North Eastern Regional Power Committee

MINUTES OF THE 17th NER Telecommunication, SCADA & Telemetry (NE-TeST) COORDINATION SUB-COMMITTEE MEETING OF NERPC

Date : 26/06/2020 (Friday)

Time : 10:30 hrs

Venue : "NERPC", Shillong.

The List of Participants in the 17th NETeST Meeting is attached at ***Annexure–I.***

Shri A.K. Thakur, Member Secretary, NERPC welcomed all the participants to the 17th North Eastern Telecommunication, SCADA & Telemetry meeting. He appreciated the presence of all the utilities members and having 100% attendance inspite of the meeting being held through Video Conference.

He then requested Shri B. Lyngkhoi, Director (O&P) to take up the agenda items for discussion.

A. CONFIRMATION OF MINUTES

CONFIRMATION OF MINUTES OF THE 16th MEETING OF "NORTH EASTERN TELECOMMUNICATION, SCADA & TELEMETRY (NETeST)" SUB COMMITTEE OF NERPC.

Director, NERPC informed that minutes of the 16th NETeST Meeting held on 20th February, 2020 at Shillong were circulated by NERPC vide letter No. NERPC/SE(O)/TeST/2019/4847-4884 dated 16th March, 2020.

The Sub-committee confirmed the minutes of the 16th NETeST Meeting as no comments/observations were received from the constituents.

A.1 Status of FO works under different projects:

Project	States	Current Status	Comments/ Issues
MW Vacation & OPGW Project		Completed except 3 links (Nirjuli-Ranganadi- ROW issue. Sihmui-Melriat, Zemabawk2-Aizawl- Front not ready)	P&E Mizoram to make front ready for at Sihmui and Zemabawk.
NER FO Expansion	**Tripura**	All links completed.	After completion 132kV Palatana (OTPC) - Udaipur (TSECL) OPGW cut due to diversion by railway. Affected links 132kV Udaipur - Rokhia, 66kV Udaipur - Gumti & 66kV Gumti - Amarpur.
		SM Nagar~Rokhia & SM Nagar~Monarchak	Front to be made available by TSECL. Execution also by TSECL. Material handed over.
	Meghalaya	3 out of 4 links completed. NEHU-NEIGRIMS pending.	Nehu- Neigrims connected via part of original ULDC path NEHU to Kliehriat-I
	Manipur	132kV Loktak (NHPC)-Rengpang.	ROW issue recently solved. Delay due to Covid19 situation.
	Nagaland	Wokha –Kohima LILO at New Kohima pending.	DoP Nagaland to complete the LILO part.
		132kV Doyang- Sanis	Newly added to the contract.
ULDC upgradation	**All states**	Completed.	Umtru connected.

Deliberation in the meeting

Project	States	Current Status	Comments/ Issues
MW Vacation & OPGW Project		Completed except 2 links (Sihmui-Melriat, Zemabawk2-Aizawl-Substation not ready) Note: Nirjuli-Ranganadi LILO at Leikhi/Parey is also completed & jointly verified with NERLDC as per MOM of last 15-16TH NETeST	**Sihmuii:** Existing 48V battery-bank drained. P&ED-Mizoram to replace the battery-bank. **Zemabawk-II:** Substation is getting dismantled and shifted to a new place. P&ED-Mizoram will shift the RTUs and Communication equipment also to the new location. NERTS will provide all the related wiring diagrams and necessary help.
NER FO Expansion	**Tripura**	All links completed.	After completion 132kV Palatana (OTPC) - Udaipur (TSECL) OPGW cut due to diversion by railway. TSECL will write a letter to Ministry of Railway to expedite the work. NERTS wrote to CMD TSECL with copy to Railway to expedite the work. However Railway intimated delay due to covid19.
		SM Nagar~Rokhia & SM Nagar~Monarchak (Execution by TSECL)	TSECL informed that line is under construction and delayed due to COVID-19 situation.

	Meghalaya	3 out of 4 links completed. NEHU-NEIGRIMS pending.	MePTCL requested for status with documents of the project & MePTCL requested PG to submit SAT report for the 3 links. Issue of rodent at one site to be resolved by MePTCL.
	Manipur	132kV Loktak (NHPC)- Rengpang.	ROW issue recently resolved. Delay due to COVID-19 situation. For sites as completed, Manipur to issue clearance/handing over.
	Nagaland	Wokha –Kohima LILO at New Kohima pending.	DoP Nagaland to complete the LILO part. DoP Nagaland to update the progress status by NERPSIP.
		132kV Doyang-Sanis	Newly added to the contract in Nov'19.
ULDC upgradation	**All states**	Completed.	Agenda item may be closed.

The Sub-committee noted as above.

Action: State Utilities, NERTS, NERPC.

B. N E W I T E M S

B.1 Strengthening of PLCC System by NER States:

In 16th NETeST meeting NERLDC informed the forum that the real-time data transfer from several substations in the NER is dependent on PLCC links and hence the maintenance of PLCC panels should be done at periodic intervals. It was also deliberated that certain T-connections if made by state-utilities for power transfer will lead to signal loss in PLCC communication; hence, it should be avoided. Forum agreed that due consideration on maintenance of PLCC panels should be given. NERLDC also suggested that each constituent should prepare the action plan for necessary BOQs

for upgradation / renovation of PLCC and submit their proposal at NETeST forums. While preparing BOQs each constituent should ensure the feature of Speech and Data for PLCC links along with separate protection panels.

It was also deliberated that NERPSIP communication details" needs to be elaborated by the states in detail.

Deliberation in the meeting

Director, NERPC requested states to update the progress on strengthening of PLCC systems. The summary of discussion is mentioned below:

S N	States	Current Status
1.	Meghalaya	Digital PLCC project under PSDF completed. Almost all stations are having PLCC backup. Installation of Data-Concentrator at Mawlai Station delayed due to COVID-19.
2.	Tripura	Proposal for PLCC links for all important stations through PSDF funding. NERPC requested TSECL to put the proposal in next TCC/NERPC meeting.
3.	Manipur	PLCC strengthening proposal approved by higher management. Further progress delayed due to COVID-19.
4.	Nagaland	PLCC installation work completed. Commissioning delayed due to COVID-19.

MePTCL requested NERPC that the projects status of NERPSIP related to communication systems corresponding to Meghalaya state is not being updated to it.

Director, NERPC stated that he will ensure that States coordinator of NERSIP and POWERGRID coordinator would be invited in the next NETeST meeting for briefing project status of respective states.

The Sub-Committee noted as above.

Action: All State Utilities & NERPC.

B.2 Improvement of Data Availability of NER

As per IEGC 4.6.2, all users shall ensure telemeter power system parameters to RLDC. The present level of data availability of NER grid is as tabled in the **Annexure-1**, which is less than 50% in the region.

SN	Utility	Availability	Stations Not Reporting	Latest Status/ Issues
1	**Assam**	48.5%	51.5% stations not reporting.	Impacted due to SAS upgradation work. NERPC to form Team for monitoring and expedite the work.
2	**Tripura**	18.95% (12 out of 25 reporting)	Dhalabil, Badarghat, Baramura, SM Nagar, BJ Nagar	Links completed. Voice and data configuration pending.
			Gumti, Amarpur, Rokhia	End equipment installation at Palatana station pending.
			Sabroom, Satchand	Island FO link. Needs PLCC to bring data to WB location Udaipur.
			Monarchak	FO Under construction. TSECL to submit action plan for remaining 13 stations.
3	**Meghalaya**	45.69%		Absence of DI card for isolator status is causing low availability. Proposal moved by MRT team for procurement of DI card.
5	**Manipur**	52.81%		Patch cord issue by rodents.
6	**Nagaland**	35.49% (4 out of 17 reporting)	13 stations not reporting	Nagaland to submit action plan for improving data availability
7	**Mizoram**	18.40%	Luangmual, Zuangtui	Can be integrated to nearest station Aizawl.
			Kolasib	RTU delivery and installation pending by NERTS.
8	**Ar. Pradesh**	7.15%		DoP AP to submit action plan for improving data availability.

NERLDC requested NERPC to advise TSECL, DoP-Mizoram, DoP-Arunachal Pradesh and DoP-Nagaland for improvement of the data availability of respective state-owned stations.

Periodic reminder letters regarding data-availability has been sent to all constituents but no substantial response has been received yet. The associated letters in this regard are attached as **Annexure-2.**

Deliberation in the meeting

SN	Utility	Availability	Stations Not Reporting	Latest Status/ Issues
1	**Assam**	48.5%	51.5% stations not reporting.	Impacted due to SAS upgradation work. Will provide the updated status by mail.
2	**Tripura**	18.95% (12 out of 25 reporting)	Dhalabil, Badarghat, Baramura, SM Nagar, BJ Nagar	Links completed. Voice and data configuration pending.
			Gumti, Amarpur, Rokhia	End equipment installation at Palatana station pending.
			Sabroom, Satchand	Island FO link. Needs PLCC to bring data to WB location Udaipur.
			Monarchak	FO Under construction. TSECL to submit action plan for remaining 13 stations.
3	**Meghalaya**	45.69%		Proposal moved by MRT team for procurement of DI card through PSDF funding.
5	**Manipur**	52.81%		**Jiribam:** will be shifted to OPGW from GPRS. **Churachandpur** and **Kakching:** issue at CC panel to be rectified with help from

				NERTS.
6	**Nagaland**	35.49% (4 out of 17 reporting)	13 stations not reporting	5 stations do not have RTU. Saini: RTU delivered but installation delayed due to COVID-19. Melrui: Proposal for RTU pending with Higher Management. Singrijan: Station dismantled. May be removed from data base.
7	**Mizoram**	18.40%	Luangmual, Zuangtui	BSNL ISP will be installed at Mizoram-SLDC by 03rd July 2020.
			Kolasib	RTU delivery on 30.03.2020. Installation pending. Delayed due to COVID-19
8	**Ar. Pradesh**	7.15%		Materials for VSAT received for 8 stations. Installation delayed due to COVID-19.

The states utilities raised the issue of data point being considered by RLDC for considering Communication Availability. Regarding the methodology of calculation for communication availability, there was endless discussion going on between TSECL, AEGCL, NEEPCO, MeECL and NERLDC. They were not in agreement with the methodology adopted by NERLDC and after discussing for a long time the forum could not conclude. Hence, Members requested NERPC to review the same.

In view of above, Member Secretary, NERPC decided to constitute a committee to study various issues w.r.t data availability in the light of CERC' Regulations.

The scope of the Committee:

"To study:

a. list of data points to be considered for generation utilities, transmission utilities in NER,
b. Methodology for calculation of Data Availability,

c. List of stations of state utilities to be considered for calculation of data availability."

Further, the present data points and methodology followed by NERLDC is attached at **Annexure – B.2.**

The members of the committee will be from NERPC, NERLDC, NERTS, NEEPCO, Assam, Meghalaya & Tripura with inputs from all utilities.

The Sub-Committee noted as above.
Action: All state utilities.

B.3 Status of URTDSM

The status on various issues related to URTDSM and other PMU related matters needs to be updated to the forum as listed below:

AEGCL: PMUs in Samaguri station was disconnected at site by AEGCL due to upgradation works from conventional stations to SAS based stations. As the SAS activities have been completed, the PMUs need to be re-connected to the CT/PTs at the site. As minuted in the 16th NETeST meeting, AEGCL may please update on the following action points –

- Procurement of cables to connect PMU to Kiosk with an approx. length of 2,000 m (total of multiple cables).
- Target date for completion of the necessary works of PMUs reconnection at Samaguri station.
- Preparation of list of material required for the PMUs re-installation works and conveying it to NERPC for information.
- Issuance of a letter from NERPC to CGM of AEGCL for the PMU re-installation works.

NERTS : As minuted in the 16th NETeST meeting, NERTS is requested to update the status on the following –

- Resolving the CVT connections issues in remaining three (03) stations namely, 220 kV Dimapur (PG) S/s, 220 kV Mariani (AS) and Tinsukia.
- Resolving the angle issue which is persistent in 400 kV Bongaigaon – Siliguri 1. All the angle are measured with respect to 400 kV Bongaigaon Bus.

- Change in CT connections at all stations where CVT connections have been changed OR some other plan like further transposition in lines to rectify the phases.
- Installation of pending analytical application: Five (05) applications of Power

Analytics Software (PAS) out of Six (06) were uploaded in NERLDC URTDSM system, by IIT Bombay and POWERGRID officials, in the month of July'19. However, an application for Control schemes for improving system security is still pending for uploading. NERTS is requested to expedite the works related to it.

Deliberation in the meeting

NERLDC informed that DOCO Certificate on behalf of AEGCL, TSECL and MePTCL has been issued to NERTS after receiving the necessary consent from the respective state-utilities. Update regarding various issues related to URTDSM is listed below:

AEGCL: AEGCL (MRT) informed that PMUs in Samaguri station is reporting to Assam-SLDC after completion of SAS activities. The PMUs in Agia station is not reporting to Assam-SLDC due to SAS-upgradation activities. It is delayed due to COVID-19.

NERLDC stated that frequent shut-down of URTDSM system of Assam-SLDC is due to failure of Air-conditioning system catering to the cooling requirements of the corresponding Server Room. SLDC-Assam may inform the status with action plan.

NERTS: NERLDC informed that one (01) package of analytical applications developed by IIT-Bombay is yet to be deployed. It is getting delayed on PAN-India level as IIT-Bombay is not able to develop the corresponding application in time.

NERTS will take up the matter with nodal region i.e. NR-1 and requested NERLDC to take up the issue with NLDC/NRLDC.

NERTS mentioned that the issues related to correction of phase-current and phase-angles will be discussed in OCC meetings as it is an operational issue which may involve transposition/phase-configuration change of transmission lines (in primary). It may be noted that same was earlier raised by NERTS in NETeST meeting to be forwarded to OCC but later as per instruction of NERLDC, changes in secondary circuit had been made.

The Sub-Committee noted as above.

Action: NERLDC, NERTS. & AEGCL.

B.4 GPRS connectivity for Substations and Leased line for SLDC:

It was deliberated in the 16th NETeST meeting and accepted by the forum that GPRS will be discouraged due to its unreliability and intermittency in real-time data transfer and the same may be replaced with broadband connection till a permanent mode of communication like Fiber-Optic, PLCC, VSAT, etc. is established. Many stations which are still working on GPRS for real-time data transfer are - Tripura: PK Bari, Dharmanagar, Manipur: Tipaimukh, etc.

Deliberation in the meeting

NERLDC mentioned that the GPRS communication is not reliable and lot of intermittency is faced in case the same is used for real-time data transfer purposes.

NERTS stated that the Leased-line connections can be used in place of GPRS for better performance wherever feasible and also informed the forum that GPRS has been included in the Technical Standards for Communication by CEA (wherever OPGW not available).

NERPC informed the forum that as per Technical Standards for Communication System in Power System Operations Regulations, 2020 Cellular communication may be used for data acquisition system, where feasibility of access to wideband network is not possible. The aspect of data encryption and data security is dealt in Chapter VI Cellular communication of the technical standard for Communication System.

The Sub-Committee noted as above.

Action: P&ED Mizoram, DoP Nagaland, DoP AP, TSECL and NERTS.

B.5 Selected cases of sub-stations for rectification of corresponding data/communication related issues:

Utility	Station	Latest Status/ Issues
NEEPCO	Ranganadi-2nd channel	FO link through but equipment installation pending at BNC. Delay due to Covid19.
	Kathalguri	VoIP Phone not working since 21.01.2020.
NTPC	BgTPP	No VOIP at unit control room (3 no.)
OTPC	Palatana	Dual channel pending for completion of FO link. OTPC to arrange for connection of data channel to SDH/PDH mux.
NHPC	Loktak	RTU procurement underway. By March 2020.

Meghalaya	Killing	Frequent failure.
	Ampati, Rongkhon, Nangalbibra, Nongstoin	EMS/ SCADA modeling pending at SLDC.
Mizoram	Kolasib	RTU not delivered by NERTS
	Saitual, Khawzawl,Champhai, Serchhip, Lunglei	EMS/ SCADA modeling pending at SLDC.
Nagaland	Meluri, Kiphire	EMS/ SCADA modeling pending at SLDC.

Deliberation in the meeting

Utility	**Station**	**Latest Status/ Issues**
NEEPCO	Ranganadi-2nd channel	BNC link is completed. NEEPCO is to connect PLCC link up to BNC wide band node. Earlier delay is due to Covid19.
	Kathalguri	Completed.
NTPC	BgTPP	No VOIP at unit control room (3 no.) NTPC to extend telephone inside their premise and discuss with NERTS (for any port) and get it done.
OTPC	Palatana	OTPC to ensure 2nd channel up to next wide band node (Silchar) through PLCC as discussed in earlier NETeST. For configuration of 2nd port of RTU, OTPC will take up with BHEL. OTPC will buy media converters or others as required to transfer real-time data on FO/PLCC.
NHPC	Loktak	RTU procurement underway. PO placed. Delayed due to COVID-19.
Meghalaya	Killing	Data is reporting but intermitting some time. MePTCL informed the forum that the problem has been rectified.
	Ampati, Rongkhon,	Completed and reporting.

	Nangalbibra, Nongstoin	
Mizoram	Kolasib	RTU delivered on 30.03.2020. Installation delayed due to COVID-19.
	Saitual, Khawzawl, Champhai, Serchhip, Lunglei	SLDC, Mizoram will follow-up with M/s GE T&D India Limited for database modeling of stations. NERLDC SCADA team will help for needful database modeling/configuration.
Nagaland	Meluri, Kiphire	Completed and reporting.

The forum requested all state utilities to ensure that RTU and related communication systems for real-time data transfer to be included in substation and generating station DPR package proposals.

The Sub-Committee noted as above.

Action: All utilities.

B.6 Status of pilot VSAT project:

As discussed in MoM of 16th NETeST meeting the forum unanimously agreed that VSAT scheme implementation for States will be beneficial to NER.

Deliberation in the meeting

NERLDC mentioned that the VSAT feasibility study report was submitted by NERLDC. NERPC stated that the same is included in the minutes as **Annexure B.6.**

Director, NERPC thanked NERLDC for the completion of demo. He stated that the report shall be studied by all constituents and feedback shall be given to NERPC and NERLDC. He informed the forum that NERPC and NERLDC will sit together for cost analysis and explore the possibility of PSDF funding.

The Sub-Committee noted as above.

Action: All utilities.

B.7 VSAT For Roing Tezu Namsai:

As discussed in MoM of 16th NETeST meeting the forum unanimously agreed that VSAT scheme implementation for States will be beneficial to NER.

The forum may discuss on further action plans on deployment of VSAT Communication in NER.

Deliberation in the meeting

NERTS mentioned that all approvals have been taken from higher management and tendering for establishment of VSAT systems at Roing, Tezu and Namsai will be done within 1st week of July 2020.

The Sub-Committee noted as above.

Action: NERTS.

B.8: Readiness for supply of CFEs in Badarpur (2nd TS Node)

The Terminal Servers have been dispatched from the NOIDA office of M/s GE T&D India Limited and will be received at NERLDC, Shillong. Further installation at Badarpur site will also be done till Jul'20.

