



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

विषय: प्रचालन समन्वय उप-समिति की 226^{वीं} बैठक की अतिरिक्त कार्यसूची।

Subject: Additional Agenda of the 226th OCC meeting.

प्रचालन समन्वय उप-समिति की 226^{वीं} बैठक दिनांक 16.12.2024 को 10:30 बजे से एनआरपीसी सचिवालय, कटवारिया सराय, नई दिल्ली में आयोजित की जाएगी। उक्त बैठक की अतिरिक्त कार्यसूची उत्तर क्षेत्रीय विद्युत् समिति की वेबसाइट <http://164.100.60.165> पर उपलब्ध है।

कृपया बैठक में उपस्थित होने की सुविधा प्रदान करें।

The 226th meeting of Operation Co-ordination Sub-Committee is scheduled to be held on **16.12.2024** from **10:30 Hrs** at **NRPC Secretariat, Katwaria Saarai, New Delhi**. The additional agenda of this meeting has been uploaded on the NRPC website <http://164.100.60.165>.

Kindly make it convenient to attend the meeting.

Signed by Dhamendra
Kumar Meena
Date: 13-12-2024 12:33:20

(डी.के मीना)
निदेशक (प्रचालन)

सेवा में : प्रचालन समन्वय उप समिति के सभी सदस्य।

To : All Members of OCC

खण्ड-क: उ.क्षे.वि.स.

Part-A: NRPC

1. Implementation of AUFLS scheme in accordance with the report of Task Force on Automatic under Frequency Load Shedding (AUFLS) (Agenda by NRPC Sectt.)

- 1.1 In line with the report of Task Force on Automatic under Frequency Load Shedding (AUFLS) and df/dt scheme (copy enclosed as **Annexure-I**), NPC Secretariat 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).
- 1.2 NPC Secretariat has communicated to RPC's that they have computed the quantum of load shedding in different stages of AUFLS based on the Peak Demand Met of the Region in the financial year (2023-24). The region wise Peak Demand Met considered by NPC Sectt. is as follows:

Region	NR	SR	WR	ER	NER
Peak Demand Met (MW)	80,548	68,094	72,556	29,299	3,603

- 1.3 The quantum of load shedding in different stages of AUFLS region-wise is as follows:

Sr. No.	Stage	Frequency (Hz)	Demand Disconnection (%)	Quantum of Load shed in MW					
				NR	SR	WR	ER	NER	All India Load shed
AUFLS Set Points and Percentage Quantum of Relief				NR	SR	WR	ER	NER	All India Load shed
1	Stage 1	49.4 Hz	5.00%	3801.7	3213.9	3424.5	1382.8	173.5	11996.55
2	Stage 2	49.2 Hz	6.00%	4562.04	3856.7	4109.4	1659.4	208.3	14395.86
3	Stage 3	49.0 Hz	7.00%	5322.4	4499.5	4794.3	1935.9	243.03	16795.17
4	Stage 4	48.8 Hz	7.00%	5322.4	4499.5	4794.3	1935.9	243.03	16795.17
Total (in MW)				19008.5	16069.5	17122.4	6914.3	867.9	59982.7

- 1.4 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 in consultation with the stakeholders.
- 1.5 NRPC Sectt. has computed each State/UT Stage-wise AUFLS quantum for NR based upon the task force report and quantum of load shedding in different stages of AUFLS region-wise finalized by NPC. The details of which are mentioned in the table below:-

State/UT	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
	Stage-1 Relief	Stage-2 Relief	Stage-3 Relief	Stage-4 Relief	
Chandigarh	15.850	19.020	22.190	22.190	79.248
Delhi	299.338	359.205	419.073	419.073	1496.690
Haryana	526.332	631.599	736.865	736.865	2631.661
Himachal Pradesh	97.246	116.695	136.145	136.145	486.231
UT J&K & Ladhak	145.406	174.487	203.569	203.569	727.031
Punjab	601.638	721.966	842.293	842.293	3008.190
Rajasthan	811.056	973.268	1135.479	1135.479	4055.282
Uttar Pradesh	1191.769	1430.122	1668.476	1668.476	5958.843
Uttarakhand	113.069	135.682	158.296	158.296	565.343
Total	3801.704	4562.045	5322.386	5322.386	19008.52

- 1.6 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.


GUIDELINES FOR IDENTIFICATION OF AUFLS FEEDERS

The following to be considered for identification of 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 & Stage-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.
- 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.

Members may kindly deliberate.

भारत सरकार केंद्रीय विद्युत प्राधिकरण दक्षिण क्षेत्रीय विद्युत समिति 29, रेसकोर्स क्रॉस 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 ¹⁸	दिनांक/ Date
		29 th 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.

