Before the
MAHARASHTRA ELECTRICITY REGULATORY COMMISSION
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Case No. 202 of 2020

Suo Motu Proceeding in the matter of Grid Failure in the Mumbai Metropolitan Region on 12 October 2020 at 10.02 Hrs.

Coram

I.M. Bohari, Member
Mukesh Khullar, Member

Parties to the proceeding

1. Maharashtra State Electricity Transmission Co. Ltd.
2. Maharashtra State Electricity Distribution Co. Ltd.
3. BEST Undertaking
4. Maharashtra State Load Dispatch Centre
5. State Transmission Utility
6. Tata Power Company Ltd.-Generation
7. Tata Power Company Ltd.- Transmission
8. Tata Power Company Ltd.- Distribution
9. Adani Electricity Mumbai Ltd.- Generation
10. Adani Electricity Mumbai Ltd. -Transmission
11. Adani Electricity Mumbai Ltd.-Distribution
12. Indian Railways
13. Mindspace Business Parks Pvt. Ltd.
14. Gigaplex Estate Pvt. Ltd.

Appearance (All Representatives)

1.	Maharashtra State Electricity Transmission Co. Ltd.	…… Shri Sanjay Taksande
2.	Maharashtra State Electricity Distribution Co. Ltd.	…….Shri Paresh Bhagwat
3.	BEST Undertaking	…….Shri N.N. Chaugule
4.	Maharashtra State Load Dispatch Centre	…… Shri S.V. Jaltare
5.	State Transmission Utility	…….Shri S.V. Jewalikar
6.	Tata Power Company Ltd.-Generation	……Shri Devanand Pallikuth
7.	Tata Power Company Ltd.- Transmission	
8.	Tata Power Company Ltd.- Distribution	
9.	Adani Electricity Mumbai Ltd.- Generation	….. Shri Mahesh Bhadoria

10. Adani Electricity Mumbai Ltd. -Transmission ..…. Shri Dilip Devasthale
11. Adani Electricity Mumbai Ltd.-Distribution … . Shri Shrikant Yeole
…… Shri Kapil Sharma
…… Shri Kishor Patil
12. Mindspace Business Parks Pvt. Ltd. and
13. Gigaplex Estate Pvt. Ltd. …….Shri Nitin Chunarkar

ORDER

Dated: 22 October, 2020

1. In exercise of the powers conferred by clause (zp) of sub-section (2) of Section 181 read along with Section 86 (1) (h) of the Electricity Act, 2003 (**EA**), the Commission has notified the MERC (State Grid Code) Regulations, 2020 (**Grid Code**). These Regulations lay down the rules, guidelines and standards to be followed by State Entities and Users of Intra-State Transmission System (**InSTS**) to plan, develop, operate and maintain InSTS as an integrated part of Western Region Grid System and National Grid, in the most efficient, reliable and economic manner, while facilitating a healthy competition in the generation and supply of electricity.

2. Regulation 46.1.1 of the Grid Code specifies the reportable events which are mandatorily required to be reported by the User/Transmission Licensee or SLDC or STU as the case may be. These events, inter alia, include events such as Blackout/partial system blackout, System islanding/system split, Grid indiscipline, Loss of major generating unit, Protection failure on any element of InSTS, Power system instability. Tripping of any element of the State Grid etc.

3. Further, as per Regulation 46.2.4 of the Grid Code, events affecting the generation capacity and/or load of more than 1000 MW needs to be reported immediately in writing within 24 hours from the occurrence to the Commission by MSLDC or Transmission Licensee or User, as the case may be. The report needs to include brief details of the event, extent and probable causes of the event.

4. A partial grid disturbance occurred in Mumbai system on 12 October 2020 at 10.02 Hrs leading to multiple tripping of 400 kV EHV lines and Generating units which affected the supply to a large part of Mumbai Metropolitan Region (**MMR**).

5. Maharashtra State Load Dispatch Centre (**MSLDC**) vide its letter dated 13 October 2020, has submitted the preliminary report of the above partial grid disturbance and stated that a loss of 3508 MW load and a loss of 1375 MW generation occurred due to partial grid disturbance in MMR occurred on 12 October 2020 at 10.02 Hrs. Also, the preliminary reports were filed by Adani Electricity Mumbai Ltd. (**AEML**) and Tata Power Company Ltd. (**TPC**) on 14 October 2020 intimating the event information and power supply position in their respective areas.

6. Vide its letter dated 14 October 2020, the Commission directed MSETCL to submit the following information:

   i. System conditions prior to the occurrence (pre-fault).

   ii. Details of outage management on the infrastructure affected.

iii. Brief description of the occurrence, sequence of events and the areas affected thereof.

iv. Status of the Islanding facility and the reasons for its failure.

v. Generation loss and units tripped during Occurrence.

vi. Restoration of normalcy and the chronological steps taken.

vii. Preliminary analysis of this grid failure.

7. The occurrence severely affected the power supply to a large section of population of MMR. Hence, occurrence was required to be taken cognizance of for ascertaining actions pertaining to dereliction of actions, if any, in operation and maintenance of lines, system security, failure of protection and to achieve intended islanding of critical load-generation balance for areas. Further, the Regulation 32 of the MERC (Conduct of Business) Regulations, 2004 provides that

> "*The Commission may initiate any proceedings suo motu, or on a Petition filed by any affected or interested person."*

8. Accordingly, the Commission deemed it appropriate to initiate a suo motu proceeding to find the primary reasons for the partial grid failure, response and performance of Licensees/Generators and for identifying preventive measure and issued Notice dated 17 October 2020 asking MSLDC to submit the detailed report of the partial grid failure of MMR by 19 October 2020. Also, other impleaded Respondents (such as the Generating Companies, Transmission and Distribution Licensees operating in MMR) were asked to file their submission on MSLDC's Report by 20 October 2020. The Commission's Notice stipulated that all the details including (but not limited to) the following aspects/matters shall be discussed at the hearing on 21 October 2020:

a. What are the reasons of the occurrence in MMR on 12 October, 2020 at 10.02 hrs?

b. Whether standard Protocol was followed to restore the grid? Reasons for non-restoration of grid immediately.

c. The actions expected from all the stake holders (Generation, Transmission and Distribution) and their individual performance/actions. Response of all the stake holders.

d. Details of load met and extent of load shedding on an hourly basis from the start of the problem and restoration of the normalcy.

e. Details of the protections provided and their performance on the day of grid disturbance (Generators and Lines) and its adequacy.

f. Details of the past Grid Disturbances failure of power in parts of MMR (2010 onwards) in the past and status of Action required to be taken by STU/SLDC to avoid recurrence.

g. Did the Mumbai Islanding operate as is envisaged? Status of Mumbai Islanding and its relevance in the changed scenario.

h. Details of the margins available in the Mumbai Transmission and corrective action taken by STU.

i. Current status of the schemes proposed for strengthening of the Mumbai Transmission by STU.

j. Action plan for Preventing re-occurrence of such events in MMR.

k. Follow up action on the Order issued by the Commission 1 December,2010 in Case No. 84 of 2010.

l. What protocol was followed by the Distribution Licensees while restoring the loads? (Priority of restoration).

