CHALLENGES FACED IN NER GRID OPERATION

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INTRODUCTION

The North Eastern Regional grid is one of the smallest grids both in terms of area covered and its peak demand as compared to other five electrical regions of the country and comprises of seven sister states of Arunachal Pradesh, Assam, Nagaland, Manipur, Meghalaya, Mizoram and Tripura. Installed capacity of NER is 4236 MW. Peak demand met in NER during 2018-19 was 2850 MW as against 174682 MW in the Country. This energy scenario in the region is dented with overwhelming challenges that primarily stems from the regions' poor connectivity. All States in the region are not connected by 400 KV network. Certain pockets of the region are marred with weak links that pose serious threats to the incessant power flow across the region.

As such the System Operators, RLDC at the regional level and SLDCs at each State, often encounter critical impediments in their constant attempts in ensuring a secure and reliable operation of the regional grid. This is coupled with the Market Operation issues faced by the States who engage in earnest efforts to ensure effective participation in the Electricity Market taking into account merit order of Central Sector as well as State Sector generating stations.

This paper summarises the challenges faced in operating NER Grid from the System Operators' perspective and the existing best practices as well as those envisaged to be undertaken in the near future for addressing these issues.

SECTION-1: NER GRID WEAK LINKS AND OPERATIONAL ISSUES

Southern part of the NER Grid has few connectivities at 400 KV level with rest of the Grid and is more vulnerable. There are only two 400kV connectivities viz. Palatana - Silchar D/C

and two 400kV circuits from Silchar-Azara and Silchar - Byrnihat respectively. All other interstate connectivity is through 132kV lines. This zone has one of the largest generating plant of NER named Palatana with installed capacity of 726 MW (2*131+2*232). There is also an international connectivity from Surajmaninagar(Tripura) to Comilla(Bangladesh).