Deliberation in the meeting

NERLDC conveyed that the terminal servers have been delivered at NERLDC, Shillong premises and same will be transported to Badarpur site as and when feasible.

NERLDC also requested NERTS to re-route the communication channels of RTUs on IEC-101 protocol in sync with the installation and commissioning of Terminal Servers at Badarpur (PG) station. It was also insisted that a communication link shall be established between Badarpur (PG) and Backup NERLDC, Guwahati. NERTS agreed to do the necessary changes in consultation with NERLDC.

The Sub-Committee noted as above.

Action: NERLDC.

B.9 Data validation status of substations:

SN	Utility	Completed	Pending	Latest Status/ Issues
1	**PGCIL**	20 stations out of 23	Roing, Tezu, Namsai	Data validation to be done with existing setup.
2	**Assam**			MoM signed with NERLDC for Action

				plan. Deadlines needs to be adhered.
3	**Meghalaya**			MoM signed with NERLDC for Action plan. Deadlines needs to be adhered.
4	**Nagaland**			MoM signed with NERLDC for Action plan. Deadlines needs to be adhered.

Deliberation in the meeting

SN	Utility	Completed	Pending	Latest Status/ Issues
1	**PGCIL**	20 stations out of 23	Roing, Tezu, Namsai	Completed
2	**Assam**			In progress.
3	**Meghalaya**			Completed
4	**Nagaland**			Completed

The Sub-Committee noted as above.

Action: AEGCL .

B10. Dual channel availability for reliable and redundant communication system in NER:

The Dual-channel availability for reliable and redundant communication system to be provided at Main NERLDC, Shillong as well as Backup NERLDC, Guwahati.

Separate annexures for forced outages in communication links shall be included and reported to the NETeST forum. NERLDC has issued a letter to POWERGRID-NERTS regarding connecting present/temporary Backup NERLDC to wide-band node at Kahilipara through Fiber/ADSS on interim basis.

NERTS is requested to take appropriate action on it.

Deliberation in the meeting

NERLDC mentioned that dedicated and redundant ports in RTUs shall be made available at all stations of North-Eastern region. To ensure the physical redundancy, a total of 4 ports in Central-Sector stations are required to report to Main and Backup Control Centers of NERLDC.

NERTS stated that proposal for new RTUs (with TS & requisite ports as per approved technical architecture) has been initiated at corporate center level. Each RTU will report to Main & Back up RLDC. Requirements/TS as followed in all other region will be full filled.

It was also mentioned by NERTS (from field experience) that too many ports in a single rack/RTU (reporting to multiple master SCADA in parallel) puts the RTUs in "hang/unstable" condition.

The Sub-Committee noted as above.

Action: NERTS and NERLDC

B.11. Utilities executing regional projects to submit monthly progress report to NERLDC/NERPC:

As minuted in the 16th NETeST meeting, all utilities shall share the monthly progress report with NERPC. The progress report is not getting shared with NERLDC for informational purposes.

Deliberation in the meeting

NERLDC mentioned that it was agreed in the earlier NETeST meetings that progress reports of all regional projects in NER shall be submitted to NERPC and subsequently to NERLDC for monitoring and information purposes.

NERTS and State-Utilities mentioned that the progress reports are being submitted in OCC forum and can be referred from it. In case any progress report is not available in Minutes-of-Meeting of OCC, then the same can be asked by NERPC for submission.

The Sub-Committee noted as above.

Action: NERTS, NERLDC & NERPC.

B.12. Integration of Dikshi HEP real time data and pending Voice communication:

The real-time data availability from Dikshi station is intermittent due to some technical issues as conveyed by the site. The voice communication has not been made available from Dikshi station yet. In case of Tenga station, the voice communication is not available at NERLDC as well as SLDC itself. The communications issued from NERLDC to M/s Devi Energies Private Limited in this regard is attached as Annexure-12a and Annexure-12b. An undertaking was also submitted by M/s Devi Energies Private Limited before first time-charging stating that the voice communication will be made available within 6 months after FTC of the Dikshi and Tenga stations.

NERLDC raised the concern in 16th NETeST meeting about non-availability of voice communication between Dikshi HEP with SLDC Arunachal and NERLDC. Forum acknowledged the absence of representative from DoP-Arunachal Pradesh as well as M/s Devi Energies Private Limited.

NERPC informed the forum that matter will be taken to higher officials of concerned utilities by NERPC.

Deliberation in the meeting

Director, NERPC stated that M/s Devi Energies Private Limited has informed that purchase-order has been placed for PLCC equipment to be placed in Dikshi, Tenga and Balipara (PG) stations but it delayed due to COVID-19 pandemic situations.

NERLDC apprised the forum that M/s Devi Energies Private Limited informed NERLDC via letter as attached **Annexure-B.12** that they would install Session Initiated Phones (SIP) for establishing voice-communication between Dikshi/Tenga and Arunachal Pradesh-SLDC until the PLCC equipment is commissioned.

The Sub-Committee noted as above.

Action: DoP, AP/NERLDC.

B.13. Issue of mismatch in timestamp of SoE of PGCIL owned Substations:

Mismatch of timing between NERLDC SCADA time and field time is observed in substation of PGCIL. However, the issues of few stations are still pending and those are list in the table below. As Sequence of Events (SoE) is important for grid disturbance analysis. The mismatch should be rectified at the earliest.

Sl. No.	Station Name	SOE mismatch	Present Status
1	Tezu	05:30 hr	Resolved from 07.05.2020.

2	Ziro	Date and Time	Resolved from 05.05.2020

Deliberation in the meeting

NERTS stated that the Sequence of events (SoE) related issues have been resolved in all its stations.

NERLDC informed the forum that NERLDC would be raising the issues for Mismatch of SoE for Generating stations from next NETeST meetings.

The Sub-Committee noted as above.

Action: NERLDC/NERTS.

B.14. Automatic Generation Control (AGC) in Indian Grid:

As per the CERC order on AGC, all the ISTS stations need to get connected with NLDC for receiving AGC signals. The action-points discussed and minuted in the 16th NETeST meeting are mentioned below:

- BgTPP: POWERGRID informed the forum that BgTPP is connected on optical-fiber links but the end equipment required for AGC needs to be procured by plants itself.

- AGBPP: Link between plant and NLDC is yet to be established and tested. NERTS informed that the link configuration is already completed and asked NERLDC for joint testing within a week. NEEPCO was requested to install and commission necessary hardware and software for the AGC at the earliest as the target date for completion of AGC in Pan-India is March-2020.

- Kopili: As station under recovery after incident of penstock burst, the plant will not come under AGC till the recovery of station.

- Khandong and Doyang: Manager, NEEPCO informed the forum that the plants are under renovation. Therefore, the plants will come under AGC scheme after completion of renovation.

- Loktak: Manager, NHPC informed the forum that the plant will undergo renovation work for implementing local SCADA system. It will not be possible for Loktak to implement AGC. NERLDC requested Loktak-HEP to write their concerns to NLDC via CC-NHPC

Deliberation in the meeting

NERLDC informed the forum that as per the CERC order on AGC, all the ISTS stations need to get connected with NLDC for receiving AGC signals. The status is as follows:

Sl. No.	Station Name	Present Status
1.	BgTPP	AGC operational for Unit 1 & 3.
2.	AGBPP	Siemens requested for some data from DVR of each unit. Units are of Mitsubishi and BHEL/GE-make and require OEM visit. Have received offer from BHEL. Delayed due to COVID-19.
3.	Kopili, Doyang, Khandong	All stations under renovation/ restoration. Letter already written to NLDC by NEEPCO.
4.	Loktak	Purchase-order has been placed to Andritz Hydro. Target Date: **By Oct. 2020.**

The Sub-Committee noted as above.

Action: All concerned utilities.

B.15. <u>Status of RGMO to the Load Despatch Centres:</u>

The real-time telemetry status of RGMO is requested to be made available for Load Dispatch purposes at SLDC-level as well as NERLDC for efficient grid-operation purposes.

The list of stations for the aforesaid requirement are – Khandong, Kopili, Kopili Stg II, Doyang, AGBPP, AGTCCPP, Ranganadi, Monarchak, Tuirial, Pare, Loktak, Palatana, BgTPP, Kameng, Baramura, Rokhia, LTPS, LRPP, NPTS, NRPP, Langpi, New Umtru, Leshka, Likimro, Dikshi, Umiam Stage I, Umiam Stage II, Umiam Stage III, Umiam Stage IV.

<u>Deliberation in the meeting</u>

NERLDC requested that all generating stations of NER needs to provide the RGMO related "real-time digital status" to the SLDCs/NERLDC which is essential for real-time grid operation as well as post-dispatch analysis.

NERPC suggested that Thermal unit below 200MW, Gas based unit below 50MW and Hydro units below 25MW do not require RGMO as per IEGC. NEEPCO and NHPC representative informed the forum that they would explore necessary arrangements to

be made for integration of RGMO-related data into the existing RTU/Gateway work. The work requires involvement of OEM and it will be difficult to get OEM due to COVID-19. It will cause delay.

The Sub-Committee noted as above.

Action: NERLDC/NERTS.

B.16. Status of FSC in stations of NER:

The status of switching devices associated with FSC in the 400kV Bongaigaon-Balipara ckt. 3 and 4 (at Balipara end) needs to be made available for monitoring by Load Despatch Centres at state-level as well as NERLDC.

Deliberation in the meeting

NERLDC mentioned that the real-time ON-OFF status of FSCs in Balipara station is required for grid operation purposes. NERTS requested NERLDC to provide a list of signals required from the site corresponding to FSC set-up and the same data will be configured and provided after checking the requirement at the site (as per practice followed in the other region).

The Sub-Committee noted as above.

Action: NERLDC/NERTS.

B.17. Inter country connectivity between Tripura and Comilla, Bangladesh:

Deliberation in the meeting

NERTS requested NERDLC to take up with NLDC to implement ICCP in between NLDC(India) to NLDC(Bangladesh) so that any data going out of country may be achieved through single point complying all cyber security norms at both ends. Link/channel can be provided by POWERGRID from NLDC India up to border area/station and same will be forwarded by concerned counterpart in Bangladesh up to NLDC Bangladesh.

Similarly, for voice also, separate link can be established in between NLDC(India) to NLDC(Bangladesh) with separate EPABX/VOIP exchange (at NLDC India/Bangladesh end) which is separated from India's internal ULDC/LD&C network. It may be noted that similar voice link has already been established & running successfully in between NLDC India and NLDC Bhutan (separate voice exchange at NLDC Bhutan).

Tripura & other utilities supported for the proposal keeping in view country's security in concern & better monitoring through NLDC. It was mentioned that compliance of cyber security is better at NLDC level and not updated at station/SLDC level. Hence data exchange in between NLDCs is preferred. Forum noted and it was informed that same has already discussed in 10th NETeST (Point.B.19) & recommended for same. NERLDC informed that it would be taken up with NLDC for further needful.

NERLDC informed the forum that they will have an internal discussion and then would be taken up with NLDC for further needful.

The Sub-Committee noted as above.

Action: NERLDC/NERTS.

Date & Venue of next NETeST meeting

It is proposed to hold the 18th NETeST meeting of NERPC in second week of September, 2020. However, the exact date and venue will be intimated in due course.

The meeting ended with thanks to the Chair.

****

Annexure-I

List of Participants in the 17th NETeST Meeting held on 26.06.2020

SN	Name & Designation	Organization	Contact No.
1.	Sh. G. Yinyo,	Ar. Pradesh (VC)	0943620050
2.	Sh. Anaru Khaklari, DM	Assam (VC)	-
3.	Sh. Manas Jyoti Bora, JM	Assam (VC)	-
4.	Sh. Roshan Oinam, Manager, MSPCL	Manipur (VC)	09863895218
5.	Smti. Khoisnam Steela, DGM (SLDC),	Manipur (VC)	08730831103
6.	Sh. M. Romeo, DM, MSPCL	Manipur (VC)	09012657280
7.	Sh. Sh. D.J. Lyngdoh, EE	Meghalaya (VC)	-
8.	Sh. Banjop Saibon, SE	Meghalaya (VC)	-
9.	Sh. B. Narry, AEE, PLCC, MePTCL	Meghalaya	09089000911
10.	Sh. B. Nikhla, EE, MePTCL	Meghalaya	-
11.	Sh. K. Kynjing, AE, MePTCL	Meghalaya	-
12.	Sh. Benjamin L. Tlumtea, Sr. EE	Mizoram (VC)	09466151424
13.	Sh. Jacob Larinfela, AE	Mizoram (VC)	08787688235
14.	Sh. Nitovi Wotsa, EE	Nagaland (VC)	09436004928
15.	Sh. Rokobeito Iralu, SDO	Nagaland (VC)	09436837020
16.	Sh. Anil Debbarma, DGM (SLDC)	Tripura (VC)	09612589250
17.	Smti. Sampa Sen, Sr. Manager	Tripura (VC)	-
18.	Sh. Partha Acharya, Manager	Tripura (VC)	-
19.	Sh. Joypal Roy, DGM(E/M)	NEEPCO	08837200069
20.	Sh. M.K. Ramesh, GM	NERLDC (Webex)	09449599174
21.	Sh. Sakal Deep, Engineer	NERLDC(VC)	09774528218
22.	Sh. Akhil Singhal, Chief Manager	NERLDC(VC)	09650598187
23.	Sh. S. Paul, Chief Manager	PGCIL	09433379985
24.	Sh. Roshitesh Kumar, Asst. Manager	PGCIL(VC)	09402184618
25.	Sh. P. J. Singh, Jr. Engg.	PGCIL(VC)	09435303572
26.	Sh. Pulak Deka, Manager(M)	NHPC (Webex)	06900178738
27.	Sh. Kangkan Paul, DM (EEMG)	NTPC (Webex)	09435029320
28.	Sh. Alokesh Hazarika, Mgr.	OTPC (Webex)	08787606131
29.	Sh. A. K. Thakur, MS	NERPC	09810271963
30.	Sh. B. Lyngkhoi, Director (O&P)	NERPC	09436163419
31.	Sh. S. Mukherjee, Dy. Director	NERPC	08794277306
32.	Sh. Sadiq Imam, AD-I	NERPC	07004133772
33.	Sh. Rajib Das, AD-II	NERPC	09954947474

Power System Operation Corporation Limited

Feasibility Study Report of VSAT Communication in North Eastern Region

North Eastern Regional Load Despatch Centre
Shillong, Meghalaya
March – 2020

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Executive Summary

Seamless uninterrupted connectivity is the cornerstone for ensuring success of real-time data acquisition for mission critical power system operation in any part of the country. As power system is growing, any disruption in connectivity of communication system leading to non-availability of real-time data for monitoring in the Load Despatch Centres, can potentially be a threat to the safety and security of the grid. It is also imperative that all voice communications are also dependent on reliable and redundant communication links. Moreover, the economic and commercial aspects play major role in power system operation these days.

In addition, the North Eastern Region faces unique challenges due to the hilly terrain and geographical location of the substations; lack of adequate network connectivity remains a major challenge for providing real-time data to the load despatchers at state level as well as regional level in North Eastern Region. As most NER States have hilly terrain, in many places laying optical fiber cable (OFC) is difficult and even if it is executed further maintenance and rectification in case of outages is a major challenge for the utilities. Hence, the satellite communication technology such as VSAT should be considered as a communication media for the substations of NER. It should also be considered for substations with an optical fiber connectivity as a redundant communication channel so as to meet the criteria of 100% availability of real-time data for main and redundant data channel as mandated by the Hon'ble Commission.

Various pilot projects with VSAT as communication medium have been installed-and-tested in North Eastern Region in recent past with satisfactory results; some of such locations are Tezu, Dikshi, Tenga and Killing. Many new projects of VSAT technology deployment for getting the real-time data from sub-stations such as Roing, Tezu, Namsai, etc. are under pipeline and expected to be installed in near future.

The VSAT bandwidth connectivity charges have fallen in the past few years making it viable for being used in the power sector for the utilities. Hence, by adopting a reliable and easy-to-install communication technology such as VSAT will remove the communication related issues which is the single most major hurdle resulting in non-availability of real-time data to the Load Despatchers in North-Eastern region.

This report focuses on the above-mentioned aspects in detail and emphasizes on the adoption of VSAT technology in North Eastern Region of India.

1.0 Background

The power system network of North Eastern Region has a big interconnected transmission network operating at various voltage levels such as - ±800kV HVDC, 400kV AC, 220kV AC, 132kV AC, 66kV AC, etc. The current installed generation capacity in NER is around 4373 MW, transmission lines are spanning over a large circuit-kilometres and a high total transformation capacity of the substations. Many transmission and generation projects are under implementation, which are expected to be completed within few years leading to a more complex, meshed and interconnected network. Keeping the vast scope and possibility of the expansion in the generation and transmission sector in NER, govt. has established dedicated State Load Despatch Centres in all the seven (07) states of NER and NERLDC at the regional level to ensure reliable and secure operation of the grid.

One of the main factors in functioning of State/Regional Load Despatch Centres is the real-time data from stations under its control area; failing of which can lead to formation of blind spots in the power system, which are non-monitored and can lead to major grid disturbances, which may subsequently propagate to other regions as well. At present, the real-time data availability in NER is less than 50% most of the times which is primarily due to non-availability or disruption in communication links. Hence, establishment of reliable and redundant communication links is need-of-the-hour for improvement and stability of the power system operation in NER.

2.0 Need for Satellite Communication Technology - VSAT

Various technologies available in the communication systems are Optical Fiber, Power Line Carrier Communication, Radio Communication like VHF/UHF, GPRS, etc. All such technologies have its own advantages, disadvantages and needs to be adopted based on its feasibility and economy for the operations in power sector of India. At present, the communication system planning in NER is based on the Fiber-Optic related projects, which are majorly being executed, by POWERGRID-NERTS and POWERGRID-NERPSIP. However, most of the area of NER being hilly terrains, the site conditions are not suitable for easy laying of Optical Fiber and further restoration in case of any fiber cut can take many days. Moreover, the Right-of-Way (RoW) issues are also getting faced by all utilities in North-Eastern region.

The major backbone of transmission in NER is at 132kV voltage level which needs to be monitored and operated in a secure manner by the SLDCs and NERLDC. But for monitoring and operation of the power system in NER, the real-time data availability from the stations in NER has been quite low of the order of 30%-50% in the past few years majorly due to communication related issues. A graph illustrating the data-availability statistics is shown below.