9. In response, submissions were filed by MSLDC, TPC, AEML, Maharashtra State Electricity Distribution Co. Ltd. (**MSEDCL**), State Transmission Utility (**STU**), Mindspace Business Parks Pvt. Ltd (**MBPPL**) and Gigaplex Estate Pvt. Ltd. (**GEPL**).

10. **MSLDC, in its Reports dated 13 October and 17 October 2020 submitted the following:**

10.1 System Conditions prior to Occurrence (pre-fault):

i. Maharashtra State demand: 17664 MW

ii. Mumbai demand: 2590 MW

iii. Mumbai Generation:

Sr. No.	Description	Capacity (MW)	Actual Generation (MW)
1	TPC-G Unit – 5	500	454
2	TPC-G Unit – 7A & 7B	180	182
3	AEML-G Dahanu Units	2X250	485
4	TPC-G Hydro	447	228
Total		**1627**	**1349**

iv. TPC-G Unit-8 (250 MW) was issued Zero schedule by TPC-D and BEST since 16:55 hrs dated 11 April 2020 and was planned to be brought on bar by 14:00 Hrs of 12 October 2020. Bhira Pumped Storage Unit (BPSU) of TPC-G (150 MW) tripped on 12 October 2020 at 09:45 hrs due to Butterfly Valve (BFV) open feedback fail.

v. Mumbai demand:

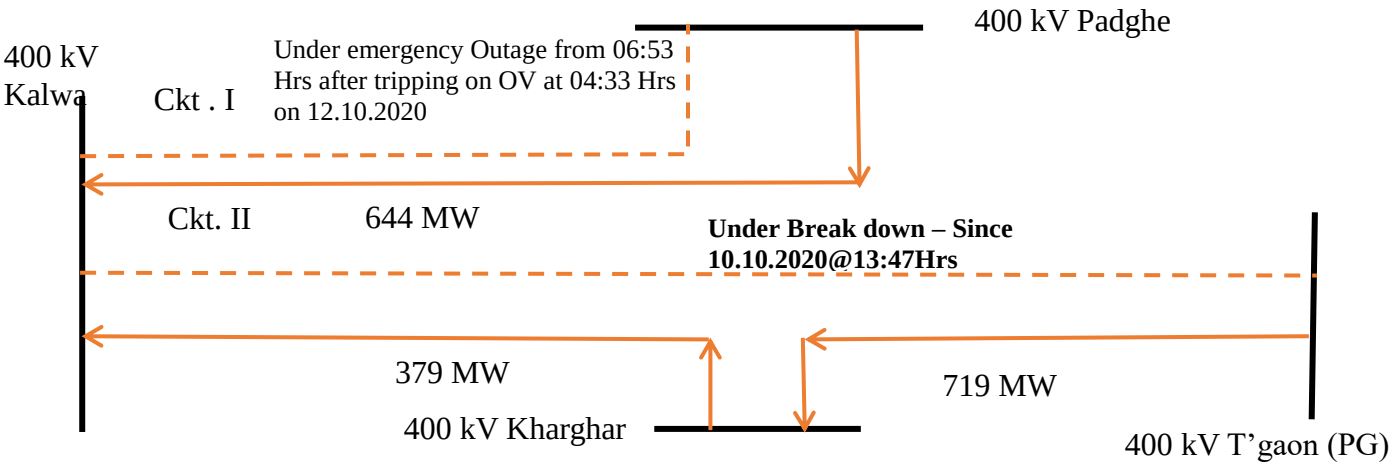
Sr No.	Description	Demand
1	TPCL	1633
2	BEST	
3	AEML	957
Total		**2590**

vi. There was a net exchange of 1241MW power through interconnected lines.

vii. 400 kV Talegaon (PG) – Kalwa Single Circuit (S/C) line was under break down from 10 October 2020 @ 13:47 Hrs due to the conductor snapping at Location No. 33 & 34.

viii. 400 kV Padghe–Kalwa Ckt. I tripped on over-voltage on 12 October 2020 @ 04:33 Hrs. An emergency outage was availed on this Line at 06:53 hrs for replacing de-capped insulator string at the location No.1044 occurred during the fault on B phase to Earth fault on 10 October 2020.

ix. The status of the 400 kV lines connected to 400kV Kalwa and Kharghar Substations and the load flow prior to the incident on the 400kV circuits was as below:



x. Power flow was towards 400 kV Kalwa and Kharghar Substations.

xi. The Substation loading prior to the Grid Disturbance was 1029 MW at 400 kV Kalwa Substation and 358 MW at 400 kV Kharghar substation.

10.2 Details of Outage Management on the infrastructure affected**:**

i. In view of breakdown of the 400 kV Talegaon (PG) – Kalwa S/C Line, MSLDC had directed TPC-G on 10 October, 2020 to bring on bar Unit 8 (250 MW) which had been withdrawn under 'Zero Schedule'. TPC-G, vide email dated 10 October 2020 at 16.21 Hrs confirmed that the activities to bring on Unit 8 have been initiated and Unit shall be synchronised by 14:00 Hrs on 12 October 2020. Further, MSLDC at 09:30 Hrs on 11 October 2020, through e-mail, directed TPC-G and AEML-G to maximise their respective generations in view of non-availability of 400kV Talegaon(PG)- Kalwa line.

ii. 400 kV Padghe- Kalwa Ckt. I Line was tripped due to over-voltage on 12 October 2020 @ 04:33 Hrs. Maharashtra State Electricity Transmission Co. Ltd. (**MSETCL**) field office availed opportunity outage on this circuit for replacement of de-capped insulator string at the location No.1044 occurred during the fault on B phase to Earth fault on 10 October 2020. Outage feasibility was confirmed as the Mumbai demand was in the range of 1842 MW, Mumbai generation availability was 1627 MW at the time of outage and the duration of completion of outage was till 09:00 AM. Hence, based on approval from WRLDC, emergency outage was issued for carrying out said replacement works.