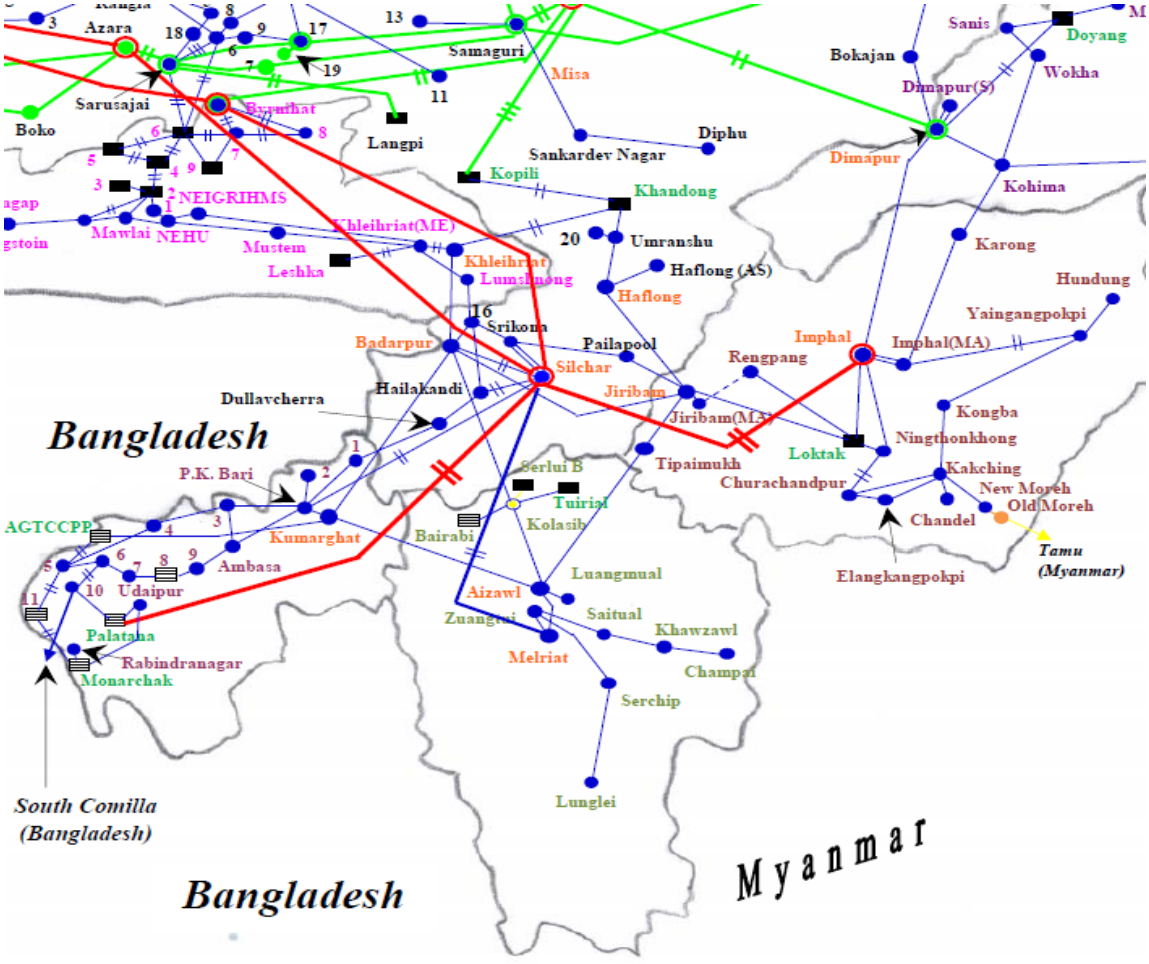


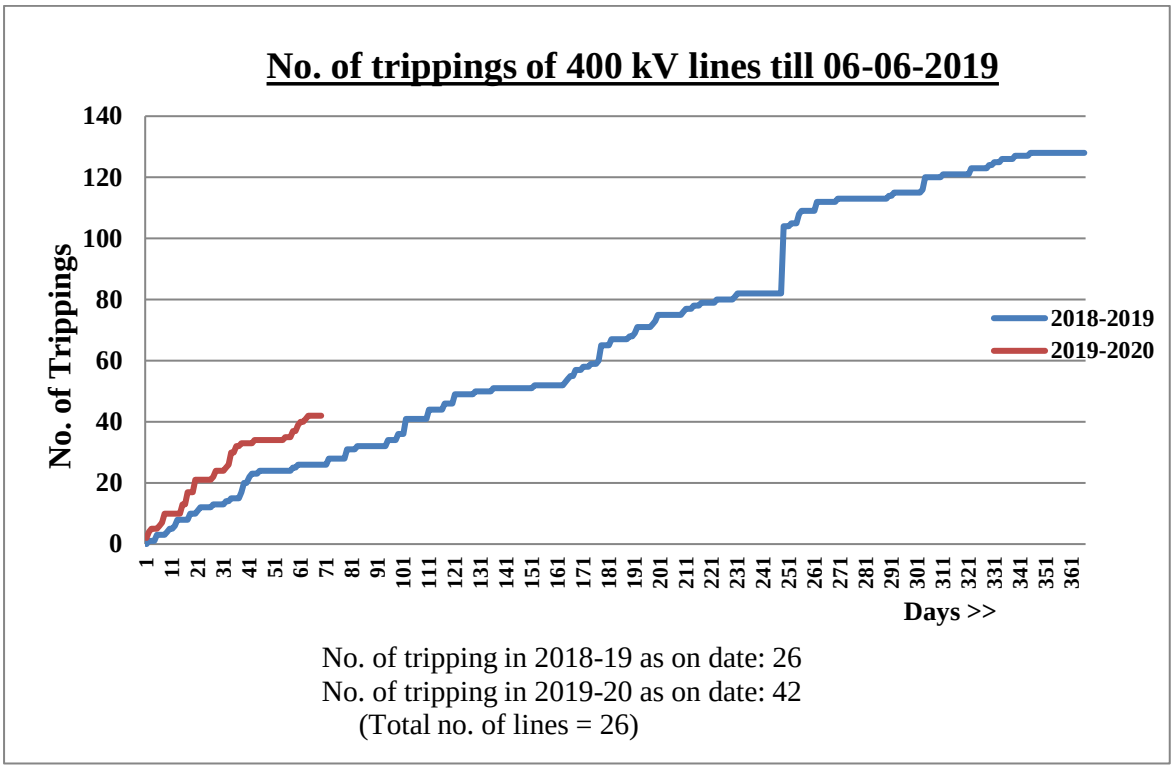
Figure 1: Power map showing Southern part of NER Grid.

Hence, tripping or outage of any of the 400 kV lines mentioned above has potential of causing disturbances of various degrees in this zone. Special protection schemes (SPS) have been designed to tackle the contingencies.