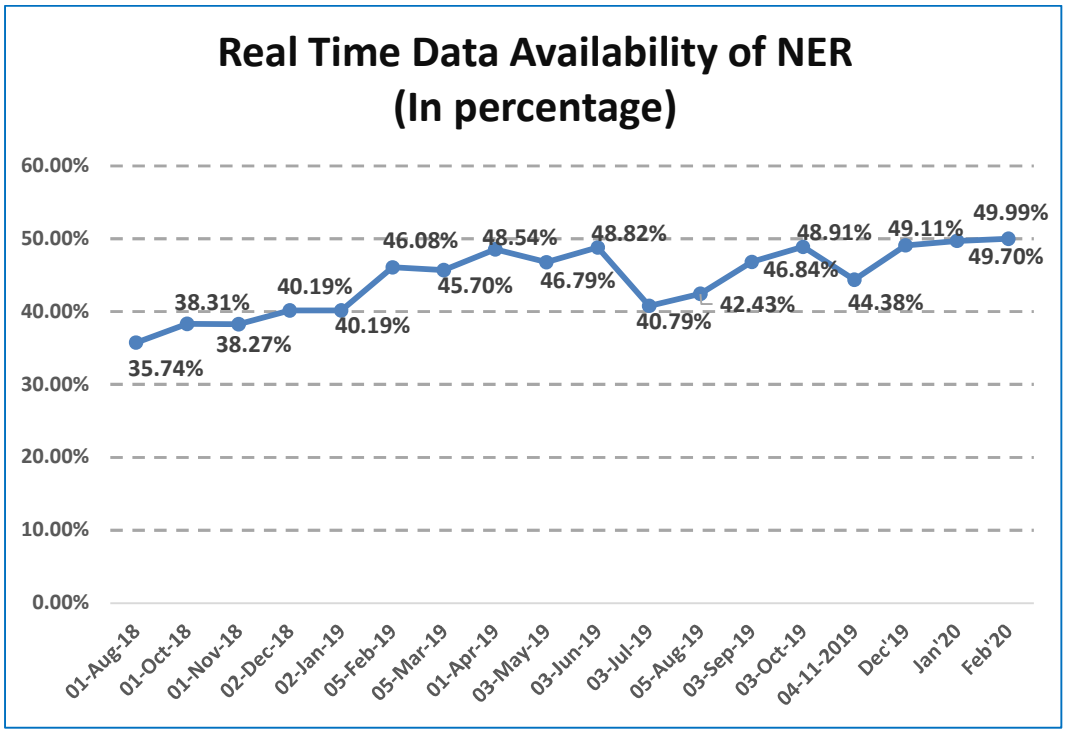


Figure 1: Real-time data availability percentage in North-Eastern region (Aug'18-Feb'20)

The Power Line Carrier Communication (PLCC) systems are primarily working in Assam and Meghalaya states and are not available for data transfer at majority of the places in other states. Many Fiber-Optic laying works under Fiber-Optic Expansion Project and Microwave Vacation Project are under progress in NER but getting delayed due to tough/hilly terrain, weather conditions, natural calamities, critical law-and-order situations, RoW issues, etc. Several stations in NER are tail-end stations (with radial feeders) for which no alternate communication path has been planned yet. The list of tail end stations (with radial feeders) in North-Eastern region are attached as ***Annexure-1***.

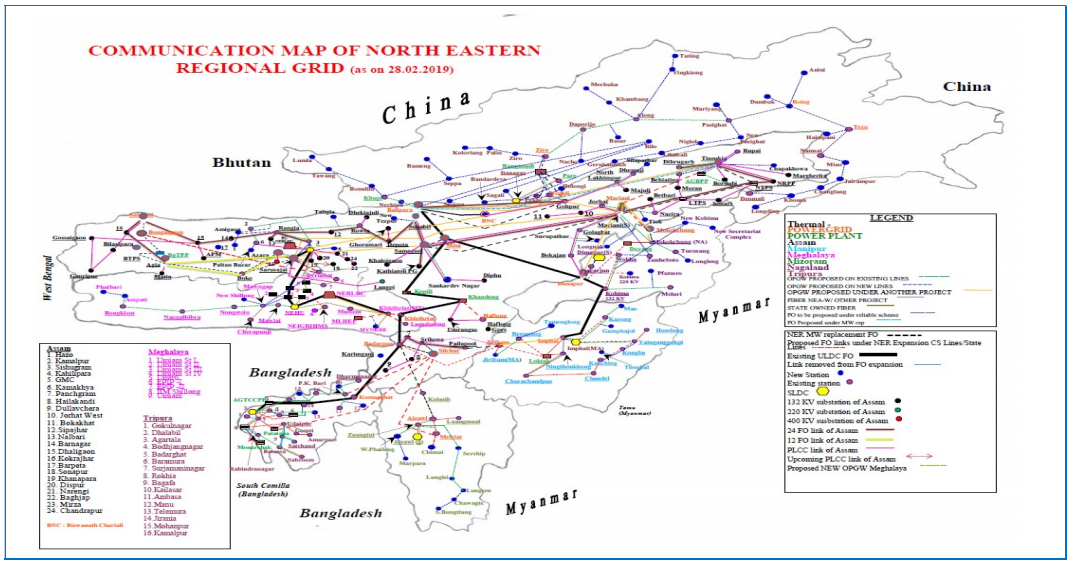


Figure 2: Communication map of North-Eastern region including tail-end stations (with radial feeders)

Due to non-availability of a reliable and suitable communication system in NER, the state constituents under various commercial mechanisms are paying heavily towards penalty against Zero Crossing Violations (ZCV), Deviation Settlement Mechanisms (DSM), etc. If the data availability gets improved, then the corresponding SLDCs of the states will be able to monitor respective over-drawl/under-drawl and can significantly maintain its actual drawl close to the entitles schedule leading to significant cost savings. The ***heavy penalties of the order of 141 crores*** paid by state-utilities of NER are mentioned in *table* below.

Sl. No	Description	Penalty on account of DSM charges (in INR)	Penalty of account of ZCV violation charges (in INR)	Total of DSM Charges and ZCV Violation charges (in INR)
1	Arunachal Pradesh	- 6,71,91,242.79	38,72,22,674	32,00,31,431.2
2	Assam	54,66,47,888.3	15,30,26,164	69,96,74,052.3
3	Meghalaya	4,51,46,532.79	5,03,64,619	95,51,11,51.79
4	Manipur	7,83,57,619.59	2,35,34,527	10,18,92,146.6
5	Mizoram	- 4,51,64,514.57	11,74,17,303	7,22,52,788.43
6	Nagaland	93,15,461.276	11,43,56,408	12,36,71,869.3
7	Tripura	- 14,38,64,481.2	7,66,62,748	- 6,72,01,733.17
	Total Amount *(aggregated for the period of 31-December-2018 to 10-February-2020)*			**1,41,30,33,440 (payable to pool fund) 6,72,01,733 (receivable from pool fund)**

Table 1: Statistics related to DSM and ZCV related penalties paid by NER utilities

The VSAT technology, if implemented, can be utilized for needs of various other schemes, which require data from remote locations such as SAMAST, AMR, etc.

3.0 Initiatives taken under NETeST forum

In order to improve the real-time data availability in NER, the issues related to non-availability of real-time data were taken up in the NETeST (North Eastern Telecommunication, SCADA & Telemetry) forum and exploring other communication technologies options with less time of installation, more reliability, economic feasibility, etc. was envisaged. The projects related to Fiber-Optics were getting delayed due to RoW issues, natural calamities, weather constraints, etc. A study was done by NERLDC to overcome this problem and finding out a suitable communication system solution for North-Eastern region. The forum was in apprehension that VSAT technology will not work satisfactorily in NER due to seasonal variation and bad weather conditions such as heavy rainfall, cloud covers, etc. Many preliminary attempts were made in early 90's for it but were not satisfactory. Out of all the technologies available, NERLDC gave a presentation to highlight the VSAT set-up which has a stable track-record of functioning in the KPTCL system and can be a probable solution as a communication medium due to several advantages it offers.

In the 11th NETeST meeting, it was decided that a team from NER utilities will visit KPTCL premises in Bengaluru to assess the technical feasibility of VSAT technology. The committee comprising of following members visited KPTCL VSAT set-up in Bengaluru on

10-Dec-2018 and subsequently an in-principle approval for implementation of Pilot project in Killing station at a price of 5.38 lakhs (excluding taxes) was agreed upon by the forum –

- Shri M.K. Ramesh, General Manager (System Logistics), NERLDC, POSOCO, Shillong
- Shri Pranab Saha, AGM, AEGCL, Guwahati
- Shri Arup Sarmah, Deputy Manager, AEGCL, Guwahati
- Shri Tanya Tazi, Sr. Manager, NEEPCO, Shillong
- Shri Binod Debbarma, Manager, NERTS, POWERGRID, Shillong

Figure 3: Team from NER utilities (POSOCO-NERLDC, AEGCL, NEEPCO and POWERGRID-NERTS) visit to KPTCL VSAT set-up in Bengaluru on 10-December-2018

The team after visiting KPTCL premises (with VSAT installations and SLDC) in Bengaluru found that the real-time data availability of around 1344 RTUs at Karnataka-SLDC was more than 99.7% since 2007 while using VSAT communication and it was mentioned in the study tour-report (refer ***Annexure-2***) that performance of VSAT communication technology is more suitable for NER terrain.

Meanwhile, NERLDC approached M/s NELCO for a free-of-cost demo in Tezu substation owned by POWERGRID. The demo project's VSAT setup was done by M/s NELCO with coordination from NERLDC and POWERGRID-NERTS in Tezu substation in which the data was integrated with NERLDC. The data availability of demo project was of the order of 95% and worked under bad weather conditions also. A data-availability status (refer ***Annexure-3***) in support of the satisfactory performance of VSAT demo project in Tezu substation was furnished by NERLDC in the 15th NETeST meeting held at Guwahati on 21st October 2019. After the successful functioning of VSAT in Tezu substation, POWERGRID-NERTS initiated a proposal for internal administrative approval regarding setting up of VSAT communication for three (03) nos. of its stations in Arunachal Pradesh i.e. Roing, Tezu and Namsai. It is also to be noticed that as per technical advice from NERLDC, some IPPs stations of NER i.e. Dikshi and Tenga adopted VSAT Technology and are transferring real-time data satisfactorily on VSAT communication links to its respective SLDC.

Initially, the VSAT pilot project was envisaged using KPTCL hub. The estimated cost of Rs. 5.38 lakhs for VSAT terminals, Rs. 1.4 Lakhs for Terminal Servers (for converting 101 to 104 protocol) was put forward, and all the constituents in 13th NETeST meeting unanimously agreed for it on cost-sharing basis. However, NERLDC approached M/s Hughes Communication to demonstrate VSAT connectivity for RTU/SAS data transfer between NEHU SLDC and Killing Substation of Meghalaya on no-cost basis. M/s Hughes dispatched two (02) numbers VSAT antenna and Indoor equipment on 23-11-2019. The antenna and indoor equipment was delivered on 03-01-2020. The antenna at SLDC NEHU was erected on 20-01-2020. The VSAT IDU of SLDC NEHU was configured with ground HUB (located at Manesar) on 10-02-2020. The antenna at 400 kV Killing S/s was erected on 12-02-2020. The VSAT IDU of 400 kV Killing S/s was configured with ground HUB (located at Manesar) on 13-02-2020, which connected the Killing S/s with SLDC NEHU. Subsequently, the real-time data of 400 kV Killing S/s was telemetered to SLDC NEHU on 14-02-2020. The same has been made operational on 14th February 2020 and will be in service for at least a period of one (01) month. Some brief statistics on the performance of VSAT installed at 400 kV Killing S/s is attached as ***Annexure-4.*** The real-time data availability was in order of 96%; the non-availability of data on 16th February 2020 was due to high latency, which was rectified by the M/s Hughes Communication India Limited within a short time of 3-4 hours and the non-availability of the data on 02nd March 2020 was due to some changes in configuration in order to check the Voice communication over VSAT. The voice-testing on VSAT between Killing station and Meghalaya-SLDC was also tested successfully and corresponding Minutes-of-Meeting between Meghalaya-SLDC and NERLDC are attached as ***Annexure-5.***

Figure 4: VSAT antenna installed at Killing substation under Pilot Project

Figure 5: VSAT antenna installed at Meghalaya-SLDC (at NEHU) substation under Pilot Project

Figure 6: VSAT IDU and Terminal Server at Killing substation under Pilot Project

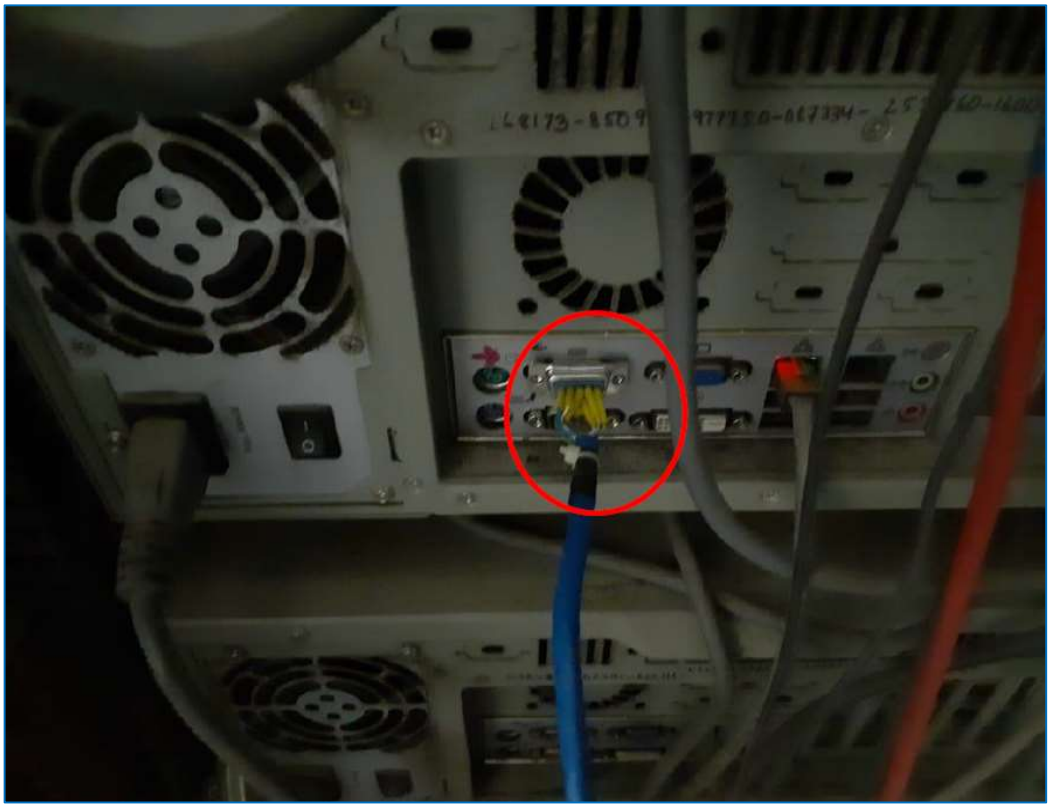


Figure 7: Gateway along with connecting cable at Killing substation under Pilot Project

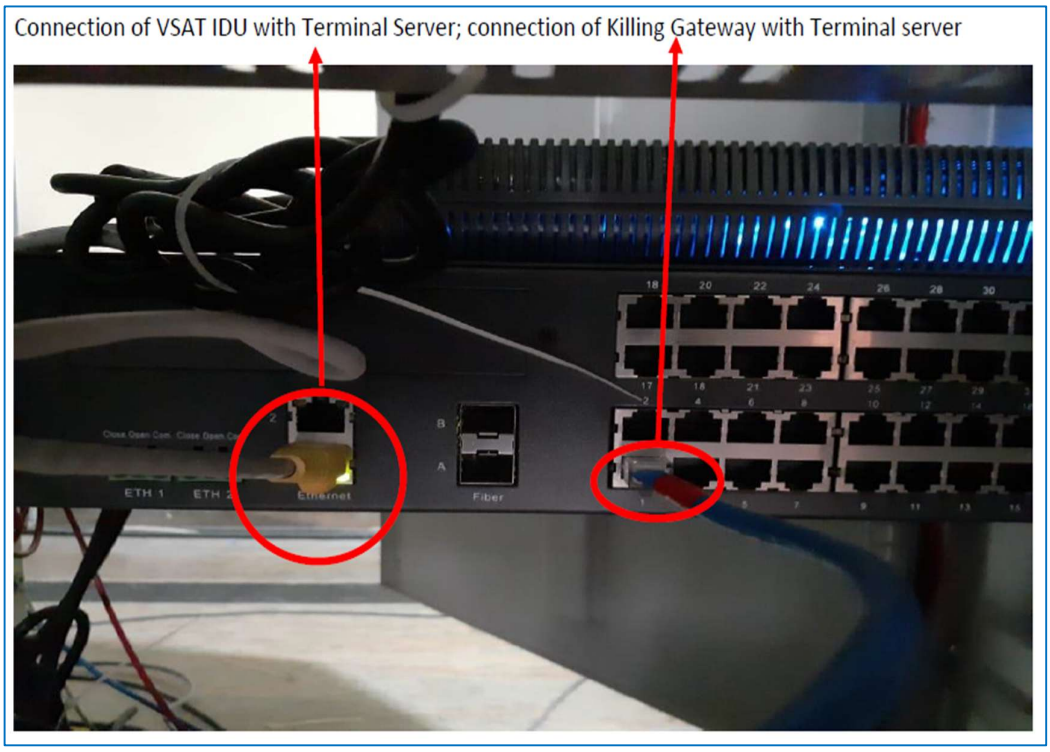


Figure 8: Connection of VSAT IDU with Terminal Server; Connection of Gateway with Terminal Server - Killing substation under Pilot Project

Figure 9: Session Initiated Protocol Phones Installed for Voice Testing under Pilot Project

4.0 Communication Link Availability in NER stations

As the output of the gateway is important for the configuration with VSAT equipment. A list of RTU/Gateways of central sector stations is attached as ***Annexure-6*** for reference purposes.

Under the central-sector and state-sector stations, there can be a requirement of Protocol Converters from IEC-101 to IEC-104 to facilitate data transfer through VSAT communication setup based on the criteria mentioned in *table* below.

S. No.	Description	Protocol Converter Required (Yes/No)
1	Substations with RTUs in-which ports can be configured for IEC-104 protocol	No
2	Substations with RTUs in-which the ports cannot be configured for IEC-104 protocol (i.e. working on IEC-101 protocol only)	**Yes**

Table 2: Cases in which Protocol Converter (IEC-101 to IEC-104) are required along with VSAT communication setup implementation

List of Stations for VSAT implementation

Based on the current communication status of NER; stations (refer ***Annexure-7***) in which the VSAT communication setup can be implemented can be based on the criteria as mentioned in *table* below.

S. No.	Description of Criteria	VSAT communication required (Yes/No)	Remarks
1	Stations with non-availability of main communication media *(**Note:** GPRS, Broadband, etc. not to be considered as a permanent communication media due to issues related to latency, intermittency and cyber security)*	**Yes**	Will act as a reliable source of communication for Real-time data and voice transfer

S. No.	Description of Criteria	VSAT communication required (Yes/No)	Remarks
2	Stations with non-availability of redundant/alternate communication media *(**Note:** GPRS, Broadband, etc. not to be considered as a permanent communication media due to issues related to latency, intermittency and cyber security)*	**Yes**	Will act as a reliable alternate source of communication for Real-time data and voice transfer

Table 3: Criteria based on which deployment of VSAT communication setup to be considered in stations of NER

5.0 Architectural Setup Proposed for VSAT in NER

In view of establishing VSAT communication set-up in North-Eastern region, various architectures can be used based on different cost implications and advantages offered by it. The different architectures of implementing VSAT communication in North-Eastern region which may be adopted are listed below.