10.3 Brief description of Occurrence, sequence of events and areas affected:

i. 400 kV Padghe -Kalwa Ckt -I Line and 400 kV Talegaon (PG) -Kalwa Lines were under outage.

ii. At 9.58 Hrs on 12 October 2020, 400 kV Padghe -Kalwa Ckt.II line tripped due to snapping of R-Phase conductor thereby shifting of the complete load of Kharghar SS and Kalwa SS to 400 kV Talegaon (PG) -Kharghar (SC) Line. This resulted in

a load flow of 1387 MW on 400 kV Talegaon (PG) -Kharghar S/C and 1000 MW on 400 kV Kharghar-Kalwa S/C line .

iii. The load trimming scheme (**LTS**) installed on this line with a setting of 1300 Amp, 3 sec delay operated with a load relief of 18 MW.

iv. The high loading on 400kV Talegaon (PG) -Kharghar S/C line resulted in sparking on its Y-phase and Y-phase CT clamp on 400 kV Kharghar-Kalwa Substation at 400 kV Khargar end. Hence, 400 kV Talegaon (PG) -Kharghar line was hand tripped in emergency by the Substation operator at Kharghar end at 10.02 hrs. Thus, the non-availability of 400 kV source lines resulted in complete failure of supply to the 400 kV buses of 400 kV Kalwa and Khargar Substations.

v. 220 kV Kharghar and Kalwa Substations are connected to 220 kV Trombay Substation of MSETCL and Mumbai network. 400 kV source was not available to Kalwa and Kharghar Substations, but 220 kV network area connected was intact. This condition initiated Auto-closing of 220 kV Interconnector between 220 kV Kalwa -1 Substation and 400/220 kV Kalwa Substation.

vi. 220 kV Padghe -Temghar 1 & 2 at 400 /220kV Padghe Substation tripped on overloading. 220 kV Boisar- Boisar (PG) Ckt.-3 overloaded and LTS operated at Boisar (Local Load and 220 kV Boisar-Borivali line).

vii. Further , the grid frequency dropped to Under Frequency Relay (**UFR**) setting of 47.9 Hz with reverse power from MMR to MSETCL network , thereby fulfilling all the conditions of Mumbai islanding and resulted in opening of all MSETCL-MMR inter-connections that initiated the operation of Mumbai Islanding scheme.

viii. With the operation of Mumbai islanding scheme, total load relief obtained was 600 MW from TPC-D and BEST network while 500 MW in AEML-D network. The isolated Mumbai network demand dropped to 1490 MW. Further drop in frequency to 46.8 Hz due to load-generation imbalance in MMR area resulted in separation of TPC and AEML network.

ix. The load-generation imbalance persisted in TPC network (Demand: 1033 MW, Generation: 864 MW). With large dip in frequency in the isolated TPC network, Trombay Unit 5 and Unit 7 tripped on under frequency resulting into total black out in TPC-D and BEST network. Also, during the incident, TPC-G Hydro units at Khopoli, Bhivpuri and Bhira Generating Stations also tripped.

x. AEML-T network got islanded from TPC-T network and 250x2 AEML-G Units continued to supply critical load of @ 385 MW in Mumbai in islanded mode of operation.

10.4 Load Loss:

Sr. No.	Name of the Substation/Area	Load loss (MW)
1	Mumbai region	2205
2	220kV Kalwa	237
3	220kV Apta and 220kV Taloja	184
4	220kV Temghar	126
5	220kV Boisar	207

6	220kV Mulund	87
7	220kV Bhandup	63
8	220kV Colorchem	125
9	220kV Nerul	80
10	220kV Sonkhar	58
11	220kV TFPIL-Siemens-RCP	30
11	220kV Mahape	106
Total MW		**3508**

10.5 Status of Islanding facility and the reasons for its failure:

i. Though the islanding scheme operated as envisaged, it was partially successful. The Mumbai network got separated from MSETCL network but TPC island was unable to sustain due to continuous drop in frequency and tripping of its generators (500 MW Unit 5 and 180 MW Unit 7) while AEML-T island was able to sustain with its generators (2 x 250 MW DTPS) and critical load.

10.6 Generation loss and units tripped during occurrence:

Sr. No.	Generation Unit	Generation loss (MW)
1	TPC-G Unit 5	454
2	TPC-G Unit – 7A and 7B	180
3	DTPS	242
4	TPC-G Khopoli Hydro	08
5	TPC-G Bhivpuri	70
6	TPC-G Bhira Hydro	120
7	Uran	271
Total		**1375**

10.7 Restoration of normalcy and chronological steps taken:

i. 400 kV Talegaon (PG)-Kharghar line was restored through Transfer Bus Coupler (TBC) Bay at Kharghar at 10:27 Hrs and supply to Trombay bus was restored at 10:56 Hrs through 220 kV Kharghar – Nerul - Trombay line.

ii. 400 kV Padghe – Kalwa Ckt. I line restored at 10:41 Hrs.

iii. Black start facilities at Khopoli and Bhivpuri Hydro generating stations of TPC-G were initiated however units at Khopoli tripped on under excitation while charging of 110 KV Khopoli- Karanjade line and at Bhivpuri on operation of ESD of sets (Emergency Shutdown) at 10:41 Hrs. Due to this, there was considerable delay in bringing these units on bar and were finally brought on bar at 13:33 Hrs.

iv. At 10:55 Hrs, supply from MSETCL Kalwa Substation was extended to Salsette Substation. Further, 220 KV Trombay–Salsette ckt. I line was charged and taken in service. 220 kV Trombay–Carnac lines were charged and load restoration in South Mumbai area was started subsequently. On priority, critical loads viz Railways, Hospitals, Airport were restored.

