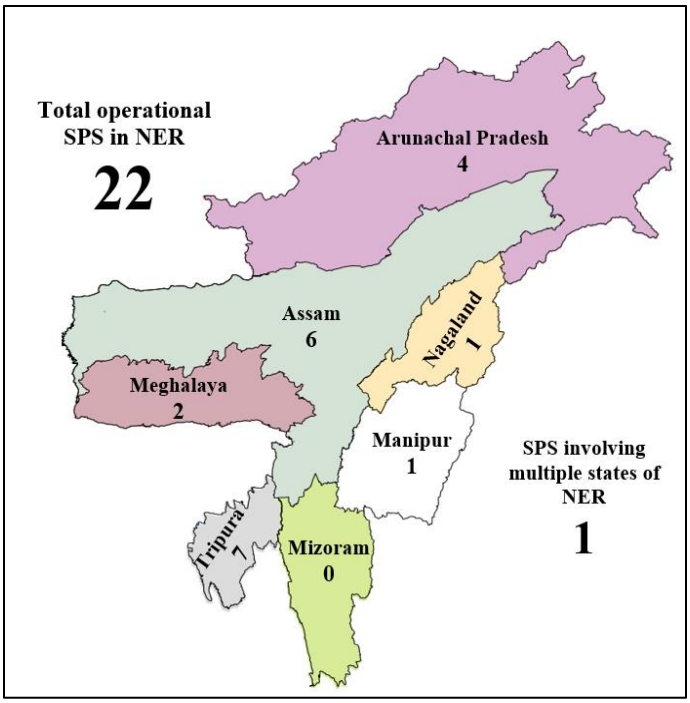

उत्तर पूर्वी क्षेत्र के सिस्टम प्रोटेक्शन स्कीम

System Protection Schemes of North-Eastern region

जारी करने की तिथि : 31st **जनवरी**'25 /

Issued on: **31st January' 25**

<u>प्रलेख प्रबन्धन तंत्र</u>
<u>Document Management System</u>

दस्तावेज़ का नाम/ Document Name	उत्तर पूर्वी क्षेत्र के सिस्टम प्रोटेक्शन स्कीम (एसपीएस) दस्तावेज़ / System Protection Scheme (SPS) document of NER		
दस्तावेज़ का आईडी/ Document ID	NERLDC/SPS/2024-25/ Rev 0		
संशोधन संख्या/ Revision No	0	**जारी करने की लतलि/ Date of Issue**	31-01-2025
वर्गीकरण / Classification	बाहरी / External		

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A. प्रस्तावना / Introduction:

The complexities of the Indian electric power system operation are increasing day by day. The size of the Grid has expanded manifold and is on a high growth phase with All India Demand Met crossing about 250 GW. The need of System Protection Schemes (SPS) also known as System Integrity Protection Schemes (SIPS) or Remedial Action Schemes (RAS) is spelt due to long haulage of power. Due to heavy flow of power through these long corridors, any outage usually results in congestion in this part of the network.

This results into reduction in transfer capability across this corridor. Subsequently disturbance in a large area of the Grid resulting into loss of load and generation.

SPS- System Protection scheme is a scheme in addition to the normal protection system to take care of some special contingencies like tripping of important corridor/flow gates etc. to avoid the voltage collapse, cascade tripping, load generation mismatch and finally blackouts in the system.

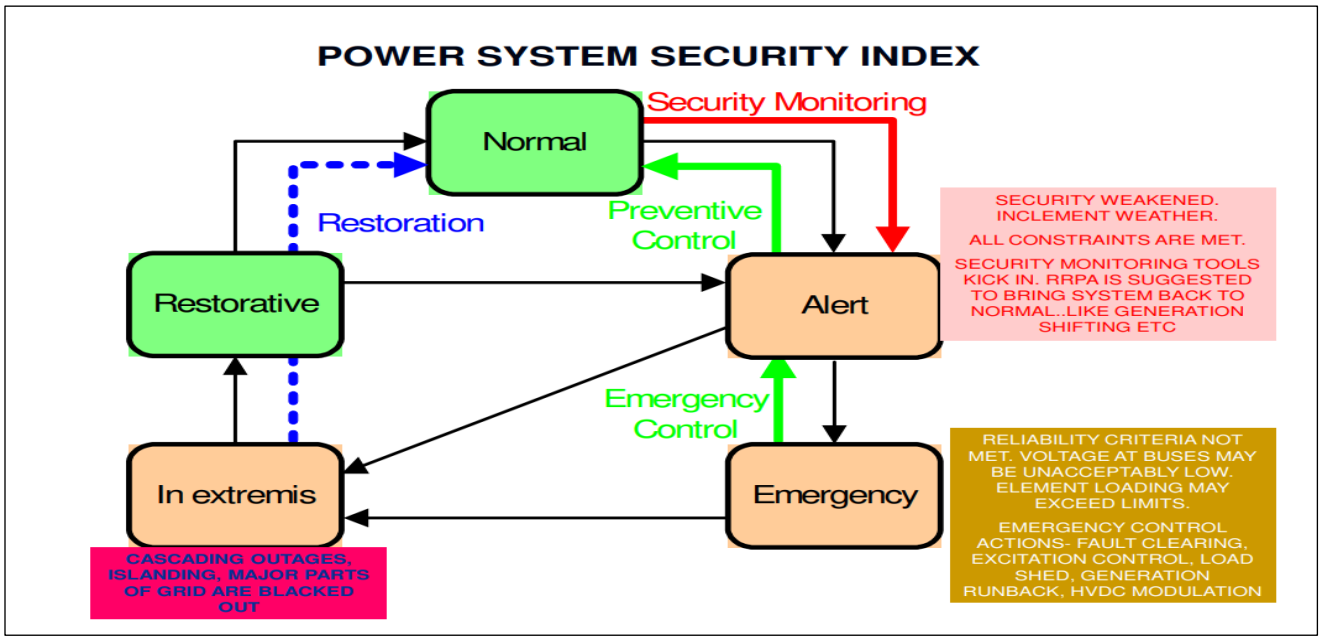


Fig 1: Power System Security Index

SPS is defined as a "protection scheme that is designed to detect a particular system condition which may cause unusual stress to the power system and therefore, take a predetermined action to counteract the observed condition in a controlled manner". System Protection Schemes are used during rare contingencies, when focus for the protection is on the power system supply capability rather than on specific equipment and when the consequences of an operating condition are outside the capability of conventional protection. SPS consists of three main parts i.e., the **input** which is the level of physical magnitudes and status of circuits breakers, **decision making** system which initiate some actions based on inputs and **output** which may be generator tripping/ back down and or load tripping.

SPS are tailor made schemes & are required to operate infrequently. The control actions taken are predetermined & can be armed or disarmed depending upon system conditions. It can comprise of a large number of coordinated actions, in a cascaded manner.

For large interconnected system the non-operation of unit (like differential protection etc) / non-unit (Like distance protection or over-current protection etc.) or backup protections may lead to wide spread disturbances.

Also there is heavy rush of power flow from an inter-regional or important intra-regional corridors. Tripping of these tie lines may overload other lines in the corridor which may result in cascading. This necessitates the implementation of SPS as safety net for the grid.

The following schemes do not constitute an SPS and are exclusions from SPS definition:

- Under frequency or under voltage load shedding
- Locally sensing devices applied on an element to protect it against equipment damage for non-fault conditions by tripping or modifying the operation of that element, such as, but not limited to, generator loss-of-field or transformer top-oil temperature
- Auto-Reclosing schemes
- Locally sensed and locally operated series and shunt reactive devices, FACTS devices, phase shifting transformers, variable frequency transformers, generation excitation systems, and tap-changing transformers
- Schemes that prevent high line voltage by automatically switching the affected line
- Schemes that automatically de-energize a line for non-fault operation when one end of the line is open
- Out-of-step relaying
- Schemes that provide anti-islanding protection (e.g., protect load from effects of being isolated with generation that may not be capable of maintaining acceptable frequency and voltage)
- Protection schemes that operate local breakers other than those on the faulted circuit to facilitate fault clearing, such as, but not limited to, opening a circuit breaker to remove infeed so protection at a remote terminal can detect a fault or to reduce fault duty.
- Automatic sequences that proceed when manually initiated solely by an operator
- Sub-synchronous resonance (SSR) protection schemes
- Modulation of HVDC or SVC via supplementary controls such as angle damping or frequency damping applied to damp local or inter-area oscillations
- A Protection System that includes multiple elements within its zone of protection, or that isolates more than the faulted element because an interrupting device is not provided between the faulted element and one or more other elements.

एस.पी.एस की आवश्यकता / Need for SPS:

As per Indian Electricity Grid Code (IEGC), interstate transmission system (ISTS) shall be capable of withstanding and be secured against the certain outages without necessitating load shedding or rescheduling of generation during steady state operation. These include outage of a 132 kV D/C line or Outage of a 220 kV D/C line or Outage of a 400 kV S/C line or Outage of a single ICT or Outage of one pole of HVDC bi-pole or Outage of 765 kV S/C line.

The aforesaid contingencies would be superimposed over a planned outage of another 220 kV D/C line or 400 kV S/C line in another corridor and not emanating from the same sub-station. ISTS shall be capable of withstanding the loss of most severe single system infeed without loss of stability. It has also been stated that any one of the aforesaid events shall not cause loss of supply, abnormal frequency on sustained basis, unacceptable high or low voltage, system instability, unacceptable overloading of ISTS elements.

As per the IEGC or transmission planning criteria, the system is not designed for 400 kV double circuit line or outage of HVDC bi-pole. In practice it has been observed that there are some contingencies happening in the

system resulting in outage of multiple elements for which system is not designed.

Disturbances like loss of load, loss of generation or loss of transmission line in large grid may cause wide variations in frequency, voltage & load angles. Originating causes of grid failure may be due to equipment failure (including those of protective systems), human error and cascade tripping or large scale disturbances due to weather and/or natural calamities.

Disturbances cause discomfort to the people as well as results into huge economic loss. Therefore, in addition to conventional unit protection system few System Protection Schemes (SPS) are also desirable for safe and reliable operation of the power system.

The main objective of SPS is to preserve the integrity of the electric system by using automatic measures that are simple, reliable and safe for the system as a whole and to provide the most extensive coverage against all possible extreme credible contingencies.

B. रेडी रेकनर / Ready Reckoner:

क्र.सं / Sl. No.	योजना का नाम / Name of Scheme	एजेंसी / Agency	स्थिति (अक्षम/सक्षम) / Status (Disabled/ Enabled)	नियंत्रण क्षेत्र / Control Area	श्रेणी प्रकार / Category Type
SPS IN OPERATIONAL STATE					
SPS involving multiple States of NER					
SPS related to Overloading of Critical line(s)					
1	SPS related to ensuring reliable power supply to Arunachal Pradesh & Assam through the 132 kV Roing-Chapakhowa D/C lines	ISTS	Enabled	NER	Load rejection, Line tripping & Reactor tripping
SPS in Arunachal Pradesh					
SPS related to Safe evacuation of Generation					
2	SPS related to overloading of any one of the 400/132kV, 2x360 MVA ICTs at Panyor Lower Hydro Power Station	NEEPCO	Enabled	NER	Generation backdown
SPS related to under voltage condition					
3	SPS related to outage of 132 kV Panyor LHPS- Ziro (PG) Line	NEEPCO & PGCIL	Enabled	NER	Load rejection
4	SPS at Tezu substation related to prevention of Under Voltage scenario in Arunachal Pradesh power system	PGCIL	Enabled	NER	Load rejection
5	SPS at Namsai substation related to prevention of Under Voltage scenario in Arunachal Pradesh power system	PGCIL	Enabled	NER	Load rejection
SPS in Assam					
SPS related to Tripping of critical line(s) / corridor					
6	SPS related to overloading of 220 kV BTPS - Salakati D/C Line	AEGCL	SPS is kept OFF	NER	Line tripping
7	SPS related to outage of 220 kV BTPS (Salakati) – Rangia I & II Line	AEGCL	Enabled	NER	Load rejection & line tripping
8	SPS related to outage/tripping of 220 kV Azara-Sarusajai D/C Line	AEGCL	Enabled	NER	Load rejection
9	SPS related to tripping of 220 kV Misa- Samaguri D/C Line	AEGCL	Enabled	NER	Load rejection
10	SPS related to outage/tripping of any one circuit of 220 kV Balipara-Sonabil D/C	AEGCL	Enabled	NER	Load rejection

SPS related to Safe evacuation of Generation					
11	SPS related to the safe evacuation of power from BgTPP(NTPC) generation	NTPC	Enabled	NER	Generation backdown
SPS in Manipur					
SPS related to under voltage condition					
12	SPS related to outage/tripping of 400 kV New Kohima – Imphal D/C Line	PGCIL	Enabled	NER	Reactor tripping
SPS in Meghalaya					
SPS Related to Tripping of Critical Line(s)/Corridor					
13	SPS related to outage/tripping of any one circuit of the 132 kV Khliehriat (PG)- Khliehriat D/C line	MePTCL	Enabled	NER	Load rejection
SPS related to Safe evacuation of Generation					
14	SPS related to outage/tripping of any one circuit of 132 kV Leshka – Khliehriat D/C Line	MePGCL	Enabled	NER	Generation backdown
SPS in Nagaland					
SPS related to tripping of critical line / corridor					
15	SPS related to outage/tripping of any one circuit of 132 kV Dimapur(PG)-Dimapur(NA) D/C Line	DoP Nagaland	Enabled	NER	Load rejection
SPS in Tripura					
SPS related to Safe evacuation of Generation					
16	SPS related to secure evacuation of power from the Monarchak (NEEPCO) Power Plant	NEEPCO	Enabled	NER	Generation backdown
SPS related to under voltage condition					
17	SPS related to outage/ tripping of both circuits of 400 kV SM Nagar(NTL) - PK Bari(NTL) D/C Lines	NTL(Indi grid)	Enabled	NER	Reactor tripping
18	SPS related to outage/ tripping of both circuits of 400kV PK Bari (NTL) – Silchar(PG) Lines	NTL(Indi grid)	Enabled	NER	Reactor tripping
SPS Related to Tripping of Critical Line(s)/Corridor					
19	SPS related to outage/tripping of 400kV Palatana-Silchar D/C Line when both modules of Palatana are in service	PGCIL & OTPC	Enabled	NER	ICT tripping
20	SPS related to overloading of 132 kV Surajmaninagar (TSECL)-Surajmaninagar (NTL) Line	TSECL	Enabled	NER	Load rejection
21	SPS related to outage/tripping of 400 kV Palatana – Surajmaninagar line (charged at 132 kV)	PGCIL, TSECL & OTPC	Enabled	NER	Load rejection
22	SPS related to outage/tripping of both 400/132 kV, 2x125 MVA ICTs at Palatana	PGCIL, TSECL & OTPC	Enabled	NER	Load rejection

DISABLED SPS					
क्र. सं / Sl. No.	**योजना का नाम / Name of Scheme**	**एजेंसी / Agency**	**स्थिति (अक्षम/सक्षम) / Status (Disabled/Enabled)**	**नियंत्रण क्षेत्र / Control Area**	**श्रेणी प्रकार / Category Type**
1	SPS related to Reverse power flow more than 60 MW from LV to HV side of 2 X 315 MVA, 400/220 kV Azara ICTs causes tripping of 400/220 kV, 2x315 MVA ICTs at Azara (AEGCL)	AEGCL	Disabled	NER	ICT tripping
2	SPS related to tripping of 132 kV Umiam Stg-I to Umiam Stg-III D/C lines	MePTCL	Disabled	NER	Load rejection

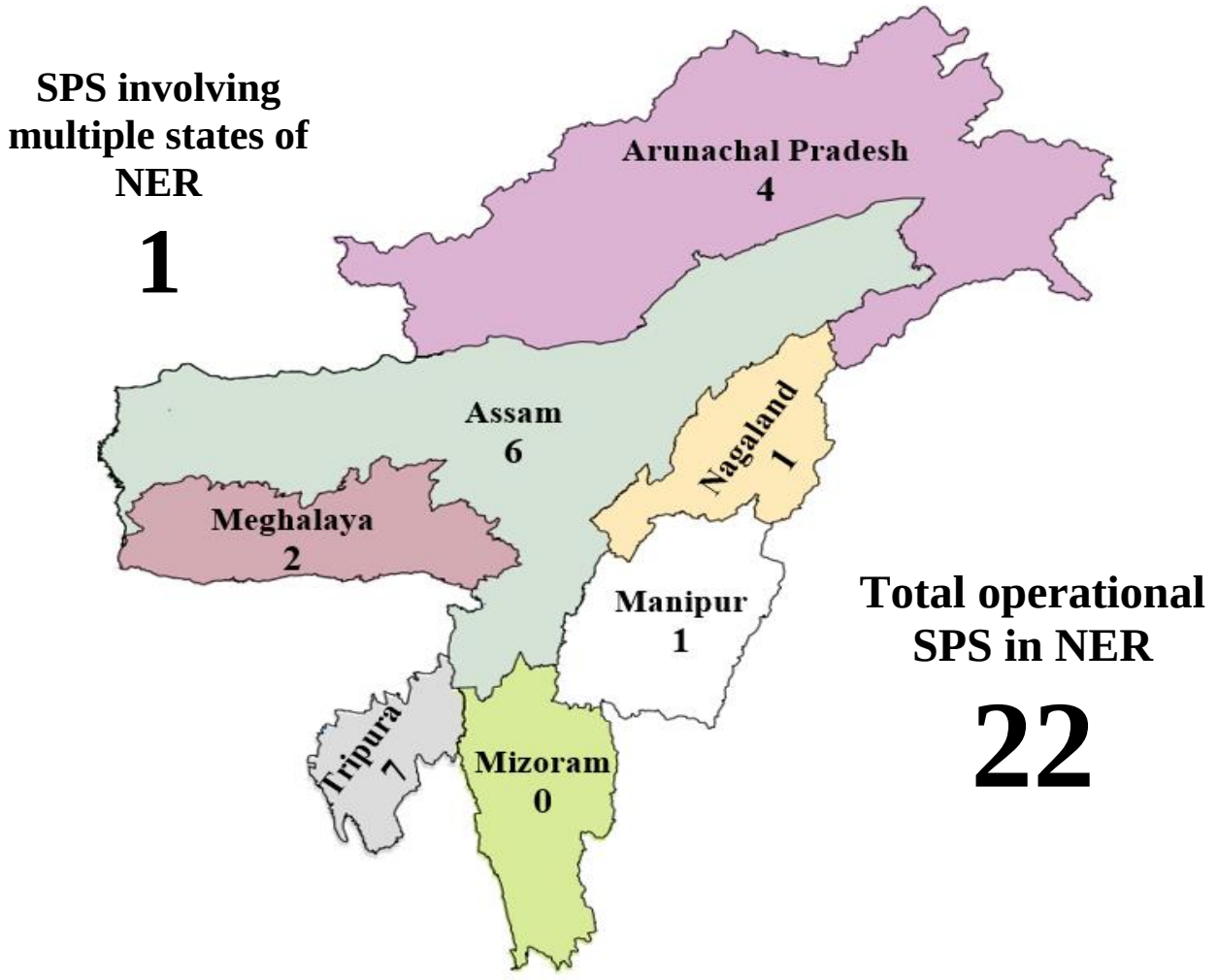


Fig 2: SPS overview of NER

एन.ई.आर में श्रेणीवार एस.पी.एस वितरण / Category wise SPS Distribution in NER

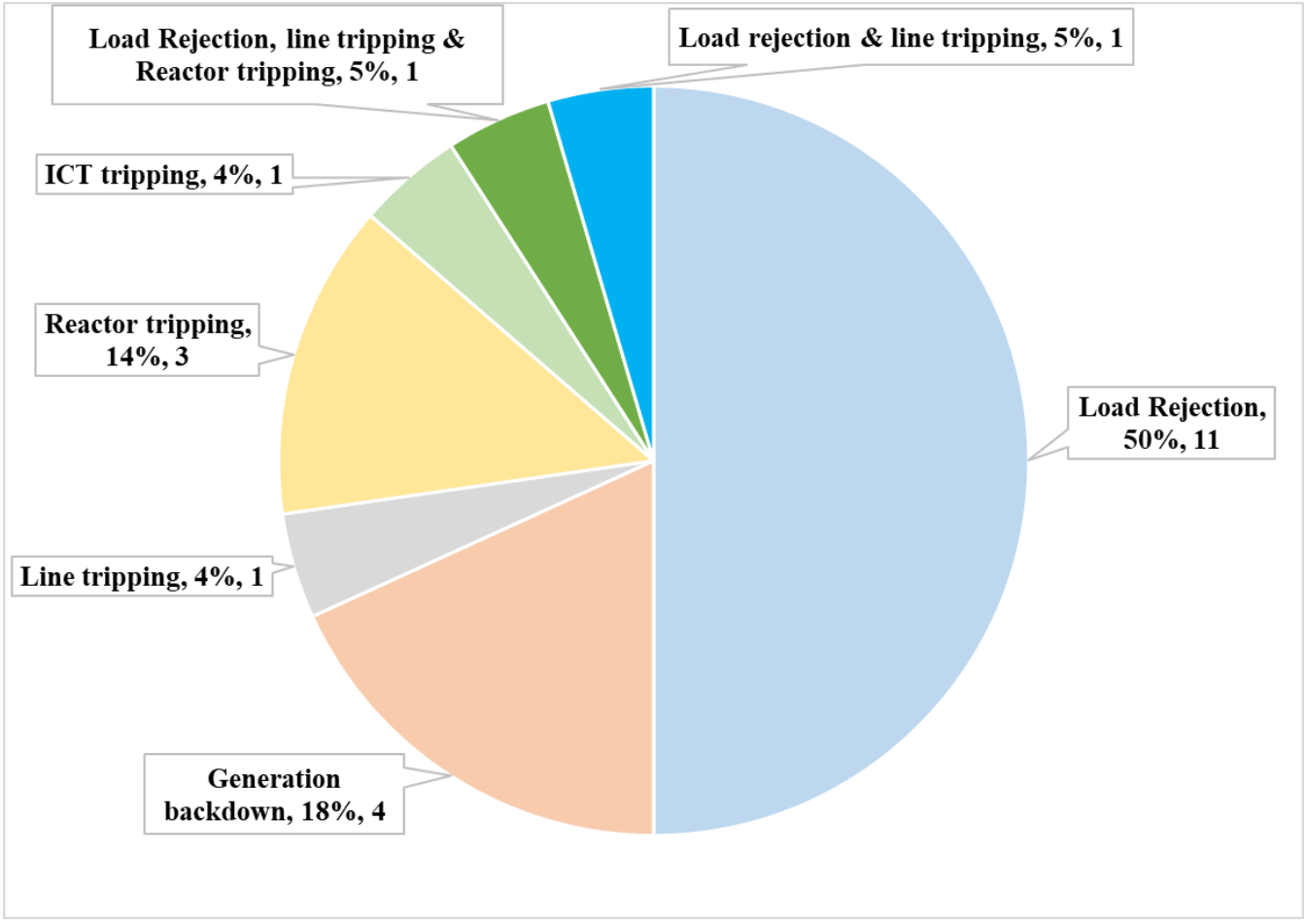


Fig 3: Category wise SPS distribution in NER

C. विनियामक आवश्यकताएँ / Regulatory Requirements :

As per clause 29(14) under System Security of the IEGC-2023,
NLDC, RLDCs, SLDCs, CTU, STUs or users may identify the requirement of System Protection Schemes (SPS) (including inter-tripping and run-back) in the power system to operate the transmission system within operating limits and to protect against situations such as voltage collapse, cascade tripping and tripping of important corridors/flow-gates. Any such SPS at the intra-regional level shall be finalized by the concerned RPC.
SPS at the inter-regional and cross-border levels shall be finalized by the NLDC in coordination with the concerned RPCs. SPS shall be installed and commissioned by the concerned users. SPS shall always be kept in service. If any SPS at the intra-regional level is to be taken out of service, the permission of the concerned RLDC shall be required. If any SPS at the inter-regional and cross-border levels is to be taken out of service, permission of NLDC shall be required.

As per clause 16 (System Protection Scheme) of IEGC-2023,

1. SPS for identified system shall have redundancies in measurement of input signals and communication paths involved up to the last mile to ensure security and dependability.

2. For the operational SPS, RLDC or NLDC, as the case may be, in consultation with the concerned RPC(s) shall perform regular load flow and dynamic studies and mock testing for reviewing SPS parameters & functions, at least **once** in a year. RLDC or NLDC shall share the report of such studies and mock testing including any short comings to respective RPC(s). The data for such studies shall be provided by CTU to the concerned RPC, RLDC and NLDC.

3. The users and SLDCs shall report about the operation of SPS immediately and **detailed report** shall be submitted within **three days** of operation to the concerned RPC and RLDC in the format specified by the respective RPCs.

4. The performance of SPS shall be assessed as per the **protection performance indices** specified in these Regulations. In case, the SPS fails to operate, the concerned User shall take corrective actions and submit a **detailed report** on the **corrective actions** taken to the concerned RPC within a fortnight.

As per clause. 4.3 of planning Criteria

After suffering single contingency (N-1), grid is still vulnerable to experience second contingency, though less probable ('N-1-1'), wherein some of the equipment's may be loaded up to their emergency limits.
To bring the system parameters back within their normal limits, load shedding/re-scheduling of generation may have to be applied either manually or through automatic system protection schemes (SPS).
Such measures shall generally be applied within one and a half hour (1½) after the disturbance

सिस्टम प्रोटेक्शन स्कीम (एसपीएस) के कुप्रचालन की निगरानी / Monitoring of System Protection Scheme (SPS) Mis-operation:

Definition of SPS mis-operations are defined as follows:

i. Failure to Operate – Any failure of a SPS to perform its intended function within the designed time when system conditions intended to trigger the SPS occurs;

ii. Failure to Arm – Any failure of a SPS to automatically arm itself for system conditions that are intended to result in the SPS being automatically armed;

iii. Unnecessary Operation – Any operation of a SPS that occurs without the occurrence of the intended system trigger condition(s);

iv. Unnecessary Arming – Any automatic arming of a SPS that occurs without the occurrence of the intended arming system condition(s); and

v. Failure to Reset – Any failure of a SPS to automatically reset following a return of normal system conditions if that is the system design intent any change in network/ modification.

Objectives:

i. Reporting of all SPS mis-operation
ii. Analysis of all SPS Mis-operations and/or
iii. Mitigation of all SPS Mis-operations

D. एनईआर में एसपीएस की सूची / List of SPS in NER:

Normally all the System protection schemes are proposed, discussed and getting approved in RPC meetings such as OCC, PCC, TCC and RPC Board meetings.

The Summary of System Protection Schemes (SPS) both inter/Intra regional including cross border SPS which are in service, and no of schemes Approved, no of schemes under implementation stage are detailed below:

क्र.सं./ Sl. No	क्षेत्र / Region	कार्यरत योजनाओं की संख्या / No. of Schemes in service	चर्चा के अंतर्गत योजनाओं की संख्या / No. of Schemes under discusssion	स्वीकृत एवं कार्यान्वयनाधीन योजनाओं की संख्या / No of schemes approved and under Implementation
1	**SPS in NER**	22	1*	2

***No. of Schemes under discussion: SPS related to Bangladesh**

The System Protection Schemes for inter / intra-regional corridor (Region wise) divided in to five categories as stated below.

a) SPS related to tripping of critical line / corridor
b) SPS related to safe evacuation of Generation
c) SPS related to overloading of Transformers
d) SPS related to maintaining transfer capability
e) SPS related to under voltage condition

Brief Overview of SPS in North-Eastern Region which are in service is listed below:

क्र.सं./ Sl. No	एस.पी.एस संचालनाधीन / SPS Under Operation
1	**SPS/MS/001:** Ensuring reliable power supply to Arunachal Pradesh & Assam through the 132 kV Roing-Chapakhowa D/C line
2	**SPS/AP/001:** Overloading of any one of the 400/132kV, 2x360 MVA ICTs at Panyor Lower Hydro Power Station
3	**SPS/AP/002:** Outage of 132 kV Panyor LHPS- Ziro (PG) Line
4	**SPS/AP/003:** SPS at Tezu substation related to prevention of Under Voltage scenario in Arunachal Pradesh power system
5	**SPS/AP/004:** SPS at Namsai substation related to prevention of Under Voltage scenario in Arunachal Pradesh power system
6	**SPS/AS/001:** Overloading of 220 kV BTPS - Salakati D/C Line

क्र.सं./ Sl. No	एस.पी.एस संचालनाधीन / SPS Under Operation
7	**SPS/AS/002:** Related to the safe evacuation of power from BgTPP(NTPC) generation
8	**SPS/AS/003:** Outage of 220 kV BTPS (Salakati) – Rangia I & II Line
9	**SPS/AS/004:** Outage/tripping of 220 kV Azara-Sarusajai DC Line
10	**SPS/AS/005:** Tripping of 220 kV Misa- Samaguri DC Line
11	**SPS/AS/006:** Outage/tripping of any one circuit of 220 kV Balipara-Sonabil D/C
12	**SPS/MA/001:** Outage/tripping of 400 kV New Kohima – Imphal D/C Line
13	**SPS/ME/001:** Outage/tripping of any one circuit of the 132 kV Khliehriat (PG)- Khliehriat D/C line
14	**SPS/ME/002:** Outage/tripping of any one circuit of 132 kV Leshka – Khliehriat D/C Line
15	**SPS/NA/001:** Outage/tripping of any one circuit of 132 kV Dimapur(PG)- Dimapur(NA) D/C Line
16	**SPS/TR/001:** Secure evacuation of power from the Monarchak (NEEPCO) Power Plant
17	**SPS/TR/002:** Outage/ tripping of both circuits of 400 kV SM Nagar(NTL) -PK Bari(NTL) D/C Line
18	**SPS/TR/003:** Outage/ tripping of both circuits of 400kV PK Bari (NTL) – Silchar(PG) Line
19	**SPS/TR/004:** Outage/tripping of 400kV Palatana-Silchar D/C Line when both modules of Palatana are in service.
20	**SPS/TR/005:** Overloading of 132 kV Surajmaninagar (TSECL)- Surajmaninagar (NTL) Line
21	**SPS/TR/006:** Outage/tripping of 400 kV Palatana – Surajmani Nagar line (charged at 132 kV)
22	**SPS/TR/007:** Outage/tripping of both 400/132 kV, 2x125 MVA ICTs at Palatana

क्र.सं./ Sl. No	कार्यान्वयन के अंतर्गत एस.पी.एस. / SPS Under Implementation
1	SPS scheme at Pasighat substation related to overloading of 132 kV Tinsukia-Rupai/132 kV Tinsukia-Ledo Lines
2	SPS scheme at BTPS(Assam) substation related to overloading of any of the 2x160 MVA ICTs at BTPS(Assam)

क्र.सं./ Sl. No	एस.पी.एस पर चर्चा शास्रार्थ / SPS Under Discussion
1	SPS related to Outage of one circuit of 400 kV Surajmani Nagar (TSECL)- South Comilla line (Charged at 132 kV)

E. सेवा में एस.पी.एस. योजनाएं / SPS Schemes under operation

I. पूर्वोत्तर के कई राज्यों को शामिल करने वाली एस.पी.एस. / SPS involving multiple States of NER:

विषय /Item	सूचना स्पष्टीकरण / Information Explanation
योजना का नाम / Scheme Name	**SPS/MS/001:** 132 केवी रोइंग-चापाखोवा दोहरा सर्किट लाइन के माध्यम से अरुणाचल प्रदेश और असम को विश्वसनीय बिजली आपूर्ति सुनिश्चित करना / Ensuring reliable power supply to Arunachal Pradesh & Assam through the 132 kV Roing-Chapakhowa D/C line
रिपोर्टिंग पार्टी / Reporting party	AEGCL, PGCIL
वर्गीकरण/ Classification	SPS related to Overloading of Critical line(s)
संदर्भ संक्या/ Reference No.	**SPS/MS/001**
संचालन प्रक्रिया / Operating Procedure	N/A
डिज़ाइन उद्देश्य / Design Objectives	To relieve impact of tripping of either 132 kV Tinsukia-Ledo or Tinsukia-Rupai Line and secure operation thereafter.
संचालन / Operation	Load shedding in Rupai area of Assam and disconnection of line and Bus Reactor depending on SPS operation.
मोडलिंग/ Modelling	**Description:** 132 kV Tinsukia-Ledo line and 132 kV Tinsukia-Rupai line serves as crucial lines for ensuring reliable power supply to Arunachal Pradesh from Assam through the 132 kV Roing-Chapakhowa DC lines. On tripping of 132 kV Tinsukia-Ledo line or 132 kV Tinsukia-Rupai line, overloading scenario will arise. Loading of 132 kV Tinsukia-Ledo line or 132 kV Tinsukia-Rupai line should be limited to 60 MW (corresponding to 260 A), hence load disconnection is required in Assam and Arunachal Pradesh Power system.

Network diagram:

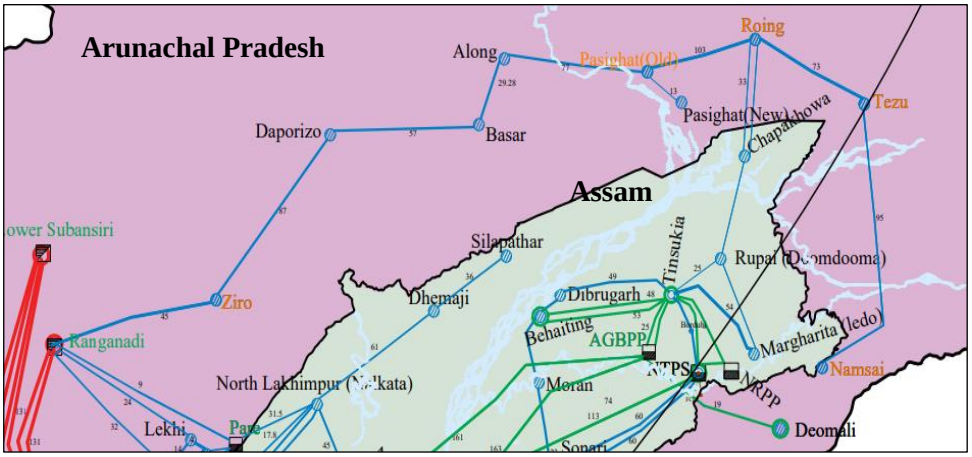


Fig 4: Network diagram

Triggering of Criteria 1:

On tripping of either 132 kV Tinsukia-Ledo or 132 kV Tinsukia-Rupai line with current exceeding **300 A** for 1.7 seconds in 132kV Tinsukia - Rupai or 132 kV Tinsukia - Ledo line will lead to the operation of the Criteria 1. The 132 kV Chapakhowa- Roing D/C line will open at both substation along with 20 MVAR Bus Reactor at Roing (PG) substation and disconnection of 8-10 MW load from 132kV Rupai substation if overloading over 300 A exists for 2.9 sec.

Logic Diagram:

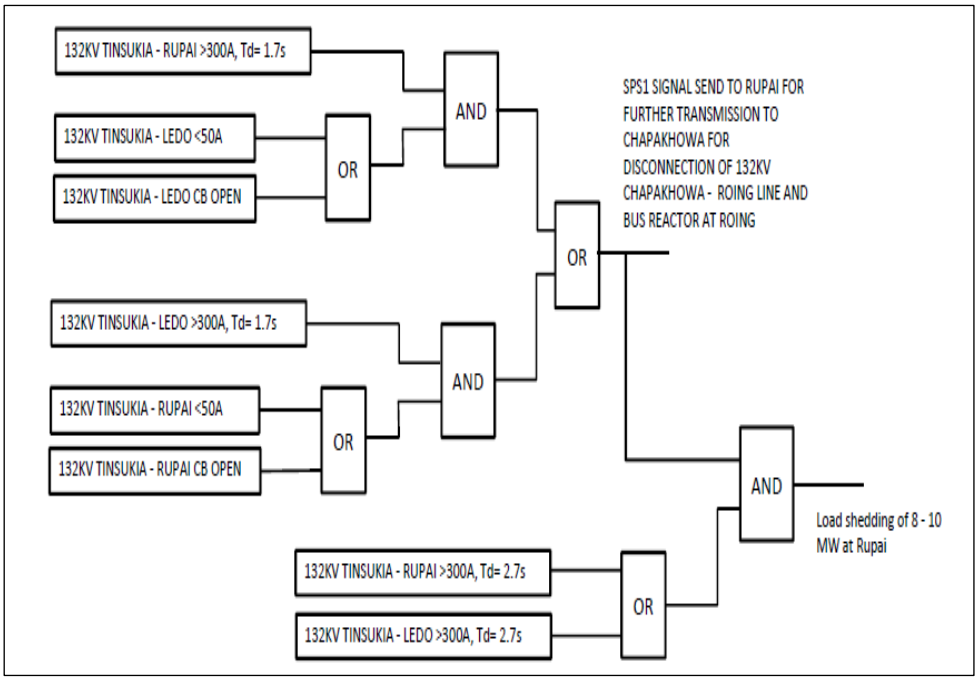
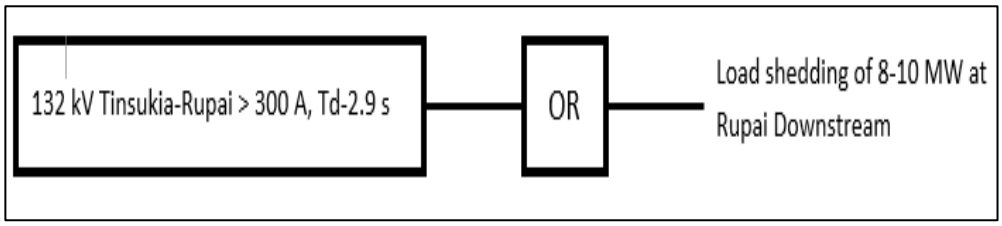


Fig 5: Logic diagram implemented at Tinsukia Substation of Assam

	Triggering of Criteria 2: Whenever the current in 132 kV Tinsukia-Rupai Line crosses 300 A for 2.9 seconds (which might happen during tripping/Outage of 132 kV Paynor LHPS – Ziro line), 8-10 MW load at Rupai S/S will be shed to mitigate the overloading of 132 kV Tinsukia-Rupai line.  Fig 6: Logic diagram implemented at Rupai Substation of Assam
मूल सेवा वर्ष / Original In-Service Year	08-Sep-2024
हालिया मूल्यांकन समूह / Recent Assessment Group	AEGCL, PGCIL, NERLDC & NERPC
हाल की मूल्यांकन तिथि / Recent Assessment Date	NA

क्र.सं./ Sl. No	समीक्षा के लिए चेकलिस्ट / Checklist for review	हाँ/ना/ Yes/ No
I.	Does the scheme describe the intended purposes, conditions, and actions?	Yes
II.	Do the modelling and its intended actions appear to achieve the desired systemperformance objectives?	Yes
III.	Are the actions permissible in accordance with Transmission Planning Criteria (or any other applicable criteria)?	Yes
IV.	Do the actions satisfy Transmission Planning Criteria?	Yes
V.	Has the scheme been assessed within the last 5 years?	NA
VI.	Are the set thresholds of actions appropriate to meet system performance objectives?	Yes
VII.	Is the logic event-based only (as opposed to partly/fully parameter-based) which does not pose high potential for interaction with other schemes in the same region?	Yes
VIII.	Is the effect of inadvertent activation or failure to operate likely to be local (as opposed to widespread)?	Yes
IX.	Are the near-term system plans unlikely to have a significant effect on the scheme which would warrant its re-assessment (including its continued need, serving the intended purposes, and meeting current performance requirements)?	Yes
X.	Is the level of redundancy appropriate?	Yes
XI.	Has coordination or adverse interaction with other schemes been evaluated?	Yes

II. अरुणाचल प्रदेश में एस.पी.एस. / SPS in Arunachal Pradesh:

विषय /Item	सूचना स्पष्टीकरण / Information Explanation
योजना का नाम / Scheme Name	**SPS/AP/001:** पन्योर लोअर हाइड्रो पावर स्टेशन पर 400/132 केवी, 2x360 एम.वी.ए आई.सी.टी में से किसी एक का ओवरलोडिंग / Overloading of any one of the 400/132 kV, 2x360 MVA ICTs at Panyor Lower Hydro Power Station
रिपोर्टिंग पार्टी / Reporting party	Paynor LHPS (NEEPCO)
वर्गीकरण/ Classification	SPS related to Safe evacuation of Generation
संदर्भ संक्या/ Reference No.	**SPS/AP/001**
संचालन प्रक्रिया / Operating Procedure	N/A
डिज़ाइन उद्देश्य / Design Objectives	For safeguarding of 400/132 kV ICTs at Paynor LHPS during N-1 contingency due to overloading.
संचालन / Operation	**Triggering of Criteria 1:** One Unit of Paynor LHPS will trip if any of the ICT loading >130% for 2 seconds. **Triggering of Criteria 2:** One Unit of Paynor LHPS and One Unit of Pare HEP will trip if any of the ICT loading >145% (Under Implementation stage)
मोडलिंग/ Modelling	**Description:** Evacuation of Paynor LHPS generation (3*135 = 405 MW) and Pare HEP generation (2*55= 110 MW) is mainly through 400 kV Paynor LHPS – Biswanath Chariali D/C. Generating Units of Paynor LHPS and Pare HEP are connected in 132 kV system only, which leads to high loading of 2*360 MVA ICT at Paynor LHPS. Also, N-1 contingency of 2*360 MVA ICT is not satisfied during peak hydro season.

Network Diagram:

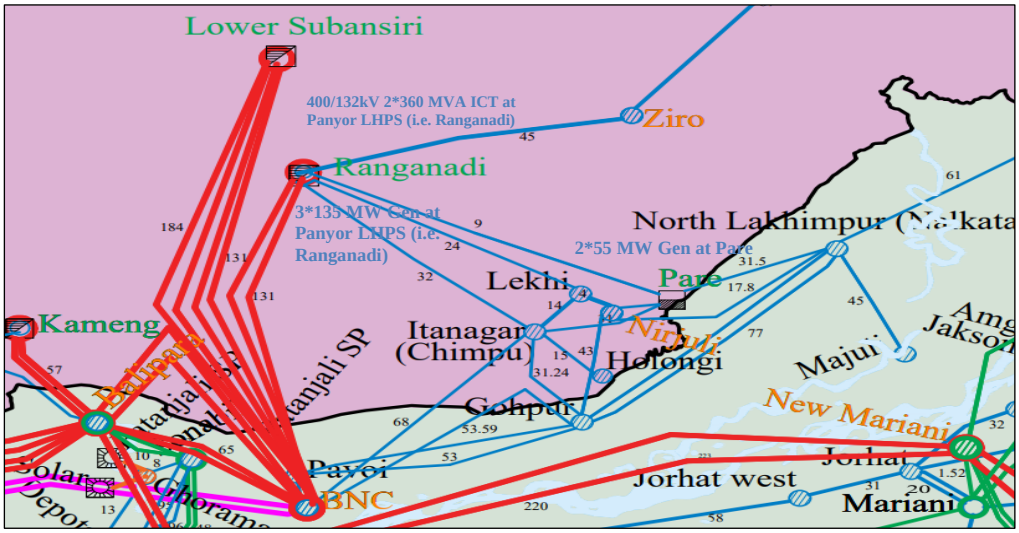


Fig 7: Network diagram

Triggering of Criteria 1:

As per the scheme, when loading in any of the ICT will cross 130% for 2 seconds, SPS will resulted into the tripping of 135 MW, Unit III at Panyor LHPS. Tripping of Unit will result in lowering the loading of ICT at RHEP.
Hence, reliability of Panyor LHPS & Pare HEP generation and Capital load of Arunachal Power system will improve.

