सत्यमेव जयते
भारत सरकार
Government of India
विद्युत मंत्रालय
Ministry of Power
पूर्वी क्षेत्रीय विद्युत समिति
Eastern Regional Power Committee
14, गोल्फ क्लब रोड, टालीगंज, कोलकाता-700033
14 Golf Club Road, Tollygunj, Kolkata-700033
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सं /NO. ERPC/EE/OPERATION/2024/ 683 **दिनांक/DATE: 16.07.2024**

सेवा में /To
संलग्न सूची के अनुसार /As per list enclosed.

विषय : हाइब्रिड मोड (भौतिक रूप से ईआरपीसी, कोलकाता और एमएस टीम्स ऑनलाइन प्लेटफॉर्म के माध्यम से) के माध्यम से 10.07.2024 (बुधवार) को आयोजित AUFLS (स्वचालित अंडर-फ़्रीक्वेंसी लोड शेडिंग योजना) पर विशेष बैठक की कार्यवृत्त-- संबंध में।

Sub: Minutes of Special meeting on AUFLS (Automatic Under-Frequency Load shedding scheme) held on 10.07.2024(Wednesday) via hybrid mode (physically at ERPC, Kolkata and through MS Teams online platform)- reg.

महोदय/महोदया,

Sir(s)/Madam,

कृपया **10.07.2024 (बुधवार)** को **10:30** बजे हाइब्रिड मोड के माध्यम से बुलाई गई **AUFLS** पर विशेष बैठक की संलग्न **कार्यवृत्त** ढूंढें।
यह आपकी जानकारी और आवश्यक कार्रवाई के लिए है। यह ईआरपीसी वेबसाइट (**www.erpc.gov.in**) पर भी उपलब्ध है।
Please find enclosed **MOM of Special meeting on AUFLS** convened on **10.07.2024(Wednesday) via hybrid mode** at **10:30 hrs** .
This is for your kind information and necessary action. The same is also available on ERPC website (**www.erpc.gov.in**).

टिप्पणियाँ, यदि कोई हों, कृपया यथाशीघ्र इस कार्यालय को अग्रेषित करें।
Observations, if any, may please be forwarded to this office at the earliest.

इसे सदस्य सचिव के अनुमोदन से जारी किया जाता है।
This issues with the approval of Member Secretary.

भवदीय /Yours faithfully,
16/07/2024
(S.Kejriwal)
SE(Operation)
एसई (ऑपरेशन)

LIST OF ADDRESSES:

1. EXECUTIVE DIRECTOR, ERLDC, GRID-INDIA
2. All SLDC Heads of Eastern Region.
3. All STUs and state TRANSCOs of Eastern Region.
4. All state DISCOMs of Eastern Region.

ERPC:: Kolkata

MOM OF Special meeting on AUFLS (Automatic Under-Frequency Load shedding scheme) held on 10.07.2024(Wednesday) via hybrid mode (physically at ERPC, Kolkata and through MS Teams online platform)

☐ *List of participants is attached at **Annex A.***

☐ ***Background:***

❖ *A Task Force was constituted by NPC vide letter dated 25.08.2023 on Implementation of AUFLS and df/dt scheme under the chairmanship of Member Secretary,SRPC and comprising members from NPC,RPCs and Grid-India.*

❖ *The Task force after convening meeting on 11.09.2023 submitted its report (**Annex-B**) to NPC in 14th NPC meeting on 05.02.2024, wherein certain recommendations were made.*

❖ *Accordingly, as per decision of 214th OCC meeting, this special meeting was convened to deliberate on successful implementation of Automatic Under Frequency Load Shedding (AUFLS) in Eastern region.*

☐ ***Discussion***

❖ *Member Secretary, ERPC welcomed all the participants to the meeting. He highlighted the need of reviewing existing AUFLS scheme and implementation of recommendations of Task force on AUFLS in Eastern region in view of extant NPC guidelines as well as uptick in peak demand met for constituent states of ER over the recent years.*

❖ *ERLDC put up a concise presentation **(Annex-C)** outlining the significance of AUFLS, extant guidelines of NPC on AUFLS implementation and distribution of ER load relief quantum among the constituent states based on the methodology finalized by NPC.*

(All figs in MW)

Constituents	***Total existing Load relief quantum (including four stages of AUFLS)***	***Total proposed Load relief Quantum (including four stages of AUFLS)***
Bihar	*440*	*1568*
Jharkhand	*314*	*435*
DVC	*552*	*897*
Odisha	*735*	*1521*
West Bengal	*1432*	*2472*
Sikkim	*0*	*25*
Total (Eastern Region)	***3473***	***6917***

❖ *ERLDC intimated that revised total load relief quantum of 6917 MW for Eastern region has been arrived at after considering instantaneous peak demand (based on SCADA data) for the region(including states) and normalizing the same w.r.t individual contribution in regional peak demand as well as factoring in individual energy consumption (MU).*

❖ *Further details of AUFLS load quantum enclosed at **Annex-C***

❖ *All ER states were enquired of their respective action plans for implementing revised load relief quantum.*

➢ *West Bengal SLDC submitted:*

- *Presently 1586 MW (including WBSEDCL and CESC) load is identified under AUFLS in West Bengal.*
- *Revised load relief quantum(2472 MW) was agreed to , however decision i.r.o identification of new feeders shall be finalized in upcoming State Level Coordination Forum and thereafter shall be reverted within one month.*
- *The need and exact timeline for procurement of new UFR relays i.r.o additional load relief may be confirmed by planning dept. of WBSETCL.*
- *Intentional time delay of 100-200 ms has been kept in functional UFRs as confirmed by testing dept.,WBSETCL.This is in addition to inherent measurement delay of about 100 ms Therefore, it was requested to put this issue in PCC forum for fruitful deliberation.*
- *Need for seperate relays was stressed i.r.o some feeders being supplied from multiple sources.*
- *Integration of all pending 33 kV feeders in SCADA (capable of reporting analog MW data along with CB status) shall take tentatively 6 months as the same needs to be carried out in a separate tendering process. This was apprised by representative of Communication dept. of WB SLDC.*
- *CESC apprised of around 450 MW load relief across all four stages in AUFLS at present in their command area and all existing UFR feeders are integrated in SCADA.*
- *Both WBSEDCL and CESC affirmed demarcation of feeders for revised quantum in AUFLS within a month after due consultation with top management.*
- *IPCL (DISCOM) was advised to identify 10 MW load relief quantum and install UFRs at the identified feeders.*

SLDC Bihar submitted:

- *Revised load relief quantum of AUFLS (1568 MW) was agreed to and identified feeders for implementing the same shall be intimated within a month.*
- *Inability to detect rapid fall in frequency (f<49.4 Hz) was cited as reason of zero response in the frequency event on 15th May 2023.*
- *UFR testing was conducted by BSPTCL last year.*
- *Some intentionally disabled UFRs in few feeders shall be enabled at the earliest and updated in upcoming OCC meeting.*

SLDC Odisha stated:

- *Revised load relief quantum of AUFLS (1521 MW) was agreed to and identified feeders for implementing the same shall be intimated within a month.*
- *DISCOMs shall furnish the revised feeder list for additional load relief and thereafter OPTCL to implement the same at 33 kV level.*
- *Agreed for additional relief of 150 MW load in Stage-I of AUFLS.*
- *SAS issue was pointed out for non-reporting of few UFR feeders in SCADA. Same to be corrected at the earliest.*

SLDC DVC mentioned::

Earmarking additional load shedding quantum is encountering two major challenges as:

- *Domestic feeders at 33 kV level are limited in their control area. Industrial loads contribute major share in their internal demand.*
- *Few feeders that have been dedicated in CTPS islanding scheme can't be considered for AUFLS load relief.*

SLDC Jharkhand consented to the revised load relief quantum of AUFLS (435 MW) and identified feeders for implementing the same shall be updated in a month in coordination with respective DISCOM.

ERLDC proposed for:

- *Interim shifting of load from Stage-III & Stage –IV to Stage-I & stage-II by all ER states as the first two stages play pivotal role in safeguarding regional grid against sudden frequency roll-off.*
- *Intentional time delay was also underlined as a potential cause for delayed UFR operation.*
- *Actual Load relief by ER states during a major frequency event on 15th May 2023 was highlighted wherein all states failed to achieve desired load relief, especially Bihar had zero load relief in response to frequency dipping below 49.4 Hz for around 400 ms.*

Decisions:

- *All SLDCs were instructed to shift the load quantum from Stages –III & IV to stage-I & II respectively as an interim measure till new feeders for additional load relief gets identified by individual state DISCOMs.(**Action:** All SLDCs and DISCOMs)*
  This must be implemented at the earliest with necessary changes in frequency settings of the existing UFRs and the same shall be reviewed in upcoming OCC meeting.
- *All SLDCs were advised to share the identified feeders list for revised load relief quantum within a month. The status shall be reviewed in monthly OCC meetings. (**Action:** All SLDCs and DISCOMs)*
- *Curtailment of critical loads should be avoided. However , in stage-III and stage-IV, as it operates only in severe threat to grid stability, industrial loads may also be considered. Accordingly DVC and IPCL (having dominant industrial consumers) were urged to identify industrial feeders for load relief in stage-III and stage-IV. (**Action:** All SLDCs and DISCOMs)*
- *In view of not achieving desired load relief on 15th May 2023 (when frequency <49.4 Hz),all SLDCs were advised to devise a plan for testing of UFRs in consultation with respective utilities and share the same with ERPC/ERLDC. This shall be reviewed in monthly OCC meetings. The periodicity of testing of relays shall be twice in a year at 110 / 132 kV level and above Substations and once in a year at 66 kV level and below Substations.UFR inspection may be carried out randomly on sample basis by ERPC to monitor the operational healthiness.(**Action:** All SLDCs,STUs and state TRANSCOs)*
- *All SLDCs were directed to remove any intentional time delay in all functional UFRs with immediate effect, only inherent measurement delay of the relays shall be allowed. This may be done in coordination with state TRANSCOs.This issue shall be discussed in the upcoming PCC meeting.(**Action:** All SLDCs, STUs and state TRANSCOs)*
- *All SLDCs were urged to expedite and ensure SCADA visibility of existing as well as newly identified feeders under AUFLS for effective supervision of load relief quantum. .(**Action:** Communication dept. of All SLDCs and state TRANSCOs)*
- *All SLDCs were suggested to put UFRs in place for all the feeders being catered by multiple upstream sources, thereby ensuring reliable UFR operation and accurate load relief as per desired quantum. (**Action:** All SLDCs,STUs and state TRANSCOs)*
  Meeting ended with vote of thanks to the chair.

