	• Voltage and Current • MW and MVAR	CB Status	Protection Trip operated • Transformer differential protection (87T) • Non direction IDMT O/C & E/F protection (51,51N) And any other as per requirement
6.	Stations with STATCOM/ FSC/ TCSC/ SVC/ Phase Shifter	On HV side of STATCOM/ FSC/ TCSC/ SVC	• Voltage and Current • MW and MVAR	CB Status of each Module (FSC, MSR,	Protection Trip operated

		On both Primary & Secondary sides of Phase Shifter		MSC as applicable)	• Over current protection • Differential And any other as per requirement
7.	Battery Energy Storage Stations (BESS) of 50 MW and more	At Line bay of 132 kV and above of Battery Energy Storage Systems	• Voltage and Current • MW and MVAR	CB Status, Controller Status, RGMO/ FGMO Status, Modes (Energy Storage, Frequency Regulation etc.,)	Protection Trip operated LVRT, HVRT And any other as per requirement
8.	All ISTS Lines in NER and Sikkim of 132 kV and above	At one end of all Transmission Line Bays of 132 kV and above in NER and Sikkim. Note: Of the two ends of the line, PMU needs to be provided at only ONE end	• Voltage and Current • MW and MVAR	CB Status	• Distance protection relay (21-1/21-2) • Over Voltage Protection (59) • Main1+Main2 Protection (Combined) And any other as per requirement
9.	Inter-Regional/Trans-national Tie lines at 132 kV and above	At both ends of Line Bays of all Inter-Regional and Trans-National tie lines	• Voltage and Current • MW and MVAR	CB Status	• Distance protection relay (21-1/21-2) • Over Voltage Protection (59)

					• Main1+Main2 Protection (Combined) And any other as per requirement
10	220 kV Substations: only Stations catering to Metropolitan cities.	At one end of all Transmission Line Bays of 220 kV and above Note: Of the two ends of the line, PMU needs to be provided at only ONE end	• Voltage and Current • MW and MVAR	CB Status	• Distance protection relay (21-1/21-2) • Over Voltage Protection (59) • Main1+Main2 Protection (Combined) And any other as per requirement
		Bus bars of 220 kV	Bus voltage and frequency and DF/DT	Bus Sectionalizer/ Bus Coupler wherever applicable	Bus Bar Protection operated • Bus bar differential protection (87B) • Local breaker backup protection (50LBB) And any other as per requirement
11	Bulk consumers at 132 kV and above	At the one end of 132 kV and above	• Voltage and Current • MW and MVAR	CB Status	• Distance protection relay (21-1/21-2)

					• Over Voltage Protection (59) • Main1+Main2 Protection (Combined) And any other as per requirement
		Bus bars of 132 kV and above	Bus voltage and frequency and DF/DT	Bus Sectionalizer/ Bus Coupler wherever applicable	Bus Bar Protection operated • Bus bar differential protection (87B) • Local breaker backup protection (50LBB) • And any other as per requirement

12	Islanding, Separating and Restoration Points-	At one end of line which is connected to black start stations, islanding & restoration points	• Voltage and Current • MW and MVAR	CB Status	• Distance protection relay (21-1/21-2) • Over Voltage Protection (59) • Main1+Main2 Protection (Combined) And any other as per requirement

$ The list of protection signals are general in nature. The actual protection signals shall be decided during the execution stage of the Projects in consultation with the GRID INDIA. The actual signals shall be provided based on the availability of the spare ports in the PMUs. In any case, no additional PMUs shall be installed just for the capturing the protection signals.

Note:

1. *Wherever Line Voltage/Bus Voltage and Line Current are mentioned above, it means 3-phase Voltages and 3-phase Currents.*
2. *In One-and-Half-Breaker Scheme, CB Status means Status of both Main and Tie Breakers.*
3. *For NER: 132 kV and above Voltage level shall be considered in place of 220 kV and above*

Annexure-II

CEA-PS-14-12/9/2024-PSETD Division I/43540/2024

सत्यमेव जयते

भारत सरकार/ Government of India
विद्युत मंत्रालय/ Ministry of Power
केन्द्रीय विद्युत प्राधिकरण/ Central Electricity Authority
विद्युत प्रणाली अभियांत्रिकी एवं प्रौद्योगिकी विकास प्रभाग
Power System Engineering & Technology Development Division

Date: 04.10.2024

Office Order

विषय: Constitution of Committee to examine the various guidelines currently in force for the PMU installation and to suggest the ways to harmonize the requirements into one single guideline - reg.

महोदया/ महोदय,

This is in reference to the minutes of the meeting issued vide dated 18.07.2024 of the meeting held on 20.06.2024 for clarifications regarding the installation of Phasor Measurement Units (PMUs) wherein Member (Power System), CEA advised to examine the various PMU guidelines currently in force viz., CERC interface guidelines, CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations 2022 and Report of the Sub-Committee on PMU Placement and Analytics under URTDSM Phase II.

2. In the view of above the committee is constituted with following members.

1.	Member (Power System), CEA	Chairman
2.	Chief Engineer (NPC), CEA	Member
3.	Chief Engineer (PCD), CEA	Member
4.	Representative of CTUIL	Member
5.	Representative of Powergrid	Member
6.	Representative of Grid India	Member
7.	Representative of NTPC	Member
8.	Representative of NHPC	Member
9.	Representative of EPTA	Member
10.	Representative of Independent Power Producers Association of India (IPPAI)	Member
11.	Representative of CPRI	Member
12.	Representative of National Physical Laboratory (NPL)	Member
13.	Representative of Sustainable Projects Developers Association(SPDA)	Member
14.	Representative of Indian Wind Power Association (IWPA)	Member
15.	Director (PSE&TD), CEA	Member Convener

तीसरी मंजिल,सेवा भवन, आर. के. पुरम-I, नई दिल्ली-110066 टेलीफैक्स: 011-26732304 ईमेल: ce-psetd@nic.in वेबसाइट:www.cea.nic.in
3rd Floor, Sewa Bhawan, R.K Puram-I, New Delhi-110066 Telefax: 011-26732304 Email: ce-psetd@nic.in Website: www.cea.nic.in

f- JEIC (PMRP)

3. The committee shall study the different guidelines for the requirement of PMU installation currently in Force in the country and shall suggest the ways to harmonize the requirements for PMU installation into one single guidelines.

4. The committee shall finalise the single guidelines within three months of the constitution of the committee.

This issues with the approval of Competent Authority.

भवदीय,

4/10/2024

(भंवर सिंह मीना/ Bhanwar Singh Meena)

निदेशक/ Director

To,

CEO, CTUIL, 2nd Floor, Corporate Centre, Plot No:2, "Saudamini",Sec-29, Near IFFCO Chowk, Gurgaon	pcgarg@powergrid.in Cc: kksarkar@powergrid.in rakesh.kumar@powergrid.in
CMD, Powergrid Corporation of India Ltd. Saudamini, Plot No. 2, Sector – 29, Gurgaon – 122001 (Haryana)	cmd@powergrid.in tyagir@powergrid.in
M/s Grid Controller of India limited -9 (1st Floor), Qutab Institutional Area, Katwaria Sarai, New Delhi -110016	cmd@grid-india.in Cc: vivek.pandey@grid-india.in manas@grid-india.in priyam.jain@grid-india.in
CMD, NTPC Limited, NTPC Bhawan, SCOPE Complex, Institutional Area, Lodhi Road, New Delhi - 110003	cmd@ntpc.co.in
CMD, NHPC Limited, NHPC Office Complex, Sector-33, Faridabad - 121003 (Haryana)	cmd@nhpc.nic.in
Electric Power Transmission Association	ddg.epta@epta.in epta.dg@gmail.com
Independent Power Producers Association of India (IPPAI), Diamond House, 2nd Floor, 11, Primrose Road, Bengaluru - 560025	dharun@ippaimail.org gulrez@ippaimail.org
Director General, Central Power Research Institute, Prof. Sir C.V. Raman Road, Post Box No: 8066, Bengaluru	dgcpri@cpri.in
Director, CSIR-National Physical Laboratory,	director@nplindia.org

Annexure-III

CEA-PS-14-12/9/2024-PSETD Division I/45349/2024

भारत सरकार/ Government of India
विद्युत मंत्रालय/ Ministry of Power
केन्द्रीय विद्युत प्राधिकरण/ Central Electricity Authority
विद्युत प्रणाली अभियांत्रिकी एवं प्रौद्योगिकी विकास प्रभाग
Power System Engineering & Technology Development Division

सेवा में,

<as per attached list>

विषय: Minutes of the meeting held on 05.12.2024 to examine the various guidelines currently in force for the PMU installation and to suggest the ways to harmonize the requirements into one single guidelines-reg.

महोदया/ महोदय,

A meeting of the committee was convened on 05.12.2024 at 11:00 hrs at Manthan Conference Hall, 2nd Floor, Sewa Bhawan, R.K. Puram Sector-1, New Delhi under the chairmanship of Member (PS), CEA to examine the various guidelines currently in force for the PMU installation and to suggest the ways to harmonize the requirements into one single guidelines.

The minutes of the meeting is attached for your information and necessary action.

भवदीय,

Signed by Pankaj Kumar Verma
Date: 17-12-2024 13:03:48

(पंकज कुमार वर्मा/Pankaj Kumar Verma)
उप-निदेशक/Dy. Director

Copy To,

1. Chief Engineer, PCD Division, CEA
2. Chief Engineer, NPC, CEA
3. Director (PSE&TD), CEA
4. SA to Member (PS), CEA
5. PS to Chief Engineer (PSE&TD), CEA

तीसरी मंजिल,सेवा भवन, आर. के. पुरम-I, नई दिल्ली-110066 टेलीफैक्स: 011-26732435 ईमेल: ce-psetd@nic.in वेबसाइट:www.cea.nic.in
3rd Floor, Sewa Bhawan, R.K Puram-I, New Delhi-110066 Telefax: 011-26732435 Email: ce-psetd@nic.in Website: www.cea.nic.in

To,

1.	CMD, NTPC Limited, NTPC Bhawan, SCOPE Complex, Institutional Area, Lodhi Road, New Delhi-110003	cmd@ntpc.co.in Sachingarg01@ntpc.co.in ankurtripathy@ntpc.co.in
2.	CMD, Powergrid Corporation of India Ltd. Saudamini, Plot No. 2, Sector – 29, Gurgaon – 122001 (Haryana)	awanish.kumar@powergrid.in mohan.kishor@powergrid.in Cc: cmd@powergrid.in tyagir@powergrid.in
3.	M/s CTUIL, 2nd Floor, Corporate Centre, Plot No:2, "Saudamini",Sec-29, Near IFFCO Chowk, Gurgaon	tanay@powergrid.in rshakya@powergrid.in Cc: pcgarg@powergrid.in ashok@powergrid.in
4.	CMD, NHPC Limited, NHPC office complex, Sector-33, Faridabad - 121003	surendramishra@nhpc.nic.in Cc: cmd@nhpc.nic.in
5.	Director, CSIR-National Physical Laboratory, Dr. K.S. Krishnan Marg, New Delhi - 110012	avni.khatkar@nplindia.org Cc: director@nplindia.org
6.	M/s Grid Controller Of India Limited (1st Floor), Qutab Institutional Area, Katwaria Sarai, New Delhi-110016	amangautam@gridindia.in Cc: cmd@grid-india.in
7.	Director General, Central Power Research Institute, Prof. Sir C.V. Raman Road, Post Box No: 8066, Bengaluru	kaliappan@cpri.in Cc: dgcpri@cpri.in
8.	Electric Power Transmission Association	sumeet.sharma@adani.com Cc: ddg.epta@epta.com epta.dg@gmail.com
9.	Indian Wind Power Association Door – E, 6th Floor, Shakti Towers-1 766, Anna Salai, Chennai – 600002	kmn@windplus.in Cc: secretary.general@windpro.org jwpahq@windpro.org
10.	President, Sustainable Projects Developers Association (SPDA), 910, 9th floor Surya Kiran Building, 19, KG Marg, New Delhi - 110001	upendra.kumar@avaada.com ankit.gupta@avaada.com Cc: spda@solarpda.com spda@spdaonline.com