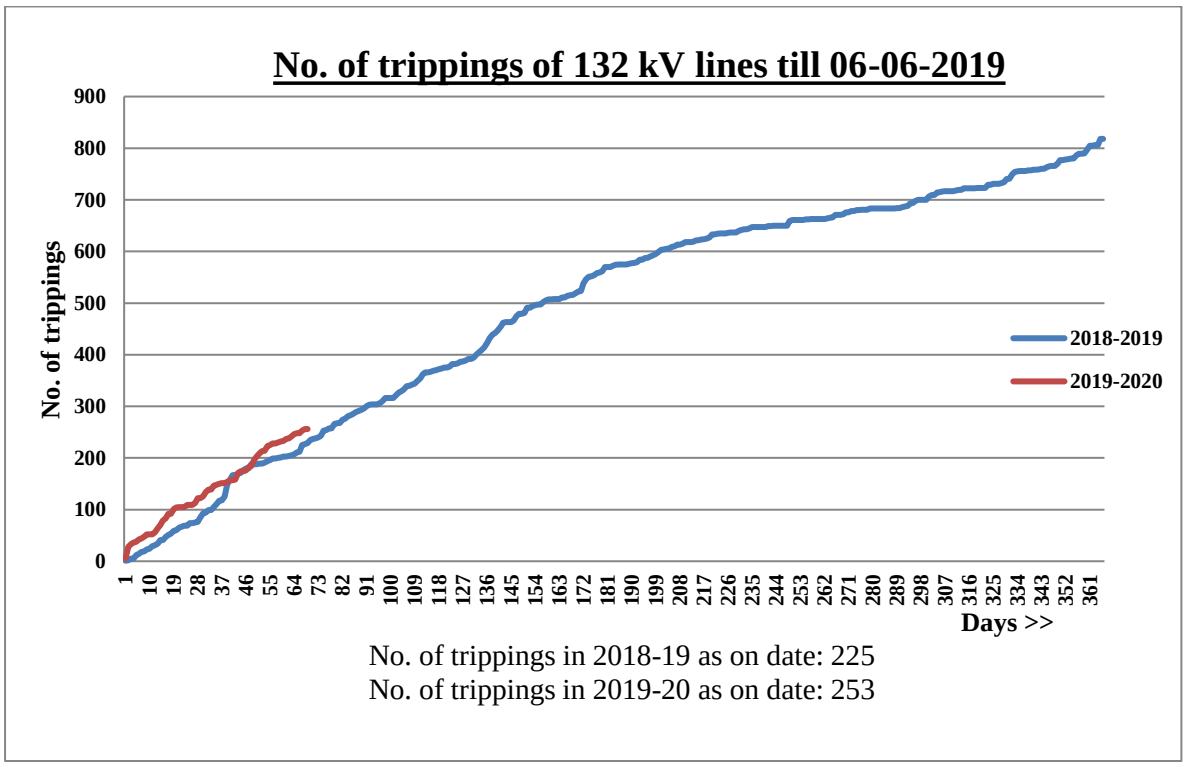
SECTION-2: TRIPPING OF TRANSMISSION LINE IN NER GRID- A CAUSE OF CONCERN

Trippings in a transmission system is one of the major health index of the grid. In NER grid, line trippings are generally high due to various reasons such as lightning strikes, improper

protection coordination and fast growing of trees in the vicinity of the lines. It can be clearly seen from the plots showing number of trippings of 400 kV and 132 kV lines.



Graph 1: Number of Tripping of 400kV lines for 2018-2019 and 2019-2020



Graph 2: Number of Tripping of 132kV lines for 2018-2019 and 2019-2020

The above plots indicate very high number of line trippings during 2018-19 as well as in the first quarter of 2019-20. From the comparative study of 2018-19 and 2019-20, it has been observed that the line trippings for 2019-20 are in increasing pattern.

Appropriate actions are being taken at Regional Power Committee Forum to reduce the tripping of lines.

Remedial Measures:

1. Installation of transmission line surge arrestors in various lightning prone zones.
2. Proper protection co-ordination.
3. Time to time patrolling of the lines will help in addressing vegetation problems near the transmission lines.

SECTION-3: THE NEW INITIATIVES AND CHALLENGES AHEAD

Security Constrained Economic Despatch (SCED)

The needy DISCOMs are restrained from requisitioning/scheduling power from the generating stations with which they do not have contracts or share allocation despite surpluses still remaining unscheduled in cheaper power stations. The relatively costlier stations were getting despatched whereas margins were still available in stations with lower marginal cost.

Security Constrained Economic Despatch (SCED) is a novel model based on the idea of optimising the despatch of generation resources at inter-state level to reduce overall variable charges for production of electricity. The objective is to achieve minimisation of the production cost of the system without compromising grid security. The scheme advocates flexibility in scheduling of generation for utilizing any un-despatched surplus in existing cheaper generating stations. Coal based generating stations whose tariff is determined by CERC have been included as eligible participants in the pilot project on SCED that is operational at present.