v. At 11:11 Hrs, AEML-T Network was synchronized with MSETCL Network through 220 kV Versova-Boisar (MSETCL) Line. During synchronization, AEML Unit 2 tripped on Reverse Power Protection which was taken in service at 13: 06 Hrs.

vi. TPC-G Unit 7A (120 MW) was brought on bar at 12:59 Hrs.

vii. TPC-G Khopoli (72 MW), Bhivpuri (72 MW) and Bhira (150 MW) units were synchronized at 13:33 Hrs. Bhira Pumped Storage Unit (BPSU) (150 MW) was synchronized at 14:24 Hrs.

viii. 400 kV Padghe–Kalwa Ckt. II and 400 kV Kharghar–Kalwa S/C were taken in service at 18:48 Hrs & 18:59 Hrs respectively.

ix. TPC-G Unit 8 (250MW) was synchronized at 21:36 Hrs. TPC-G Unit 5 (500 MW) was synchronized at 22:28 Hrs. TPC-G U 5 and U 8 took considerable time to come on bar inspite of continuous instructions from MSLDC although the power supply to TPC-G's Trombay bus was extended at 10:56 Hrs.

x. The total load in the Thane, Navi Mumbai and Raigad region was restored by 01:00 Hrs of 13 October 2020.

xi. The remaining load to the tune of 400 MW in Malad, Versova, Chembur, Vikhroli, Ghatkopar of the AEML loading through TPC network was also restored by 01:00 Hrs of 13 October 2020.

xii. In view of the limitation of loading on 400 kV Talegaon(PG)–Kharghar S/C line, due to non-availability of TPC-G Unit 5 and 8, loads were directed to be shed on rotation basis in MMR region till the restoration of complete generation of TPC-G at 01:00 Hrs of 13 October 2020.

10.8 Preliminary analysis of the Grid failure:

i. Tripping of 400 kV Padghe–Kalwa Ckt. II and subsequent hand tripping of 400 kV Talegaon (PG) – Kharghar S/C resulted in the complete failure of power supply to 400kV Kalwa and Kharghar Substations. Non-availability of 400 kV sources resulted in shifting of the complete load of 220 kV network on other sources viz Padghe, Uran, Boisar, Koyna circuits and Mumbai generators. Tripping of other sources on overload, subsequent fall in grid frequency and reverse power flow from MMR to MSETCL network initiated the operation of Mumbai Islanding scheme and separation of Mumbai network.

ii. AEML-T network got islanded from TPC-T network and 2x250 AEML-G Units continued to supply critical load of @ 385 MW in Mumbai in islanded mode of operation. Load-generation imbalance persisted in TPC network (Demand: 1033 MW, Generation: 864 MW). Hence, there was a large dip in frequency in the isolated TPC network, resulting in under frequency tripping of TPC-G Unit 5 and Unit 7 . Thus, there was total black out in TPC and BEST network.

iii. This is a preliminary analysis based on the available data. Detailed analysis based on data loggers and event logs is underway and further conclusion shall be drawn on its basis and same will be submitted to the Commission.

11. **Vide its submission dated 14 October and 20 October 2020, AEML stated as under:**

11.1 During the partial grid failure, AEML-T's transmission system successfully islanded from MSETCL and TPC-T system and continued to feed around 400 MW load to essential installations. AEML-D's load of around 500 MW was affected because of the interruptions/grid disturbance.

11.2 AEML has followed standard protocol as per directives of MSLDC while restoring the grid. Further, supply restoration process was carried out under MSLDC's instructions received from time to time. AEML-T Network restoration with grid commenced with synchronization of 220 kV Versova-Boisar (MSETCL) Line at 11:11 Hrs. on 12 October 2020. Restoration with TPC network was completed through TPC Versova - AEML Versova at 01:58 Hrs on 13 October 2020 and with MSETCL through MSETCL Borivali-AEML Aarey at 17:29 Hrs on 13 October 2020.

11.3 AEML-G's Dahanu Thermal Power Station (**DTPS**) responded to load variations during the incident and operated in islanded mode successfully as per the present islanding scheme. Also, AEML-T's Transmission System operated in islanded mode till the restoration of connectivity to Grid.

11.4 The summary of hourly load restoration after charging of 33/22kV Lines from AEML-T and TPC -T in coordination with SLDC is given in the table below:

Time	Load met in MW	Load Shed in MW
10:00	1375	0
11:00	470	905
12:00	490	885
13:00	733	642
14:00	1101	274
15:00	1199	176
16:00	1177	198
17:00	1148	227
18:00	1181	194
19:00	1348	27
20:00	1385	0

11.5 Adequate protection has been provided to the Generators as well as Transmission Lines. Also, these protections system worked satisfactory during the partial grid disturbance.

11.6 AEML's generation and supplied around 340 MW to 390 MW of critical/essential loads when no other generation/power source was available due to the said Grid disturbance.

11.7 AEML also submitted the status of various ongoing schemes.

11.8 AEML in its submission referred the past grid instances which are summarised as under :

Sr. No.	Date	Event Details	Capacity Affected
1	13-Jun-10	ICT Tripping at TPC Dharavi Substation	60 MVA
2	18-Nov-10	Multiple Transmission Line Tripping resulted in Tripping of ADTPS Unit 1 and 2 (Partial Islanding)	1600 MVA
3	21-Nov-10	Multiple Transmission Lines Tripping at TPC Dharavi	480 MVA
4	29-Sep-11	Load Trimming Scheme (LTS) at TPC Dharavi operated due to overloading of 110 kV Trombay Dharavi Line	310 MVA
5	02-Jul-12	Multiple Line Tripping at TPC Trombay and Dharavi	140 MVA
6	27-Apr-13	110 kV DC TPC Salsette - Saki Line Tripped	100 MVA
7	12-Jul-13	Simultaneous Tripping of 110 kV TPC Salsette to TPC Vikhroli and TPC Dharavi to TPC Vikhroli Lines	120 MVA
8	20-Sep-13	Load Shedding done to Limit Loading on 220 kV MSETCL Kalwa-Borivali Lines due to tripping of 220 kV TPC Salsette-Borivali Line 1 & 2	193 MVA
9	02-Sep-14	Load Shedding done to Limit Loading on multiple lines due to TPC U 5 Tripping (U-8 Under Outage)	250 MW
10	08-May-15	Load Shedding carried out due to Bus Fault at 400 kV MSETCL Kalwa Substation	395 MVA
11	13-Jul-15	Interruption due to 220 kV MSETCL Tarapur- M Borivli Line Tripping.	505 MVA
12	22-Feb-16	110 kV TPC Khopoli-Lodhivali and 110 kV TPC Trombay-Chembur Line-3 tripped	90 MVA
13	28-Jun-16	220 kV Kalwa-Salsette Line-3 and 4 tripped simultaneously due to Tower Collapse	300 MVA.
14	12-Jan-17	Activation of LTS at TPC Saki, TPC Borivali & TPC Vikhroli due to simultaneous tripping of 220 kV Kalwa-Salsette Line-3, 4 & 6.	430 MVA
15	12-Mar-17	Activation of Under-LTS at TPC Saki, TPC Borivali & TPC Vikhroli due to overloading of 220 kV Kalwa-Salsette Line-3, 4 & 6.	430 MVA
16	09-Dec-17	Bus Fault at Padghe resulted in overloading of 220 kV Ghodbunder - Gorai Line, backing down of ADTPS withdrawn to limit the loading on 220 kV Boisar - Boisar Line	Near miss incident
17	12-Jun-18	110 kV Circuit Breaker failure followed by cascaded tripping of ICT's	140 MVA