****

Annex-A

List of participants (attended physically)

Special meeting on Automatic Under-frequency Load shedding scheme

Venue: ERPC Conference Hall, Kolkata **Time: 12:00 Hrs.** **Date: 10.07.2024 (Wednesday)**

Sl. No.	Name	Designation & Organisation	Organisation	Contact No.	E-mail Id	Signature
1	N S Mondal	Member Secretary	ERPC	9958389967	mserpc-power@nic.in	
2	R Sutradhar	Executive Director	ERLDC	9436302714	rajibsutradhar@grid-india.in	
3	S C De	CGM	ERLDC	9436335429	scde@Grid-India.in	
4	S. Kumar	Sr GM	"	9436335372		
5	D. Biswas	Sr. DGM	"	9434740941	dbiswas@grid-india.in	
6	L. MURALIKRISHNA	Sr. Mgr	"	9831337529	lmurali@grid-india.in	
7	CHANDAN	DGM	DVC	9931118212	chandan@dvc.gov.in	
8	Preetosh Ghosh	Dy. M	DVC	9674299618	preetosh.ghosh@dvc.gov.in	P. Ghosh
9	Bidyut Biswas	Manager	DVC	7735327563	bidyut.biswas@dvc.gov.in	
10	Shambhu Das	Sr. Manager	DVC	7980161164	shambhu.das@dvc.gov.in	
11	Jayanta Ghosh	Executive	IPCL	8910046266	jayanta.ghosh@indiapower.com	
12	Ayan Sen.	Asst. Manager	IPCL	9073958269	ayan.sen@sptpl.in	Asen
13	Akash kr. Modi	Manager	GRLDC	8584079082	akmodi@grid-india.in	आकाश मोदी
14	Kumar Satyam	AEE	ERPC	7355225072	Satyam.24365@gov.in	Kumar Satyam
15	Alok Pratap Singh	Chief Manager	ERLDC	9007285390	apsingh@grid-india.in	
16	Agniva Chatterjee	AD	ERPC	8100307502	agniva.cea@gov.in	
17	SAUMEN ROY	Addl. Manager	CESC	9163365691	saumen.roy@rpsg.in	
18	DEBARSHI DE	SM	CESC	9230521123	debarshi.de@rpsg.in	
19	RANJAN KUMAR S	SM.	SLDC, JUSNL	9472705837	ranjanelect04@gmail.com	

Special meeting on Automatic Under-frequency Load shedding scheme

Venue: ERPC Conference Hall, Kolkata **Time: 12:00 Hrs.** **Date: 10.07.2024 (Wednesday)**

Sl. No.	Name	Designation & Organisation	Organisation	Contact No.	E-mail Id	Signature
20	UJJWALA K. GURIA	SM (OPH-2)	JBVNL	9973861864	coml.osev@rediffmail.com	
21	Preetam Banerjee	Addl. C.E.	WBSEDCL	7003871189	preetam72@gmail.com	
22	SHOUVIK BANERJEE	ACE/SLDC/WBSETCL	WBSETCL	9434910379	svkbanerjee@yahoo.com	
23	RITA CHAKRABORTY	CE/SLDC/WB	WBSETCL	9434910041	ce.wbsldc@gmail.com	
24	BISWAJIT MADHU	ACE/WBSETCL	WBSETCL	9434910071	hownuhcem@gmail.com	
25	BILASH ACHARI	DGM (ERLDC)	GRID-INDIA	7003472016	bilash.achari@gridindia.in	
26	P P Jena	EE	ERPC	9776198991	ppjena.erpc@gov.in	
27	S. KEJRIWAL	SE	ERPC	9831919509	shyam.kejriwal@gov.in	
28	Rimil Topno	SM (SLDC)	SLDC, JUSNL	9835715518	sldcranchi@gmail.com	
29	Shashi Bhushan Kr.	SM, JBVNL	JBVNL	8789774664	shashi.bce@gmail.com	
30	A. Das.	DD. ERPC	ERPC	9681214774	amupdas@nic.in	
31	S.R. Swain	AEE, ERPC	ERPC	9337791451	saswat.ranjan@gov.in	
32	D.K. Khaitha	AD, ERPC	ERPC	7683889161	dilip.k.khaitha050@gmail.com	
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Annex-A

List of Participants (via virtual mode)

Name	First Join	Last Leave	In-Meeting Duration	Role
ERPC Kolkata	7/10/24, 11:06:56 AM	7/10/24, 2:07:26 PM	2h 19m 47s	Organizer
Pranay Jena	7/10/24, 10:32:48 AM	7/10/24, 11:09:13 AM	36m 25s	Presenter
SLDC ODISHA	7/10/24, 10:50:18 AM	7/10/24, 12:52:11 PM	2h 1m 52s	Presenter
AEE,ULDC,BSPTCL	7/10/24, 10:50:20 AM	7/10/24, 2:07:26 PM	3h 17m 6s	Presenter
ARVIND KUMAR	7/10/24, 10:54:39 AM	7/10/24, 2:07:26 PM	3h 12m 47s	Presenter
Dilip Kant Jha	7/10/24, 11:04:12 AM	7/10/24, 11:30:39 AM	26m 27s	Presenter
CRITL BSPTCL	7/10/24, 11:04:12 AM	7/10/24, 1:31:17 PM	2h 27m 5s	Presenter
sldc bihar	7/10/24, 11:06:00 AM	7/10/24, 2:07:26 PM	3h 1m 26s	Presenter
deepak kumar	7/10/24, 11:16:19 AM	7/10/24, 11:33:20 AM	17m 1s	Presenter
eee bsptcl	7/10/24, 11:16:44 AM	7/10/24, 12:50:12 PM	1h 33m 28s	Presenter
Sweety Kumari	7/10/24, 11:24:30 AM	7/10/24, 2:07:26 PM	2h 42m 56s	Presenter
Dilip Kant Jha	7/10/24, 11:34:08 AM	7/10/24, 12:57:40 PM	1h 21m 41s	Presenter
DEEPAK KUMAR	7/10/24, 11:34:57 AM	7/10/24, 1:23:03 PM	1h 48m 5s	Presenter
SLDC Ranchi	7/10/24, 12:24:00 PM	7/10/24, 1:08:03 PM	44m 3s	Presenter
eee critl	7/10/24, 12:57:31 PM	7/10/24, 1:31:12 PM	33m 40s	Presenter
CE SLDC BIHAR	7/10/24, 1:10:51 PM	7/10/24, 1:31:27 PM	20m 36s	Presenter

Annx-B

Annexure-XI 14th NPC

भारत सरकार केंद्रीय विद्युत प्राधिकरण दक्षिण क्षेत्रीय विद्युत समिति 29, रेसकोर्स क्रास रोड बेंगलूर- 560 009	सत्यमेव जयते	Government of India Central Electricity Authority **Southern Regional Power Committee** 29, Race Course Cross Road Bengaluru-560 009
Email:mssrpc-ka@nic.in	Web site: www.srpc.kar.nic.in	Phone: 080-22282516
सं/No. SRPC/SE(O)/TF-AUFLS_dfdt/2023-24/ 4495-45		दिनांक/ Date **29th September 2023**

सेवा में / To

Member Secretary
National Power Committee (NPC)
Central Electricity Authority
New Dlehi-110 066

विषय/ Subject:Report of the "Task Force on Implementation AUFLS & df/dt Scheme" -reg.

Ref: NPC letter No. CEA/GO-15-14/1/2021-NPC Division/280-295 dated 25th August 2023

महोदय/महोदया/ Sir/ Madam,

Enclosed, please find the final Report of the "**Task Force** on Implementation of Automatic Under Frequency Load Shedding (AUFLS) and df/dt scheme".

Submitted for kind needful please.

भवदीय /Yours faithfully,

29/09/2023

(के पी मधु / K P Madhu)
अधीक्षक अभियंता/सदस्य सांयोजक
Superintending Engineer/Member Convener

Copy to:

1. Smt. Rishika Sharan, Chief Engineer & Member Secretary, NPC, New Delhi
2. Shri Chandra Prakash, Chief Engineer GM, CEA, New Delhi
3. Shri P.D.Lone, Superintending Engineer, WRPC, WRPC, Mumbai
4. Shri Shyam Kejriwal, Superintending Engineer, ERPC, Kolkata
5. Shri Santosh Kumar, Superintending Engineer, NRPC, New Delhi
6. Shri S M Aimol, Superintending Engineer NERPC, Shillong.
7. Shri Satyendra Kumar Dotan, Director, NPC, CEA, New Delhi
8. Shri Vivek Pandey, General Manager, NLDC, New Delhi

Copy for kind information to:

1. SA to Chairperson, CEA, New Delhi.
2. SA to Member GO&D, CEA, New Delhi.
3. Chairman & Managing Director, GRID-INDIA, New Delhi.
4. Member Secretary, NRPC, New Delhi.
5. Member Secretary, ERPC, Kolkata.
6. Member Secretary, WRPC, Mumbai.
7. Member Secretary, NERPC, Shillong.

Annx-B

Report
on
Implementation of AUFLS and df/dt Scheme

Task Force Constituted by National Power Committee, CEA
Under Chairmanship of Member Secretary, SRPC

Report No. NPC/CEA/TF-AUFLS-001 September 2023

REPORT

OF

TASK FORCE

ON

IMPLEMENTATION OF

AUFLS AND df/dt SCHEME

EXECUTIVE SUMMARY

REPORT OF THE TASK FORCE ON

IMPLEMENTATION OF AUFLS AND df/dt SCHEME

EXECUTIVE SUMMARY

National Power Committee (NPC), vide letter No. CEA/GO-15-14/1/2021-NPC Division/250 dated 18th August 2023 and vide letter No. CEA/GO-15-14/1/2021-NPC Division/280-295 dated 25th August 2023 constituted a Task Force on Implementation of Automatic Under Frequency Load Shedding (AUFLS) and df/dt scheme with the following Terms of Reference:

i. Review the recommendations of the Report as per directions by the 13th NPC Meeting within two months.

ii. Prioritization of the loads under the AUFLS and df/dt scheme.

iii. To oversee the implementation of the report on Automatic Under Frequency Load Shedding (AUFLS) and df/dt scheme.

iv. Any other suggestions/recommendations on related matters.

The Task Force comprised of the following Members:

1	Member Secretary, SRPC	Shri Asit Singh	**Chairperson**
2	Chief Engineer NPC,CEA	Smt Rishika Sharan	Member
3	Chief Engineer GM,CEA	Shri Chandra Prakash	Member
4	Superintending Engineer, WRPC	Shri P D Lone	Member
5	Superintending Engineer, ERPC	Shri Shyam Kejriwal	Member
6	Superintending Engineer, NRPC	Shri Santhosh Kumar*	Member
7	Superintending Engineer, NERPC	Shri S M Aimol	Member
8	Director, NPC,CEA	Shri Satyendra Kumar Dotan	Member
9	General Manager, NLDC	Shri Vivek Panday	Member
10	Superintending Engineer, SRPC	Shri K P Madhu	**Member Convener**

* NRPC replaced Shri Anzum Parwej.

The Task Force reviewed report of the Sub-Committee to review the AUFLS and df/dt scheme in line with the decisions of NPC in its 13th Meeting and relevant Regulations in Central Electricity Regulatory Commission (Indian Electricity Grid Code) Regulations, 2023 and identified the following:

- Total 25% relief will be planned in 4 stages-49.4 Hz, 49.2 Hz, 49.0 Hz & 48.8 Hz.
- Pumping load will be tripped before first stage (> 49.50 Hz). Battery energy system in charging mode will go in discharging mode (> 49.50 Hz), no storage will be in storage/charging mode at frequency < 49.50 Hz.
- All distribution licensees, STUs and bulk consumers shall provide automatic under frequency relays (UFR) and df/dt relays for load shedding in their respective systems to arrest frequency decline that could result in grid failure as per the plan given by the RPCs from time to time. The default UFR settings shall be as follows:

Sr. No.	***Stage of UFR Operation***	***Frequency (Hz)***
1	***Stage-1***	*49.40*
2	***Stage-2***	*49.20*
3	***Stage-3***	*49.00*
4	***Stage-4***	*48.80*
Note 1: All states (or STUs) shall plan UFR settings and df/dt load shedding schemes depending on their local load generation balance in coordination with and approval of the concerned RPC. *Note 2: Pumped storage hydro plants operating in pumping mode or ESS operating in charging mode shall be automatically disconnected before the first stage of UFR*		

- The following shall be factored in while designing and implementing the UFR and df/dt relay schemes:

  (a) The under-frequency and df/dt load shedding relays are always functional.

  (b) Demand disconnection shall not be set with any time delay in addition to the operating time of the relays and circuit breakers.

  (c) There shall be a uniform spatial spread of feeders selected for UFR and df/dt disconnection.