11.	Independent Power Producers Association of India (IPPAI), Diamond House, 2nd Floor, 11, Primrose Road, Bengaluru-560025	dharun@ippaimail.org gulrez@ippaimail.org divya@ippaimail.org
12.	M/s Adani Power	Sunnykumar.singh@adani.com
13.	M/s Sterlite Power	anurag.patel@sterlite.com Sahil.varma@sterlite.com
14.	M/s Apraava Energy	shadique.afgal@apraava.com wasim.alam@apraava.com
15.	M/s INDIGRID	lokendra.ranawat@indigrid.com
16.	M/s Avada Energy	pawan.kumar2@avaada.com

Minutes of the meeting held on 05.12.2024 to examine the various guidelines currently in force for the PMU installation and to suggest the ways to harmonize the requirements into one single guideline.

1. List of participants is at Annexure-III-B. No member from Independent Power Producers Association of India (IPPAI) and Indian Wind Power Association participated in the meeting.

2. Member (Power Systems) welcomed all the participants and stated that as discussed in the meeting held on 20.06.2024, there are multiple guidelines available regarding the installation of PMUs and there is need to harmonize these guidelines into one single guideline. In this regard, EPTA in consultation with POWERGRID has prepared a draft unified guidelines. These draft guidelines have been circulated among all the Members of the Committee.

3. Deputy Director (PSETD), CEA, displayed a comparative statement of provisions for PMU in different documents which is attached at Annexure-III-A. The locations for which deliberations were held are listed below and the remaining locations mentioned in Annexure-I were agreed by all.

I. PMU Locations at Substations of 400 kV and above Voltage Level

4. As per the Draft Guidelines, PMU locations at 400 kV and above Voltage level Substation were proposed for all the transmission lines bays of 400 kV and above and bus bars of 400 kV and above. The Representative of Grid India stated that PMU at any one end of the line is sufficient to provide visibility of the Network.

5. The Representative of POWERGRID stated that in case of PMU to be installed at one end the transmission line, it will be difficult to decide whether the PMU will be under the scope of the existing substation owner or the new TSP. Therefore, PMU should be installed at both ends of the 400 kV and above transmission line to avoid any ambiguity in the scope of TBCB based transmission Scheme.

6. Chief Engineer (PSE&TD), CEA stated that in case of different owner of the bays at both ends of the line, the scope of PMU installation will be clearly specified in the RfP document. He suggested that in the RfP the provision of the space for PMU for future lines may be mentioned.

7. Chief Engineer (NPC), CEA stated that optimal location should be selected for installation of PMU. Installing PMU at both ends will not provide additional information. Grid India agreed and stated that installation of PMU at one end only will be sufficient to meet the requirement of the grid.

8. Based on the discussion, it was decided that PMUs are to be installed at the one end of the Transmission line of 400 kV and above.

9. All participants agreed that there is no requirement to install the PMUs in the Transformer bays.

II. PMU Locations at Switchyard of 220 kV and above voltage level of Generating Stations (200 MW and above for Thermal, 50 MW and above for Hydro and 100 MW and above for Gas)

10. Representative of NTPC was in agreement with the above requirement of PMU installation for the upcoming projects. However, he raised the concern that PMU location for the existing substation of 220 kV and above voltage level of Switchyard should be decided after a proper assessment of the requirement of PMU.

11. Representative of Grid India suggested that Nuclear Power Plants Pumped Storage Plant (PSP) should also be considered for PMU installation for better visibility.

12. Based on the discussion, it was agreed that for the new Generating Unit (all Nuclear units, Thermal units with 200 MW and above, Hydro units with 50 MW and above, all the Pump Storage Plant) connected with 220 kV and above switchyard, PMUs are to be installed at the LV side of Generator Transformer. In addition to this, PMUs are to be installed at 220 kV Switchyard for all Transmission Lines of 220 kV and above and Bus bars of 220 kV and above. In case of North Eastern region and Sikkim, PMUs are to be installed for LV side of Generator Transformer connected with 132 kV and above Voltage, for all Transmission Lines of 132 kV and above and Bus bars of 132 kV and above.

13. It was agreed that for the existing Generating units PMU requirements shall be based on the assessment.

III. PMU Locations at Substations of 220 kV and above voltage level of RE Generating stations with renewable/ Hybrid plants of 50 MW and more

14. It was agreed that at the RE Generating Station (Solar Park Pooling Station) with renewable/ Hybrid plants of 50 MW and more, PMUs are to be installed at all the 220 kV and above transmission line and Bus bars of 220 kV and above. For the line connecting the RE generating station and the RE pooling station, PMU are to be installed at the RE developer's end only. For the line emanating from RE Generation plant, PMUs need not be installed at the other end.

IV. PMU Locations at Stations with STATCOM/ FSC/ TCSC/ SVCC Phase Shifter

15. It was agreed that no separate PMUs for FSC/TCSC are required as the PMU located at one of the ends of the line will be sufficient to measure the voltage and current. However, it should be ensured that in the case of FSC/TCSC, the digital signals pertaining to circuit breaker status of each module of FSC/TCSC are measured by the PMU. Therefore, PMU should be located at the end of the line where FSC/TCSC is installed.

16. It was agreed that in the existing line if later on FSC/TCSC is installed then it should be ensured that PMU is installed at the end where FSC/TCSC is installed irrespective of whether PMU is installed on the other end.

17. It was agreed that PMUs are to be installed at HV side of the coupling Transformer for the Synchronous Condenser (SynCon).

V. PMU Location at Inter-Regional/ Trans-national Tie Lines

18. It was agreed that many inter-regional level lines exist at voltage levels lower than 132 kV, therefore, to bring more clarity only lines of 132 kV and above may be included in elements to be considered under Inter-Regional/ Trans-national Lines for PMUs installations.

VI. PMU Location at Islanding, Separating and Restoration Points

19. It was discussed that under URTDSM phase-II guidelines, PMUs are to be installed at one end of the line which is connected to black start stations along with circuit breaker status via synchro phasors for Islanding, Separating and Restoration Points.

20. Representative of Grid-India stated that PMU at Islanding, Separating and Restoration points helps in quick and smooth restoration after a Blackout. Therefore, PMUs should also be installed at these locations.

21. After deliberation, it was agreed that PMUs are to be installed at any one end of the line which is connected to the black start stations.

VII. PMU Location at Load Centre

22. Under URTDSM phase-II guidelines, PMUs are to be installed on all 220 kV substations for measuring voltage of 220 kV bus and current of two lines/transformer catering to load centers. It was opined that covering all load centers will lead to the installation of PMUs to all the Substations. Therefore, it was agreed that PMUs are to be installed at 220 kV and above substations catering the load of Metropolitan cities.

23. Representative of NPL stated that PMU should be tested as per the applicable Indian Standard i.e IS/IEC/IEEE 60255-118-1. She further mentioned that testing facility for PMU is available with NPL as well as CPRI. However, PMUs are not getting tested in their laboratory since these are not getting manufactured in India. She further stated that as of now there is no testing facility available with NPL to test PMU as per IEEEC 37.118.2. However, NPL is ready to extend the testing facility if there is the requirement to do so.

24. Representative of CPRI stated that IEEE C37.242-2021 which is about the installation of PMU may also be specified. He further stated that IEC 61850-90-5 which is about transfer of data from PMU to next level may also be incorporated in the unified

guidelines. POWERGRID stated that the existing Phasor Data Concentrator (PDC) are not compatible with IEC 61850-90-5. Therefore, it will not be possible to use the IEC 61850-90-5 for the PMUs communicating the data with existing PDC. Chief Engineer (PSE&TD) suggested that this provision may be included where new PDC are being installed. He requested POWERGRID to provide the feedback after discussing with PMUs manufacturers regarding inclusion of IEC 61850-90-5.

25. The Representative of CPRI stated that as per the General requirement of PMU clause of the draft guidelines, the PMU shall support data reporting rates of 25 and 50 samples per second for 50 Hz System and 100 samples per second for RE generating plants including the hybrid generation plant. However, as on date no manufacturers have tested their PMU for 100 samples per second. POWERGRID stated that some of the manufacturers have confirmed 100 samples per second. Grid India stated that for RE generating plants, PMU should support reporting rate of minimum 200 samples per second. In this regard, Chief Engineer (PSE&TD), CEA requested POWERGRID to check the availability of PMUs with the sampling rate of 200 samples per second.

26. Grid India suggested to mention the sampling rate of 25 and 50 samples per second for Generating Plant, BESS and other Grid-connected Inverter.

27. Grid India stated that as per draft guidelines, the protection signal for line i.e Main-1 and Main-2 are to be provided. However, these information are of no use to Grid India. The information required in the case of the line is the actual Protection zone operated. POWERGRID stated that providing the information of all the protection will lead to more number of inputs to PMUs. However, PMUs have constraints regarding the number of input signals. If there is the requirement of all the protection signals then it may happen that they have to install an additional PMU for each line. Chief Engineer (PSETD), CEA requested Grid India to modify draft guidelines accordingly.

28. Chief Engineer (PSETD), CEA requested POWERGRID to check the compatibility of PMU with NAVIC based time receiver system.

29. TSPs raised the issue that a single requirement of PMUs signal is not coming from Grid India. M/s Adani stated that WRLDC is asking them to provide the PMU signal for the Transformer bays at one of their stations. Grid India stated that as per CERC guidelines signals at the Transformer bays are to be provided if PMUs are installed at the transformer bays. In case PMUs are not installed at the transformer bay then signals for transformer bays are not required. Further, he stated that as per these draft guidelines, there is no requirement to install the PMU in the transformer bay. Chief Engineer (PSETD), CEA requested Grid India to convey the requirement to WRLDC accordingly. Further Chief Engineer (PSETD), CEA requested Grid India to issue the instruction to all RLDCs to maintain uniformity regarding any issue.

The meeting was concluded with following decisions.

(i) As per the discussion in the meeting Grid India may carry out the necessary changes in the draft guidelines and submit within one week.

(ii) POWERGRID may take the feedback from PMU manufacturers regarding the sampling rate of 200 samples/ sec, availability of IEC 61850-90-5 compliant PMUs and compatibility of PMU with NAVIC based time receiver system.

(iii) Grid India may instruct WRLDC to remove the requirement of PMUs in the Transformer bay.