12. **Vide its submission dated 14 October and 20 October 2020, TPC reiterated the events as submitted by MSLDC and stated as under:**

12.1 During partial grid failure, when the grid frequency dropped to 47.9 Hz with reverse power from MMR to MSETCL network, Mumbai Islanding Scheme operated and isolated MSETCL network from Mumbai Transmission Network. As a part of the islanding operations, load shedding took place at 10:05 Hrs.

12.2 TPC has carried out the restoration activities as per the Black Start Guidelines of Western Regional Load dispatch Centre (**WRLDC**) in consultation with MSLDC .

12.3 TPC-T system elements including protection system worked as per the set process during the Occurrence and Restoration of Grid.

12.4 In view of 8.5 kM of overhead section converted to EHV cables between Karanjade and Waghivali on 220 KV Bhira-Dharavi 7 & 8, 110 KV Khopoli-Chembur and 110 KV Khopoli-Bhokarpada-Mankhurd lines, installation of reactors at Karanjade should be approved on priority by STU and the Commission to restrict over voltages.

13. **Vide its submission dated 20 October 2020, MSEDCL stated as under:**

13.1 MSEDCL's demand and availability in MW at 10:00 hrs and 11:00 hrs i.e before and after the grid disturbance on 12.10.2020 was as under:

Particulars	**At 10:00 hrs**	**At 11:00 hrs**
Demand (MW)	16132	14015
Availability (MW)	16742	17009

13.2 MSEDCL has load of about 2025 MW prior to incidence on EHV Substation whose power supply affected. The grid failure resulted in load loss of MSEDCL load about 1925 MW. The details of the affected load and consumer of MSEDCL is as under:

Sr. No.	**Name of Circle**	**Area**	**Affected consumers (Lakhs)**	**Demand at 10:00 hrs on 12.10.20 (MW)**	**Load affected (MW)**
1	Thane urban Circle	Thane Municipal Corporation area, S&T ward area of MCGM (Mulund & Bhandup)	7.7	414	349
2	Vashi Circle	Navi Mumbai Municipal Corporation area, Panvel Municipal Corporation Area, Uran Tehsil of Raigad District.	8.81	1056	1056
3	Pen circle	Raigad District except Uran Tehsil & Panvel urban region.	2.45	178	178
4	Palghar Circle	Palghar District & Vasai	2.11	216.7	181.4
5	Kalyan Circle 1& 2	Part of Kalyan& nearby area	0.812	160	160
6	Torrent Power (DF)	Bhiwandi	1.49		
		Total	**23.37**	**2024.7**	**1924.4**

13.3 MSEDCL has restored the supply step by step in consultation with SLDC and MSETCL.

14. **Vide its submission dated 20 October 2020, BEST stated as under:**

14.1 Due to nationwide lockdown from 23 March 2020 arising out of Covid pandemic, BEST's demand was substantially reduced. In order to achieve demand-supply balance and to optimize the overall power purchase cost, BEST and TPC-D issued Zero schedule to TPC-G's Unit-8 after considering prevalent network reliability factors. After receipt of concurrence from MSLDC, TPC-G had kept this Unit under Zero schedule from 11 April 2020.

14.2 Prior to grid failure incident of 12 October 2020, BEST's demand was around 584 MW at 10:00 hrs and actual availability of supply was matching with demand.

14.3 Subsequent to grid failure event, TPC communicated that during incident of grid failure, Under Frequency Relay (UFR) got activated on total 73 Nos. of BEST's 22/33 KV feeders at T-D interface with shedding demand of around 247 MW.

14.4 The restoration of supply was carried out step by step in consultation with MSLDC and TPC. The supply of the major installations such as Hospitals, Covid Centers, Pumping Stations, Mantralaya, Government /Police/MCGM establishments, etc. was restored on first priority.

14.5 The gradual pick up of BEST's demand after restoration process at 11:56 Hrs on 12 October 2020 is as under:

Time	12:00	12:30	13:00	13:30	14:00	14:30	15:00
Demand in MW	50	340	451	533	561	596	624

14.6 In addition to the above, at following major hospitals and Covid centers, where there was no backup generator, BEST's DG sets were deployed during period of grid failure:

1. Sion Hospital – 500 KVA
2. Nair Hospital – 250 KVA
3. St. George Hospital – 250 KVA
4. Castrol Covid Center – 250 KVA

14.7 Delayed restoration of power supply in Mumbai has caused immense hardship to BEST's consumers in the critical Covid pandemic scenario. The prolonged power failure could have been avoided, had Mumbai system survived from outside grid disturbance after operationalization of Mumbai Islanding scheme and if TPC was able to bring its hydro/ thermal generation into service without delay. Hence, further review of Mumbai Islanding scheme considering load/generation balance is necessary.

14.8 Mumbai Generating Companies, Transmission Licensees and MSLDC were aware of critical situation arising due to failure of 400 kV lines in the early morning of 12 October, 2020. Accordingly, a contingency plan should have been initiated to avoid any further grid disturbance.

14.9 Strengthening of Mumbai Transmission is essential to remove the congestion in Mumbai Transmission System. Also, timely execution of the Transmission scheme is necessary.