  (d) SLDC shall ensure that telemetered data of feeders (MW power flow in real time and circuit breaker status) on which UFR and df/dt relays are installed is available at its control centre. SLDC shall monitor the combined load in MW of these feeders at all times. SLDC shall share the above data with the respective RLDC in real time and submit a monthly exception report to the respective RPC. RLDC shall inform SLDCs as well as the concerned RPC on a quarterly basis, durations during the quarter when the combined load in MW of these feeders was below the level considered while designing the UFR scheme by the RPC. SLDC shall take corrective measures within a reasonable period and inform the respective RLDC and RPC, failing which suitable action may be initiated by the respective RPC.

(e) RPC shall undertake a monthly review of the UFR and df/dt scheme and also carry out random inspection of the under-frequency relays. RPC shall publish such a monthly review along with an exception report on its website.

(f) SLDC shall report the actual operation of UFR and df/dt schemes and load relief to the concerned RLDCs and RPCs and publish the monthly report on its website.

Through detailed deliberations, the Task Force finalized the methodology for identification quantum of relief at each stages of AUFLS, distribution among Regions by NPC, distribution of relief quantum among State/UT in Regions by respective RPCs for implementation in the Region, guidelines for identification of feeders, Mapping of feeders, Reporting by SLDCs/RLDCs, Testing/inspection of UFRs, setting of UFR for Pumps & Energy Storage Systems (ESS).The observations and recommendations are elaborated in the Task Force Report,

Salient observations & conclusion by the Task Force are summarized below:

- **AUFLS Set Points and Quantum of Relief**

  Total 25% relief would be planned in four stages: Stage-1 at 49.4 Hz, Stage-2 at 49.2 Hz, Stage-3 at 49.0 Hz & Stage-4 at 48.8 Hz. The 25% total relief distribution in four stages would be in such a way that 5% in Stage-1, 6% in Stage-2 and 7% each in Stage 3 & 4.

- **Identification of AUFLS Quantum by NPC and RPCs**

  NPC Division to communicate the Region wise relief quantum (based on Regional Peak Demand Met during the previous year) by **31st of May** to RPCs for implementation in the next Financial Year (FY). Distribution of relief among State/UT to be carried out based on Regional relief and demand contribution in the average of Peak demand met ratio and demand met (consumption) ratio of State/UT in the previous FY.

- **Quantum Identification for AUFLS by States/UT and monthly vetting**

  Each SLDC shall carry out month-wise Stage-wise analysis and furnish to RPC/RLDC in the following manner:

  AUFLS Stage -1:

  Actual Relief for the month = Average actual load (for the month) of all the feeders identified in the stage**.** For this Feeders are to be mapped at SLDC. The mapping would be extended to RLDC. If feeders are not mapped then values are to be collected from field. (Any outage would not be excluded).

  Desired Relief for the month = (Recommended AUFLS quantum in the stage x Average demand for the month of State/UT)/Demand Contribution of the State/UT

  The same exercise would be repeated for each Stage.

As a general guideline Actual Relief for the month should be 10% more than the Desired Relief for the month considering the Relay/breaker issues and a resilient safety net.

The data would be vetted by RLDC and discussed in OCC Meetings of RPC.

- **Analysis of AUFLS Event**

AUFLS Stage-1:

Actual Relief during incident = (Actual relief (during incident) of all the feeders identified in the stage)

Desired Relief during incident= (Recommended AUFLS quantum in the stage x demand of State/UT at time of incident)/Demand Contribution of the State.

The same exercise would be repeated for each Stage.

The data would be vetted by RLDC and discussed in OCC Meetings of RPC.

- **Guidelines for identification of AUFLS feeders**

AUFLS relays under Stage-1 & Stage-2 should be implemented preferably on downstream network at 11/22/33 kV level and AUFLS relays under Stage-3 & Satge-4 should be implemented on upstream network at EHV (66/110/132 kV) level so that load relief obtained is fast and reliable.

- **Mapping of AUFLS feeders**

SLDCs in coordination with STU/Discoms, map the feeders for loading, breaker status etc. and create display for monitoring of all the stages. The SLDC would extend the mutually agreed displays to RLDC. SLDCs also develop the SCADA Displays Discom-wise/Sub SLDC wise as applicable as well as feeder wise for all the stages.

Mapping verification between SLDC and Discom/STU to be carried out at least once in three (3) months and between RLDC and SLDCs at least once in six (6) months.

SLDCs shall download the data and store it for two years. The Data should be made available to RPCs/RLDCs/CEA/CERC for further studies or analysis.

- **Settings of UFR for Pumping load/Energy Storage Systems**

All Energy Storage Systems would change from charging mode to discharging mode at 49.50 Hz. If it is not possible then they would be tripped at 49.50 Hz. If ESS is injecting active power at 49.50 Hz not to be tripped.

Pumping load will be tripped before AUFLS first stage. Irrigation Pumps would be tripped at 49.50 Hz

All the relays procured in future to have a sampling period ranging from three (03) cycles to five (05) Cycles. No additional time delay to be incorporated in the relay other than the inherent measuring time.

- **Testing/Inspection of UFR**

SLDCs shall in consultation with the Utilities responsible for testing should chalk out a plan of relays testing schedule before 1st of December and submit the same to RPC/RLDC. The periodicity of testing of relays shall be twice in a year at 110 / 132 kV level and above Substations and once in a year at 66 kV level and below Substations.

RPC would carry UFR inspection randomly on sample basis by the RPC Secretariat or through RLDC.

- **df/dt Scheme**

The df/dt load shedding is specific to regions and therefore, the quantum of load shedding required to be wired up under the df/dt scheme may be discussed at regional levels in the RPCs. The RPCs in consultation with the stakeholders can decide the set points and quantum of Load shedding required under df/dt scheme.

Various aspects as brought out above have been deliberated by the Task Force and action by the agencies have been finalized. However, SLDCs and concerned utilities to ensure proper setting of relays considering sluggishness to achieve the desired load relief at all the stages of AUFLS and df/dt.

REPORT

OF

TASK FORCE

ON

IMPLEMENTATION

OF

AUFLS & df/dt SCHEME

INDEX

REPORT OF THE TASK FORCE ON

IMPLEMENTATION OF AUFLS AND df/dt SCHEME

1.0 INTRODUCTION

National Power Committee (NPC) in its 13th Meeting held on 05.07.2023 had accepted the report of the Sub-Committee (constituted as per the decision in 10th meeting of NPC) to review the AUFLS and df/dt scheme with the following observations:

a) The first stage will be set at 49.4 Hz.

b) Total 25% relief will be planned in 4 stages-49.4 Hz, 49.2 Hz, 49.0 Hz & 48.8 Hz.

c) Pumping load will be tripped before first stage (> 49.4 Hz). Battery energy system in charging mode will go in discharging mode (> 49.4 Hz), no storage will be in storage/charging mode at frequency < 49.4 Hz.

d) A Task Force under chairmanship of MS, SRPC with Members from Grid India, RPCs/NPC may be formed. The task force will also oversee the implementation of the report.

Keeping this in view, MS NPC, vide letters dated 18.08.2023 & 25.08.2023 constituted Task Force on Implementation of Automatic Under Frequency Load Shedding (AUFLS) and df/dt scheme with the following Terms of Reference:

i. Review the recommendations of the Report as per directions by the 13th NPC Meeting within two months.

ii. Prioritization of the loads under the AUFLS and df/dt scheme.

iii. To oversee the implementation of the report on Automatic Under Frequency Load Shedding (AUFLS) and df/dt scheme.

iv. Any other suggestions/recommendations on related matters.

A copy of the letters is at **Annexure-I**.

The Task Force committee was constituted with the following Members:

1.	**Shri Asit Singh,** Member Secretary, SRPC ……**Chairperson**	2.	Smt. Rishika Sharan, Chief Engineer NPC,CEA ……. Member
3.	Shri Chandra Prakash, Chief Engineer GM,CEA …… Member	4.	Shri P D Lone Superintending Engineer, WRPC …… Member
5.	Shri Shyam Kejriwal Superintending Engineer, ERPC ..…….. Member	6.	Shri Santhosh Kumar* Superintending Engineer,NRPC …….. Member
7.	Shri S M Aimol Superintending Engineer, NERPC …….. Member	8.	Shri Satyendra Kumar Dotan Director, NPC,CEA …….. Member
9.	Shri Vivek Pandey General Manager, NLDC …….. Member	10.	**Shri K P Madhu** Superintending Engineer, SRPC ……. **Member Convener**

* NRPC replaced Shri Anzum Parwej.

The Task Force had its Meeting on 11.09.2023 through Video Conferencing (VC) and deliberated various aspects in the implementation of AUFLS & df/dt scheme. During the deliberations, it was observed that the frequency setting adopted by all the Regions for the four stages of AUFLS are uniform and same as mandated in CERC (IEGC) Regulations, 2023. It emerged that the load relief to obtained shall be reviewed yearly based on the actual peak met during the previous Financial Year and implemented in the next Financial Year. Mapping of identified feeders at SLDC/RLDC needed to be ensured by the utilities and monitoring of the feeders at real time by control rooms.

2.0 PROVISIONS IN CERC REGULATIONS

Central Electricity Regulatory Commission (Indian Electricity Grid Code) Regulations, 2023 effective from 01st October 2023 provides the following in respect of AUFLS and df/dt:

Regulation No.29: ***SYSTEM SECURITY***

……..

(12) All distribution licensees, STUs and bulk consumers shall provide automatic under frequency relays (UFR) and df/dt relays for load shedding in their respective systems to arrest frequency decline that could result in grid failure as per the plan given by the RPCs from time to time. The default UFR settings shall be as specified in Table-2 below:

Sr. No.	*Stage of UFR Operation*	*Frequency (Hz)*
1	*Stage-1*	*49.4*
2	*Stage-2*	*49.2*
3	*Stage-3*	*49.0*
4	*Stage-4*	*48.8*
Note 1: All states (or STUs) shall plan UFR settings and df/dt load shedding schemes depending on their local load generation balance in coordination with and approval of the concerned RPC. *Note 2: Pumped storage hydro plants operating in pumping mode or ESS operating in charging mode shall be automatically disconnected before the first stage of UFR.*		

(13) The following shall be factored in while designing and implementing the UFR and df/dt relay schemes:

(a) The under-frequency and df/dt load shedding relays are always functional.

(b) Demand disconnection shall not be set with any time delay in addition to the operating time of the relays and circuit breakers.

(c) There shall be a uniform spatial spread of feeders selected for UFR and df/dt disconnection.

(d) SLDC shall ensure that telemetered data of feeders (MW power flow in real time and circuit breaker status) on which UFR and df/dt relays are installed is available at its control centre. SLDC shall monitor the combined load in MW of these feeders at all times. SLDC shall share the above data with the respective RLDC in real time and submit a monthly exception report to the respective RPC. RLDC shall inform SLDCs as well as the concerned RPC on a quarterly basis, durations during the quarter when the combined load in MW of these feeders was below the level considered while designing the UFR scheme by the RPC. SLDC shall take corrective measures within a reasonable period and inform the respective RLDC and RPC, failing which suitable action may be initiated by the respective RPC.

(e) RPC shall undertake a monthly review of the UFR and df/dt scheme and also carry out random inspection of the under-frequency relays. RPC shall publish such a monthly review along with an exception report on its website.

(f) SLDC shall report the actual operation of UFR and df/dt schemes and load relief to the concerned RLDCs and RPCs and publish the monthly report on its website.