Architecture 1: Establishing a dedicated VSAT Hub for the North-Eastern region (owning the hub for NER)

A dedicated Hub Antenna can be established at a strategic location in North-Eastern region for telemetering the real time data from NER site to respective SLDCs. The strategic location can be based upon the criteria that a major wide-band location of CTU may be near to it for further transfer of data on wide-band network wherever required by the utilities of North-Eastern region in future. The usage of communication as per *Architecture 1* can be further divided into two cases as per the requirements of NER constituents –

Case 1: All data transfer to be facilitated by Satellite Communication (i.e. VSAT) itself. The real-time data in case of state-sector stations will be transferred from *"Substation VSAT Antenna"* → *"Satellite"* → *"Hub Antenna at Strategic location"* → *"Satellite"* → *"SLDC VSAT Antenna"* → *"SLDC SCADA system"*.

Similarly, for central sector stations the similar data transfer arrangement will be *"Substation VSAT Antenna"* → *"Satellite"* → *"Hub Antenna at Strategic location"* → *"Satellite"* → *"NERLDC VSAT Antenna"* → "NERLDC SCADA system".

The data transfer between SLDCs and NERLDC will be on Fiber-Optic links only on ICCP protocol as per the present scenario.

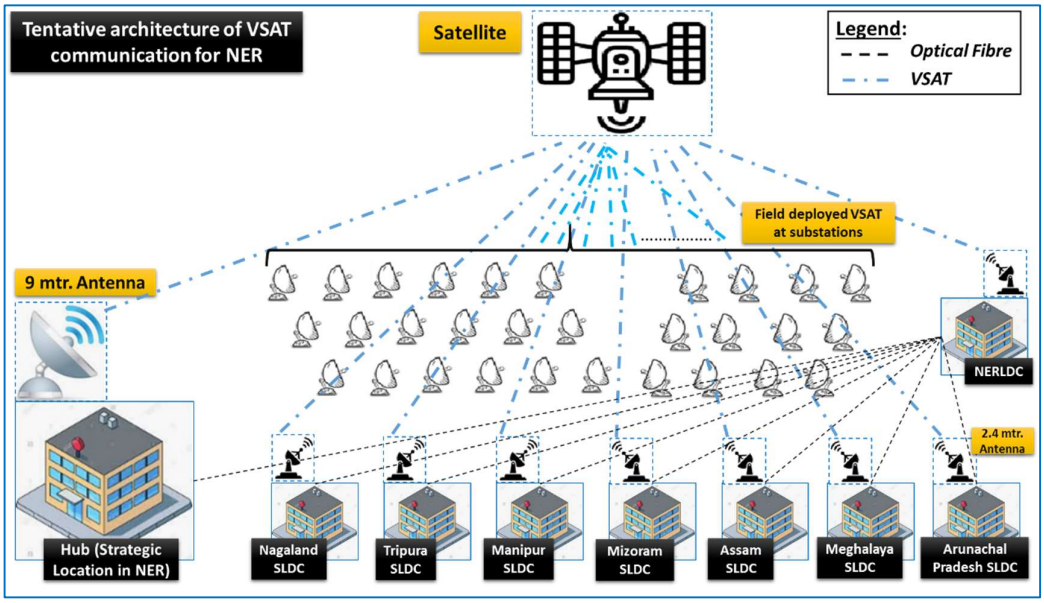


Figure 10: Proposed architecture of VSAT Communication in NER – As per *Architecture 1, Case 1*

Case 2: The data transfer will make use of VSAT communication as well as Optical-Fiber setup in North-Eastern region. It will save latency by reducing the multiple satellite hops. The real-time data in case of state-sector stations will be transferred from *"Substation VSAT Antenna"* → *"Satellite (Transponder)"* → *"Hub Antenna at Strategic location"* → *"Wide-band Optical Fiber Communication (separate hardware required for end equipment)"* → *"SLDC SCADA system"*.

Similarly, for central sector stations the similar data transfer arrangement will be *"Substation VSAT Antenna"* → *"Satellite"* → *"Hub Antenna at Strategic location"* → *"Wide-band Optical Fiber Communication (separate hardware required for end equipment)"* → *"NERLDC SCADA system"*.

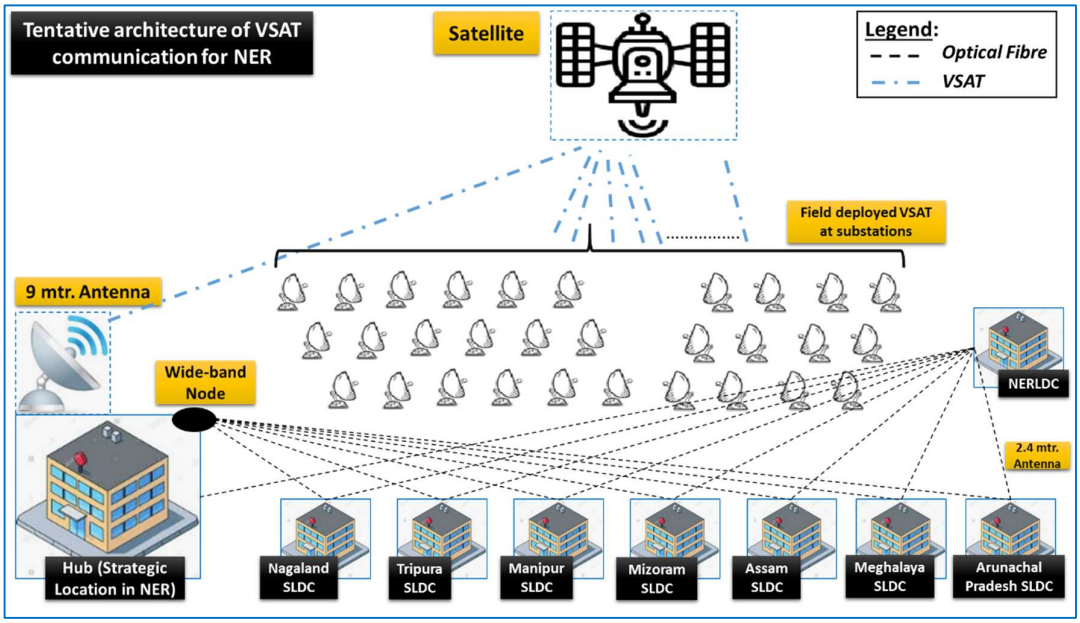


Figure 11: Proposed architecture of VSAT Communication in NER – As per *Architecture 1, Case 2*

The flow of real-time data and voice-communication from Station to respective Load Despatch Centre are detailed below.

a) Telemetry of Real-time data along with Voice from state-owned station to SLDC

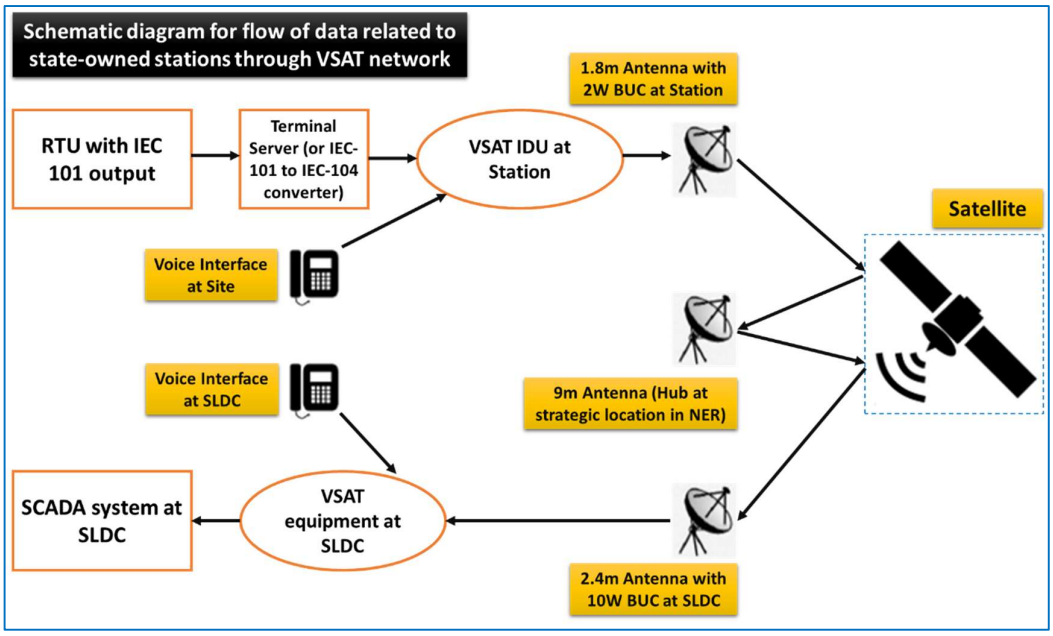


Figure 12: Proposed flow of data of State-owned stations (with IEC-101 protocol) through VSAT network – As per *Architecture 1, Case 1* in Section 5.0

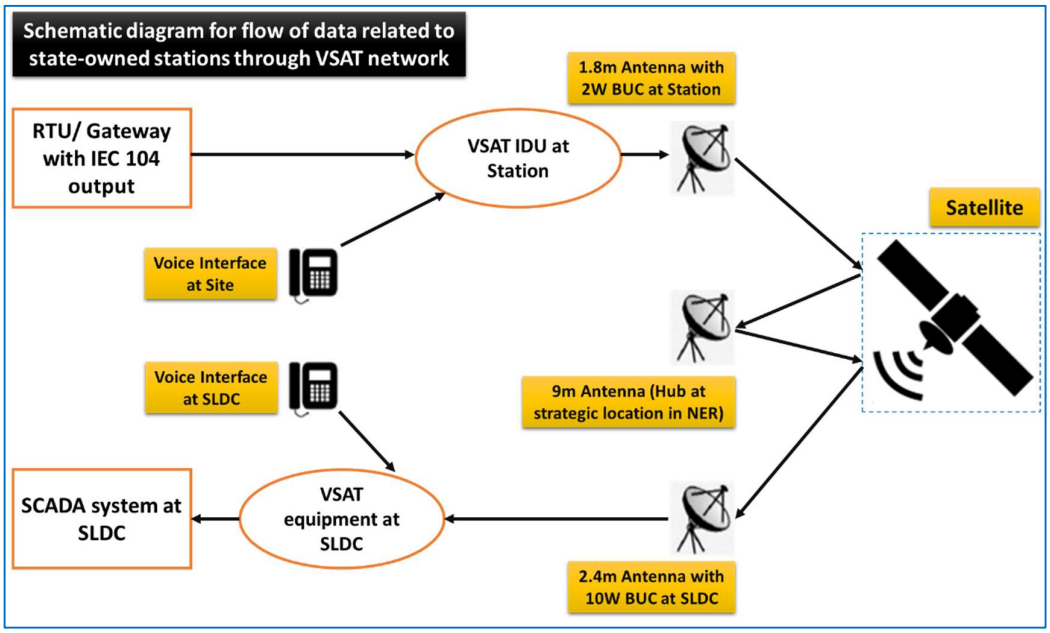


Figure 13: Proposed flow of data of State-owned stations (with IEC-104 protocol) through VSAT network – As per *Architecture 1, Case 1* in Section 5.0

The RTU/gateway of each station will provide data on IEC 60870-104 protocol. In case of IEC-101 protocol, the protocol converter is required for IEC-101 to IEC-104 conversion. The gateway will be further connected to VSAT IDU (four port). The voice interface will also connect with VSAT IDU. VSAT IDU, which is a MODEM that will convert the IP signals into radio signals. Further, VSAT IDU will be connected to BUC and amplifier mounted on

the Antenna. BUC will convert Low frequency signals to high frequency signals (Extended-C band).

The Signals will be transmitted to satellite then to Main Hub, where routing will be carried out. The routing will help the data packets to reach the concerned SLDCs via Satellite and to Antenna installed at SLDC.

The SLDCs will be equipped with 2.4m antenna with 10W BUC at Outdoor Equipment. RF and baseband equipment will be indoor units at SLDCs, which will be connected to SCADA system of the SLDC.

This architecture will transmit the real-time data from station to SLDC in two hops, one from Station to Main Hub (RLDC) via satellite and other from Main Hub (RLDC) to SLDC via Satellite.

b) Telemetry of Real-time data along with Voice from Centre-owned station to RLDC

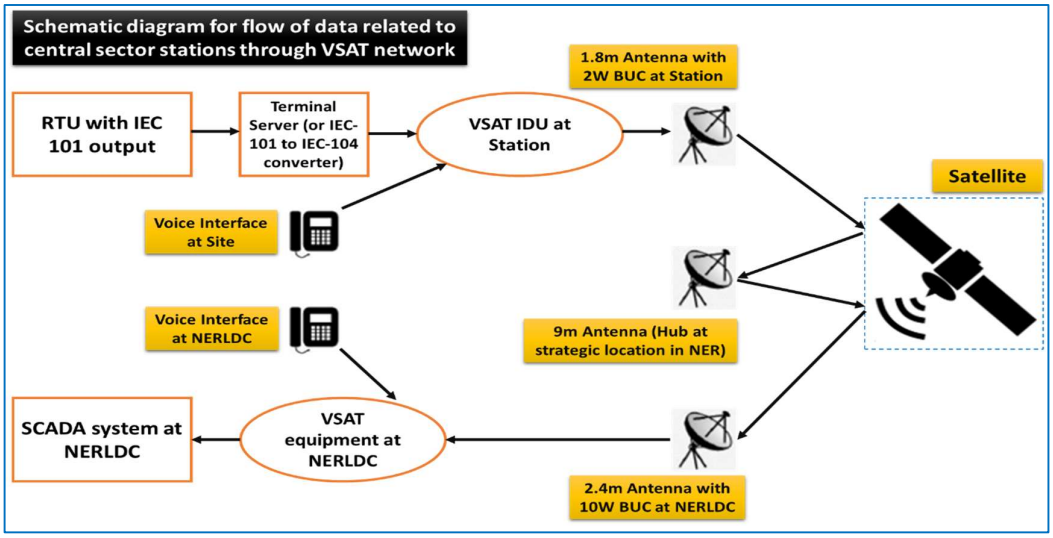


Figure 14: Proposed flow of data of Centre-owned stations (with IEC-101 protocol) through VSAT network – As per *Architecture 1, Case 1* in Section 5.0

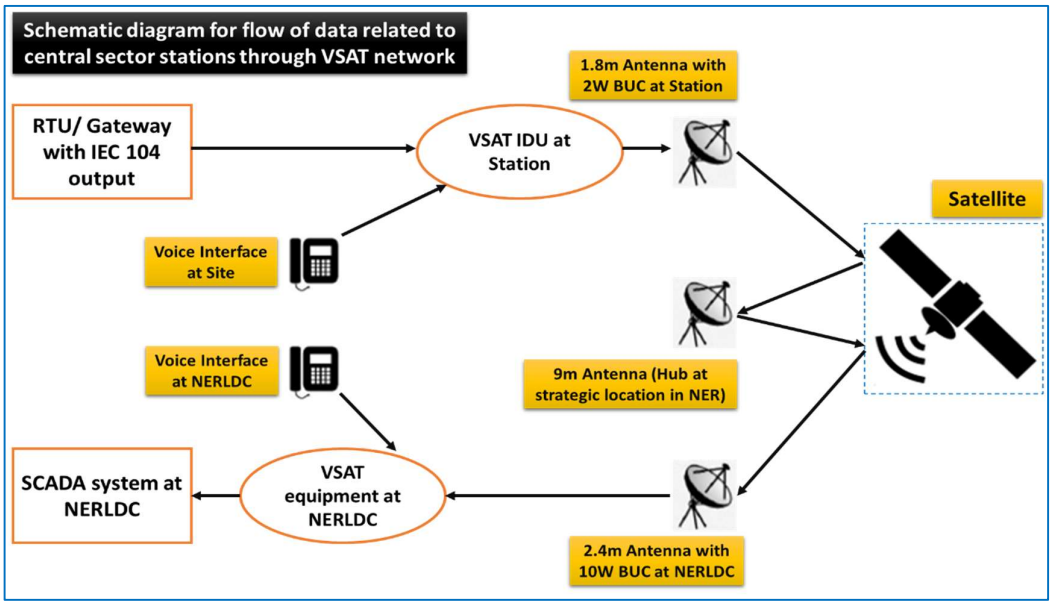


Figure 15: Proposed flow of data of Centre-owned stations (with IEC-104 protocol) through VSAT network – As per *Architecture 1, Case 1* in Section 5.0

The RTU/gateway of each station will provide data on IEC 60870-104 protocol. The gateway will be connected to router, which will be further connected to VSAT IDU (four port). The voice interface will also connect with VSAT IDU. VSAT IDU, which is a MODEM that will convert the IP signals into radio signals. Further, VSAT IDU will be connected to BUC and amplifier mounted on the Antenna. BUC will convert Low frequency signals to high frequency signals (Extended-C band).

The Signals will be transmitted to satellite then to Main Hub, where routing will be carried out. The routing will help the data packets to reach the RLDC. The RLDC will be equipped with 9m antenna, serving as Main Hub, as outdoor Equipment. RF and baseband equipment will be indoor units at RLDC, which will be connected to SCADA system of the RLDC.

This architecture will transmit the data to RLDC in signal hop, which is from station to Main Hub (RLDC) via satellite.

Similarly, for the Architecture 1, *Case 2* proposed in the *section 5.0* above, the corresponding flow of data is represented in *figures* below.

