ग्रिड-इंडिया
GRID-INDIA

ग्रिड कंट्रोलर ऑफ इंडिया लिमिटेड
(भारत सरकार का उद्यम)
GRID CONTROLLER OF INDIA LIMITED
(A Government of India Enterprise)
[formerly Power System Operation Corporation Limited (POSOCO)]
राष्ट्रीय भार प्रेषण केन्द्र / National Load Despatch Centre

आज़ादी का अमृत महोत्सव

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संदर्भ: NLDC/SO/FRO/2024-25 **दिनांक:** 21st Mar 2024

सेवा में,

All the Stakeholders

विषय: Assessment of Frequency Response Obligation of each control area for FY 2024-25 – Reg.

संदर्भ: Central Electricity Regulatory Commission (Indian Electricity Grid Code) Regulations, 2023

महोदय/महोदया,

In compliance with Reg. 30 (10) (f) of the Central Electricity Regulatory Commission (Indian Electricity Grid Code), Regulations 2023, NLDC, in consultation with RLDCs, has assessed frequency response obligation of each control area as per Annexure-2 of CERC (IEGC), 2023, giving due consideration to generation and load within each control area and details as given in Table 4 under Reg. 30 (10) (g) of CERC (IEGC), 2023.

The Frequency Response Obligation of each control area for FY 2024-25 is enclosed herewith. It may be downloaded from the Grid-India website https://posoco.in/en/notices/

सधन्यवाद,

भवदीय,

(एस. सी. सक्सेना/S.C. Saxena)
कार्यपालक निदेशक, रा.भा.प्रे.कें./Executive Director, NLDC

Copy for kind information:

1. Chairman and Managing Director, Grid India
2. Director (Market Operation), Grid India
3. Director (System Operation), Grid India
4. Secretary, Central Electricity Regulatory Commission
5. Member Secretary, NPC/NRPC/WRPC/SRPC/ERPC/NERPC, CEA
6. Executive Director, NRLDC/WRLDC/SRLDC/ERLDC/NERLDC, Grid India

Grid Controller of India Limited
National Load Despatch Centre

Frequency Response Obligation (FRO) of each control area for FY 2024-25

Issue Date: 21st March, 2024

I. Calculation of Frequency Response Obligation (FRO) of each control area:

As per Annexure-2 of IEGC, 2023, the minimum Frequency Response Obligation (FRO) of each control area in MW/Hz has been calculated as:

FRO = (Control Area average Demand + Control Area average Generation) * minimum all India Target Frequency Response Characteristic/ (Sum of average demand of all control areas + Sum of average generation of all control areas)

The relevant terms and their definitions, used in the assessment of FRO are available at **Section-V**

1. Control Area Identification:

Total Control Areas considered for FRO assessment	Control Areas for whom FRO shall be nil i.e. FRO=0	Control Areas for whom FRO has been assessed
179	06	173

a) All Indian states (28 Nos.)
b) Union Territories viz. Delhi, Chandigarh, J&K and Ladakh, DD & DNH (04 Nos.)
c) Control Areas viz. AMNSIL, Balco (Bulk Consumer) and DVC (03 Nos.)
d) Regional Thermal (Coal/Lignite) Generating Entity of 200 MW and above (79 Nos.)
e) Regional Hydro Generating Entity of 25 MW and above (53 Nos.)
f) Regional Gas based Generating Entity of Gas Turbine above 50 MW (10 Nos.)
g) Transnational Control Areas viz. Nepal and Bhutan (02 Nos.)
   Note: Bangladesh and Myanmar are exempted and not been considered for FRO assessment due to asynchronous connection with India

FRO shall be nil in case of a control area not having any generation resources viz. Chandigarh, Goa, DD & DNH, Sikkim, Manipur and BALCO (Bulk Consumer).

As per Reg. 30(10) (h) of CERC (IEGC), 2023 quoted below, the WS sellers, nuclear generating stations and hydro generating stations (with pondage up to 3 hours or Run of the river projects) have been excluded from assessment of FRO and have the option to provide primary response.