The meeting ended with thanks to the chair.

Annexure-III-A

Comparative statement of provisions for PMU in different documents

S.No.	Station	Location for PMU Placement		
		Report of the Sub-Committee on PMU Placement and Analytics under URTDSM Phase II	**CERC guidelines on "Interface Requirements"**	**Draft Guidelines**
1.	Substations of 220 kV and above Voltage Level	➢ At one end of all 400 kV and above transmission lines ➢ At the HV side of all ICTs connected to 220 kV and above	➢ Line ➢ Bus bars ➢ Transformer ➢ Reactor	➢ All Transmission Line Bays of 400 kV and above ➢ Bus bars of 400 kV and above
2.	Switchyard of 220 kV and above voltage level of Generating Stations	Generating units with capacity above 200 MW for Thermal units, 50 MW for Hydro units and 100 MW for Gas units ➢ Generating Transformers (GTs) at LV side (having HV side of 220 kV and above)	➢ Generator Transformer (both HV and LV side)	Substations of 220 kV and above voltage level of Generating Stations (200 MW and above for Thermal, 50 MW and above for Hydro and 100 MW and above for Gas) ➢ Generating Units connected (through GT) with 220 kV and above Bus ➢ All Transmission Lines of 220 kV and above ➢ Bus bars of 220 kV and above
3.	Substations of 220 kV and above voltage level	➢ At RE developer end of the evacuating line connecting the Renewable Energy Pooling Stations (PS) to point of	➢ Line ➢ Bus bars ➢ Transformer	tations of 220 kV and above voltage level of RE Generating stations

	of RE Generating stations	interconnection with the grid of 50 MW and above.	➢ Reactor	with renewable/ Hybrid plants of 50 MW and more. ➢ All Transmission Lines of 220 kV and above ➢ Bus bars of 220 kV and above
4.	Renewable Energy (RE) Pooling Stations of 220 kV and above voltage level connecting 50 MW and more	➢ At one end of all 400 kV and above transmission lines ➢ At the HV side of all ICTs connected to 220 kV and above	➢ Line ➢ Bus bars ➢ Transformer ➢ Reactor	Renewable Energy (RE) Pooling Stations of 220 kV and above voltage level connecting 50 MW and more ➢ All Transmission Line Bays of 220 kV Level ➢ Bus bars of 220 kV and above
5.	High Voltage Direct Current stations (HVDC)	➢ On HV side of converter transformers	➢ Converter Transformer	➢ AC side of Converter transformers in HVDC Stations
6.	Stations with STATCOM/ FSC/ TCSC/ SVCC/ Phase Shifter	➢ On HV side of coupling transformer of SVC/STATCOM ➢ At one end of the line wherever FSC/ TCSC are installed.	➢ Coupling Transformer	➢ HV side of STATCOM/ FSC/ TCSC/ SVCC/Phase Shifter
7.	Battery Energy Storage Stations (BESS) of 50 MW and more	Not included	Not included	➢ Battery Energy Storage Systems
8.	All ISTS Lines in NERC Sikkim of 132kV and above	➢ All 132 kV and above ISTS lines in NER and Sikkim and important load centers	➢ Line ➢ Bus bars ➢ Transformer ➢ Reactor	➢ Line Bays of all 132 kV and above lines
9.	Inter-Regional/Trans-national Tie lines	➢ Both ends of Inter-regional and trans-	➢ Line	➢ Line Bays of all Inter-Regional

		national tie lines ➢ Boundary buses for such lines.	➢ Bus bars ➢ Transformer ➢ Reactor	and Trans-National tie lines
10.	All 220 kV substations cater to load centers.	➢ 220 kV Bus bars ➢ Two lines/transformer catering to load centers	➢ Line ➢ Bus bars ➢ Transformer ➢ Reactor	Not included
11.	Islanding, Separating and Restoration Points	➢ At one end of line which is connected to black start stations	➢ Line ➢ Bus bars ➢ Transformer ➢ Reactor	Not included
12.	Critical substations	➢ ICTs ➢ Bus reactors ➢ Switchable line reactors	➢ Line ➢ Bus bars ➢ Transformer ➢ Reactor	Not included

Annexure-III-B

List of Participants

CEA

1. Sh. A.K. Rajput, Member (PS)
2. Ms Rishika Sharan, Chief Engineer (NPC)
3. Sh. Y. K Swarkar, Chief Engineer (PSE&TD)
4. Sh. Bhanwar Meena , Director (PSE&TD)
5. Sh. Satyendra Kumar Dotan, Director (NPC)
6. Sh. Pankaj Kumar Verma, Deputy Director (PSE&TD)
7. Sh. Bhavesh Mahawar, Assistant Director (PSE&TD)

NTPC

1. Sh. Sachin Garg, DGM(CC-OS)
2. Sh. Ankur Tripathi, Sr Manager (PE-Electrical)

POWERGRID

1. Sh. Awanish Kumar, Chief Manager
2. Sh. Mohan Kishor.N, DGM

CTUIL

1. Sh. Rahul Kumar Shakya, Engineer
2. Sh. Tanay Jaiswal, Engineer Trainee

NHPC

Sh. Surendra Kumar Mishra , GM (O&M)

CSIR-NPL

Ms. Avni khatkar, Scientist

CPRI

Dr. Kaliappan Perumal

GRID INDIA

Sh. Aman Gautam, Manager

EPTA

1. Sh. Manvendra Deswal, DDG
2. Sh. Sumeet Sharma, VP, Adani
3. Sh. Sunny Kumar Singh, Manager, Adani
4. Sh. Anurag Patel, Chief Manager, Sterlite Power
5. Sh. Sahil Kumar, Asst. Manager, Sterlite Power
6. Md. Shaique Afjal , Lead- Regulatory Affairs & Policy Advisory, Apraava Energy
7. Md. Washim Alam, Sr Manager (BD & Regulatory), Apraava Energy
8. Sh. Lokendra Singh Ranawat, Head Regulatory, Indigrid

Sustainable Projects Developers Association (SPDA)

Sh. Pawan Kumar, GM, Avaada Energy

Annexure-IV

CEA-PS-14-12/9/2024-PSETD Division I/47196/2025

सत्यमेव जयते

भारत सरकार/ Government of India
विद्युत मंत्रालय/ Ministry of Power
केन्द्रीय विद्युत प्राधिकरण/ Central Electricity Authority
विद्युत प्रणाली अभियांत्रिकी एवं प्रौद्योगिकी विकास प्रभाग
Power System Engineering & Technology Development Division

सेवा मे,
<as per attached list>

विषय: **Minutes of the Meeting to examine the various guidelines currently in force for the Phasor Measurement Unit (PMU)installation and to suggest the ways to harmonize the requirements into one single guidelines**

महोदया/ महोदय,

A meeting of the committee was convened on 27.01.2025 at 15:00 hrs at Manthan Conference Hall, 2nd Floor, Sewa Bhawan, R.K. Puram Sector-1, New Delhi under the chairmanship of Member (PS), CEA to examine the various guidelines currently in force for the **Phasor Measurement Unit (PMU)** installation and to suggest the ways to harmonize the requirements into one single guidelines.

The minutes of the meeting is attached for your information and necessary action.

भवदीय,
Signed by Pankaj Kumar Verma
Date: 28-02-2025 13:13:20
(पंकज कुमार वर्मा /Pankaj Kumar Verma)
उप-निदेशक/Dy. Director

Copy To,

1. Chief Engineer, PCD Division, CEA
2. Chief Engineer, NPC, CEA
3. CE (ETI) Division
4. Director (PSE&TD), CEA
5. SA to Member (PS), CEA
6. PS to Chief Engineer (PSE&TD), CEA

To,

1.	CMD, NTPC Limited, NTPC Bhawan, SCOPE Complex, Institutional Area, Lodhi Road, New Delhi-110003	cmd@ntpc.co.in Sachingarg01@ntpc.co.in ankurtripathy@ntpc.co.in amaurya@ntpc.co.in abhisheksaini@ntpc.co.in amanna@ntpc.co.in
2.	CMD, Powergrid Corporation of India Ltd. Saudamini, Plot No. 2, Sector – 29, Gurgaon – 122001 (Haryana)	mohan.kishor@powergrid.in sanjay4kumar@powergrid.in Cc: cmd@powergrid.in tyagir@powergrid.in
3.	M/s CTUIL, 2nd Floor, Corporate Centre, Plot No:2, "Saudamini",Sec-29, Near IFFCO Chowk, Gurgaon	tanay@powergrid.in rshakya@powergrid.in Cc: ashok@powergrid.in
4.	CMD, NHPC Limited, NHPC office complex, Sector-33, Faridabad - 121003	surendramishra@nhpc.nic.in jaganathpani@nhpc.nic.in Cc: cmd@nhpc.nic.in
5.	Director, CSIR-National Physical Laboratory, Dr. K.S. Krishnan Marg, New Delhi - 110012	avni.khatkar@nplindia.org Cc: director@nplindia.org
6.	M/s Grid Controller Of India Limited (1st Floor), Qutab Institutional Area, Katwaria Sarai, New Delhi-110016	amangautam@gridindia.in manas@grid-india.in Cc: cmd@grid-india.in
7.	Director General, Central Power Research Institute, Prof. Sir C.V. Raman Road, Post Box No: 8066, Bengaluru	kaliappan@cpri.in Cc: dgcpri@cpri.in
8.	Electric Power Transmission Association	sumeet.sharma@adani.com Cc:ddg.epta@epta.com epta.dg@gmail.com
9.	Indian Wind Power Association Door – E, 6th Floor, Shakti Towers-1 766, Anna Salai, Chennai – 600002	kmn@windplus.in cr.srinivas@enerfra.com Cc: secretary.general@windpro.org jwpahq@windpro.org

10.	President, Sustainable Projects Developers Association (SPDA), 910, 9th floor Surya Kiran Building, 19, KG Marg, New Delhi - 110001	upendra.kumar@avaada.com ankit.gupta@avaada.com pawan.kumar2@avaada.com Cc: spda@solarpda.com spda@spdaonline.com
11.	Independent Power Producers Association of India (IPPAI), Diamond House, 2nd Floor, 11, Primrose Road, Bengaluru-560025	dharun@ippaimail.org gulrez@ippaimail.org divya@ippaimail.org
12.	M/s Adani Power	Sunnykumar.singh@adani.com

Minutes of the meeting held on 27.01.2025 of the committee to examine the various guidelines currently in force for the Phasor Measurement Unit (PMU) installation and to suggest the ways to harmonize the requirements into one single guideline.

1. List of participants is at **Annexure-IV-A**.
2. At the outset of the meeting, Member (Power Systems), CEA welcomed all the participants and stated that based on the deliberation held during the first meeting held on 05.12.2024, a draft report was prepared and shared among committee members for their comments. The comments were received from GRID INDIA and POWERGRID. GRID INDIA is of the view that a discussion is essential to evaluate the inclusion of Interconnecting Transformers (ICTs) in the criteria, as these ICTs are currently utilized in critical applications for calculating inertia and short-circuit strength. Further POWERGRID has also commented on the list of protection signals required. Thereafter he requested to take the agenda points.