Logic Diagram:

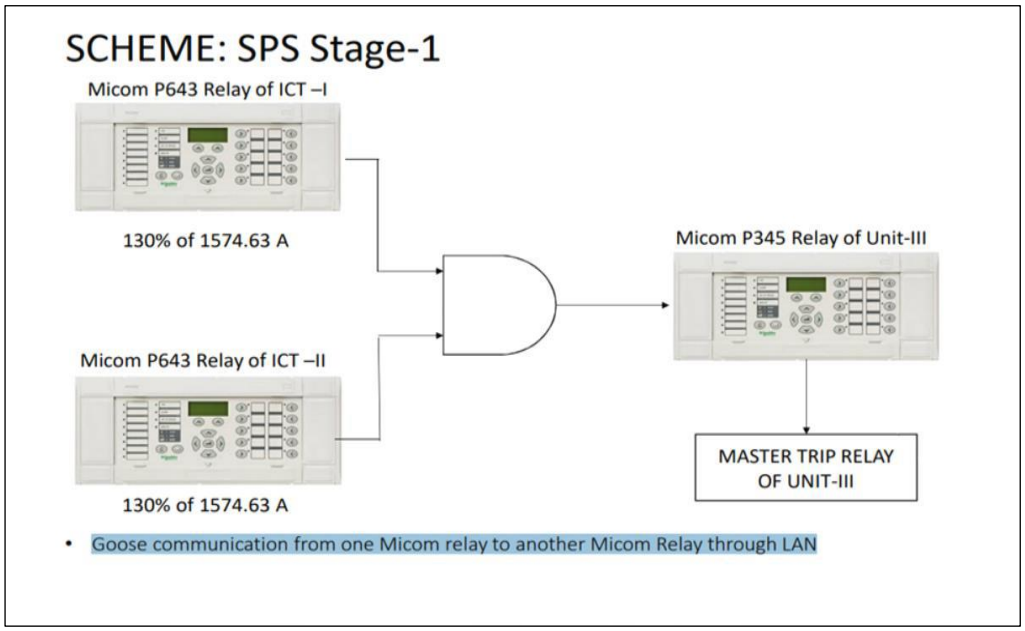
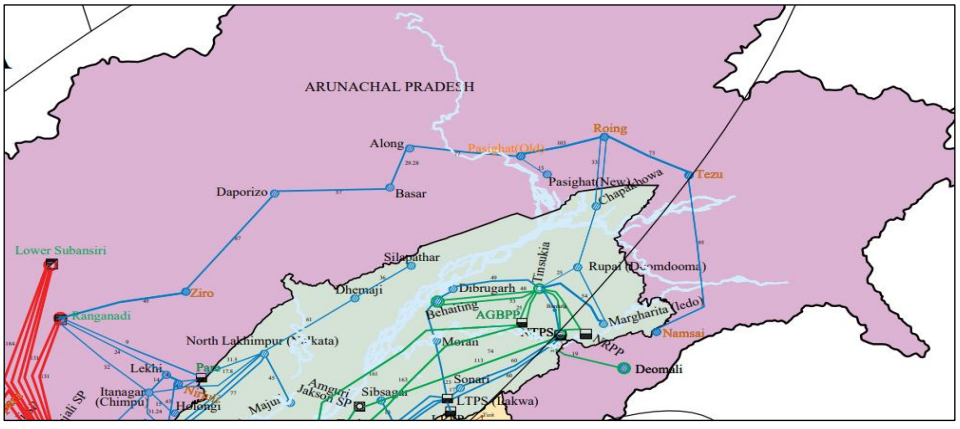
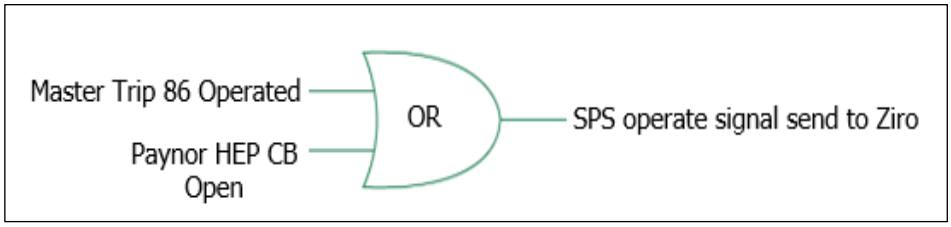
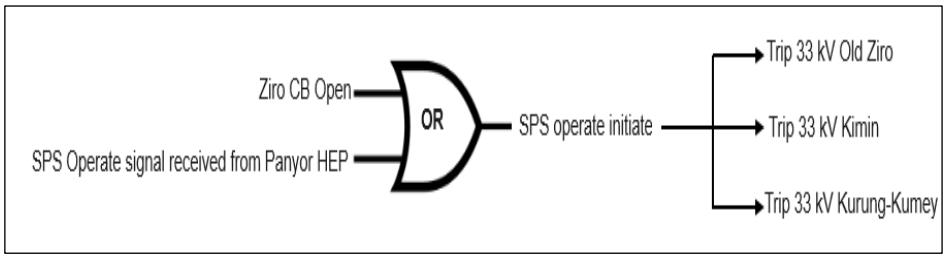


Fig 8: Logic diagram implemented at Panyor LHPS

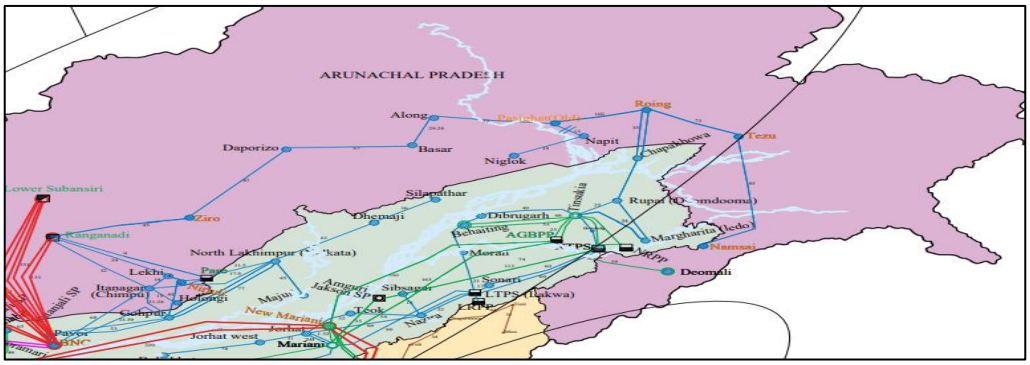
	Triggering of Criteria 2: One Unit of RHEP and One Unit of Pare HEP will trip if any of the ICT loading >145%. Tripping of Units will result in lowering the loading of ICT at Paynor LHPS. ***Presently, only Logic I is in service while Logic II is under implementation stage.***
मूल सेवा वर्ष / Original In-Service Year	**2024**
हालिया मूल्यांकन समूह / Recent Assessment Group	Paynor LHPS (NEEPCO), DoP AP, NERLDC & NERPC
हाल की मूल्यांकन तिथि / Recent Assessment Date	Mock testing performed on 13-Dec-24

क्र.सं./ Sl. No	समीक्षा के लिए चेकलिस्ट / Checklist for review	हाँ/ना/Yes/No
I.	Does the scheme describe the intended purposes, conditions, and actions?	Yes
II.	Do the modelling and its intended actions appear to achieve the desired system performance objectives?	Yes
III.	Are the actions permissible in accordance with Transmission Planning Criteria (or any other applicable criteria)?	Yes
IV.	Do the actions satisfy Transmission Planning Criteria?	Yes
V.	Has the scheme been assessed within the last 5 years?	Yes
VI.	Are the set thresholds of actions appropriate to meet system performance objectives?	Yes
VII.	Is the logic event-based only (as opposed to partly/fully parameter-based) which does not pose high potential for interaction with other schemes in the same region?	Yes
VIII.	Is the effect of inadvertent activation or failure to operate likely to be local (as opposed to widespread)?	Yes
IX.	Are the near-term system plans unlikely to have a significant effect on the scheme which would warrant its re-assessment (including its continued need, serving the intended purposes, and meeting current performance requirements)?	Yes
X.	Is the level of redundancy appropriate?	Yes
XI.	Has coordination or adverse interaction with other schemes been evaluated?	Yes

विषय /Item	सूचना स्पष्टीकरण / Information Explanation
योजना का नाम / Scheme Name	**SPS/AP/002:** 132 केवी पनयोर एल.एच.पी.एस- जीरो (पीजी) लाइन में आउटेज / Outage of 132 kV Panyor LHPS- Ziro (PG) Line
रिपोर्टिंग पार्टी / Reporting party	RHEP (NEEPCO) & PGCIL
वर्गीकरण/ Classification	SPS related to under voltage condition
संदर्भ संख्या/ Reference No.	**SPS/AP/002**
संचालन प्रक्रिया / Operating Procedure	NA
डिज़ाइन उद्देश्य / Design Objectives	Disconnection of 33 kV Load at Ziro (PG) to mitigate low voltage issue in Arunachal Power System and to safeguard overloading of 132 kV Tinsukia-Rupai Line.
संचालन / Operation	**Triggering of Criteria:** Disconnection of 33 kV feeders of Arunachal Pradesh at Ziro(PG)
मोडलिंग/ Modelling	**Description:** The reliability of Ziro, Daporijo, Along, Pasighat, Roing, Tezu, Namsai, Chapakhowa, Ledo and Rupai area has been increased after commissioning of 132 kV Roing- Chapakhowa D/C Line in the month of July 2023. As per System Study, severe low voltage issue may arise on tripping of 132 kV Panyor LHPS-Ziro (PG) line, which may lead to cascading tripping in Arunachal Pradesh powers system. Hence, SPS designed to isolate the downstream load of Ziro substation on tripping/Outage of 132 kV Panyor LHPS-Ziro line. **Network Diagram:**  Fig 9: Network diagram

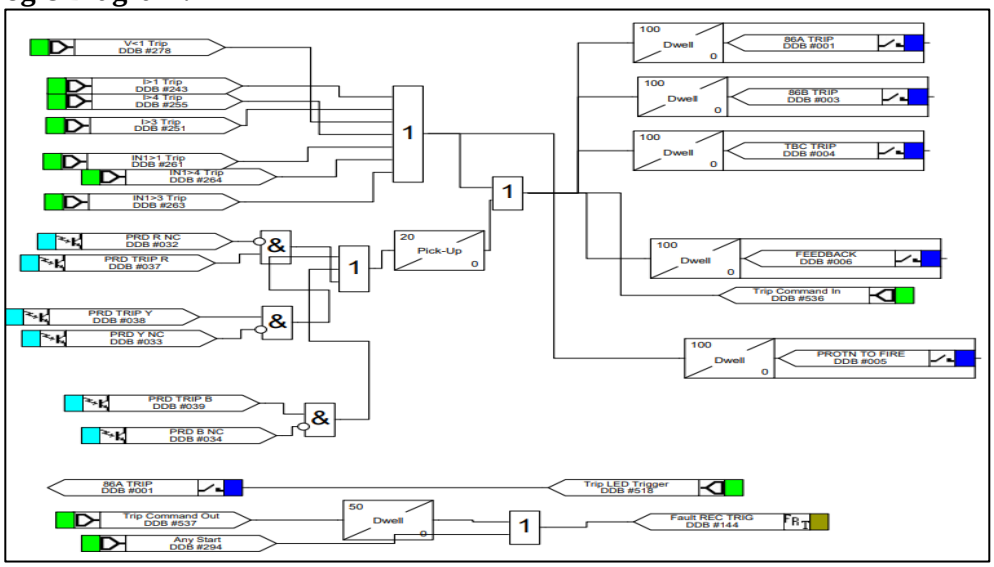
	Triggering of Criteria: Outage/Tripping of 132 kV Panyor LHPS-Ziro(PG) Line will lead to operation of SPS which will trip the following elements at Ziro(PG) to prevent under-voltage scenario in Ziro/Daporizo area of Arunachal Pradesh Power System: i) 33 kV Ziro-Old Ziro Line ii) 33 kV Ziro-Kimin Line and iii) 33 kV Ziro-Kurung-Kumey The loss of 132 kV Panyor LHPS- Ziro Line should initiate the "Operation of SPS". Two major potential events were taken into consideration while designing the SPS: **CASE A:** CB tripped at Ziro end only. **CASE B:** A/R successful at Ziro end, but CB tripped at Panyor LHPS end. As per CASE A and CASE B, "SPS OPERATE LOGIC" configured both at Ziro end and at Panyor LHPS end. **Logic Diagram:**  Fig 10: Logic diagram implemented at Panyor LHPS  Fig 11: Logic diagram implemented at Ziro(PG)
मूल सेवा वर्ष / Original In-Service Year	**2024**
हालिया मूल्यांकन समूह / Recent Assessment Group	Panyor LHPS (NEEPCO), PGCIL, NERLDC & NERPC
हाल की मूल्यांकन तिथि / Recent Assessment Date	Oct'24 (Revised logic at Panyor LHPS taken care the CB open & 86 operation)

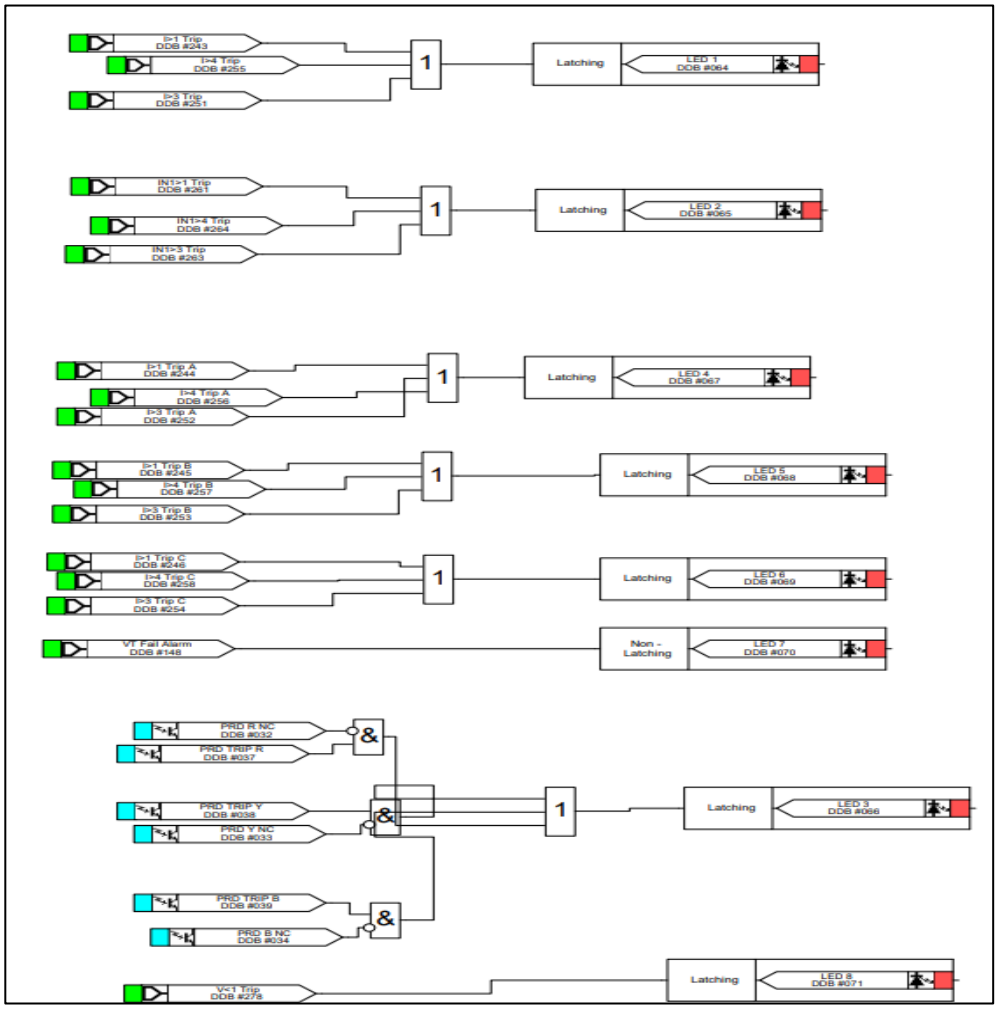
क्र.सं./ Sl. No	समीक्षा के लिए चेकलिस्ट / Checklist for review	हाँ/ना/ Yes/ No
I.	Does the scheme describe the intended purposes, conditions, and actions?	Yes
II.	Do the modelling and its intended actions appear to achieve the desired system performance objectives?	Yes
III.	Are the actions permissible in accordance with Transmission Planning Criteria (or any other applicable criteria)?	Yes
IV.	Do the actions satisfy Transmission Planning Criteria?	Yes
V.	Has the scheme been assessed within the last 5 years?	Yes
VI.	Are the set thresholds of actions appropriate to meet system performance objectives?	Yes
VII.	Is the logic event-based only (as opposed to partly/fully parameter-based) which does not pose high potential for interaction with other schemes in the same region?	Yes
VIII.	Is the effect of inadvertent activation or failure to operate likely to be local (as opposed to widespread)?	Yes
IX.	Are the near-term system plans unlikely to have a significant effect on the scheme which would warrant its re-assessment (including its continued need, serving the intended purposes, and meeting current performance requirements)?	Yes
X.	Is the level of redundancy appropriate?	Yes
XI.	Has coordination or adverse interaction with other schemes been evaluated?	Yes

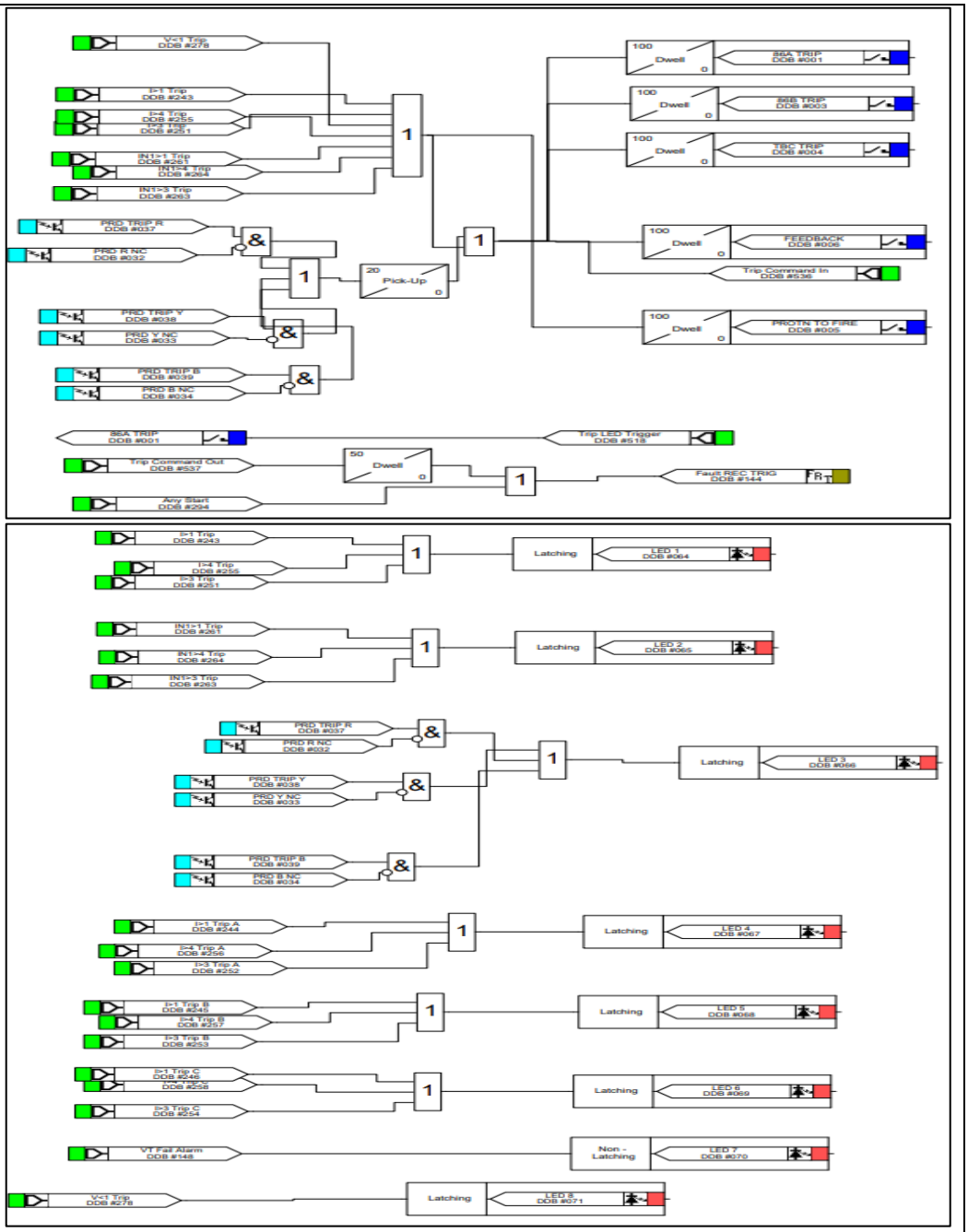
विषय /Item	सूचना स्पष्टीकरण / Information Explanation
योजना का नाम / Scheme Name	**SPS/AP/003:** अरुणाचल प्रदेश बिजली प्रणाली में अंडर वोल्टेज परिदृश्य की रोकथाम से संबंधित तेजू सबस्टेशन पर एस.पी.एस / SPS at Tezu substation related to prevention of Under Voltage scenario in Arunachal Pradesh power system
रिपोर्टिंग पार्टी / Reporting party	PGCIL
वर्गीकरण/ Classification	SPS related to low voltage issue
संदर्भ संख्या/ Reference No.	**SPS/AP/003**
संचालन प्रक्रिया / Operating Procedure	NA
डिज़ाइन उद्देश्य / Design Objectives	The objective is to mitigate low voltage issues at Tezu Substations by implementing a coordinated load-shedding scheme through automatic disconnection of 132/33 kV ICTs during specific low-voltage conditions.
संचालन / Operation	**Triggering of criteria:** If voltage at Tezu drops to 105 kV for 2.5 seconds, then trip the HV side CB of ICTs at Tezu
मोडलिंग/ Modelling	**Description:** With the addition of load at Niglok area of Arunachal Pradesh of around 18 MW, there has been a significant impact in voltage scenario of Arunachal Pradesh power system. As per System Study, severe low voltage issue may arise in Arunachal Pradesh power system which may lead to cascading tripping. Hence, this SPS is designed to mitigate low voltage issues at Tezu Substations by implementing a coordinated load-shedding scheme through automatic disconnection of 132/33 kV ICTs during specific low-voltage conditions. **Network Diagram:**  Fig 12: Network diagram

Triggering of Criteria: If voltage at Tezu drops to 105 kV for 2.5 seconds, then a signal will be generated to trip the HV side CB of ICTs at Tezu.

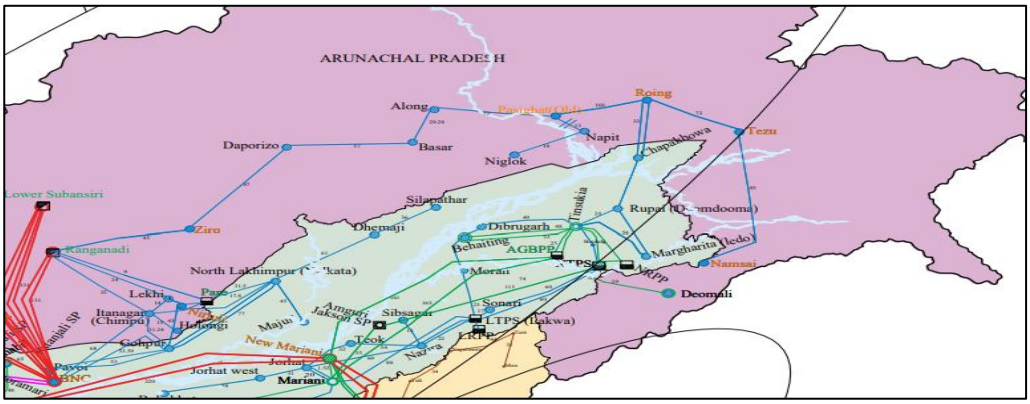
Logic Diagram:

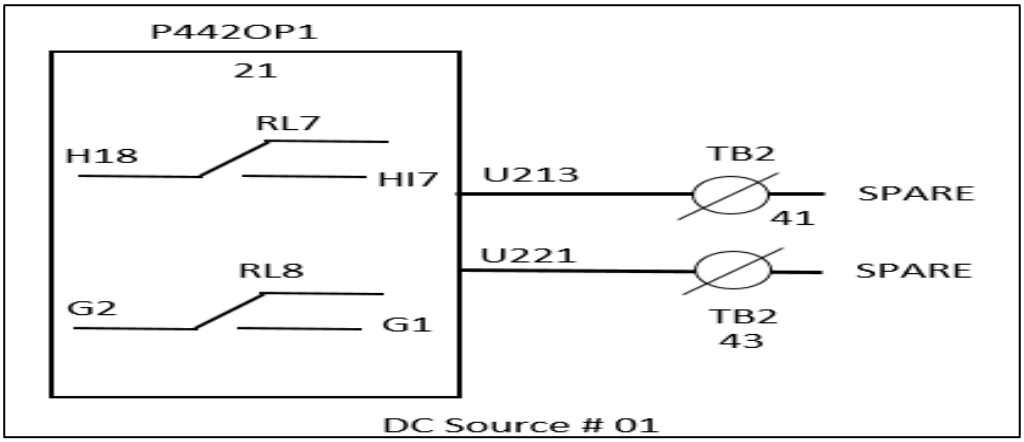
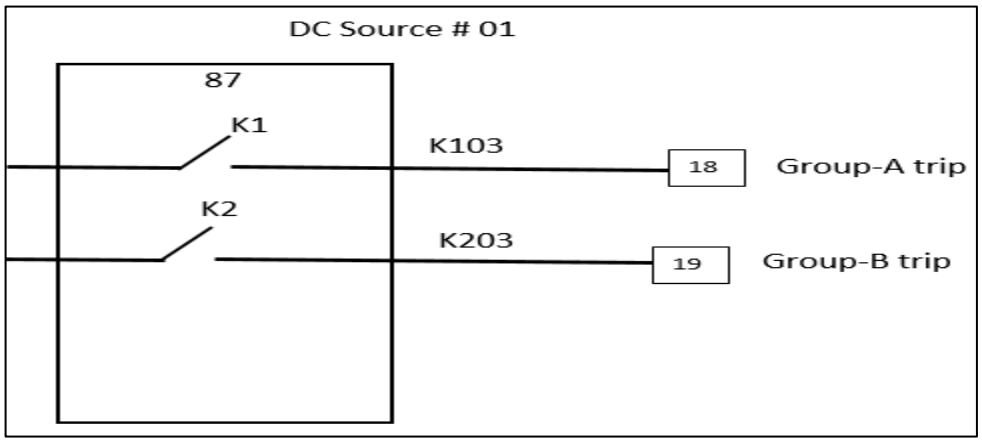




	 Fig 13: PSL at ICT-1 & ICT-2
मूल सेवा वर्ष / Original In-Service Year	**12-Dec-24**
हालिया मूल्यांकन समूह / Recent Assessment Group	POWERGRID, NERLDC & NERPC
हाल की मूल्यांकन तिथि / Recent Assessment Date	NA

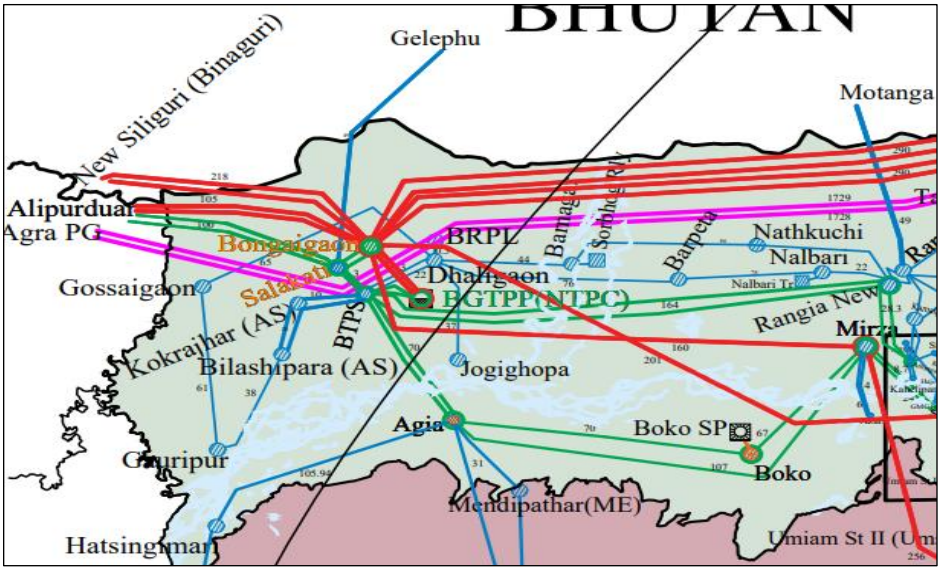
क्र.सं./ Sl. No	समीक्षा के लिए चेकलिस्ट / Checklist for review	हाँ/ना/ Yes/ No
I.	Does the scheme describe the intended purposes, conditions, and actions?	Yes
II.	Do the modelling and its intended actions appear to achieve the desired system performance objectives?	Yes
III.	Are the actions permissible in accordance with Transmission Planning Criteria (or any other applicable criteria)?	Yes
IV.	Do the actions satisfy Transmission Planning Criteria?	Yes
V.	Has the scheme been assessed within the last 5 years?	NA
VI.	Are the set thresholds of actions appropriate to meet system performance objectives?	Yes
VII.	Is the logic event-based only (as opposed to partly/fully parameter-based) which does not pose high potential for interaction with other schemes in the same region?	Yes
VIII.	Is the effect of inadvertent activation or failure to operate likely to be local (as opposed to widespread)?	Yes
IX.	Are the near-term system plans unlikely to have a significant effect on the scheme which would warrant its re-assessment (including its continued need, serving the intended purposes, and meeting current performance requirements)?	Yes
X.	Is the level of redundancy appropriate?	Yes
XI.	Has coordination or adverse interaction with other schemes been evaluated?	Yes

विषय /Item	सूचना स्पष्टीकरण / Information Explanation
योजना का नाम / Scheme Name	**SPS/AP/004:** अरुणाचल प्रदेश बिजली प्रणाली में अंडर वोल्टेज परिदृश्य की रोकथाम से संबंधित नामसाई सबस्टेशन पर एस.पी.एस / SPS at Namsai substation related to prevention of Under Voltage scenario in Arunachal Pradesh power system
रिपोर्टिंग पार्टी / Reporting party	PGCIL
वर्गीकरण/ Classification	SPS related to low voltage issue
संदर्भ संक्या/ Reference No.	**SPS/AP/004**
संचालन प्रक्रिया / Operating Procedure	NA
डिज़ाइन उद्देश्य / Design Objectives	The objective is to mitigate low voltage issues at Namsai Substation by implementing a coordinated load-shedding scheme through automatic disconnection of 132/33 kV ICTs during specific low-voltage conditions.
संचालन / Operation	**Triggering of criteria:** If voltage at Namsai drops to 105 kV for 2.5 seconds, then trip the HV side CB of ICTs at Namsai
मोडलिंग/ Modelling	**Description:** With the addition of load at Niglok area of Arunachal Pradesh of around 18 MW, there has been a significant impact in voltage scenario of Arunachal Pradesh power system. As per System Study, severe low voltage issue may arise in Arunachal Pradesh power system which may lead to cascading tripping. Hence, this SPS is designed to mitigate low voltage issues at Tezu Substations by implementing a coordinated load-shedding scheme through automatic disconnection of 132/33 kV ICTs during specific low-voltage conditions. **Network Diagram:**  Fig 14: Network diagram

	Triggering of Criteria: If voltage at Namsai drops to 105 kV for 2.5 seconds, then a signal will be generated to trip the HV side CB of ICTs at Namsai. **Logic Diagram:**  Under voltage condition in P442(21) 132 kV Tezu line bay U/V setting in any feeder – 105 kV, Td-2.5 s Output contact assigned –RL7 RL7 will be hardwired to  Fig 15: Logic diagram implemented at Namsai
मूल सेवा वर्ष / Original In-Service Year	**Dec-24**
हालिया मूल्यांकन समूह / Recent Assessment Group	POWERGRID, NERLDC & NERPC
हाल की मूल्यांकन तिथि / Recent Assessment Date	NA

क्र.सं./ Sl. No	समीक्षा के लिए चेकलिस्ट / Checklist for review	हाँ/ना/ Yes/ No
I.	Does the scheme describe the intended purposes, conditions, and actions?	Yes
II.	Do the modelling and its intended actions appear to achieve the desired system performance objectives?	Yes
III.	Are the actions permissible in accordance with Transmission Planning Criteria (or any other applicable criteria)?	Yes
IV.	Do the actions satisfy Transmission Planning Criteria?	Yes
V.	Has the scheme been assessed within the last 5 years?	NA
VI.	Are the set thresholds of actions appropriate to meet system performance objectives?	Yes
VII.	Is the logic event-based only (as opposed to partly/fully parameter-based) which does not pose high potential for interaction with other schemes in the same region?	Yes
VIII.	Is the effect of inadvertent activation or failure to operate likely to be local (as opposed to widespread)?	Yes
IX.	Are the near-term system plans unlikely to have a significant effect on the scheme which would warrant its re-assessment (including its continued need, serving the intended purposes, and meeting current performance requirements)?	Yes
X.	Is the level of redundancy appropriate?	Yes
XI.	Has coordination or adverse interaction with other schemes been evaluated?	Yes

III. असम में एस.पी.एस / SPS in Assam:

विषय /Item	सूचना स्पष्टीकरण / Information Explanation
योजना का नाम / Scheme Name	**SPS/AS/001:** 220 केवी बीटीपीएस - सलाकाती दोहरा सर्किट लाइन पर ओवरलोडिंग / Overloading of 220 kV BTPS - Salakati D/C Line
रिपोर्टिंग पार्टी / Reporting party	AEGCL
वर्गीकरण/ Classification	SPS related to Tripping of critical line(s) / corridor
संदर्भ संक्या/ Reference No.	**SPS/AS/001**
संचालन प्रक्रिया / Operating Procedure	N/A. After upgradation of 220 kV BTPS-Salakati D/C lines, this SPS is kept OFF (Discussion: Minutes of 63rd PCCM |18th January 2024).
डिज़ाइन उद्देश्य / Design Objectives	Reduce overloading of 220 kV BTPS - Salakati D/C Line
संचालन / Operation	Tripping of 220 kV Agia – Boko and 220 kV Agia – Mirza Line
मोडलिंग/ Modelling	**Description:** 220 kV BTPS - Salakati D/C Line along with 400 kV Bongaigaon(PG)-BgTPP(NTPC) provide important link for evacuation of 750 MW generation from BgTPP(NTPC) in NER Grid. **Network Diagram:**  Fig 16: Network diagram

Triggering of Criteria:

When the current flow in either of the 220 kV BTPS (Salakati) - Salakati (PG) Circuit I and II crosses 824 A for 1.1 sec, an "SPS operate" signal would be sent from BTPS to Agia via OPGW network.

On receipt of the SPS operate signal at Agia, the 220 kV Agia - Boko and 220 kV Agia - Mirza Circuit Breakers are tripped. This is done to prevent overloading of the 220 kV BTPS– Salakati (PG) lines.

Definite Time Non-Directional Overcurrent Protection has been used (50) with a time delay of 1.1s and pickup of 824 A. The SPS will be blocked in case of pickup of Dir-Earth fault protection (67N) and start of Zones of Distance Protection (21).

Logic Diagram:

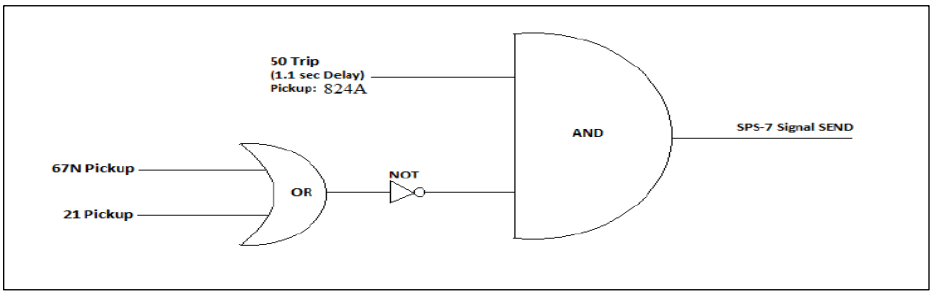


Fig 17: Logic diagram implemented at BTPS end for 220 kV BTPS (Salakati)– Salakati (PG) ckt I & II in Main 1 Relay

Connection Diagram:

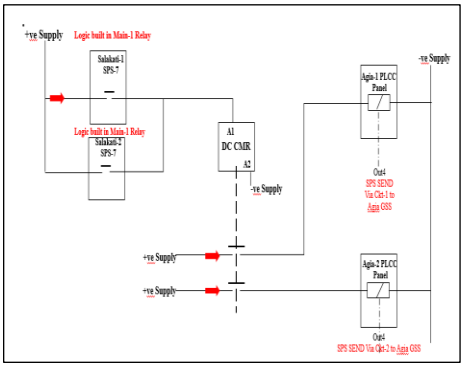


Fig 18: BTPS

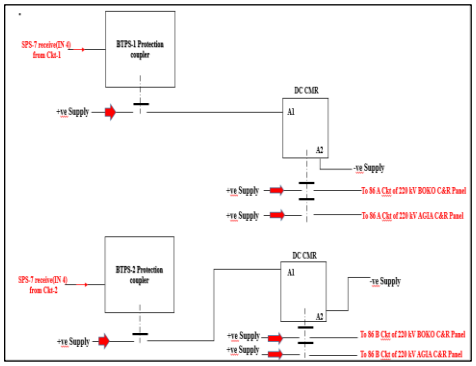
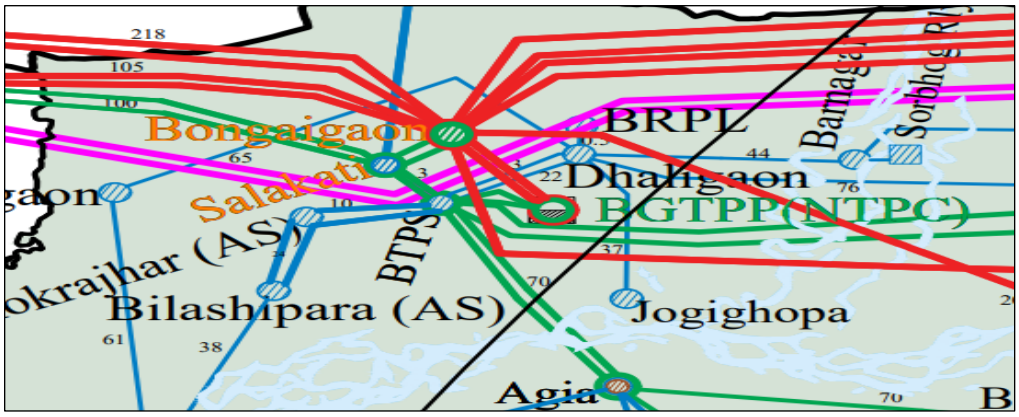
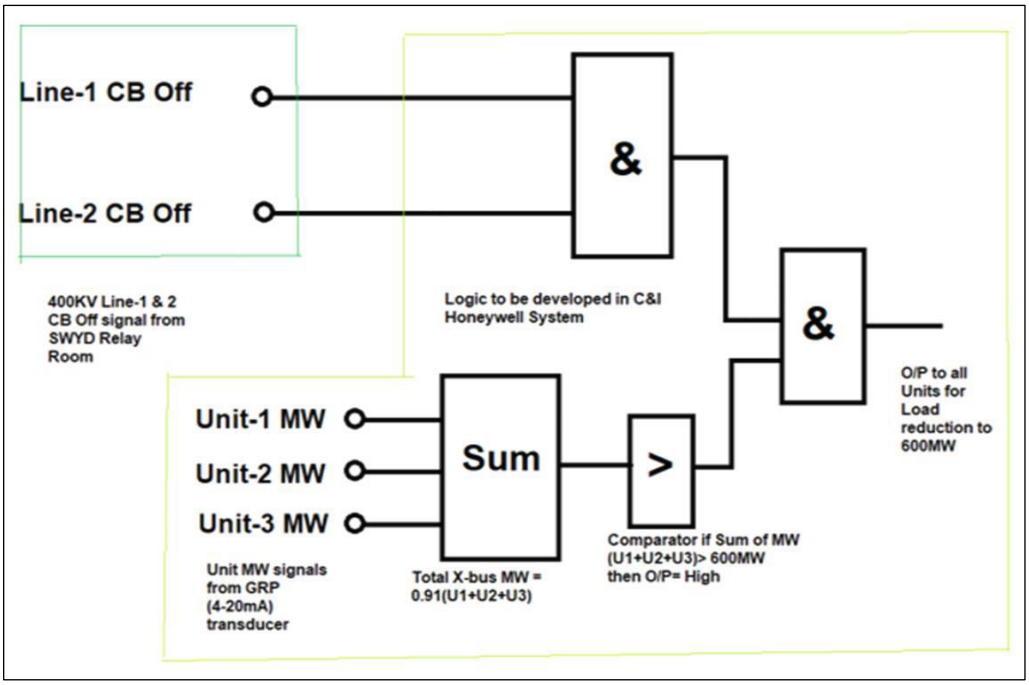


Fig 19: Agia

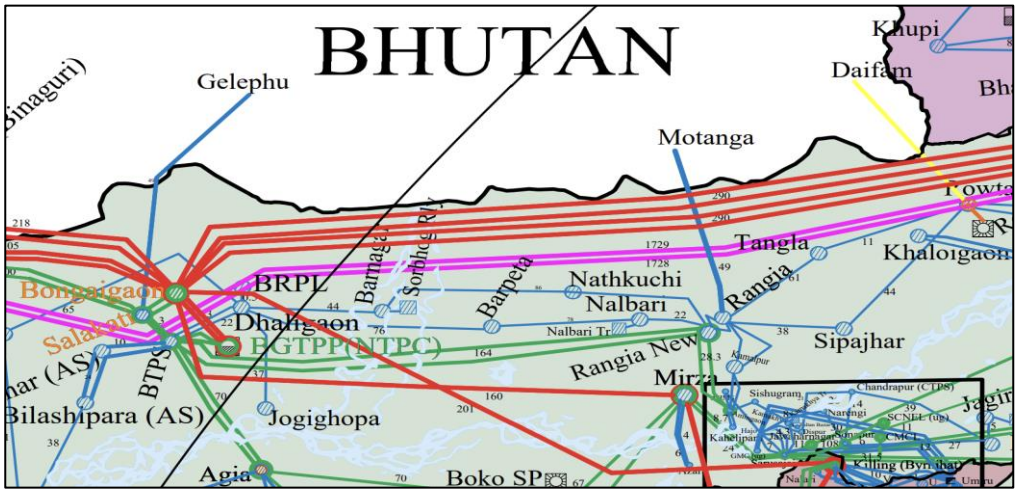
मूल सेवा वर्ष / Original In-Service Year	01-Sept-2021
हालिया मूल्यांकन समूह / Recent Assessment Group	AEGCL, NERLDC & NERPC
हाल की मूल्यांकन तिथि / Recent Assessment Date	10-July -23 (Revised current setting from 600 A to 824A)