3.0 AUFLS SET POINTS AND QUANTUM OF RELIEF

The AUFLS setting with %age of quantum of load shedding concluded in the Report is given below (Table 10.1 in the Report):

Sr. No.	*Stage*	*Frequency*	*Demand Disconnection*	*Total Quantum of LS*
Stage-I Defense plan- Load Shedding				
1	I-A	49.2 Hz	3.50%	
2	I-B	49.0 Hz	3.50%	
3	I-C	48.8 Hz	4.00%	
4	I-D	48.7 Hz	4.50%	
5	I-E	48.6 Hz	4.50%	**20%**
Stage-II Desperate plan- Load Shedding				
6	II-F	48.4 Hz	6.00%	
7	II-G	48.2 Hz	6.00%	
8	II-H	48.0 Hz	6.00%	**18%**
Grand Total (Stage-I + II)				**36%**

In the 13th Meeting of NPC, it had been observed that the first stage will be set at 49.4 Hz and total 25% relief will be planned in four stages-49.4 Hz, 49.2 Hz, 49.0 Hz & 48.8 Hz. The AUFLS settings to be adopted for total relief of 25% of previous year peak demand met for implementation in the subsequent year.

The percentage relief from Stage-1 may be kept as 5 % since it is better to check the falling frequency and get sufficient quantum of relief at initial level itself and there may not arise the occasion for further reduction of frequency leading to more load shedding at other stages. In the Report of Expert Committee on IEGC also equal quantum of Load Relief was proposed for all stages. Keeping lower quantum of relief at higher level may lead to activation of lower stages since in most of the real time conditions the desired relief may not be achieved.

The Task Force recommended the following AUFLS Set Points and Percentage Quantum of Relief for implementation:

Table 1: AUFLS Set Points and Percentage Quantum of Relief

Sl No	Stage	UFR set points in Hz	Quantum of Relief
1	**Stage-1**	**49.4**	**5%**
2	**Stage-2**	**49.2**	**6%**
3	**Stage-3**	**49.0**	**7%**
4	**Stage-4**	**48.8**	**7%**
		Total	**25%**

4.0 IDENTIFICATION OF AUFLS QUANTUM BY NPC AND RPCs

NPC Division to communicate the Region wise relief quantum (based on Regional Peak Demand Met during the previous year) by **30th of June** to RPCs.

If the peak demand is lower than the previous year peak demand, the same settings should be continued (settings remain unchanged).

4.1. Methodology for AUFLS Quantum (MW) Distribution among Regions:

Let All India Peak Demand in Previous Year in MW= **AP**

Sum of Regional Peak in MW = (RP_{NR}+ RP_{WR} + RP_{SR} + RP_{ER} +RP_{NER})**= RP**

Table 2: Methodology for AUFLS Quantum (MW) Distribution among Regions

Region	Regional Peak Demand (MW)	Stage-1 49.4 Hz (5%)	Stage-2 49.2 Hz (6%)	Stage-3 49.0 Hz (7%)	Stage-4 48.8 Hz (7%)	Total (MW)
	(1)	(2)	(3)	(4)	(5)	(6)
Northern Region	RP_{NR}	0.05* RP_{NR}*AP/RP	0.06* RP_{NR}*AP/RP	0.07* RP_{NR}*AP/RP	0.07* RP_{NR}*AP/RP	Sum Clmn. (2) to (5)
Western Region	RP_{WR}	0.05* RP_{WR}*AP/RP	0.06* RP_{WR}*AP/RP	0.07* RP_{WR}*AP/RP	0.07* RP_{WR}*AP/RP	Sum Clmn. (2) to (5)
Southern Region	RP_{SR}	0.05* RP_{SR}*AP/RP	0.06* RP_{SR}*AP/RP	0.07* RP_{SR}*AP/RP	0.07* RP_{SR}*AP/RP	Sum Clmn. (2) to (5)
Eastern Region	RP_{ER}	0.05* RP_{ER}*AP/RP	0.06* RP_{ER}*AP/RP	0.07* RP_{ER}*AP/RP	0.07* RP_{ER}*AP/RP	Sum Clmn. (2) to (5)
North Eastern Region	RP_{NER}	0.05* RP_{NER}*AP/RP	0.06* RP_{NER}*AP/RP	0.07* RP_{NER}*AP/RP	0.07* RP_{NER}*AP/RP	Sum Clmn. (2) to (5)
All India	AP	Sum above	Sum above	Sum above	Sum above	25% OF AP

Sample calculation for AUFLS Quantum (MW) for 2023-24 is given below:

All India Peak Demand in 2022-23: 2,07,231 MW

Table 2A: Computation of AUFLS Quantum (MW) Distribution among Regions

Region	Regional Peak Demand (MW)	Stage-1 49.4 Hz (5%)	Stage-2 49.2 Hz (6%)	Stage-3 49.0 Hz (7%)	Stage-4 48.8 Hz (7%)	Total (MW)
	(1)	(2)	(3)	(4)	(5)	(6)
Northern Region	76,561	3270	3924	4577	4577	**16,348**

Western Region	71,677	3061	3673	4285	4285	**15,305**
Southern Region	64,337	2748	3297	3847	3847	**13,738**
Eastern Region	27,218	1162	1395	1627	1627	**5,812**
North Eastern Region	3,603	154	185	215	215	**769**
All India	**2,07,231**	**10394**	**12473**	**14552**	**14552**	**51,972**

4.2. Three options were considered by the Task Force for distribution of relief among State/UT. The Task Force recommended that Distribution of relief among State/UT to be carried out based on Regional relief and demand contribution in the average of Peak demand met ratio and demand met (consumption) ratio of State/UT in the previous FY.

4.3. After the receipt of the allocated load shedding quantum of the Region from NPC, AUFLS relief quantum should be distributed among the State/UT in the region by the RPCs by **July /August** in consultation with the stakeholders (in OCC Meeting).

Sample calculation for Northern Region is given below:

Table 3: State/UT contribution ratio for AUFLS Relief Quantum

State/UT	Actual Consumption in MU for 2022-23	Consumption Ratio	Actual Demand Met in 2022-23	Demand Met Ratio	State/ UT Contribution
	(1)	(2)=(1)/(A)	(3)	(4)=(3)/(B)	(5)=[(2)+(4)]/2
Chandigarh	1788	0.004	407	0.005	**0.004**
Delhi	35143	0.077	7695	0.089	**0.083**
Haryana	60945	0.133	12768	0.147	**0.140**
Himachal Pradesh	12542	0.027	2071	0.024	**0.026**
UT J&K & Ladhak	19322	0.042	2967	0.034	**0.038**
Punjab	69220	0.151	14311	0.165	**0.158**
Rajasthan	100057	0.219	17206	0.199	**0.209**
Uttar Pradesh	143050	0.313	26589	0.307	**0.310**
Uttarakhand	15386	0.034	2599	0.030	**0.032**
Total	457453 **(A)**	1.000	**86613 (B)**	**1.000**	1.000

4.4. Each State/UT relief quantum would be computed by RPC by distributing the NPC communicated Regional relief quantum based on ratio at 4.2. This quantum would become the base for monthly analysis of visible relief and also the analysis during any event.

Sample calculation of Demand Distribution for Northern Region:

Table 4: State/UT Demand Distribution in MW

State/UT	State/ UT Contribution	Load Relief in MW
	(a)=Column (5) of Table 3	(b)=a* B in Column (3) of Table 3
Chandigarh	0.004	330
Delhi	0.083	6342
Haryana	0.140	10743
Himachal Pradesh	0.026	1965
UT J&K & Ladhak	0.038	2928
Punjab	0.158	12118
Rajasthan	0.209	15978
Uttar Pradesh	0.310	23722
Uttarakhand	0.032	2436
Total	1.000	76561 **(C)**

4.5. Each State/UT Stage-wise AUFLS quantum would be computed by RPC. This Stage-wise recommended AUFLS quantum shall become the base for monthly analysis of visible relief and also the analysis during any tripping.

Sample calculation for NR is as follows:

Table 5: State/UT Stage-wise AUFLS in MW

State/UT	State/ UT Contribution	Stage-1 49.4 Hz (5%)	Stage-2 49.2 Hz (6%)	Stage-3 49.0 Hz (7%)	Stage-4 48.8 Hz (7%)	Total
	(c)=Column (5) of Table 3	NR in Column (2) of Table 2A* (c)	NR in Column (3) of Table 2A* (c	NR in Column (4) of Table 2A* (c	NR in Column (5) of Table 2A* (c	
Chandigarh	0.004	14	17	20	20	70

Delhi	0.083	271	325	379	379	1354
Haryana	0.140	459	551	642	642	2294
Himachal Pradesh	0.026	84	101	117	117	420
UT J&K & Ladhak	0.038	125	150	175	175	625
Punjab	0.158	517	621	724	724	2587
Rajasthan	0.209	682	819	955	955	3412
Uttar Pradesh	0.310	1013	1216	1418	1418	5065
Uttarakhand	0.032	104	125	146	146	520
Total	1.000	3270	3924	4577	4577	16348

5.0 QUANTUM IDENTIFICATION FOR AUFLS BY STATES/UT AND MONTHLY VETTING

5.1. States/UT shall identify the load relief for each stage considering the Quantum of relief and their demand contribution considering the intra-day, seasonality etc. 10% additional relief would be finalised considering the demand growth of the year, planned and forced outages, UFR and breaker issues etc. SLDC would communicate feeder-wise, Stage-wise details etc. to RPC/RLDC.

5.2. Each SLDC shall carry out month-wise Stage-wise analysis and furnish to OCC in the following manner:

AUFLS Stage -1:

Actual Relief for the month = Average actual load (for the month) of all the feeders identified in the stage**.** For this Feeders are to be mapped at SLDC. The mapping would be extended to RLDC. If feeders are not mapped then values are to be collected from field. (Any outage would not be excluded).

Desired Relief for the month = (Recommended AUFLS quantum in the stage x Average demand for the month of State/UT)/Demand Contribution of the State/UT

Similar exercise for each Stage.

The data would be vetted by RLDC and discussed in OCC Meetings of RPC.

5.3. Self-checking scheme: If Actual Relief for the month is **less the Desired Relief** for the month, **SLDC** would carry out feeder –wise analysis and in consultation with Discoms/STU take **corrective action** (like identifying new feeder, additional feeder, modifying the declared relief of feeders, verifying the mapped figures etc.). The same

would be implemented by SLDC/STU/Discoms before next OCC by submitting a compliance Report.

5.4. A**s a general guideline Actual Relief for the month should be 10% more than the Desired Relief for the month considering the Relay/breaker issues and a resilient safety net.**

Table 6: AUFLS – Monthly Report - …….(Month)

State/UT:……..

	Stage-1 49.4 Hz	Stage-2 49.2 Hz	Stage-3 49.0 Hz	Stage-4 48.8 Hz	**STATE TOTAL**
Recommended (A)					
Implemented (B)					
SCADA monitored (C)					
Actual flow on SCADA monitored (D)					
Balance implemented (E) = (B) – (C)					
Actual flow on balance implemented (F)					
Desired relief (G)= (B)x Average State Demand for the month/(State Demand Contribution)					
Actual relief (H) = (D+F)					
Deficit (-)/Surplus (+) H-G					

6.0 ANALYSIS OF AUFLS EVENTS

6.1. The following methodology to be adopted for AUFLS analysis during event:

AUFLS Stage-1:

Actual Relief during incident = (Actual relief (during incident) of all the feeders identified in the stage)

Desired Relief during incident= (Recommended AUFLS quantum in the stage x demand of State/UT at time of incident)/Demand Contribution of the State.

Similar exercise for each Stage.

The data would be vetted by RLDC and discussed in OCC Meetings of RPC.

6.2. If Actual Relief during incident is less the Desired Relief during incident, SLDC would carry out feeder –wise analysis and in consultation with Discoms/STU take corrective action. Necessary directions will be issued to Discoms/STU by SLDC. The same would be implemented by SLDC/STU/Discoms before next OCC by submitting a compliance Report.

6.3. The relief realization to be analyzed based on the demand at the time of incident. The data needed to be vetted by RLDC and discussed in OCC Meetings of RPC. Reason for non-tripping of the relays during the incident needed to be mentioned. If Actual Relief during incident is less than the Desired Relief during incident, SLDC would carry out feeder –wise analysis and in consultation with Discoms/STU take corrective action. Necessary directions shall be issued to Discoms/STU by SLDC. The same would be implemented by SLDC/STU/Discoms before next OCC by submitting a compliance Report.