1. *"WS Sellers commissioned after the date as specified in CEA Technical Standards for Connectivity shall have the option to provide primary response individually through ESS or through a common ESS installed at its pooling station.*
2. *Nuclear generating stations and hydro generating stations (with pondage up to 3 hours or Run of the river projects) shall be exempt from mandatory primary response. They may provide the primary response to the extent possible, considering the safety and security of machines and humans."*

2. Data Source and Resolution for FRO assessment:

Particulars	Data Source	Data Resolution
State, UTs and Control Area average Demand and Generation	SCADA telemetry	5 minutes
Regional Entity Generating station average Generation	Interface Energy Meter data	15 minutes
Transnational Control Area average Demand and Generation	SCADA telemetry	5 minutes

3. Reference Contingency https://posoco.in/en/reference-contingency/english-reference-contingency-2024-25/) and Minimum All India Target Frequency Response Characteristic (as per Annex-2 of IEGC, 2023) for Generation/Load loss in Indian Power System for FY 2024-25:

FY 2024-25	Solar Hours	Non-Solar Hours
Reference Contingency (MW)	7000	4500
Minimum All India Target FRC (MW/Hz)	23,333	15,000

Minimum All India Target Frequency Response Characteristic = Quantum of load or generation loss in reference contingency divided by frequency deviation value of 0.3 Hz

II. Assessment of Frequency Response Obligation (FRO) of control areas for FY 2024-25:

FRO has been assessed for **173 control areas** for solar as well as non-solar hours. The table is enclosed as **Annexure-I**

III. Calculation of Frequency Response Performance (FRP) of each control area:

The performance of each control area in providing frequency response characteristic shall be calculated for each reportable event. Each control area shall separately assess their frequency response characteristic and share with RLDC along with high resolution data of at least one (1) second for regional entity generating stations and ten (10) second for state control area. The concerned generating station and state control area shall furnish the requisite data to the LDCs within two days of notification of reportable event by the NLDC.

Frequency Response Performance (FRP) = Actual Frequency Response Characteristic (AFRC)/ Frequency Response Obligation (FRO)

FRC Calculation shall be done in accordance with Methodology for Computation of Primary Frequency Response Obligation and Performance, available as Annexure-V of NLDC Operating Procedure.

Timeline for FRC and FRP computation during events

Particulars	Stipulated Timeline*
Submission of high resolution data by regional entity generating stations and state control area to RLDCs[#]	2 working days after the event
FRC and FRP computation by NLDC	3 working days after the event
FRC and FRP computation by RLDC, SLDC and Generating Units	6 working days after the event

**Timeline for data submission and FRC computation are excluding the day of event*

[#] In case of delay in data submission by regional entity generating stations and state control area to RLDCs, SCADA data available at RLDCs shall be used for FRC and FRP calculations.

FRC and FRP Calculation Sheet to be used by all SLDC/RLDC/NLDC/CONTROL AREA

S.No	Particulars	Dimension	Control Area/ Region/Generator
1	Actual Net Interchange before the Event (Time= hh:mm:ss)	MW	
2	Actual Net Interchange after the Event (Time= hh:mm:ss)	MW	
3	Change in Net Interchange (2 - 1)	MW	
4	Generation Loss (+) / Load Throw off (-) during the Event	MW	
5	Control Area Response (4-3)	MW	
6	Frequency before the Event	Hz	
7	Frequency after the Event	Hz	
8	Change in Frequency (7-6)	Hz	
9	Frequency Response Characteristic (5 / 8)	MW/Hz	
10	Frequency Response Obligation (FRO) of control area	MW/Hz	
11	Frequency Response Performance (FRP) (9/10)		

Note: In addition to the above, FRC would also be calculated for events involving significant change in frequency, say during hourly boundary, cloud movement etc.