3. Deputy Director (PSETD), CEA stated that since GRID INDIA has requested to take the opinion of the Analytics Tool Developer regarding the placement of PMU, two Analytics Tool Developer i.e. M/s Electric Power Group (EPG) and M/s GE have been invited in the meeting.

4. Thereafter M/s EPG gave the presentation. The brief of the Presentation is as follows:
   (i) Followings are the factors which are key drivers for Synchrophasor Technology and Wide Area Measurement System (WAMS) Analytics.
      (a) Digitization of Economy: Power Electronics Controllers and High-Speed Computing and Communications
      (b) Integration of Renewables: Variability from IBRs reduces inertia and demands real-time monitoring.
      (c) Rising Power Demands: Large data centers and concentrated loads stress the grid.
      (d) Power Quality Issues: Voltage sags, harmonics, and instability require continuous monitoring.
      (e) Oscillations: Interconnected networks face local and inter-area oscillations.
      (f) Dynamic Grid Needs: Adaptation to real-time conditions like dynamic line ratings.
      (g) Resilience Challenges: Frequent disturbances require fast fault detection and recovery.

   (ii) Strategic Placement of PMUs is important. Fewer PMUs, when strategically located, can provide sufficient coverage for essential grid analytics. Focus should be on Important Buses, Tie lines, Inverter based Resources (IBRs) (RE) Point of common Coupling (PCC), High Voltage Direct Current (HVDC), Static VAR Compensators (SVCs), STATCOM, Large Data Centers and Generation buses.

   (iii) Following are the key analytics enabled by PMU:

(a) Voltage Stability and Sensitivity

- Purpose: Monitor Voltage profiles at buses to ensure grid stability and detect voltage anomalies.
- Need: Analyze voltage stability and sensitivity to maintain system reliability.
- PMU Requirements: Measure bus voltage.
- PMU Location: One end of the line.

(b) Oscillation Detection and Source Location

- Purpose: Identify and monitor power system oscillations and their sources like generation buses, major tie lines etc to enhance grid stability.
- Need: Analyze oscillation amplitude, damping, duration, and dissipating energy.
- PMU Requirements: Measure bus voltages and currents.
- PMU Location: One end of the line.

(c) Generator and System Modeling

- Purpose: Accurately capture real-time generator dynamics and system behavior for improved grid control.
- Need: Analyze voltages and currents to compare real and reactive power dynamics with simulation models.
- PMU Requirements: Measure bus voltage and currents.
- PMU Location: One end of the line (high-voltage side of the generator).

(d) Linear State Estimation (LSE)

- Purpose: Enhance grid observability, data validation, and calibration to improve traditional state estimation techniques.
- Need: Voltages and currents from buses for real-time state estimation.
- PMU Requirements: Measure bus voltage and currents.
- PMU Location: One end of the line.

(e) System Inertia

- Purpose: Real-time monitoring of system inertia to assess frequency stability and inertial awareness in asynchronous areas.
- Need: Monitor active power from all inputs into the bus and measure bus frequency.
- PMU Requirements: Measure bus voltage and all element currents.
- PMU Location: One end of the line.

(f) System Strength

- Purpose: Real-time monitoring of system strength to assess voltage stability and the impact of renewable energy (RE) resources.
- Need: Voltages and currents from all elements connected to the bus to evaluate system robustness.

- PMU Requirements: Measure bus voltage and all element currents.
- PMU Location: One end of the line.

(g) Phase Angle Difference Monitoring

- Purpose: Measure angle differences across key tie lines to assess angular stability and stress on the transmission network.
- Need: Monitor voltage, phase angles, and resynchronization conditions.
- PMU Requirements: Measure bus voltages and phase angles.
- PMU Location: Both ends of the line.

(h) Islanding Detection and Resynchronization

- Purpose: Identify and isolate portions of the grid during disturbances or faults and ensure seamless resynchronization.
- Need: Monitor voltage, angle differences, and frequency from both ends of the line.
- PMU Requirements: Measure bus voltages and currents.
- PMU Location: Both ends of the line.

(i) Line Parameter Measurements

- Purpose: Improve transmission models, enable dynamic line ratings, and enhance fault analysis.
- Need: Monitor voltages and currents from lines to evaluate resistance, reactance, and impedance.
- PMU Requirements: Measure bus voltage and currents.
- PMU Location: Both ends of the line.

(j) Fault Location

- Purpose: Accurately identify fault locations within the power system.
- Need: Use voltages and currents from both ends of the line to calculate the distance to the fault.
- PMU Requirements: Measure bus voltage and currents.
- PMU Location: Both ends of the line.

(iv) Strategic PMU Placement enables efficient observation of system dynamics, including voltage, frequency, and phase angles, with fewer PMUs.

(v) Analytics Coverage supports key functions like fault detection, oscillation monitoring, and system resilience with optimal PMU distribution.

(vi) Full observability can be achieved with approximately 1/3 PMU coverage, enhanced by Linear State Estimation technology.

5. Following queries were raised by the Committee members to the representative of M/s EPG.

   (i) Whether PMUs need to be installed at data centers (distribution level)?
   Response: Yes, PMUs need to be installed at data centers due to their high reactive power requirements. In the USA, it has been seen that sudden change in the load at the data centre are leading to Oscillations Therefore it becomes essential that PMUs are to be installed at data centers.

   (ii) How does the System Strength tool work?
   Response: The tool measures effective Short Circuit Ratio (SCR) using Thevenin equivalent. To evaluate the strength of a bus, PMUs need to measure all elements connected to it.

   (iii) Do PMUs need to be installed on ICTs (Interconnecting Transformers)?
   Response: Yes, PMUs need to be installed on ICTs if they are connected to the Nodes which are used for Inertia and Strength applications, as these measurements require monitoring all elements connected to the particular bus where inertia or strength is being evaluated.

   (iv) Do PMUs need a processor or data filtering hardware?
   Response: No, PMUs do not require a processor or hardware for data filtering. This is managed entirely by software.

   (v) How does the Inertia tool work?
   Response: The inertia tool uses the change in active power relative to frequency to assess system inertia.

   (vi) Can the locking and unlocking phenomena use NAVIC for synchronization?
   Response: Yes, switching to NAVIC is possible, provided the pulse synchronization concept is maintained.

   (vii) What is the current resolution capability of PMUs?
   Response: Based on present trends, a resolution of 100 Hz is sufficient.

   (viii) Do different buses with sectionalizers need to be measured using PMUs?
   Response: Yes, it is necessary to measure all sectionalized buses using PMUs to ensure comprehensive data and observability.

6. It was deliberated that to evaluate the inertia at/strength of a bus, PMUs need to measure all elements connected to the bus including ICTs. Since the Nodes to which RE Pooling stations are connected typically have issues relating to inertia and strength, it was opined that in case of RE Pooling Substation, PMUs need to be installed on HV side of 765/400 kV ICTs and in the absence of 765 kV Bus, on the HV side of 400/220

kV ICT. Grid-India suggested that in the already executed Project, five to eight substations in each region may be identified where all elements including ICTs will be monitored using PMUs.

7. On the list of protection signals as specified in the draft report, representative from the POWERGRID stated that the list of protection signals as mentioned in the Draft report is long list which may lead to installation of the additional PMUs to provide the mentioned list of Protection signals. Representative of GRID INDIA stated that if there are ports available in the PMUs to capture the signals then the mentioned protection signals may be provided. There is no such requirement to install the additional PMUs to provide the all the Protection Signals mentioned in the report. It was opined that the list may be kept in the report as a general list. However, the actual protection signals which may be provided based on the availability of the spare ports can be decided during the execution stage in consultation with GRID INDIA.

8. On the applicability of guidelines, it was decided that as per the Minutes of the meeting (MoM) issued of the meeting held under the chairmanship of Member (PS), CEA on 20.06.2024, for the Transmission Scheme for which bidding was completed after December, 2022 but before January 2024 i.e. date of notification of CERC Interface Guidelines, PMUs shall be installed as per RfP document. For the transmission Scheme for which bid is to be completed after January, 2024, PMUs shall be installed as per CERC Interface Guidelines. The Guidelines on Unified Philosophy for Placement of Phasor Measurement Unit (PMU) in Indian Grid shall be effective from the date of issue of the guidelines. These guidelines shall be applicable for the underbidding Schemes for which price bid has not been submitted and for all the upcoming Schemes. The applicability of these guidelines shall be mentioned in the letter while issuing the guidelines.

9. The meeting was concluded with the decision that based on the above deliberation, the guidelines shall be modified and issued.

   The meeting ended with thanks to the chair.

*****

Annexure-IV-A

List of Participants

CEA

1. Sh. A.K. Rajput, Member (PS)
2. Sh. N.R.L.K. Prasad, Chief Engineer (PSE&TD)
3. Sh. Satyendra Kumar Dotan, Director (NPC)
4. Sh. Pankaj Kumar Verma, Deputy Director (PSE&TD)
5. Ms Priyam Srivastava, Deputy Director (PCD)

CTUIL

Sh. Tanay Jaiswal, ET

GRID-INDIA

1. Sh. Manas R. Chand, DGM
2. Sh. Aman Gautam, Manager

POWERGRID

1. Sh. Mohan Kishor N., DGM
2. Sh. Sanjay Kumar, Manager

NHPC

Sh. Jaganath Pani, Sr. Manager

NTPC

1. Sh. Avinash Manna, DGM
2. Sh. Ankur Tripathi, Sr. Manager
3. Sh. Akhileshwar Maurya, Sr. Manager
4. Sh. Abhishek Saini, Dy. Manager

CSIR-NPL

Ms. Avni Khatkar, Scientist

ADANI

1. Sh. Sumeet Sharma, Vice President
2. Sh. Sunny Kumar Singh, Manager

STERLITE

Sh. Anurag Patel, Chief Manager

EPG

1. Dr. Krish Narender, COO & Technology Lead
2. Sh. Sudhir Gadh, Ex. Director

GE

Sh. Dayakishan Bhardwaj

Annexure-X

S. No.	Name of the Scheme	Implementing Agency	Implementation schedule	FOTE (No.)	OPGW (Km.)	Cost (Cr.)	Constraint Faced	Previous Status update by TSP	Current Status update by TSP
Schemes approved in 30th NCT, awarded through OM Letter dtd. 24.06.2025									
1	OPGW installation on existing 400 kV Sikar (PG) – Agra (PG) D/c line (owned by PG) which is proposed to be LILO at 400 kV GSS Kumher (RRVPN)	POWERGRID	Matching time frame with transmission scheme of "LILO of one circuit of 400kV Sikar – Agra D/c (Quad Moose) line at 400 kV GSS Kumher (6.5 ckm) along with 80 MVAR, 420 kV switchable line reactor at Kumher end of Sikar – Kumher 400 kV section"	3	386	26.49			
2	OPGW installation on existing 220 kV Chittorgarh (RVPN)-RAPP B (NPCIL)	POWERGRID	Matching time frame with transmission scheme of "LILO of 220 kV Chittorgarh-	2	130	8.55			