14.10 Transmission constraints in Mumbai tie-lines compel Mumbai Distribution Licensees to purchase costly power from embedded generators rather than availing option of cheaper power sources from outside. Considering targeted quantum of RPO in ensuing period, in

addition to conventional contractual power, more RE power is anticipated to flow from outside. It is therefore, necessary to expeditiously strengthen MMR Transmission System taking into consideration short/long term perspective to avoid reoccurrence of such grid failure and to ensure free flow of power in the network.

15. **Vide its submission dated 20 October 2020, Gigaplex Estate Private Limited (GEPL) stated as under:**

15.1 22 kV Raheja incomer feeder emanating from MSETCL Substation and supplying power to GEPL tripped at 10:06 Hrs on 12 October, 2020 and entire load (2.69 MW) of GEPL auto shifted from grid to DG sets. GEPL SEZ continued to operate as an Island mode through DG set till restoration of incomer feeder for about 2 Hrs and 32 Minutes.

15.2 At 12:05 Hrs. 22 kV Raheja feeder (Incomer feeder to GEPL) was restored by 220 kV MSETCL, AKP Substation.

16. **Vide its submission dated 20 October 2020, Mindspace Business Parks Pvt. Ltd. (MBPPL) stated as under:**

16.1 On 12 October, 2020, all four 22 kV incomers sourcing power to Serene Electricity Distribution Licensee Div. of MBPPL were tripped at 10:06 Hrs. and entire load of 6.42 MW auto shifted from grid to DG sets. MBPPL SEZ continued to operate in an Island mode for 10 Hrs. and 42 Minutes till restoration of incomer feeders.

17. **Vide its submission dated 20 October 2020, STU stated as under:**

17.1 MSLDC submission shows that (N-1) condition was prevailing prior to occurrence since 10 October 2020. Even with (N-2) condition arising with overvoltage tripping of 400 kV Kalwa – Padghe circuit-I on 12 October 2020, the system was stable. The loss of two more 400 kV lines (i.e. 400 kV Kalwa – Padghe Ckt.-II and Talegaon(PG)- Khargar) created (N-4) operating condition and resulted into operation of Mumbai Islanding Scheme which was only partially successful.

17.2 On 18 and 21 November 2010, partial grid disturbance took place in Mumbai region affecting 425 MW affecting a large part of Mumbai. Due to this major disturbance, an Enquiry Committee under the chairmanship of Dr. S.A. Khaparde, Professor, IIT Bombay was constituted by the Commission to analyse the disturbances and to identify remedies so that such instances may not recur in future.

17.3 The final report on Partial Grid Disturbance in Mumbai System was submitted by Dr. Prof. S.A Khaparde of IIT, Bombay. The suggestions of the Khaparde Committee in its final report and its compliance is summarised as under:

17.4 Short Term Plan:

Sr. No.	Details of work	Status of Plan /Activity		
		TPC	AEML (RInfra)	MSETCL
1	Current Carrying capacity of all the 220 kV Transmission lines in Mumbai need to be calculated and made available to the system	Completed.	Completed	Completed

Sr. No.	Details of work	Status of Plan /Activity		
		TPC	AEML (RInfra)	MSETCL
	operators for ready reference.			
2	There are two settings for overload condition. One is for alarm and other for tripping. All Utilities to check relay configurations for these two conditions to avoid line tripping on overload alarm setting instead of overload tripping setting.	Completed	Completed	Completed
3	Shifting of the Aarey Load to TPC Substation can be explored to relieve Aarey-Borivali lines.	Completed	Completed	N.A.
4	High reliability Special Protection Scheme for automatic load shedding in case of network overloading or tripping must be commissioned.	Completed.	Completed	Completed
5	220 kV double circuit connection between Trombay and Saki as it helps in relieving critical loading during peak before network augmentation takes place.	Interconnection of 220 kV Salsette-Sahar and Sahar-Saki is already established in 2014. WIP for following lines which is expected to be completed by FY22 1. Installation of 220 kV Trombay-Saki SC line in progress (3 tower pending 2 in hutments, 1 with Metro 4) 2. Installation of 220 kV Trombay-Salsette SC line in progress (3 tower pending 2 in hutments, 1 with Metro 4) 3. Thus, Saki RS will have one 220 kV source from Trombay. The other 220kV source for Saki RS will be from Trombay via Salsette RS-Sahar RS.	-	N.A.
6	Auto-closure for hybrid lines considering dynamic line rating keeping in view the environmental conditions and age of line may be implemented.	Auto-closure for hybrid lines is implemented on selected line wherever feasible.	Completed	N.A.
7	Review of protection setting at all interconnecting points between TPC, RInfra, MSETCL and Transmission and Distribution interconnection. Review of existing protection schemes.	Completed.	Completed	Completed

Sr. No.	Details of work	Status of Plan /Activity		
		TPC	AEML (RInfra)	MSETCL
	Relay configuration checks on regular intervals.			
8	Reconfiguration of Alert and Trip mode of relays on account of overload	Action Completed.	Completed	Grid lines setting carried out
9	Single phase auto reclosing scheme to be implemented for all overhead lines including 220 kV lines in Mumbai. Auto reclosing of Hybrid (O/H+U/G) lines	1. It is not feasible for 110 kV lines because these lines are controlled by gang operated breakers. 2. For 220 kV lines, single phase auto-closure is not implemented due to cable section and involvement of Generating stations. However, 3 ph auto-reclosing is implemented for selected lines. 3. The AR is not provided to lines emanating from Trombay thermal generating station for hybrid lines.	Completed	Completed
10	Effect of auto reclosing on Turbine-Generator shaft to be studied	Comparison of effect of auto reclosing on Turbine-Generator shaft is being perused with other utilities having similar set up.	N.A.	N.A.
11	Review of Mumbai Islanding scheme and UFR and df/dt load shedding settings in view of increasing demand.	Action completed. Settings advised by WRPC are implemented. Further study is in progress at WRPC.	Completed	N.A.
12	The under frequency and over frequency settings of generators to be checked to ensure that conservative setting leading to unit tripping does not jeopardize the island.	Completed The under frequency and over frequency settings are checked and adapted as per OEM Recommendation. These settings will not jeopardize the islanding.	N.A.	N.A.
13	In-feed lines and substation equipments at MSETCL Borivali substation should be upgraded by MSETCL to handle higher loading of 220 KV Borivali-Borivali line.	N.A.	N.A.	Completed
14	Enhancing/modifying existing load trimming schemes to avoid tripping of healthy line during contingencies	Completed	Completed	Completed