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
<p><i>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.</i></p> <p><i>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</i></p>		

- 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 & Stage-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

S.NO.	DESCRIPTION OF CONTENTS	PAGE NO.
1.0	INTRODUCTION	1
2.0	PROVISIONS IN CERC REGULATIONS	2
3.0	AUFLS SET POINTS AND QUATUM OF RELIEF	4
4.0	IDENTIFICATION OF AUFLS QUANTUM BY NPC AND RPCs	5
5.0	QUANTUM IDENTIFICATION FOR AUFLS BY STATES/UT	8
6.0	AN ANALYSIS OF EVENTS	9
7.0	GUIDLINES FOR IDENTIFICATION OF AUFLS FEEDERS	11
8.0	MAPPING OF AUFLS FEEDERS	12
9.0	SETTINGS OF UFR PUMP LOADS/ESS	14
10.0	TESTING/INSPECTION OF UFR	15
11.0	df/dt SCHEME	16

ACKNOWLEDGEMENT

ANNEXURE - I Copy of letters dated 18th & 25th August 2023 from NPC
regarding constitution of Task Force

ANNEXURE – II Format for testing of AUFLS Relays

ANNEXURE – III Sample RPC Inspection Report Format

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
<p><i>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.</i></p> <p><i>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.</i></p>		

(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):

<i>Sr. No.</i>	<i>Stage</i>	<i>Frequency</i>	<i>Demand Disconnection</i>	<i>Total Quantum of LS</i>
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

SI 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. 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.

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)						
SI 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 & Stage-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 be carried out at least once in three (3) months. Mapping verification between RLDC and SLDC would be carried out 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 forums 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 at 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 Level 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.

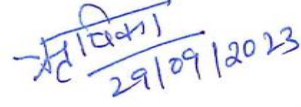
GM, NLDC informed that it is appreciable to note that the recommendations are in line with New IEGC. He added that the df/dt relays are also equally important and need to take up seriously. It is not compulsory that all the regions need to have same set points since the contingencies will be different 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

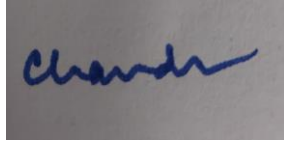
The Task Force is thankful to SRPC Secretariat for their assistance and support in preparation of the Report.



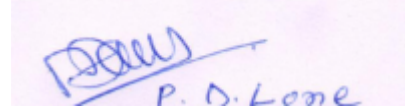
1. Superintending Engineer (O)
SRPC
- Convener of the Task Force



2. Chief Engineer (NPC)
CEA



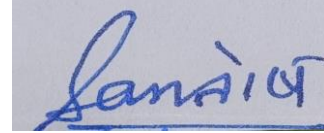
3. Chief Engineer (GM)
CEA



4. Superintending Engineer
WRPC



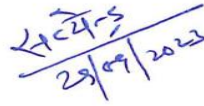
5. Superintending Engineer
ERPC



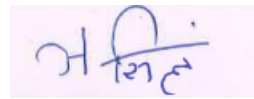
6. Superintending Engineer
NRPC



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:-

- Review of the recommendations of the report as per directions by the 13th NPC meeting within 2 months.
- Prioritization of the loads under AUFLS and df/dt scheme.
- To oversee the implementation of the report on Automatic Under Frequency Load Shedding (AUFLS) and df/dt scheme.
- 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

शुभिका शरण
18/8/2023

(शुभिका 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



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)

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.

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:-

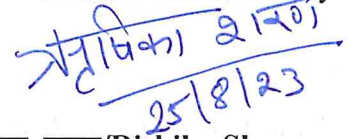
1	Member Secretary, SRPC	Shri Asit Singh	Chairperson
2	Chief Engineer NPC,CEA	Smt. Rishika Sharan	Member
3	Chief Engineer GM,CEA	Shri Chandra Prakash	Member
4	Superintending Engineer,WRPC	Shri P.D.Lone	Member
5	Superintending Engineer,ERPC	Shri Shyam Kejriwal	Member
6	Superintending Engineer, NRPC	Shri 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


25/8/23

(ऋषिका शरण/Rishika Sharan)

मुख्य अभियन्ता एवं सदस्य सचिव, रा. वि. स /
Chief Engineer & Member Secretary, NPC

Distribution list:

1. Shri Asit Singh, Member Secretary, SRPC, No.29, Race Course Cross Road, Bengaluru-560009. [Email: mssrpc-ka@nic.in]
2. Shri Chandra Prakash, Chief Engineer GM, CEA, Sewa Bhawan, RK Puram. New Delhi. [Email: cp_cea@nic.in]
3. Shri P.D.Lone, Superintending Engineer, WRPC, WRPC, Plot No- F-3, MIDC Area, Marol, Opp. SEEPZ, Central Road, Andheri (East), Mumbai-400093.[Email: pramod.lone@gmail.com]
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

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

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**