IV. Grading of Frequency Response Performance (FRP)

Each control area shall be graded based on median Frequency Response Performance annually (at least 10 events) as per following criteria:

FREQUENCY RESPONSE CRITERIA

Performance	Grading
FRP≥ 1	Excellent
0.85 ≤ FRP < 1	Good
0.75 ≤ FRP	Average
0.5≤ FRP < 0.75	Below Average
FRP	Poor

As per Reg. 30(10) (q) of CERC (IEGC), 2023*, NLDC, RLDCs and SLDCs shall grade the median Frequency Response Performance annually, considering at least 10 reportable events. In case the median Frequency Response Performance is less than 0.75 as calculated as per Annexure2, NLDC, RLDCs, SLDCs, as the case may be, after analyzing the FRP shall direct the concerned entities to take corrective action. All such cases shall be reported to the concerned RPC for its review.*

V. Definitions as per CERC (IEGC) Regulations, 2023

S.No.	Particulars	Definitions
1	**'Control Area'**	means an electrical system bounded by interconnections (tie lines), metering and telemetry which controls its generation and/or load to maintain its interchange schedule with other control areas and contributes to regulation of frequency as specified in these regulations;
2	**'Event'**	means an unscheduled or unplanned occurrence in the grid including faults, incidents and breakdowns;
3	**Free Governor Mode of Operation**	Means the mode of operation of governor where machines are loaded or unloaded directly in response to grid frequency i.e. machine unloads when grid frequency is more than 50 Hz and loads when grid frequency is less than 50 Hz. The amount of loading or unloading is proportional to the governor droop.
4	**'Frequency Response Characteristics' or 'FRC'**	Means automatic, sustained change in the power consumption by load or output of the generators that occurs immediately after a change in the load-generation balance of a control area and which is in a direction to oppose any change in frequency. Mathematically it is equivalent to FRC = Change in Power (ΔP) / Change in Frequency (Δf);
5	**'Frequency Response Obligation' or 'FRO'**	means the minimum frequency response a control area has to provide in the event of any frequency deviation;
6	**'Frequency Response Performance' or 'FRP'**	means the ratio of actual frequency response with frequency response obligation;
7	**'Governor Droop'**	in relation to the operation of the governor of a generating unit means the percentage drop in system frequency which would cause the generating unit under governor action to change its output from no load to full load;
8	**'Load'**	means the active, reactive or apparent power consumed by a utility/installation of consumer;
9	**'Maximum Continuous Rating' or 'MCR'**	means the maximum continuous output in MW at the generator terminals guaranteed by the manufacturer at rated parameters;
10	**'Nadir Frequency'**	means minimum frequency after a contingency in case of generation loss and maximum frequency after a contingency in case of load loss;
11	**'Primary Reserve'**	means the maximum quantum of power which will immediately come into service through governor action of the generator or frequency controller or through any other resource in the event of sudden change in frequency as specified in clause (10) of Regulation 30 of CERC (IEGC), 2023;
12	**'Reference contingency'**	means the maximum positive power deviation occurring instantaneously between generation and demand and considered for estimation of reserves;
13	**Reportable Event**	Means any load or generation loss incident involving net change of more than 1000 MW of load or generation or a frequency change involving 0.1 Hz or more. The event shall be notified by the NLDC.

Annexure-I

Frequency Response Obligation of Control Areas in Northern Region for FY 2024-25

Northern Region			
Sl. No.	States	FRO (MW/Hz)	
		Solar Hours	Non-Solar Hours
1	Punjab	796	512
2	Haryana	614	395
3	Rajasthan	1304	838
4	Delhi	287	184
5	Uttar Pradesh	1739	1118
6	Uttarakhand	158	102
7	Chandigarh*	0	0
8	Himachal Pradesh	136	88
9	J&K(UT) and Ladakh(UT)	185	119