क्र.सं./ Sl. No	समीक्षा के लिए चेकलिस्ट / Checklist for review	हाँ/ना/ Yes/ No
I.	Does the scheme describe the intended purposes, conditions, and actions?	Yes
II.	Do the modelling and its intended actions appear to achieve the desired system performance objectives?	Yes
III.	Are the actions permissible in accordance with Transmission Planning Criteria (or any other applicable criteria)?	Yes
IV.	Do the actions satisfy Transmission Planning Criteria?	Yes
V.	Has the scheme been assessed within the last 5 years?	Yes
VI.	Are the set thresholds of actions appropriate to meet system performance objectives?	Yes
VII.	Is the logic event-based only (as opposed to partly/fully parameter-based) which does not pose high potential for interaction with other schemes in the same region?	Yes
VIII.	Is the effect of inadvertent activation or failure to operate likely to be local (as opposed to widespread)?	Yes
IX.	Are the near-term system plans unlikely to have a significant effect on the scheme which would warrant its re-assessment (including its continued need, serving the intended purposes, and meeting current performance requirements)?	Yes
X.	Is the level of redundancy appropriate?	Yes
XI.	Has coordination or adverse interaction with other schemes been evaluated?	Yes

विषय /Item	सूचना स्पष्टीकरण / Information Explanation
योजना का नाम / Scheme Name	**SPS/AS/002:** बी.जी.टी.पी.पी (एनटीपीसी) उत्पादन से बिजली की सुरक्षित निकासी से संबंधित / Related to the safe evacuation of power from BgTPP(NTPC) generation
रिपोर्टिंग पार्टी / Reporting party	BgTPP(NTPC)
वर्गीकरण/ Classification	SPS related to Safe evacuation of Generation
संदर्भ संक्या/ Reference No.	**SPS/AS/002**
संचालन प्रक्रिया / Operating Procedure	N/A
डिज़ाइन उद्देश्य / Design Objectives	Safe evacuation of power from BgTPP(NTPC) generation
संचालन / Operation	Reduction of generation from BgTPP to 600 MW to safeguard overloading of 400/220 kV, 2 X 315 MVA ICTs at BgTPP.
मोडलिंग/ Modelling	**Description:** BgTPP is having an installed capacity of 3 x 250 MW. At present, BgTPP is connected to rest of NER Grid through 400 kV BgTPP -Bongaigaon I & II lines and 400/220 kV, 2x315 MVA ICTs at BgTPP. As per the scheme, under outage of 400 kV Bongaigaon - BgTPP D/C with generation from 3 Units of BgTPP, there may be sudden overloading in 2 X 315 MVA ICT at BgTPP. **Network Diagram:**  Fig 20: Network diagram

	Triggering of Criteria: When all the units of BgTPP are in service and the sum of generation is greater than 600 MW, Outage/tripping of both circuits of 400 kV Bongaigaon-BgTPP D/C, should result in generation reduction at BgTPP to 600 MW in order to maintain safe loading on 2 X 315 MVA ICT. **Logic Diagram:**  Fig 21: SPS logic diagram at BgTPP
मूल सेवा वर्ष / Original In-Service Year	**15-Oct-2020**
हालिया मूल्यांकन समूह / Recent Assessment Group	BgTPP(NTPC), NERLDC & NERPC
हाल की मूल्यांकन तिथि / Recent Assessment Date	Mock testing performed on 10-Oct-24

क्र.सं./ Sl. No	समीक्षा के लिए चेकलिस्ट / Checklist for review	हाँ/ना/ Yes/No
I.	Does the scheme describe the intended purposes, conditions, and actions?	Yes
II.	Do the modelling and its intended actions appear to achieve the desired system performance objectives?	Yes
III.	Are the actions permissible in accordance with Transmission Planning Criteria (or any other applicable criteria)?	Yes
IV.	Do the actions satisfy Transmission Planning Criteria?	Yes
V.	Has the scheme been assessed within the last 5 years?	Yes
VI.	Are the set thresholds of actions appropriate to meet system performance objectives?	Yes
VII.	Is the logic event-based only (as opposed to partly/fully parameter-based) which does not pose high potential for interaction with other schemes in the same region?	Yes
VIII.	Is the effect of inadvertent activation or failure to operate likely to be local (as opposed to widespread)?	Yes
IX.	Are the near-term system plans unlikely to have a significant effect on the scheme which would warrant its re-assessment (including its continued need, serving the intended purposes, and meeting current performance requirements)?	Yes
X.	Is the level of redundancy appropriate?	Yes
XI.	Has coordination or adverse interaction with other schemes been evaluated?	Yes

विषय /Item	सूचना स्पष्टीकरण / Information Explanation
योजना का नाम / Scheme Name	**SPS/AS/003:** 220 केवी बीटीपीएस (सलाकाती) - रंगिया I और II लाइन का आउटेज / Outage of 220 kV BTPS (Salakati) – Rangia I & II Line
रिपोर्टिंग पार्टी / Reporting party	AEGCL
वर्गीकरण/ Classification	SPS related to Tripping of critical line(s) / corridor
संदर्भ संख्या/ Reference No.	**SPS/AS/003**
संचालन प्रक्रिया / Operating Procedure	N/A
डिज़ाइन उद्देश्य / Design Objectives	To avoid blackout of Rangia area of Assam and maintain connectivity to 132 kV Rangia – Motonga (Bhutan) Line.
संचालन / Operation	Load Shedding at Rangia area of Assam and tripping of CB of 132 kV Rangia (220) - 132 kV Rangia I & II lines at Rangia (220 kV) end.
मोडलिंग/ Modelling	**Description:** 220 kV BTPS (Salakati) – Rangia I & II Line serves as the backbone for safe power supply at Rangia, Nalbari, Part Load of Bornagar, Sipajhar, Tanga and Kamalpur areas of Assam. **Network Diagram:**  Fig 22: Network diagram

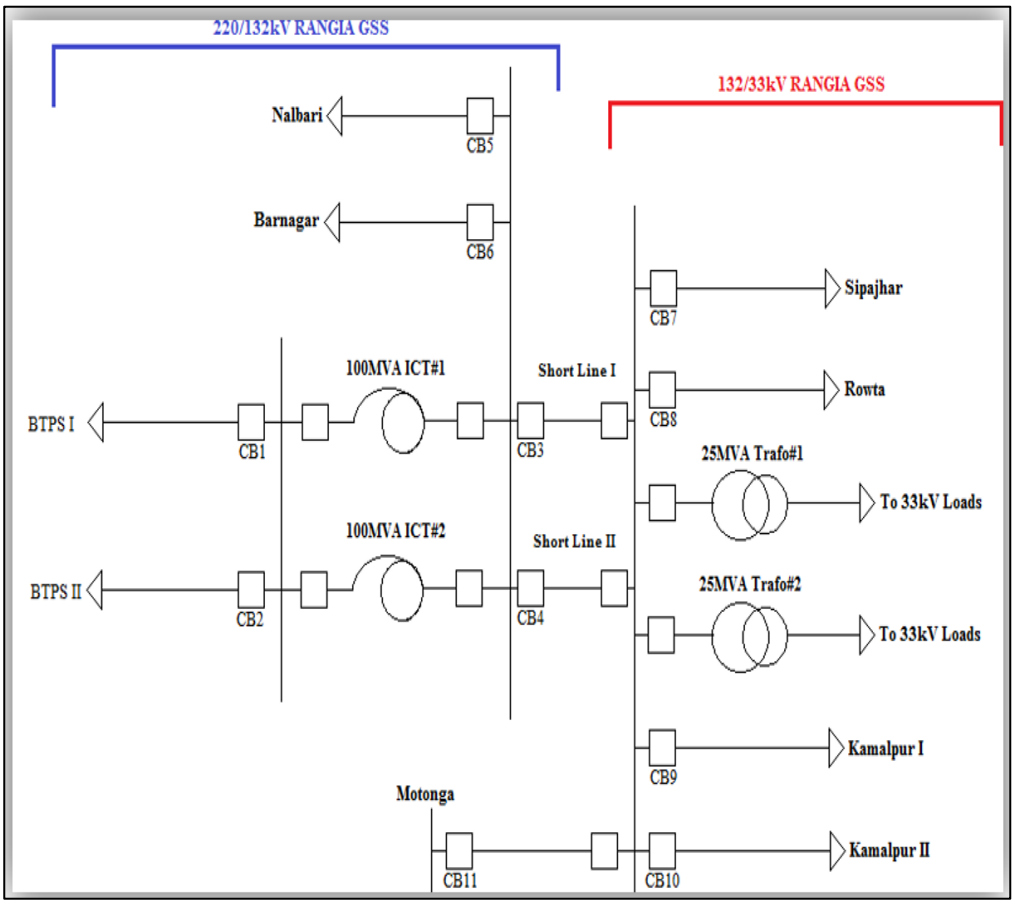


Fig 23: Connectivity diagram at Rangia GSS

Triggering of Criteria

1. As per the scheme, under the outage of both the circuit of 220 kV BTPS - Rangia I & II will lead to opening of CB of 132 kV Rangia (220) - 132 kV Rangia I & II lines at Rangia (220) end. Thus isolating the 220 kV Rangia GSS from 132 kV Rangia GSS. At this instant 132 kV Nalbari and 132 kV Barnagar Line would be devoid of any power flow. The power from 132 kV Motonga is restricted to 132/33 kV Rangia GSS when Short Lines are opened.
2. Also, the scheme will lead to the opening of CB of 132 kV Rangia - Sipajhar, 132 kV Rangia- Kamalpur I & II and 132 kV Rangia – Tangla lines at 132 kV Rangia end. On successful operation, 33 kV loads of 132/33 kV Rangia GSS will fed radially from Bhutan through 132 kV Motonga – Rangia line. Thus, the blackout of Rangia can be avoided.
3. Scheme will also work in the case of shutdown of any one circuit and tripping of the other circuit.

Logic Diagram:

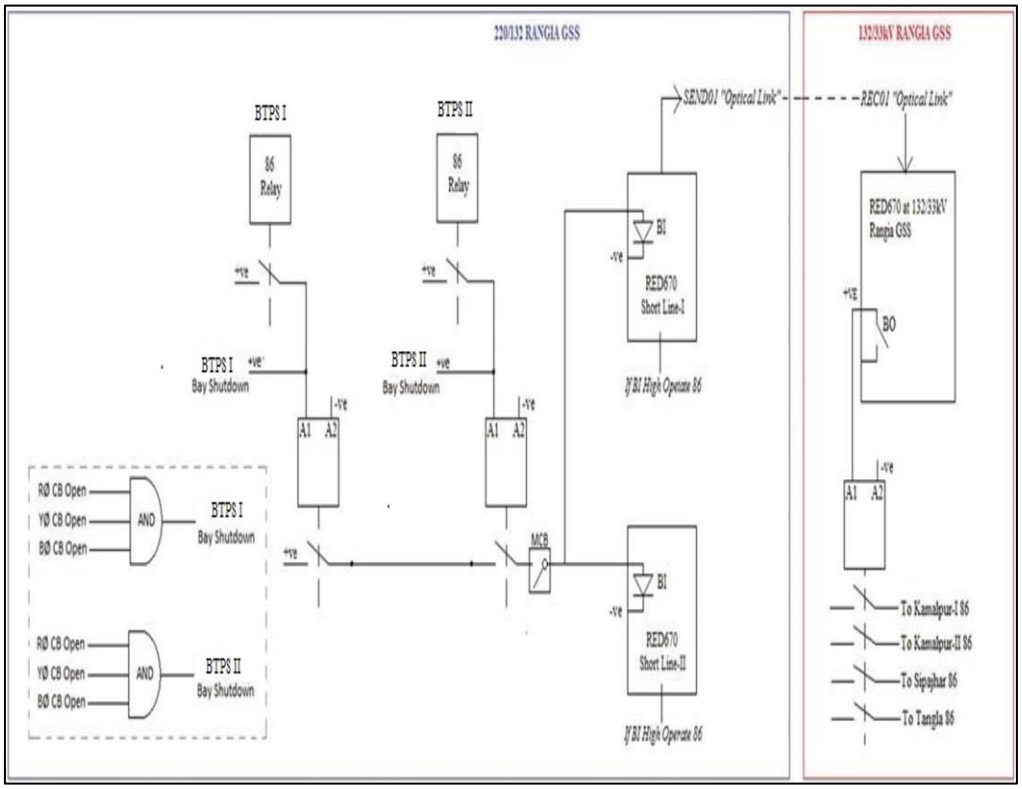


Fig 24: Logic diagram implemented at 220/132 kV Rangia GSS & 132/33 kV Rangia GSS

<u>LOGIC designed for implementation at 220/132 kV Rangia GSS</u>

i. "Potential free NO contacts" from 86 relays of BTPS Line I & II are separately connected to the energization point (A1) of two individual Contact Multiplier relays (CMR)

ii. The CB Open status (of each pole) is received through Binary Inputs by the REL670 Distance Protection relay. A soft logic is to be configured in the REL670 relay with "each pole open status" as inputs to the **AND** logic. The output from the **AND** gate when "*High*" would indicate the CB to be in open state.

iii. The **AND** gate output signal is to be linked with a spare Binary Output of the REL670 relay which would be externally wired to the energization point (A1) of the CMR.

<u>The same is to be done separately for each circuit.</u>

As per the above points, each CMR would pick up (continuously latch) for the following two cases:

a) When the Circuit has tripped due to fault (86 Operate Status)

b) When the Circuit is under shutdown (CB Open Status)

iv. An **AND** logic is further implemented by connected the NO contacts of each CMR in series which is extended to a configured Binary Input (BI) in both the local end line differential relays (RED670) for 132kV Short Line I & II. The BI's in the RED670 relay when "High" would trip the 86 relay of individual short line.

The following condition is achieved with the above logic:

a) In case of loss of both the circuits (**CB1 and CB2**) due to a tripping event, both the CMRs would pick up (Continuously latch)
b) In case of one circuit being under shutdown (its concerned CMR would be continuously latched), if the other charged circuit is lost due to a tripping event, the state of both the CMRs in pickup condition would be achieved.

Hence, both the above cases (*a, b*) would make the BI's high in the two RED670 relays which would in turn trip the circuit breakers (**CB3 and CB4**) of the short line I & II respectively.

v. **"*Dedicated Digital Signals***" can be sent between local and remote end line differential relays, which completely depend on the Optical fiber link. As these signals are transmitted over dedicated end-to-end optical link (which is independent of LAN network), there is negligible chance of loss of signal.

vi. When configured Binary Input (BI) in RED670 of Short Line-I is "true", the RED670 relay would trip its 86 relay and also send a signal "**SEND01**" via the optical link to the remote end RED670 relay located at 132/33kV Rangia GSS

LOGIC designed for implementation at 132/33kV Rangia GSS

i. The RED670 relay would receive the signal **"SEND01"** sent from remote end through **"REC01"** input.

ii. If "REC01" is "true/high", a separate Binary Output would be configured to excite a Contact multiplier relay (CMR) which would trip the 86 relays of Kamalpur I&II, Sipajhar and Tangla lines. (**CB7**, **CB8**, **CB9** and **CB10**)

If the above scheme is operated successfully, the power drawn from Motonga would be used to supply the **33kV Local** at 132/33kV Rangia GSS. Thus, the blackout of Rangia can be avoided.

Note:

i. As the scheme is dependent on the 86 operate status of BTPS I & II at 220/132kV Rangia GSS, it is utmost necessary that the CB1 and CB2 are opened during the fault event. In certain cases, both circuits may trip at BTPS end whereas only one circuit may be tripped only at Rangia end. In that case, both circuits are lost but the SPS would

	not operate. ii. To counteract against the undesired situation, a "**Direct Trip**" signal should be sent from BTPS to 220 kV Rangia GSS when 86 relay of the line operates at BTPS. When DT signal is received from BTPS end, the 86 would operate at Rangia and SPS can be fulfilled. **On event of successful operation of the Special Protection Scheme, the restoration procedure should be as such:** • "The CB's of the 220kV Line should be closed at first (CB1 and CB2) followed by the charging of the remaining 132kV lines in both the substations as CB open status (CB1 and CB2) would continuously send a tripping command to the 132 kV system." • "For switching off the SPS scheme, the "MCB" as shown in Fig. should be cut off" **Restoration of the system post operation of the system protection scheme (SPS)** For restoration of the lines, the following cases may be applicable: Case I: if both the circuits are restored within the stipulated time period all the 132kV feeders will be charged normally one by one (the feeders with lowest load in the antecedent condition will be attempted first). Case II: If only one of the 220kV line is restored, keeping into account the loading, all the 132kV lines may be charged with some load restrictions. Case III: If both the 220kV lines are not restored, alternate power sources to the feeders may be arranged such as Barnagar may be fed from Dhaligaon end, Sipajhar & Tangla may be fed from Rowta end, Nalbari fed from Barpeta end, Kamalpur may be fed from Amingaon end with load restrictions being imposed as per real time grid condition. However, all switching operations as mentioned above are subjected to real time grid condition and situations best known to the system operator.
मूल सेवा वर्ष / Original In-Service Year	**2023**
हालिया मूल्यांकन समूह / Recent Assessment Group	AEGCL, NERLDC & NERPC
हाल की मूल्यांकन तिथि / Recent Assessment Date	NA

क्र.सं./ Sl. No	समीक्षा के लिए चेकलिस्ट / Checklist for review	हाँ/ना/Yes/No
I.	Does the scheme describe the intended purposes, conditions, and actions?	Yes
II.	Do the modelling and its intended actions appear to achieve the desired system performance objectives?	Yes
III.	Are the actions permissible in accordance with Transmission Planning Criteria (or any other applicable criteria)?	Yes
IV.	Do the actions satisfy Transmission Planning Criteria?	Yes
V.	Has the scheme been assessed within the last 5 years?	Yes
VI.	Are the set thresholds of actions appropriate to meet system performance objectives?	Yes
VII.	Is the logic event-based only (as opposed to partly/fully parameter-based) which does not pose high potential for interaction with other schemes in the same region?	Yes
VIII.	Is the effect of inadvertent activation or failure to operate likely to be local (as opposed to widespread)?	Yes
IX.	Are the near-term system plans unlikely to have a significant effect on the scheme which would warrant its re-assessment (including its continued need, serving the intended purposes, and meeting current performance requirements)?	Yes
X.	Is the level of redundancy appropriate?	Yes
XI.	Has coordination or adverse interaction with other schemes been evaluated?	Yes

विषय /Item	सूचना स्पष्टीकरण / Information Explanation
योजना का नाम / Scheme Name	**SPS/AS/004:** 220 केवी अज़ारा-सरुसजाई डी/सी लाइन का आउटेज/ट्रिपिंग / Outage/tripping of 220 kV Azara-Sarusajai D/C Line
रिपोर्टिंग पार्टी / Reporting party	AEGCL
वर्गीकरण/ Classification	SPS related to tripping of critical lines/corridor
संदर्भ संक्या/ Reference No.	**SPS/AS/004**
संचालन प्रक्रिया / Operating Procedure	N/A
डिज़ाइन उद्देश्य / Design Objectives	To achieve a load reduction in the Sarusajai and Kahilipara areas, ensuring enhanced reliability and stability for securing the Capital area of Assam power system.
संचालन / Operation	Load reduction of 140-150 MW in capital area of Assam power system on tripping of 220 kV Azara-Sarusajai D/C
मोडलिंग/ Modelling	**Description:** Due to tripping of 220 kV Azara-Sarusajai D/C, all the 220 kV corridor which is providing power support to capital area of Assam power system are loaded more than its thermal rating. Severe low voltage issue may arise and lead to voltage collapse in capital area of Assam power system. About 140-150 MW load disconnection is to be done at Sarusajai and Kahilipara areas in order to secure the Capital area of Assam power system from cascading tripping and voltage collapse.

Network Diagram:

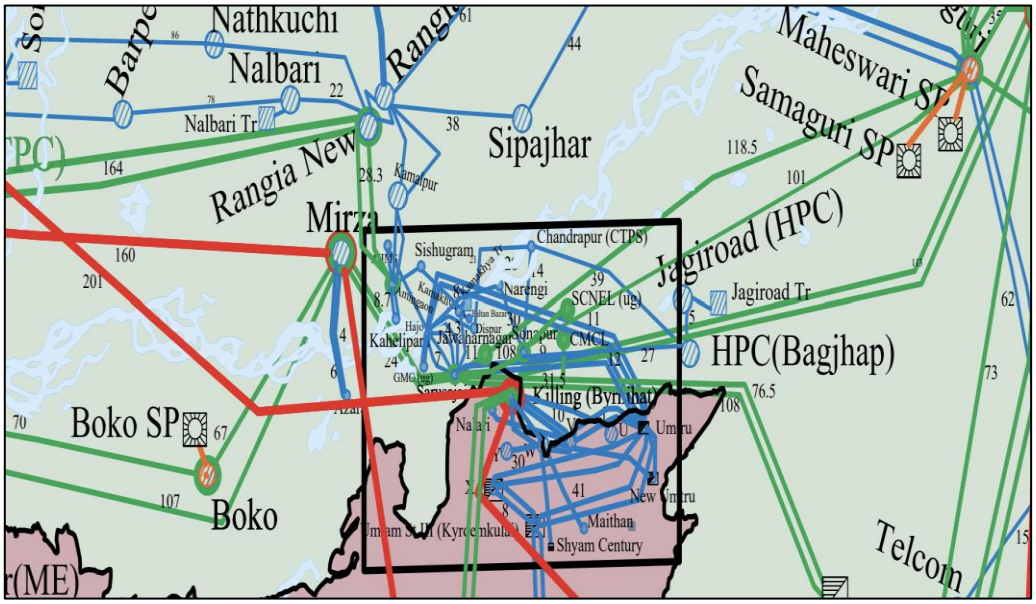


Fig 25: Network diagram

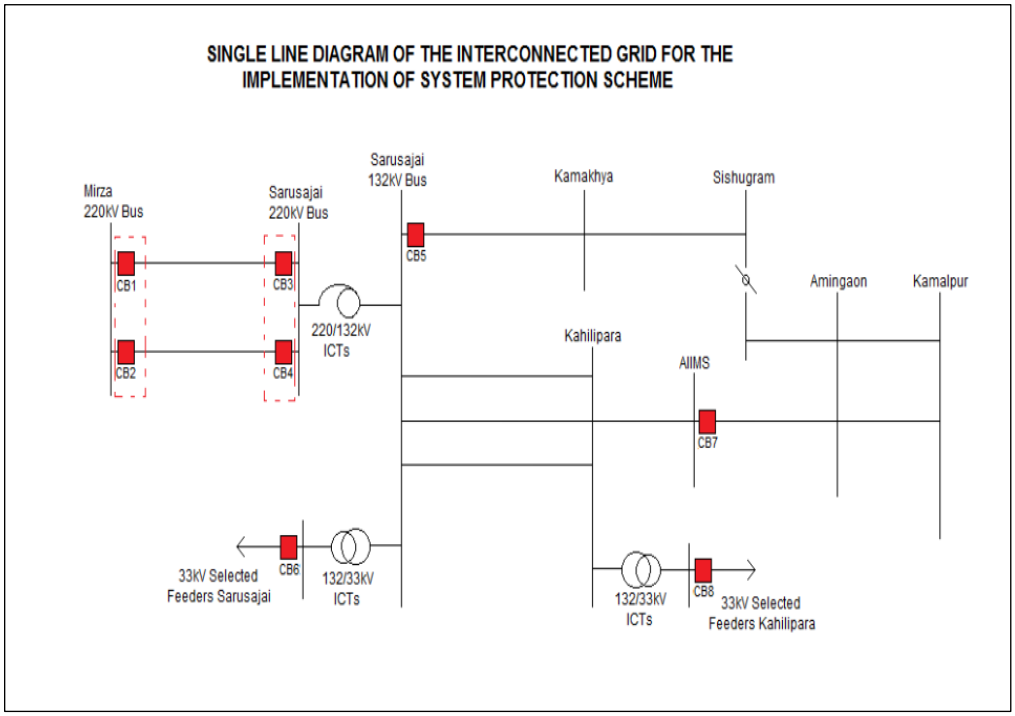


Fig 26: Connectivity diagram

Triggering of Criteria:

The Outage/tripping of 220 kV Azara-Sarusajai D/C will lead to the tripping of 132 kV Kahilipara – Kamalpur and 132 kV Sarusajai – Kamakhya lines. For tripping of 132 kV Kahilipara – Kamalpur line, OPGW connectivity between Sarusujai and Kahilipara will be used to send the tripping signal for tripping Kamalpur feeder at Kahilipara.

	Logic Diagram: On the event of loss of the 220k Mirza – Sarusajai Line I & II, the following elements are to be tripped (CB Opened) to prevent under-voltage scenario at Guwahati area: a. 132kV Sarusajai – Kamakhya Line (CB5) b. 132kV AIIMS – Kamalpur Line (CB7) (Note: Logic would be same after the inclusion of Amingaon GSS) c. Selected 33kV Feeders at Sarusajai GSS d. Selected 33kV Feeders at Kahilipara GSS The 132 kV Bus at Sishugram is segregated into two sections, one being fed from Kamakhya while the other being linked to Kamalpur. The connectivity at Kamalpur is such that, it is connected either to Kahilipara Grid or to the Rangia Grid. A through LILO between Kahilipara – Kamalpur – Rangia is not present. Hence, disconnecting the circuits of 132kV Sarusajai – Kamakhya (CB5) and 132kV AIIMS – Kamalpur (CB7) would be effective. (The same was verified by Simulation studies by NERLDC). The later margin of load to be disconnected was decided to be achieved by tripping of selected 33kV Feeders at Sarusajai and Kahilipara (As per consent from APDCL) The loss of 220kV Mirza – Sarusajai Lines I & II should initiate the "Operation of SPS". Two major potential events were taken into consideration while designing the SPS. **CASE A**: Both CB's tripped at Sarusajai end **CASE B**: AR successful at Sarusajai end, but both CB's tripped at Mirza end As per CASE A and CASE B, it is observed that the "SPS OPERATE LOGIC" is to be configured both at Mirza end and Sarusajai end. per the above figure, "SPS Operate" signal will also be sent from Mirza end, if both CB's are opened at Mirza. Sarusajai upon receiving the signal from Mirza would proceed further will the logic described below.

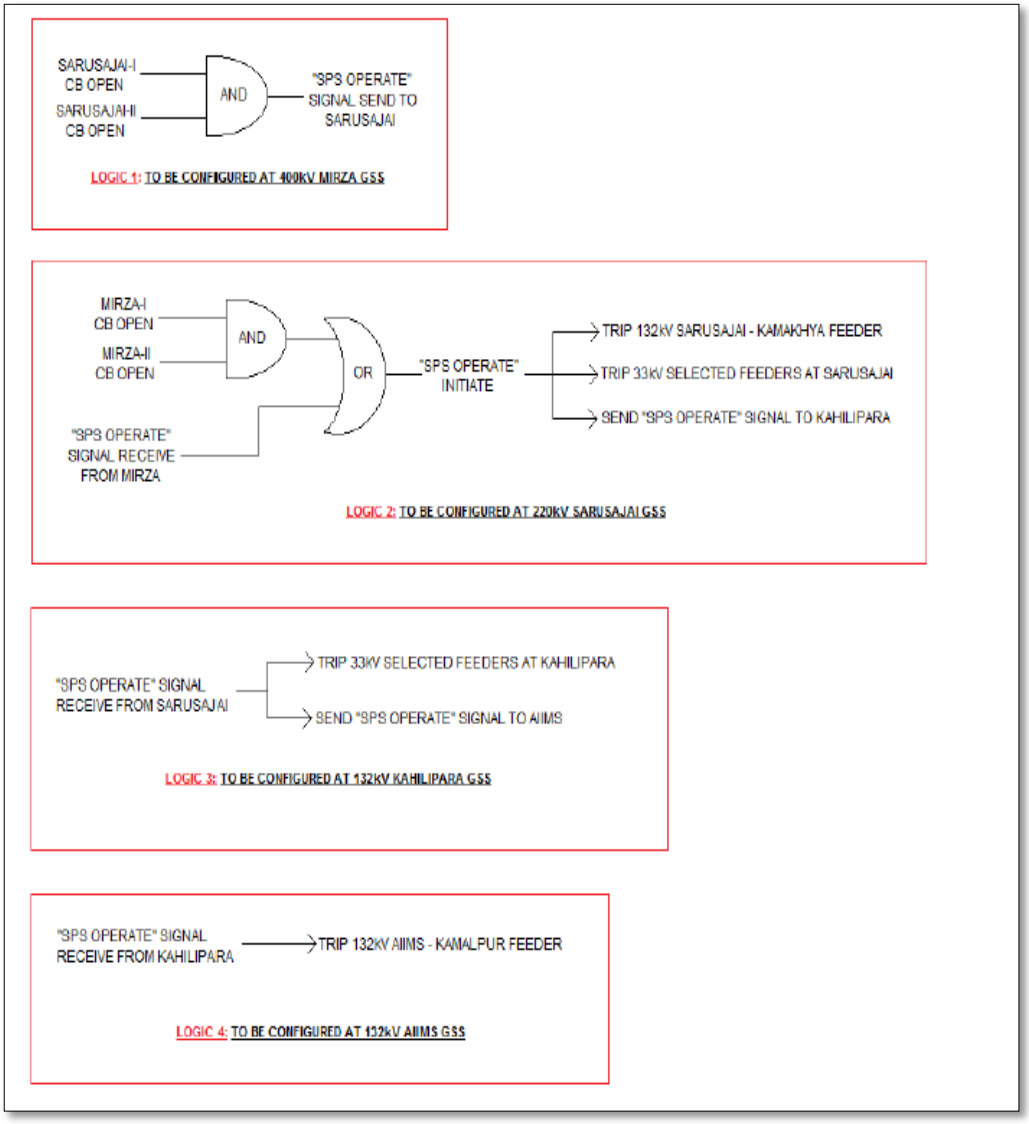


Fig 27: Logic diagrams implemented at 400 kV Mirza, 220 kV Sarusajai, 132 kV Kahilipara & 132 kV AIIMS

At Sarusajai end

1. The "CB Open status" is readily available to the BCU and the distance relays via CB auxiliary contact wirings to the BI (Binary Inputs) of the IED.
2. A separate Binary Output (BO) will be configured in each BCU of Line I and Line II, which will be latched (closed) when CB Open status (of each CB pole) is high.
3. As, both the CB's of Ckt I and Ckt II are to be opened for initiation of the SPS logic, an AND logic is achieved by hardwiring the two BO's in series which is then terminated to the operating coil of Contact Multiplier Relay circuits (CMR).
4. When the "SPS Operate" signal will be high, the 132kV Sarusajai – Kamakhya feeder (CB5) and 33kV Feeders at Sarusajai will be opened via the CMR circuit.
5. At the same time a "SPS OPERATE SIGNAL" (utilized by a spare DT circuit) will be

send to Kahilipara GSS. At Kahilipara, when the "SPS OPERATE SIGNAL" would be received, the selected 33kV Feeders would be opened via a CMR circuit and at the same time, a "SPS OPERATE SIGNAL" would be send to AIIMS GSS via a spare DT circuit.

6. When the "SPS OPERATE SIGNAL" is received at AIIMS GSS, it would trip the 132kV AIIMS – Kamalpur Line (CB7).

7. Hence, all the tripping operation related to the SPS is achieved.

Circuit Connection:

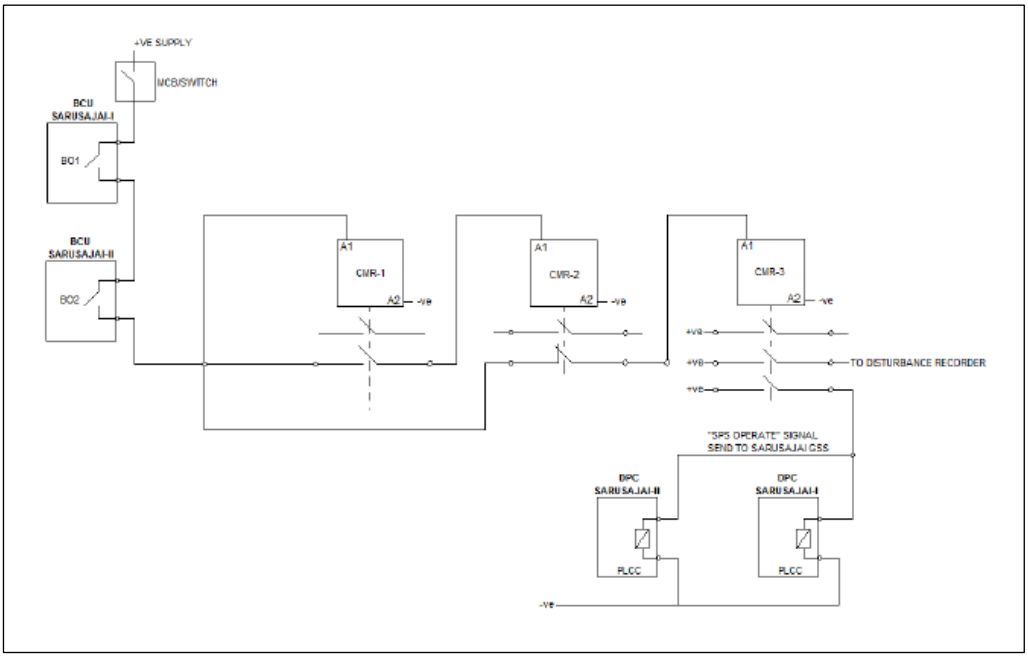


Fig 28: Circuit wiring at Mirza (i.e. Azara) substation

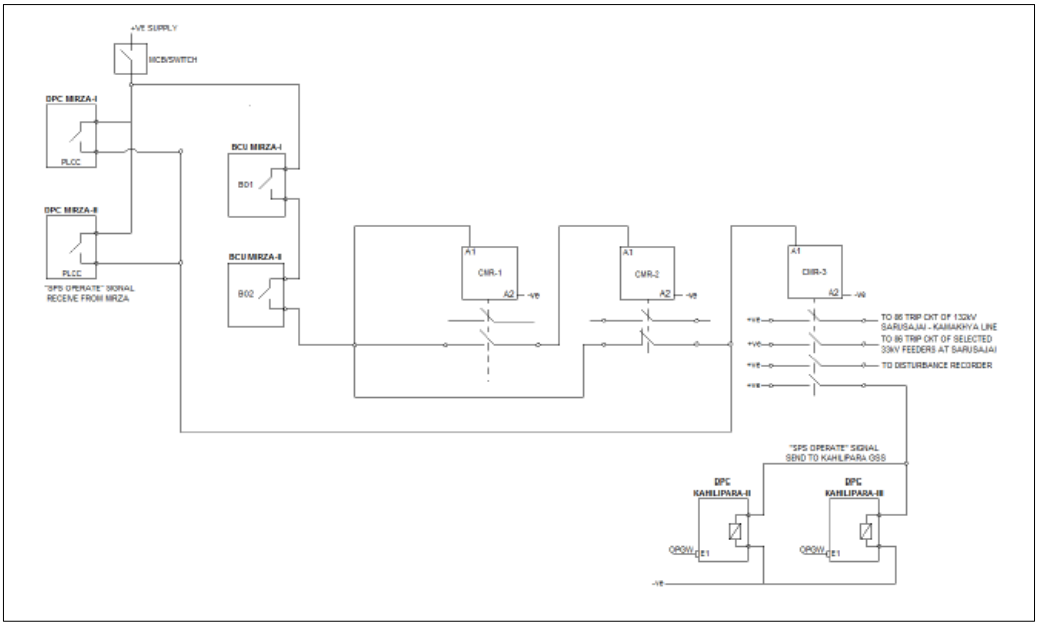


Fig 29: Circuit wiring at Sarusajai substation

Use of Contact Multiplier Relays (CMR) in "SPS OPERATE CIRCUIT"

a. The CB open status will be continuously high. As "SPS OPERATE" is utilized via a "DT send circuit" which is based on CB Open status of both lines at Sarusajai end, so a self reset mechanism should be adopted to send a DT as prolonged DT send signal will damage the Protection Coupler equipment.

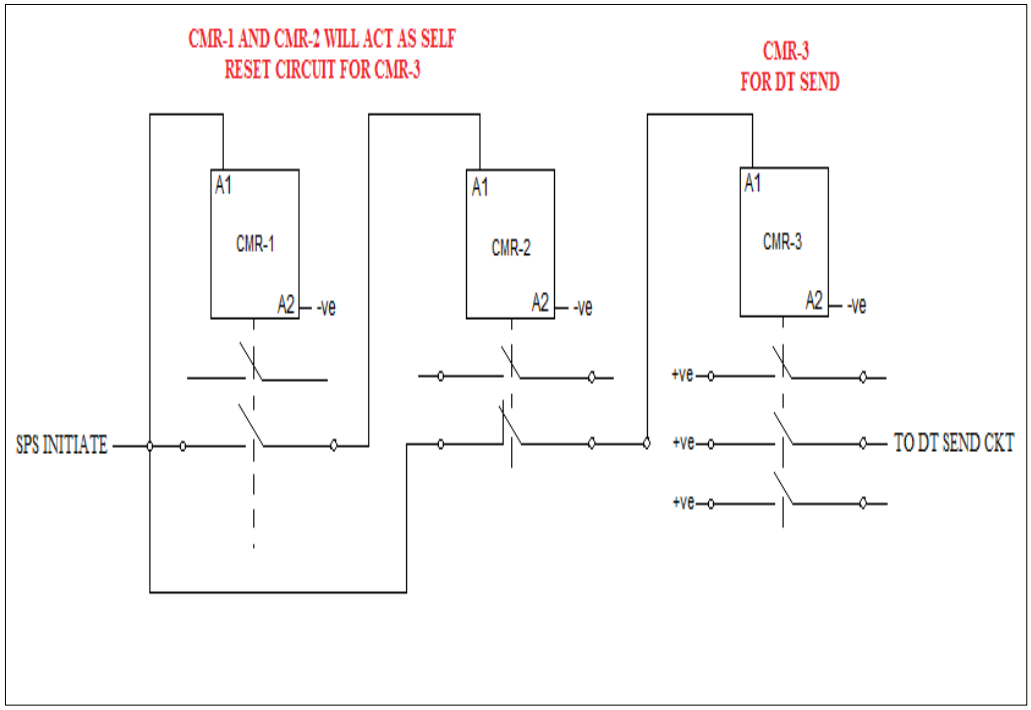


Fig 30: Circuit diagram of use of CMR

Upon Activation of the SPS Initiate signal, CMR-1 and CMR-3 will pick up spontaneously. The path of pickup coil of CMR-3 is through a NC contact of CMR-2. It can be observed that, the pickup coil of CMR-2 is through an NO contact of CMR-1. Hence, the sequence of the operation will be as such:

a. CMR-1 picks up. At the same time the signal is extended to CMR-3 through NC contact of unpicked CMR-2 and CMR-3 picks up.

b. Upon Pickup of CMR-1, the NO contact will be closed and CMR-2 will be picked up.

c. Upon Pickup of CMR-2, the NC contact will be opened and pick up of CMR-3 will be dropped off.

d. The DT send signal is hence high for a short period of time. On practical realization of the circuit and simulation of the same, the DT send circuit was high for 18ms which is in safe limit of the Protection Coupler circuit.

Note: The CMR circuit is necessary because the SPS is based on signal send from one station to another. Keeping Sarusajai in view, the loss of circuits can also be sensed by status of 86 relays (for all protection functions except Zone 1 operation). However, 86 relays are not a self-reset equipment. Hence, to include all events of tripping the "CB Open Status" can be considered an effective signal. As these signals (unlike protection signals) are continuously high, hence, a DT self-reset hard wired circuit is required to prevent the healthiness of the Protection Coupler Equipment.