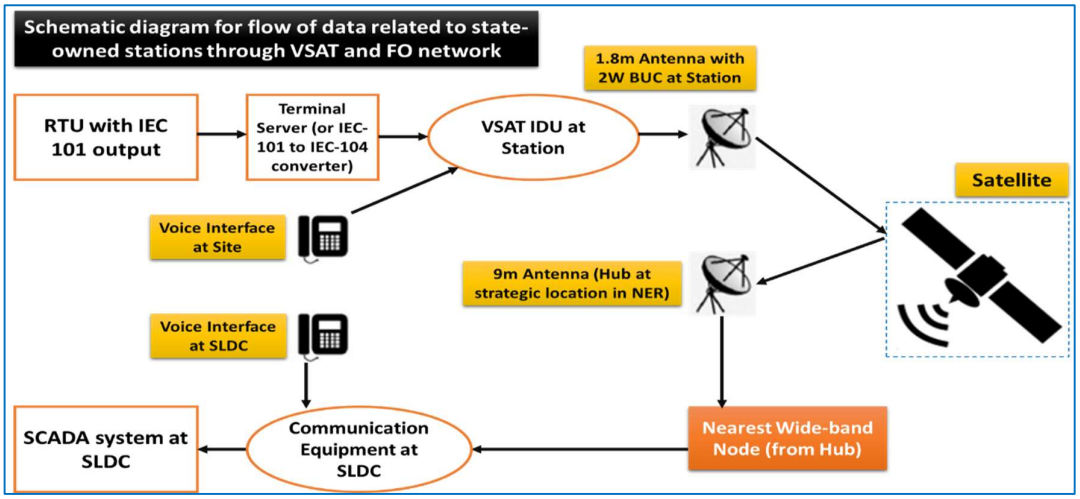


Figure 16: Proposed flow of data of State-owned stations (with IEC-101 protocol) through VSAT network – As per Architecture 1, Case 2 in Section 5.0

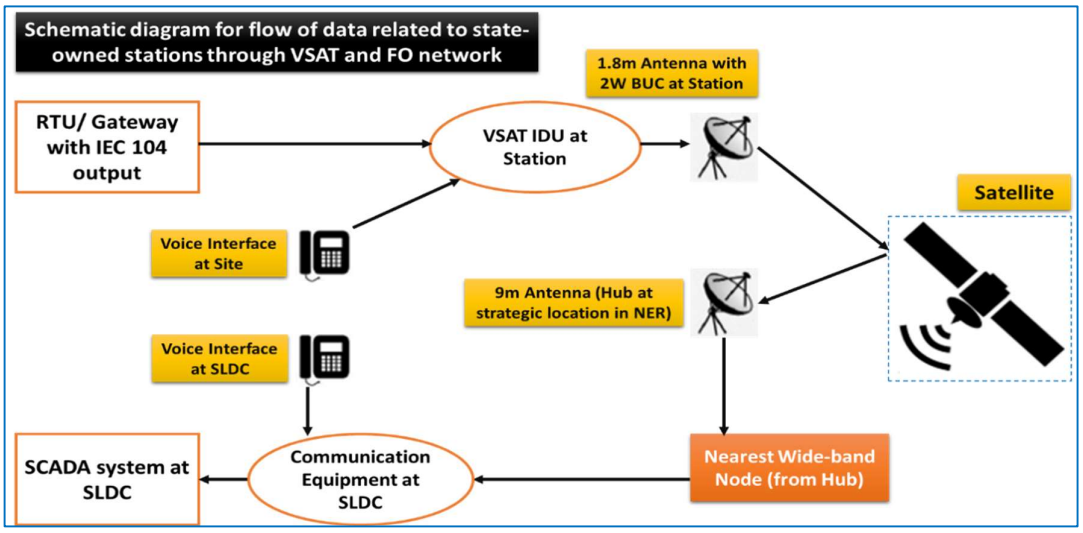


Figure 17: Proposed flow of data of State-owned stations (with IEC-104 protocol) through VSAT network – As per Architecture 1, Case 2 in Section 5.0

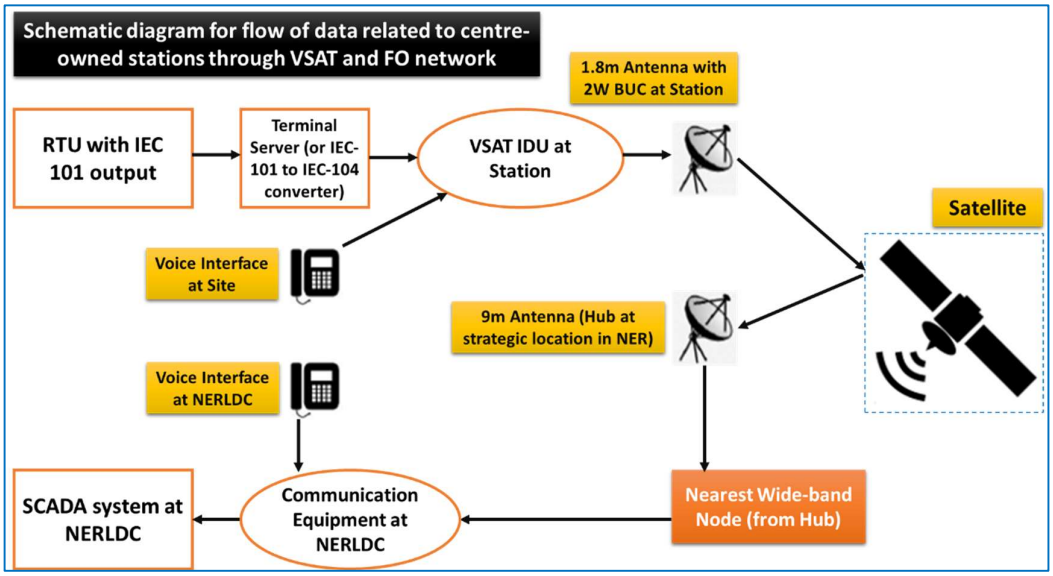


Figure 18: Proposed flow of data of Centre-owned stations (with IEC-101 protocol) through VSAT network – As per Architecture 1, Case 2 in Section 5.0

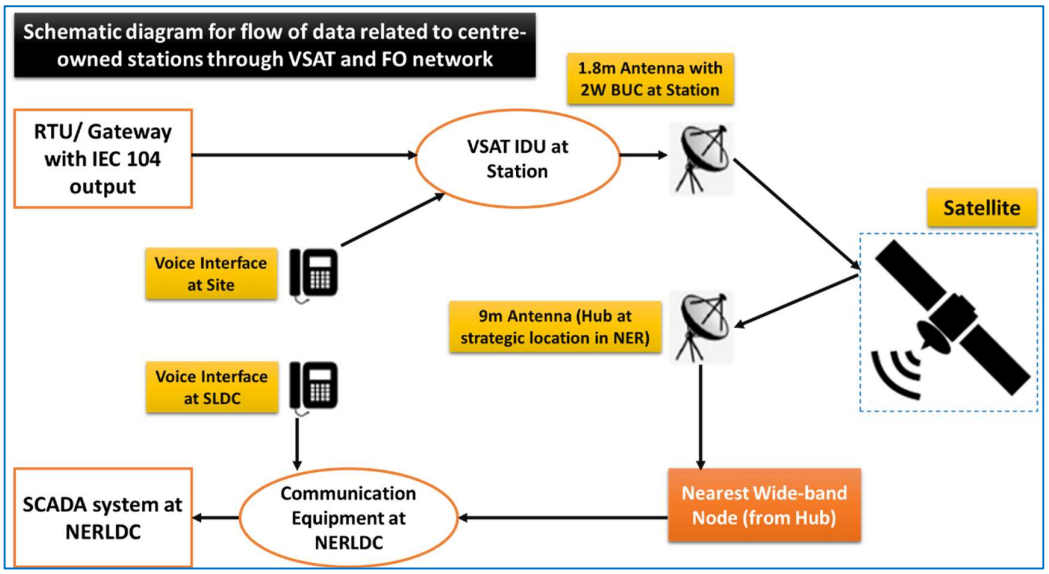


Figure 19: Proposed flow of data of Centre-owned stations (with IEC-104 protocol) through VSAT network – As per Architecture 1, Case 2 in Section 5.0

The data from RTUs to get directed to respective state SLDC and NERLDC as well. The major hardware required in case of depicted *Architecture 1* is listed in *table* below.

S. No.	Description	Remarks
1	9m Antenna with Baseband equipment and RF equipment	Will act as a primary HUB at strategic location in premises of one of the NER constituents (where all wide-band nodes are available).
2	1.8m antenna at remote stations with 2W Block Up Converter (BCU) and 4 port In-Door Unit (IDU)	For facilitating the VSAT communication at site.

S. No.	Description	Remarks
3	2.4m antenna with 10W BUC with Baseband equipment and RF equipment	To be deployed at each SLDC (of NER) and NERLDC.
4	Fiber backhaul between SLDC and NERLDC	Optional

Table 4: Major hardware required in case of Architecture 1

Architecture 2: Hiring of VSAT Hub for the North-Eastern region (availing services of VSAT from service provider for NER)

It is also feasible that instead of establishing a dedicated hub in NER, the existing hub(s) of the VSAT equipment vendor can be used on hiring basis. The usage of communication as per *Architecture 2* will involve establishment of the VSAT setup in NER along with availing hub services on hiring basis at some recurring charges per annum to be paid to the VSAT service provider. It will primarily consist of two price components –

- Capital Expenditure on equipment set-up
- Recurring expenditure from 2nd year onwards in terms of channel cost

The data from RTUs to get directed to respective state SLDC and NERLDC as well. The major hardware required in case of depicted *Architecture 2* is listed in *table* below.

S. No.	Description	Remarks
1	1.8m antenna at remote stations with 2W Block Up Converter (BCU) and 4 port In-Door Unit (IDU)	For facilitating the VSAT communication at site.
2	2.4m antenna with 10W BUC with Baseband equipment and RF equipment	To be deployed at each SLDC (of NER) and NERLDC.
3	Fiber backhaul between SLDC and NERLDC	Optional

Table 5: Major hardware required in case of Architecture 2

6.0 Technical Requirements for VSAT

Technical Parameters Observed from Pilot Project:

Some suggestions for technical parameters (as observed from Pilot Project at Killing station) to be taken care while implementing the VSAT technology for telemetry of real-time data along with voice-data are as follows –

- The maximum latency for two hop, as described in *section 5.0*, architecture should be in order of 1000-1200 ms. (**Note:** As observed in case of Killing S/s, real-time data reports consistently to SLDC NEHU when the latency between 400 kV Killing S/s and SLDC is in order of 1000-1200 ms.)
- The output of RTU/SAS gateway should be in IEC-60870-104 protocol, which enables easy configuration with VSAT. Else, equipment for protocol converter needs to be installed as attached in ***Annexure-8***.
- Depending on the number of ports in Indoor Unit of VSAT, various system can be configured with VSAT network. (**Note:** During the pilot project of Killing, Indoor unit

of Hughes-make was used (Model: HT 1300) which had two LAN ports. On one port the gateway of 400 kV Killing was connected and another port the Session Initiated Protocol Phone was connected. The phone and gateway were connected on different networks.)

- Extended C-Band with a bandwidth of 128Kbps may be required for Voice and Data Transfer.
- Exchange set-up may need to be deployed at strategic locations for facilitating voice-communication between different locations.

As per survey, the most strategic location for VSAT hub for North-Eastern region can be premises of Assam-SLDC which has sufficient space (as compared to NERPC/NERTS/etc. premises) and it is also near to the wide-band node location of POWERGRID-NERTS at Guwahati. A Memorandum of Understanding (MoU) needs to be signed between all NER constituents in regard to it.

Technical Standards for Communication by CEA

The Central Electricity Authority has published the CEA (Technical Standards for Communication System in Power System Operations) Regulations, 2020 which have been come into effect from 27th February 2020. The relevant clauses related to VSAT are quoted below.

Quote

- Regulation 19: Centralized monitoring –

(8) For very small aperture terminal communication, network management system (NMS) shall have facility of maintaining link availability status along with signal strength of the nodes.

(9) For very small aperture terminal communication, redundant configuration shall be enabled in network management system.

- Regulation 29: Requirement for Very Small Aperture Terminal –

(1) Very small aperture terminal communication shall be used for supervisory control and data acquisition (SCADA) control functions of power system operation and shall not be used for primary protection function of power system as geo-stationery satellite hop delay is 240 milliseconds.

(2) Very small aperture terminal shall be able to work with all geostationary satellites to the extent possible, visible from India and work efficiently from all parts of India.

(3) Very small aperture terminal shall work either on Ku-band or C-band or extended C band or any other band for interruption free continuous operation in extremely rainy (more than 10 millimeter/hour intensity) and cloudy conditions.

(4) Very small aperture terminal communication shall be adopted after ensuring link availability of 99.5 per cent. and required level of signal strength.

(5) Very small aperture terminal communication shall not be part of national or State wideband backbone network.

(6) All regulatory clearance from regulatory bodies shall be taken to operate the very small aperture terminal communication.

(7) All regulatory guidelines including size of the antenna shall be followed.

(8) Pool band width feature shall be adopted for the very small aperture terminal network.

(9) Uplink and down link configuration of very small aperture terminal communication shall be redundant (1 + 1) at Hub.

(10) Very small aperture terminal communication network shall be designed based on Frequency Time Division Multiple Access (FTDMA) or Multi-frequency Time Division Multiple Access (MFTDMA) or Single Channel Per Carrier Demand Assigned Multiple Access (SCPC DAMA) technology or any other proven future technology with configurable data rate as per data communication requirement.

(11) Bit error rate shall be lesser than 1 X 10 $^{-7}$ (data) to 1 X 10 $^{-4}$ (Voice).

(12) Very small aperture terminal communication shall support broadcast, unicast, multicast,

transmission control protocol (TCP) spoofing.

(13) Very small aperture terminal communication shall support IP RJ45 (IP or E&M).

(14) Receiving device shall support the International Electro-Technical Commission (IEC) - 60870-5-104 and the International Electro-Technical Commission (IEC) - 60870-5-101 protocols for interfacing data as well as to IPv4, IPv6, RIP v1, v2, Address Resolution Protocol (ARP) / Virtual Local Area Network (VLAN), Internet Control Message Protocol (ICMP), Transmission Control Protocol (TCP), User Datagram Protocol (UDP), Telnet, Internet Group Management Protocol (IGMP), v1, v2, Simple Network Management Protocol (SNMP) for networking utilities.

(15) Very small aperture terminal communication system shall be designed for 230 V +/- 30%

alternating current (AC) power supply at 50 Hz.

(16) Very small aperture terminal communication system shall be designed for trouble free operation at temperature range -10 deg. C to 55 deg. C and humidity up to 95 per cent. non-condensing, and wind speed of minimum 80 kilometers per hour (kmph).

(17) Very small aperture terminal communication system shall be able to deliver bi-directional

composite data traffic.

(18) Round trip delay shall be less than 800 milliseconds (ms).

(19) Very small aperture terminal in door unit (IDU) (for remote sites) shall support Transport

Control Protocol/ Internet Protocol (TCP/IP) without the need of an external router.

(20) Very small aperture terminal in door unit (IDU) shall have separate storage banks for software and firmware, to enable configuration changes pertaining to either the terminal (firmware) or the overall system architecture (software), without affecting the other.

(21) Very small aperture terminal shall be able to take the software and firmware downloads from the hub over the air, without any disturbance to the online user traffic while in operation on per terminal (Unicast), per group (Multicast) or entire network (Broadcast) basis.

(22) The relevant standards and code of practice of very small aperture terminal communication as specified in the Bureau of Indian Standards (BIS) and the International Telecommunications Union (ITU-R) shall be followed.

Unquote

7.0 Economic considerations for deployment of VSAT communication setup in NER

The financial considerations are evaluated and some reference financial figures (in case of CAPEX and OPEX type of models) are mentioned in *tables* below. The CAPEX type of model involves establishment of a dedicated hub at a strategic location in NER; whereas

the OPEX type of model is based on usage of hub of VSAT service provider with recurring charges.

- **Capex Type of financial model for establishment VSAT communication set-up in NER**

  In the capex type of model, a dedicated hub needs to be established at a strategic location in North-Eastern region which will be used by all constituents of NER for data and voice transfer. Some tentative figures corresponding to the associated financial implications are mentioned in *table* below.

Tentative financial implications of VSAT communication in case of dedicated hub at NER (for 200 sites)				
VSAT CAPEX for Real Time SCADA data for 200 sites – With 1 year Warranty				
Sl. No.	**Details**	**Main Hub**	**VSATs**	**Total Cost (in INR)**
1	**Initial Regulatory Charges**			
1.1	Closed User Group (CUG) Application	10,000	--	10,000
1.2	License Fee	1,00,000	--	1,00,000
1.3	Earth Station Approvals	25,000	--	25,000
1.4	Standing Advisory Committee on Radio Frequency Allocation (SACFA) Approvals	5,000	2,00,000	2,05,000
1.5	Network Operating and Control Centre (NOCC) Fees	85,000	--	85,000
	Total Regulatory Fee	2,25,000	2,00,000	**4,25,000**
2	**Initial Equipment Cost**			
2.1	Equipment Cost	10,88,14,588	4,31,65,769	15,19,80,357
	Total Equipment Cost	10,88,14,588	4,31,65,769	**15,19,80,357**
3	**Installation and Commissioning**			
3.1	Installation and Commissioning (Including NOCC test)	92,12,500	24,20,000	1,16,32,500
	Total I&C cost	92,12,500	24,20,000	**1,16,32,500**
4	**Test Instruments**			
4.1	Test Instruments	35,00,000	--	35,00,000
	Total Test Instruments Cost	35,00,000		**35,00,000**
5	**Capital Expenditure**	12,17,52,088	4,57,85,769	**16,75,37,857**

VSAT OPEX for Real Time SCADA data for 200 sites - Per Annum				
Sl. No.	**Details**	**Main Hub**	**VSATs**	**Total Cost (in INR)**
1	**Regulatory Charges**			
1.1	Transponder Costs	42,00,000	--	42,00,000
1.2	License Fee	5,000	1,00,000	1,05,000
1.3	Royalty	18,20,000	--	18,20,000

VSAT OPEX for Real Time SCADA data for 200 sites - Per Annum				
Sl. No.	**Details**	**Main Hub**	**VSATs**	**Total Cost (in INR)**
1.4	NOCC Fee	85,000	--	85,000
	Total Regulatory Fee	61,10,000	1,00,000	62,10,000
2	**Annual Maintenance Contract**	22,84,092	10,10,316	32,94,408
3	**Software Support**	24,50,000	24,20,000	48,70,000
4	**24 X 7 Maintenance**	39,00,000	21,60,000	60,60,000
5	**Operational Expenditure**	1,47,44,092	56,90,316	**2,04,34,408**

Miscellaneous CAPEX				
Sl. No	**Description**	**Unit**	**Unit Price (in INR)**	**Total Price (in INR)**
1	IEC 101 to 104 Protocol Converter	200	30,000	60,00,000
2	Session Initiated Protocol Phones	200	3,000	6,00,000
3	**Miscellaneous Capital Expenditure**			**66,00,000**

Note:

- The Operational Expenditure from the above figures can be calculated as approx. **"1,02,172 INR per station per annum"**.
- The above figures are based upon quotation by M/s Envision Networks Private Limited (attached as **Annexure-9**).

Table 6: Tentative financial implications of VSAT communication in case of dedicated hub at NER (for 200 sites)

- **Opex Type of financial model for establishment VSAT communication set-up in NER on hiring (hub services) basis**

  In the opex type of model, the hub services can be taken on hiring basis from the service provider of VSAT communication. Some tentative figures corresponding to the associated financial implications are mentioned in *table* below.