Sl. No.	Entity	Capacity (MW)	FRO (MW/Hz)	
			Solar Hours	Non-Solar Hours
1	Dadri-1 (TH)	840	32	20
2	Dadri -2 (TH)	980	40	26
3	Jhajjar (TH)	1500	57	36
4	Rihand-1 (TH)	1000	55	36
5	Rihand-2 (TH)	1000	54	35
6	Rihand-3 (TH)	1000	55	35
7	Shree Cement (TH)	300	13	8
8	Singrauli (TH)	2000	103	66
9	Tanda-2 (TH)	1320	65	42
10	Unchahar stg-4 (TH)	500	22	14
11	Unchahar (TH)	420	41	26
12	Anta (G)	419	8	5
13	Auraiya (G)	663	11	7
14	Dadri (G)	830	19	12
15	AD Hydro (H)	192	7	5
16	Bairasiul (H)	180	6	4
17	Bhakra (H)	1415	51	33
18	Budhil (H)	70	3	2
19	Chamera-1 (H)	540	19	12
20	Chamera-2 (H)	300	14	9
21	Chamera-3 (H)	231	11	7
22	Dehar (H)	990	21	14
23	Dhauliganga (H)	280	11	7
24	Dulhasti (H)	390	19	12
25	Karcham (H)	1045	34	22
26	Kishenganga	330	14	9

*FRO shall be nil in case of a control area not having any generation resources
^The generation for year 2023 was zero

Sl. No.	Entity	Capacity (MW)	FRO (MW/Hz)	
			Solar Hours	Non-Solar Hours
27	Koldam (H)	800	41	26
28	Koteswar (H)	400	10	6
29	Malana-2 (H)^	186	0	0
30	Nathpa Jhakri (H)	1500	64	41
31	Parbati-2 (H)	800	1	1
32	Parbati-3 (H)	520	4	3
33	Pong (H)	396	14	9
34	Rampur (H)	412	15	10
35	Sainj (H)	100	4	2
36	Salal (H)	690	26	17
37	Sewa-II (H)	120	6	4
38	Singoli Bhatwari (H)	99	4	3
39	Sorang (H)	100	2	1
40	Tanakpur (H)	94	3	2
41	Tehri (H)	1000	41	26
42	Uri-1 (H)	480	20	13
43	Uri-2 (H)	240	11	7

*FRO shall be nil in case of a control area not having any generation resources
^The generation for year 2023 was zero

Frequency Response Obligation of Control Areas in Western Region for FY 2024-25

Western Region			
Sl. No.	States	FRO (MW/Hz)	
		Solar Hours	Non-Solar Hours
1	Chhattisgarh	436	280
2	DNH & DD*	0	0
3	Gujarat	1693	1088
4	Goa*	0	0
5	Madhya Pradesh	1045	671
6	Maharashtra	2530	1626
7	Arcelor Mittal Nippon Steel India Limited	73	47
8	Bharat Aluminium Company Ltd (Bulk Consumer)*	0	0

Sl. No.	Entity	Capacity (MW)	FRO (MW/Hz)	
			Solar Hours	Non-Solar Hours
1	ACB (India) Limited + Maruti Clean Coal and Power Limited (TH)	793	34	22
2	Adani Power Limited - Raigarh TPP (TH)	600	28	18
3	Adani Power Limited-Raipur TPP (TH)	600	57	37
4	Bharat Aluminium Company Ltd. (TH)	1200	50	32
5	D B Power Limited (TH)	1200	61	39
6	Dhariwal Iinfrastructure Limited (TH)	600	25	16
7	GMR Warora Energy Limited (TH)	1370	31	20
8	Jaypee Nigrie Super Thermal Power Plant (TH)	1320	61	39
9	Jhabua Power Limited (TH)	600	24	16
10	Jindal Power Limited, Stage-1 (TH)	500	42	27
11	Jindal Power Limited, Stage-2 (TH)	2400	120	77
12	Jindal Steel & Power Ltd , DCPP (TH)	270	6	4
13	KSK Mahanadi Power Company Limited (TH)	2400	74	47
14	LANCO Amarkantak Power Limited (TH)	600	25	16
15	Mahan Energen Limited. (TH)	1200	43	28
16	MB Power (Madhya Pradesh) Limited (TH)	1200	58	37
17	NTPC Gadarwara (TH)	1600	66	43
18	NTPC Khargone (TH)	1320	50	32
19	NTPC Korba Stage I &II (TH)	2100	115	74
20	NTPC Korba Stage III (TH)	500	29	19
21	NTPC Lara Stage I (TH)	1600	80	51