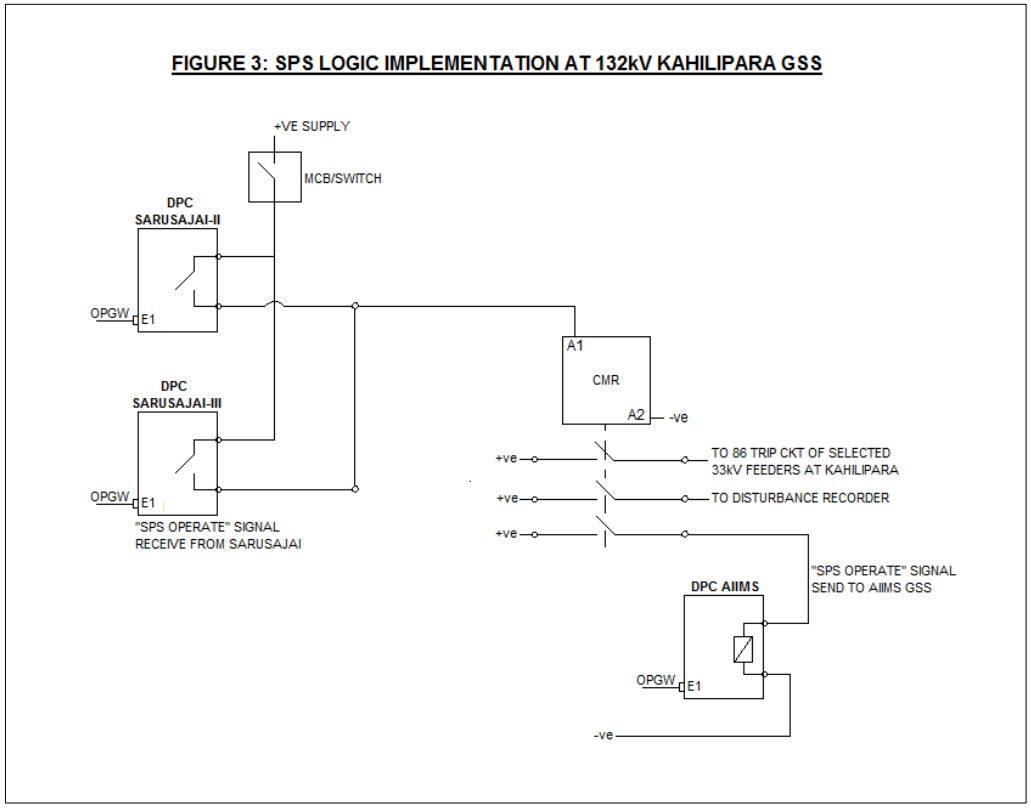


Fig 31: Circuit wiring at Kahilipara substation

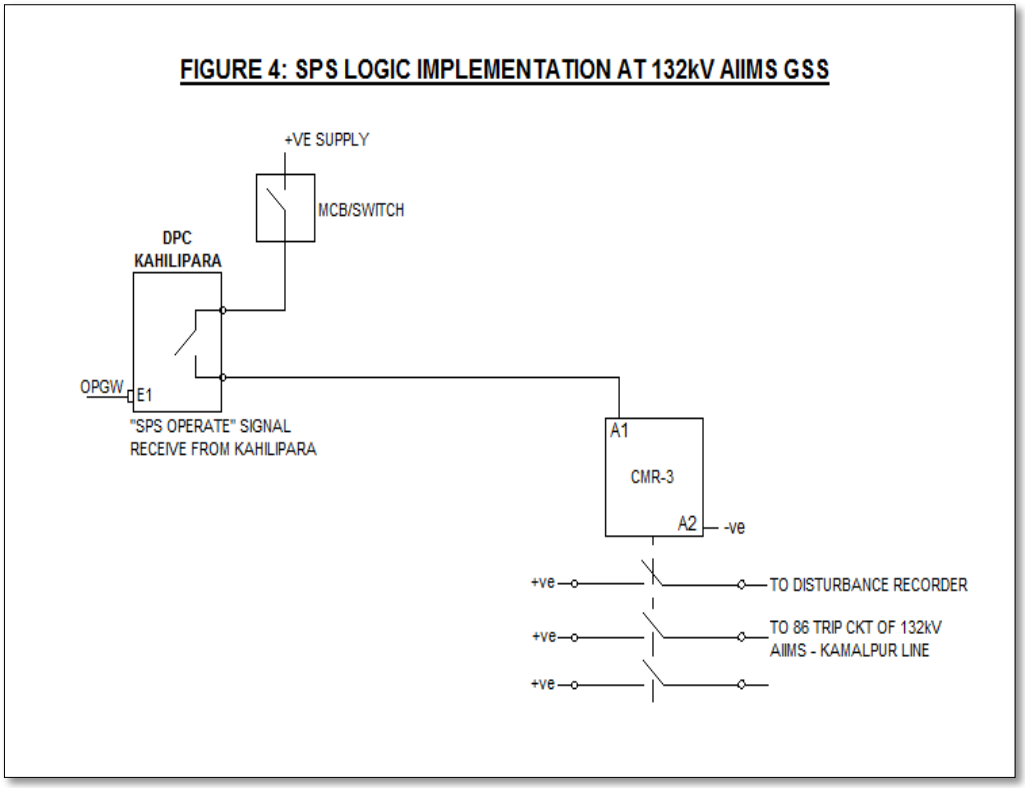
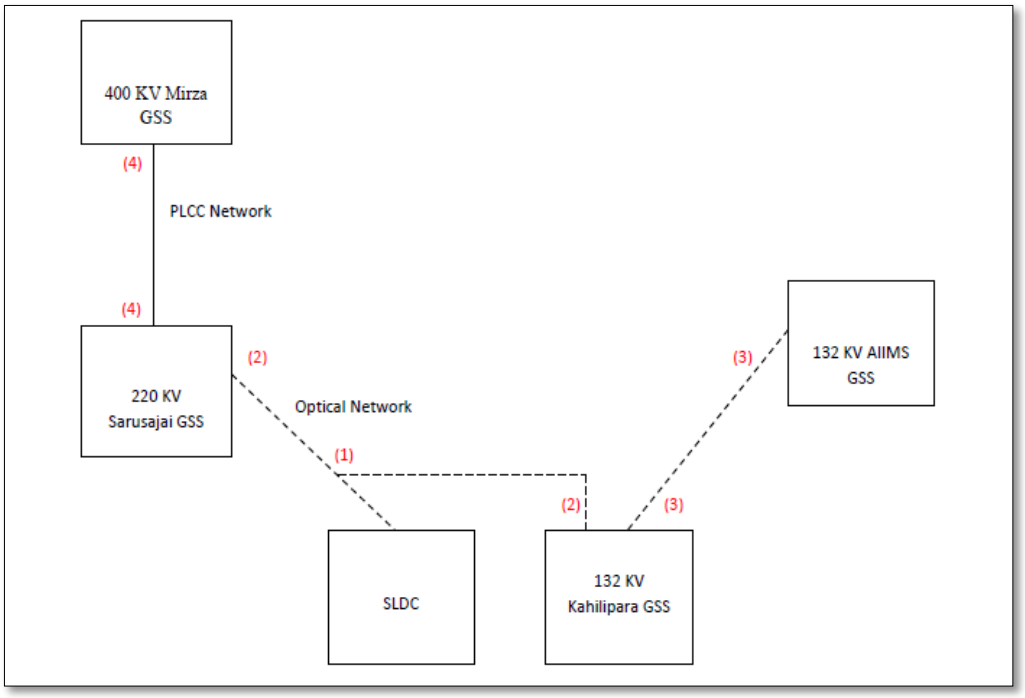
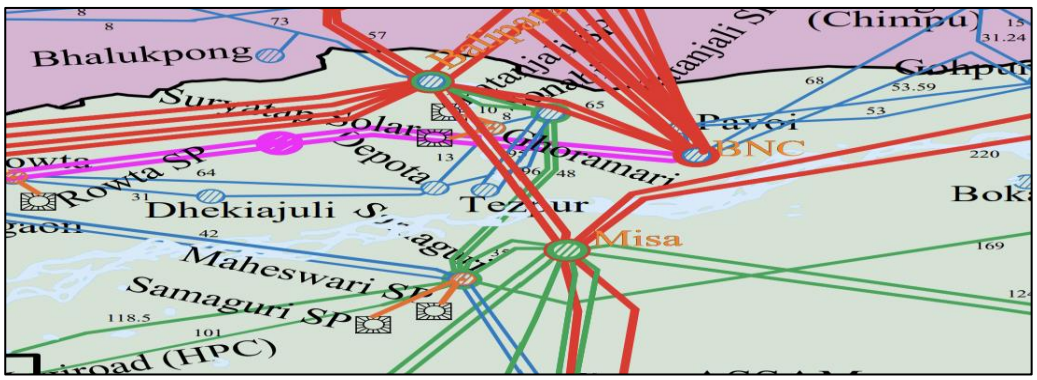


Fig 32: Circuit wiring at AIIMS substation

	PLCC and Optical Fibre Network:  Fig 33: PLCC and Optical Fibre Network i. Optical Network exists between Sarusajai to SLDC. Same to be dropped down at Kahilipara. ii. PDH with E1 Port to be installed in the existing DPC to enable communication via OPGW iii. PDH with E1 Port to be installed in the existing DPC to enable communication via OPGW. iv. PLCC Network of both 220kV Mirza – Sarusajai I, II to be utilized for redundancy. (Inter Circuit-Coupling available) v. At Sarusajai end there are two numbers of PLCC panels for Mirza-Sarusajai line-I & II. But as protection coupler of line-I is faulty therefore other panel is used for both the lines and only M1 relay is considered for protection tripping purposes. Hence, other panel needs to be revived for implementation of both M1 & M2 relays of both the lines separately.
मूल सेवा वर्ष / Original In-Service Year	**July-2023**
हालिया मूल्यांकन समूह / Recent Assessment Group	AEGCL, NERLDC & NERPC
हाल की मूल्यांकन तिथि / Recent Assessment Date	Mock testing performed on 23-June-24

क्र.सं./ Sl. No	समीक्षा के लिए चेकलिस्ट / Checklist for review	हाँ/ना/ Yes/ No
I.	Does the scheme describe the intended purposes, conditions, and actions?	Yes
II.	Do the modelling and its intended actions appear to achieve the desired system performance objectives?	Yes
III.	Are the actions permissible in accordance with Transmission Planning Criteria (or any other applicable criteria)?	Yes
IV.	Do the actions satisfy Transmission Planning Criteria?	Yes
V.	Has the scheme been assessed within the last 5 years?	Yes
VI.	Are the set thresholds of actions appropriate to meet system performance objectives?	Yes
VII.	Is the logic event-based only (as opposed to partly/fully parameter-based) which does not pose high potential for interaction with other schemes in the same region?	Yes
VIII.	Is the effect of inadvertent activation or failure to operate likely to be local (as opposed to widespread)?	Yes
IX.	Are the near-term system plans unlikely to have a significant effect on the scheme which would warrant its re-assessment (including its continued need, serving the intended purposes, and meeting current performance requirements)?	Yes
X.	Is the level of redundancy appropriate?	Yes
XI.	Has coordination or adverse interaction with other schemes been evaluated?	Yes

विषय /Item	सूचना स्पष्टीकरण / Information Explanation
योजना का नाम / Scheme Name	**SPS/AS/005:** 220 केवी मीसा-सामागुरी डी/सी लाइन की ट्रिपिंग / Tripping of 220 kV Misa-Samaguri D/C Line
रिपोर्टिंग पार्टी / Reporting party	AEGCL, PGCIL
वर्गीकरण/ Classification	SPS related to tripping of critical lines/corridor
संदर्भ संक्या/ Reference No.	**SPS/AS/005**
संचालन प्रक्रिया / Operating Procedure	N/A
डिज़ाइन उद्देश्य / Design Objectives	To achieve a load reduction at Samaguri area of Assam to enhance the reliability and stability of the Capital area of Assam power system.
संचालन / Operation	Load reduction of 50-60 MW in capital area of Assam power system on tripping of 220 kV Misa-Samaguri D/C
मोडलिंग/ Modelling	**Description:** Due to tripping of 220 kV Misa-Samaguri D/C, all the 220 kV corridor which is providing power support to capital area of Assam power system are loaded more than its thermal rating. Severe low voltage issue may arise and lead to voltage collapse in capital area of Assam power system. Load reduction of 50-60 MW at Samaguri area will be required in order to secure the Capital area of Assam power system. **Network Diagram:**  Fig 34: Network diagram

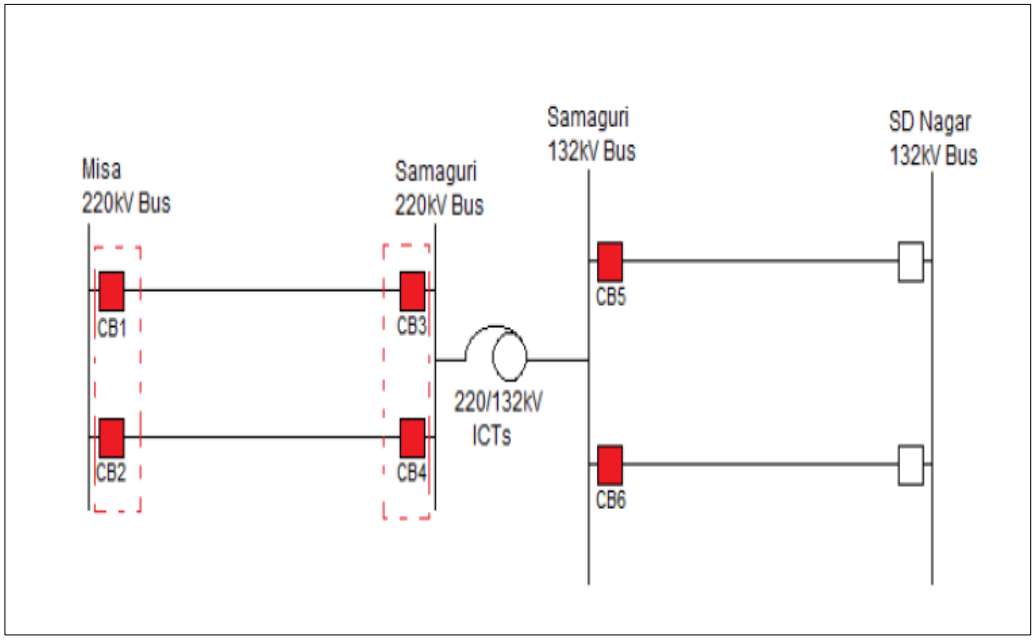


Fig 35: Connectivity diagram at Samaguri substation

Triggering of Criteria:

On the event of loss of 220kV Samaguri – Misa Line I & II, the following elements are to be tripped to prevent under-voltage scenario in Samaguri area:

i) 132kV Samaguri – SD Nagar Line I

ii) 132kV Samaguri – SD Nagar Line II

The loss of 220kV Samaguri – Misa Line I & II should initiate the "Operation of SPS". Two major potential events were taken into consideration while designing the SPS.

CASE A: Both CB's tripped at Samaguri end

CASE B: A/R successful at Samaguri end, but both CB's tripped at Misa end

As per CASE A and CASE B, "SPS OPERATE LOGIC" configured both at Samaguri end and Misa end.

Logic Diagram:

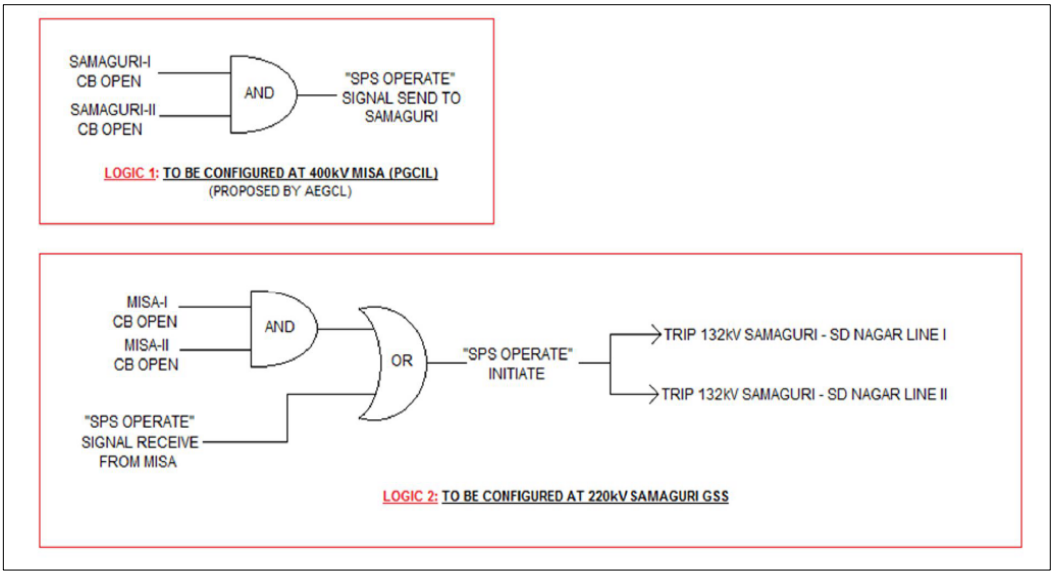


Fig 36: Logic Diagram implemented at Misa and Samaguri substation

Circuit Connection:

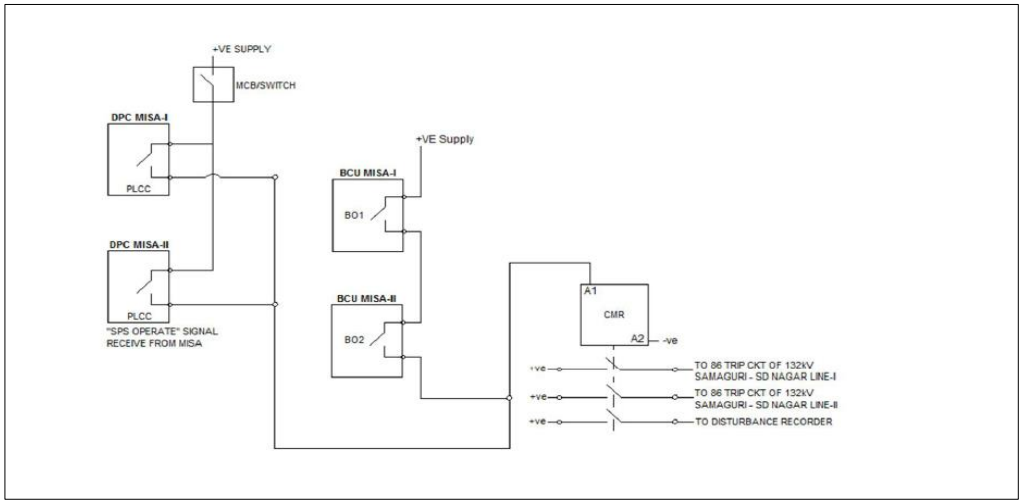


Fig 37: Circuit Connection Diagram implemented at Samaguri substation

LOGIC CONFIGURATION AT MISA (PGCIL)

AT PGCIL END: "CB Open" status of both Samaguri ckt I & II are fed to the relay via Binary Inputs. A soft logic (using AND gate) is designed in the PSL "Programmable Sequential Logic" in the MiCOM relay. The output of the AND gate is linked to a Binary Output (BO) which is connected with the PLCC protection coupler. The drop-off time of the Binary Output when the AND logic is high is kept at 50ms. If both the CB's of Samaguri Line I & II are detected in OPEN State, the Logic is fulfilled and a "DT signal" is sent to Samaguri for initiating the SPS operation.

	RESTORATION OF THE SYSTEM POST OPERATION OF THE SYSTEM PROTECTION SCHEME (SPS) For restoration of the lines the following cases may be applicable: **Case I:** If both the lines are restored within the stipulated time 132kV Samaguri- Sankardevnagar I&II will be charged normally. **Case II:** If only one of the 220kV line is restored charging of 132kV Samaguri- Sankardevnagar may be done keeping into account the real time loading, also Load of the Diphu feeder may be shifted to Bokajan and Morigaon feeder which is generally fed from Khaloigaon may be shifted to Baghjap which would help in reducing the line load. **Case III:** If both the 220kV lines are not restored, then until the lines are charged, the load of Diphu feeder may be shifted to Bokajan, load of Morigaon feeder may be shifted to Baghjap and load of Lumding feeder may be shifted to Diphu. However, all switching operations as mentioned above are subjected to real time grid condition and situations best known to the system operator.
मूल सेवा वर्ष / Original In-Service Year	**July-2023**
हालिया मूल्यांकन समूह / Recent Assessment Group	AEGCL, PGCIL, NERLDC & NERPC
हाल की मूल्यांकन तिथि / Recent Assessment Date	Mock testing performed on 23-June-24

क्र.सं./ Sl. No	समीक्षा के लिए चेकलिस्ट / Checklist for review	हाँ/ना/ Yes/ No
I.	Does the scheme describe the intended purposes, conditions, and actions?	Yes
II.	Do the modelling and its intended actions appear to achieve the desired system performance objectives?	Yes
III.	Are the actions permissible in accordance with Transmission Planning Criteria (or any other applicable criteria)?	Yes
IV.	Do the actions satisfy Transmission Planning Criteria?	Yes
V.	Has the scheme been assessed within the last 5 years?	NA
VI.	Are the set thresholds of actions appropriate to meet system performance objectives?	Yes
VII.	Is the logic event-based only (as opposed to partly/fully parameter-based) which does not pose high potential for interaction with other schemes in the same region?	Yes
VIII.	Is the effect of inadvertent activation or failure to operate likely to be local (as opposed to widespread)?	Yes
IX.	Are the near-term system plans unlikely to have a significant effect on the scheme which would warrant its re-assessment (including its continued need, serving the intended purposes, and meeting current performance requirements)?	Yes
X.	Is the level of redundancy appropriate?	Yes
XI.	Has coordination or adverse interaction with other schemes been evaluated?	Yes

विषय /Item	सूचना स्पष्टीकरण / Information Explanation
योजना का नाम / Scheme Name	**SPS/AS/006:** 220 केवी बालीपारा-सोनाबिल दोहरा सर्किट के किसी एक सर्किट का आउटेज/ट्रिपिंग / Outage/tripping of any one circuit of 220 kV Balipara-Sonabil D/C
रिपोर्टिंग पार्टी / Reporting party	AEGCL
वर्गीकरण/ Classification	SPS related to tripping of critical line / corridor
संदर्भ संक्या/ Reference No.	**SPS/ AS/006**
संचालन प्रक्रिया / Operating Procedure	N/A
डिज़ाइन उद्देश्य / Design Objectives	To avoid loading/ cascade tripping of critical lines to enhance the reliability and stability of the Capital area of Assam power system.
संचालन / Operation	Load reduction of 90 MW in Sonabil area of Assam power system on tripping of 220 kV Misa-Sonabil D/C and disconnection of 220 kV Sonabil-Samaguri D/C in case of tripping of any one circuit of 220 kV Balipara-Sonabil Lines.
मोडलिंग/ Modelling	**Description:** 220 kV Balipara-Sonabil D/C Line acts a critical element for reliable power supply to capital area of Assam power system. N-1 contingency not satisfied by 220 kV Balipara-Sonabil D/C line during peak hour when combined loading of this lines exceeding 270 MW. The potential tripping of any one circuit of the 220 kV Balipara- Sonabil D/C line could lead to a cascading effect, affecting the capital area of Assam power system. Also, the tripping of 220kV Sonabil – Balipara D/C line impact the reliable power supply to radially connected areas from Sonabil Grid Substation namely 132kV Depota, 132kV Ghoramari, 132kV Rowta, 132kV Dhekiajuli, 132kV Tezpur and 132kV Tangla (132kV network is kept in radial configuration as synchronizing the same with Rangia Grid pose potential threat of overloading of Rangia 2x100MVA ICTs).

Network Diagram:

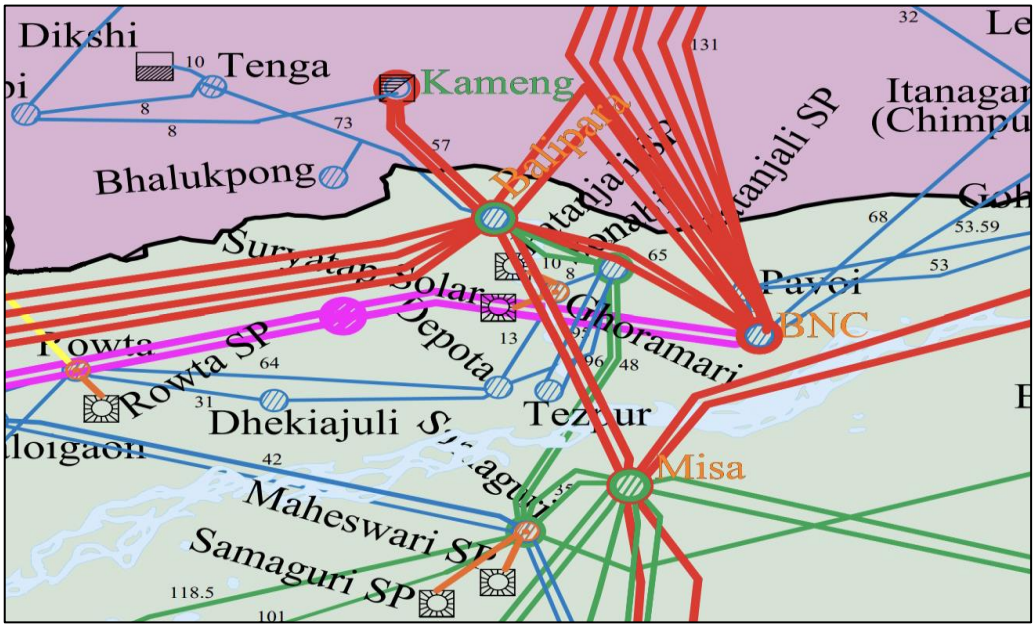


Fig 38: Network diagram

Triggering of Criteria:

Two sets of Triggering criteria implemented under the SPS scheme at Sonabil are elaborated below.

Criteria I (When loading of any one of the 220 kV Balipara- Sonabil D/C crosses 630 A):

Outage/tripping of any one of the 220 kV Balipara- Sonabil D/C line may lead to loading of more than 630 A in the remaining line.

Scheme will operate the SPS under detection of 630 A by the Definite Time Overcurrent relay (50) implemented at the Sonabil end of the 220 kV Balipara-Sonabil D/C line will reduce the line loading by opening the CB's only at the Sonabil end for 220 kV 220 kV Sonabil –Samaguri D/C line. Time delay of 1700 msecs incorporated so as to avoid the SPS operation during successful Autorecloser in the 220kV Sonabil – Balipara D/C line.

Logic Diagram:

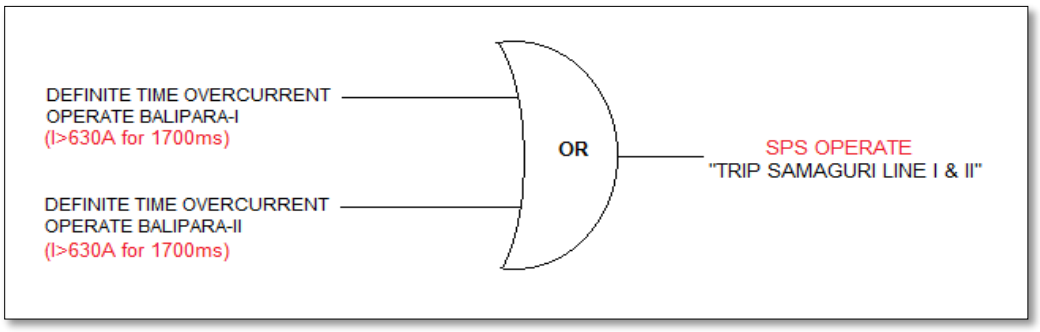


Fig 39: Logic diagram implemented at Sonabil

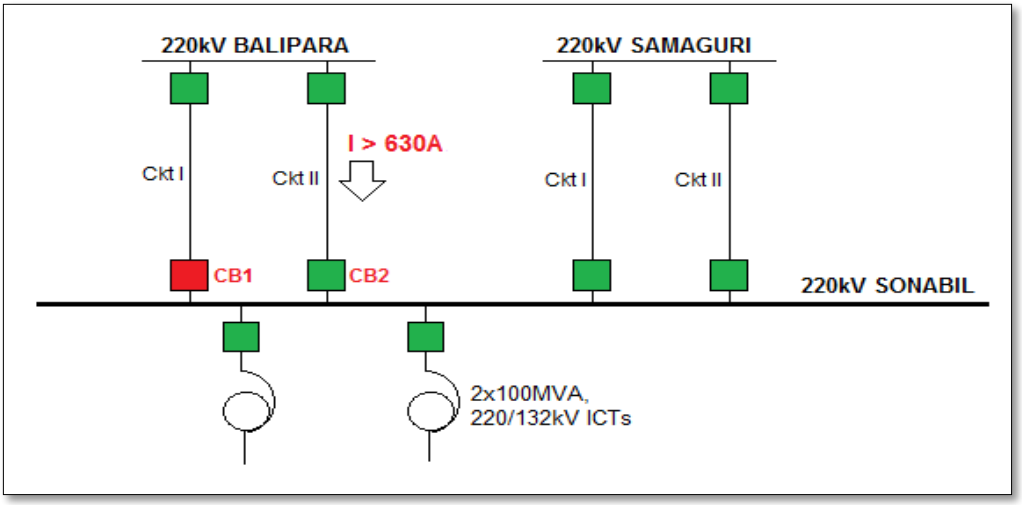


Fig 40: SLD at Sonabil

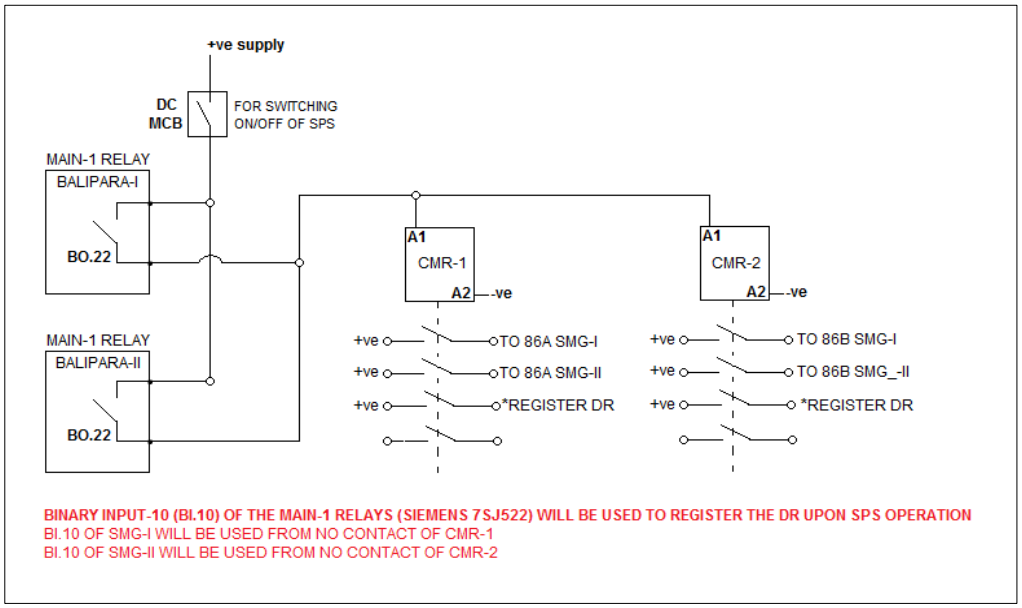


Fig 41: Connection diagram at Sonabil

Criteria II (Tripping of both the 220 kV Balipara- Sonabil D/C Lines):

Outage/tripping of both the 220 kV Balipara- Sonabil D/C line will result in the feeding of the total load of Depota, Ghoramari, Rowta, Dhekiajuli, Tezpur and Tangla area from 220kV Sonabil – Samaguri D/C lines. This condition is vulnerable for 220kV Samaguri – Misa D/C lines and interconnectivity of Samaguri with Guwahati (Capital) area.

To avoid the overload tripping of 220kV Samaguri – Misa D/C lines has to achieve by controlled load shedding of around 90 MW in the radially feed 132 kV substations to safeguard the Sonabil transmission network. The shedding would be achieved by tripping of 33kV Outgoing Feeders (DISCOM) at the downstream 132kV Substations. The exchange of SPS tripping signals would be achieved by using spare codes of the PLCC protection coupler in the 132kV Lines.

Criteria II also covers the successful Autorecloser operation at the Sonabil end and tripping of both the circuits at the Balipara end.

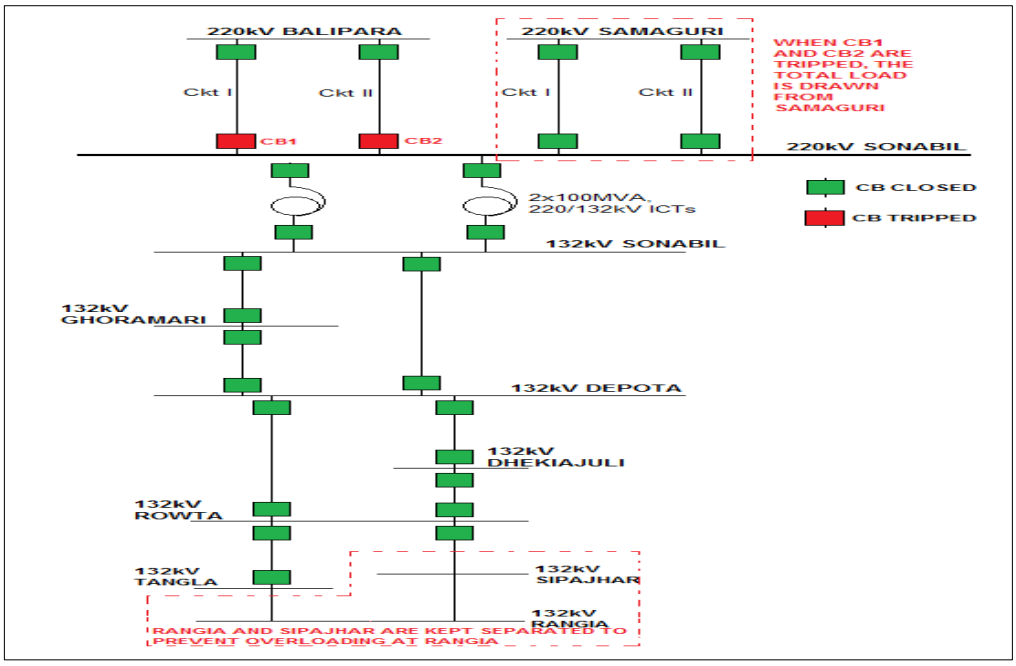


Fig 42: SLD at Sonabil

Logic Diagram:

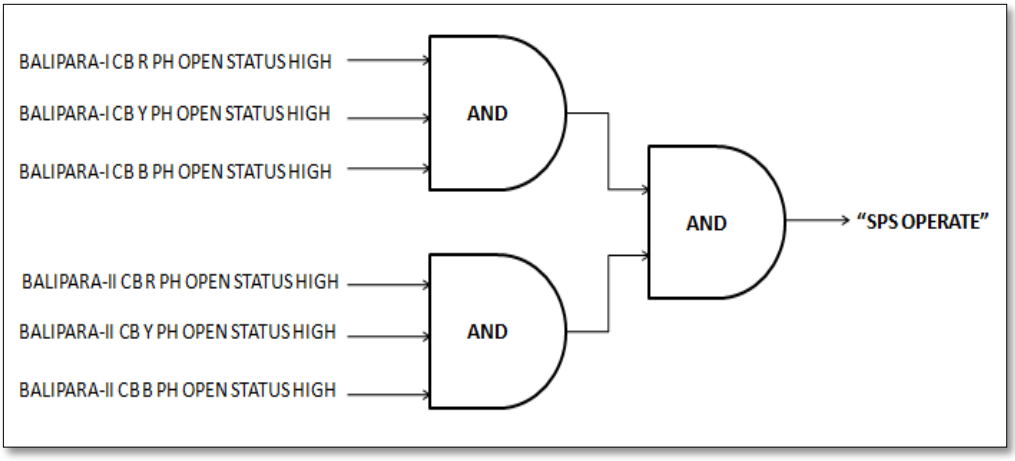


Fig 43: Logic Implemented at **Sonabil** end for 220 kV Balipara I & II Lines

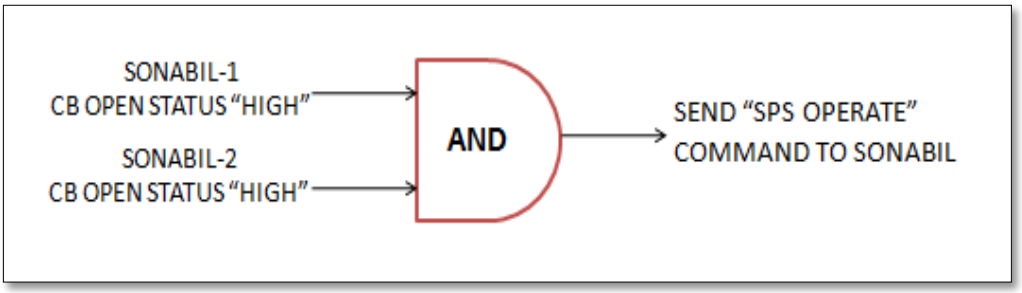


Fig 44: Logic to be configured at **Balipara** end for 220 kV Sonabil I & II Lines

Connection Diagram

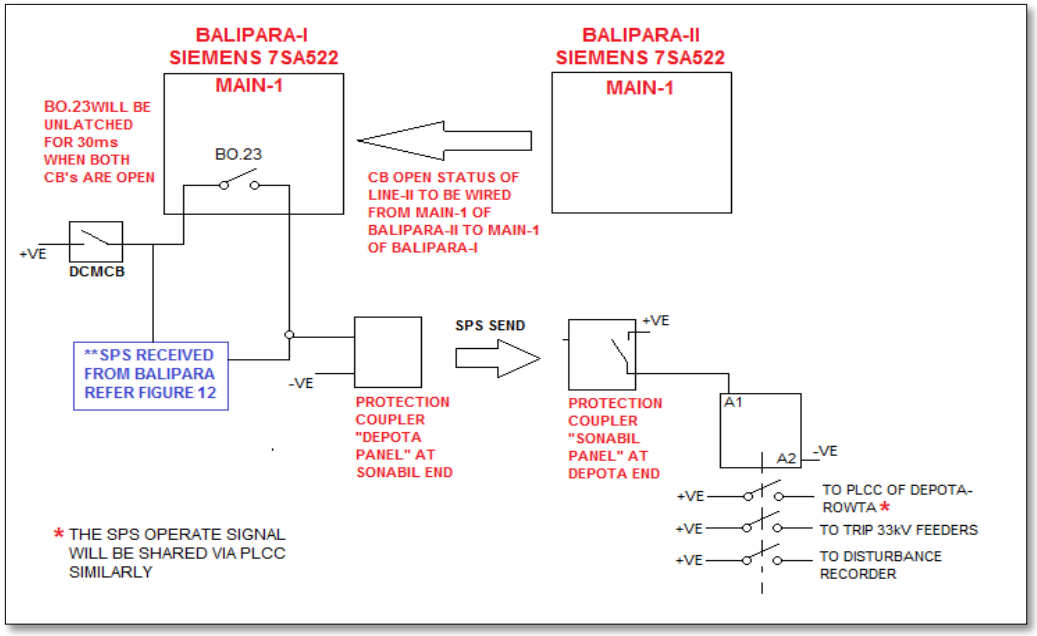


Fig 45: Connection Diagram (Triggering Criteria-II)

Exchange of "SPS Operate" signals:

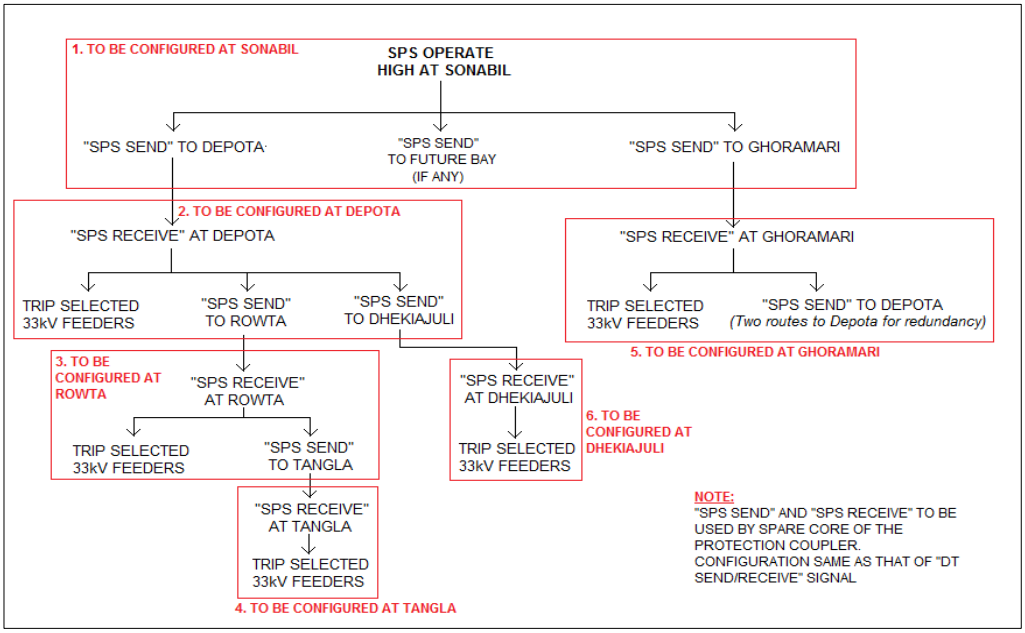


Fig 46: Exchange of "SPS Operate" signals between substation and 33kV trip operations

NOTE: In case of loss of carrier healthiness in any of the downstream lines (viz. 132kV Sonabil - Depota, 132kV Sonabil – Ghoramari, 132kV Depota – Rowta, 132kV Rowta – Tangla, 132kV Depota – Dhekiajuli), the 132kV Incomer CB will be tripped at the connecting sub-station end.