Tentative financial implications of VSAT communication in case of hiring of hub (for 200 sites)				
VSAT CAPEX for Real Time SCADA data for 200 Sites – With 1 year Warranty				
Sl. No.	**Details**	**Quantity**	**Unit Price (in INR)**	**Total Cost (in INR)**
1	Equipment (1.2m Extended C band Antenna , 2 W BUC, Satellite Modem and RF Cables (30m Pair) and Integration Material	200	94,558	1,89,11,600
2	Installation and Commissioning + Freight Forwarding + Transit Insurance + SACFA Charges	200	13,571	27,14,200
3	Router at Hub (2 Fast Ethernet Ports)	100	85,000	85,00,000
4	DC - DC Convertor (48 V - 24 V)	200	4,500	9,00,000
5	VSAT Platform Charges	-	25,000	25,000
	Capital Expenditure			**3,10,50,800**

VSAT OPEX for Real Time SCADA data for 200 Sites - Per Annum				
Sl. No.	**Details**	**Quantity**	**Unit Price (in INR)**	**Total Cost (in INR)**
1	Satellite BW - Plan 128 Kbps	200	61,875	1,23,75,000
2	VAS - Proactive Monitoring Services: Site Up/Down Monitoring Portal	200	3,000	6,00,000
3	VSAT Hardware AMC from 2nd Year	200	9,000	18,00,000
4	Router AMC From 2nd Year	200	9,800	19,60,000
	Operational Expenditure			**1,67,35,000**

Miscellaneous CAPEX				
Sl. No	**Description**	**Unit**	**Unit Price (in INR)**	**Total Price (in INR)**
1	IEC 101 to 104 Protocol Converter	200	30,000	60,00,000
2	Session Initiated Protocol Phones	200	3,000	6,00,000
	Miscellaneous Capital Expenditure			**66,00,000**

Note:

- The Operational Expenditure from the above figures can be calculated as approx. **"83,675 INR per station per annum"**.
- The above figures are based upon quotation by M/s Tata Net NELCO (attached as **Annexure-10**).

Table 7: Tentative financial implications of VSAT communication in case of hiring of hub (for 200 sites)

8.0 Recommendations and suggestions for deployment of VSAT communication setup in NER

The North-Eastern part of India has unique challenges in terms of its terrain, availability of adequate vendors with required expertise, availability of material and other resources, climatic conditions, natural disasters such as floods/earthquakes/landslides/etc., law and order issues, etc. as compared to other regions of the country. Hence, the technology to be deployed for communication system needs to be chosen accordingly which can overcome issues created by all aforesaid factors and ensure the 99.9% real-time data availability in the region.

The VSAT technology offers all the benefits to overcome the project-works specific issues being faced in NER such as easy installation, less time for deployment, less maintenance requirement, no impact of terrain specific problems, no impact of natural disasters, economical in terms of initial cost and very nominal recurring cost on monthly/quarterly/yearly basis.

In consideration of the technical feasibility, it is recommended that VSAT communication may be considered as a main communication media or backup communication media for the stations as per the requirements of the utilities of North Eastern Region.

On considering the various regulation laid by CERC and CEA for setting up of communication systems, it may be considered to be taken up with CTU by NERPC; which will serve the purpose of providing main/redundant path for data transfer related to Supervisory Control and Data Acquisition (SCADA), Scheduling, Accounting, Metering and Settlement of Transactions (SAMAST), Automatic Meter Reading (AMR), etc.

Annexure-1: List of Tail-end Stations (with radial feeders) in North-Eastern region with no path diversification

Tail end station of Assam	
Sl. No.	Station
1	Rupai
2	Chapakhowa
3	Silapathar
4	Margherita
5	Bordubi
6	New Tezpur
7	Hazo
8	Paltan Bazar
9	Dullavchera
10	Bokakhat
11	Baghjap
12	Langpi
13	Khaloigaon
14	Kathiatoli (PG)
15	Diphu
16	Ghoramari
17	Ashok Paper Mill
18	Matia
19	Sonapur
20	Khanapara
21	Nalbari
22	Dhekiajuli
23	Majuli
24	Betbari
25	Mirza
26	Dispur
27	Guwahati Medical College

Tail end station of Arunachal Pradesh	
Sl. No.	Station
1	Longding
2	Anini
3	Dambuk
4	Mariyang
5	Tuting
6	Mechuka
7	Bameng
8	Koloriang
9	Halaipani
10	Holongi
11	Seijosa
12	Lumla
13	Banderdeva

Tail end station of Meghalaya	
Sl. No.	Station
1	Phulbari
2	New Shillong
3	Umiam Stage-II
4	Leshka HEP
5	IIM Shillong
6	Cherapunjee
7	Lumshong

Tail end station of Tripura	
Sl. No.	Station
1	Gokulnagar
2	Telemura
3	Satchand
4	Sabroom
5	Ambasa
6	Jirania
7	Dharmanagar

Tail end station of Mizoram	
Sl. No.	Station
1	Marpara
2	Chimui
3	Luangmual
4	S. Bungtlang

Tail end station of Manipur	
Sl. No.	Station
1	Mao
2	Tamenglong
3	Hundung

Tail end station of Nagaland	
Sl. No.	Station
1	New Secretariat Complex
2	Longleng
3	Meluri

Table 8: List of Tail-end stations (with radial feeders) in North-Eastern region

Annexure-2: Study Tour report by committee formed by NETeST forum

Study Tour Report on VSAT Communication at KPTCL

A Team members from following organisations of NER have visited KPTCL, LD, Bangalore forVSAT Communication as approved in 10th& 11th NETEST and 149th OCC meeting of NERPC.

1) Shri.M.K.Ramesh, General Manager (SL),NERLDC, Shillong.
2) Shri. Pranab Saha, AGM, AEGCL,Guwhati.
3) Shri.Arup Sarmah, DM, AEGCL, Guwahati.
4) Shri.TanyaTazi ,Sr.Manager, NEEPCO.
5) Shri.BinodDebbarma, Manager, NERTS, POWERGRID.

A team have visited KPTCL ,LD on 10-12-2018 and detailed discussion with EE Design,KPTCL and AEE,VSAT KPTCL.

EE,Design,KPTCL has given warm welcome to the team and explained about the Technical details and advantages of VSAT system in Karnataka State. He also explained the existing VSAT scheme supporting real time data to SLDC from 1060RTUs + 284 Discoms RTUs. This technology supportsVoice communications and Energy meter data interface from remote stations. Extended C Band technology is used for dealing with adverse condition and It is working since 2007 with 99.7% availability.
EE KPTCL also explained about their disaster Management scheme for VSAT with full set VSAT Communication system located in Neelamangla 400kvstation with hot standby.

The team also monitor the hardware functionality, NMS , Functions of HUB and Remote antenna with interfacing equipment. Team Tested voice communication with Remote hydel station called Sharavathi Hydro Generating station and found satisfactory.

The team also tested the delay by pinging to remote station through IP address from NMS. The delay is 1180msec ,which includes LAN network delay and Satellite UP & Down link time, which has no impact on SCADA data updation.

Team visited Grid Control Room of KPTCL ,SLDC to confirm the data availability is more than 99% for 132kV above through VSAT communication system.
Team is convinced about the performance of VSAT Communication Technology and more suitable for NER Terrain.
Team also Visited SRLDC and real time data availability is more than 99%

(B. Debbarma) POWERGRID

(Tanya Tazi) NEEPCO.

(Pranab Saha) AEGCL

ARUP SARMAH (AEGCL)

(M.K.Ramesh) POSOCO

Annexure-3: Data availability trends related to VSAT Demo Project in Tezu Substation – No impact of Rainy/Cloudy Weather on Data-Availability

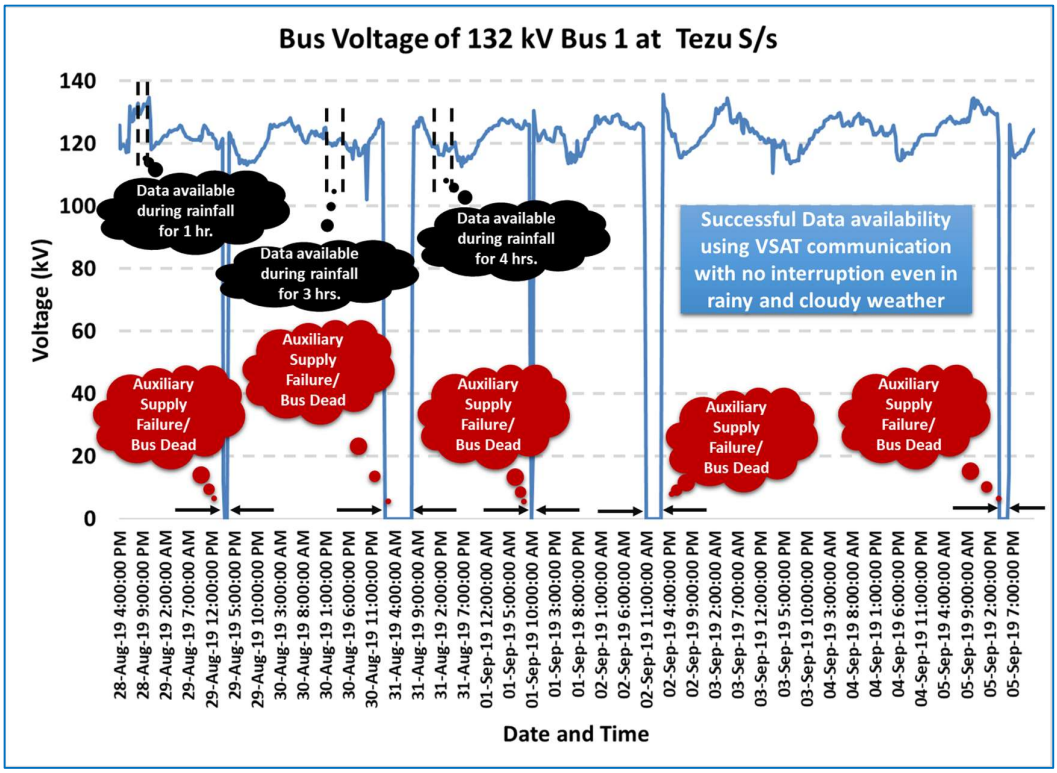


Figure 20: Trend of Bus 1 Voltage of Tezu Substation during VSAT Demo Project

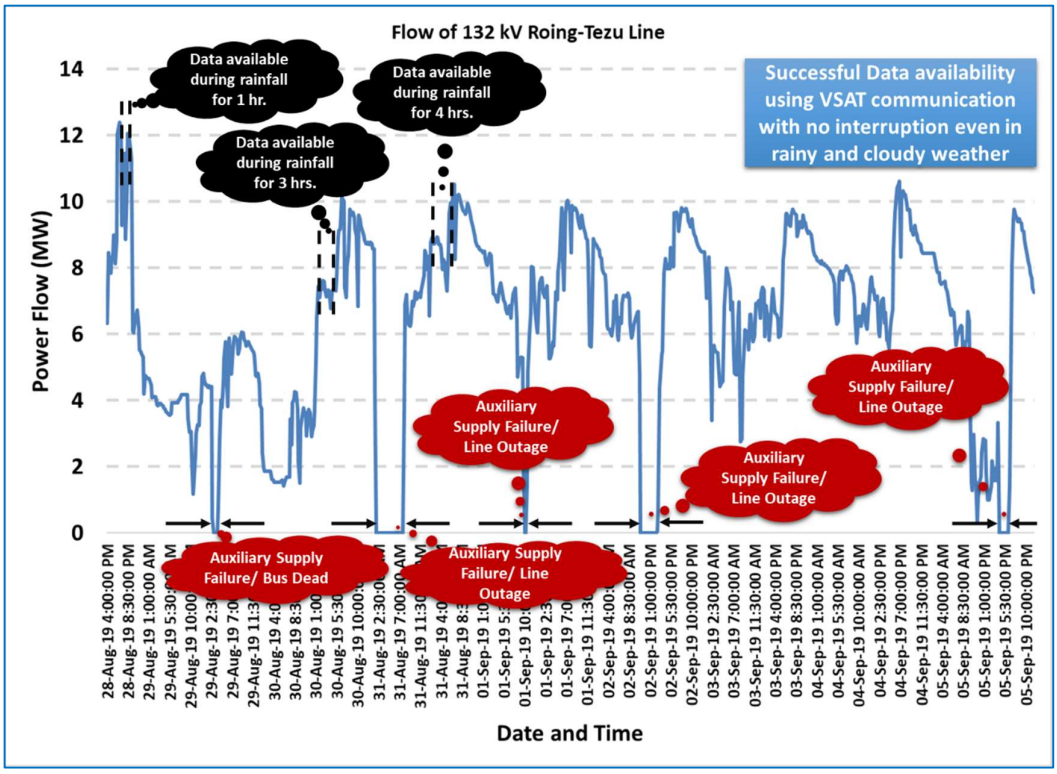


Figure 21: Trend of 132kV Roing-Tezu line MW at Tezu Substation end during VSAT Demo Project

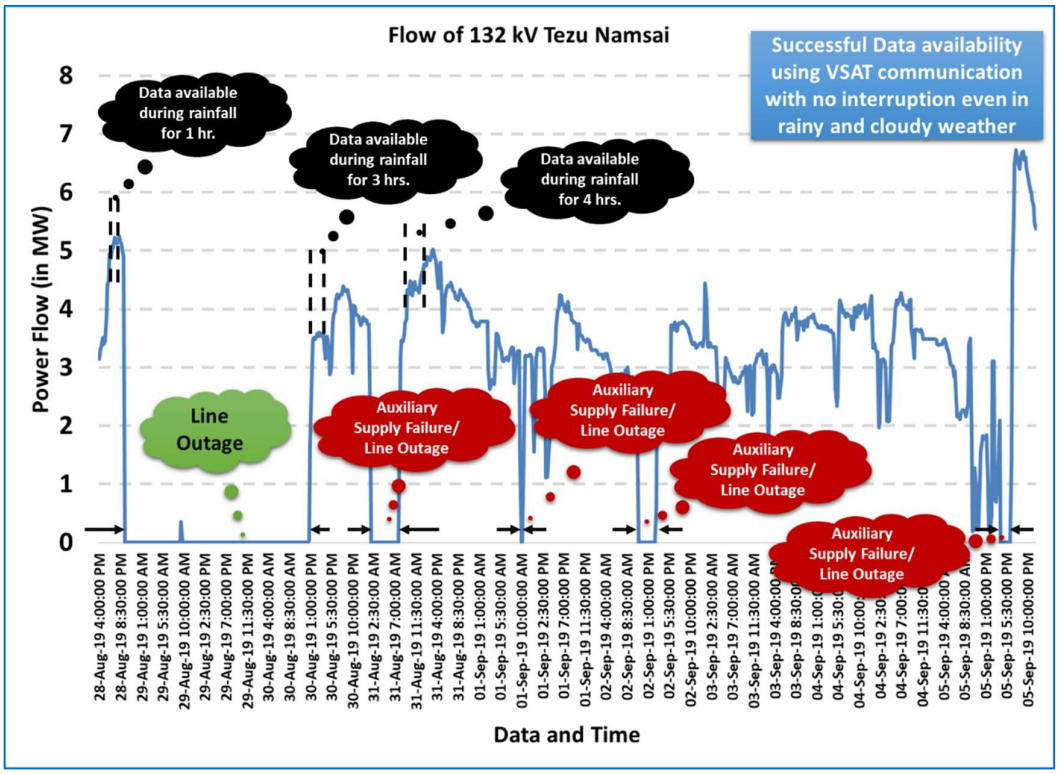


Figure 22: Trend of 132kV Tezu-Namsai line MW at Tezu Substation end during VSAT Demo Project

Annexure-4: Data availability trends related to VSAT Pilot Project in Killing Substation

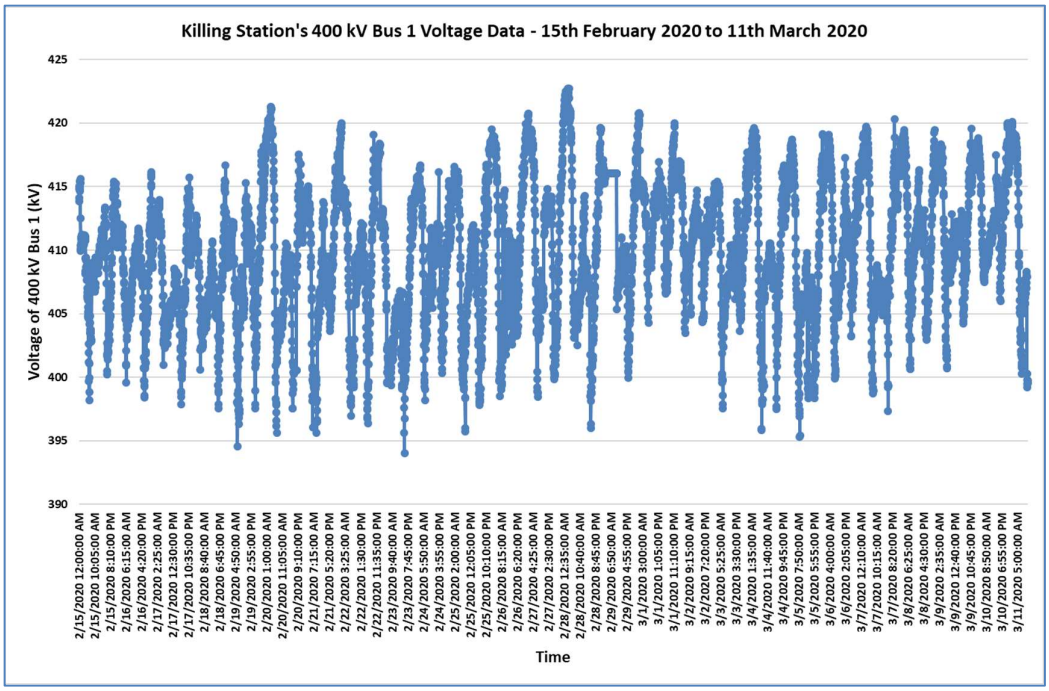


Figure 23: Trend of 400kV Bus 1 Voltage at Killing Substation during VSAT Pilot Project

Annexure-5: Minutes of Meeting between NERLDC and Meghalaya-SLDC related to testing of voice and data in VSAT Pilot Project

Minutes of Meeting for testing of simultaneous working of voice and data of 400 kV Killing S/s over VSAT

Members present:

Sakal Deep, Engineer	David J. Lyngdoh, Executive Engineer
NERLDC, POSOCO	SLDC NEHU, MePTCL

Background:

A pilot VSAT project was implemented in NER for its usage in Power sector of NER. Under this project, a setups were installed at Meghalaya owned 400 kV Killing Substation and State Load Despatch Centre (SLDC) NEHU, Meghalaya. The installation and commissioning phase were completed on 14th February 2020.