Based on National Statements on SCED issued by NLDC during first four weeks, it is seen that SCED has resulted in a National saving as below:

Week No.	Dates	Amount (in Rs.)
1	01.04.2019 to 07.04.2019	15.47 Cr
2	08.04.2019 to 14.04.2019	18.37 Cr
3	15.04.2019 to 21.04.2019	30.00 Cr

4	22.04.2019 to 28.04.2019	23.19 Cr

Reserves Regulation Ancillary Services (RRAS)

The Reserves Regulation Ancillary Services (RRAS) was introduced as a framework for operationalising slow tertiary reserves at the ISTS level. The primary objective of RRAS is to restore the frequency at desired level and to relieve the congestion in transmission network. RRAS supports both regulation up and regulation down service by responding to signals for increase and decrease in generation within the technical limit and time limit so as to balance the changes in system frequency or congestion in the system. The Regional Entity generating stations whose tariff for full capacity is determined by CERC are eligible to participate in RRAS.

Highlights of RRAS:

- **CERC Regulations notified in August, 2015**
- **Stakeholder Consultations in October, 2015**
- **Mark-up for delivery of Regulation Up Services in January,2016**
- **CERC Approved Procedure in March, 2016**
- **Implementation Start Date: 12th April, 2016**
- **CERC Revised Approved Procedure in November, 2016**
- **Nodal Agency for RRAS** – NLDC through RLDCs
- **RRAS Providers** –ISGS – 100 % tariff determined/adopted by CERC

Total - 56 Nos. (NR – 14, WR – 19, SR – 12, ER – 8, NER – 3), Installed capacity- 59 GW

- **In-house developed software**
- **Separate Merit Order Stack** - Variable cost of generation - Time-block - Region-wise Regulation Up – Lowest to Highest and Regulation Down – Highest to Lowest
- **Un – Requisitioned Surplus (URS) capacities of ISGS**
- Factoring ramp up/down rate, response time, transmission constraints
- **Triggering Events**-i) Extreme weather forecasts and/or special day; ii) Generating unit or transmission line outages; iii) Trend of load met; iv) Trends of frequency; iv)Abnormal event - outage of hydro units due to silt, coal supply blockade etc.; v)Excessive loop flows leading to congestion; vi) Such other events.

- **Revising of Schedules of RRAS Providers by RLDCs** - Quantum directly incorporated
  - Despatch/Withdrawal instructions by NLDC
- **RRAS Energy Accounting**
  - RPC on weekly basis with DSM Account - Interface meters data and schedule.
- **RRAS Energy Settlement**
  - Under separate account head of RRAS from Regional DSM Pool Account
    - Regulation Up-Fixed & variable charges with markup (50p/unit)
    - Regulation Down-RRAS provider shall pay 75 % of variable charges to Pool Fund
  - No retrospective settlement
  - Any deviation settled as per CERC DSM Regulations, 2014
  - Penalties for sustained failure to provide RRAS and violation of directions of RLDC
  - All RRAS provider participated in Ancillary Services.
  - Highest Regulation 'Up' in a day: 3816 MW; Highest Regulation 'Down' in a day: 2702 MW

Item (Apr'16 to Apr'19)	Total	Average (₹ per unit)
Regulation Up		
Energy scheduled	11390 MU	--
Fixed charges paid	₹ 1403 Crores	₹1.24
Variable charges paid	₹ 3868 Crores	₹3.42
Markup paid	₹ 567 Crores	₹0.50
Total paid for RRAS Up	₹ 5838 Crores	₹5.16
Regulation Down		
Energy scheduled	1326 MU	--
Variable charges retained by RRAS	₹ 83 Crores	₹0.63
Variable Charges refunded to DSM	₹ 249 Crores	₹1.88

Fast Response Ancillary Services (FRAS)

One of the limitations inherent in the RRAS framework is that it predominantly utilizes the thermal power stations which have ramping limitations. On the other hand, Hydro stations can

respond very quickly and much faster than thermal/gas stations. In order to harness the flexibility and fast response provided by storage and pondage hydro, a framework of Fast Response Ancillary Services for providing frequency regulation services was proposed by the FOR Technical Committee. Based on the above recommendation the CERC endorsed implementation of a pilot on FRAS for hydro stations vide its order in Petition No. 07/SM/2018 (Suo-Motu) dated 16th July, 2018. The pilot on FRAS shall have the following features:

- Total energy delivered over the day shall be maintained as declared by the hydro station.
- The total energy dispatched under FRAS shall be squared off by the end of the day
- Incentive shall be paid from the DSM Pool on mileage basis at the rate of 10 paisa/kWh both for "up" and "down"

Currently five hydro plants in NER of Kopili, Kopili-II, Khandong, Doyang and Loktak are being given FRAS instructions under the pilot scheme.