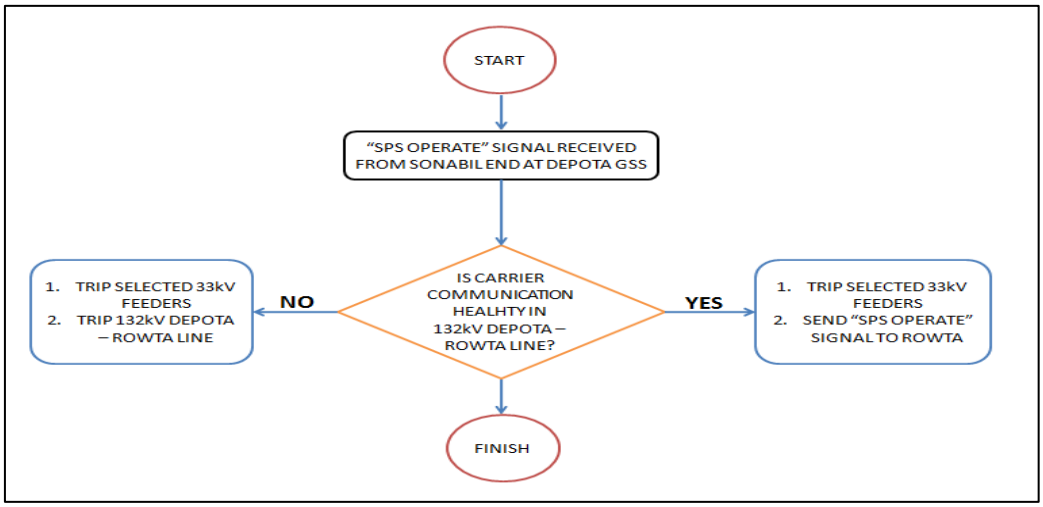


Fig 47: SPS Logic in downstream substation considering the healthiness of Carrier Channel

List of the 33 kV Feeders to be tripped during successful operation of the SPS at Sonabil:

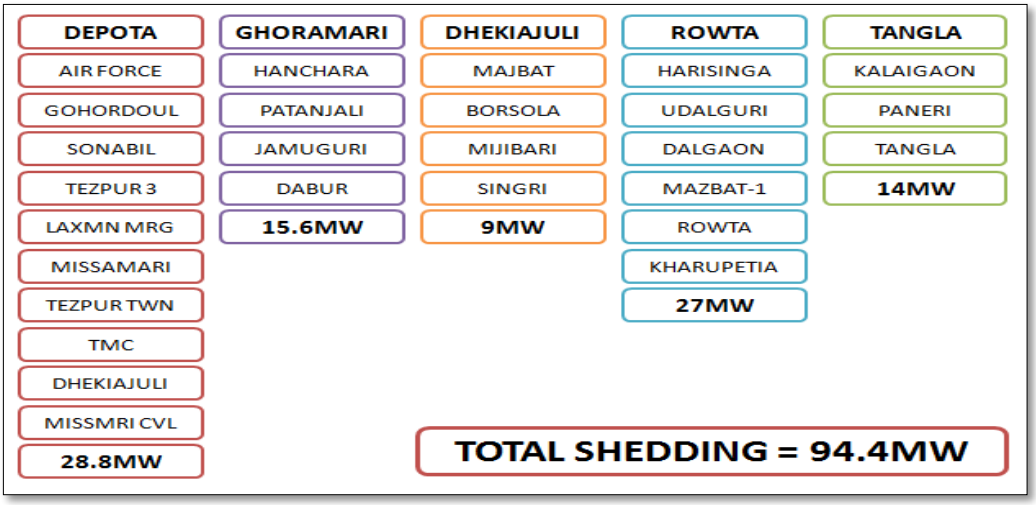
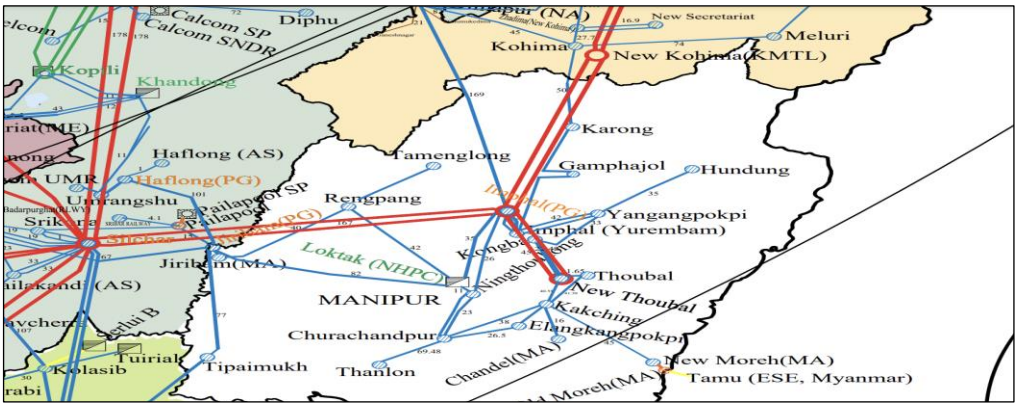


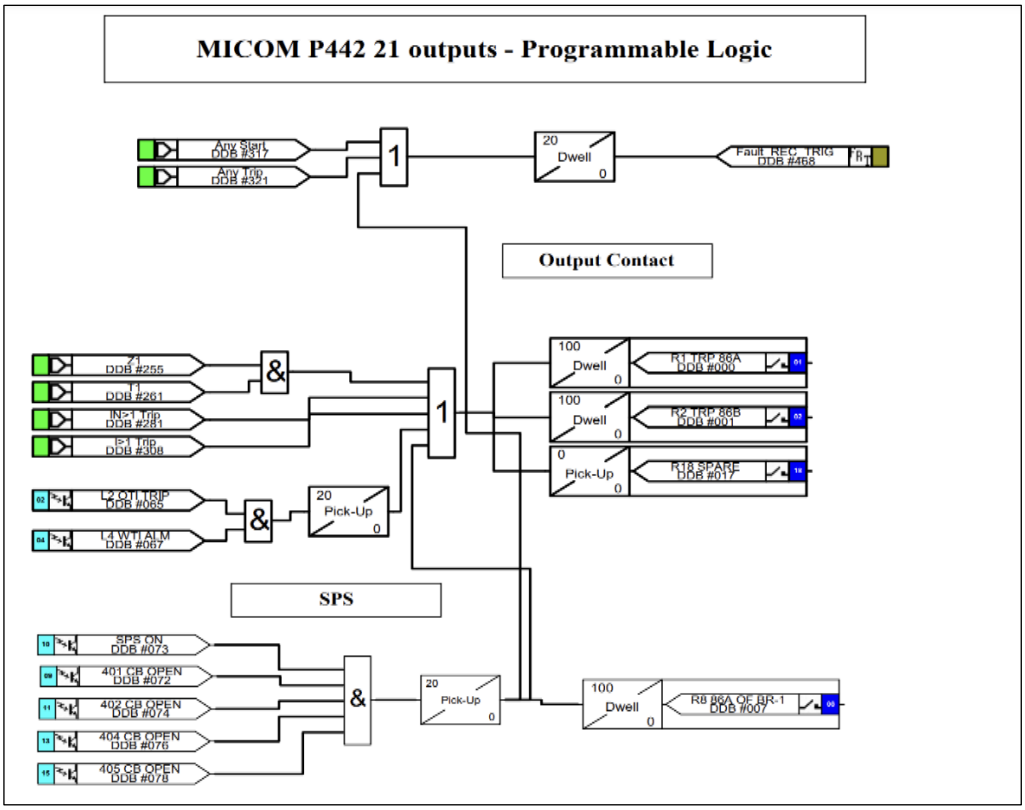
Fig 48: List of the 33 kV Feeders to be tripped during successful operation of the SPS at Sonabil

मूल सेवा वर्ष / Original In-Service Year	**2024**
हालिया मूल्यांकन समूह / Recent Assessment Group	AEGCL, NERLDC & NERPC
हाल की मूल्यांकन तिथि / Recent Assessment Date	NA

क्र.सं./ Sl. No	समीक्षा के लिए चेकलिस्ट / Checklist for review	हाँ/ना/ Yes/ No
I.	Does the scheme describe the intended purposes, conditions, and actions?	Yes
II.	Do the modelling and its intended actions appear to achieve the desired systemperformance objectives?	Yes
III.	Are the actions permissible in accordance with Transmission Planning Criteria (or any other applicable criteria)?	Yes
IV.	Do the actions satisfy Transmission Planning Criteria?	Yes
V.	Has the scheme been assessed within the last 5 years?	NA
VI.	Are the set thresholds of actions appropriate to meet system performance objectives?	Yes
VII.	Is the logic event-based only (as opposed to partly/fully parameter-based) which does not pose high potential for interaction with other schemes in the same region?	Yes
VIII.	Is the effect of inadvertent activation or failure to operate likely to be local (as opposed to widespread)?	Yes
IX.	Are the near-term system plans unlikely to have a significant effect on the scheme which would warrant its re-assessment (including its continued need, serving the intended purposes, and meeting current performance requirements)?	Yes
X.	Is the level of redundancy appropriate?	Yes
XI.	Has coordination or adverse interaction with other schemes been evaluated?	Yes

IV. मणिपुर में एस.पी.एस / SPS in Manipur:

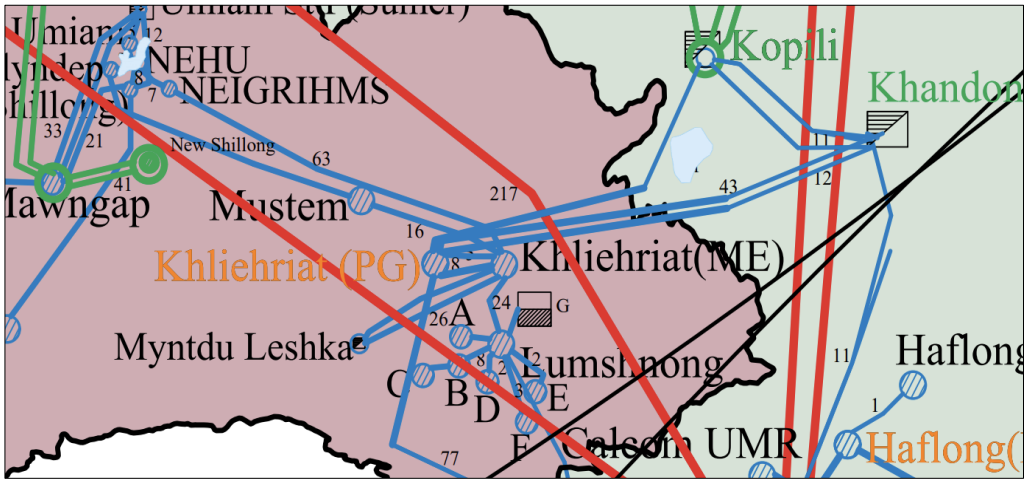
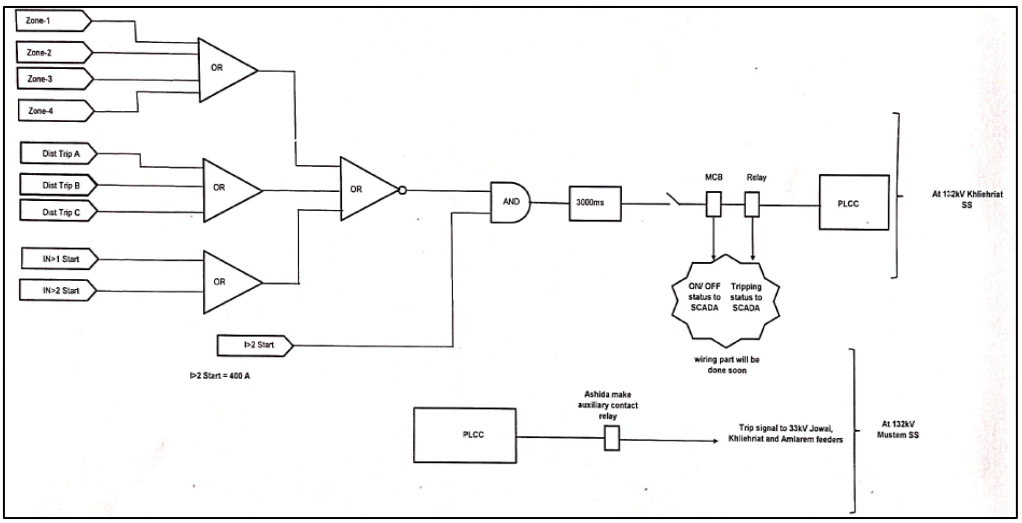
विषय /Item	सूचना स्पष्टीकरण / Information Explanation
योजना का नाम / Scheme Name	**SPS/MA/001:** 400 केवी न्यू कोहिमा-इंफाल दोहरा सर्किट लाइन में खराबी/ट्रिपिंग / Outage/tripping of 400 kV New Kohima – Imphal D/C Line
रिपोर्टिंग पार्टी / Reporting party	NERTS(PG)
वर्गीकरण/ Classification	SPS related to under voltage condition
संदर्भ संक्या/ Reference No.	**SPS/MA/001**
संचालन प्रक्रिया / Operating Procedure	NA
डिज़ाइन उद्देश्य / Design Objectives	Prevent extremely low voltage problem at Manipur power system due to the outage of 400 kV New Kohima – Imphal D/C Line.
संचालन / Operation	Disconnection of both 125 MVAR and 80 MVAR Bus Reactor at Imphal (PG)
मोडलिंग/ Modelling	**Description:** Tripping of 400 kV New Kohima – Imphal (PG) D/C will lead to the tripping of **125 MVAR** and **80 MVAR** Bus Reactor at **Imphal(PG)** to prevent extremely low voltage problem at Manipur power system. This scheme will be helpful while taking shutdown of 400 kV Silchar (PG) – Imphal (PG) D/C. **Network Diagram:**  Fig 49: Network diagram

	Triggering of Criteria: Opening of Main & Tie CB at Imphal (PG) for 400 kV New Kohima – Imphal (PG) D/C line leads to the activation of SPS scheme at Imphal(PG). This will result into the tripping of **125 MVAR** and **80 MVAR** Bus Reactor at **Imphal(PG)** to prevent extremely low voltage problem at Manipur power system. **Logic Diagram:**  Figure 50: SPS Logic Diagram at 400 kV Imphal (PG)
मूल सेवा वर्ष / Original In-Service Year	**Not known**
हालिया मूल्यांकन समूह / Recent Assessment Group	PGCIL, NERLDC & NERPC
हाल की मूल्यांकन तिथि / Recent Assessment Date	NA

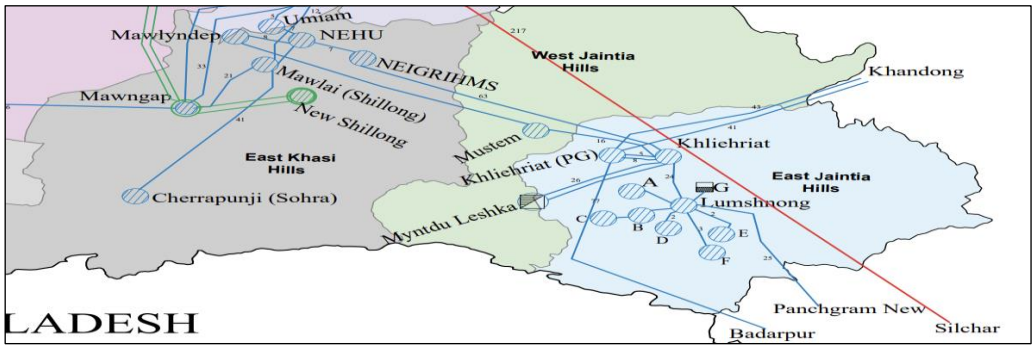
क्र.सं./ Sl. No	समीक्षा के लिए चेकलिस्ट / Checklist for review	हाँ/ना/ Yes/ No
I.	Does the scheme describe the intended purposes, conditions, and actions?	Yes
II.	Do the modelling and its intended actions appear to achieve the desired systemperformance objectives?	Yes
III.	Are the actions permissible in accordance with Transmission Planning Criteria (or any other applicable criteria)?	Yes
IV.	Do the actions satisfy Transmission Planning Criteria?	Yes
V.	Has the scheme been assessed within the last 5 years?	NA
VI.	Are the set thresholds of actions appropriate to meet system performance objectives?	Yes
VII.	Is the logic event-based only (as opposed to partly/fully parameter-based) which does not pose high potential for interaction with other schemes in the same region?	Yes
VIII.	Is the effect of inadvertent activation or failure to operate likely to be local (as opposed to widespread)?	Yes
IX.	Are the near-term system plans unlikely to have a significant effect on the scheme which would warrant its re-assessment (including its continued need, serving the intended purposes, and meeting current performance requirements)?	Yes
X.	Is the level of redundancy appropriate?	Yes
XI.	Has coordination or adverse interaction with other schemes been evaluated?	Yes

v. मेघालय में एस.पी.एस. / SPS in Meghalaya:

विषय /Item	सूचना स्पष्टीकरण / Information Explanation
योजना का नाम / Scheme Name	**SPS/ME/001:** 132 केवी खलीहरियाट (पीजी)- खलीहरियाट दोहरा सर्किट लाइन के किसी एक सर्किट का आउटेज/ट्रिपिंग / Outage/tripping of any one circuit of the 132 kV Khliehriat (PG)- Khliehriat D/C line
रिपोर्टिंग पार्टी / Reporting party	MePTCL
वर्गीकरण/ Classification	SPS Related to Tripping of Critical Line(s)/Corridor
संदर्भ संख्या/ Reference No.	**SPS/ME/001**
संचालन प्रक्रिया / Operating Procedure	N/A
डिज़ाइन उद्देश्य / Design Objectives	To reduce overloading of 132 kV Khlieriat(PG)-Khlieriat D/C Line by load shedding at 132 KV Mustem substation
संचालन / Operation	Disconnection of 33 kV feeders at Mustem substation to shed 20-25 MW load.
मोडलिंग/ Modelling	**Description:** N-1 contingency not satisfied by the 132 KV Khliehriat (PG)-Khliehriat(ME) D/C line as the loading of the 132 KV Khliehriat (PG)-Khliehriat(ME) D/C line is expected to be in the range of 90-110 MW under the condition of atleast 2*50 MW and 1*25 MW generation of Kopili & Khandong power station. Hence, the SPS scheme envisages shedding of 20-25 MW load at 132 KV Mustem substation in the event of tripping of any circuit of 132 KV Khliehriat (PG)-Khliehriat(ME) D/C line.

	Network Diagram:  Fig 51: Network diagram **Triggering of Criteria:** **Logic Diagram:**  Fig 52: Implemented at Khliehriat((ME) end for 132 KV Khliehriat (PG)-Khliehriat D/C lines
मूल सेवा वर्ष / Original In-Service Year	**13-Feb-2024**
हालिया मूल्यांकन समूह / Recent Assessment Group	MePTCL, PGCIL, NERLDC & NERPC
हाल की मूल्यांकन तिथि / Recent Assessment Date	Mock testing performed on 22-Nov-24

क्र.सं./ Sl. No	समीक्षा के लिए चेकलिस्ट / Checklist for review	हाँ/ना/ Yes/ No
I.	Does the scheme describe the intended purposes, conditions, and actions?	Yes
II.	Do the modelling and its intended actions appear to achieve the desired systemperformance objectives?	Yes
III.	Are the actions permissible in accordance with Transmission Planning Criteria (or any other applicable criteria)?	Yes
IV.	Do the actions satisfy Transmission Planning Criteria?	Yes
V.	Has the scheme been assessed within the last 5 years?	NA
VI.	Are the set thresholds of actions appropriate to meet system performance objectives?	Yes
VII.	Is the logic event-based only (as opposed to partly/fully parameter-based) which does not pose high potential for interaction with other schemes in the same region?	Yes
VIII.	Is the effect of inadvertent activation or failure to operate likely to be local (as opposed to widespread)?	Yes
IX.	Are the near-term system plans unlikely to have a significant effect on the scheme which would warrant its re-assessment (including its continued need, serving the intended purposes, and meeting current performance requirements)?	Yes
X.	Is the level of redundancy appropriate?	Yes
XI.	Has coordination or adverse interaction with other schemes been evaluated?	Yes

विषय /Item	सूचना स्पष्टीकरण / Information Explanation
योजना का नाम / Scheme Name	**SPS/ME/002:** 132 केवी लेश्का - खलीहरियाट दोहरा सर्किट लाइन के किसी एक सर्किट का आउटेज/ट्रिपिंग / Outage/tripping of any one circuit of 132 kV Leshka – Khliehriat D/C Line
रिपोर्टिंग पार्टी / Reporting party	MePGCL
वर्गीकरण/ Classification	SPS related to Safe evacuation of Generation
संदर्भ संक्या/ Reference No.	**SPS/ME/002**
संचालन प्रक्रिया / Operating Procedure	N/A
डिज़ाइन उद्देश्य / Design Objectives	Tripping a unit will alleviate the load on the 132 kV Leshka–Khliehriat circuit, thereby enhancing the reliability and operational stability of Leshka generation.
संचालन / Operation	Disconnection of One Unit of Leshka HEP
मोडलिंग/ Modelling	**Description:** Under the full generation of Leshka Generation (3*42 = 126 MW), if one circuit of 132 kV Leshka – Khliehriat D/C trips/goes under outage, the full generation could not be evacuated via a single line of 132 kV Leshka – Khliehriat line. Therefore, reduction of generation of Leshka is required and the following action is undertaken through this SPS scheme. The implemented SPS would trip Unit I at Leshka HEP if any one circuit of 132 kV Leshka – Khliehriat D/C trips during the availability of all the three units at Leshka HEP. Hence, reliability of Leshka generation shall increase. **Network Diagram:**  Fig 53: Network diagram

Triggering of Criteria:

With all three units of Leshka HEP in operation, the tripping of the circuit breaker (CB) of any circuit at Khliehriat (MePTCL) on the 132 kV Leshka–Khliehriat D/C line will activate the scheme that trips Unit I at Leshka HEP. This ensures the safe evacuation of power from Units 2 and 3 using the remaining single circuit.

Logic Diagram:

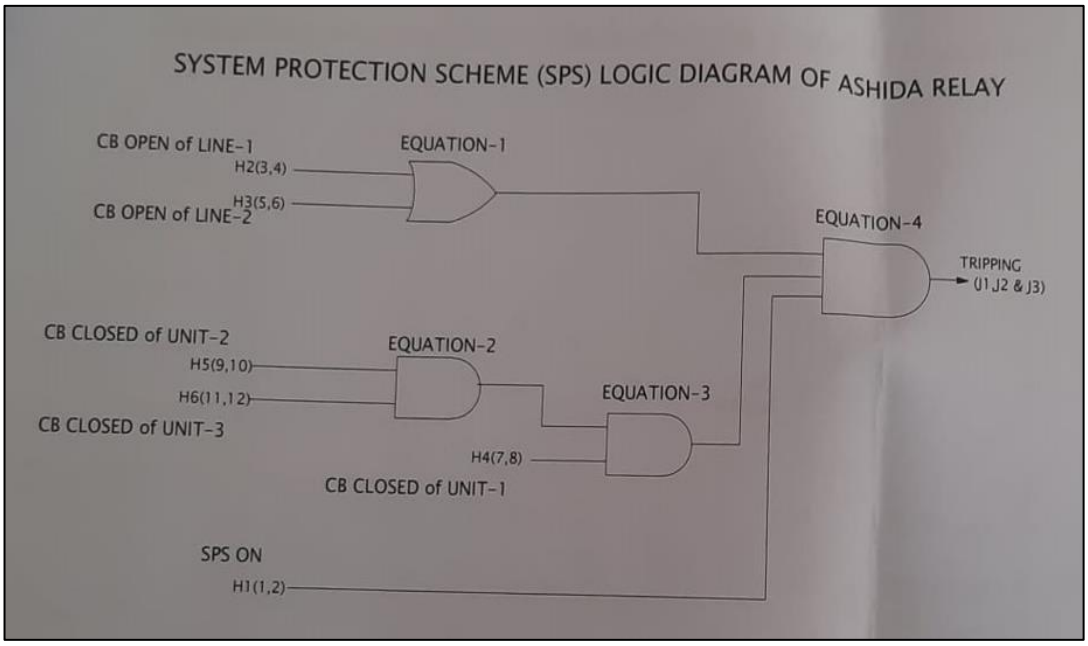


Fig 54: Logic diagram implemented at Leshka

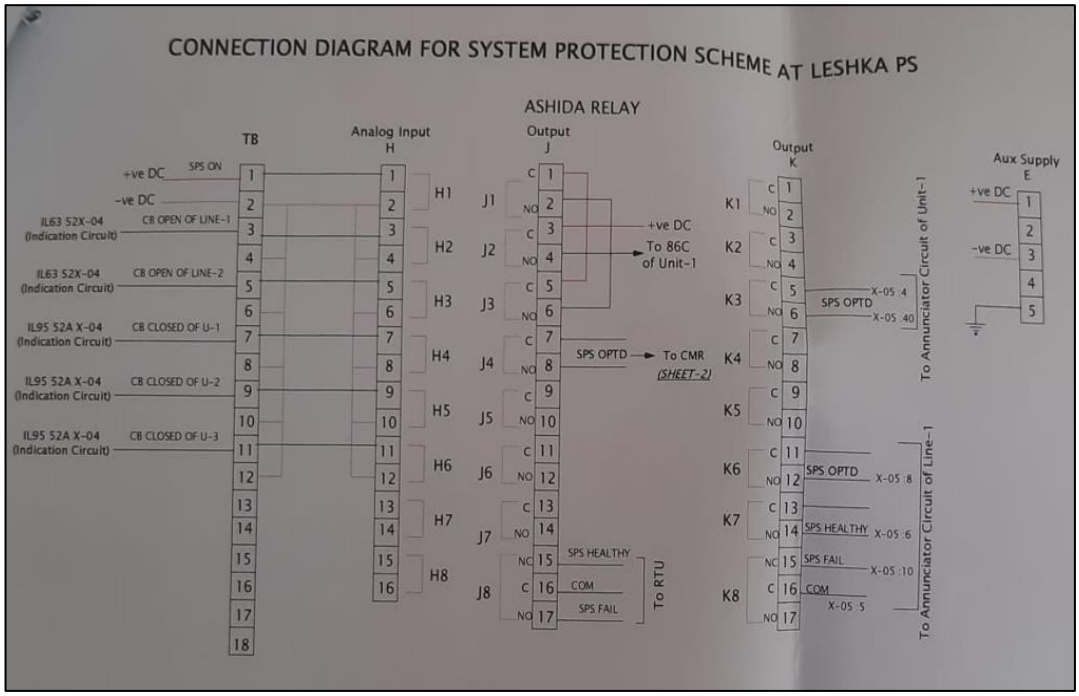
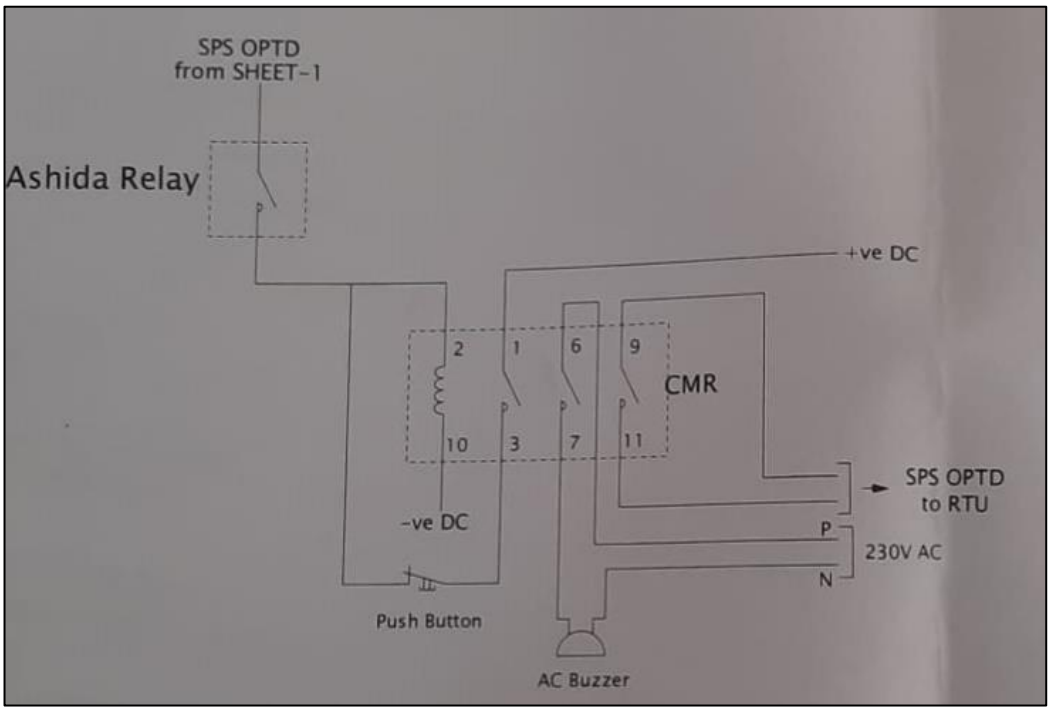


Fig 55: Connection diagram at Leshka

	 Fig 56: Hardwire diagram at Leshka
मूल सेवा वर्ष / Original In-Service Year	**29-May-24**
हालिया मूल्यांकन समूह / Recent Assessment Group	MePGCL, NERLDC & NERPC
हाल की मूल्यांकन तिथि / Recent Assessment Date	13-Dec-24

क्र.सं./ Sl. No	समीक्षा के लिए चेकलिस्ट / Checklist for review	हाँ/ना/Yes/No
I.	Does the scheme describe the intended purposes, conditions, and actions?	Yes
II.	Do the modelling and its intended actions appear to achieve the desired systemperformance objectives?	Yes
III.	Are the actions permissible in accordance with Transmission Planning Criteria (or any other applicable criteria)?	Yes
IV.	Do the actions satisfy Transmission Planning Criteria?	Yes
V.	Has the scheme been assessed within the last 5 years?	NA
VI.	Are the set thresholds of actions appropriate to meet system performance objectives?	Yes
VII.	Is the logic event-based only (as opposed to partly/fully parameter-based) which does not pose high potential for interaction with other schemes in the same region?	Yes
VIII.	Is the effect of inadvertent activation or failure to operate likely to be local (as opposed to widespread)?	Yes
IX.	Are the near-term system plans unlikely to have a significant effect on the scheme which would warrant its re-assessment (including its continued need, serving the intendedpurposes, and meeting current performance requirements)?	Yes
X.	Is the level of redundancy appropriate?	Yes
XI.	Has coordination or adverse interaction with other schemes been evaluated?	Yes

VI. नागालैंड में एस.पी.एस. SPS in Nagaland:

विषय /Item	सूचना स्पष्टीकरण / Information Explanation
योजना का नाम / Scheme Name	**SPS/NA/001:** 132 केवी दीमापुर (पीजी)-दीमापुर (एनए) दोहरा सर्किट लाइन के किसी एक सर्किट का आउटेज/ट्रिपिंग / Outage/tripping of any one circuit of 132 kV Dimapur(PG)-Dimapur(NA) D/C Line
रिपोर्टिंग पार्टी / Reporting party	DoP, Nagaland
वर्गीकरण/ Classification	SPS related to tripping of critical line / corridor
संदर्भ संख्या/ Reference No.	**SPS/NA/001**
संचालन प्रक्रिया / Operating Procedure	N/A
डिज़ाइन उद्देश्य / Design Objectives	Uninterrupted power supply to the Dimapur area of Nagaland.
संचालन / Operation	Disconnection of the load at 66 kV Power House and 33 kV Metha at Dimapur(NA)
मोडलिंग/ Modelling	**Description:** Nagarjan i.e. Dimapur State substation is connected with rest of the grid through 132 kV Dimapur(PG)- Dimapur (Nagarjan) 1 & 2 Line. Dimapur area of the Nagaland power system is radially connected with 132 kV Dimapur (PG)-Dimapur(NA) D/C Line. Loading profile of Jun'23 – Oct-23 shows N-1 contingency of any one circuit not satisfied most of the time as the combine loading was above 85 MW for 22% of times and above 80 MW for 35% of times. This SPS ensures the safe operation of the grid by disconnection of selected load at Nagarjan area, thus protecting the 132 kV Dimapur PG lines from potential overloading.

Network Diagram:

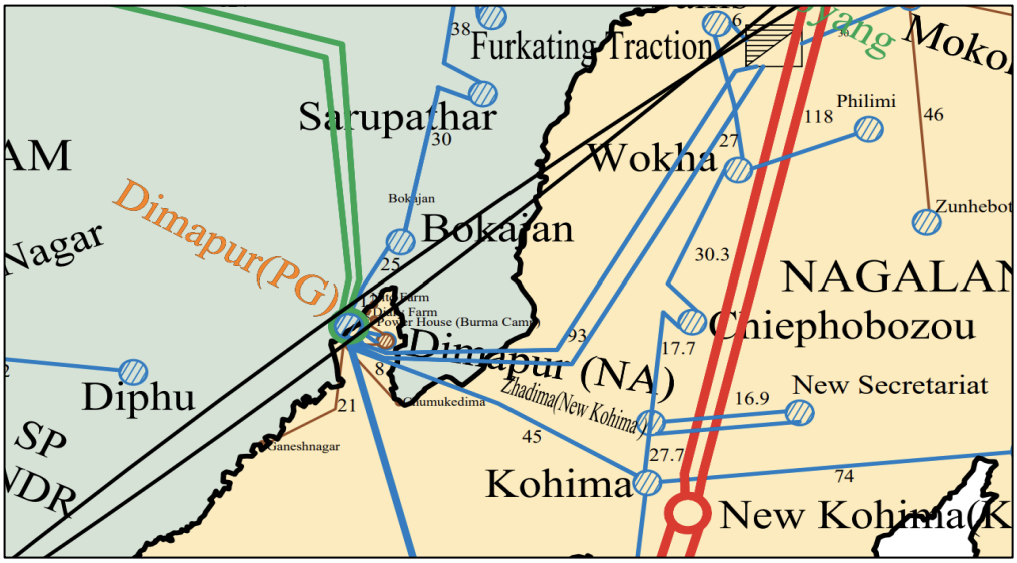


Fig 57: Network diagram

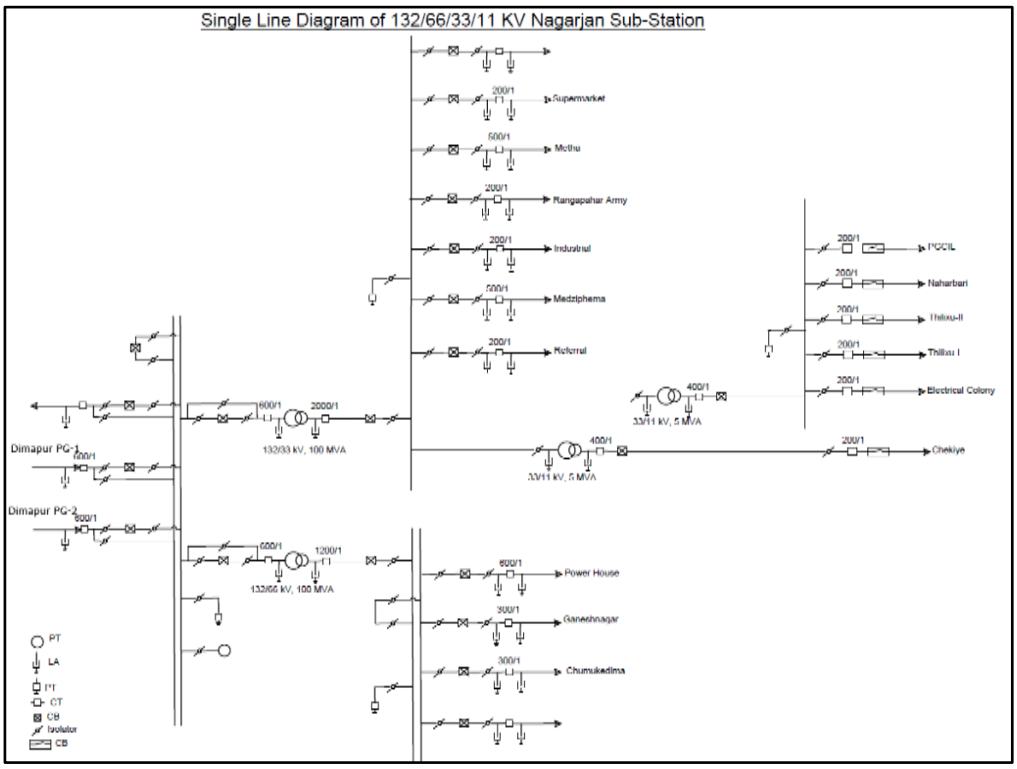
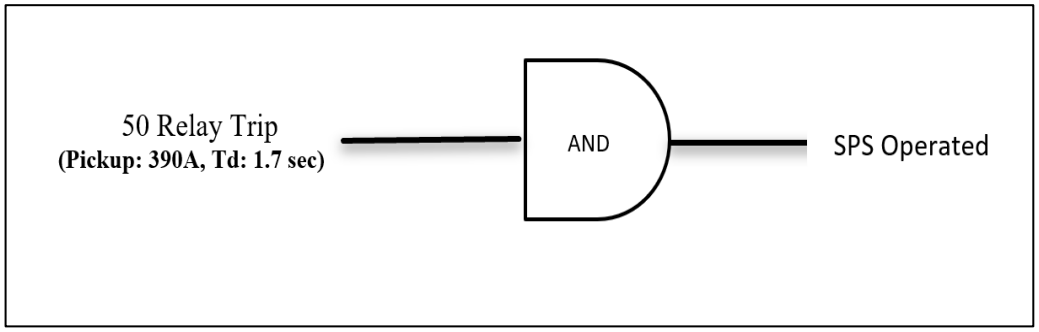
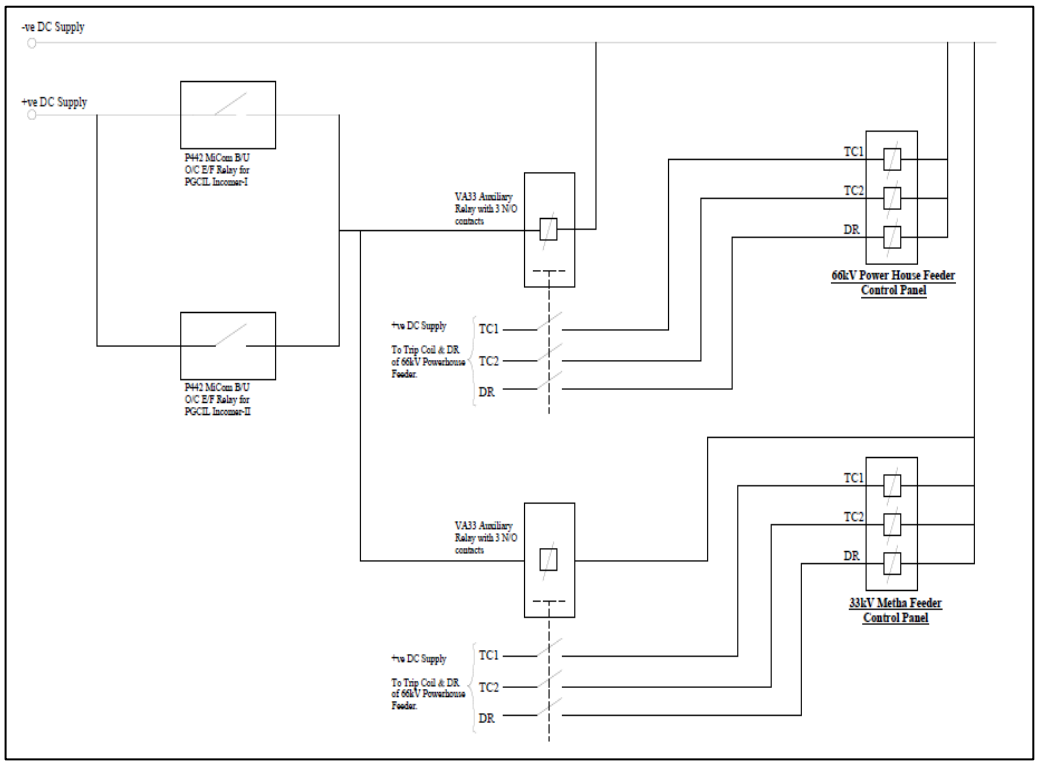


Fig 58: SLD of 132/66/33/11 kV Dimapur (Nagarjan) substation

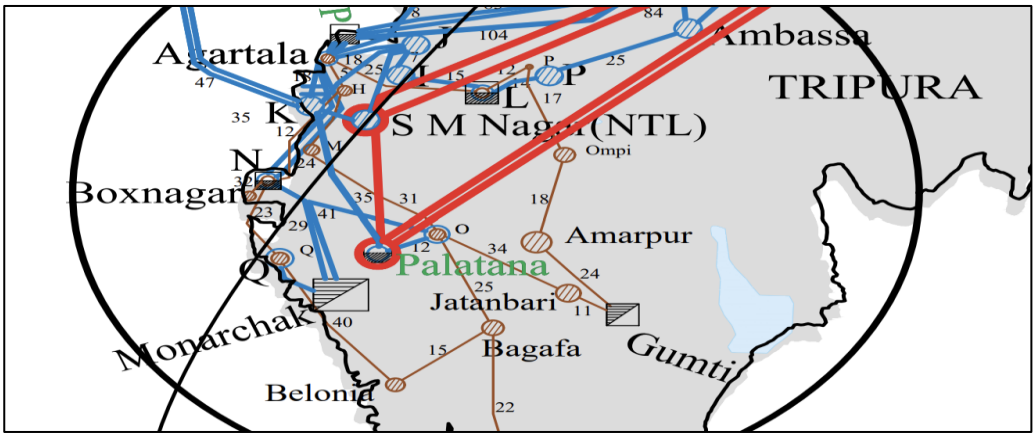
Triggering of Criteria:

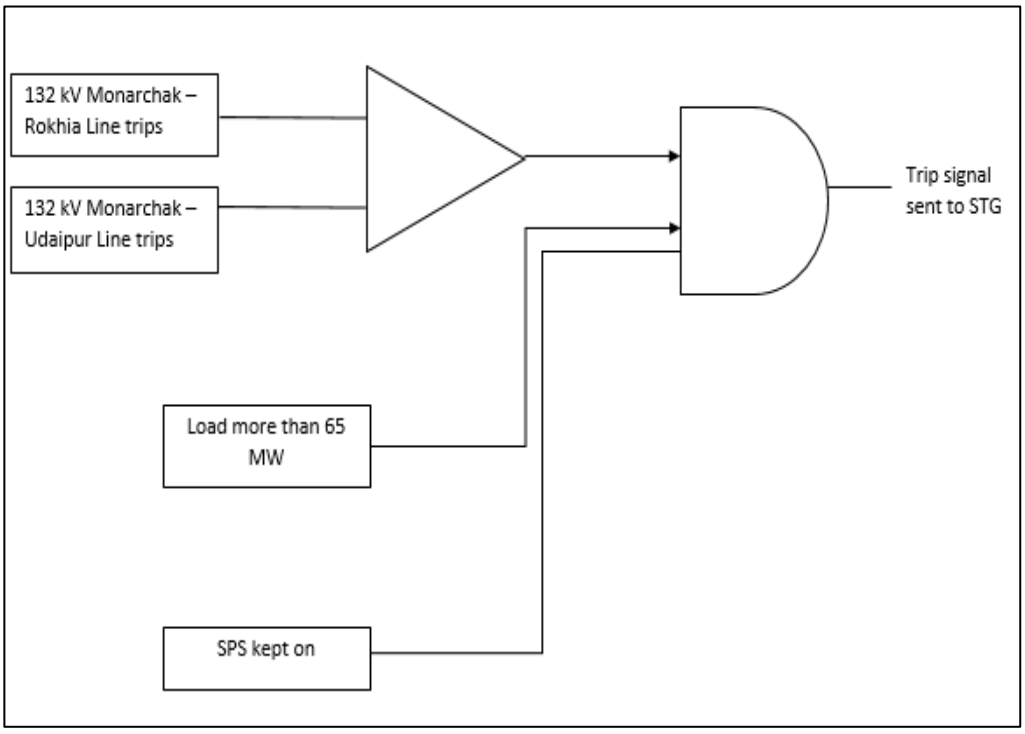
Whenever the current flow in either of the 132 kV Dimapur-Dimapur (Nagarjan) 1&2 Line crosses 390 A, a signal will be generated and trip the circuit breaker of 66 kV Power house and 33 kV Metha feeder from Dimapur (Nagarjan).