*FRO shall be nil in case of a control area not having any generation resources
^The generation for year 2023 was zero

Sl. No.	Entity	Capacity (MW)	FRO (MW/Hz)	
			Solar Hours	Non-Solar Hours
22	NTPC Mouda Stage I (TH)	1000	48	31
23	NTPC Mouda Stage II (TH)	1320	56	36
24	NTPC SAIL Power Company Limited (TH)	500	27	18
25	NTPC Sipat Stage I (TH)	1980	101	65
26	NTPC Sipat Stage II (TH)	1000	52	33
27	NTPC Solapur (TH)	1320	51	33
28	NTPC Vindhyachal Stage I (TH)	1260	64	41
29	NTPC Vindhyachal Stage II (TH)	1000	55	35
30	NTPC Vindhyachal Stage III (TH)	1000	56	36
31	NTPC Vindhyachal Stage IV (TH)	1000	53	34
32	NTPC Vindhyachal Stage V (TH)	500	29	18
33	R.K.M Powergen Private Limited (TH)	1440	51	33
34	Sasan Power Limited (TH)	3960	216	139
35	SKS Ispat and Power Limited (TH)	600	17	11
36	The Tata Power Co Ltd (MTPS) (TH)	4150	106	68
37	TRN Energy Private Limited (TH)	600	23	15
38	DGEN Mega Power Project (G)	1200	4	2
39	NTPC Jhanor Gandhar (G)	657	5	3
40	NTPC Kawas (G)	656	4	3
41	Ratnagiri Gas and Power Private Limited (G)	1966	6	4
42	Sardar Sarovar Project (H)	1450	28	18

*FRO shall be nil in case of a control area not having any generation resources
^The generation for year 2023 was zero

Frequency Response Obligation of Control Areas in Southern Region for FY 2024-25

Southern Region			
Sl. No.	States	FRO (MW/Hz)	
		Solar Hours	Non-Solar Hours
1	Andhra Pradesh	966	621
2	Karnataka	1107	712
3	Kerala	265	170
4	Tamil Nadu	1380	887
5	Telangana	960	617

Sl. No.	Entity	Capacity (MW)	FRO (MW/Hz)	
			Solar Hours	Non-Solar Hours
1	Coastal Energen Pvt Ltd., (TH)	1200	37	24
2	Infrastructure Leasing & Financial Services (IL&FS) (TH)	1200	45	29
3	Meenakshi Energy Limited (TH)^	1000	0	0
4	New Neyveli Thermal Power Project (TH)	1000	47	30
5	Neyveli Thermal Power Station -1 Expansion (TH)	420	18	12
6	Neyveli Thermal Power Station 2 - Stage 1 (TH)	1470	17	11
7	Neyveli Thermal Power Station 2 - Stage 2 (TH)	500	18	12
8	Neyveli Thermal Power Station -2 Expansion (TH)	500	15	10
9	NLC Tamil Nadu Power Limited (NTPL) (TH)	1000	40	26
10	NTPC Kudgi (TH)	2400	83	53
11	NTPC Ramagundam Super Thermal Power Station (TH)	2100	91	59
12	NTPC Ramagundam Super Thermal Power Station - Stage 3 (TH)	500	25	16
13	NTPC Simhadri Stage -2 (TH)	1000	43	28
14	NTPC Simhadri Stage-1(TH)	1000	41	26
15	NTPC Talcher Stage - 2(TH)	2000	104	67
16	NTPC TamilNadu Energy Company Ltd.,(TH)	1500	57	37
17	NTPC Telangana Super Thermal Power Plant(TH)	800	40	26
18	Sembcorp Energy India Limited Project-1(TH)	1320	66	42
19	Sembcorp Energy India Limited Project-2(TH)	660	33	21
20	Simhapuri Energy Limited(TH)	600	17	11

