

# Power System Operation Corporation Limited

## Western Regional Load Despatch Centre

GRID EVENTS FOR COMPUTATION OF FREQUENCY RESPONSE CHARACTERSTICS

Last updated on: 12.03.2021

DATE	ANTECEDENT TIME (A)	POST EVENT TIME (B)	Delta f (in Hz)	Delta P (in MW)	Event Description
10.03.21	19:35:30	19:36:50	0.063	1507	On 10th-March-2021 at 19:35Hrs, 400kV Rango-Kishanganj & 400kV Teesta III - Kishanganj tripped due to R-B-N Fault and resulted in Complete outages of Stations at 400kV( Rangpo, Teesta III, Dikchu) ,220kV (Jorethang,Tashiding,New Melli) and 132kV (Chuzachen,Gangtok) level. Consequently, Generation loss of 1561 MW due to loss of evacuation path and Load loss of 54 MW occurred in Sikkim. Net generation loss 1507 MW.
19.02.21	15:27:00	15:28:10	0.05	1300	On 19th February 2021, at 15:26 hrs multiple trippings occurred at Bhadla(PG) station. It has been reported that while availing planned shutdown of 220kV Bus-II at Bhadla(PG), multiple 220kV solar generation evacuation lines also tripped. As per SCADA data the total generation loss in the event was 1300MW.
26.12.20	10:18:00	10:19:10	0.02	1011	As reported On 26th December 2020, At 10:18hrs B-Phase CT of Unit-5 main bay in Wanakbori substation bursted which resulted in tripping of Bus-2 at Wanakbori S/S . Unit-8 at Wanakbori(GIS) station tripped due to operation of Surge Protection Relay at the same time. Generation loss of 1000MW observed (Unit-8:802MW and Unit 5-210MW). In PMU Frequency, It is observed that maximum change in the frequency was around 0.078 Hz and Generation of Unit-5 & 8 was 208 MW & 803 MW respectively. Accordingly, FRC has been calculated for total generation loss of 1011 MW at Wanakbori generating station.
29.11.20	13:16:30	13:17:30	0.06	1690	On 29th November 2020, at 13:16 Hrs Units 1,3,4 and 5 tripped at Jindal TPS (780 MW) due to flash over in GIS Chamber and Bellary TPS (906 MW) tripped due to electrical side problem. Complete Generation loss of 1690 MW. 400kV Jindal - BTPS , 400kV Jindal - BPS - 1, 400kV Jindal - Guttur and 400kV BTPS - Hiriyur -1 tripped during this event.

12.10.20	10:05:00	10:06:00	0.11	1540	On 12th of October 2020, As reported, At 09:58hrs, 400kV Kalwa-Padghe line-2 tripped on R-ph fault. At 10:05hrs, 400kV Pune-Khargar line emergency hand tripped (due to heavy sparking on isolator) and 400 KV Kalwa – Khargar line also hand tripped due to CT jumper hot spot leading to Mumbai system blackout . Trombay Unit-5(500MW), Trombay Unit-7(A) & 7(B), Uran-5(108MW) and Uran-6(108MW) Uran(A0) tripped at 10:05hrs during Mumbai blackout. Adani system got islanded and survived with a total load of 400MW (feeding through Dahanu Unit-1 and Unit2). It is reported that loads at Bhiwandi area feeding from Padghe also tripped. Total load loss was observed to be 2600MW (2200MW of Mumbai, 400MW of Khargar, Navi Mumbai, Bhiwandi and Thane). Total Generation loss was around 840MW at TATA) and 220MW at Uran.FRC has been calculated for load relief of 1540 MW.
13.08.20	07:03:00	07:04:00	0.05	1210	On 13th of August 2020 at 07:03 hrs, As reported, 400kV Jhakri-Panchakula ckt- 1 and 2 tripped due to sparking of Y-Ph Isolator for ckt1 at Panchakula end and the second ckt tripped at Jhakri end. In this connection, SPS operated at Jhakri, Karcham and Rampur. Consequently, 02 Nos Units of Karcham (Unit-2 &4), 02 Nos units of Jhakri (Unit-3 & 5) and 02 Nos Units of Rampur (Unit – 3 & 4) tripped. As per SCADA data generation loss 1200 MW occurred during the event. 1210 MW generation loss has been considered in the calculation as per the reported region
06.08.20	13:50:20	13:51:20	0.04	1348	On 06th August 2020, As reported at 13:50 Hrs 400 KV Akal-Jodhpur (RS) Ckt-1 tripped due to DT received at Jodhpur end. At the same time, 400/220 kV 315 MVA ICT 1 & 315 MVA ICT 2 at Barmer(RS) also tripped.Wind generation loss of around 1348 MW occurred (as observed from SCADA data)
22.07.20	12:49:30	12:50:40	0.080	1402	On 22nd of July 2020 at 12:49 hrs, As reported 400/220 KV 500MVA ICT-1 & ICT-3 at Bhadla Rajasthan tripped due on overcurrent. 400/220 KV 500MVA ICT-2 was already under outage due to PRD operation. During the event Solar generation loss at Bhadla Rajasthan 1402 MW ( as observed from SCADA data).