6.4. SLDCs shall issue directions to state utilities to carry out self-testing of the relays and where ever tripping is not observed (due to discrepancy in measured frequency), such relays are recommended to retune to set the points accordingly at 49.41 Hz. or 49.42 Hz. etc. The implementation of the same is being monitored in OCC.

Table 7: AUFLS – Tripping Report at ….. hrs on ……..

State/UT:……..

Description	Stage-1 49.4 Hz	Stage-2 49.2 Hz	Stage-3 49.0 Hz	Stage-4 48.8 Hz	STATE TOTAL
Recommended (A)					
Implemented (B)					
SCADA monitored (C)					
Actual flow on SCADA monitored (D)					
Balance implemented (E) = (B) – (C)					
Actual flow on balance implemented (F)					
Desired relief (G)= (B)x State Demand at the time of tripping/(State Demand Contribution)					
Actual relief (H) = (D+F)					
Deficit (-)/Surplus (+) H-G					

Further feeder wise and Stage-wise details will also be furnished as per the Table given below:

Table 8: AUFLS – Feeder-wise Tripping Report at ….. hrs on ……..

AUTOMATIC UNDER FREQUENCY LOAD SHEDDING STAGE-1 (49.4)						
Sl No	Sub Station	Feeder Description	Average load per year (In MW)	Tripped (Y/N)	Reason if not tripped	Actual flow in MW
1						
2						
3						
4						
TOTAL MW RELIEF						

7.0 GUIDELINES FOR IDENTIFICATION OF AUFLS FEEDERS

The following to be considered for identification of feeders:

i. AUFLS relays under Stage-1 & Stage-2 should be implemented preferably on downstream network at 11/22/33 kV level.

ii. AUFLS relays under Stage-3 & Satge-4 should be implemented on upstream network at EHV (66/110/132 kV) level so that load relief obtained is fast and reliable as it is a desperate measure for areas that have disintegrated.

iii. As far as possible the feeders/transformers are feeding radial loads shall be identified.

iv. Telemetry availability would be considered as important factor so that the feeders/transformer loading can be extended to SLDC/RLDC for mapping

v. Feeders catering to critical loads are to be avoided. VIP areas, Airport, Metro, Railways, Defence, Govt Hospitals, Government Offices, continuous process industries etc. needs to be prioritized

vi. No mixed feeders with RE/Distributed generations should be identified. If identified the feeder should be never in injecting mode. Steps to segregate the feeder (load/RE/Distributed generation) would be taken.

vii. If Grid feeder is identified the other side breakers should be in normally open condition. If they are to be closed frequently then UFR with same set points to be provided at other ends.

viii. The feeders identified for AUFLS would be as far as possible not common for df/dt, scheduled power cuts, load shedding, SPS, ADMS etc. In case of difficulty to

identify dedicated feeders the same is to be approved in OCC/PCSC. Adequate care is to be taken if round robin scheme is adopted for ADMS, SPS etc.

ix. The Islanding loads/feeders which are to be retained would not be enabled for AUFLS. However loads in the Island can be identified for AUFLS but same has to be factored while designing the Island.

Chairperson, Task Force observed that the sampling rate is configured by the OEM and cannot be changed by S/S officials. There are relays with 3 cycle sampling rate and also with 6-10 cycle sampling rate. The only way to achieve the tripping at desired frequency is to set the relay set points based on the behaviour of each relay. 3-5 cycle sampling time is advisable since if response time is below 3 cycles, during some transients also unwanted tripping may happen.

NERPC mentioned that in their system most of the 33 kV feeders are radially loaded and 132 kV feeders are grid connected and difficult to get desired relief in tripping of 132 kV grid connected feeder since if relay trip at one S/s the load may be fed from other end. Requested that NER may be given some relaxation such that the feeders at 33 kV also may be identified at lower stages.

It was clarified that these are General Guidelines in which some changes may be carried according to specific constraints. However, if Grid feeder is identified the other side breakers should be in normally open condition. If they are to be closed frequently then UFR with same set points to be provided at other end also.

8.0 MAPPING OF AUFLS FEEDERS

SLDC in coordination with STU/Discoms map the feeders for loading, breaker status etc. and create display for monitoring. The SLDC would extend the mutually agreed display to RLDC. Display to be implemented at SLDC which would be extended to RLDC.

Table 9: AUFLS Monitoring in MW

Description	Stage-1 49.4 Hz	Stage-2 49.2 Hz	Stage-3 49.0 Hz	Stage-4 48.8 Hz	TOTAL (all the Stages)
Recommended (A)					
Implemented (B)					
Unmapped quantum (C)					
SCADA monitored (D)					
Actual flow (E)					
Desired relief (F)= (D)x State Demand/(State Demand Contribution)					
Deficit (-)/Surplus (+) E-F					

SLDC would further develop the SCADA Displays Discom-wise/Sub SLDC wise as applicable as given below:

Table 10: AUFLS Monitoring in MW STAGE-1 (49.4)

Description	DISCOM / SUB SLDC -1	DISCOM / SUB SLDC -2	DISCOM / SUB SLDC -3	.....	STATE TOTAL
Recommended (A)					
Implemented (B)					
Unmapped quantum (C)					
SCADA monitored (D)					
Actual flow (E)					
Desired relief (F)= (D)x Discom Demand/(Discom Demand Contribution)					
Deficit (-)/Surplus (+) E-F					

Similar display for all stages.

SLDC would further develop the SCADA Displays feeder wise as given below:

Table 11: Feeder wise AUFLS monitoring in MW

AUTOMATIC UNDER FREQUENCY LOAD SHEDDING STAGE-1 (49.4)											
Sl.No	Discom/ SUB-LDC	Voltage level	Substation / Feeder Name (A-B)	Average load (MW)	Relay function enabled (Y/N)	SCADA Visibility (Y/N)	Radial feeder (Y/N)	RE injection feeder (Y/N)	CB Status Both ends	Actual flow in MW(A)	Actual flow in MW (B)
1											
2											
3											
TOTAL (MW)											

Similar display for all Stages.

SLDCs would download the data and store it for two years. SLDCs would collect feeder loading details of unmapped feeders.

Concrete action plan with definitive timelines would be made by SLDC/STU/Discom to achieve 100% mapping. This would be followed up in OCC.

Mapping verification between SLDC and Discom/STU would carried out at least once in three (3) months. Mapping verification between RLDC and SLDC would be carried at least once in six (6) months.

Any change in feeder would be informed to RPC & RLDC and mapping would be ensured.

SE(P) WRPC informed that 85-90% of AUFLS relays installed in WR are at the voltage level of 11kV/22kV/33kV and also these relays are installed in many switching distribution level remotely located substations of the States. The implementation of the AUFLS display on SCADA system was deliberate in various forum of WRPC. However the States have expressed inability to implement the display in SCADA due to communication issues in remotely located S/Ss. However, efforts are still being made to improve the visibility of these feeders in SCADA.

9.0 SETTINGS OF UFR/PUMP LOADS/ESS

All Energy Storage Systems would change from charging mode to discharging mode at 49.45 Hz. If it is not possible then they would be tripped at 49.45 Hz. If ESS is injecting active power at 49.45 Hz not to be tripped.

Pumping load will be tripped before AUFLS first stage. Irrigation Pumps would be tripped at 49.45 Hz.

Load disconnection shall not be set with any time delay in addition to the operating time of the relays and circuit breakers.

During Testing if delay is observed (> 75 msec) in Relay Pick up and sending the command to breaker then set points to be enhanced to 49.41 Hz, 49.21 Hz, 49.01 Hz and 48.81 Hz as applicable or any higher value to ensure tripping 49.40 Hz, 49.20 Hz, 49.00 Hz and 48.80 Hz

All the relays to be procured in future to have a sampling period ranging from three cycles to five Cycles. No additional time delay to be incorporated in the relay other than the inherent measuring time.

With reference to the discussions regarding the trip setting of storage device operating in charging/pumping mode it is requested to consider the following inputs from NLDC.

(A) CEA Technical Standards of connectivity to the grid Regulations (2019 amendment), Connectivity standards mandate the wind generating stations, generating stations using inverters, wind - solar photo voltaic hybrid systems and energy storage systems as under

Quote

" The generating unit shall be capable of operating in the frequency range 47.5 to 52 Hz and be able to deliver rated output in the frequency range of 49.5 Hz to 50.5 Hz"

Unquote

In future several storage systems (BESS, PSP) are expected to be commissioned. Few hybrid RE stations with BESS/PSP are also envisaged. Considering the possible derating of inverter based resources at frequency below 49.5 Hz, it is desirable to take measures to arrest the frequency decline below 49.5 Hz. It is therefore desirable that the storage device operating in charging/pumping mode are tripped in a graded manner before the frequency dips below 49.5 Hz.

(B) Grid India vide its letter dated 2nd Jul 2018 had suggested to raise the UFR stage-I setting to 49.6 Hz and consider 49.8 Hz for initiating the tripping of pump storage/BESS operating in charging pumping mode. Thus keeping a margin of 0.2 Hz between tripping of storage and AUFLS stage-I.

(C) The Expert Group on IEGC considered 49.50 Hz as the nadir frequency for working out the AUFLS setting. Relevant extracts are quote below:

Under Frequency Relay (UFR) Settings: (a) Considering the All India electricity grid operating as a synchronous grid and being one of the largest grids in the world, the defence plans now need to be looked at from a national level rather than regional level. The same needs to be mandated in the IEGC itself rather than any discussion at the RPC level. As indicated in the section on primary response, for the reference contingency of 4500 MW generating station outage, the frequency would dip to 49.50 Hz and quickly recover to 49.70 Hz. So, the chances of the frequency falling below 49.50 Hz in an integrated large power system like India would be rare. The frequency would fall below this value only in case of part separation of systems leading to a generation deficit in one system

(D) The IEGC-2023 has mandated UFR stage-I as 49.4 Hz

It is suggested that the tripping of storage system (in charging pumping mode) may be initiated in a graded manner from 49.6 Hz onwards and to be complete by 49.5 Hz.

In view of NLDC observations the following is recommended:

All Energy Storage Systems would change from charging mode to discharging mode at 49.50 Hz. If it is not possible then they would be tripped at 49.50 Hz. If ESS is injecting active power at 49.50 Hz not to be tripped.

Pumping load will be tripped before AUFLS first stage. Irrigation Pumps would be tripped at 49.50 Hz.

10.0 TESTING/INSPECTION OF UFR

Testing Procedure SLDC for UFR by Discoms/STU:

i. Wherever relays are installed at 110 / 132 kV level and above S/s: The periodicity of testing shall be Twice in a year.

ii. Wherever relays are installed at 66 kV level and below S/s: The periodicity of testing shall be once in a year.

iii. SLDCs shall in consultation with the Utilities responsible for testing should chalk out a plan of relays testing schedule before 1st of December and submit the same to RPC/RLDC.

iv. Test shall be carried out by the State testing teams and report of the test carried out should be submitted to SLDC. SLDC shall submit a compiled progressive report of the same to RPC/RLDC every month. The format for testing of AUFLS relays is at **Annexure-II.**

v. SLDC should monitor the periodicity of test and ensure that the relays are tested as per the schedule. Deviation if any shall be intimated to RPC/RLDC with proper justification.

vi. If possible, relays through test up to breakers may be carried out. If this is not possible the continuity of trip circuit of UFR up to the trip coil of breaker should be checked during the testing.

vii. SLDC's shall ensure that at least 10% of the total relay testing be witnessed/carried out by other Circle Testing Engineer/RLDC/RPC.