	D/c Line (owned by PG) which is proposed to be LILO at RRVPNLs 220 kV GSS Begun (Chittorgarh)		RAPP B D/c Lines at RVPNs proposed 220 kV GSS Begun (Chittorgarh)"						
Schemes approved in 27th NCT, awarded through OM Letter dtd. 24.02.2025									
3	OPGW installation on existing 765 kV Fatehpur-Varanasi S/c & 765 kV Fatehpur-Sasaram S/c Lines which are proposed to be LILO at New Prayagraj (ISTS)	POWERGRID	24 months from the date of allocation or with matching timeframe of the transmission project "Interregional (NR-WR) Transmission System strengthening to relieve the loading of 765 kV Vindhyachal-Varanasi D/c line" whichever is earlier	2	**579**	**33.24**		**Under tendering**	
4	VOIP	POWERGRID	18 months			**156.52**			

	Communication system for Grid-Operation for all Five Regions NR, NER, SR, WR, ER as PAN India								
5	Establishment of State-of-the-Art National Unified Network Management System (N-UNMS) in main & backup configuration integrating all the regional UNMSs	POWERGRID	24 months			**128**			
		Schemes approved in 26th NCT, awarded through OM Letter dtd. 30.01.2025							
6	Redundant Communication for Salal (NHPC) station	POWERGRID	18 months from the date of allocation		62	3.41		**Under tendering**	
		Schemes approved in 22nd NCT, awarded through OM Letter dtd. 02.09.2024							
7	Optical fiber	POWERGRID	02.03.2026	3	35	7.2		Comm eq	

	connectivity for NLDC new building August Kranti Marg, New Delhi		(Revised in 26th NCT)					deliverd , DCPS converter supplied, in talk with NLDC comm room not ready	
		Schemes approved in 20th NCT, awarded through OM letter dtd. 15.07.2024							
8	Supply and installation of 24 Fibre OPGW on PKTCL lines for providing redundant communication for Parbati Pooling (Banala) (PG) S/s, Parbati-II (NHPC) & Parbati-III (NHPC) stations	PKTCL	18 months from the date of allocation		88.635	5.31		Completed in may mid	
9	Supply and installation of 24 Fibre OPGW & FOTE to providing redundant	POWERGRID	18 months from the date of allocation (with matching schedule with Scheme 4)	4	0.783	1.24		Completed in may mid	

	communication for Parbati Pooling (Banala) (PG) S/s, Parbati-II (NHPC) & Parbati-III (NHPC) stations								
10	Redundant Communication for Chamera-III (NHPC) & Budhil (GreenCo) using 3 pairs of fibers sharing from HPPTCL network.	POWERGRID	18 months from the date of allocation	1	0	0.3		Awarded	
		Schemes approved in 19th NCT, awarded through OM letter dtd. 29.05.2024							
11	OPGW installation on existing 400 kV Kota - Merta line which is LILOed at ShriCement & proposed to be LILOed at 765/400 kV Beawar (ISTS)	POWERGRID	24 months from the date of allocation	3	311	18.5		Tendered surveyed type test of cable required	

	S/s								
12	Supply and Installation of 12 nos. FOTE and additional ethernet (125 nos.) cards for existing FOTE in view of resource disjoint and critical locations.	POWERGRID	12 months from the date of allocation	12	0	5.2	Time schedule is less	awarded	
13	Supply and Installation of 11 nos. FOTE Equipment at Backup SLDCs in NR & Backup NRLDC.	POWERGRID	12 months from the date of allocation	11	0	3.3	Time schedule is less		
14	Supply and installation of OPGW on 400kV Fatehgarh I (Adani) - Fatehgarh-II (PG) line (6.5 kms), (Fatehgarh-I (Adani)	Adani Transmission Ltd.	18 months from the date of allocation	0	6.5	0.325			

	- Bhadla(PG) line LILOed at Fatehgarh-II) as redundant communication for Fatehgarh-I (Adani)								
15	OPGW installation on 765kV Agra (PG) -Fatehpur (PG)D/c line may be consisdered as a separate scheme in matching timeframe of Ph-IV (Part-4:3.5GW) scheme	POWERGRID	24 months from the date of allocation	2	335	16.5		Awarded in nov.	
16	OPGW installation on existing 400 kV Kurukshetra - Malerkotla line alongwith FOTE at both ends. Part-A	NRSSXXXI (B) Transmission Ltd (Sekura)	18 months from the date of allocation		140	9			
17	OPGW installation on existing 400 kV	POWERGRID	18 months from the date of allocation	2		0.6		Awarded	

	Kurukshetra - Malerkotla line alongwith FOTE at both ends. Part-B		(with matching time frame of OPGW on 400 kV Kurukshetra - Malerkotla transmission line)						
		Schemes Modified/approved in 16th NCT, awarded through OM letter dtd. 03.01.2024							
18	Supply and Installation of OPGW on 400kV Kishenpur-Wagoora line.	POWERGRID	21.11.2026 (Revised in 26th NCT)	2	183	9.15			
19	Supply and Installation of OPGW on 400kV Agra- ballabhgarh line.	POWERGRID	21.05.2026 (Revised in 26th NCT)	2	181	9.05			
		Schemes approved in 11th NCT, awarded through OM letter dtd. 16.02.2023							
20	OPGW installation on existing 400 kV Jallandhar (PG) - Kurukshetra (PG) line which is to be LILOed at 400 kV Dhanansu (PSTCL)	POWERGRID	10.01.2027 (Revised in 26th NCT)	2	229	10.3			

21	Supply and Installation of OPGW on existing 400 kV Koldam-Ludhiana (PG) line which is to be LILOed at 400 kV Ropar (PSTCL)	Indigrid	implementation timeframe of 18 months	2	150	6.7			
22	Redundant communication System for Bhinmal (PG) and Kankroli (PG) ISTS stations	POWERGRID	21.05.2026 (Revised in 26th NCT)	8	5	2.55			
23	OPGW installation on 220 kV Anta (NTPC) - Bhilwara Line	POWERGRID	implementation timeframe of 18 months	2	187	9.35		complete	
		Schemes approved in 9th NCT, awarded through OM letter dtd. 15.11.2022							
24	Transmission lines which are to be provided with OPGW alongwith necessary accessories and	POWERGRID	21.11.2026 (Revised in 26th NCT)		312			u/c	

	FOTE are mentioned as under • 765kV S/c Jaipur (Phagi) (RVPNL) – Gwalior line (312 km) (Ckt-1 is proposed) (to be LILOed at Dausa) • 400kV D/c Agra – Jaipur (South) (PG) line (254 km) (to be LILOed at Dausa)				254	28.5			

Brief on
Unified Real Time Dynamic State Measurement (URTDSM)
Project Phase-II (for ISTS Portion)

Contents

Brief on
Unified Real Time Dynamic State Measurement
URTDSM Project Phase-II
for discussion in RPCs

1.0 Background of URTDSM Phase-II Proposal:

POWERGRID has been entrusted to prepare the DPR for URTDSM Phase-II project in the 13th NPC meeting held on 05.07.2023. The DPR is to be made on basis of 'Report of the Sub-Committee on PMU Placement and Analytics under URTDSM Phase II' constituted by National Power Committee.

Presently 1400 PMUs and 32 Control centres have been established under the URTDSM Phase-I project. This project was implemented with 70% of the project cost as PSDF grant and 30% was through POWERGRID Equity (RTM for 30% portion and no tariff for 70% grant portion).

Similarly, DPR for URTDSM Phase-II Project, which included 4000PMUs(new) and 34 control centres was prepared with funding pattern of 70% PSDF grant and 30% POWERGRID equity in line with Phase-I. The DPR, with an estimate of Rs.3922 Crores, was submitted to NPC/CEA on 11.03.2024. The scope included replacement of 34 control centres and supply of 4000 new PMUs including integration of 1400 existing PMUs.

In the 14th NPC meeting held in Bengaluru on 03.02.2024, DPR status was updated to members. It was suggested to optimize the cost. Further, NPC vide email dated 18.04.2024 has informed that PSDF funding shall not be available for the project and alternate sources of funding shall be explored by POWERGRID. Hence, POWERGRID approached all the Constituents in the RPCs for concurrence for execution of the URTDSM Phase-II Project on RTM basis.

In the 15th NPC Meeting held on 14.11.2024, the committee recommended that "PowerGrid is to submit the revised proposal in consultation with Grid India, only for the existing network after segregating the PMUs and control centers under ISTS and STUs system. The proposal may also be revised to optimize the number of control centers and PMUs at ISTS & STUs system separately. The revised proposal for ISTS portion may be put up to the NCT for further consideration."

During previous NPC & RPC meetings for URTDSM phase-II project, it was discussed that the number of PMUs for URTDSM Phase-II need to be optimized for reducing the overall project cost. The initial DPR prepared by POWERGRID was based on the sub-committee recommended philosophy of PMU placement. However, CEA has published new guidelines for unified philosophy of PMU placement in Indian Grid in March 2025, which will supersede all existing guidelines and sub-committee report etc.,

According to 15th NPC, POWERGRID was entrusted to put up proposal for ISTS portion to NCT and revised proposal for ISTS and STU portion separately for discussion. ISTS portion comprises of Control Centers of Grid-India (NLDCs and RLDCs) and PMUs for Central Sector locations as per latest CEA Guidelines referred above.

POWERGRID prepared DPR for URTDSM Phase-II ISTS portion (upgradation of control centers at NLDCs, RLDCs and installation of new PMUs for Central Sector stations as per latest CEA guidelines). Tentative cost and BOQ for STUs portion (Control centers of SLDCs across India and new PMUs for State sector substations) is also put up for discussion in the 16th NPC.

Upon the concurrence of 16th NPC for proposed DPR for ISTS portion, the same will be put up to NCT for approval in RTM route. For the State Sector, funding methodology is to be finalized in reference to the tentative cost and BOQ.

2.0 Brief Details of URTDSM Phase-I Project:

POWERGRID took up the implementation of URTDSM phase-1 in Jan 2014 and the project was commissioned progressively from 2018 to 2021 with installation of 1409 PMUs and PDCs at 32 control centers, the project was funded 70% from PSDF grant and 30% from POWERGRID equity.

The existing system of URTDSM Phase-I is under maintenance support through Annual Maintenance contract with the contractor, which will end in Jan 2027. The PMUs installed at substations can be in service for fifteen years from their date of commissioning.

3.0 Need for URTDSM Phase-II Project

3.1 Need for new PMUs

After commissioning of URTDSM Phase-I Scheme, expansion of power system has taken place at considerable pace with addition of large-scale renewable generation and incorporation of new transmission system technologies (SVC, STATCOM, FSC, etc.,). Over the years, there have been significant organizational, regulatory, Market operations, and technological changes. The placement of PMUs at new renewable generation plants and other new technology devices (FACTS) is required to know their dynamic response during disturbances and to verify that they are operating under the limits stipulated as per the regulatory norms.

The Committee report on PMU has defined a new philosophy for placement of PMUs and suggested to cover additional equipment such as ICTs, SVCs, Bus Reactors, FSC, TCSC etc. have been considered for measurement through PMU, which were not in Phase-I implementation.

3.2 Upgradation of Control centers

AMC support for the existing control centers will lapse by Jan 2027. Due to this, the maintenance of the existing hardware and software beyond its design life cycle of 7 years will be very challenging owing to lack of spares and services, poor performance and increasing cyber vulnerabilities due to obsolete technologies.

Moreover, the existing hardware and software cannot support the new analytics being envisaged under Phase-II project for better monitoring of the power system.