	Logic Diagram:  Fig 59: Logic diagram implemented at Dimapur(Nagarjan) substation  Fig 60: Hardwire diagram implemented at Dimapur(Nagarjan) substation
मूल सेवा वर्ष / Original In-Service Year	**28-Feb-2024**
हालिया मूल्यांकन समूह / Recent Assessment Group	DoP, Nagaland, PGCIL, NERLDC & NERPC
हाल की मूल्यांकन तिथि / Recent Assessment Date	Mock testing performed on 26-Sept-24

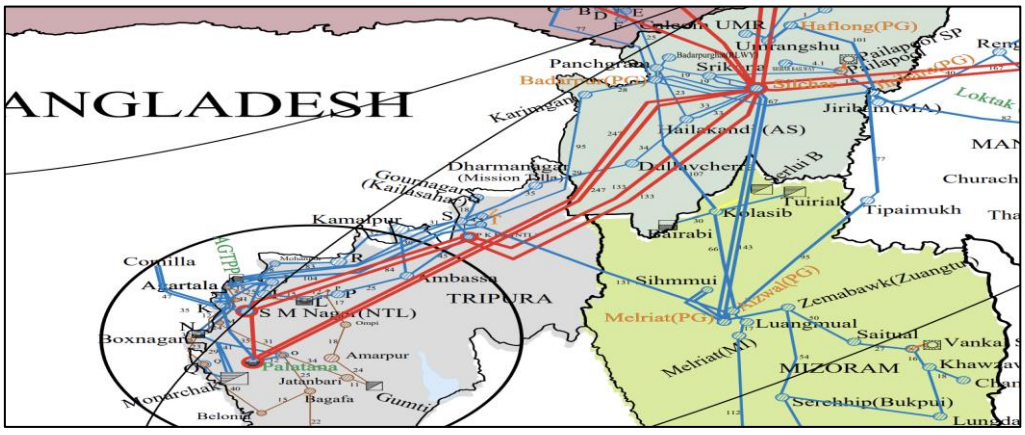
क्र.सं./ Sl. No	समीक्षा के लिए चेकलिस्ट / Checklist for review	हाँ/ना/ Yes/ No
I.	Does the scheme describe the intended purposes, conditions, and actions?	Yes
II.	Do the modelling and its intended actions appear to achieve the desired systemperformance objectives?	Yes
III.	Are the actions permissible in accordance with Transmission Planning Criteria (or any other applicable criteria)?	Yes
IV.	Do the actions satisfy Transmission Planning Criteria?	Yes
V.	Has the scheme been assessed within the last 5 years?	NA
VI.	Are the set thresholds of actions appropriate to meet system performance objectives?	Yes
VII.	Is the logic event-based only (as opposed to partly/fully parameter-based) which does not pose high potential for interaction with other schemes in the same region?	Yes
VIII.	Is the effect of inadvertent activation or failure to operate likely to be local (as opposed to widespread)?	Yes
IX.	Are the near-term system plans unlikely to have a significant effect on the scheme which would warrant its re-assessment (including its continued need, serving the intended purposes, and meeting current performance requirements)?	Yes
X.	Is the level of redundancy appropriate?	Yes
XI.	Has coordination or adverse interaction with other schemes been evaluated?	Yes

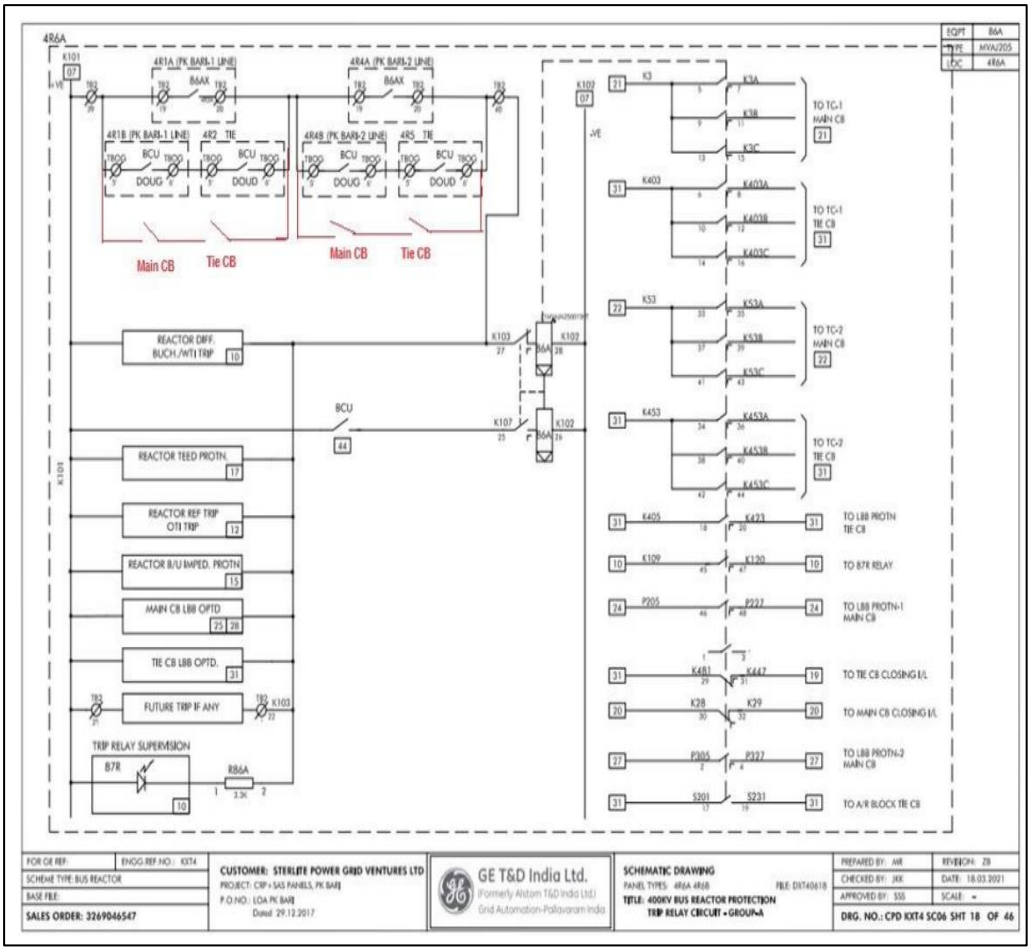
VII. त्रिपुरा में एस.पी.एस / SPS in Tripura:

विषय /Item	सूचना स्पष्टीकरण / Information Explanation
योजना का नाम / Scheme Name	**SPS/TR/001:** मोनार्चक (नीपको) पावर प्लांट से बिजली की सुरक्षित निकासी / Secure evacuation of power from the Monarchak (NEEPCO) Power Plant
रिपोर्टिंग पार्टी / Reporting party	Monarchak (NEEPCO)
वर्गीकरण/ Classification	SPS related to Safe evacuation of Generation
संदर्भ संक्या/ Reference No.	**SPS/TR/001**
संचालन प्रक्रिया / Operating Procedure	N/A
डिज़ाइन उद्देश्य / Design Objectives	To prevent a blackout at the Monarchak power station and ensure the safe evacuation of power from the GTG at Monarchak, with a capacity of 65.42 MW, in the event of a trip on either the 132 kV Monarchak–Rokhia line or the 132 kV Monarchak–Udaipur line, when the combined GTG+STG generation exceeds 65 MW.
संचालन / Operation	Tripping of STG at Monarchak (NEEPCO) power plant
मोडलिंग/ Modelling	**Description:** The Monarchak power station, with an installed capacity of 101 MW (65.42 MW from GTG and 35.58 MW from STG), is connected to the NER Grid through the 132 kV Monarchak–Rokhia line and the 132 kV Monarchak–Udaipur line. According to TSECL, the evacuation lines have a loading capacity of 65 MW each. **Network Diagram:**  Fig 61: Network diagram

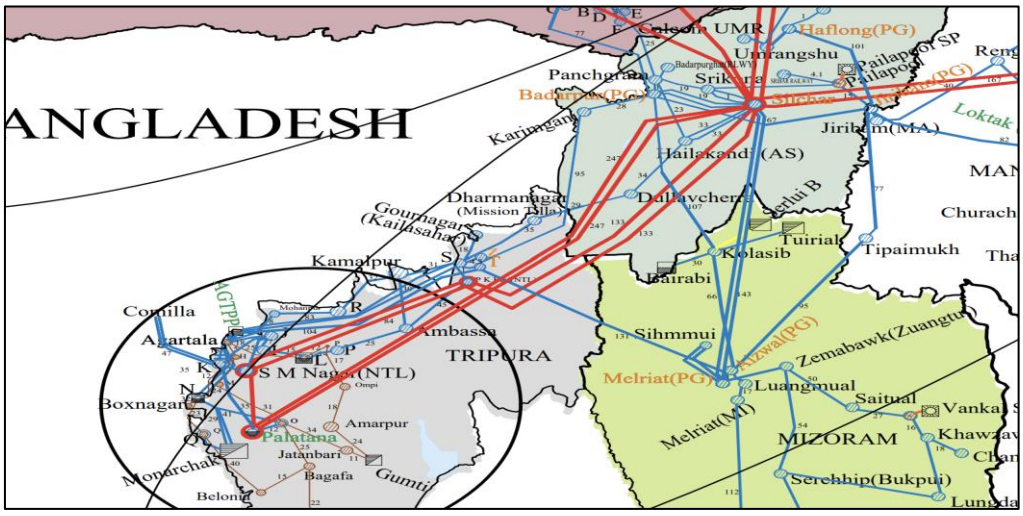
	Triggering of Criteria: When all units of Monarchak are operational, and the total generation exceeds 65 MW, the outage of either the 132 kV Monarchak–Rokhia line or the 132 kV Monarchak–Udaipur line should trigger the tripping of the STG at Monarchak to ensure the safe evacuation of power from the generating station. **Logic Diagram:**  Fig 62: Logic diagram implemented at Monarchak Power Plant
मूल सेवा वर्ष / Original In-Service Year	**19-Jan-22**
हालिया मूल्यांकन समूह / Recent Assessment Group	NEEPCO, TSECL, NERLDC & NERPC
हाल की मूल्यांकन तिथि / Recent Assessment Date	NA

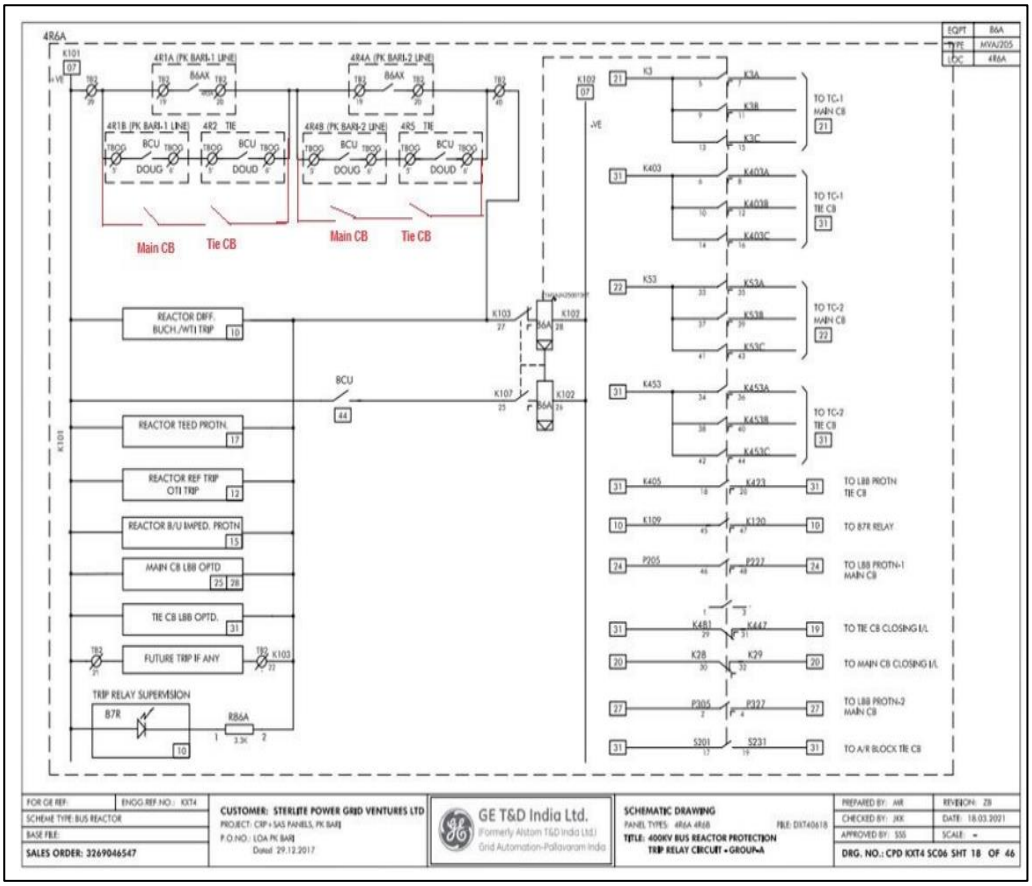
क्र.सं./ Sl. No	समीक्षा के लिए चेकलिस्ट / Checklist for review	हाँ/ना/ Yes/No
I.	Does the scheme describe the intended purposes, conditions, and actions?	Yes
II.	Do the modelling and its intended actions appear to achieve the desired systemperformance objectives?	Yes
III.	Are the actions permissible in accordance with Transmission Planning Criteria (or any other applicable criteria)?	Yes
IV.	Do the actions satisfy Transmission Planning Criteria?	Yes
V.	Has the scheme been assessed within the last 5 years?	NA
VI.	Are the set thresholds of actions appropriate to meet system performance objectives?	Yes
VII.	Is the logic event-based only (as opposed to partly/fully parameter-based) which does not pose high potential for interaction with other schemes in the same region?	Yes
VIII.	Is the effect of inadvertent activation or failure to operate likely to be local (as opposed to widespread)?	Yes
IX.	Are the near-term system plans unlikely to have a significant effect on the scheme which would warrant its re-assessment (including its continued need, serving the intended purposes, and meeting current performance requirements)?	Yes
X.	Is the level of redundancy appropriate?	Yes
XI.	Has coordination or adverse interaction with other schemes been evaluated?	Yes

विषय /Item	सूचना स्पष्टीकरण / Information Explanation
योजना का नाम / Scheme Name	**SPS/TR/002:** 400 केवी एसएम नगर (एनटीएल) -पीके बारी (एनटीएल) दोहरा सर्किट लाइन के दोनों सर्किट में आउटेज/ट्रिपिंग / Outage/ tripping of both circuits of 400 kV SM Nagar(NTL) -PK Bari(NTL) D/C Line
रिपोर्टिंग पार्टी / Reporting party	NTL (Indi-grid)
वर्गीकरण/ Classification	SPS related to under voltage condition
संदर्भ संख्या/ Reference No.	**SPS/TR/002**
संचालन प्रक्रिया / Operating Procedure	N/A
डिज़ाइन उद्देश्य / Design Objectives	To prevent under voltage situation at SM Nagar(NTL) and nearby areas of Tripura power system after tripping of 400 kV SM Nagar(NTL) -PK Bari(NTL) D/C Line
संचालन / Operation	Tripping of both the 2 x 125 MVAR Bus Reactors at SM Nagar (NTL)
मोडलिंग/ Modelling	**Description:** 400 kV SM Nagar (NTL) SS provides alternate path for evacuation of 726 MW generation of Palatana (OTPCL) via 400 kV Palatana- S M Nagar (NTL) - P K Bari (NTL)- Silchar(PG). Also, 400 kV S M Nagar(NTL) substation connected to 132 kV S M Nagar(TSECL) via 132 kV S M Nagar(NTL)- S M Nagar(TSECL) S/C line. 132 kV S M Nagar (TSECL) is the drawl point for Comilla area of Bangladesh power system. **Network Diagram:**  Fig 63: Network diagram

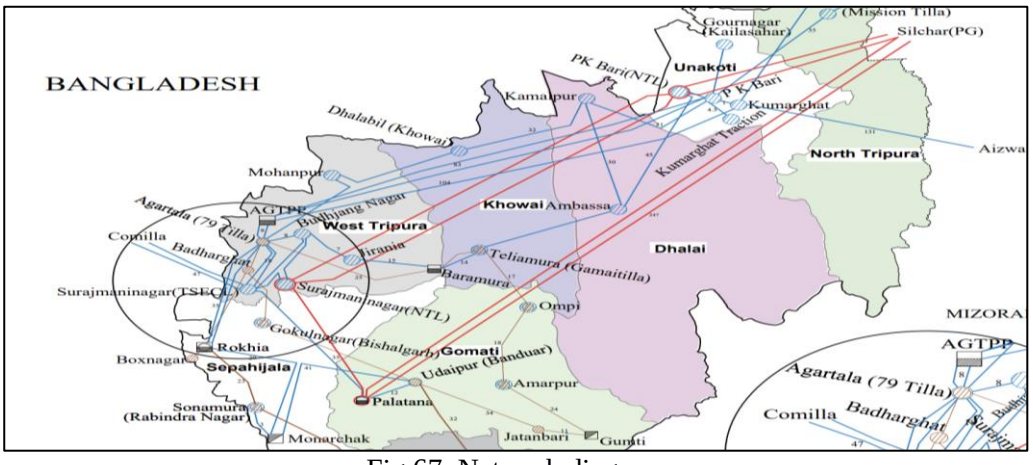
	Triggering of Criteria: Outage/tripping of both circuits of 400 kV SM Nagar-PK Bari D/C will trip 2 x 125 MVAR Bus Reactors at SM Nagar (NTL) to prevent under voltage situation at S M Nagar (NTL) and nearby areas of Tripura Power system. Logic will also operate in case of the outage of any one circuit and tripping of the other circuit. **Logic Diagram:**  Fig 64: Logic diagram implemented at Surajmaninagar(NTL) substation
मूल सेवा वर्ष / Original In-Service Year	**24-Mar-2021**
हालिया मूल्यांकन समूह / Recent Assessment Group	NTL (IndiGrid), NERLDC & NERPC
हाल की मूल्यांकन तिथि / Recent Assessment Date	Mock testing performed on 05-Aug-24

क्र.सं./ Sl. No	समीक्षा के लिए चेकलिस्ट / Checklist for review	हाँ/ना/Yes /No
I.	Does the scheme describe the intended purposes, conditions, and actions?	Yes
II.	Do the modelling and its intended actions appear to achieve the desired systemperformance objectives?	Yes
III.	Are the actions permissible in accordance with Transmission Planning Criteria (or any other applicable criteria)?	Yes
IV.	Do the actions satisfy Transmission Planning Criteria?	Yes
V.	Has the scheme been assessed within the last 5 years?	NA
VI.	Are the set thresholds of actions appropriate to meet system performance objectives?	Yes
VII.	Is the logic event-based only (as opposed to partly/fully parameter-based) which does not pose high potential for interaction with other schemes in the same region?	Yes
VIII.	Is the effect of inadvertent activation or failure to operate likely to be local (as opposed to widespread)?	Yes
IX.	Are the near-term system plans unlikely to have a significant effect on the scheme which would warrant its re-assessment (including its continued need, serving the intended purposes, and meeting current performance requirements)?	Yes
X.	Is the level of redundancy appropriate?	Yes
XI.	Has coordination or adverse interaction with other schemes been evaluated?	Yes

विषय /Item	सूचना स्पष्टीकरण / Information Explanation
योजना का नाम / Scheme Name	**SPS/TR/003:** 400kV पीके बारी (एनटीएल) - सिलचर (पीजी) लाइन के दोनों सर्किटों का आउटेज/ट्रिपिंग / Outage/ tripping of both circuits of 400kV PK Bari (NTL) – Silchar(PG) D/C Lines
रिपोर्टिंग पार्टी / Reporting party	NTL (Indi-grid)
वर्गीकरण/ Classification	SPS related to under voltage condition
संदर्भ संख्या/ Reference No.	**SPS/TR/003**
संचालन प्रक्रिया / Operating Procedure	N/A
डिज़ाइन उद्देश्य / Design Objectives	To prevent under voltage situation at P K Bari (NTL) and nearby areas of Tripura power system after tripping of 400kV PK Bari (NTL) – Silchar(PG) D/C Lines
संचालन / Operation	Tripping of both the 2 x 125 MVAR Bus Reactors at PK Bari (NTL)
मोडलिंग/ Modelling	**Description:** 400 kV P K Bari (NTL) SS provides alternate path for evacuation of 726 MW generation of Palatana (OTPCL) via 400 kV Palatana- S M Nagar (NTL) - P K Bari (NTL) – Silchar (PG). **Network Diagram:**  Fig 65: Network diagram

	Triggering of Criteria: Outage/tripping of both circuits of 400kV PK Bari (NTL) – Silchar(PG) D/C will trip 2 x 125 MVAR Bus Reactors at P K Bari(NTL) to prevent under voltage situation at P K Bari(NTL) and nearby areas of Tripura system. Logic will also operate in case of the outage of any one circuit and tripping of the other circuit. **Logic Diagram:**  Fig 66: Logic diagram implemented at PK Bari (NTL) substation
मूल सेवा वर्ष / Original In-Service Year	**29-Apr-2021**
हालिया मूल्यांकन समूह / Recent Assessment Group	NTL(IndiGrid), NERLDC & NERPC
हाल की मूल्यांकन तिथि / Recent Assessment Date	Mock testing performed on 06-Aug-24

क्र.सं./ Sl. No	समीक्षा के लिए चेकलिस्ट / Checklist for review	हाँ/ना/ Yes/ No
I.	Does the scheme describe the intended purposes, conditions, and actions?	Yes
II.	Do the modelling and its intended actions appear to achieve the desired systemperformance objectives?	Yes
III.	Are the actions permissible in accordance with Transmission Planning Criteria (or any other applicable criteria)?	Yes
IV.	Do the actions satisfy Transmission Planning Criteria?	Yes
V.	Has the scheme been assessed within the last 5 years?	NA
VI.	Are the set thresholds of actions appropriate to meet system performance objectives?	Yes
VII.	Is the logic event-based only (as opposed to partly/fully parameter-based) which does not pose high potential for interaction with other schemes in the same region?	Yes
VIII.	Is the effect of inadvertent activation or failure to operate likely to be local (as opposed to widespread)?	Yes
IX.	Are the near-term system plans unlikely to have a significant effect on the scheme which would warrant its re-assessment (including its continued need, serving the intended purposes, and meeting current performance requirements)?	Yes
X.	Is the level of redundancy appropriate?	Yes
XI.	Has coordination or adverse interaction with other schemes been evaluated?	Yes

विषय /Item	सूचना स्पष्टीकरण / Information Explanation
योजना का नाम / Scheme Name	**SPS/TR/004:** जब पलाटाना के दोनों मॉड्यूल सेवा में हैं तो 400kV पलाटाना-सिलचर दोहरा सर्किट लाइन का आउटेज/ट्रिपिंग / Outage/tripping of 400kV Palatana-Silchar D/C Line when both modules of Palatana are in service.
रिपोर्टिंग पार्टी / Reporting party	NERTS(PG), OTPC
वर्गीकरण/ Classification	SPS Related to Tripping of Critical Line(s)/Corridor
संदर्भ संख्या/ Reference No.	**SPS/TR/004**
संचालन प्रक्रिया / Operating Procedure	After the commissioning of the 400 kV Palatana–Surajmaninagar(NTL) I Line, the SPS deactivated. However, the SPS at Palatana must remain active during the shutdown of the 400 kV Palatana–Surajmaninagar (ISTS) Line-1.
डिज़ाइन उद्देश्य / Design Objectives	To Relieve Impact of Tripping Both Circuits of 400 kV Palatana-Silchar Lines
संचालन / Operation	Tripping of HV side breaker of 2*125 MVA, 400/132 kV ICT at Palatana
मोडलिंग/ Modelling	**Description:** Palatana Gas Based Power plant with Installed capacity of 726 MW power evacuated mainly through 400kV Palatana-Silchar D/C Line. Hence, tripping of both the lines leading to cascade tripping at Tripura power system. However, the evacuation issued resolved after commissioning of the 400 kV Palatana–Surajmaninagar (NTL) I Line. **Connectivity Diagram:**  Fig 67: Network diagram

Triggering of Criteria:

i. The logic for operation of SPS would be tripping of both circuits of 400 kV Silchar-Palatana D/C.

ii. Under any one of the following conditions, SPS-2 should operate:

- Tripping/opening of both 400 kV Silchar-Palatana I & II lines at both Silchar and Palatana ends
- Tripping/opening of both 400 kV Silchar-Palatana I & II lines only at Silchar end
- Tripping/opening of both 400 kV Silchar-Palatana I & II lines only at Palatana end
- Tripping/opening of 400 kV Silchar-Palatana I line at Palatana end and 400 kV Silchar-Palatana II line at Sichar end
- Tripping/opening of 400 kV Silchar-Palatana I line at Silchar end and 400 kV Silchar-Palatana II line at Palatana end
- In event of one circuit under shutdown, SPS should operate for tripping of the other circuit either at Palatana end or Silchar end.

iii. When the above conditions are satisfied, a signal will be generated at Palatana. The signal from the above logic should trip HV side breaker of 2x125 MVA, 400/132 kV ICT at Palatana.

Logic Diagram:

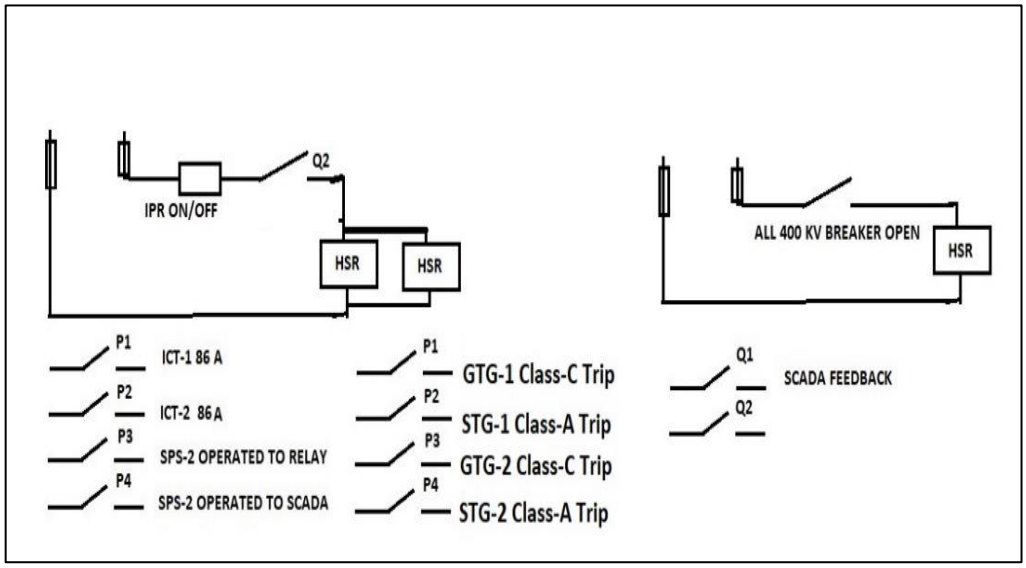


Figure 68: Logic diagram at Palatana

मूल सेवा वर्ष / Original In-Service Year	**23-Feb-2015**

हालिया मूल्यांकन समूह / Recent Assessment Group	PGCIL, OTPC, NERLDC & NERPC
हाल की मूल्यांकन तिथि / Recent Assessment Date	23.06.2017 (Special Meeting on SPS at NERLDC)

क्र.सं./ Sl. No	समीक्षा के लिए चेकलिस्ट / Checklist for review	हाँ/ना/ Yes/ No
I.	Does the scheme describe the intended purposes, conditions, and actions?	Yes
II.	Do the modelling and its intended actions appear to achieve the desired systemperformance objectives?	Yes
III.	Are the actions permissible in accordance with Transmission Planning Criteria (or any other applicable criteria)?	Yes
IV.	Do the actions satisfy Transmission Planning Criteria?	Yes
V.	Has the scheme been assessed within the last 5 years?	NA
VI.	Are the set thresholds of actions appropriate to meet system performance objectives?	Yes
VII.	Is the logic event-based only (as opposed to partly/fully parameter-based) which does not pose high potential for interaction with other schemes in the same region?	Yes
VIII.	Is the effect of inadvertent activation or failure to operate likely to be local (as opposed to widespread)?	Yes
IX.	Are the near-term system plans unlikely to have a significant effect on the scheme which would warrant its re-assessment (including its continued need, serving the intended purposes, and meeting current performance requirements)?	Yes
X.	Is the level of redundancy appropriate?	Yes
XI.	Has coordination or adverse interaction with other schemes been evaluated?	Yes

विषय /Item	सूचना स्पष्टीकरण / Information Explanation
योजना का नाम / Scheme Name	**SPS/TR/005:** 132 केवी सूरजमणिनगर (टीएसईसीएल)-सूरजमणिनगर (एनटीएल) लाइन पर ओवरलोडिंग / Overloading of 132 kV Surajmaninagar (TSECL)- Surajmaninagar (NTL) Line
रिपोर्टिंग पार्टी / Reporting party	TSECL
वर्गीकरण/ Classification	SPS related to tripping of critical line / corridor
संदर्भ संक्या/ Reference No.	**SPS/TR/005**
संचालन प्रक्रिया / Operating Procedure	N/A
डिज़ाइन उद्देश्य / Design Objectives	Avoid cascade tripping due to overload tripping of 132 kV Surajmaninagar(TSECL)-Surajmaninagar (NTL) Line
संचालन / Operation	Tripping of HV side Circuit Breaker of two 132/33 kV ICT's at Surajmaninagar (TSECL)
मोडलिंग/ Modelling	**Description:** Surajmaninagar (TSECL) is connected with Surajmaninagar (NTL) Substation through 132 kV Surajmaninagar(TSECL)- Surajmaninagar(NTL) Line and 132 kV Surajmaninagar (TSECL)-Bduhjang Nagar - Surajmaninagar (NTL) Line. The loading in the 132 kV Surajmaninagar (ISTS) –Surajmaninagar (TSECL) line would cross 450 A (100 MW) during the outage/tripping of the following elements: I. 132 kV Budjangnagar-Surajmaninagar(ISTS) Line II. Monarchak Generation loss and III. 132 kV PK Bari(NTL)-PK Bari(TSECL) Line

Connectivity Diagram:

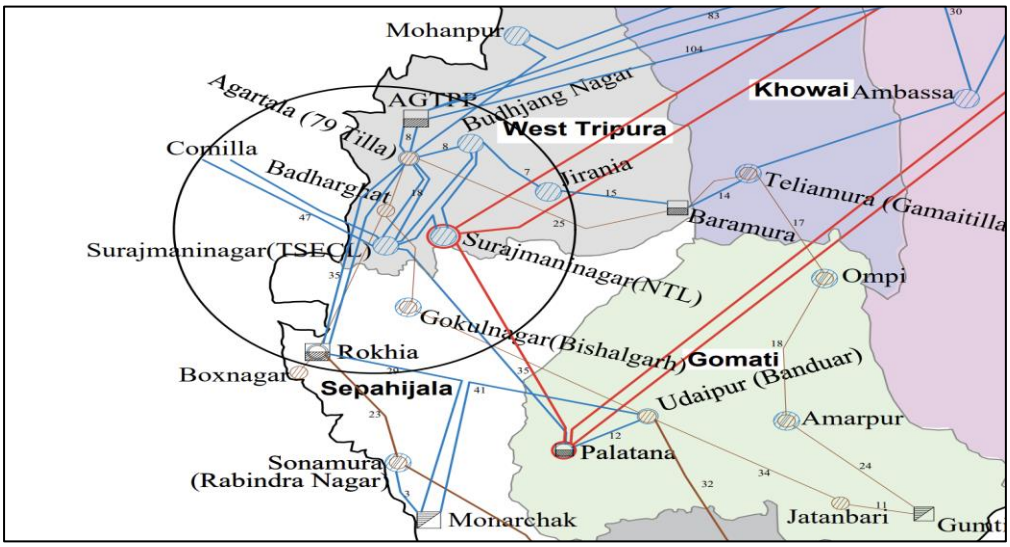


Fig 69: Network diagram

Triggering of Criteria:

A non-tripping, non-directional definite time overcurrent protection function is utilized from the Main-1 Protection Relay at Surajmaninagar (TSECL) for the 132 kV Surajmaninagar (ISTS)–Surajmaninagar (TSECL) line. If the current recorded by the relay reaches 450 A and persists for a duration of 2 seconds, the overcurrent (OC) stage will be triggered. Consequently, the binary output of the relay will latch.

This latched binary output is connected to the Control and Monitoring Relay (CMR), whose normally open (NO) auxiliary contact is linked to the Master Trip Relay of the ICTs at Surajmaninagar (TSECL).

According to this logic, whenever the current on the 132 kV Surajmaninagar (ISTS)–Surajmaninagar (TSECL) line exceeds 450 A for 2 seconds, the Special Protection Scheme (SPS) will activate. This will result in the tripping of the HV-side 132 kV circuit breakers (CBs) of the ICTs at Surajmaninagar (TSECL).

Logic Diagram:

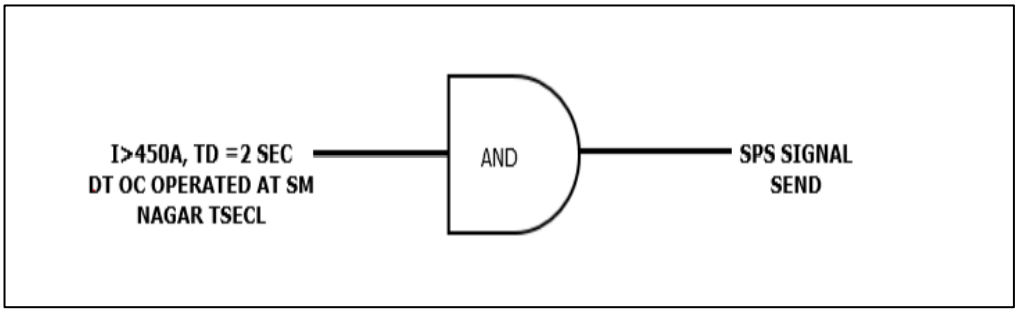
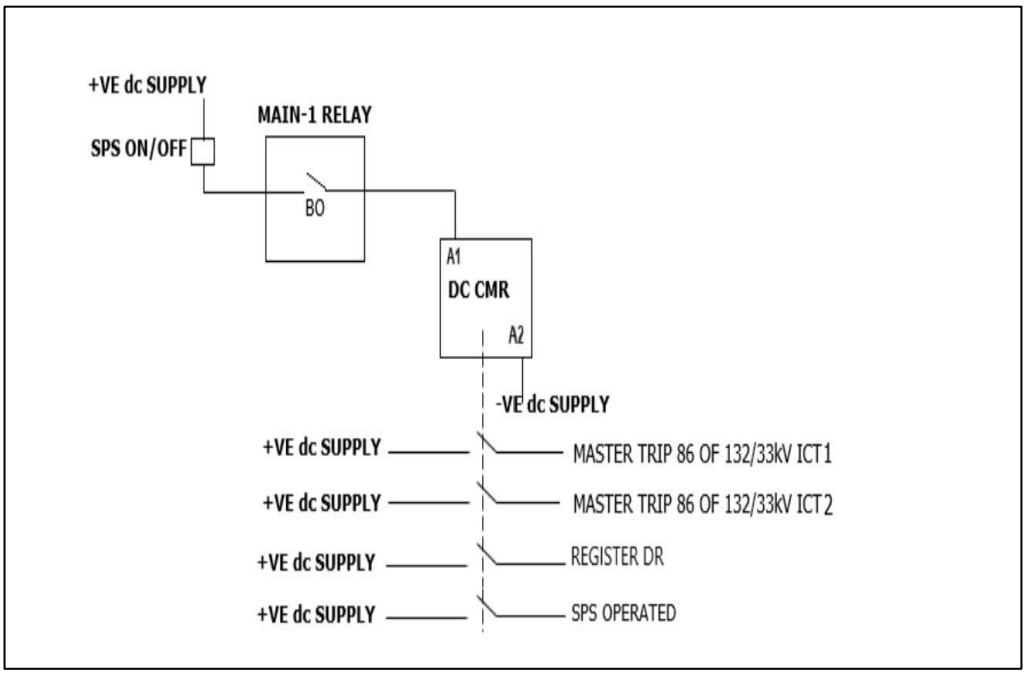
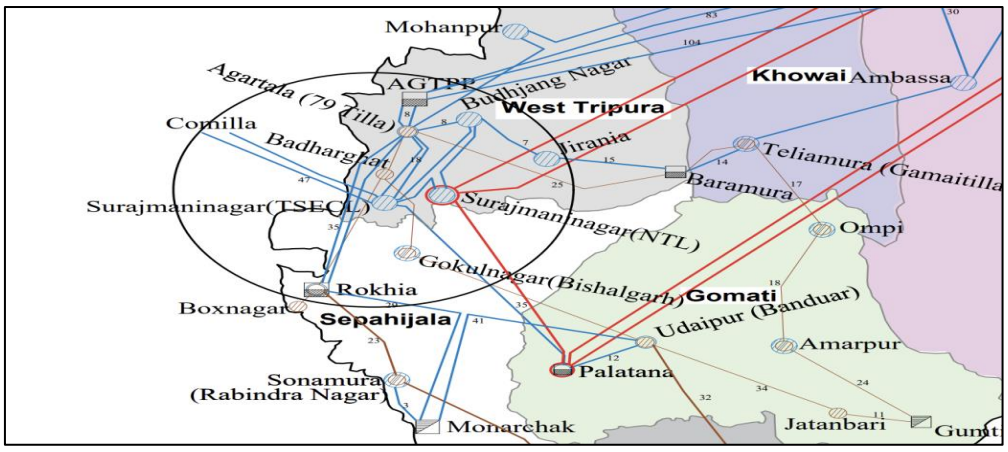
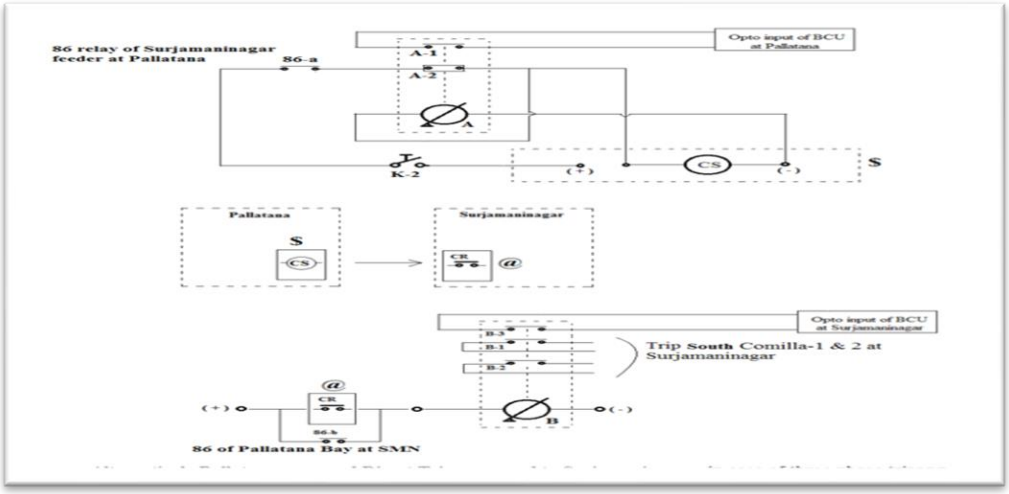


Fig 70: SPS in Main relay of 132 kV SM Nagar ISTS at SM Nagar TSECL

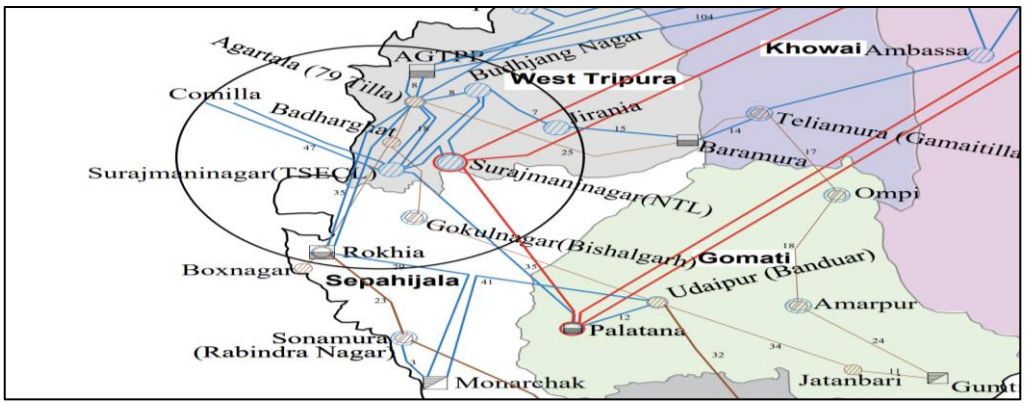
	 Fig 71: SPS implementation wiring diagram at Surajmaninagar (TSECL)
मूल सेवा वर्ष / Original In-Service Year	**11-Nov-2024**
हालिया मूल्यांकन समूह / Recent Assessment Group	TSECL, NERLDC & NERPC
हाल की मूल्यांकन तिथि / Recent Assessment Date	NA

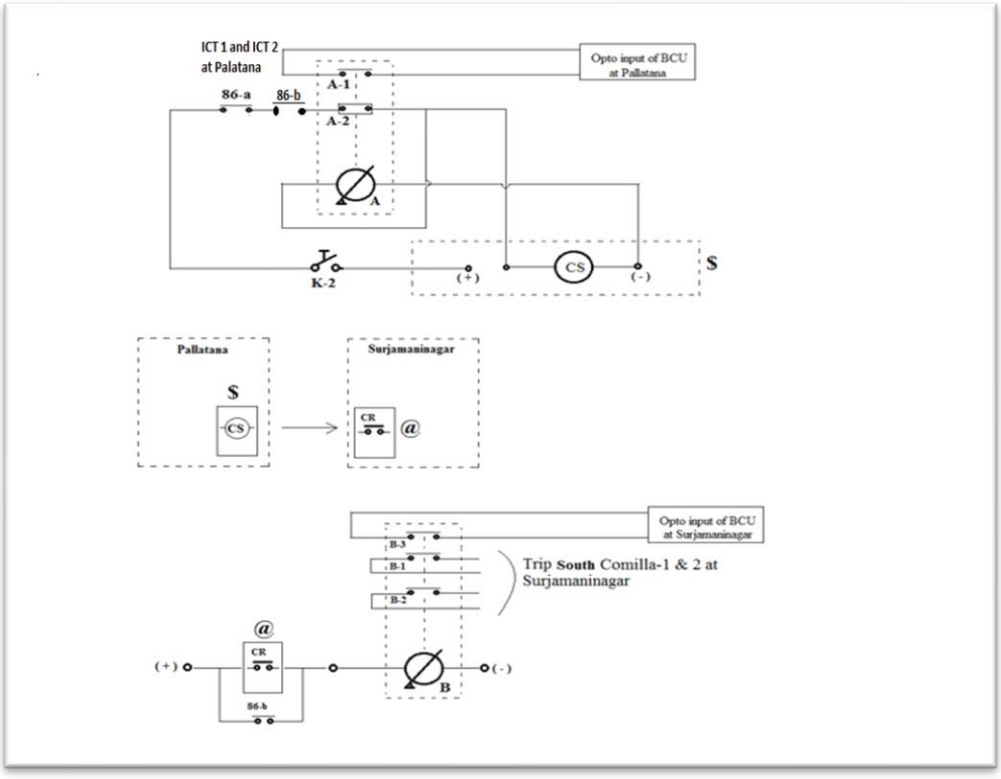
क्र.सं./ Sl. No	समीक्षा के लिए चेकलिस्ट / Checklist for review	हाँ/ना/ Yes/ No
I.	Does the scheme describe the intended purposes, conditions, and actions?	Yes
II.	Do the modelling and its intended actions appear to achieve the desired systemperformance objectives?	Yes
III.	Are the actions permissible in accordance with Transmission Planning Criteria (or any other applicable criteria)?	Yes
IV.	Do the actions satisfy Transmission Planning Criteria?	Yes
V.	Has the scheme been assessed within the last 5 years?	NA
VI.	Are the set thresholds of actions appropriate to meet system performance objectives?	Yes
VII.	Is the logic event-based only (as opposed to partly/fully parameter-based) which does not pose high potential for interaction with other schemes in the same region?	Yes
VIII.	Is the effect of inadvertent activation or failure to operate likely to be local (as opposed to widespread)?	Yes
IX.	Are the near-term system plans unlikely to have a significant effect on the scheme which would warrant its re-assessment (including its continued need, serving the intended purposes, and meeting current performance requirements)?	Yes
X.	Is the level of redundancy appropriate?	Yes
XI.	Has coordination or adverse interaction with other schemes been evaluated?	Yes

विषय /Item	सूचना स्पष्टीकरण / Information Explanation
योजना का नाम / Scheme Name	**SPS/TR/006:** 400 केवी पलटाना-सूरजमाणि नगर लाइन (132 केवी पर चाजे) की आउटेज/ट्रिपिंग / Outage/tripping of 400 kV Palatana – Surajmani Nagar line (charged at 132 kV)
रिपोर्टिंग पार्टी / Reporting party	NERTS(PG), TSECL, OTPC
वर्गीकरण/ Classification	SPS related to tripping of critical line / corridor
संदर्भ संख्या/ Reference No.	**SPS/TR/006**
संचालन प्रक्रिया / Operating Procedure	N/A
डिज़ाइन उद्देश्य / Design Objectives	Avoid Cascading tripping/blackout at Tripura power system due to the outage/tripping of 400 kV Palatana – Surajmani Nagar line (charged at 132 kV)
संचालन / Operation	Tripping of 400 kV SM Nagar – Comilla D/C (charged at 132 kV) during outage/tripping of 400 kV Palatana – SM Nagar(TSECL) line (charged at 132 kV)
मोडलिंग/ Modelling	**Description:** NER Grid is connected to South Comilla (Bangladesh) Power System through 400 kV SM Nagar (TSECL) – Comilla D/C (presently charged at 132 kV level). The total contracted capacity is 160 MW export to South Comilla (Bangladesh). The safe and secure operation of cross border lines is of prime importance during grid operation and utmost measures are taken to ensure the reliability of power supply to Bangladesh. Tripping of cross border link followed by shifting of entire 160 MW load from India Grid to Bangladesh Grid. **Connectivity Diagram:**  Fig 72: Network diagram