17.5 Long term measures suggested by Khaparde Committee and action taken are as under:

i. <u>Augmentation in Mumbai generation explicitly or implicitly:</u>

- No Generation is proposed.

ii. <u>400 KV network connectivity and HVDC interconnection to fill up the gap of implicit generation addition</u>:

1000 MW HVDC terminal stations at Kudus and Aarey and HVDC cable link lines between Kudus and Aarey is included in the STU Five Year Plan FY 2019-20 to FY 2024-25 with note as below,

> *"Two HVDC schemes were part of STU plan 2018-19 to 2023-24 with a note that consolidated detail study will be carried out considering all Mumbai related schemes separately. Subsequent STU study indicated that with inclusion of 400 kV Velgaon, 400 kV Kalwa Switching, 400 kV Kalwa-Padghe M/C line etc., these HVDC schemes will not be required. However in view of earlier CEA study in this regard and as HVAC schemes were not referred to CEA, the STU study including these HVAC schemes has been now referred to CEA for their comments. Hence 1000 MW Kudus-Aarey HVDC link is included in the year 2024-25 of this STU five year plan (2019-20 to 2024-25) is subject to averse comments if any by CEA in the matter may lead to deletion of the scheme from STU five year plan*.".

The following 400 kV Substations are in STU Five Year Plan:

(1) 400 KV Vikhroli

(2) 400 kV Kalwa-II (Bus Split)

(3) 400 kV Velgaon

Also, 400 kV Navi Mumbai awarded to M/s. Sterlite under Tariff Based Competitive Bidding (**TBCB**).

iii. <u>400 KV Vikhroli and 400 kV Ghodbunder to be taken up immediately</u>:

400 kV Vikhroli is taken up under TBCB and the SPV, Kharghar-Vikhroli Transmission Pvt. Ltd. (KVTPL) is transferred to Adani Transmission Limited (**ATL**). KVTPL has filed Petition for grant of Transmission Licence before the Commission and 400 kV Vikhroli Substation is targeted for completion in March 2022. 400 kV Ghodbunder is dropped from earlier STU Plan due to land issue.

iv. <u>Possibility of additional interconnection/LILO of existing 220 / 400 KV lines. Bringing extra power to Mumbai by any means to cater to the load growth of Mumbai</u>

The following works are completed / Work in Progress/Planned:

Sr. No.	Description of the scheme	Status
1	220 kV Kharghar – Sonkhar HTLS Conversion	Completed
2	220 kV Sonkhar – Trombay HTLS Conversion	Completed
3	220 kV Kharghar Tap – Trombay HTLS Conversion	Completed
4	220 kV Mulund – Bhandup LILO Section HTLS Conversion	Completed
5	LILO of 220 kV Boisar - Ghodbunder & Tarapur -Borivali at Kudus. (Twin AAAC) -	WIP
6	220 kV Kalwa – Mulund-II HTLS Conversion	Completed

7	220 kV Mulund-II – Trombay HTLS Conversion	WIP
8	220 kV Kalwa – Trombay HTLS conversion	WIP
9	LILO of 220 kV Boisar (M) - Borivali S/c Line at Boisar (PG) Line	Completed
10	220 kV Boisar PG - Boisar (M) D/C HTLS conversion	WIP
11	Conversion of 220 kV Kalwa-Trombay D/C line into M/C	Future Consideration
12	220 kV third circuit between MSETCL Kalwa and Tata Power Salsette (KS line # 5)	Planned
13	400 kV Kalwa – Padgha 4 circuits	planned

v. Implementation of bus splitting arrangement:

a) For reducing high fault level at 400/220 kV Kalwa Substation and adjoining 220 kV Substations existing transmission network, the following Bus Coupler are kept open ;

(i) 220 kV Kalwa-I – Kalwa-II Inter-connector

(ii) 220 kV Mulund

(iii) 220 kV Temghar

b) Creation of 2nd 400 kV Kalwa Substation with splitting of 220 kV Bus with provision of 3x500 MVA ICT and reorientation of existing 220 kV lines to the newly created split bus will resolve the constraints at existing Kalwa Substation. This scheme is part of STU Plan for FY 2019-20 to FY 2024-25.

vi. Pilot project on installation of PMU for availability of synchro phaser data to Control Centres:

A PMU pilot project was carried out by MSETCL. Subsequently, PMUs have also been installed into Maharashtra system by CTU.

vii. Up-grading of substation equipment-

Proposed & Done whenever required.

17.6 Status of the schemes suggested by Standing Committee Report under the Chairmanship of Shri. U.G. Zalte during December, 2011:

Status of transmission proposals in the 5-year Business plan suggested by Zalte Committee is as below.

Sr. No.	Description of Scheme	Implementing Utility	Expected date of COD
Short Term			
1	Second ckt. stringing of 220 kV Borivali (MSETCL) – Borivali (TPC-T) D/D line	TPC-T	Completed
2	LILO of 220 kV Boisar (MSETCL) – Borivali (MSETCL) at Ghodbunder	AEML-T	Completed
3	Early commissioning of 220 KV Chembur	AEML-T	Completed

Sr. No.	Description of Scheme	Implementing Utility	Expected date of COD
Medium Term			
1	220 kV Kalwa – Salsette 3rd and 4th Ckt	TPC-T	Completed
2	Commissioning of 220 kV Saki S/S	TPC-T	Completed
3	Interconnection of 220 KV Saki (TPC-T) – Saki (AEML-T)	AEML-T	Completed
4	Interconnection of proposed 220 KV Versova Substation (TPC-T) – Versova Substation (AEML-T)	TPC-T	Completed
5	400 KV Navi Mumbai (PGCIL)	CTU	WIP
6	400 KV Vikhroli	KVTPL	KVTPL has filed Petition for grant of Transmission Licence before the Commission. Target for completion is March 2022.
Long Term			
1	1000 MW VSC based HVDC between Nagothane to Aarey	AEML-T	Dropped
2	400 kV Ghodbunder	AEML-T	Dropped (Land issue)
3	400 kV Marve (TPC-T)	TPC-T	Dropped (Land issue)

17.7 Following schemes are planned for strengthening of Mumbai system to increase exchange capacity from outside and enhance reliability & security of Mumbai network.