Inspection of UFR Relays by RPC:

RPC would carry UFR inspection randomly on sample basis by the **RPC Secretariat or through RLDC.** The Sample Inspection Report is at **Annexure-III.**

Based on Inspection Report necessary directions would be issued by RPC which would be complied within six months.

11.0 df/dt SCHEME

In the Report it is mentioned that enabling frequency should be set at 49.9 Hz. i.e., the relay should always be enabled when the system frequency is below 49.9Hz. The following given in the Report:

Stage	'X' in MW = Largest generating station or peak import in the region whichever is higher			
	Enabling Frequency 'Hz'	df/dt setting 'Hz/sec'		Quantum of Load Shedding 'MW'
		RE rich	RE low	
Stage-1	49.9	0.10	0.05	30% of 'X'
Stage-2	49.9	0.15	0.10	40% of 'X'
Stage-3	49.9	0.20	0.25	50% of 'X'
The quantum is for a region as whole, and the RPCs shall decide how to further distribute the quantum amongst the States.				

The df/dt load shedding is specific to regions and therefore, the quantum of load shedding required to be wired up under the df/dt scheme be discussed at regional levels in the RPCs.

The RPCs in consultation with the stakeholders can decide on the quantum of Load shedding required to be wired up in Stage-1, 2 & 3 of the df/dt schemes.

In the Report, df/dt suggested for largest generating station/peak import in the region. Further the set point is suggested at 49.9 Hz which is lower most operating range of IEGC. The set point should be away from the operating range. **df/dt may be for credible contingency of each Region.**

The Task Force observed that df/dt load shedding is specific to regions and therefore, the quantum of load shedding required to be wired up under the df/dt scheme may be discussed at regional levels in the RPCs. The RPCs in consultation with the stakeholders can decide on the quantum of Load shedding required to be wired up in Stage-1, 2 & 3 of the df/dt schemes.

General Observations:

CE (GM), CEA opined that a comprehensive study needed to be carried out at National Leve l on the implementation of df/dt relays in the States. A common umbrella is needed at National Level (integrated grid) even though the issue is region specific.

NLDC suggested that it is very important that there should be a common methodology for df/dt relays at National Level. The settings/quantum may be Region Specific based on the LGB of each region taking care of most credible contingencies. He observed that in Rajasthan, there is concentrated RE and in case of trippings, the rate of fall of frequency may be high where as in WR where distributed RE generation are there the rate of fall in frequency may be less for the same quantum of trippings of generation. However it is pertinent to note that the same relay operation methodology (time duration for the operation of relay) should be identified for tripping of relays also.

MS SRPC informed that df/dt relays are implemented only in three regions (WR, NR and SR). Further studies needed to be carried out on the settings/quantum of df/dt relays and its implementation. In SR there are seven Islanding schemes in place, many SPSs, and other protection schemes and it is very difficult to get feeders for further protection schemes.

WRPC observed that the set points may be close to operating frequency.

MS SRPC informed that on other hand there was some recommendation that all protection settings should be away from operating range and accordingly df/dt settings in SR was kept at 49.5 Hz **& (0.2Hz/sec fall of frequency) and 49.3 Hz& & (0.3Hz/sec fall of frequency).** He opined that at present the concentration may be on implementation of AUFR relays. Subsequently df/dt relay issues may be discussed at NPC level and

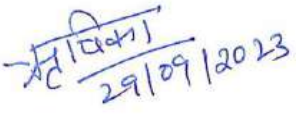
accordingly decision may be taken. At present df/dt relay implementation may be discussed and finalised at Regional Level.

GM, NLDC informed that it is appreciable to note that the recommendations are in line with New IEGC. He added that the df/dt relays are also equally important and need to take up seriously. It is not compulsory that all the regions need to have same set points since the contingencies will be different w.r.t different states. Monitoring certainly will help in getting confidence on safety net. Unfortunately most of the feeders are at lower voltage levels. For SLDCs it will be a challenge to acquire 100 % visibility but effort to be put to achieve the same. In Islanding visibility takes a significant role.

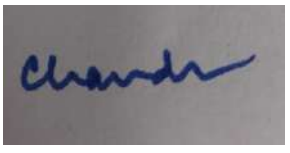
Acknowledgement

The Task Force is thankful to SRPC Secretariat for their assistance and support in preparation of the Report.

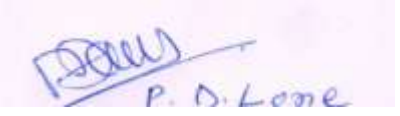
1. Superintending Engineer (O)
   SRPC
   - Convener of the Task Force



2. Chief Engineer (NPC)
   CEA

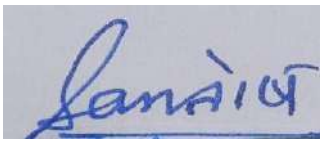


3. Chief Engineer (GM)
   CEA



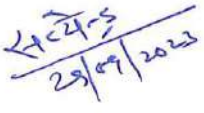
4. Superintending Engineer
   WRPC

5. Superintending Engineer
   ERPC

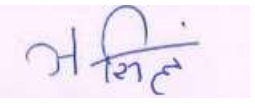


6. Superintending Engineer
   NRPC

7. Superintending Engineer
   NERPC



8. Director (NPC)
   CEA



9. General Manager
   NLDC

10. Member Secretary
    SRPC
    - Chairperson Task Force

ANNEXURE-I

Copy of letters dated 18th & 25th August 2023 from NPC

सत्यमेव जयते

भारत सरकार/Government of India
विद्युत मंत्रालय/ Ministry of Power
केन्द्रीय विद्युत प्राधिकरण/Central Electricity Authority
राष्ट्रीय विद्युत समिति प्रभाग/NPC Division
1st Floor, Wing-5, West Block-II, R.K. Puram, New Delhi-66

No. CEA-GO-15-14/1/2021-NPC Division/250 Date: 18 .08.2023

To,

(As per distribution list)

विषय:- आटोमेटिक अंडर फ्रीक्वेंसी लोड शेडिंग (एयूएफएलएस) और डीएफ/डीटी योजना पर टास्क फोर्स के गठन के संबंध में।

Subject: - Constitution of task force on Automatic Under Frequency Load Shedding (AUFLS) and df/dt scheme-reg.

It was decided in the 13th NPC meeting held on 05.07.2023 at Kolkata that a task force under chairmanship of MS, SRPC with Members from GRID-INDIA, RPCs/NPC may be formed.

Accordingly, the Constitution of the task force is as follows:-

1	Member Secretary, SRPC	Chairperson
2	Chief Engineer NPC,CEA	Member
3	Chief Engineer GM,CEA	Member
4	Representative from WRPC	Member
5	Representative from NRPC	Member
6	Representative from, ERPC	Member
7	Representative from NERPC	Member
8	Representative from NPC, CEA	Member
9	Representative from GRID-INDIA	Member
10	K.P Madhu, SE, SRPC	Member Convener

Taskforce may opt other members from any organization, if required.

2. Terms of Reference of the Taskforce is as follows:-
   i. Review of the recommendations of the report as per directions by the 13th NPC meeting within 2 months.
   ii. Prioritization of the loads under AUFLS and df/dt scheme.
   iii. To oversee the implementation of the report on Automatic Under Frequency Load Shedding (AUFLS) and df/dt scheme.
   iv. Any other suggestions/recommendations on related matters.

3. In this regard, it is requested that RPCs and GRID-INDIA may send their nominations (of the Rank not below SE from RPCs and GM from GRID-INDIA) to cenpccea@gmail.com by 22.08.2023.

This letter is issued with the approval of the competent authority.

भवदीय/Yours faithfully

18/8/2023

(ऋषिका शरण/Rishika Sharan)
मुख्य अभियन्ता एवं सदस्य सचिव,रा.वि.स /
Chief Engineer & Member Secretary, NPC

Distribution list:

1. CMD, GRID-INDIA, B-9 (1st Floor), Qutab Institutional Area, Katwaria Sarai, New Delhi 110016.
2. Member secretary, SRPC
3. Member secretary, ERPC
4. Member secretary, WRPC
5. Member secretary, NRPC
6. Member secretary, NERPC
7. Chief Engineer GM,CEA

Copy for kind information to:

1. SA to Chairprson,CEA
2. SA to Member GO&D, CEA

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सत्यमेव जयते

भारत सरकार/Government of India
विद्युत मंत्रालय/ Ministry of Power
केन्द्रीय विद्युत प्राधिकरण/Central Electricity Authority
राष्ट्रीय विद्युत समिति प्रभाग/NPC Division
1st Floor, Wing-5, West Block-II, R.K. Puram, New Delhi-66

No. CEA-GO-15-14/1/2021-NPC Division/289-295 Date: 25.08.2023

To,

(As per distribution list)

विषयः- आटोमेटिक अंडर फ्रीक्वेंसी लोड शेडिंग (एयूएफएलएस) और डीएफ/डीटी योजना पर टास्क फोर्स के गठन के संबंध में।

Subject: - Constitution of task force on Automatic Under Frequency Load Shedding (AUFLS) and df/dt scheme-reg.

It was decided in the 13th NPC meeting held on 05.07.2023 at Kolkata that a task force under chairmanship of MS, SRPC with Members from GRID-INDIA, RPCs/NPC may be formed.

In this regards, NPC division vide letter No- CEA-GO-15-14/1/2021-NPC Division/250 dated 18.08.2023 requested RPCs and GRID-INDIA to send nomination for task force on Automatic Under Frequency Load Shedding (AUFLS) and df/dt scheme.

Accordingly, based on the nomination received from RPCs and GRID-INDIA the Constitution of the task force is as follows:-

1	Member Secretary, SRPC	Shri Asit Singh	**Chairperson**
2	Chief Engineer NPC,CEA	Smt. Rishika Sharan	Member
3	Chief Engineer GM,CEA	Shri Chandra Prakash	Member
4	Superintending Engineer,WRPC	Shri P.D.Lone	Member
5	Superintending Engineer,ERPC	Shri Shyam Kejriwal	Member
6	Superintending Engineer, NRPC	Shri Anzum Parwej	Member
7	Superintending Engineer NERPC	Shri S M Aimol	Member
8	Director,NPC,CEA	Shri Satyendra Kumar Dotan	Member
9	General Manager, NLDC	Shri Vivek Panday	Member
10	Superintending Engineer, SRPC	Shri K.P Madhu	**Member Convener**

2. Terms of Reference of the Taskforce is as follows:-

i. Review of the recommendations of the report as per directions by the 13th NPC meeting within 2 months.

ii. Prioritization of the loads under AUFLS and df/dt scheme.

iii. To oversee the implementation of the report on Automatic Under Frequency Load Shedding (AUFLS) and df/dt scheme.

iv. Any other suggestions/recommendations on related matters.

Task force can co-opt any member, if required.