	Triggering of Criteria: • Switch K2 at Palatana shall be kept closed to keep the SPS in service. • When Surajmaninagar line at Palatana trips, it's trip relay NO contact 86-a will make and extend the DC + to Carrier send relay CS of protection coupler as well as to the High Speed trip **relay A** through it's own NC contact A-2. • CS will send a code through PLCC to Surajmaninagar. Relay A will operate and it's NC contact A-2 will open there by preventing continuous operation of CS. • NO contact A-1 shall be wired to one binary input of one BCU at Palatana to log the event with time stamping. • At Surajmaninagar, the carrier receive contact of Palatana protection coupler CR will be made parallel with one NO contact 86-b of the trip relay for Palatana feeder and shall be used to operate a newly installed High Speed Trip Relay B at Surajmaninagar. • NO contacts B-1 and B-2 of relay B shall be used to trip South Comilla-1 and South Comilla-2 feeders. • NO contact B-3 shall be wired to one binary input of one BCU at Surjamaninagar to log the event with time stamping. **Logic Diagram:**  Fig 73: SPS Logic Diagram related to outage of 400 kV Palatana – SM Nagar Line (charged at 132 kV)
मूल सेवा वर्ष / Original In-Service Year	**05-Aug-2020**
हालिया मूल्यांकन समूह / Recent Assessment Group	PGCIL, TSECL, OTPC, NERLDC & NERPC
हाल की मूल्यांकन तिथि / Recent Assessment Date	NA

क्र.सं./ Sl. No	समीक्षा के लिए चेकलिस्ट / Checklist for review	हाँ/ना/ Yes/ No
I.	Does the scheme describe the intended purposes, conditions, and actions?	Yes
II.	Do the modelling and its intended actions appear to achieve the desired systemperformance objectives?	Yes
III.	Are the actions permissible in accordance with Transmission Planning Criteria (or any other applicable criteria)?	Yes
IV.	Do the actions satisfy Transmission Planning Criteria?	Yes
V.	Has the scheme been assessed within the last 5 years?	NA
VI.	Are the set thresholds of actions appropriate to meet system performance objectives?	Yes
VII.	Is the logic event-based only (as opposed to partly/fully parameter-based) which does not pose high potential for interaction with other schemes in the same region?	Yes
VIII.	Is the effect of inadvertent activation or failure to operate likely to be local (as opposed to widespread)?	Yes
IX.	Are the near-term system plans unlikely to have a significant effect on the scheme which would warrant its re-assessment (including its continued need, serving the intended purposes, and meeting current performance requirements)?	Yes
X.	Is the level of redundancy appropriate?	Yes
XI.	Has coordination or adverse interaction with other schemes been evaluated?	Yes

विषय /Item	सूचना स्पष्टीकरण / Information Explanation
योजना का नाम / Scheme Name	**SPS/TR/007:** पलाटाना में 400/132 केवी, 2x125 एमवीए आईसीटी दोनों का आउटेज/ट्रिपिंग / Outage/tripping of both 400/132 kV, 2x125 MVA ICTs at Palatana
रिपोर्टिंग पार्टी / Reporting party	NERTS(PG), TSECL, OTPC
वर्गीकरण/ Classification	SPS related to tripping of critical line / corridor
संदर्भ संख्या/ Reference No.	**SPS/TR/007**
संचालन प्रक्रिया / Operating Procedure	N/A
डिज़ाइन उद्देश्य / Design Objectives	Avoid Cascading tripping/blackout at Tripura power system due to the outage/tripping of both 400/132 kV, 2x125 MVA ICTs at Palatana
संचालन / Operation	Entire load disconnection of South Comilla by way of tripping of 132kV SM Nagar-South Comilla D/C
मोडलिंग/ Modelling	**Description:** NER Grid is connected to South Comilla (Bangladesh) Power System through 400 kV SM Nagar (TSECL) – Comilla D/C (presently charged at 132 kV level). The total contracted capacity is 160 MW export to South Comilla (Bangladesh). The safe and secure operation of cross border lines is of prime importance during grid operation and utmost measures are taken to ensure the reliability of power supply to Bangladesh.Tripping of cross border link followed by shifting of entire 160 MW load from India Grid to Bangladesh Grid. **Connectivity Diagram:**  Fig 74: Network diagram

	Triggering of Criteria: • Switch K2 at Palatana shall be kept closed to keep the SPS in service. • When both ICTs at Palatana trips, it's trip relay NO contact 86-a and 86-b will make and extend the DC + to Carrier send relay CS of protection coupler as well as to the newly installed High Speed trip relay A through it's own NC contact A-2. • CS will send a code through PLCC to Surajmaninagar. Relay A will operate and it's NC contact A-2 will open there by preventing continuous operation of CS. • NO contact A-1 shall be wired to one binary input of one BCU at Palatana to log the event with time stamping. • At Surajmaninagar, the carrier receive contact of Palatana protection coupler CR will be made parallel with one NO contact 86-b of the trip relay for Palatana Feeder and shall be used to operate a newly installed High Speed Trip Relay B at Surajmaninagar. • NO contacts B-1 and B-2 of relay B shall be used to trip South Comilla-1 and South Comilla-2 feeders. • NO contact B-3 shall be wired to one binary input of one BCU at Surajmaninagar to log the event with time stamping. **Logic Diagram:**  Fig 75: SPS Logic Diagram related to Outage of both 400/132 kV, 2x125 MVA ICTs at Palatana
मूल सेवा वर्ष / Original In-Service Year	**08-Aug-2020**
हालिया मूल्यांकन समूह / Recent	PGCIL, TSECL, OTPC

Assessment Group	
हाल की मूल्यांकन तिथि / Recent Assessment Date	NA

क्र.सं./ Sl. No	समीक्षा के लिए चेकलिस्ट / Checklist for review	हाँ/ना/ Yes/ No
I.	Does the scheme describe the intended purposes, conditions, and actions?	Yes
II.	Do the modelling and its intended actions appear to achieve the desired systemperformance objectives?	Yes
III.	Are the actions permissible in accordance with Transmission Planning Criteria (or any other applicable criteria)?	Yes
IV.	Do the actions satisfy Transmission Planning Criteria?	Yes
V.	Has the scheme been assessed within the last 5 years?	NA
VI.	Are the set thresholds of actions appropriate to meet system performance objectives?	Yes
VII.	Is the logic event-based only (as opposed to partly/fully parameter-based) which does not pose high potential for interaction with other schemes in the same region?	Yes
VIII.	Is the effect of inadvertent activation or failure to operate likely to be local (as opposed to widespread)?	Yes
IX.	Are the near-term system plans unlikely to have a significant effect on the scheme which would warrant its re-assessment (including its continued need, serving the intended purposes, and meeting current performance requirements)?	Yes
X.	Is the level of redundancy appropriate?	Yes
XI.	Has coordination or adverse interaction with other schemes been evaluated?	Yes

F. एसपीएस योजना स्वीकृत एवं कार्यान्वयनाधीन / SPS scheme approved and under implementation:

I. SPS at Pasighat substation for preventing Overloading of 132 kV Tinsukia-Rupai/132 kV Tinsukia-Ledo Lines :

विषय /Item	सूचना स्पष्टीकरण / Information Explanation
योजना का नाम / Scheme Name	132 केवी तिनसुकिया-रुपाई/132 केवी तिनसुकिया-लेडो लाइनों पर ओवरलोडिंग को रोकने के लिए पासीघाट सबस्टेशन पर एस.पी.एस / SPS at Pasighat substation for preventing Overloading of 132 kV Tinsukia-Rupai/132 kV Tinsukia-Ledo Lines
रिपोर्टिंग पार्टी / Reporting party	DoP Arunachal Pradesh
वर्गीकरण/ Classification	SPS related to Tripping of critical line(s) / corridor
संदर्भ संक्या/ Reference No.	NA
संचालन प्रक्रिया / Operating Procedure	NA
डिज़ाइन उद्देश्य / Design Objectives	To mitigate overloading on the 132 kV Tinsukia-Rupai line in the event of a tripping on the 132 kV Paynor-Ziro Line through automatic disconnection of 132 kV Pasighat-Napit line under specific conditions, after the connection of the Niglok load in the Pasighat area of Arunachal Power System
संचालन / Operation	**Trigger Condition:** i) Power Flow Direction Change: The power flow in the 132 kV Pasighat-Along Line changes from import to export mode, with a current magnitude of 10 Amperes(2 MW) ii) Overloading of Pasighat-Napit Line: The current on the 132 kV Pasighat-Napit Line exceeds 65A Ampere (15 MW with pf 0.95) with a time delay of 3.5 seconds **Action:** Trip signal generated to trip the Circuit breaker of the 132 kV Napit-I & II Lines at Pasighat Substation.
मोडलिंग/ Modelling	**Description:** The purpose of this SPS is to mitigate overloading on the 132 kV Tinsukia-Rupai line in the event of a tripping on the 132 kV Panyor-Ziro Line through automatic disconnection of 132 kV Pasighat-Napit line under specific conditions, after the connection of the Niglok load in the Pasighat area of Arunachal Power System. This SPS will alleviate the overloading of 132 kV Tinsukia-Rupai Line, ensuring reliable grid operation. This scheme is designed to enhance the reliability of the Arunachal Power System by efficiently managing line loading under specific contingencies.

Connectivity Diagram:

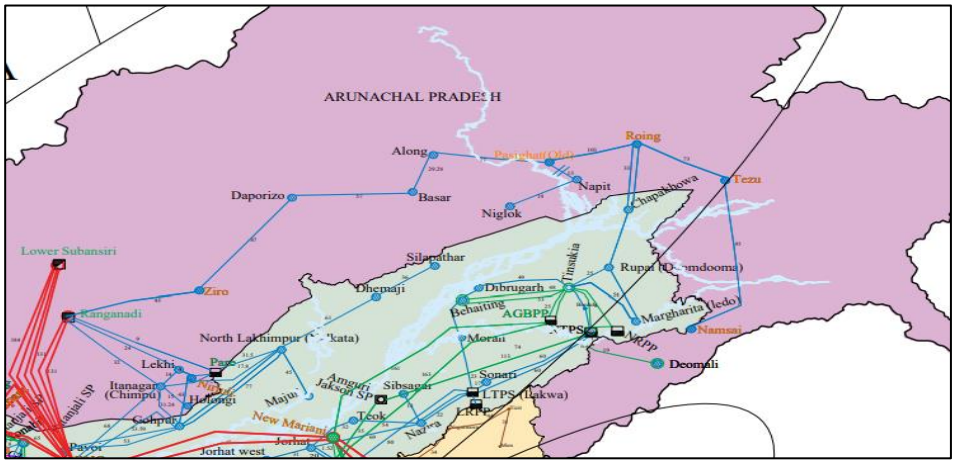


Fig 76: Network diagram

Triggering of Criteria:

i) Power Flow Direction Change: The power flow in the 132 kV Pasighat-Along Line changes from import to export mode, with a current magnitude of 10 Amperes(2 MW)

ii) Overloading of Pasighat-Napit Line: The current on the 132 kV Pasighat-Napit Line exceeds 65A Ampere (15 MW with pf 0.95) with a time delay of 3.5 seconds

Action taken: Trip signal generated to trip the Circuit breaker of the 132 kV Napit-I & II Lines at Pasighat Substation.

Logic Diagram:

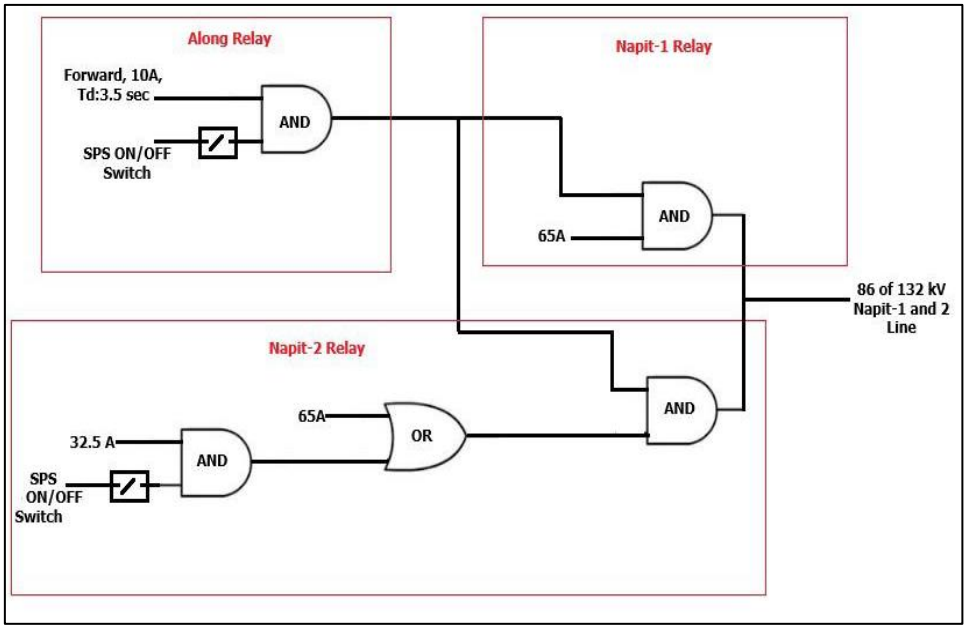


Fig 77: Logic implemented at Pasighat

II. SPS at BTPS(Assam) substation related to overloading of any of the 2x160 MVA ICTs at BTPS(Assam):

विषय /Item	सूचना स्पष्टीकरण / Information Explanation
योजना का नाम / Scheme Name	बीटीपीएस (असम) में 2x160 एमवीए आईसीटी में से किसी के ओवरलोडिंग से संबंधित बीटीपीएस (असम) सबस्टेशन पर एस.पी.एस / SPS at BTPS(Assam) substation related to overloading of any of the 2x160 MVA ICTs at BTPS(Assam)
रिपोर्टिंग पार्टी / Reporting party	APGCL
वर्गीकरण/ Classification	SPS related to overloading of Transformers
संदर्भ संक्या/ Reference No.	NA
संचालन प्रक्रिया / Operating Procedure	NA
डिज़ाइन उद्देश्य / Design Objectives	For preserving system stability against loss of N-1 contingency for 2x160MVA, 220/132kV ICTs at BTPS(Assam) during peak load conditions by implementing load shedding in case of loss of one ICT during peak load condition
संचालन / Operation	**Trigger Condition:** If any of the 2x160 MVA 220/132 kV ICTs at BTPS(Assam) are loaded to 122% of their full load capacity. Delays for Overcurrent Stage-2 and Stage-3 are kept as 2 seconds and 3 seconds **Action**: Load shedding of 140 MW will be done in two stages.
मोडलिंग/ Modelling	**Description:** 220/132/33kV BTPS(Assam) is one of the most critical substations in Lower Assam Region catering load to the districts of Kokrajhar, Dhubri, Bongaigaon, Barpeta and critical industrial loads of IOCL, Railways etc. The highest peak load was recorded at 323 MW (340MVA considering a PF of 0.95) during the summer of 2023. During period from January – June 2024, it has been observed that the transformers have time and again failed to satisfy the N-1 contingency criteria.

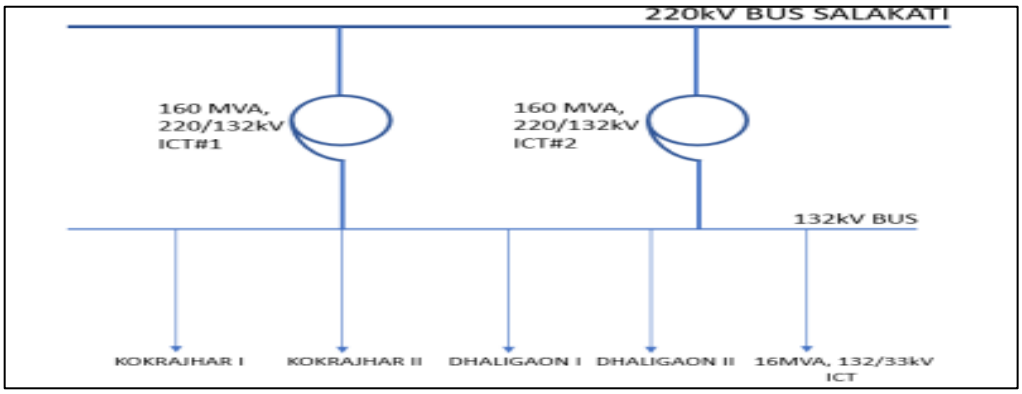


Fig 78: Feeder connected to the 132 kV Bus at 220 kV BTPS(Assam)

In that case, on the event of loss of one 160MVA ICT, the healthy ICT is prone to be overloaded resulting in blackout of the entire transmission network as shown below:

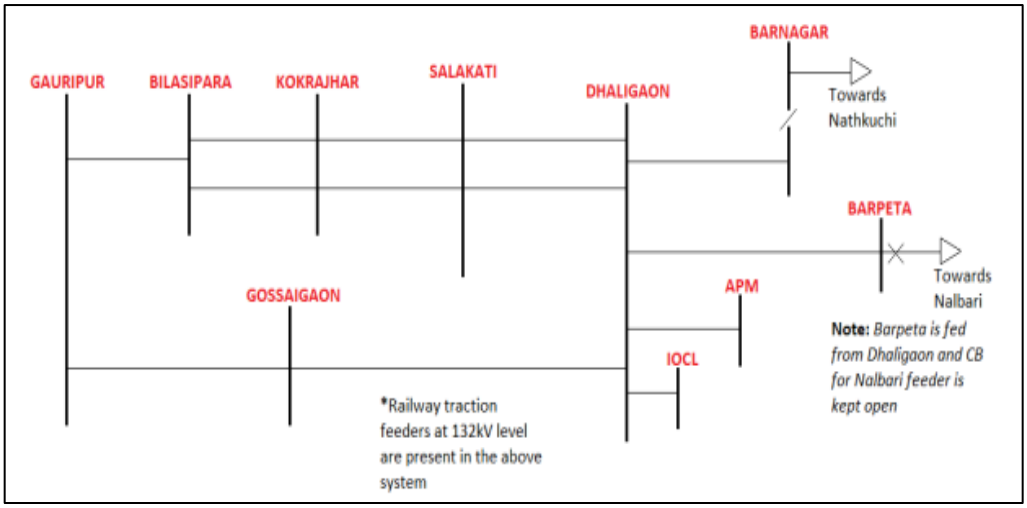


Fig 79: Affected network in case of loss of both ICTs at BTPS(Assam)

Connectivity Diagram:

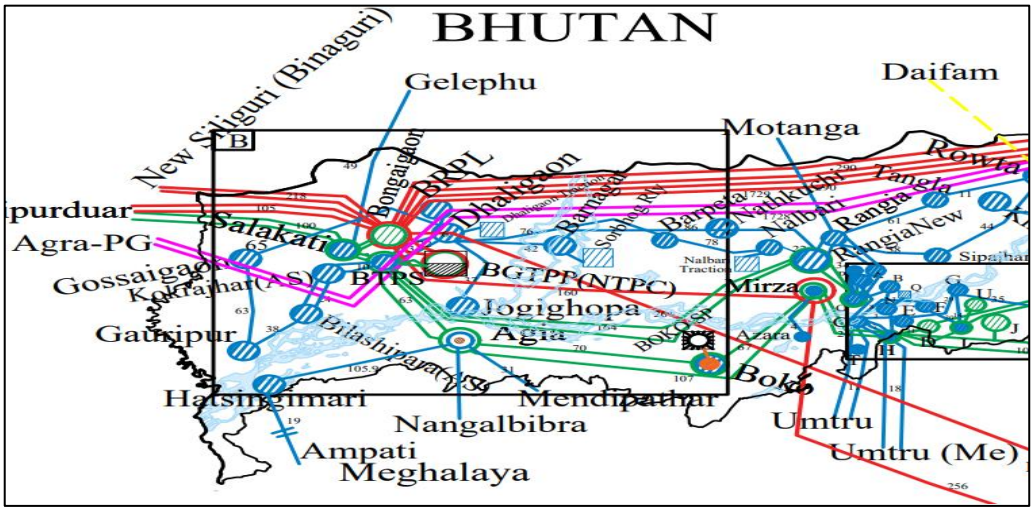


Fig 80: Network diagram

Triggering of Criteria: If any of the 2x160 MVA 220/132 kV ICTs at BTPS(Assam) are loaded to 122% of their full load capacity. Delays for Overcurrent Stage-2 and Stage-3 are kept as 2 seconds and 3 seconds

Action taken: Load shedding of 140 MW will be done in two stages. Stage-1 would include the 33kV feeders associated with "GROUP-A" and Stage-2 would include the 33kV feeders associated with "GROUP-B" as shown below. The combined load for 33kV Feeders in GROUP-A is 81.17 MW and that of the 33kV feeders included in GROUP-B is 59 MW

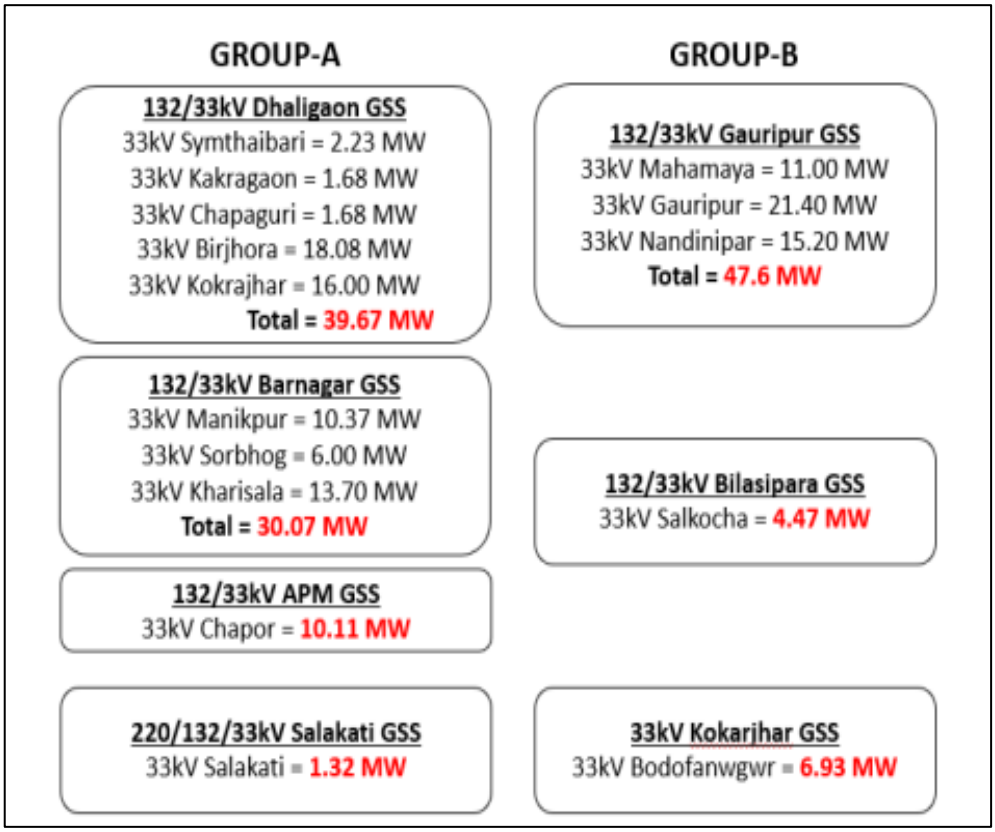


Fig 81: List of 33kV feeders (to be included in the controlled load shedding) as approved by APDCL

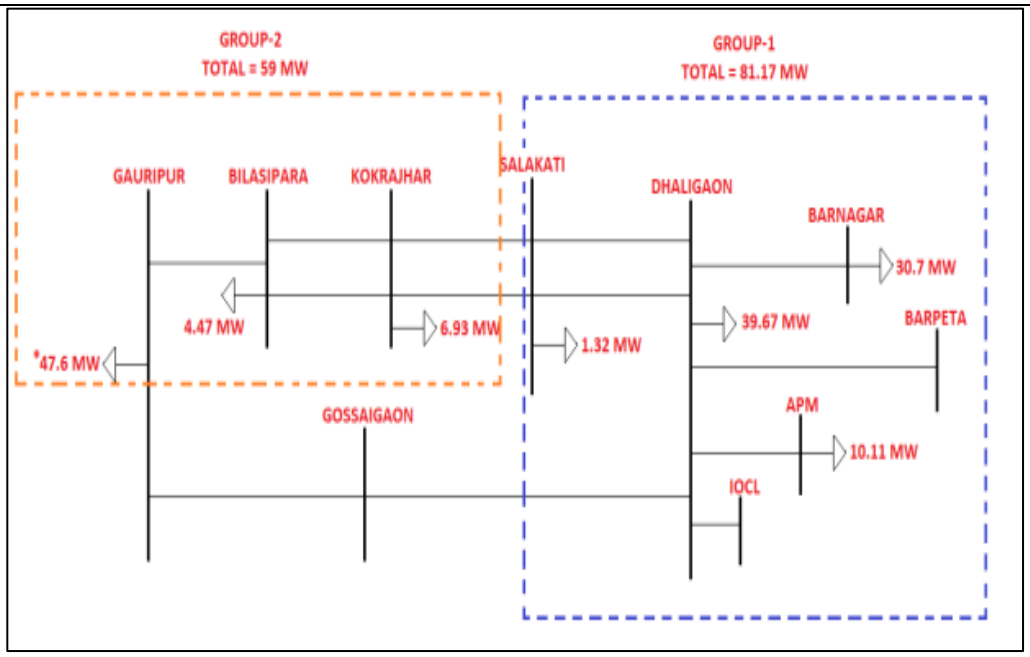


Fig 82: Overload less critical loads are divided into two groups

Logic Diagram:

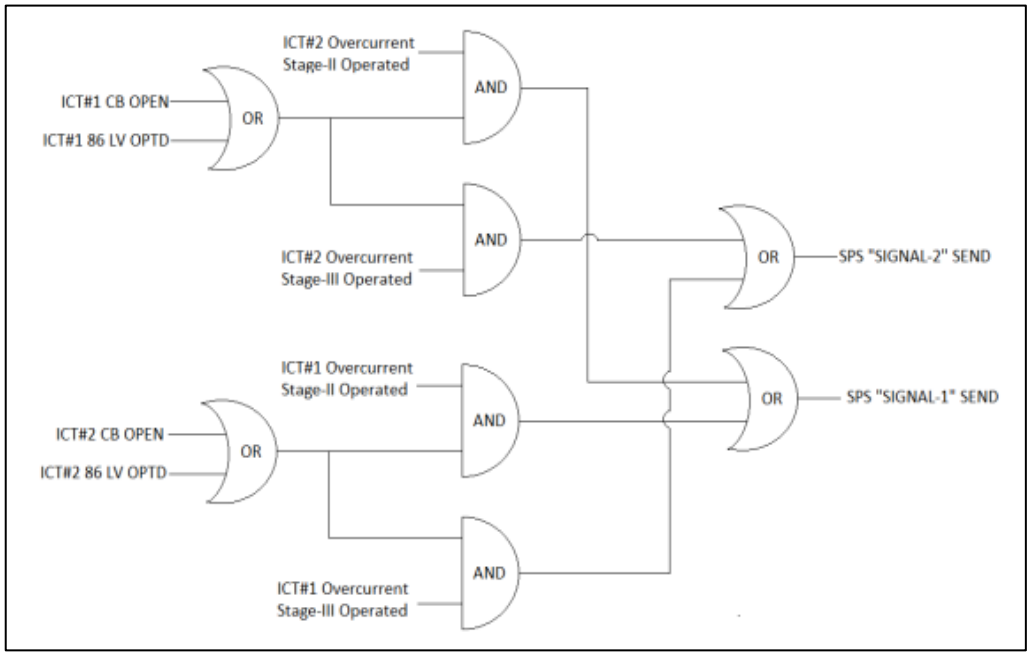


Fig 83: Logic to be implemented at BTPS(Assam)

SPS “SIGNAL-1” would disconnect the feeders in GROUP-1 (after a delay of 2 seconds) and if overload still persists, SPS “SIGNAL-2” would further disconnect the feeders in GROUP-2 (after a delay of 3 seconds). A combined load shedding of 140.17 MW will be achieved by the SPS operation. In case, if a minor overloading still persists after the operation of SPS, the same can be achieved by controlled manual load shedding by the operators.

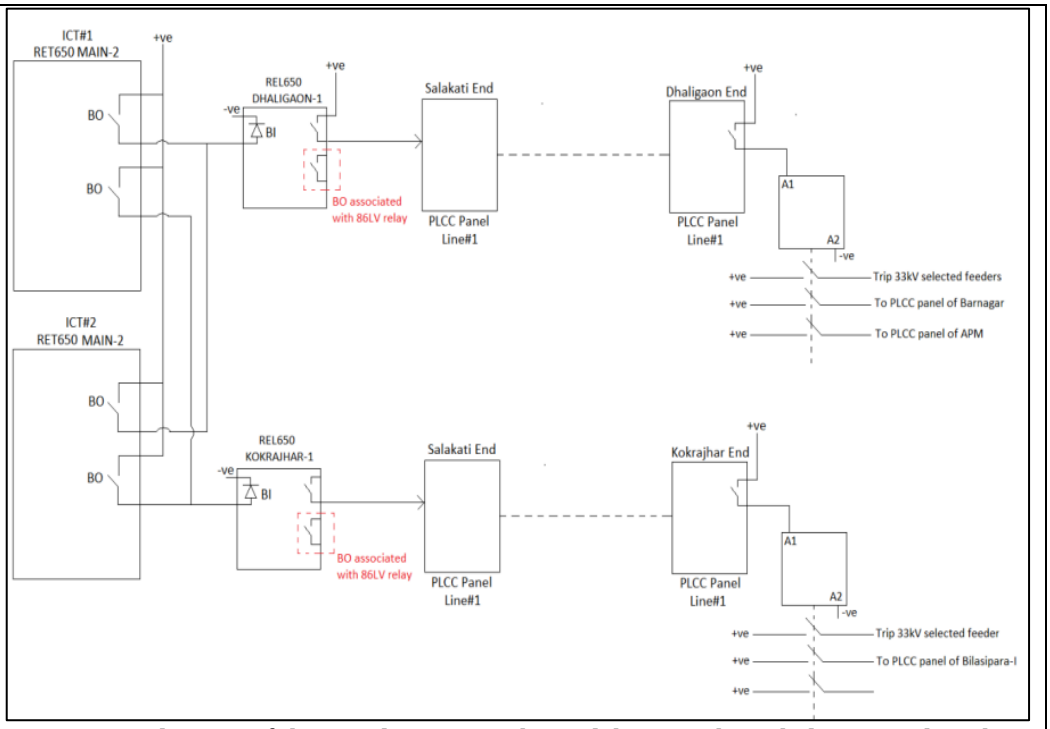


Fig 84: Hardwiring of the SPS logic at 220kV Salakati, 132kV Dhaligaon and 132kV Kokrajhar

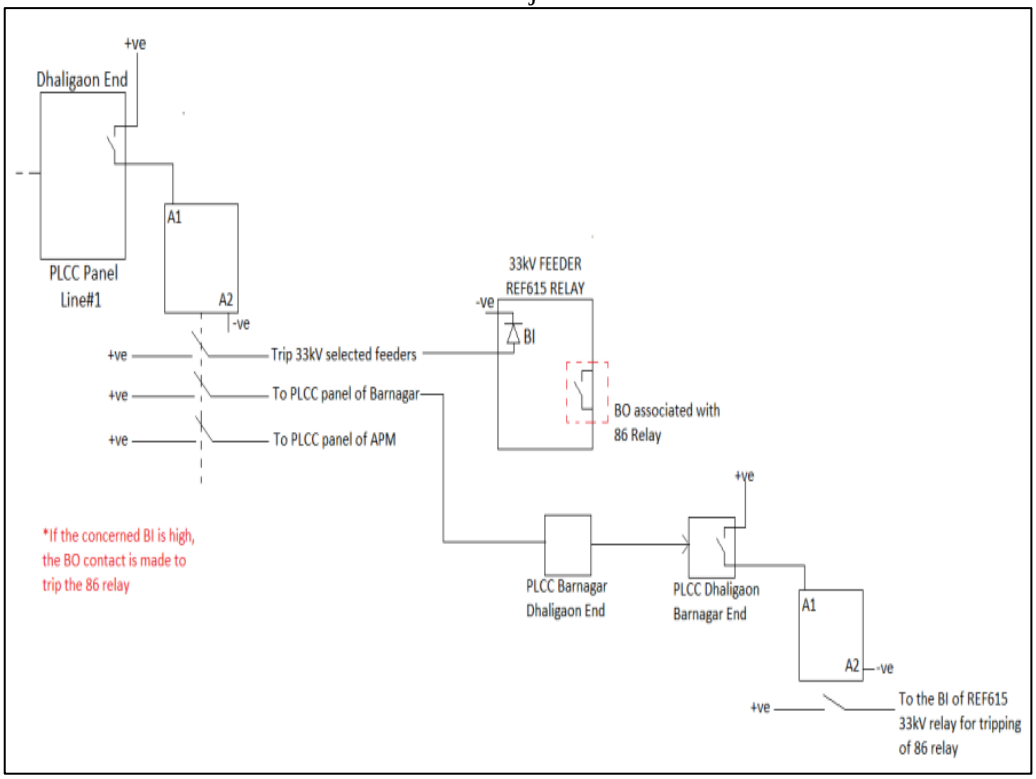


Fig 85: Hardwiring of the SPS logic to be done at downstream substations (e.g. 132kV Barnagar GSS)

The logic is to be extended for all the concerned feeders in the same way as mentioned in Fig 85 for the downstream substations.

EXTENDED LOGIC IF "CARRIER IS NOT HEALTHY"

As the above SPS scheme is dependent on Carrier Communication between the substations, the healthiness of carrier communication is of critical importance. Absence/unhealthy carrier would fail the SPS upon operation. Hence, if carrier is found unhealthy at any point in the transmission lines associated in the scheme, the following logic would come into operation:

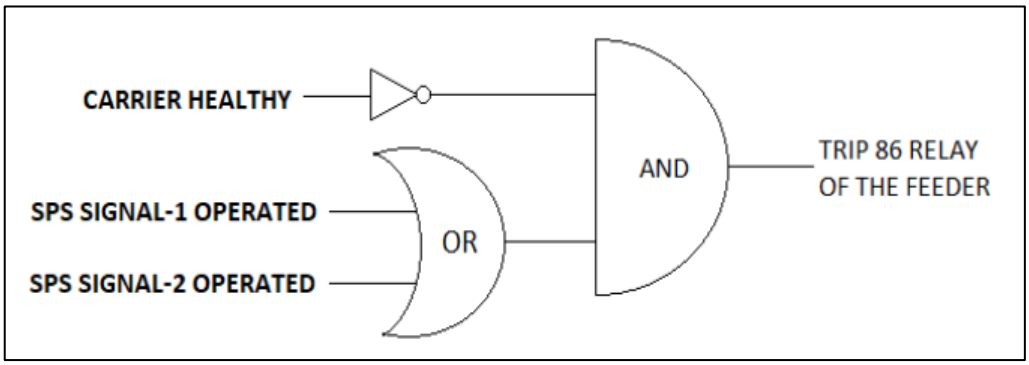


Fig 86: Logic in case of unhealthy carrier communication

As per the fig 84 and fig 85, the SPS is received by the Binary Input of the relay. The relay also monitors the healthiness of carrier communication. If carrier is found unhealthy, the relay would trip the 86 relays of the 132 kV respective feeder and cut off the total load in the lines. (downstream)

G. एसपीएस योजना पर शास्त्रार्थ / SPS scheme under Discussion:

विषय /Item	सूचना स्पष्टीकरण / Information Explanation
रिपोर्टिंग पार्टी / Reporting party	400 केवी सूरजमणि नगर (टीएसईसीएल) - साउथ कोमिला लाइन (132 केवी पर चार्ज) के एक सर्किट के आउटेज से संबंधित एस.पी.एस / SPS related to Outage of one circuit of 400 kV Surajmani Nagar (TSECL)- South Comilla line (Charged at 132 kV)
वर्गीकरण/ Classification	POWERGRID, TSECL
संदर्भ संक्या/ Reference No.	SPS related to Reliable Power Supply to Bangladesh
संचालन प्रक्रिया / Operating Procedure	NA
डिज़ाइन उद्देश्य / Design Objectives	NA
संचालन / Operation	To ensure reliable power supply to Bangladesh
मोडलिंग/ Modelling	Shifting of 30 MW load from Indian Grid to Bangladesh Grid during Outage of one circuit of 400 kV Surajmani Nagar - South Comilla line (Charged at 132 kV)

Description: NER Grid is connected to South Comilla (Bangladesh) Power System through 400 kV SM Nagar (TSECL) – Comilla D/C (presently charged at 132 kV level). The total contracted capacity is 160 MW export to South Comilla (Bangladesh). The safe and secure operation of cross border lines is of prime importance during grid operation and utmost measures are taken to ensure the reliability of power supply to Bangladesh.

Tripping of cross border link followed by shifting of entire 160 MW load from India Grid to Bangladesh Grid.

Connectivity Diagram:

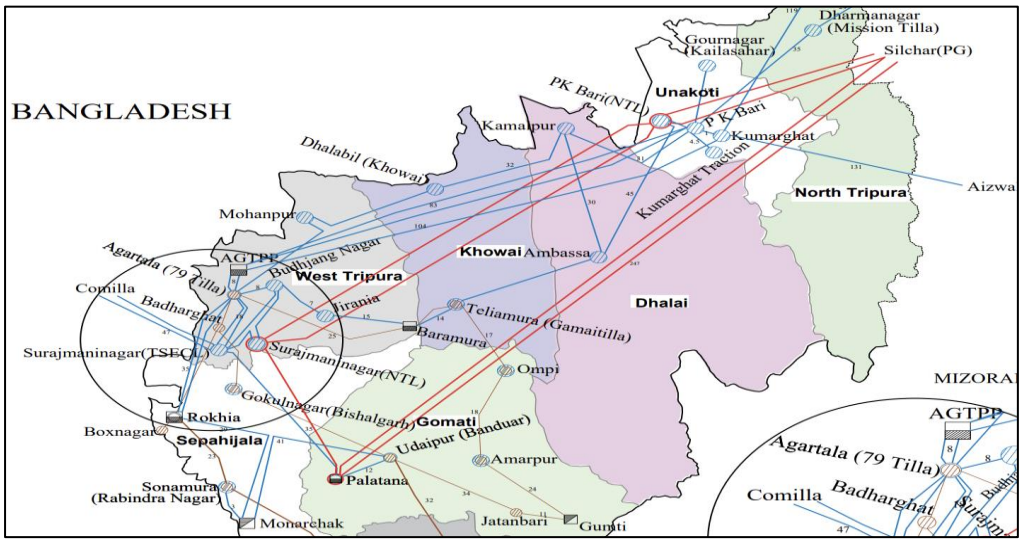


Fig 87: Network diagram

Triggering of Criteria:

- Switch K3 at Surajmaninagar shall be kept closed to keep the SPS in service.
- When South Comilla-1/2 line at Surajmaninagar trips, it's trip relay NO contact 86- 1/ 86-2 will make and extend the DC + to Carrier send relay CS of protection coupler 54 as well as to the newly installed High Speed trip relay E through it's own NC contact E-2.
- CS will send a code through PLCC/OPG to South Comilla. Relay E will operate and it's NC contact E-2 will open there by preventing continuous operation of CS.
- NO contact E-1 shall be wired to one binary input of one BCU at Surjamaninagar to log the event with time stamping.
- At South Comilla, the carrier receive contact of Surajmaninagar protection coupler CR will be made parallel with one NO contact 86-3 and 86-4 of the trip relays for Surajmaninagar – 1 & 2 Feeder and shall be used to operate a newly installed High Speed Trip Relay F at South Comilla.
- NO contacts F-1 and F-2-2 of relay F shall be used to shed 30 MW of load at

Comilla.

- NO contact F-3 shall be wired to one binary input of one BCU at South Comilla to log the event.

Logic Diagram:

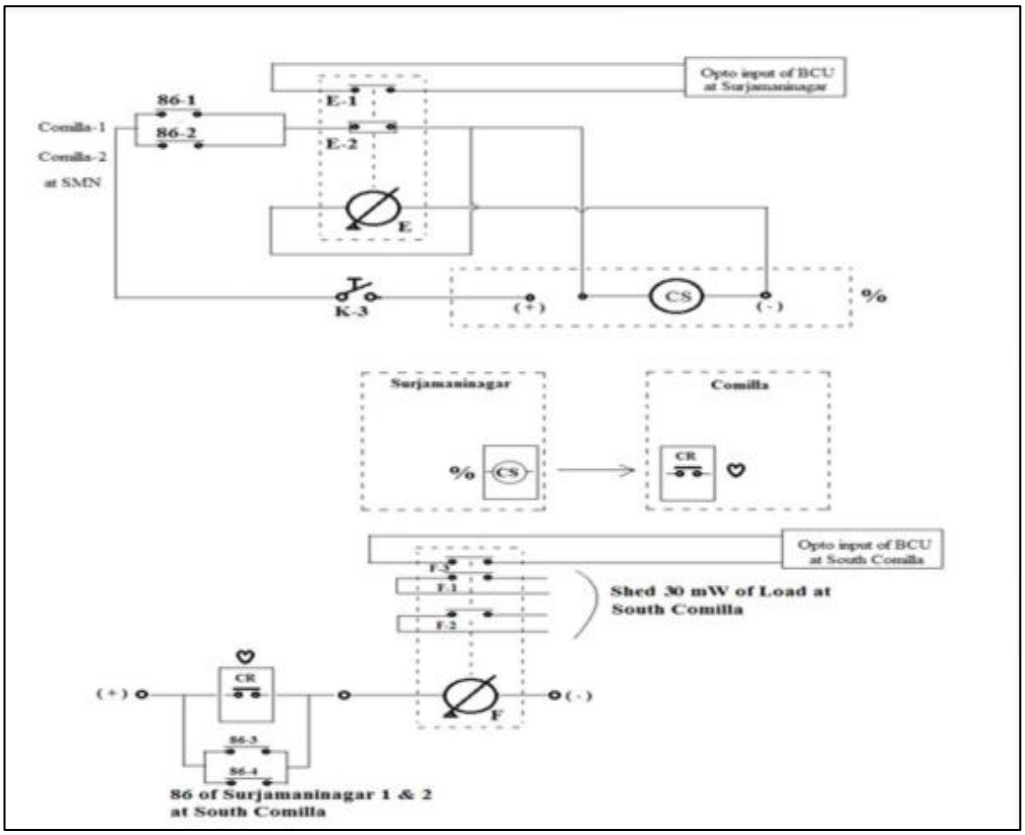


Fig 88: SPS Logic Diagram related to outage of one circuit of 400 kV Surajmani Nagar - South Comilla line (Charged at 132 kV)

Remarks: The SPS is yet to be implemented and is not operational. However, since the 132 kV SM Nagar – Comilla D/C are 400 kV Lines charged at 132 kV, it may have the capability to transfer complete 160 MW and needs clarification from Bangladesh end.