20.07.2020	20:50:30	20:51:40	0.08	1213	On 20th July 2020,As reported 220kV Amarsagar-Dechu, 220kV Amarsagar-Mada and 220kV Amarsagar-Akal tripped at 20:50 Hrs due to snapping of Main bus jumper at 220kV Amarsagar.Wind generation loss of around 1213 MW occurred ( as observed from SCADA data).
16.07.2020	16:27:20	16:28:30	0.085	1394	On 16th July 2020, 400 KV Teesta III-Kishanganj was under emergency outage availed at 15:49 Hrs, to replace gas density monitor.  At 16:27 Hrs 400 KV Rangpo-Kishanganj tripped on directional earth fault in B phase at Rangpo end and DT receipt at Kishanganj. At the same time, 400kV Rangpo-Dikchu and 400 kV Dikchu-Teesta III also tripped. As per SCADA data generation loss during the event comes out to be 1394 MW (1285 MW and 109 MW at Teesta III and Dikchu respectively).
14.07.2020	14:11:10	14:12:10	0.042	975	On 14th July 2020, at 14:11 Hrs Units 1,2,3 and 4 tripped at Koyna Hydro power plant due to DC supply fail resulting Generation loss of around 975MW (as per SCADA data)
11.06.2020	11:59:30	12:00:30	0.13	2126	On 11th June 2020, at 11:59 hrs R-phase jumper connecting CT to wavetrap broken at Saurya urja (Rajasthan end). Fault in 220kV Bhadla(Raj) – 220kV Saurya Urja - 2. 220 KV Bhadla(PG)-Saurya Urja(SU) (UNDEF) Ckt-1 & 2 also tripped. As per PMU, Y-N fault is observed in the system. Generation loss of around 1130MW & 970MW (as per SCADA data) observed in solar connected to Bhadla(PG) & Bhadla (Raj) respectively.