The URTDSM phase-1 Control centres are having issues of End of Life/End of support due to technical obsolescence of software, hardware, and cyber security appliances and will become technically obsolete. Hence to keep the WAMS URTDSM Control centres functional, the URTDSM phase 2 project which includes the upgrade of existing control centres, is to be implemented on priority.

Increased penetration of Renewable energy has required increase in more monitoring of the regional grids which requires more deployment of PMUs. The URTDSM phase 2 includes installation of PMUs as per latest CEA Guidelines on PMU placement.

3.3 Additional technical factors to establish the need for URTDSM Phase-II System

In addition to the reasons mentioned above, the following are some of the power system aspects which are being handled only with URTDSM system, which is based upon Wide Area Measurement System (WAMS) technology:

(i) PMU measurements provide synchronized voltage, current and phase angle measurements, which is not possible in RTU measurements. The phase angle measurement is valuable information about the state of the grid and the grid operators can take decisions based upon precise measured information instead of thumb rule based upon their experience.

(ii) Based upon the phase angle measurements from both the ends of the line enhanced utilization of Transmission lines closer to thermal loading of line can be achieved.

(iii) In case of system separations, the Synchrophasor measurements display the load angle separation and can be used to determine the change required in generation to synchronize the two isolated systems, this being more accurate data facilitates faster restoration and avoid any jerks or oscillations in the power system.

(iv) One of the most important applications of PMU measurement is post facto analysis so that an incident can be analyzed with high resolution data so the behavior of each element-generator, RE generator, FACTS devices, Power system islands etc.

(v) With increasing grid size and installed capacity from multiple generation sources, the approved placement shall provide a wider footprint of PMU data, increasing observability by the Operator for Grid management.

4.0 DPR for URTDSM Phase-II

As per 15th NPC recommendation, DPR of URTDSM project phase-II (for ISTS portion) in accordance with the latest CEA Guidelines on unified philosophy for PMU placement in Indian Grid is prepared by POWERGRID.

Accordingly, DPR Cost Estimate for URTDSM Phase-II (for ISTS portion) is Rs 1124.35 Cr (including the AMC charges)

POWERGRID proposes to take up URTDSM Phase-II Project (for ISTS portion) on RTM basis (upgradation of all Control Centres for NLDCs and RLDCs of Grid-India, and installation of new PMUs at Central Sector locations as per latest CEA PMU Placement Philosophy), on cost sharing PoC mechanism pan India (**100% RTM route with 70:30 Debt equity ratio**).

5.0 Approach for Implementation for URTDSM Phase II Project

The approach for Implementation for URTDSM phase-II project is as follows:

(i) The URTDSM Phase-II project shall be implemented initially for ISTS portion covering NLDCs (2), RLDCs (5), new PMUs at Central Sector locations and remote consoles for all SLDCs.

(ii) Phase-II for STU portion (SLDCs and State sector/IPP stations) shall be implemented separately, subject to finalization of funding method for state portion.

6.0 Scope of Work for URTDSM Phase II Project:

The scope of work under URTDSM Phase-II project is proposed as follows.

1. Installation of approximately 1070 nos. of PMUs at the Central Sector Substations and Power plants across the country as per the lates CEA Guidelines for unified PMU placement philosophy in Indian Grid.
2. Replacement/Establishment of PDCs and associated control center equipment comprising of software and hardware at 7 Control centers.
    a. Main and Backup NLDCs (2 nos.)
    b. All RLDCs (5 nos.)
    c. Remote Consoles for CEA/RPCs/SLDCs - 31 nos
3. The hardware and software to be installed at Control Centers shall be sized to accommodate all the PMUs currently installed under Phase-I, and the proposed PMUs under Phase-II with provision for future expansion of about 100% over and above.
4. The FO based communication system existing and being established by POWERGRID and Constituents shall meet the requirement of Phase-II. *The addition/augmentation of communication link is NOT envisaged under the scope of URTDSM Phase-II project DPR.*

5. **New Analytical applications**: Analytical applications have been suggested by the subcommittee for deployment under Phase-II scheme. Few of them, like Linear State Estimator and Oscillation Monitoring Application, are already deployed in Phase-I. However, due to obsolescence of the hardware/software issues in the existing control centers, they need to be replaced with new software and hardware. The following are the new analytical applications being proposed under Phase-II at all 7 control centers:

    a. Linear State Estimator
    b. Oscillation Monitoring Application.
    c. Real time automated event detection along with early warning system and ROCOF calculation over variable window.
    d. Voltage Stability analytics (VSA)
    e. WAMS based contingency analysis, security assessment & Islanding Detection.
    f. Real time Inertia Estimation and monitoring.
    g. Post-mortem analytics.
    h. Generator Model Validation
    i. Wide Area Control Systems (at selected nodes only)
        (i) WAMS based automatic load shedding (AUFLS and df/dt):
        (ii) Control of HVDC, PSS and STATCOM for damping system oscillations
    j. Response of Wind Farm and Solar PV for LVRT, Reactive Power etc.

    The above analytical applications are the requirements suggested based on the feedback of the system operator. It will be explored to procure them either from the prospective Bidders/Software OEMs or to develop them in association with premier academic institutes.

6. Integration of the existing PMUs.
7. Integration of the Phase-II PDCs with the existing SCADA/EMS systems at each location.
8. Integration with existing Video Projection System (VPS) (supplied under separate project) at each location.
9. Consultancy Services from premier academic institutions for development of new analytics under phase-II implementation, if required.
10. Engagement of Consultant for design of large scale WAMS system comprising of IT infrastructure for handling the vast amount of PMU data in real-time and historical data.
11. Capacity building through training of engineers from Grid-India (for Control center portion) & Central Sector Utilities (for PMU portion) are proposed as part of this URTDSM Phase-II project.

In addition to the Supply and Services under Phase-II, it is also proposed to include the Annual Maintenance Contract (AMC) charges through 100% RTM basis (70% debt and 30% Equity from POWERGRID), similar to the AMC contract being operated by POWERGRID for existing Phase-I system.

6.1 Location of SLDCs for PDC replacement and no of PMUs in each Region under URTDSM Phase II Project (ISTS portion):

Region→	NR	ER	NER	WR	SR
No of Control Centers	2	2	1	1	1
Location of 7 control centers	1. Main NLDC 2. NRLDC	1. Backup NLDC 2. ERLDC	1. NERLDC	1. WRLDC	1. SRLDC
PMUs (1070 No's) in Central Sector locations of each Region (as per latest CEA Guidelines)	218	303	151	309	89

7.0 URTDSM Phase II Project DPR Cost for ISTS portion across India:

BoQ Category	Software	Hardware	Auxiliary Power System	Services	Training	AMC	Total (including T&D)	T&D
PDCs at NLDC	144.03	21.26	2.06	2.76	0.00	3.34	173.46	25.62
PDCs at RLDC	348.57	53.9423	4.00	6.90	7.43	8.35	429.19	63.44
PMUs	17.568	321.1894	0.00	0.00	2.11	20.11	360.98	53.37
Mandatory Spares	0.00	17.1105	0.68	0.00	0.00	0.00	17.79	2.63
Total	**510.17**	**413.50**	**6.74**	**9.66**	**9.54**	**31.80**	**981.42**	**145.05**

DPR is based on a 100% RTM basis with 70% debt and 30% equity from POWERGRID.

Sl. No.	Description	Total Cost (Rs. in crores)
1	Unified Real Time Dynamic State Measurement Phase-II *(Supply, services, taxes & duties, testing & commissioning)*	949.62
2	Overheads *(IEDC, Contingencies)*	75.97
3	Consultancy charges for Panel of Experts	10.00
	Sub-Total	1035.59
4	Interest during Construction (IDC)	56.96
	TOTAL (Supply, Services)	1092.55
5	AMC charges and other services during AMC	**31.80**
	GRAND TOTAL including AMC	**1124.35**

The abstract cost estimate is given at ***Annexure***
The above project cost including AMC is based on the Budgetary quote from M/s L&T, the actual project and AMC charges will be known after the process of tendering and award, subject to approval of this proposal by Regulatory Authority.

7.1 Target Beneficiaries

The beneficiaries of the project would be all the designated ISTS customers (DICs) *as per POC mechanism for the URTDSM Phase-II (ISTS portion) as per CERC regulations.* ***(as per Clause no. 78 of CERC Tariff Regulations 2024-29).***

7.2 Project Strategy

The Unified Real Time Dynamic State Measurement System (URTDSM) Phase-II Project shall be implemented by POWERGRID. The PMU installation shall be taken up at those locations where Fiber Optic based communication system is either existing or is being installed under various projects, which shall be available by Dec' 2027. The tariff on the investments for the same shall be recovered from the beneficiaries (SLDCs) as per CERC regulations.

Upon the concurrence of POWERGRID's RTM proposal for ISTS portion by NPC/NCT, POWERGRID shall proceed for further tendering process.

The project shall be planned for a lifetime of 7 years for the IT infrastructure at Control Centers. The AMC shall be taken for 1-year (Defect liability period) and 6 years (AMC period) after operational acceptance (with an additional provision to extend the AMC by another 2 years on the same terms and conditions.

8.0 O&M facilities

The URTDSM system shall be used by respective NLDC/ RLDC/ Central Sector substations and the maintenance responsibility for the subject project shall be under the scope of Grid-India (for all 7 Control centers) and by respective Central Sector Utility for the PMU locations.

After the defect liability period (DLP) of 1 year, 6-year maintenance support by OEM shall be kept in the Project.

POWERGRID hereby proposes for funding the AMC charges also along with Supply and Services charges for SLDCs portion through 100% RTM route under this URTDSM Phase-II scheme. However, The charges for O&M of the system shall be finalized as per CERC/ RPC approval.

9.0 Time Frame

The subject project is scheduled to be commissioned within **36 months** from the date of Investment Approval.

10.0 Conclusion:

The URTDSM phase-1 Control centres are nearing their Operational life and will become technically obsolete. Hence to keep the WAMS URTDSM Control centres functional, the URTDSM Phase-II project which includes an upgrade of existing control centres, is to be implemented on priority.

Increased penetration of Renewable energy has required increase in more monitoring of the regional grids which requires more deployment of PMUs. The proposal for URTDSM Phase-II (ISTS portion) includes installation of PMUs at Central Sector locations as per the latest CEA guidelines.

1. *"**POWERGRID proposes to take up URTDSM Phase-II Project (for ISTS portion) on pan India basis, on cost sharing mechanism (100% RTM route with 70:30 Debt Equity ratio)**".*

2. ***Deliberation on URTDSM Phase-II for STU portion, subject to finalization of funding methodology for States.***

   Put up for deliberation in NPC/RPCs.