As per the discussion in 57th PCC Meeting dated 15.02.22, it was decided that the SPS has to be reviewed in next Operational meeting with Bangladesh.

H. एसपीएस योजनाओं का मॉक टेस्टिंग / Mock Testing of the SPS Schemes:

As per Clause 16.2 of IEGC-23, for the operational SPS, RLDC or NLDC, as the case may be, in consultation with the concerned RPC(s) shall perform regular load flow and dynamic studies and mock testing for reviewing SPS parameters & functions, at least once in a year. RLDC or NLDC shall share the report of such studies and mock testing including any short comings to respective RPC(s). The data for such studies shall be provided by CTU to the concerned RPC, RLDC and NLDC.

During the year 2024, the following mock testing for reviewing SPS parameters & functions have been performed in the North-Eastern Region which are as follows:

क्र.सं./Sl. No.	योजना / Scheme	मॉक टेस्टिंग की तिथि / Date of Mock Testing Performed
1	**SPS/AS/004-** SPS related to outage of 220 kV Azara-Sarusajai D/C lines	23-Jun-24
2	**SPS/AS/005**- SPS related to tripping of 220 kV Misa-Samaguri D/C lines	23-Jun-24
3	**SPS/TR/002-** SPS related to outage/ tripping of both circuits of 400 kV SM Nagar(NTL) -PK Bari(NTL) D/C Line to prevent under voltage condition	05-Aug-24
4	**SPS/TR/003:** SPS related to outage/ tripping of both circuits of 400kV PK Bari (NTL) – Silchar(PG) Line to prevent under voltage condition	06-Aug-24
5	**SPS/NA/001:** SPS related to outage/tripping of any one circuit of 132 kV Dimapur(PG)- Dimapur(NA) D/C Line	26-Sep-24
6	**SPS/AS/002:** SPS related to safe evacuation of power from BgTPP(NTPC) generation	10-Oct-24
7	**SPS/ME/001**: SPS related to outage/tripping of any one circuit of 132 KV Khliehriat (PG)- Khliehriat D/C line	22-Nov-24
8	**SPS/AP/001:** SPS related to overloading of any one of the 400/132kV, 2x360 MVA ICTs at Panyor Lower Hydro Power Station	13-Dec-24
9	**SPS/ME/002:** SPS related to outage/tripping of any one circuit of 132 kV Leshka – Khliehriat D/C Line	13-Dec-24
10	**SPS/MA/001-** SPS related to outage/tripping of 400 kV New Kohima – Imphal D/C Line	30-Jan-25

As per discussion in 73rd PCC, mock testing was not conducted for SPS of NER which has operated successfully during the year 2024. The list of SPS scheme operated successfully during 2024 are as follows:

क्र.सं./Sl. No.	योजना / Scheme	टिप्पणियाँ / Remarks
1	**SPS/AS/006:** SPS related to outage/tripping of any one circuit of 220 kV Balipara-Sonabil D/C Line	Operated Correctly in 04-Mar-24 & 20-Dec-24 (Triggering Criteria-2)
2	**SPS/AP/002:** SPS related to outage of 132 kV Panyor LHPS- Ziro (PG) Line	Operated Correctly in 25-Apr-24
3	SPS related to Reverse power flow more than 60 MW from LV to HV side of 2 X 315 MVA, 400/220 kV Azara ICTs causes tripping of 400/220 kV, 2x315 MVA ICTs at Azara (AEGCL)	Operated in 28-May-24 (As per 73rd PCC minutes, SPS is disabled)
4	**SPS/AS/004:** SPS related to outage/tripping of 220 kV Azara-Sarusajai D/C Line	Operated Correctly in 28-May-24
5	**SPS/TR/001**: SPS related to secure evacuation of power from the Monarchak (NEEPCO) Power Plant	Operated Correctly in 07-June-24 & 13-July-24
6	**SPS/AS/003**: SPS related to outage of 220 kV BTPS (Salakati) – Rangia I & II Line	Operated Correctly in 17-June-24 & 17-Aug-24
7	**SPS/MS/001**: SPS related to ensuring reliable power supply to Arunachal Pradesh & Assam through the 132 kV Roing-Chapakhowa D/C line	Operated Correctly in 23-Sept-24 (Triggering criteria-2)
8	**SPS/TR/004:** SPS related to outage/tripping of 400kV Palatana-Silchar D/C Line when both modules of Palatana are in service	SPS is kept OFF
9	**SPS/AS/001:** SPS related to overloading of 220 kV BTPS - Salakati D/C Line	SPS is kept OFF
10	SPS related to Tripping of 132 kV Umiam Stg-I to Umiam Stg-III D/C lines	Operated in May'24 (As per 73rd PCC minutes, SPS is disabled)
11	**SPS/TR/005:** SPS related to overloading of 132 kV Surajmaninagar (TSECL)- Surajmaninagar (NTL) Line	Implemented on 11-Nov-2024 after necessary testing
12	**SPS/AP/003:** SPS at Tezu substation to prevent under voltage condition	Implemented on 12-Dec-2024 after necessary testing
13	**SPS/AP/004**: SPS at Namsai substation to prevent under voltage condition	Implemented on Dec-2024 after necessary testing

The list of SPS scheme for which yearly mock testing is yet to be planned are as follows:

क्र.सं./Sl. No.	योजना / Scheme	टिप्पणियाँ / Remarks
1	**SPS/TR/006**: SPS related to outage/tripping of 400 kV Palatana – Surajmani Nagar line (charged at 132 kV)	Planned on 31st Jan'25
2	**SPS/TR/007:** SPS related to outage/tripping of both 400/132 kV, 2x125 MVA ICTs at Palatana	Planned on 31st Jan'25

I. 2024 में एसपीएस योजनाओं का प्रदर्शन / Performance of the SPS Schemes in 2024:

Performance monitoring of system protection schemes is necessary to ensure that the protection system is functioning properly and effectively. It helps to detect and diagnose any issues or failures in the system, and to identify any potential performance bottlenecks. This information can then be used to make adjustments or repairs to the system, to improve its overall performance and reliability. Additionally, monitoring performance allows operators to identify and address any issues before they become critical, helping to minimize downtime and reduce the potential for equipment damage or system failures.

During the year 2024, the performance of the SPS schemes in service (including SPS related to Bangladesh) has been mentioned below:

SPS/AS/006: SPS related to outage/tripping of any one circuit of 220 kV Balipara-Sonabil D/C Line (Triggering Criteria-2)

During the year 2024, there was 2 correct operation of SPS related to outage/tripping of any one circuit of 220 kV Balipara-Sonabil D/C Line with no event of in-correct operation and unwanted operation were reported during the year.

Details of the SPS operation are as follows:

1. *Operation of SPS related to outage/tripping of any one circuit of 220 kV Balipara-Sonabil D/C Line at 13:07 Hrs on 04.03.2024*

   On 04th Mar'24 at 13:07 Hrs, 220 kV Balipara-Sonabil II line tripped and SPS (Triggering criteria 2) at Sonabil operated successfully which caused tripping of 220/132 kV, 100 MVA ICT-I & II at Sonabil.

2. *Operation of SPS related to outage/tripping of any one circuit of 220 kV Balipara-Sonabil D/C Line at 15:04 Hrs on 20.12.2024*

   On 20th Dec'24 at 15:04 Hrs, 220 kV Balipara-Sonabil II line tripped and SPS (Trigerring criteria 2) at Sonabil operated successfully which caused tripping of 220/132 kV, 100 MVA ICT-I & II at Sonabil.

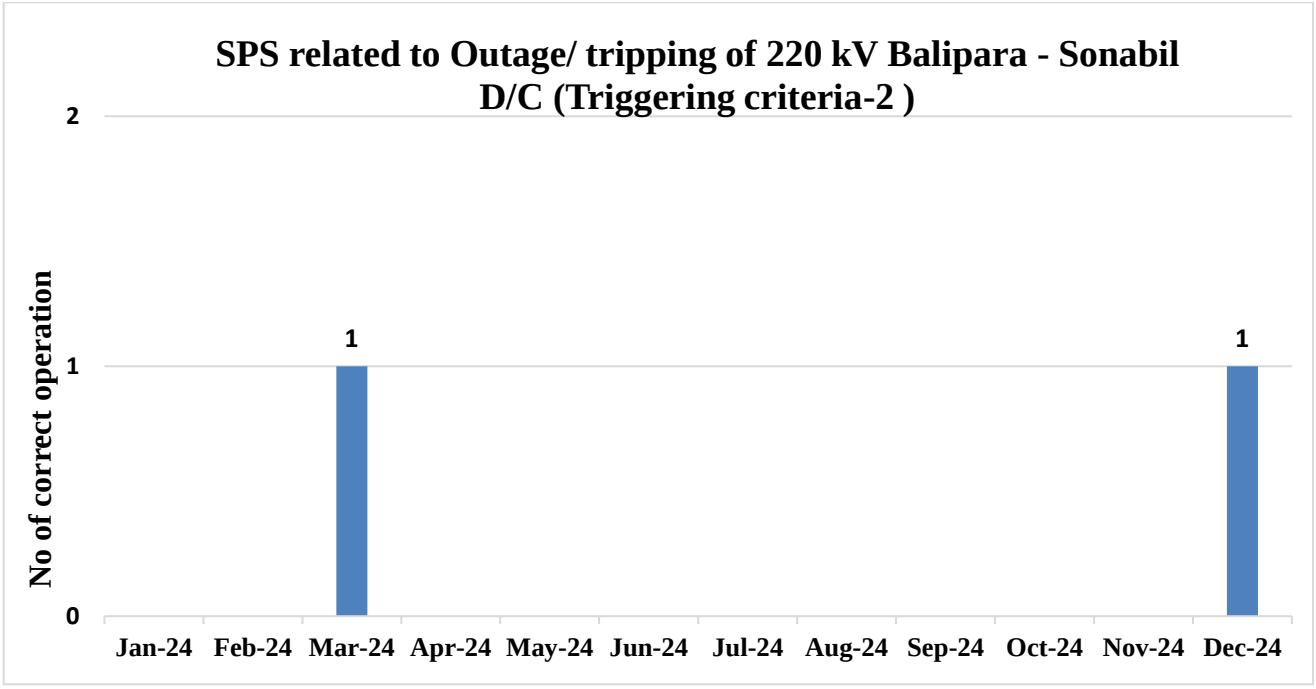


Fig. 89: SPS related to outage/tripping of any one circuit of 220 kV Balipara-Sonabil D/C Line

SPS/AP/002: SPS related to outage of 132 kV Panyor LHPS- Ziro (PG) Line

During the year 2024, there was 1 correct operation of SPS related to outage of 132 kV Panyor LHPS-Ziro (PG) Line with no event of in-correct operation and unwanted operation were reported during the year.

Details of the SPS operation are as follows:

1. *Operation of SPS related to outage of 132 kV Panyor LHPS- Ziro (PG) Line at 06:11 Hrs on 25.04.2024*
   On 25th Apr'24 at 06:11 Hrs, 132 kV Panyor-Ziro line tripped and SPS operated successfully which caused load shedding in downstream of Ziro.

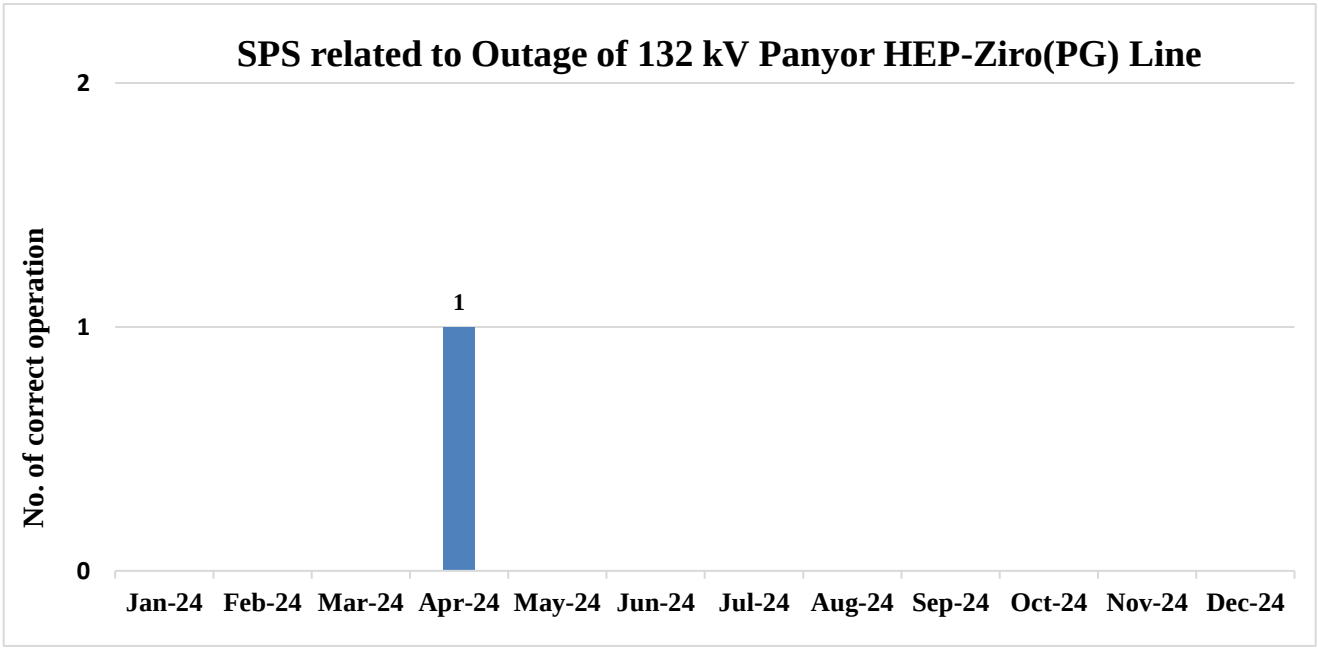


Fig. 90: SPS operation related to outage of 132 kV Panyor LHPS- Ziro (PG) Line

SPS related to Reverse power flow more than 60 MW from LV to HV side of 2 X 315 MVA, 400/220 kV Azara ICTs causes tripping of 400/220 kV, 2x315 MVA ICTs at Azara (AEGCL)

During the year 2024, there was 1 correct operation related to the SPS scheme and no in-correct operation and unwanted operation were reported during the year.

Details of the SPS operation are as follows:

1. *Operation of SPS related to related to Reverse power flow more than 60 MW from LV to HV side of 2 X 315 MVA, 400/220 kV Azara ICTs at 02:50 Hrs on 28.05.2024*

   On 28th May'24 at 02:50 Hrs, SPS related to reverse power flow in 400/220 kV ICTs at Azara operated successfully which caused tripping of ICTs at Azara.

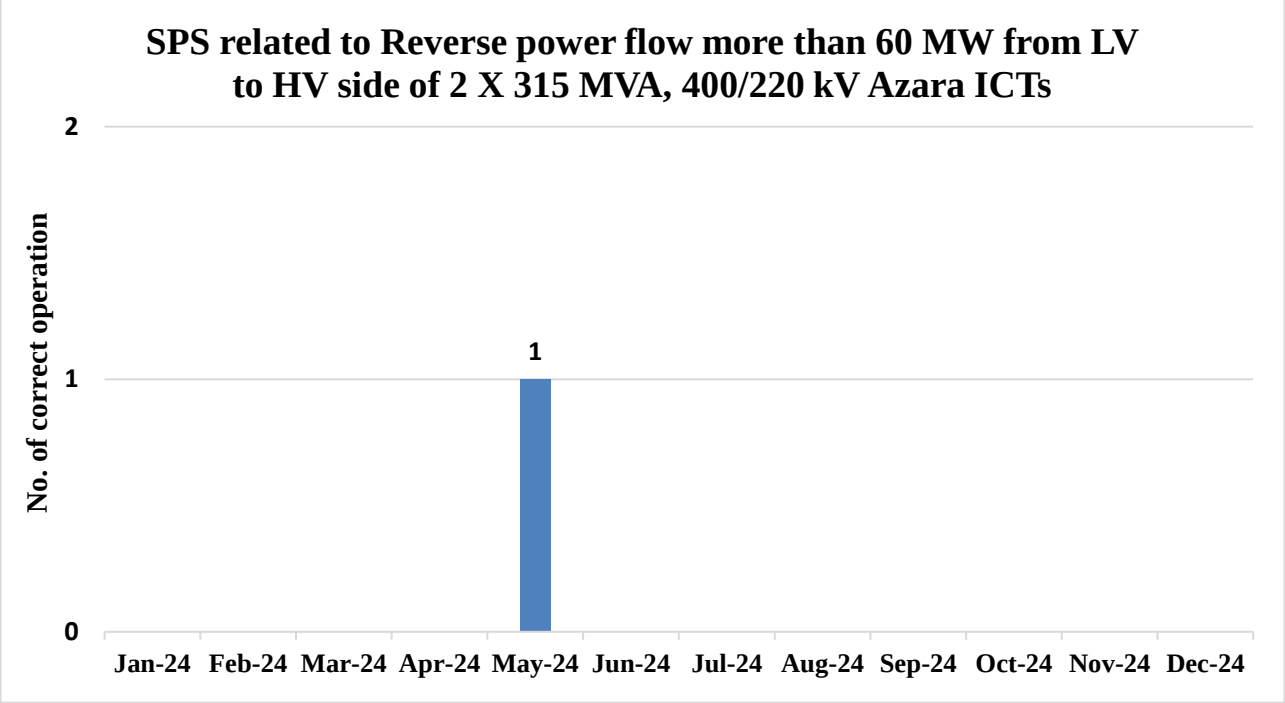


Fig. 91: SPS related to Reverse power flow more than 60 MW from LV to HV side of 2 X 315 MVA, 400/220 kV Azara ICTs

SPS/AS/004: SPS related to outage/tripping of 220 kV Azara-Sarusajai D/C Line (Criteria-1)

During the year 2024, there was 1 correct operation related to the SPS scheme and no in-correct operation and unwanted operation were reported during the year.

Details of the SPS operation are as follows:

1. *Operation of SPS related to outage/tripping of 220 kV Azara-Sarusajai D/C Lines at 02:50 Hrs on 28.05.2024*

   On 28th May'24 at 02:50 Hrs, Due to outage of 220 kV Azara-Sarusajai D/C lines, SPS operated successfully which caused tripping of 132kV Kahilipara – Kamalpur and 132 kV Sarusajai – Kamakhya lines.

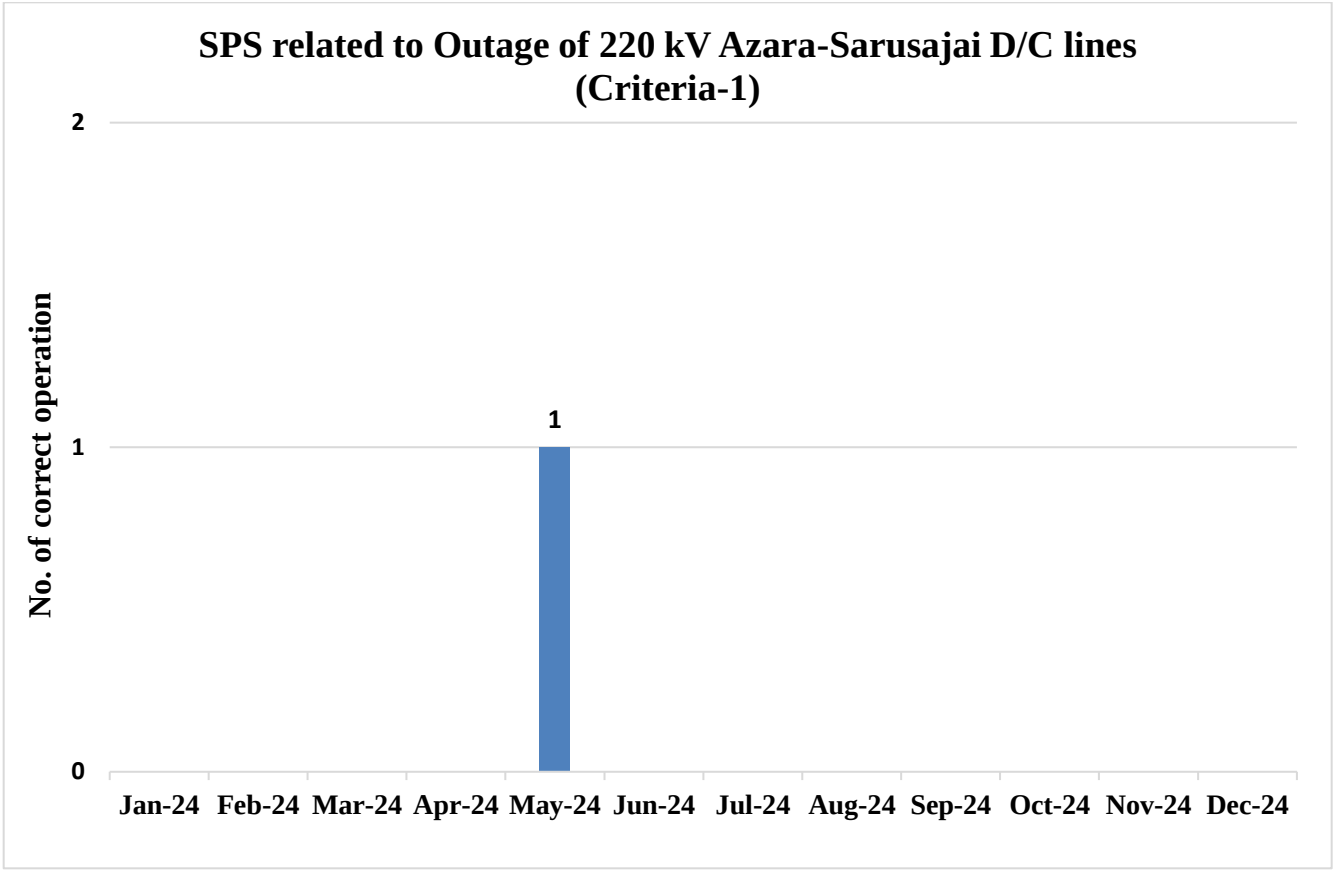


Fig. 92: SPS related to outage/tripping of 220 kV Azara-Sarusajai D/C Line (Criteria I)

SPS/TR/001: SPS related to secure evacuation of power from the Monarchak (NEEPCO) Power Plant

During the year 2024, there were 2 correct operation related to the SPS scheme and no in-correct operation and unwanted operation were reported during the year.

Details of the SPS operation are as follows:

1. *Operation of SPS related to secure evacuation of power from the Monarchak (NEEPCO) Power Plant at 07:44 Hrs on 07.06.2024*

   On 07th June'24 at 07:44 Hrs, 132 kV Monarchak-Udaipur line tripped and SPS at Monarchak Successfully operated which caused tripping of Monarchak STG.

2. *Operation of SPS related to secure evacuation of power from the Monarchak (NEEPCO) Power Plant at 00:27 Hrs on 13.07.2024*

   On 13th June'24 at 00:27 Hrs, 132 kV Monarchak-Rokhia line tripped and SPS operated successfully which caused tripping of Monarchak STG.

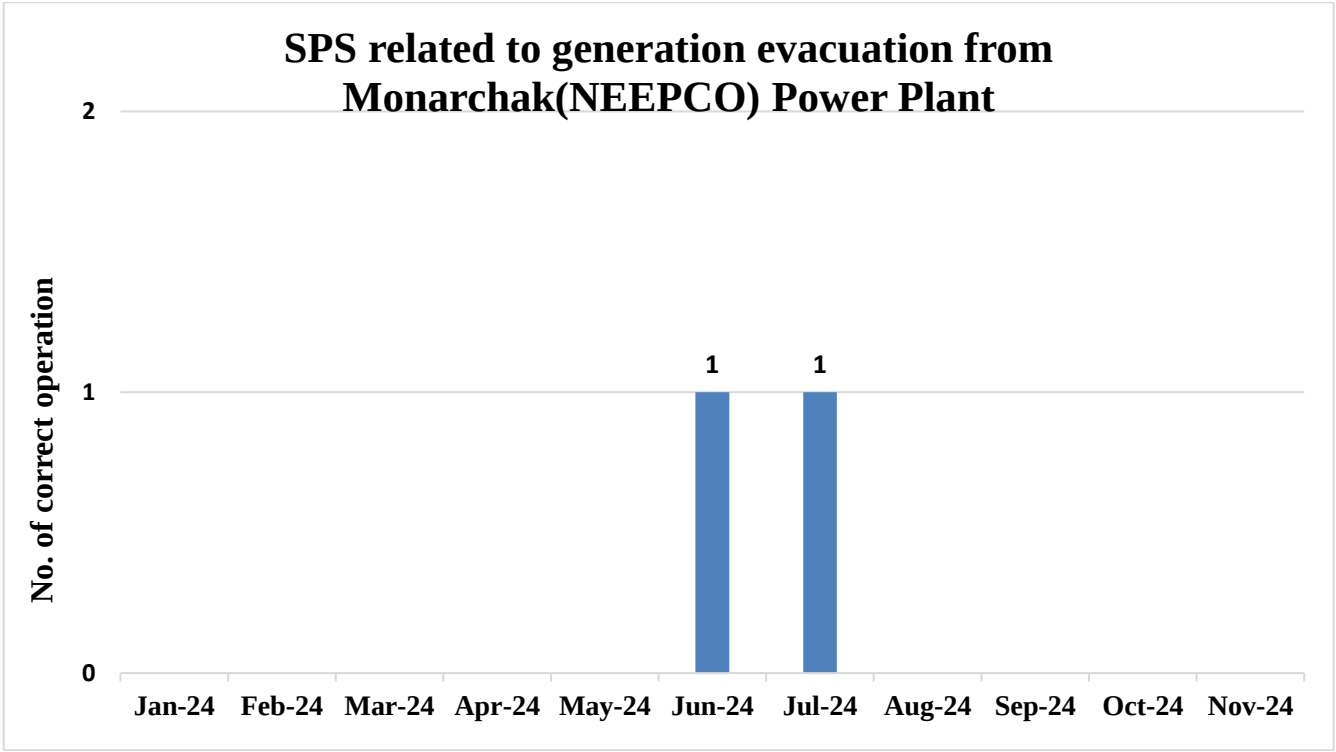


Fig. 93: SPS related to secure evacuation of power from the Monarchak (NEEPCO) Power Plant

SPS/AS/003: SPS related to outage of 220 kV BTPS (Salakati) – Rangia I & II Line

During the year 2024, there were 3 correct operation related to the SPS scheme and no in-correct operation and unwanted operation were reported during the year.

Details of the SPS operation are as follows:

1. *Operation of SPS related to outage of 220 kV BTPS (Salakati) – Rangia I & II Line at 06:52 Hrs on 17.06.2024*

   On 17th June'24 at 06:52 Hrs, 220 kV BTPS- Rangia D/C lines tripped resulting in successful operation of SPS present at Rangia. Due to which, 220 kV Rangia S/S was isolated from 132kV Rangia S/S as well as 132kV Barnagar, Sipajhar, Kamalpur, Nathkuchi, Tangla Substations were isolated from Rangia.

2. *Operation of SPS related to outage of 220 kV BTPS (Salakati) – Rangia I & II Line at 21:17 Hrs on 17.06.2024*

   On 17th June'24 at 21:17 Hrs, 220 kV BTPS- Rangia D/C lines tripped resulting in successful operation of SPS at Rangia . Due to which, 220 kv Rangia S/S was isolated from 132 kV Rangia S/S as well as 132kV Dhaligaon, Barnagar, Sipajhar, Kamalpur, Nathkuchi, Tangla Substations were isolated from Rangia System.

3. *Operation of SPS related to outage of 220 kV BTPS (Salakati) – Rangia I & II Line at 17:18 Hrs on 17.08.2024*

   On 17th August'24 at 17:18 Hrs, 220 kV Rangia-BTPS D/C & 220kV Amingaon-Rangia D/C tripped due to which SPS at Rangia operated successfully and subsequently Rangia, Amingaon, Tangla, Sipajhar & Kamalpur Areas of Assam Power System were isolated from NER grid.

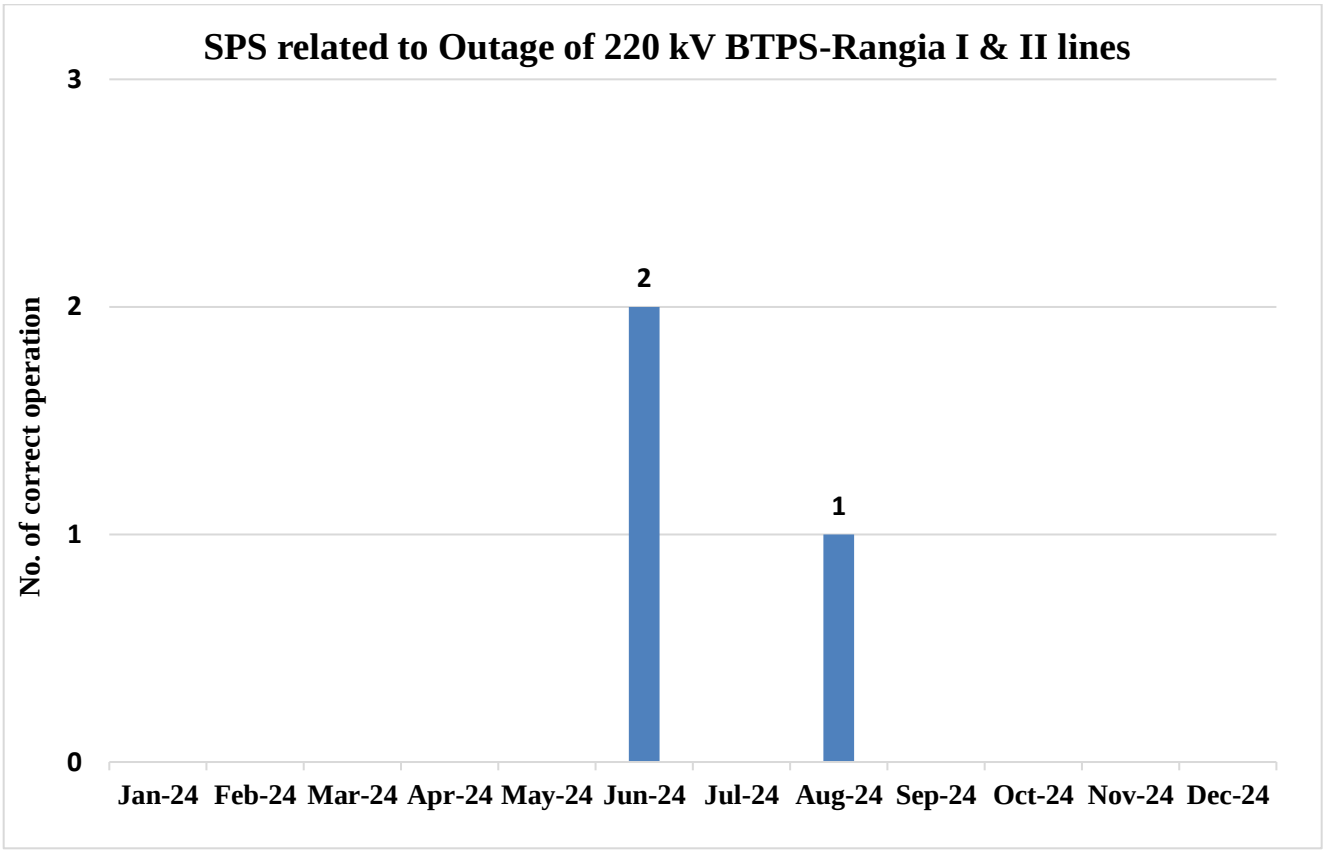


Fig. 94: SPS related to outage of 220 kV BTPS (Salakati) – Rangia I & II Line

SPS/MS/001: SPS related to ensuring reliable power supply to Arunachal Pradesh & Assam through the 132 kV Roing-Chapakhowa D/C line

During the year 2024, there were 1 correct operation related to the SPS scheme (Criteria-II). However, 2 instances of partial correct operation of SPS scheme (Criteria-I) were reported during the year.

Details of the SPS operation are as follows:

1. *Correct Operation of SPS related to ensuring reliable power supply to Arunachal Pradesh & Assam through the 132 kV Roing-Chapakhowa D/C line (Criteria II) at 21:36 Hrs of 23.09.2024*

   On 23rd June'24 at 21:36 Hrs, 132 kV Panyor-Ziro line tripped and SPS operated successfully which caused load shedding of 15 MW at 33 kV level of Rupai.

2. *Partial correct Operation of SPS related to ensuring reliable power supply to Arunachal Pradesh & Assam through the 132 kV Roing-Chapakhowa D/C line (Criteria I) at 16:48 Hrs & 17:24 Hrs of*

21.10.2024

On 21st Oct'24 at 16:48 Hrs & 17:24 Hrs, loading of 132 kV Tinsukia-Rupai line exceeded the pre-defined loading. Subsequently, SPS operation signals were triggered and received at 132 kV Rupai GSS. However, due to non-healthiness of OPGW link in 132 kV Rupai-Chapakhowa line, SPS stage-1 operation signals were not received at 132 kV Chapakhowa due to which 132 kV Chapakhowa-Roing D/C lines along with 20 MVAR Bus Reactor at Roing GSS did not trip.

SPS stage-2 operated at 132 kV Rupai S/S resulting in load shedding by tripping of 2 nos. of 33 kV feeders of Rupai S/S.

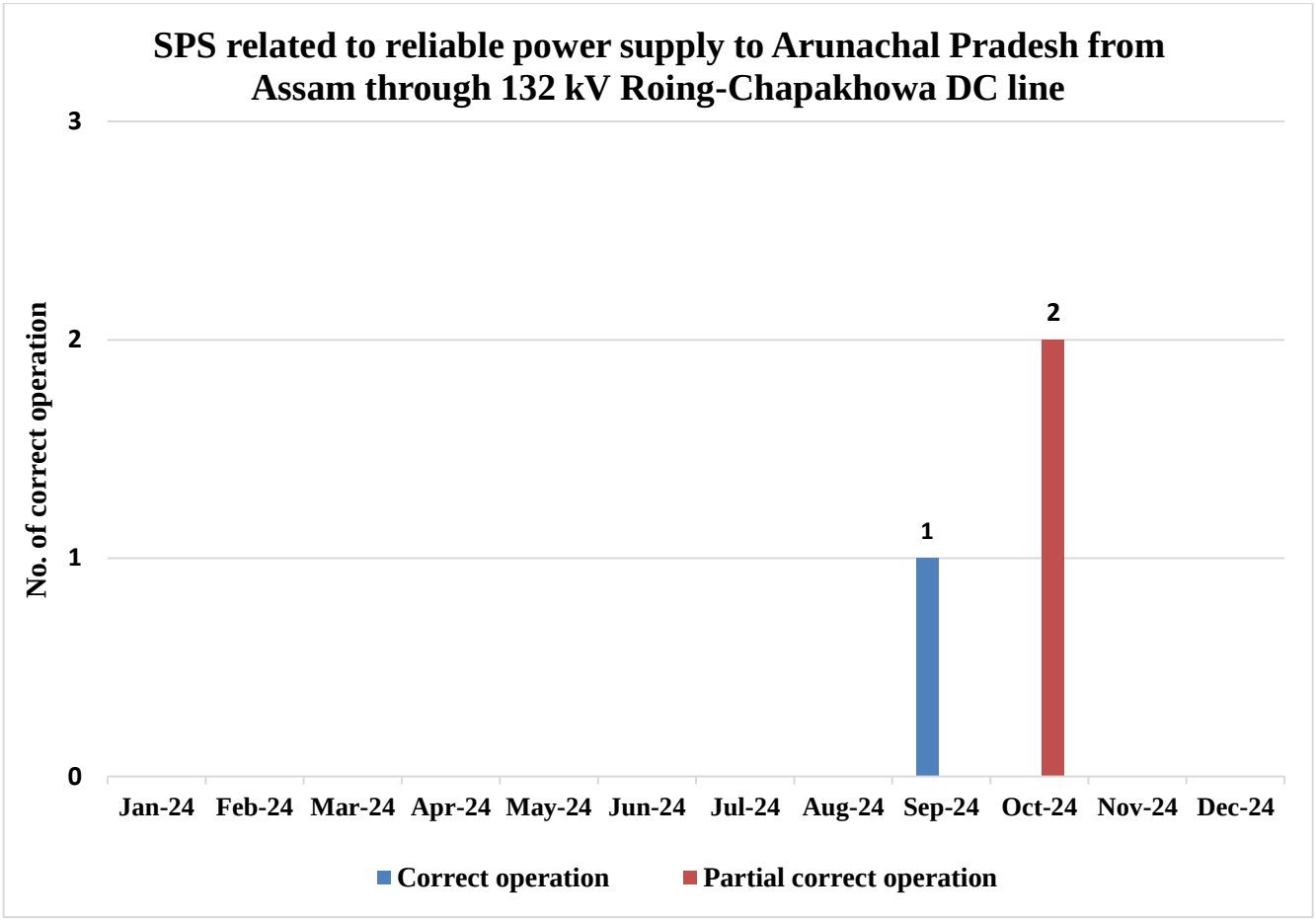


Fig. 95: SPS related to ensuring reliable power supply to Arunachal Pradesh & Assam through the 132 kV Roing-Chapakhowa D/C line

J. सभी एस.पी.एस. की वास्तविक समय निगरानी के लिए स्काडा डिस्प्ले में एस.पी.एस. की मैपिंग / Mapping of SPS in the SCADA Display for real time monitoring of all SPS:

NLDC has submitted the Guidelines on "Interfacing Requirements" after stakeholder consultation for approval of the Commission as mentioned in the Regulation 7.4, read with Regulation 14.2 of the Communication System for inter-State transmission of electricity) Regulations,2017. On dated 19-Jan-2024, CERC approved the guideline on "Interfacing Requirements" prepared by NLDC in consultation with the stakeholder. As per the Guideline, real time telemetered is SPS Signal need to be monitored. The digital status shall be as per IEC standard. Digital Status for circuit breaker must be double point while isolator status can be either single point or double point as per end device. All users shall comply with interface requirements as specified and shall share interface details with respective Control Centre.

Sl. No.	Description	Analog Points	Digital Points	Protection Signal
1	SPS Signal		DIGITAL STATUS: Enable/Disable, Operated/No Operated (Condition/Logic Wise)	

As on 09-Jan-25, mapping of 11 number of SPS has been done on SCADA display.

एसपीएस स्काडा मैपिंग का प्रदर्शन / Display of SPS SCADA Mapping

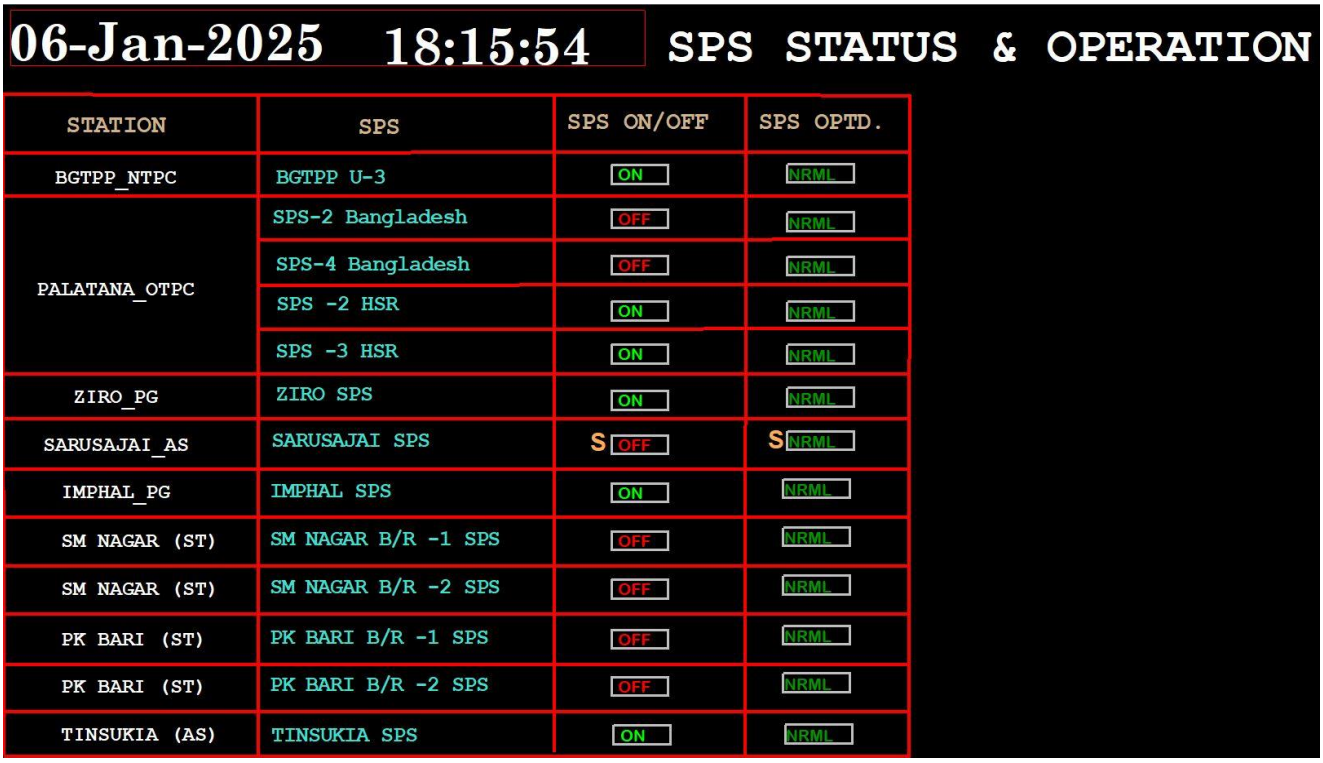


Fig 96: Display of SPS SCADA mapping

K. निष्कर्ष / Conclusion

System Protection Schemes (SPS) are systems designed to detect abnormal power system conditions and initiate predetermined corrective actions to mitigate the impact of abnormal operating conditions, usually triggered by contingencies. The use of SPS is twofold: they can be used to increase the level of security—usually as part of last-resort defence plans, but they can also improve economic utilisation of electricity networks, alleviating operational security constraints. Operationally, a preventive security approach results in high operational costs, especially when large amounts of remote renewable energy resources are connected to the grid: the pre-fault security constraints may require costly curtailments of renewables and dispatching generators out of merit. In the planning time frame, this paradigm provides an incentive to invest in costly transmission reinforcements. For these reasons, there has been growing interest in exploring and expanding the application of SPS to release extra capacity to network users.

The power transfer capability of existing transmission networks can be enhanced through the use of automated system protection schemes (SPS), which rapidly respond to disturbances on the network to keep the system's variables within operational bounds. Under conditions of huge investment for maintaining N-1 contingency in an area, System Protection Schemes can play a pivotal role in reducing the extend of the area affected. With automatic reduction of load/generation or any other designed actions intended, System Protection Scheme can aid the grid operators in maintaining safe and secure grid operation.

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