28.05.2020	17:26:50	17:27:50	0.3710	5246	On 28 May 2020, No. of elements tripped at 765/400 kV Vindhyachal PS, 765/400/220 kV Sasan, 765/400 kV Satna, 400 kV Vindhyachal-IV, V and 400 kV Rihand Stg-3 from 16:58-17:30 Hrs. As informed by POWERGRID WRTS-2/Sasan/NTPC, heavy thunder storm observed in Satna/Vindhyachal/Sasan area causing black out at 765/400 kV Sasan, 765/400 kV Vindhyachal-PS, 400 kV Rihand Stg-3, 400 kV VSTPS-IV, 400kV VSTPS-V. Total 5246 MW generation loss observed (Sasan-3103 MW, VSTPS-V- 459 MW, VSTPS-IV-744 MW and Rihand Stg-3-940 MW). As intimated by SLDC MP load loss observed in Madhya Pradesh
19.03.2020	14:36:50 <b>(From PMU)</b>	14:37:50 <b>(From PMU)</b>	0.075	1139	On 19th March 2020, at 14:36 hrs at the time of fault in 400 kV Tamanar - JPL stg-II ckt II, unit 3 and 4 at JPL stage -II station(capacity 4x600 MW) got tripped (other units were off bar) due to operation of class A & B protection as reported. As per Tamnar PMU, the fault seems to be in B phase and the fault clearing time was 280 ms. The generation loss in the event was 1139 MW as per SCADA data.
1.03.2020	06:09:20 <b>(From PMU)</b>	06:10:30 <b>(From PMU)</b>	0.043	1340	On 01th March 2020, at 06:09 hrs 400 kV Bus Bar protection operated at 400KV Naptha Jhakri Sub-Station.400kV buses 1,2,3&4 tripped along with 6 nos. 400kV lines at Naptha Jhakri Substation. Total Generation loss was around 1340 MW at NJPC (810MW), Rampur (230MW) & Karcham (300MW)
22.02.2020	18:23:30 <b>(From PMU)</b>	18:24:30 <b>(From PMU)</b>	0.063 <b>(From PMU)</b>	1134	On 22th Feb 2020, at 18:23:18 hrs Unit-II and Unit III at Bara station tripped. The reason of unit outage was differential protection as reported. As per Kanpur 3 phase voltage PMU, there was only single voltage dip and maximum dip is in Y-Phase. The total generation loss in the event was 1134 MW. In the event, Unit-I at Bara station remained connected and no generation was affected in it.

17.02.2020	17:38:30 (From PMU)	17:39:50 (From PMU)	0.095 (From PMU)	1415	On 17th Feb 2020, at 17:38:31.600 hrs, HVDC Talcher - Kolar pole-II got tripped due to persistent DC line fault. At this time TS1 and TS2 signal generated at Kolar end and load relief of 1415 MW obtained in southern region as per SCADA data. It led to the frequency rise to 50.099 Hz from 49.930 Hz. Due to primary response, the frequency gone down to 50.025 Hz. Then at 17:39:58.400 hrs, Pole-I went into ground return mode and at Talcher end, signal 3 is generated. On this signal, instantaneous backdown of 666 MW occurred in Talcher stg II. Consequently the frequency dipped to 49.96 Hz from 50.07 Hz and finally settled to a higher value of 50.04 Hz. The FRC has been calculated for the load relief of 1415 MW obtained in southern region.
18.01.2020	12:36:46 (From PMU)	12:37:15 (From PMU)	0.026 (From PMU)	1091	On 18th January 2020 , at 12:36hrs Busbar protection operated at Chandrapur, resulting in tripping of 400kV Bus1 and Bus 2 and all connected elements (400kV Chandrapur- Bhvt Line 1,2,3 &4, 400kV Chandrapur- Parli S/C,400kV Chandrapur- Chandrapur D/C, 400kV Chandrapur Khaparkheda line 2, HVDC Chandrapur-Padghe Bipole, 400/220kV Chandrapur ICT 1&2, Chandrapur unit 3,4,5 & 6 ). Due to this tripping, approx.1091 MW generation loss was observed as per SCADA data (Generation prior to tripping at Chandrapur).
01.11.2019	11:16:40	11:17:30	0.12	~1644	On 01st November 2019 , at 11:16hrs R-phase jumper of 220kv Giral line at Akal station snapped & dropped at 220kv structure leading to tripping of all 220 kV lines emanating from Akal S/S. Due to this tripping, approx.1644 MW generation loss was observed as per SCADA data. This value is calculated by summing the net delta P on all the lines emanating from Akal-Ramgarh generation complex.
21.08.2019	00:02:40	00:03:40	0.09	1364	At 00:02 hrs on 21-Aug-2019, 400 KV Dikchu - Rangpo tripped from Rangpo end only. consequently 400 KV Teesta III- Dikchu also tripped resulting in total black out at 400 KV Dikchu and 400 KV Teesta III, generation loss of 1364 MW of Teesta III-1260MW and Dikchu-104 MW.