URTDSM Phase-II WAMS System - BoQ for Main & Backup NLDC				
Sr.No	Name of the item	Unit	Main NLDC Qty	Backup NLDC Qty
A	SOFTWARE			
1	PDC Software	Lot	1	1
2	WAMS Visualisation (UI) Software	Lot	1	1
3	Analytical Applications			
(a)	Linear State Estimator	Lot	1	1
(b)	Oscillation Monitoring Application	Lot	1	1
(c)	Real time automated event detection along with early warning system and ROCOF calculation over variable window	Lot	1	1
(d)	WAMS based Voltage Stability analytics (VSA)	Lot	1	1
(e)	WAMS based contingency analysis, security assessment & Islanding Detection	Lot	1	1
(f)	Generator Model Validation, Real time Inertia Estimation and monitoring	Lot	1	1
(g)	Post-mortem analytics	Lot	1	1
(h)	Wide Area Control Systems			
i.	WAMS based automatic load shedding (AUFLS and df/dt)	Lot	1	1
ii.	Control of HVDC, PSS and STATCOM for damping system oscillations	Lot	1	1
(i)	Response of Wind Farm and Solar PV for LVRT, Reactive Power.	Lot	1	1
4	Programming Development System (PDS) Software	Lot	1	1
5	Commercial Off-The-Shelf (COTS) Softwares			
(a)	Data Historian Software	Lot	1	1
(b)	Identity Management Software	Lot	1	1
(c)	Network Access Control (NAC)	Lot	1	1
(d)	Patch Management Software	Lot	1	1
(e)	Virtualisation Software for all the virtual servers envisaged and required under the project along-with centralised management software	Lot	1	1
(f)	Operating System for all the servers	Lot	1	1
(g)	Host based intrusion prevention system (HIPS) with centralised management	Lot	1	1
(h)	End Point Security Solution	Lot	1	1
(i)	Centralised Management and Log Analyser of all FWs	Lot	1	1
(j)	Network Management System (NMS)	Lot	1	1
(k)	SIEM (Security Information and Event management)	Lot	1	1
(l)	VAPT Tool	Lot	1	1
6	Report Development & Generation Software	Lot	1	1
7	Storage system			
(a)	SAN Software	Lot	1	1

(b)	NAS Software	Lot	1	1
8	SMS & Email Interface	Lot	1	1
9	Backup Solution Software	Lot	1	1
10	Data exchange Software with external applications	Lot	1	1
B	**HARDWARE**			
1	PDC Server sized for data of 10000 PMUs	No.	2	2
2	Analytical Applications Servers	No.	2	2
3	Historian Servers	No.	2	2
(a)	Data Historian Server			
(b)	Report Development & Generation Server			
4	WAMS Visualisation (UI) Server	No	2	2
5	Programming Development System (PDS) Server	No	1	0
6	Management Applications Servers			
(a)	Identity Management Server	No.	2	2
(b)	NMS Server			
(c)	Network Access Control (NAC) Server	No.	2	2
(d)	End Point Security Solution			
(e)	Centralised Management & Log analyser of Firewall (Internal)			
7	Internal DMZ Servers			
(a)	SIEM Server	No	2	2
(b)	Centralised Management & Log analyser of Firewall (External)			
8	External DMZ Servers			
(a)	End Point Security Solution	No	2	2
(b)	Patch Management Server			
9	Anti APT	No	1	1
10	Storage System			
(a)	Storage Solution of Minimum 1200TB, RAID10, SAN or equivalent along with SAN Management Server	No.	1	1
(b)	NAS Storage of 100TB	No.	1	1
11	Workstation consoles with 23.8" dual monitor			
(a)	PDC application	No.	2	2
(b)	PDS Application	No.	1	1
(c)	Analytical Applications	No.	1	1
(d)	External DMZ	No.	1	1
(e)	Inernal DMZ	No.	1	1
(f)	Management Applications	No.	1	1
(g)	Historian Applications	No.	1	1
(h)	Server Management Console	No	1	1
(i)	Remote Diagnostic Console	No	1	1
12	Color Laser Printer	No.	1	1
13	Time System (NavIC & GPS based)	Lot	2	2
14	Firewalls (with Minimum 10Gbps NGTP)			
(a)	External Firewall with NIPS for Internet and Remote consoles	No.	2	2
(b)	External Firewall with NIPS for PDC/PMU/SCADA data	No.	2	2
(c)	Internal Firewall with NIPS	No.	2	2
15	WAN Router cum Firewall			

(a)	For Communicating with PDCs at RLDCs (8 x Fiber Optic Ports, 8 Ethernet ports (1Gbps))	No.	2	2
(b)	For communicatiing with Remote Consoles (8 x Fiber Optic ports, 8 Ethernet ports (1Gbps))	No.	2	2
(c)	For Internet/Corporate Intranet connectivity (8 x Fiber Optic ports, 8 Ethernet ports (1Gbps))	No.	2	2
(d)	WAN router at Remote Console end (4 Ethernet ports (1Gbps))	No.	3	
16	L3 LAN Switches (10G FO ports) for the following LANs			
(a)	48-port L3 LAN Switch for PDC LAN	No.	2	2
(b)	24 port L3 LAN Switch for Historian LAN	No.	2	2
(c)	24 port L3 LAN Switch for External DMZ LAN	No.	2	2
(d)	24 port L3 LAN Switch for Internal DMZ LAN	No.	2	2
(e)	24 port L3 LAN Switch for Management LAN	No.	2	2
(f)	24 port L3 LAN Switch for Analytics LAN	No.	2	2
(g)	32 port FC Switch for SAN system	No.	2	2
17	Remote Consoles, equivalent to Work station console mentioned at Item No.4 above (for NTAMC and other Strategic locations)	No.	7	
18	Server for Backup Solution	No.	1	1
19	Backup Appliance	No.	1	1
20	Laptop for VAPT	No	1	1
21	Server for Data Exchange with external applications	No	1	1
22	Any other additional hardware at Control center end for implementing Wide Area Measurement Protection and Control (WAMPAC) system	No	1	1
C	**Auxiliary Power System**			
(a)	120 kVA (96kW at 0.8 pf) UPS running in parallel	No.	2	2
(b)	VRLA type Battery banks for above UPS (each bank of 230.4 kVAH)	No.	2	2
(c)	Input ACDB (600kVA rating)	No.	1	1
(d)	Output ACDB (400kVA rating)	No.	1	1
(e)	Accessories for maintenance of VRLA type batteries	Lot	1	1
(f)	Power Distribution and cabling work required to establish UPS	Lot	1	1
(g)	UPS Monitoring System and it's integration with URTDSM System	Lot	1	1
D	**SERVICES**			
1	Integration of WAMS system with following units/applications:			
(a)	Integration with the SCADA/EMS Sytem at NLDC and backup NLDC respectively	No.	1	1
(b)	Integration with 3rd party applications	Lot	1	1
(c)	Integration (at Control center end) of existing PMUs	No	3,000	3,000
(d)	Integration (at control center end) of new PMUs supplied under this project	No	1,100	1,100
(e)	Integration of WAMS System with existing Video Projection System (VPS) of SCADA/EMS System in respective control center	Lot	1	1
(f)	Cyber Security Audit by Cert-IN certified Auditors during FAT.	Lot	1	1
(g)	Cyber Security Audit by Cert-IN certified Auditors during SAT.	Lot	1	1
(h)	Dismantling and Buyback of existing WAMS system of URTDSM Phase-I (after successful parallel operation)	Lot	1	1
(i)	SMS integration with service provider Email integration with owner email system	Lot	1	1

E	**Training**			
1	Training - Man days @15 Days x 18 persons	Man-days	270	
F	**Annual Maintenance Contract**			
(a)	Annual maintenance contract of WAMS System and all the equipment supplied in the project for a period of 7 years (1 year DLP and 6 years AMC)	Lot	1	1
(b)	Annual Training under AMC period	Lot	1	1
(c)	Six Monthly Cyber Security Audit by Cert-IN certified Auditors during 7 years AMC period	Lot	1	1
(d)	Patch Management including Signature updates for all Cyber security equipments for 7 years	Lot	1	1
(e)	Integration of new PMUs data from PDCs at respective RLDCs with PDC at NLDC during entire AMC period	No	5,000	5,000

>> The sizing for Historian Storage at NLDCs is considered @25 samples/second reporting rate of the existing and new PMUs including 100% expansion

URTDSM Phase-II WAMS System - BoQ for 5 RLDCs								
Sr.No	Name of the item	Unit	Name of RLDC					Total Qty
			NRLDC	ERLDC	NERLDC	SRLDC	WRLDC	
A	SOFTWARE							
1	PDC Software	Lot	1	1	1	1	1	5
2	WAMS Visualisation (UI) Software	Lot	1	1	1	1	1	5
3	Analytical Applications							
(a)	Linear State Estimator	Lot	1	1	1	1	1	5
(b)	Oscillation Monitoring Application	Lot	1	1	1	1	1	5
(c)	Real time automated event detection along with early warning system and ROCOF calculation over variable window	Lot	1	1	1	1	1	5
(d)	WAMS based Voltage Stability analytics (VSA)	Lot	1	1	1	1	1	5
(e)	WAMS based contingency analysis, security assessment & Islanding Detection	Lot	1	1	1	1	1	5
(f)	Generator Model Validation, Real time Inertia Estimation and monitoring	Lot	1	1	1	1	1	5
(g)	Post-mortem analytics	Lot	1	1	1	1	1	5
(h)	Wide Area Control Systems							
i.	WAMS based automatic load shedding (AUFLS and df/dt)	Lot	1	1	1	1	1	5
ii.	Control of HVDC, PSS and STATCOM for damping system oscillations	Lot	1	1	1	1	1	5
(i)	Response of Wind Farm and Solar PV for LVRT, Reactive Power.	Lot	1	1	1	1	1	5
4	Programming Development System (PDS) Software	Lot	1	1	1	1	1	5
5	Commercial Off-The-Shelf (COTS) Softwares							
(a)	Data Historian Software	Lot	1	1	1	1	1	5
(b)	Identity Management Software	Lot	1	1	1	1	1	5
(c)	Network Access Control (NAC)	Lot	1	1	1	1	1	5
(d)	Patch Management Software	Lot	1	1	1	1	1	5
(e)	Virtualisation Software for all the virtual servers envisaged and required under the project along-with centralised management software	Lot	1	1	1	1	1	5
(f)	Operating System for all the servers	Lot	1	1	1	1	1	5
(g)	Host based intrusion prevention system (HIPS) with centralised management	Lot	1	1	1	1	1	5
(h)	End Point Security Solution with centralised management	Lot	1	1	1	1	1	5
(i)	Centralised Management and Log Analyser of all FWs	Lot	1	1	1	1	1	5
(j)	Network Management System	Lot	1	1	1	1	1	5
(k)	SIEM (Security Information and Event management)	Lot	1	1	1	1	1	5
(l)	VAPT Tool	Lot	1	1	1	1	1	5
6	Report Development & Generation Software	Lot	1	1	1	1	1	5
7	Storage system							
(a)	SAN Software	Lot	1	1	1	1	1	5
(b)	NAS Software	Lot	1	1	1	1	1	5
8	SMS & Email Interface	Lot	1	1	1	1	1	5
9	Backup Solution Software	Lot	1	1	1	1	1	5
10	Data exchange Software with external applications	Lot	1	1	1	1	1	5
B	HARDWARE							
1	PDC Server sized for data of 2500 PMUs	No.	2	2	0	2	2	8
2	PDC Server sized for data of 1000 PMUs	No.	0	0	2	0	0	2
3	Analytical Applications Servers	No.	2	2	2	2	2	10
4	Historian Servers	No.	2	2	2	2	2	10