*FRO shall be nil in case of a control area not having any generation resources
^The generation for year 2023 was zero

Frequency Response Obligation of Control Areas in Eastern Region for FY 2024-25

Eastern Region			
Sl. No.	States	FRO (MW/Hz)	
		Solar Hours	Non-Solar Hours
1	Bihar	323	208
2	DVC	517	332
3	Jharkhand	104	67
4	Odisha	515	331
5	West Bengal	808	520
6	Sikkim*	0	0

Sl. No.	Entity	Capacity (MW)	FRO (MW/Hz)	
			Solar Hours	Non-Solar Hours
1	BARH-II (TH)	1320	58	37
2	BARH-I (TH)	1320	43	28
3	FARAKKA-I (TH)	1600	71	45
4	FARAKKA-II (TH)	500	26	17
5	KAHALGAON I (TH)	840	35	23
6	KAHALGAON II (TH)	1500	73	47
7	NABINAGAR (TH)	1980	106	68
8	TALCHER STG-I (TH)	1000	54	35
9	KBUNL (TH)	390	20	13
10	DARIPALI (TH)	1600	83	54
11	RANGEET (H)	60	3	2
12	TEESTA-V (H)	510	28	18
13	TEESTA-III (H)	1200	51	33
14	DIKCHU (IPP)	96	5	4
15	TASHIDING (H)	97	4	3
16	ADHUNIK (IPP)	540	24	16
17	CHUZACHEN (IPP)	110	5	3
18	GMR (IPP)	700	38	24
19	MAITHON.RT BK (IPP)	1050	53	34
20	JITPL (IPP)	1200	60	38
21	BRBCL	1000	46	30
22	NORTH KARANPURA	660	38	24
23	CHUKHA (H)	336	6	4
24	MANGDECCHU (H)	720	23	15
25	TALA (H)	1020	4	2

*FRO shall be nil in case of a control area not having any generation resources
^The generation for year 2023 was zero

Frequency Response Obligation of Control Areas in North Eastern Region for FY 2024-25

North Eastern Region			
Sl. No.	States	FRO (MW/Hz)	
		Solar Hours	Non-Solar Hours
1	Arunachal Pradesh	7	5
2	Assam	108	70
3	Manipur*	0	0
4	Meghalaya	22	14
5	Mizoram	6	4
6	Nagaland	7	5
7	Tripura	30	19

Sl. No.	Entity	Capacity (MW)	FRO (MW/Hz)	
			Solar Hours	Non-Solar Hours
1	Bongaigaon Thermal Power Plant (TH)	750	35	22
2	Agartala Gas Based Power Station (G)	135	5	3
3	Assam Gas Based Power Station (G)	291	12	8
4	ONGC Tripura Power Company Limited, Palatana (G)	727	35	22
5	Doyang Hydro Power Station (H)	75	3	2
6	Kameng Hydro Power Station (H)	600	20	13
7	Khandong Hydro Power Station (H) ^	50	0	0
8	Khandong Stg-2 Hydro Power Station (H)	25	2	1
9	Kopili Hydro Power Station (H)	200	6	4
10	Loktak Hydro Power Station (H)	105	3	2
11	Panyor Lower Hydro Power Station (H)	405	16	10
12	Pare Hydro Power Station (H)	110	6	4

*FRO shall be nil in case of a control area not having any generation resources
^The generation for year 2023 was zero

Frequency Response Obligation of Nepal & Bhutan for FY 2024-25

Transnational			
Sl. No.	States	FRO (MW/Hz)	
		Solar Hours	Non-Solar Hours
1	Nepal	33	21
2	Bhutan	63	40

*FRO shall be nil in case of a control area not having any generation resources
^The generation for year 2023 was zero