05.07.2019	03:56:10	03:56:20	0.07	1500	<p>On 05th June 2019, at 03:56:20 hrs C phase jumper of 220 KV Akal- Bhu Line-I snapped and fallen on 220 KV Bus-I at Akal station as reported by Rajasthan SLDC. It led to the tripping of 220 KV Akal-Bhu Line-I &amp; II, 220 KV Akal- Dangri-I and 400/220 KV ICT-I &amp; II at Akal station. The fault clearing time as per PMU was 680 ms and Wind generation loss in Akal station as per SCADA data is 1500 MW. After 2 minutes of incident, 400 KV Akal-Kankani-I &amp; Akal - Ramgarh-II tripped on over voltage as reported and Wind generation loss at Akal station at this second incident was 300 MW as per SCADA data. The FRC has been calculated for the first incident when generation loss was 1500 MW.</p>
19.05.2019	10:35:30	10:36:30	0.20	2975	<p>On dated 19-May-2019 at 10:35 hrs ,all units in operation i.e. unit 1- 4 &amp; 6 of 210 MW each (Unit -5 was already under planned shutdown for annual Maintenance) and Unit 7-10 of 500MW each at Vindhyaachal STPS Stage-1, Stage-2 and Stage-3 tripped along with all 400kV Buses and emanating lines connected to VSTPS Stage-1, Stage-2 and Stage-3. As reported by NTPC, incident started due to R-phase bushing failure of generator transformer of Unit-7 and subsequent tripping of other units on impedance protection and turbine over speed. Around 2975 MW of generation loss occurred as per SCADA Data.</p>
16.05.2019	19:10:00	19:11:00	0.06	1337	<p>On 16th May 2019, at 19:10 hrs smelter load of Vedanta plant that is coming through Sterlite sub-station became nil as reported. The reason of the incident is still not being intimated by SLDC. Also in the incident, SCADA data of Sterlite station was suspected. The net change in power is calculated from remote end data of 400 kV lines connected to Sterilte station and that change is 1337 MW.</p>

12.04.2019	23:55:00	23:56:10	0.10	1865	At 23:55 hrs, 12/04/19 400 KV Teesta III-Kishanganj tripped on R-Y-N Fault. As a result around 1865 MW generation of the entire complex started to flow through 400 KV Rangpo-Kishenganj S/C which tripped on overload (Back –up overcurrent with each phase current of 4000 amps) and resulted in loss of generation of around 1865 MW.
12.04.2019	15:25:20	15:26:20	0.10	1500	At 15:25 hrs Chandrapur-Bhadrawathi-4, Chandrapur-Chandrapur-1 & 2, Chandrapur U#8 & 9, Dhariwal CTU and STU Unit tripped resulting in 1500 MW generation loss.
11.04.2019	13:01:00	13:02:00	0.04	1123	On 11 April 2019, at 13:00 hrs HVDC Talcher-Kolar pole-I got blocked due to emergency switch off signal from Kolar end. Prior to incident flow on bipole was 2000 MW and in post incident flow on Pole-2 was 1000 MW. The net change in flow on bipole satisfied the SPS criteria and due to SPS operation, load loss of 1123 MW took place in southern region and generation loss of 225 MW in eastern region as per SCADA data. The generation relief in aforesaid units was on account of ramp down which took place in span of minutes, so delta P considered in FRC calculation is of load relief quantum in southern region.
12.03.2019	17:03:00	17:04:10	0.07	1170	On 12-March-2019 at 17:03 Hrs, two running units at Singareni generating 1170 MW tripped due to Bus-Bar protection operation at 400kV Ramadugu substation.