(a)	Data Historian Server							
(b)	Report Development & Generation Server							
5	WAMS Visualisation (UI) Server	No	2	2	2	2	2	10
6	Programming Development System (PDS) Server	No	1	1	1	1	1	5
7	Management Applications Servers							
(a)	Identity Management Server	No.	2	2	2	2	2	10
(b)	NMS Server							
(c)	Centralised Management & Log analyser of Firewall (Internal)	No.	2	2	2	2	2	10
(d)	Network Access Control (NAC) Server							
(e)	End Point Security Solution							
8	Internal DMZ Servers	No	2	2	2	2	2	10
(a)	SIEM Server							
(b)	Centralised Management & Log analyser of Firewall (External)							
9	External DMZ Servers	No	2	2	2	2	2	10
(a)	End Point Security Solution							
(b)	Patch Management Server							
10	Anti APT	No	1	1	1	1	1	5
11	Storage System							
(a)	Storage Solution of Minimum 600TB, RAID10, SAN or equivalent along with SAN Management Server	No.	1	1	0	1	1	4
(b)	Storage Solution of Minimum 250TB, RAID10, SAN or equivalent along with SAN Management Server	No.	0	0	1	0	0	1
(c)	NAS Storage of 50TB	No.	1	1	0	1	1	4
(d)	NAS Storage of 20TB	No.	0	0	1	0	0	1
12	Workstation consoles with dual monitor							
(a)	PDC application	No.	2	2	2	2	2	10
(b)	PDS Application	No.	1	1	1	1	1	5
(c)	Analytical Applications	No.	1	1	1	1	1	5
(d)	External DMZ	No.	1	1	1	1	1	5
(e)	Inernal DMZ	No.	1	1	1	1	1	5
(f)	Management Applications	No.	1	1	1	1	1	5
(g)	Historian Applications	No.	1	1	1	1	1	5
(h)	Server Management Console	No	1	1	1	1	1	5
(i)	Remote Diagnostic Console	No	1	1	1	1	1	5
13	Color Laser Printer	No.	1	1	1	1	1	5
14	Time System (NavIC & GPS based)	Lot	2	2	2	2	2	10
15	Firewalls (With Minimum 8Gbps NGTP)							
(a)	External Firewall with NIPS for Internet and Remote consoles	No.	2	2	2	2	2	10
(b)	External Firewall with NIPS for PDC/PMU/SCADA data	No.	2	2	2	2	2	10
(c)	Internal Firewall with NIPS	No.	2	2	2	2	2	10
16	WAN Router cum Firewall							
(a)	For Communicating with PDCs at NLDCs (8 x Fiber Optic Ports, 8 Ethernet ports (1Gbps))	No.	2	2	2	2	2	10
(b)	For Communicating with PDCs at SLDCs (8 x Fiber Optic Ports, 8 Ethernet ports (1Gbps))	No.	2	2	2	2	2	10
(c)	For communicatiing with Remote Consoles (8 x Fiber Optic ports, 8 Ethernet ports (1Gbps))	No.	2	2	2	2	2	10
(d)	For Internet/Corporate Intranet connectivity (8 x Fiber Optic ports, 8 Ethernet ports (1Gbps))	No.	2	2	2	2	2	10
(e)	WAN router at Remote Console end (4 Ethernet ports (1Gbps))	No.	2	2	2	2	2	10

17	L3 LAN Switches (10G FO ports) for the following LANs							
(a)	48-port L3 LAN Switch for PDC LAN	No.	2	2	2	2	2	10
(b)	24 port L3 LAN Switch for Historian LAN	No.	2	2	2	2	2	10
(c)	24 port L3 LAN Switch for External DMZ LAN	No.	2	2	2	2	2	10
(d)	24 port L3 LAN Switch for Internal DMZ LAN	No.	2	2	2	2	2	10
(e)	24 port L3 LAN Switch for Management LAN	No.	2	2	2	2	2	10
(f)	24 port L3 LAN Switch for Analytics LAN	No.	2	2	2	2	2	10
(g)	32 port FC Switch for SAN system	No.	2	2	2	2	2	10
18	Remote Consoles, equivalent to Work station console mentioned at Item No.4 above	No.			10			10
19	Server for Backup Solution	No.	1	1	1	1	1	5
20	Backup Appliance	No.	1	1	1	1	1	5
21	Laptop for VAPT	No	1	1	1	1	1	5
22	Server for Data Exchange with external applications	No	1	1	1	1	1	5
23	Any other additional hardware at Control center end for implementing Wide Area Measurement Protection and Control (WAMPAC) system	No	1	1	1	1	1	5
C	**Auxiliary Power System**							
(a)	60 kVA (48kW at 0.8 pf) UPS running in parallel	No.	2	2	2	2	2	10
(b)	VRLA type Battery banks for above UPS (each bank of 115.2 kVAH)	No.	2	2	2	2	2	10
(c)	Input ACDB (450kVA rating)	No.	1	1	1	1	1	5
(d)	Output ACDB (300kVA rating)	No.	1	1	1	1	1	5
(e)	Accessories for maintenance of VRLA type batteries	Lot	1	1	1	1	1	5
(f)	Power Distribution and cabling work required to establish UPS	Lot	1	1	1	1	1	5
(g)	UPS Monitoring System and it's integration with URTDSM System	Lot	1	1	1	1	1	5
D	**SERVICES**							
1	Integration of WAMS system with following units/applications:							
(a)	Integration with the SCADA/EMS Sytem at respective RLDC	No.	1	1	1	1	1	5
(b)	Integration with 3rd party applications	Lot	1	1	1	1	1	5
(c)	Integration (at Control center end) of existing PMUs	No.			3,000			3000
(d)	Integration (at Control center end) of new PMUs supplied under this project	No.	218	303	151	89	309	1070
(e)	Integration of WAMS System with existing Video Projection System (VPS) of SCADA/EMS System in respective region	Lot	1	1	1	1	1	5
(f)	Cyber Security Audit by Cert-IN certified Auditors during FAT.	Lot	1	1	1	1	1	5
(g)	Cyber Security Audit by Cert-IN certified Auditors during SAT.	Lot	1	1	1	1	1	5
(h)	Dismantling and Buyback of existing WAMS system of URTDSM Phase-I (after successful parallel operation)	Lot	1	1	1	1	1	5
(i)	SMS integration with service provider Email integration with owner email system	Lot	1	1	1	1	1	5
E	**Training**							
1	Training - Man days @15 Days x 24 persons in each Region	Man-days	360	360	360	360	360	1,800
F	**Annual Maintenance Contract**							
(a)	Annual maintenance contract of WAMS System and all the equipment supplied in the project for a period of 7 years (1 year DLP and 6 years AMC)	Lot	1	1	1	1	1	5

(b)	Annual Training under AMC period	Lot	1	1	1	1	1	5
(c)	Six Monthly Cyber Security Audit by Cert-IN certified Auditors during 7 years AMC period	Lot	1	1	1	1	1	5
(d)	Patch Management including Signature updates for all Cyber security equipments for 7 years	Lot	1	1	1	1	1	5
(e)	Integration of new PMUs (from existing substations or from new substations) with PDCs at RLDCs during entire AMC period	No	1,200	800	700	1,100	1,200	5000
(f)	Integration of PDCs at SLDCs with PDCs at respective RLDCs during AMC period	No	9	5	3	5	4	26

>> The sizing for Historian Storage at RLDCs is considered @50 samples/second reporting rate of the existing and new PMUs including 100% expansion

BOQ for Central Sector PMUs to be procured under URTDSM Phase-II								
S.No	Name of the item	Unit	Regionwise Qty					Total Qty
			NR	ER	NER	SR	WR	
A	SOFTWARE							
1	PMU configuration software	Lot	12	6	4	6	4	32
B	HARDWARE							
1	PMUs		218	303	151	89	309	1070
2	Panel for mounting PMUs (complete with all necessary accessories, cables etc. as per specification) along with identified analog channels / modules	Lot	1	1	1	1	1	5
3	Time System (GPS receiver)	Lot	218	303	151	89	309	1070
4	Substation Grade Layer-3 LAN Switches with 10 ports minimum i.1 Gbps Fibre port- 4 nos. ii.1 Gbps Cu ports- 2 nos. iii.100 Mbps Cu ports- 4 nos	No.	135	170	55	75	210	645
5	Substation Grade Layer-2 LAN Switches with 10 ports minimum i.1 Gbps Fibre port- 4 nos. ii.100Mbps Fibre ports- 4 nos. iii.100Mbps Cu ports – 2 nos.	No.	109	152	76	45	155	535
6	Armored Fibre Optic Cable and associated termination	Lot	135	170	55	75	210	645
7	LIU - FO PATCH PANEL-12 PORT	No.	244	322	131	120	365	1180
8	PMU configuration tool (Laptop)	No.	12	6	4	6	4	32
9	Integration (at substation end) of new PMUs supplied under this project with PDCs of respective Control center	No.	218	303	151	89	309	1070
B	TRAINING							
1	Training (For All Central Sector locations in each Region, 3 days for 5 persons)	Man days	150	90	90	90	90	510
C	Annual Maintenance Contract							
(a)	Annual maintenance contract of PMUs and all the associated equipment supplied in the project for a period of 7 years (1 year DLP and 6 years AMC)	Lot	1	1	1	1	1	5

>> The PMU quantity mentioned above is indicative requirement under Phase-II for only Central Sector portion.
>> Each PMU shall be supporting measurement of 2sets of Voltage and Current phasors (i.e, of 2 elements) as a minimum and shall comply with latest version of IEEE C37.118.2 and IS/IEC 60255-118.1standards with latest amendments.

URTDSM Phase-II - BOQ for Mandatory Spares			
Sl.no	**Item description**	**Unit**	**Total Qty**
A	**Spares for URTDSM system**		
1	Servers one of each type at every RLDC & NLDC	Lot	1
2	**Storage System**		
(i)	10% of the critical items at every control center like Dual redundant power supplies, controllers and storage disks/ specialized storage etc.	Lot	1
3	Workstation console with dualcolour monitor (@10% of Total Supply in each Region/State)	Lot	1
4	LAN switch one of each type at every RLDC/NLDC	Lot	1
5	Internal Firewall at every RLDC and NLDC	Lot	1
6	External Firewall at every RLDC and NLDC	Lot	1
7	WAN Routers one of each type at every RLDC and NLDC	Lot	1
8	Time System (GPS receiver) (@10% of Supply)	Lot	1
9	PMU (complete with all necessary accessories, cables etc. as per specification) along with additional analog channels / modules	No.	110
B	**Spares for Auxiliary Power Supply system**		
1	MCCB/MCB/Isolator/ Switch/Contactor of each type & rating (as applicable & used inside UPS panel)	Lot	7
2	Fuse of each type & rating (if applicable)	Lot	35
3	DC Filter assembly	Lot	7
4	Input AC Filter assembly	Lot	7
5	Output AC Filter assembly	Lot	7
6	Electronic Printed Circuit Board / Card of each type (including all cards/modules for rectifier/charger, inverter, system card, display module, interface cards etc.)	Lot	7
7	Power Semiconductor devices of each type & rating such as SCRs, IGBTs etc. for rectifier/charger module, Inverter module, Static Switch module for all the three phases (exclude those items which are covered under item-6 above)	Lot	7