भवदीय/Yours faithfully

ऋषिका 21(2)
25/8/23

(ऋषिका शरण/Rishika Sharan)
मुख्य अभियन्ता एवं सदस्य सचिव,रा.वि.स /
Chief Engineer & Member Secretary, NPC

Distribution list:

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4. Shyam Kejriwal, Superintending Engineer,ERPC, 14,Golf Club Road, ERPC Building, Tollygunje,Kolkata-700033.[Email: shyam.kejriwal@gov.in]
5. Shri Anzum Parwej, Superintending Engineer, NRPC, 18-A, Shaheed Jeet Singh Marg, Katwaria Sarai, New Delhi-110066.[Email: anjum.parwej@nic.in]
6. Shri S M Aimol, Superintending Engineer NERPC, NERPC Complex, Dong Parmaw, Lapalang, Shillong-793006.[Email: smaimol@gmail.com]
7. Shri Satyendra Kumar Dotan, Director, NPC, CEA,1st Floor, Wing-5, West Block-II, R.K. Puram, New Delhi-110066.[Email: skdotancea@nic.in]
8. Shri Vivek Panday, General Manager, NLDC, , B-9, Qutab Institutional Area, Katwaria Sarai, New Delhi -110016.[Email: vivek.pandey@grid-india.in]
9. Shri K.P Madhu, Superintending Engineer, SRPC, No.29, Race Course Cross Road, Bengaluru-560009.[Email: kp.madhu@gov.in]

Copy for kind information to:

1. SA to Chairperson, CEA, Sewa Bhawan, RK Puram. New Delhi.
2. SA to Member GO&D, CEA, Sewa Bhawan, RK Puram. New Delhi.
3. Shri S. R. Narasimhan, Chairman & Managing Director, GRID-INDIA , B-9, Qutab Institutional Area, Katwaria Sarai, New Delhi -110016. [Email: cmd@posoco.in]
4. Shri N.S. Mondal, Member Secretary, ERPC,14,Golf Club Road, ERPC Building, Tollygunje,Kolkata-700033. [Email: mserpc-power@nic.in]
5. Shri K B Jagtap, Member Secretary, NERPC, NERPC Complex, Dong Parmaw, Lapalang, Shillong-793006. [Email: ms-nerpc@gov.in]
6. Shri V.K.Singh, Member Secretary, NRPC, 18-A, Shaheed Jeet Singh Marg, Katwaria Sarai, New Delhi-110066.[Email: ms-nrpc@nic.in]
7. Shri Deepak Kumar., Member Secretary, WRPC, Plot No- F-3, MIDC Area, Marol, Opp. SEEPZ, Central Road, Andheri (East), Mumbai-400093.[email: ms-wrpc@nic.in]

******

ANNEXURE-II

Format for testing of AUFLS Relays

Annexure - II

REGION:

Inspection of AUFLS Relays at Site: **Date & Time:**

Details of Relay: **System frequency:**

Make of Relay	Serial no.	Stage	Date of Inspection

State/Name of Power Utilities:

Name of Sub-station:

Sr. No.	Name of feeder	Normal load relief envisaged in MW	UFR setting 49.2/49.0/ 48.8/48.7/ 48.6/48.4/ 48.2/48.0 Hz	Actual load at the time of inspection	Whether the feeder included in any other load shedding (such as SPS, Islanding, manual /ADMS etc)	Frequency Testing equipment used		Relay pick up frequency, Hz	Pick up time, sec	Relay drop off frequency, Hz	Relay drop off time, sec	Relay through trip test carried out Breaker Tripped or not	If Realy trip test is not carried out then continuity of Trip circuit upto Breaker trip coil checked
						Make	Sr. No.						

Name, Designation & Signature of the Site Engineer present at that time of inspection

Name & designation & sign of 3rd party inspecting officer

Note: 1. The functional testing has to be carried out by readjusting the relay setting to the present grid frequency.

2. Details of UFR operational & load relief obtained may be furnished in separate annexures.

ANNEXURE-III

Sample RPC Inspection Report Format

Annexure-III

UFR and df/dt Relay Inspection Report

Name of Substation:

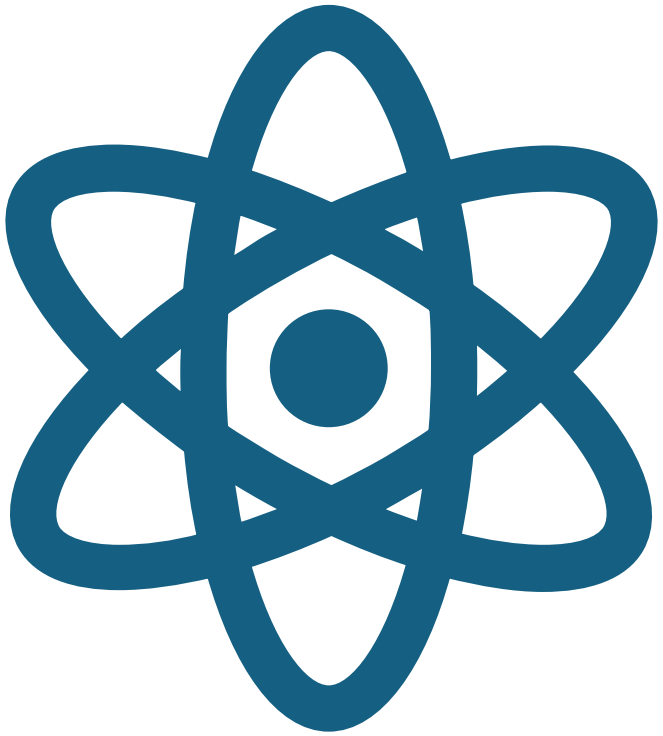
Owned by (Licensee):

Date of Inspection/Testing by RPC:

Sl. No.	Name of the feeder/PTR	Setting Details of UFR & df/dt Relay	Expected Load Relief (declared) MW)	Maximum load (MW) *	Average load (MW)*	Status of SCADA Mapping	Type of Feeder (Radial/Ring)	Observations (Including make of Relay)	Action to be taken

*** Load during previous six months**

Annex-C



PROPOSED AUFLS

FY-2024-25

PROPOSED AUFLS LOAD RELIEF QUANTUM

Region/All India	Regional Peak Demand (MW)	Stage-1 49.4 Hz (5%)	Stage-2 49.2 Hz (6%)	Stage-3 49.0 Hz (7%)	Stage-4 48.8 Hz (7%)	Total (MW)
Eastern Region	29633	1383	1660	1937	1937	**6917**

Constituent	Constituent Contribution	Stage-1 49.4 Hz (5%)	Stage-2 49.2 Hz (6%)	Stage-3 49.0 Hz (7%)	Stage-4 48.8 Hz (7%)	Total (Proposed)	Total Existing
Bihar	0.227	314	376	439	439	1568	440
Jharkhand	0.063	87	104	122	122	435	314
DVC	0.130	179	215	251	251	897	552
Odisha	0.220	304	365	426	426	1521	735
West Bengal	0.357	494	593	692	692	2472	1432
Sikkim	0.004	5	6	7	7	25	0
Total	1.000	1383	1660	1937	1937	6917	3473

CALCULATION METHODOLOGY

All India/Region	Peak Demand (MW)
All India (AP)	239980
Northern Region (RP_{NR})	81048
Western Region (RP_{WR})	74583
Southern Region (RP_{SR})	68094
Eastern Region (RP_{ER})	29633
North-Eastern Region (RP_{NER})	3678

Sum of Regional Peaks (RP):
81048+74583+68094+29633+3678= 257036 MW

Total Quantum of relief: 25% of All India peak:
0.25*239980= 59995 MW

Table 2: Methodology for AUFLS Quantum (MW) Distribution among Regions

Region	Regional Peak Demand (MW)	Stage-1 49.4 Hz (5%)	Stage-2 49.2 Hz (6%)	Stage-3 49.0 Hz (7%)	Stage-4 48.8 Hz (7%)	Total (MW)
	(1)	(2)	(3)	(4)	(5)	(6)
Northern Region	RP_{NR}	0.05* RP_{NR}*AP/RP	0.06* RP_{NR}*AP/RP	0.07* RP_{NR}*AP/RP	0.07* RP_{NR}*AP/RP	Sum Clmn. (2) to (5)
Western Region	RP_{WR}	0.05* RP_{WR}*AP/RP	0.06* RP_{WR}*AP/RP	0.07* RP_{WR}*AP/RP	0.07* RP_{WR}*AP/RP	Sum Clmn. (2) to (5)
Southern Region	RP_{SR}	0.05* RP_{SR}*AP/RP	0.06* RP_{SR}*AP/RP	0.07* RP_{SR}*AP/RP	0.07* RP_{SR}*AP/RP	Sum Clmn. (2) to (5)
Eastern Region	RP_{ER}	0.05* RP_{ER}*AP/RP	0.06* RP_{ER}*AP/RP	0.07* RP_{ER}*AP/RP	0.07* RP_{ER}*AP/RP	Sum Clmn. (2) to (5)
North Eastern Region	RP_{NER}	0.05* RP_{NER}*AP/RP	0.06* RP_{NER}*AP/RP	0.07* RP_{NER}*AP/RP	0.07* RP_{NER}*AP/RP	Sum Clmn. (2) to (5)
All India	AP	Sum above	Sum above	Sum above	Sum above	25% OF AP

REGIONAL CONTRIBUTION

Region/All India	Regional Peak Demand (MW)	Stage-1 49.4 Hz (5%)	Stage-2 49.2 Hz (6%)	Stage-3 49.0 Hz (7%)	Stage-4 48.8 Hz (7%)	Total (MW)
	(1)	(2)	(3)	(4)	(5)	(6)
Northern Region	81048	3783	4540	5297	5297	18917
Western Region	74583	3482	4178	4874	4874	17408
Southern Region	68094	3179	3815	4450	4450	15894
Eastern Region	29633	1383	1660	1937	1937	6917
North- Eastern Region	3678	172	206	240	240	858
All India	239980	11999	14399	16799	16799	59995

Table 3: State/UT contribution ratio for AUFLS Relief Quantum

State/UT	Actual Consumption in MU for 2022-23	Consumption Ratio	Actual Demand Met in 2022-23	Demand Met Ratio	State/ UT Contribution
	(1)	(2)=(1)/(A)	(3)	(4)=(3)/(B)	(5)=[(2)+(4)]/2
Chandigarh	1788	0.004	407	0.005	**0.004**
Delhi	35143	0.077	7695	0.089	**0.083**
Haryana	60945	0.133	12768	0.147	**0.140**
Himachal Pradesh	12542	0.027	2071	0.024	**0.026**
UT J&K & Ladhak	19322	0.042	2967	0.034	**0.038**
Punjab	69220	0.151	14311	0.165	**0.158**

STATES CONTRIBUTION FOR ER

Constituent	Actual Consumption in MU for 2023-24	Consumption Ratio	Actual Peak Demand met in 2023-24	Demand Met Ratio	Constituent Contribution
Bihar	40952	0.219	7578	0.234	0.227
Jharkhand	12391	0.066	1923	0.059	0.063
DVC	26784	0.143	3751	0.116	0.130
Odisha	41142	0.220	7104	0.220	0.220
West Bengal	65009	0.348	11868	0.367	0.357
Sikkim	526	0.003	137	0.004	0.004
Total*	186804	1.000	32361	1.000	1.000

FINAL AUFLS LOAD QUANTUM FOR EASTERN REGION

Region/All India	Regional Peak Demand (MW)	Stage-1 49.4 Hz (5%)	Stage-2 49.2 Hz (6%)	Stage-3 49.0 Hz (7%)	Stage-4 48.8 Hz (7%)	Total (MW)
Eastern Region	29633	1383	1660	1937	1937	6917

Constituent	Constituent Contribution	Stage-1 49.4 Hz (5%)	Stage-2 49.2 Hz (6%)	Stage-3 49.0 Hz (7%)	Stage-4 48.8 Hz (7%)	Total (Proposed)	Total Existing
Bihar	0.227	314	376	439	439	1568	440
Jharkhand	0.063	87	104	122	122	435	314
DVC	0.130	179	215	251	251	897	552
Odisha	0.220	304	365	426	426	1521	735
West Bengal	0.357	494	593	692	692	2472	1432
Sikkim	0.004	5	6	7	7	25	0
Total	1.000	1383	1660	1937	1937	6917	3473

Monthly Assessment Format by States

Table 6: AUFLS – Monthly Report - …….(Month)

State/UT:……..