Minutes:

- Real-time data of 400 kV Killing Substation is reporting to SLDC NEHU since the 14th February 2020 over VSAT network.
- On request on forum during 16th NeTEST meeting, Voice testing was carried between 400 kV Killing S/s to SLDC NEHU over VSAT network.
- NERLDC has arranged two (02) numbers to phones, which supports Session Initiation Protocol. Phones were installed at SLDC NEHU and 400 kV Killing S/s on 28th February 2020.
- Configuration of phones was carried on 02nd March 2020. Initially phones were connected on the same network on which real-time data were reporting. To do so only one (01) port out of two (02) port of VSAT Modem (IDU) was configured. During such testing, either of voice or data were getting through. However, this issue can rectified by connecting switches on both end.
    - The voice was tested with aforesaid configuration.
    - The voice was very clear and satisfactory.
    - The voice availability and quality was also confirmed by A. Wahlang, Assistant Engineer, 400 kV Killing S/s, MePTCL.
- In order to validate the simultaneous working of Voice and Real-time data between SLDC NEHU and 400 kV Killing S/s, both ports of VSAT Modem were configured on 03rd March 2020.
    - After necessary configuration, the voice was tested again along with the availability of real-time data.
    - The voice was very clear and satisfactory.
    - The voice availability and quality was also confirmed by A. Wahlang, Assistant Engineer, 400 kV Killing S/s, MePTCL.
- The simultaneous availability of real-time data and voice of 400 kV Killing S/s at SLDC NEHU were validated.

Sakal Deep, Engineer
NERLDC, POSOCO

David J. Lyngdoh, Executive Engineer
SLDC NEHU, MePTCL

Annexure-6: Types of RTUs in Central Sector stations of North-Eastern region

Sl. No.	Name of RTU	Owner	Type of RTU	Ability to Provide Data in IEC-60870-104
1	Agartala	NEEPCO	C264	Yes
2	Aizawl	PGCIL	C264	Yes
3	Badarpur	PGCIL	C264	Yes
4	Balipara	PGCIL	C264	Yes
5	BNC (HVDC)	PGCIL	C264	Yes
6	Bongaigoan	PGCIL	C264	Yes
7	BgTPP	NTPC	C264	Yes
8	Dimapur	PGCIL	C264	Yes
9	Doyang	NEEPCO	C264	Yes
10	Haflong	PGCIL	C264	Yes
11	Imphal	PGCIL	C264	Yes
12	Itanagar (Nirjuli)	PGCIL	C264	Yes
13	Jiribam	PGCIL	C264	Yes
14	Kathalguri	NEEPCO	SCOPE VIZIMAX	Yes
15	Salakati	PGCIL	C264	Yes
16	Khandong	NEEPCO	SCOPE VIZIMAX	Yes
17	Khleiriat	PGCIL	Chemtrols	No
18	Kopili	NEEPCO	SCOPE VIZIMAX	Yes
19	Kopili-Ex.	PGCIL	C264	Yes
20	Kumarghat	PGCIL	C264	Yes
21	Loktak	NHPC	S900	No
22	Mariani	PGCIL	C264	Yes
23	Melriat	PGCIL	C264	Yes
24	Misa	PGCIL	C264	Yes
25	Mokokchung	PGCIL	C264	Yes
26	Namsai	PGCIL	C264	Yes
27	Palatana	OTPC	C264	Yes
28	Pare	NEEPCO	C264	Yes
29	Ranaganadi	NEEPCO	C264	Yes
30	Roing	PGCIL	C264	Yes
31	Salakati	PGCIL	C264	Yes
32	Silchar	PGCIL	C264	Yes
33	Tezu	PGCIL	C264	Yes
34	Ziro	PGCIL	Chemtrols	No

Table 9: Type of RTUs in Central Sector stations of North-Eastern region

Annexure-7: Locations for VSAT is geographical area of states in North-Eastern region

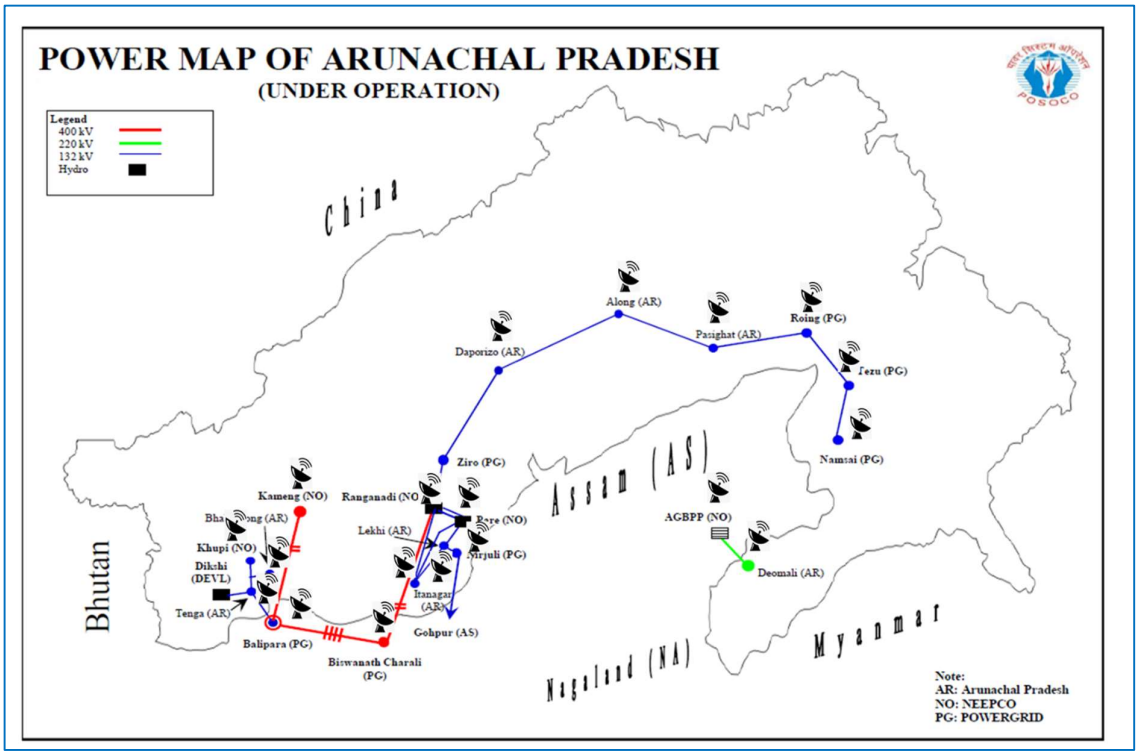


Figure 24: Locations for VSAT in geographical area of Arunachal Pradesh in North-Eastern region

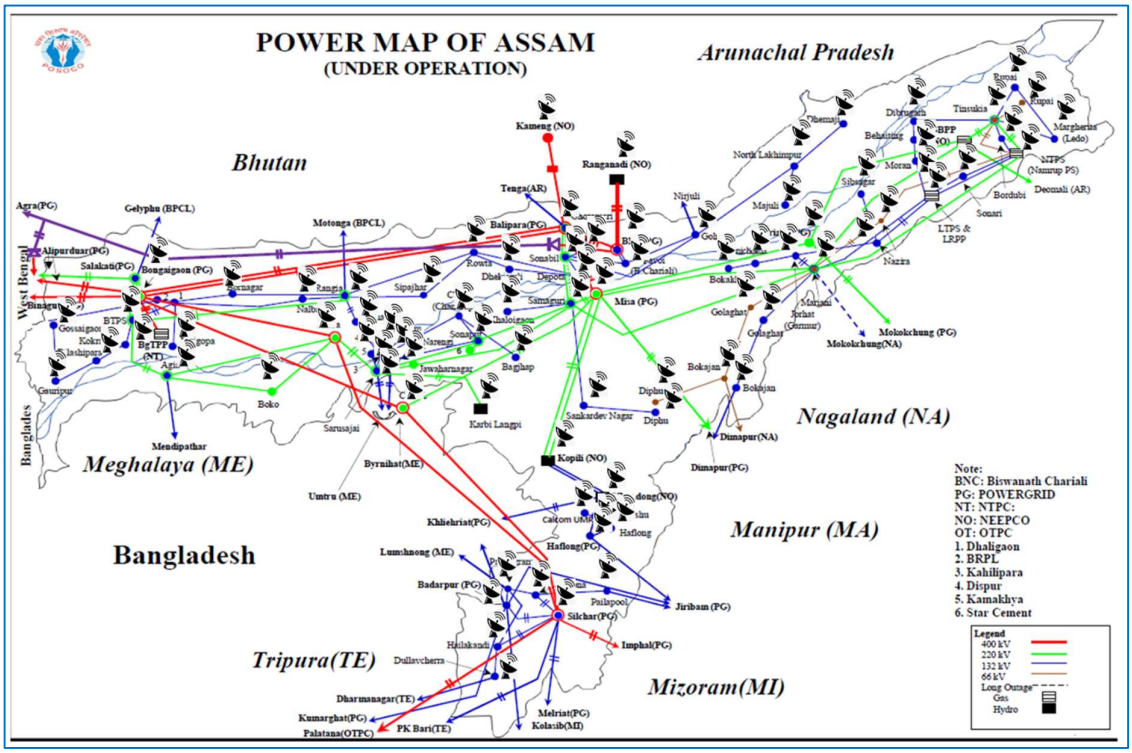


Figure 25: Locations for VSAT in stations under geographical area of Assam in North-Eastern region

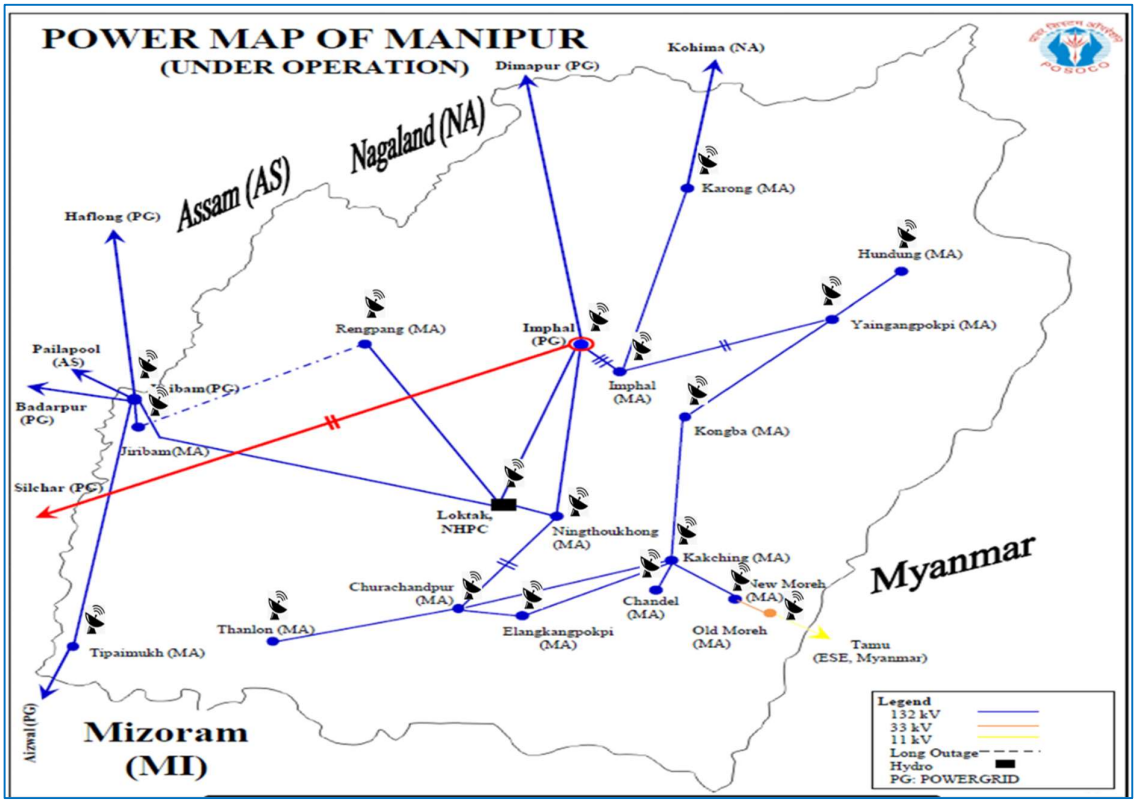


Figure 26: Locations for VSAT in stations under geographical area of Manipur in North-Eastern region

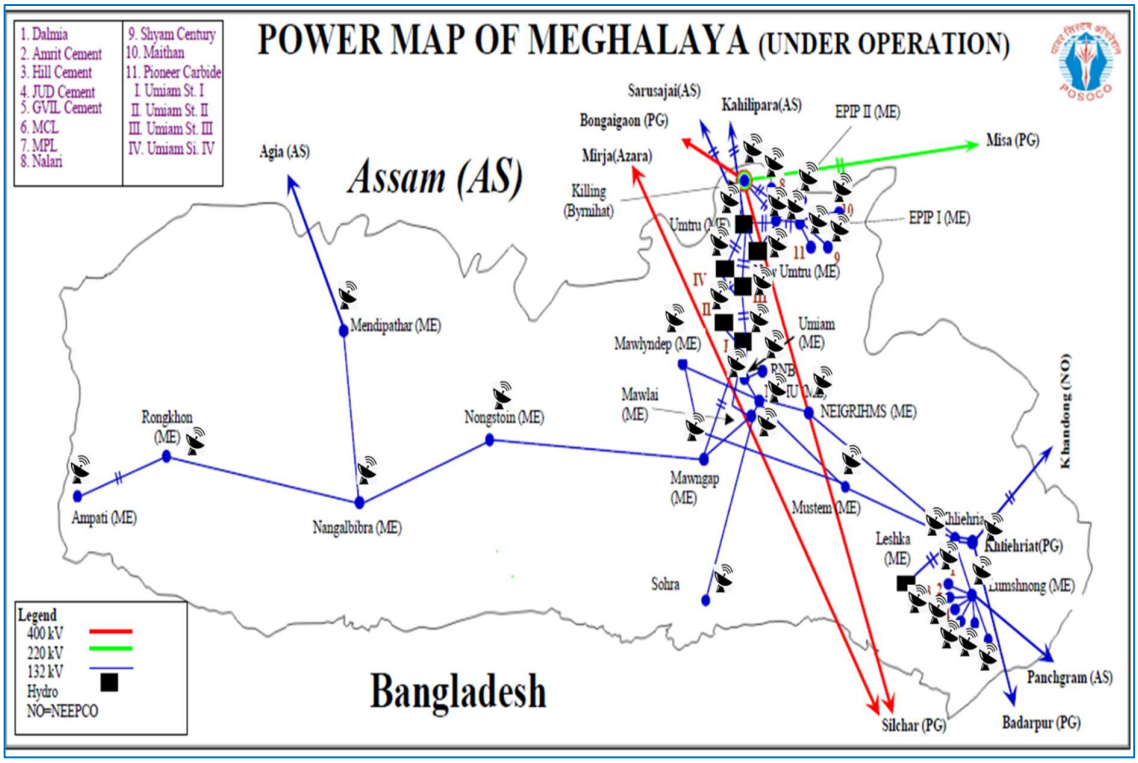


Figure 27: Locations for VSAT in stations under geographical area of Meghalaya in North-Eastern region

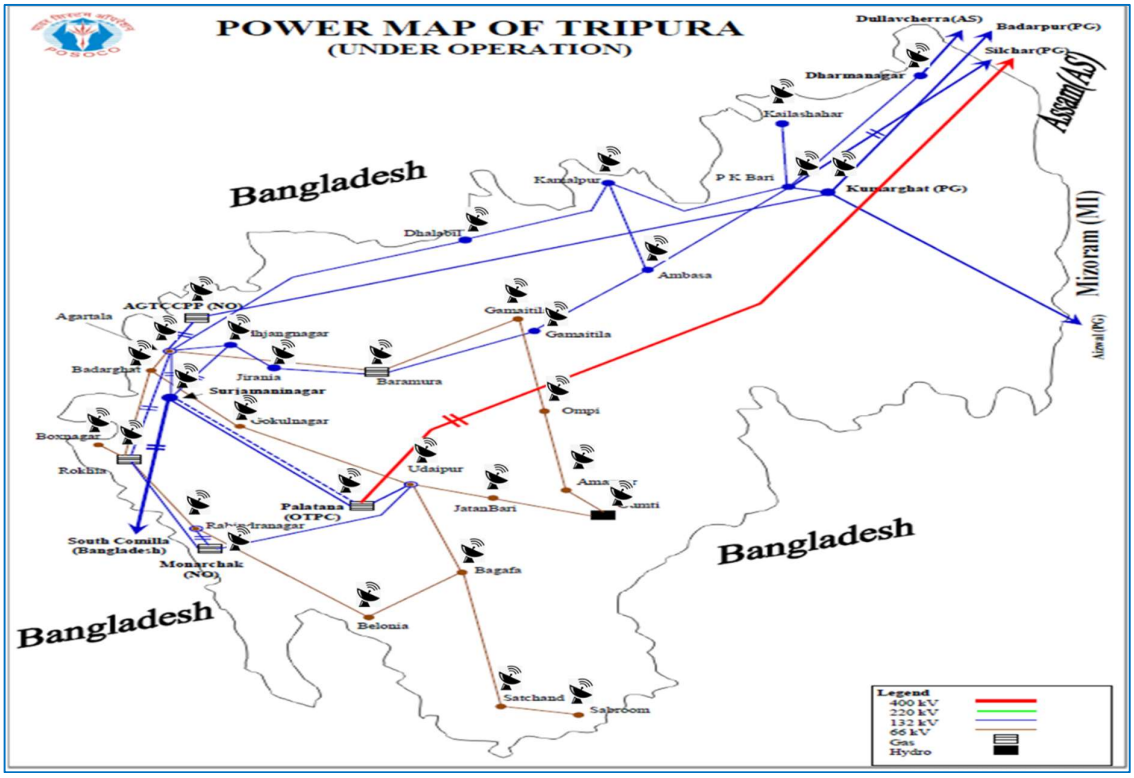


Figure 28: Locations for VSAT in stations under geographical area of Tripura in North-Eastern region