Highlights of FRAS:

- **CERC order:** Petition No. 07/SM/2018 (Suo-Motu) order dated 16th of July, 2018.
- **Implementation Start date:** 26th November'2018**.**
- **Participating Hydro Station:** 20 Pondage/Storage ISGS hydro station (74 Units having size of 25 MW to 250 MW).Northern Region : 13/Eastern Region : 2/North-Eastern Region : 5
- **Installed Capacity:** 8624 MW Northern Region : 7599 MW, Eastern Region : 570 MW, North-Eastern Region : 455 MW
- **All Constraints declared by hydro stations honored.**
- **Earlier Feedback:** 23rd Meeting of the Standing Technical Committee of the Forum of Regulators (FOR) held on 11th January 2019.
- **Summary of Despatch**

Period: 26.11.18 to 19.05.19	**Regulation Up**	**Regulation Down**
Energy Despatched	9	35
Average Energy Despatched per Day	0.05	.2
Maximum Power Despatched in a block (MW)	429	963

Despatched Range (MW)	200~ 400	200 ~ 1000
Incentive (Total= 50 lakhs)	9	35

Five minutes Scheduling and Accounting

In view of the manifold advantages evinced by the international experience, particularly in terms of reduction in the requirement of reserve, reduction in variability, robust price discovery closer to real time and bringing out the value of flexibility, a shorter dispatch and settlement period such as 5-minutes was appreciated by the FOR Technical Committee. CERC also recognised that shorter duration scheduling, metering, accounting and settlement would consequently lower the ancillary service requirements and overall costs to consumers. In view of this CERC decided to introduce the pilot project for implementing 5-minute scheduling, metering, accounting and settlement for Thermal with AGC installations and Hydro Power Stations vide its order in Petition No. 07/SM/2018 (Suo-Motu) dated 16th July, 2018.

Scheduling, Accounting, Metering and Settlement of Transactions in electricity (SAMAST)

SAMAST scheme was introduced with the aim of achieving an efficient mechanism for the proper scheduling to settlement of electricity transactions in a transparent manner for the power transactions across intra-state boundaries.

The committee formed by the Forum of Indian Regulators (FOIR) in March 2005 recommended the establishment of an intra-state ABT mechanism compatible with its inter-state counterpart. A sub-committee under the aegis of Forum of Regulators Technical Committee, after wide discussions and consultations with the stakeholders, came up with a report called Scheduling, Accounting, Metering and Settlement of Transactions in electricity (SAMAST) which was adopted by the FOR Technical Committee in July, 2016. The Report stipulated a time frame for implementation of the scheme in all states within a period of 365 days from zero date.

North Eastern Region (NER) has been lagging behind other electrical regions of the country as far as power system development is concerned. Hence, there was a need to make special efforts to implement SAMAST in NER states. Accordingly, a SAMAST group was formed in NER and it played a pro-active role in planning and implementing the SAMAST scheme. An integrated approach taking all seven states on board right from initial discussion, preparation

of DPR, drafting of SRS/ technical specifications and common tendering option by a single agency on behalf of all states have made it possible to go ahead with SAMAST in all NER states with diverse characteristics.

Real Time Market (RTM)

A clearly identified real time / intra-day energy market with improved processes in the form of auction and gate closure that is likely to be implemented soon in the near future, was for the first time proposed in the Discussion Paper on Re-designing Real Time Electricity Markets in India prepared by CERC. It is proposed to re-design the intraday market mechanisms as follows: -

- The markets shall be based on double sided closed auctions with uniform market clearing price.
- The real time market shall be conducted once in every hour for delivery in four fifteen minute blocks in each hour.

NER Grid Operation Whatsapp Group

On 20th. March, 2019, NERLDC took initiative in formation of a Whatsapp group named "NER Grid Operation" involving all power sector utilities viz. generators, transmission licensees, DISCOMs, SLDCs, RLDC and RPC. This group is very active in all real time grid operation issues and it has been instrumental in providing a common forum for sharing and dissemination of information very quickly.

CONCLUSION

This paper highlights various challenges faced in NER grid operation by the System Operators. Southern part of NER is considered to be the weak link due to which it is prone to grid disturbances. Hence, various special protection schemes have been designed to tackle such contingencies. Also, tripping of lines needs to be reduced to maintain healthiness of the grid. Therefore, to mitigate such operational issues faced in NER grid, appropriate measures has to be taken to avoid such problems in near future to ensure better performance of the grid. Apart from these issues faced in NER grid, new initiatives have also been taken such as SCED, RRAS, FRAS, SAMAST and RTM which will help in reliable and smooth operation of the grid.

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