12.03.2019	13:02:00	13:03:00	0.05	1219	<p>On 12-March-2019 at 13:03 Hrs, HVDC talcher-Kolar pole 2 tripped due to DC earth fault . Prior to incident, power flow on bipole was 2000 MW and after tripping of pole-II, power flow on pole-I jumped to 1250 MW. Then after 1.5 minutes flow on pole-I came down to 150 MW. The SPS associated with HVDC Talcher-kolar pole tripping operated at 13:03 Hrs and led to load relief of approx 1219 MW( as per SCADA data) in southern region. The SPS operation in ER region at 13:04:30, led to generation relief of aprox 734 MW (Talcher stg 2 - 641 MW, GMR-147 MW &amp; JITPL-100 MW). The FRC has been calculated for the incident at 13:03 Hrs as frequemcy change is more than 0.10 Hz.</p>
05.02.2019	11:57:10	11:58:10	0.03	869	<p>On 05th Feb 2019, at 11:57 Hrs load loss of approx. 869 MW occurred in Northern Region as per SCADA data(Delhi-226 MW, Haryana 152 MW, Rajasthan 400 MW, UP 91 MW) . Only Delhi SLDC has reported that load loss occurred due to outage of 220 kV Sarita Vihar-Badarpur D/C and 220 kV Sarita Vihar-Maharanibagh.</p>
23.01.2019	06:37:10	06:38:10	0.04	961	<p>On 23rd Januray 2019, at 06:37 Hrs 400KV Jhakri-Panchakula 1, 400KV Jhakri-Rampur 1 tripped due to bus bar protection operated at NJPC during charging of 400KV Jhakri-Karcham 1. Consequently, 961 MW generation loss occured at both Jhakri and Rampur.</p>
16.01.2019	12:26:00	12:27:10	0.05	1400	<p>On 16.01.2019 at 12:25hrs, there was a dropper flashover at 220kV GIS Bhadla substation. There was also tripping of 400kV Jodhpur-Bhadla,400kV Merta-Bhadla,400kV Bhadla-Bikaner 1&amp;2. Solar Generation loss around 1400MW as reported by NRLDC.</p>



30.10.2018	19:22:20	19:23:20	0.16	2240	On 30th Oct 2018, at 19:22 Hrs unit # 30,40 and 50 (830 MW each) of CGPL Mundra UMPP tripped due to generator Class-A2 Protection operation. Total generation loss as per SCADA data was 2240 MW.
29.08.2018	04:02:10	04:03:30	0.05	1200	On 29th Aug 2018 at 04:02 Hrs, 400kV Rampur-Nalagarh Ckt-1 Auto Reclosed Successfully and 400kV Rampur-Nalagarh Ckt-2 tripped on B-N fault, consequently the incident led to SPS operation at NJPC and Rampur Hydro stations causing tripping of 2 nos. units in each station, generation loss of 500 MW and 130 MW respectively. Further, at Karcham Wangtoo, Units-2 and 4 went into NLNE mode (No Load Not Excited) causing generation reduction of around 500 MW. Total Generation Loss reported was around 1200 MW.
12.08.2018	15:31:00	15:31:50	0.046	852	400 KV Rangpo - Binaguri II tripped on B- N phase fault, SPS -I operated and resulted into tripping of all running units of Teesta 3 (Except Unit one Unit) , one unit each of Jorethang, Tashiding, Chujachen and both units of Dikchu. As per NLDC SCADA Data, Generation loss at this point was 852 MW.
07.08.2018	14:17:00	14:18:00	0.04	890	On 07th August 2018 at 14:17Hrs,KSK unit #2 & unit #4 tripped on operation of reverse power relay. Total Generation loss is around 890 MW.
06.08.2018	13:06:20	13:06:30	0.05	1300	On 06 Aug 18, at 13:06 hrs, all lines emanating from 400 kV Lonikhand and Chakan tripped at 13:06 hrs. Prior to tripping, MSETCL was attending broken insulator in Chakan Bus coupler. As intimated by Maharashtra SLDC about 1300MW load thrown off in Pune.