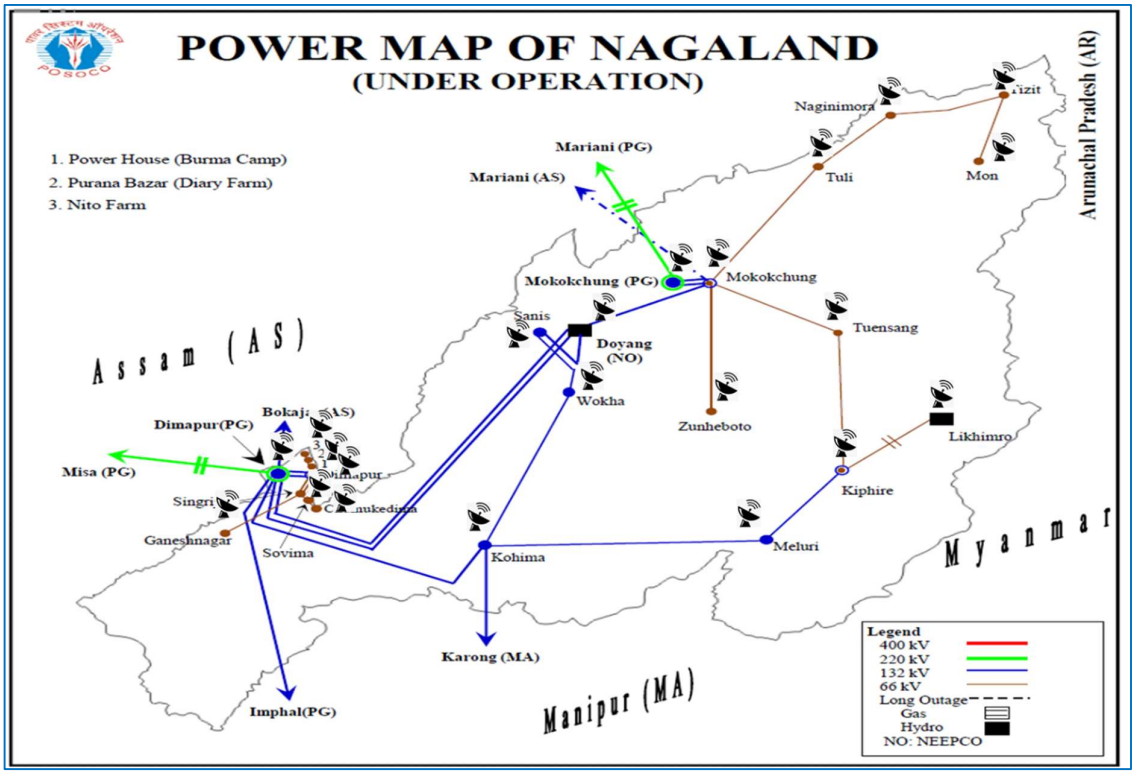


Figure 29:Locations for VSAT in stations under geographical area of Nagaland in North-Eastern region

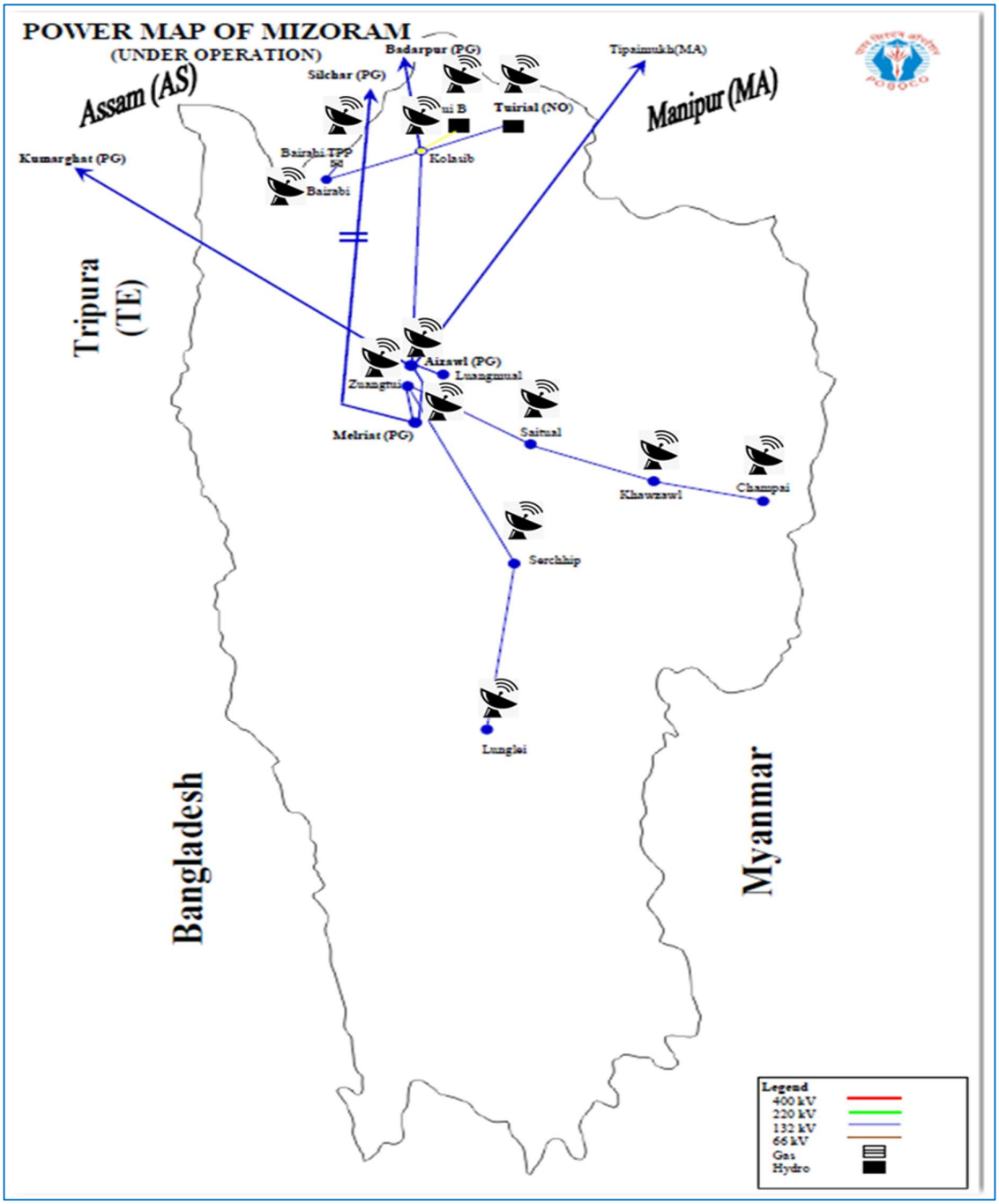


Figure 30:Locations for VSAT in stations under geographical area of Mizoram in North-Eastern region

Annexure-8: Some models for Protocol Converters – IEC 101 to IEC 104

1.0 Valiant Communications VCL-3030

Features: The VCL-3030, IEC 60870-5-101 to 60870-5-104 Protocol Converter is a ruggedized and robust, sub-station-hardened protocol converter which shall convert Serial -101 data to Ethernet -104 data. The most common application for the VCL-3030, -101 to -104 Protocol Converter is for augmenting legacy IEC 60870-5-101 RTUs that provide serial -101 data in sub-stations and SCADA data networks. By simply installing a VCL-3030, -101 to -104 Protocol Converter the existing IEC 60870-5-101 RTUs can be upgraded to Ethernet based IEC 60870-5-104 RTUs without incurring a large capex and without the tiresome task of having to rewire the RTUs that require upgradation.

Web-link: https://www.valiantcom.com/utilities/vcl-3030/101-104-protocol-converter.html

Email: ask@valiantcom.com

2.0 Phoenix Contact Resygate 3000

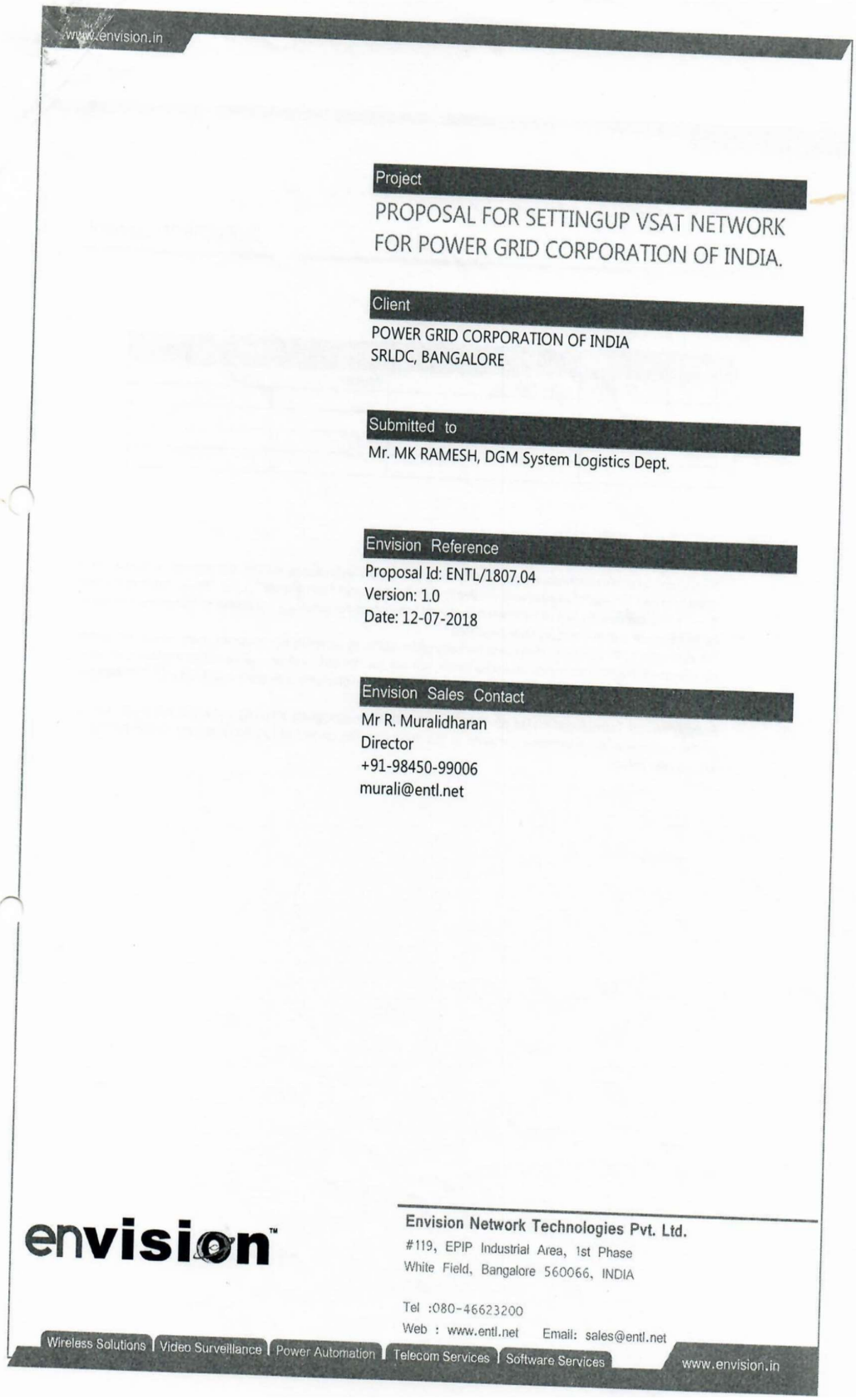
Features: Resygate 3000 is a protocol converter for up to 500 PV (process variables). It converts serial and/or TCP-based remote control protocols into standard IEC 60870-5-104 and IEC 60870-5-101 Balanced protocols. Resygate functions as a universal protocol converter with network-capable process connection. In addition, it can be used as a protocol converter or substation for network-isolated connections between control systems.

Protocol converter for 500 process variables, 3 serial interfaces, Converts the protocols IEC 60870-5-104, IEC 60870-5-101, Modbus/RTU, Modbus/TCP to IEC 60870-5-104 or IEC 60870-5-101 Connection of stations via GSM or UMTS, Connect up to 18 serial terminal devices (depending on protocol) Configure local stations easily using pre-installed software with automatic plausibility check, Use IP address ranges more effectively by forming sub-networks, Fail-safe thanks to four-fold software redundancy (one converter, four different control systems).

Web-link: https://www.phoenixcontact.com/online/portal/in?uri=pxc-oc-itemdetail:pid=2400128&library=inen&tab=1

Email: info@phoenixcontact.co.in

Annexure-9: Quotation from M/s Envision Network Technologies Private Limited for VSAT Communication systems



www.envision.in

Project

PROPOSAL FOR SETTINGUP VSAT NETWORK FOR POWER GRID CORPORATION OF INDIA.

Client

POWER GRID CORPORATION OF INDIA
SRLDC, BANGALORE

Submitted to

Mr. MK RAMESH, DGM System Logistics Dept.

Envision Reference

Proposal Id: ENTL/1807.04
Version: 1.0
Date: 12-07-2018

Envision Sales Contact

Mr R. Muralidharan
Director
+91-98450-99006
murali@entl.net

envision™

Envision Network Technologies Pvt. Ltd.
#119, EPIP Industrial Area, 1st Phase
White Field, Bangalore 560066, INDIA

Tel :080-46623200
Web : www.entl.net Email: sales@entl.net

Wireless Solutions | Video Surveillance | Power Automation | Telecom Services | Software Services | www.envision.in

7.0 Budgetary Costs

	Cost Summary			
	Budgetary onetime investments (CAPEX)			
	Details	Main Hub	VSATs	Total Proj cost
1	**Initial Regulatory charges**			
1.1	CUG application	10,000		
1.2	License fee	100,000		
1.3	Transponder allocation	-		
1.4	Earth station approvals	25,000		
1.5	SACFA approvals	5,000	150,000	
1.6	Operating llcense	-		
1.7	Nocc fees	85,000		
	Total regulatory fee	**225,000**	**150,000**	**375,000**
2	Eqpt costs	108,814,588	32,374,327	141,188,914
3	DG, UPS	5,390,000	5,512,500	10,902,500
4	Hubstn building (existing)			-
5	I&C (including NOCC tests)	9,212,500	1,815,000	11,027,500
7	Test instruments	3,500,000		3,500,000
	Total capex	**127,142,088**	**39,851,827**	**166,993,914**

	Budgetary yearly operational costs (OPEX)			
	Details	Main Hub	VSATs	Total Proj cost
1	**Regulatory costs**			
1.1	Transponder cost	4,200,000		4,200,000
1.2	License fee	5,000	75,000	80,000
1.3	Royalty	1,820,000		1,820,000
1.4	NOCC fee	85,000		85,000
	Total Regulatory	**6,110,000**	**75,000**	**6,185,000**
2	AMC support	2,284,092	757,737	3,041,828
3	SW support	2,450,000		2,450,000
4	24 X & Maintenance	3,900,000	1,620,000	5,520,000
	Total OPEX	**14,744,092**	**2,452,737**	**17,496,828**

Annexure-10: Quotation from M/s Tata Net NELCO for VSAT Communication systems

nelco

Tata net

Organisation	North East SLDC
Address	Vidyut Bhawan,Arunachal Pradesh
Submitted to	Ramesh
Submitted by	Ranbir
Proposal Date	23-01-2019 11:38
Proposal Version	Ver. 1.0

Commercial Proposal for Ex- C band VSAT Connectivity

Investment Summary

			Total (Rs)
	One Time Charges	(One Time)	
	Recurring Charges - Year 1 (BW)	(Annual)	
	Recurring Charges - Year 2 to and 3 (AMC+BW)	(Annual)	
			0

Investment Details

Product Code	Description	Qty.	UOM	Unit Price (Rs)	Total Price (Rs)	Remarks
One Time Charges						
1	Equipment - 1.2 Meter Ext-C Band Antenna, 2 Watt BUC, Satellite modem RF cables (upto 30 meters pair) and integration material.	4	nos	94,558	3,78,233	3*remote sites + 1* SLDC site
2	Installation & commissioning + Freight Forwarding + Transit Insurance+ SACFA Charges	4	nos	13,571	54,286	Subject to site readiness for VSAT I&C
3	Cisco ISR 4221 router at Nelco Hub (2*FE ports)	1	nos	85,000	85,000	Cisco standard IOS software
4	DC-DC Convertor (48V-24V)	4	nos	4,500	18,000	Optional line item
5	VSAT Platform Charges			25,000		Optional line item
Annual Recurring charges					5,35,518	
5	Satellite BW : Plan 512-EXT-C (Typical BW - UP- 192 kbps, Down- 384 Kbps , Burstable BW - UP- 64 Kbps , Down-128 Kbps)	1	nos	2,02,020	2,02,020	PO on TNSL ,GST Extra
6	Satellite BW - Plan 128 Kbps (Typical BW - UP- 16 kbps, Down- 32 Kbps , Burstable BW - UP- 32 Kbps , Down-96 Kbps)	3	nos	61,875	1,85,625	PO on TNSL ,GST Extra
7	VAS -Proactive monitoring Services a) Site up/down monitoring portal b) Auto email alert for site going down c) Auto SMS alert for site going down d)Fault ticket raise/close auto email	4	nos	3,000	12,000	PO on Nelco ,GST Extra
AMC					3,99,645	
8	VSAT Hardware AMC from 2nd year onwards	4	nos	9,000	36,000	
9	Router AMC from 2nd year onwards	1	nos	9,800	36,000	

** As per Tata Code of conduct above prices are confidential and intended for use only by the individual or entity to which it is addressed.

NOTES

Refer to detailed ' Terms and Conditions' sheet attached for general T&C.

DEVI Energies Pvt Ltd

An ISO 9001:2008 Certified Company

Dt 23.6.2020

To

The G.M (S.O-II)

NERLDC, POSOCO

Shillong

Sir,

Sub : Dikshi HEP- Submission of Compliance –Reg

1. It is to submit that the real time data from Dikshi and tenga switching station are problematic sometimes due to latency issue which is being examined by Nelco. Latency details are attached.

2. Voice communication will be implemented through SIP (Satellite) phones till permanent arrangement is made.

3. PLCC System was planned and ordered for the purpose of voice and Data transmission with our regular vendor who supplied entire transmission line & Switching Station package and it is learnt that PLCC, Wave trap are to be supplied from Mumbai and CVT from Rajasthan.

4. Because of lock down issue, we didn't get proper response from these suppliers regarding delivery and installation of PLCC panels at both ends and the same will be updated soon.

Thanking you

For Devi Energies Pvt Ltd

Managing Director
AL Nagaraju

CC to :
1. The CGM, NERLDC, Shillong
2. The Director, NERPC, Shillong
3. The Member Secretary, NERPC, Shillong

Regd. Office : # E-351, Rupa Village & Town, Rupa PO & PS, Rupa, West Kameng Dist., Arunachal Pradesh - 790003.
Corp.Off.: 8-2-268/1/A/1/B&C, 1st Floor, Thulasi Homes, Aurora Colony, Road No.3, Banjara Hills, Hyderabad-500 034. 040-23733171 Email: devienergies@rediffmail.com ; www.devienergies.com

CIN No.: U40109AR2007PTC008424

```
uest timed out.
uest timed out.
uest timed out.
```

Administrator: Command Prompt

```
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation.  All rights reserved.

C:\Users\hab60>ping 10.72.48.18

Pinging 10.72.48.18 with 32 bytes of data:
Reply from 10.72.48.18: bytes=32 time=2159ms TTL=122
Reply from 10.72.48.18: bytes=32 time=1628ms TTL=122
Reply from 10.72.48.18: bytes=32 time=1439ms TTL=122
Reply from 10.72.48.18: bytes=32 time=1559ms TTL=122

Ping statistics for 10.72.48.18:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1439ms, Maximum = 2159ms, Average = 1696ms

C:\Users\hab60>ping 10.72.48.26

Pinging 10.72.48.26 with 32 bytes of data:
Reply from 10.72.48.26: bytes=32 time=2918ms TTL=122
Reply from 10.72.48.26: bytes=32 time=2799ms TTL=122
Reply from 10.72.48.26: bytes=32 time=2078ms TTL=122
Reply from 10.72.48.26: bytes=32 time=2679ms TTL=122

Ping statistics for 10.72.48.26:
```

10.72.48.26 Protocol Timeout 1 6000