	Stage-1 49.4 Hz	Stage-2 49.2 Hz	Stage-3 49.0 Hz	Stage-4 48.8 Hz	STATE TOTAL
Recommended (A)					
Implemented (B)					
SCADA monitored (C)					
Actual flow on SCADA monitored (D)					
Balance implemented (E) = (B) – (C)					
Actual flow on balance implemented (F)					
Desired relief (G)= (B)x Average State Demand for the month/(State Demand Contribution)					
Actual relief (H) = (D+F)					
Deficit (-)/Surplus (+) H-G					

	Stage-1	Stage-2	Stage-3	Stage-4	STATE
	49.4 Hz	49.2 Hz	49.0 Hz	48.8 Hz	TOTAL
Recommended (A)	314				
Implemented (B)	250				
SCADA monitored (C)	200				
Actual flow on SCADA Monitored (D)	180				
Balance implemented (E) = (B)-(C)	50				
Actual flow on balance implemented (F)	40				
Desired relief (G)=(B)x Average State Demand for the month/(State Demand Contribution)	250*6500/7578=214				
Actual relief (H) = (D+F)	220				
Deficit (-)/Surplus (+)=H-G	6 (Surplus)				
As a general guideline Actual Relief for the month should be 10% more than the Desired Relief for the month considering the Relay/breaker issues and a resilient safety net	102.80%				

AUFLS Tripping Report Format

Table 7: AUFLS – Tripping Report at ….. hrs on ……..

State/UT:……..

Description	Stage-1 49.4 Hz	Stage-2 49.2 Hz	Stage-3 49.0 Hz	Stage-4 48.8 Hz	STATE TOTAL
Recommended (A)					
Implemented (B)					
SCADA monitored (C)					
Actual flow on SCADA monitored (D)					
Balance implemented (E) = (B) – (C)					
Actual flow on balance implemented (F)					
Desired relief (G)= (B)x State Demand at the time of tripping/(State Demand Contribution)					
Actual relief (H) = (D+F)					
Deficit (-)/Surplus (+) H-G					

Table 8: AUFLS – Feeder-wise Tripping Report at ….. hrs on ……..

AUTOMATIC UNDER FREQUENCY LOAD SHEDDING STAGE-1 (49.4)						
Sl No	Sub Station	Feeder Description	Average load per year (In MW)	Tripped (Y/N)	Reason if not tripped	Actual flow in MW
1						
2						
3						
4						
TOTAL MW RELIEF						

GUIDELINES FOR IDENTIFICATION OF AUFLS FEEDERS

AUFLS relays under Stage-1 & Stage-2 should be implemented preferably on downstream network at 11/22/33 kV level.

AUFLS relays under Stage-3 & Satge-4 should be implemented on upstream network at EHV (66/110/132 kV) level so that load relief obtained is fast and reliable as it is a desperate measure for areas that have disintegrated.

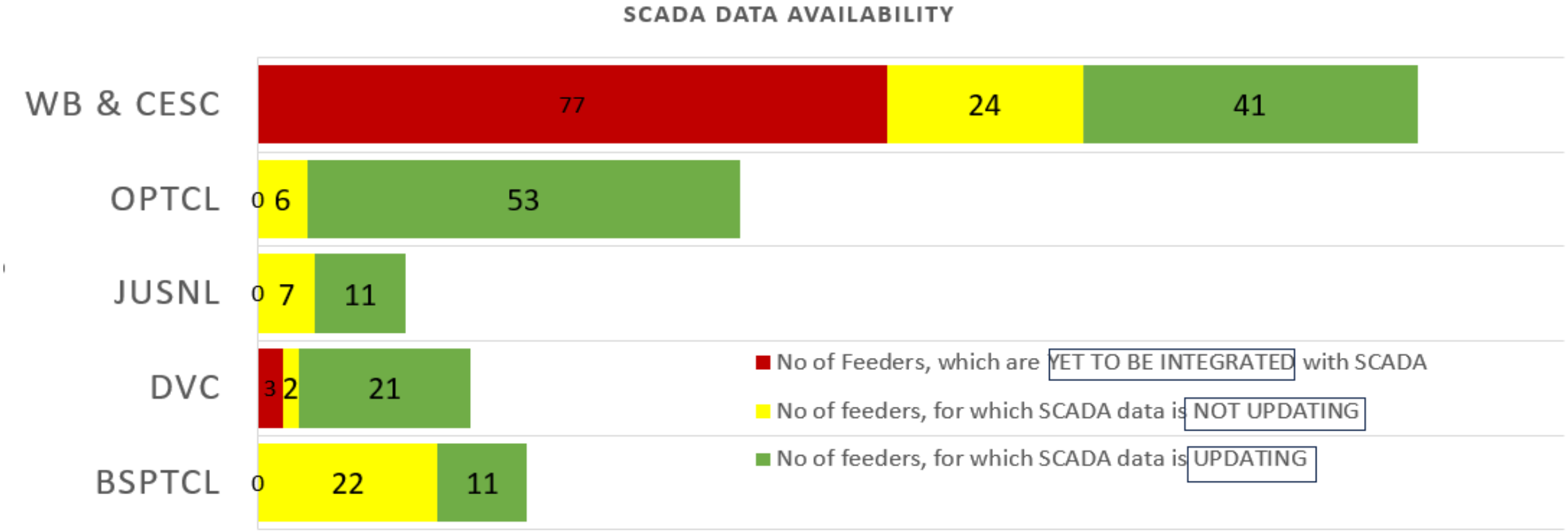
AUFLS MONITORING DISPLAY IN SCADA

Table 9: AUFLS Monitoring in MW

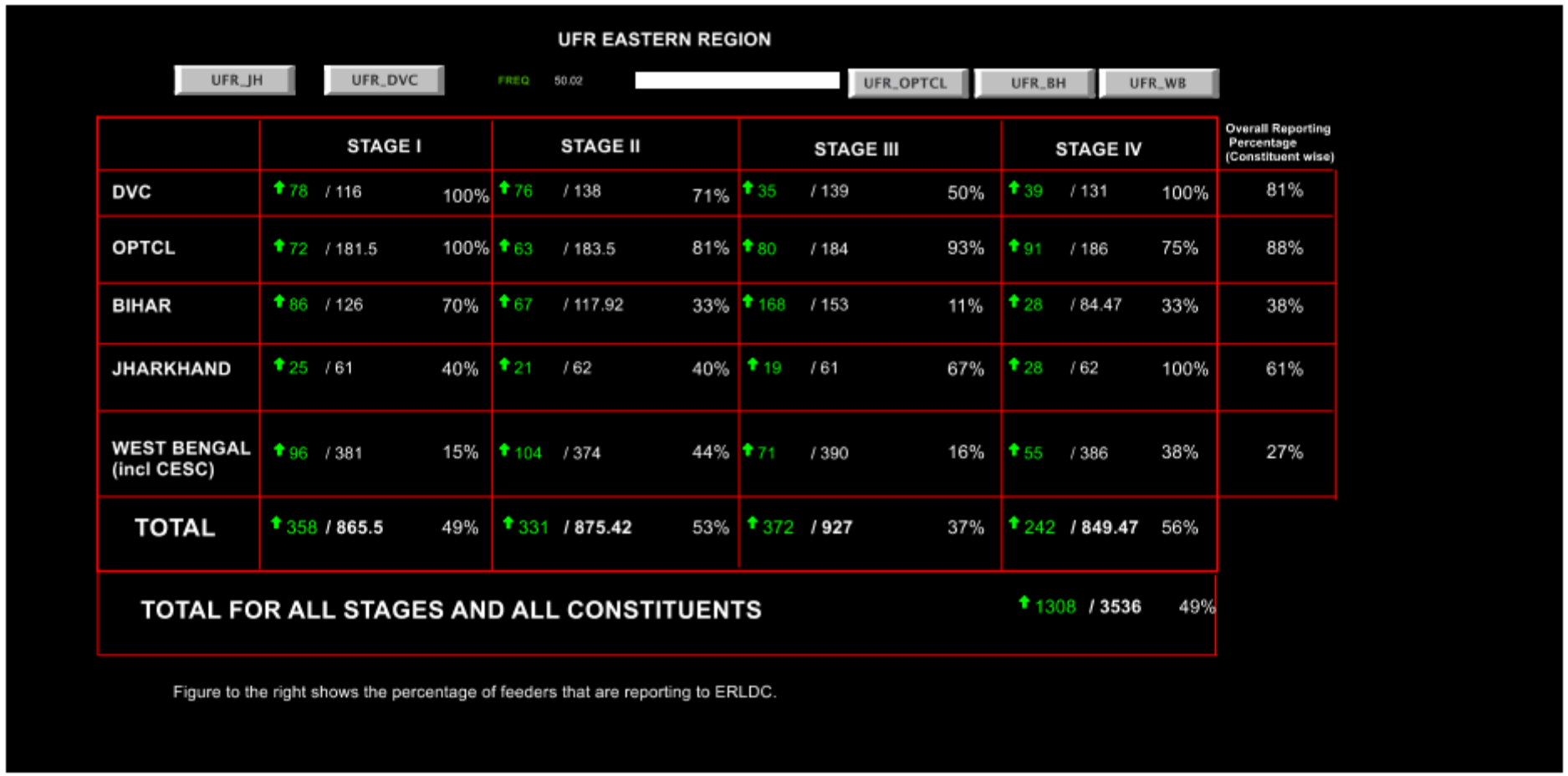
Description	Stage-1 49.4 Hz	Stage-2 49.2 Hz	Stage-3 49.0 Hz	Stage-4 48.8 Hz	TOTAL (all the Stages)
Recommended (A)					
Implemented (B)					
Unmapped quantum (C)					
SCADA monitored (D)					
Actual flow (E)					
Desired relief (F)= (D)x State Demand/(State Demand Contribution)					
Deficit (-)/Surplus (+) E-F					

Table 10: AUFLS Monitoring in MW STAGE-1 (49.4)

Description	DISCOM / SUB SLDC -1	DISCOM / SUB SLDC -2	DISCOM / SUB SLDC -3	.....	STATE TOTAL
Recommended (A)					
Implemented (B)					
Unmapped quantum (C)					
SCADA monitored (D)					
Actual flow (E)					
Desired relief (F)= (D)x Discom Demand/(Discom Demand Contribution)					
Deficit (-)/Surplus (+) E-F					



	Total No of Feeders	No of Feeders, which are YET TO BE INTEGRATED with SCADA	No of feeders, for which SCADA data is NOT UPDATING	No of feeders, for which SCADA data is UPDATING	Percentage Availability
BSPTCL	33	0	22	11	33%
DVC	26	3	2	21	81%
JUSNL	18	0	7	11	61%
OPTCL	59	0	6	53	90%
WB & CESC	142	77	24	41	29%
Total ER	278	80	61	137	49%



	STAGE I		STAGE II		STAGE III		STAGE IV		Overall Reporting Percentage (Constituent wise)
DVC	↑78 / 116	100%	↑76 / 138	71%	↑35 / 139	50%	↑39 / 131	100%	81%
OPTCL	↑72 / 181.5	100%	↑63 / 183.5	81%	↑80 / 184	93%	↑91 / 186	75%	88%
BIHAR	↑86 / 126	70%	↑67 / 117.92	33%	↑168 / 153	11%	↑28 / 84.47	33%	38%
JHARKHAND	↑25 / 61	40%	↑21 / 62	40%	↑19 / 61	67%	↑28 / 62	100%	61%
WEST BENGAL (incl CESC)	↑96 / 381	15%	↑104 / 374	44%	↑71 / 390	16%	↑55 / 386	38%	27%
TOTAL	↑358 / 865.5	49%	↑331 / 875.42	53%	↑372 / 927	37%	↑242 / 849.47	56%	
TOTAL FOR ALL STAGES AND ALL CONSTITUENTS							↑1308 / 3536	49%	

Figure to the right shows the percentage of feeders that are reporting to ERLDC.

All Energy Storage Systems would change from charging mode to discharging mode at 49.50 Hz. If it is not possible then they would be tripped at 49.50 Hz. If ESS is injecting active power at 49.50 Hz not to be tripped.

Pumping load will be tripped before AUFLS first stage. Irrigation Pumps would be tripped at 49.50 Hz.