Sr. No.	Year	MMR Peak Load / Embedded Gen. (MW)	Proposed Schemes	TTC (MW)	ATC (MW)
1	2019-20	3907 877	All Trombay I/C line HTLS + Boisar - Boisar HTLS + Boisar LILO	3092	2592
2	2020-21	4024 877	220 kV third circuit between MSETCL Kalwa and Tata Power Salsette (KS line # 5).	3212	2712
3	2021-22	4145 877	400 kV Kudus , 400 kV Vikhroli	3605	3105
4	2022-23	4269 447	400 kV Padghe - Kalwa MC	3902	3402

Sr. No.	Year	MMR Peak Load / Embedded Gen. (MW)	Proposed Schemes	TTC (MW)	ATC (MW)
5	2023-24	5036 447	400 kV Kalwa Split	4581	4081
6	2030-31	6000 447	400kV Velgaon (Planned during 2024-25)	5667	5167

18. **At the e-hearing through video conferencing held on 21 October 2020:**

18.1 Representative of MSLDC explained the grid failure incident that occurred on 12 October 2020 and the chronology of events thereof, as detailed out in its Report and stated that:

i. There was an inadvertent tripping by Station Operator at Kharghar Substation which resulted into outage of 400 kV Talegaon (PG) -Kharghar line.

ii. There was considerable delay in bringing TPC-G Unit 5 and Unit 7 on bar. Also, Hydro Generating Units that are expected to come on bar in short time, but same were also synchronized with the grid with considerable delay.

18.2 Representative of STU stated that:

i. Earlier disturbances were mainly at 220kV level, however this time, two 400kV Substations supply with four 400kV lines were out without any source.

ii. The load in MMR has increased significantly over the time since past disturbances. Hence with change in scenario, it may be required to look into whether there is any need for revision of load trimming settings.

iii. Mumbai Islanding System also needs to be reviewed particularly under the circumstances where the embedded generation capacity is getting depleted.

iv. MSLDC's assessment for allowing outage for the Padghe– Kalwa Ckt II in co-ordination with WRLDC needs to be verified for its correctness.

v. TPC-G informed that Unit 8 would take almost two days for coming on bar. However, the Unit under zero schedule should come on bar much earlier.

vi. The behavior of protection system needs to be analyzed and the reasons for drop in frequency needs to be examined in detail.

vii. Embedded generation capacity may go down with time. The Distribution Licensees need to resort to new technologies for their load management.

18.3 Representative of MSETCL stated that:

i. 400 kV Talegaon (PG) – Kalwa S/C was under breakdown from 10 October 2020 @ 13:47 Hrs due to the conductor snapping at Location No. 33 and 34.

ii. MSETCL's field office had submitted an application for opportunity outage on 400 kV Padghe – Kalwa Ckt. I for replacement of de-capped insulator string at the location No.1044 occurred during the fault on B phase to Earth fault on 10 October 2020. Generally, outage is allowed on Saturday or Sunday. But inspite of MSETCL's request on Saturday or Sunday, MSLDC allowed the outage only on Monday morning i.e. on 12 October 2020. Further, although 400 kV Padghe – Kalwa Ckt. I was tripped due to over-voltage on 12 October 2020 @ 04:33 Hrs., it had been successfully re-closed. MSETCL's field officers had requested MSLDC to cancel the outage, however it was not cancelled by MSLDC. This action of MSLDC may be one of the subject matters of the enquiry. The said line was restored later without attending the maintenance works. Hence it needs to verify the necessity of emergency outage availed on 400kV Padghe – Kalwa Ckt. I on 12 October 2020.

iii. The manual tripping by the Kharghar Station Operator is an unfortunate event.

iv. For 400kV Padghe-Kalwa Ckt. II, there was no sign of sparking, however, conductor was found broken mechanically, the reasons for the same needs to be analysed.

v. MSETCL has been undertaking the due maintenance of these 400kV lines. There was not a single tripping incident for these lines in recent past. Ground patrolling, monkey patrolling, puncture insulator detection, thermography etc. have been done as per schedule. However, MSETCL's internal enquiry would look into all aspects of maintenance and find out as to whether there were any lapses on maintenance activities on these lines which resulted into conductor failure. This enquiry is expected to be completed within two weeks.

18.4 Representative of MSEDCL reiterated its submission as made out in its replies and on the Commission's query as to whether MSEDCL had submitted chronology or events log in its replies, MSEDCL stated that its replies have been based on details compiled from various EHV Substations reading affected load and affected areas, however, MSEDCL will submit the detailed chronology of events as per directions of the Commission.

18.5 Representative of BEST, MBPPL and GEPL reiterated their submissions as made out in their respective replies.

18.6 Representative of AEML-G reiterated its submission as made out in the replies and stated that:

i. Both Units of DTPS successfully operated in islanded mode as per the present islanding scheme. However, Unit 2 which is having old governor system, did not respond quickly to the load thrown off condition and the Unit tripped later while re-synchronization with grid during restoration.

ii. On the query from the Commission about frequency, AEML-G stated that as per records, the frequency had reached as low as 46.6 Hz.

iii. Responding to the Commission's query as to how AEML Islanding System could survive, AEML-G replied that same was the result of the effective load management/curtailment undertaken by AEML-T and AEML-D.

18.7 Representative of AEML-T stated that:

i. AEML-T has fully automatic Islanding System wherein the tie-line power, Unit generation and system load is recorded and monitored in real time continuously. At 48 Hz, automatic load disconnection takes place to reduce the load on system with due consideration of the critical and priority loads.

ii. On account of automatic load management system, AEML islanding system could survive and the critical load were supplied till complete system restoration.

iii. Restoration was completed with TPC through TPC Versova-AEML Versova connectivity at 01:58 Hrs on 13 October 2020 and with MSETCL through MSETCL Borivali–AEML Aarey at 17:29 Hrs on 13 October 2020.

18.8 Representative of AEML-D stated that:

i. 33kV feeders of AEML-D are equipped with frequency-based load shedding features. Total 51 nos. of 33 kV feeders, being the priority feeders, were in service. Rest Feeders were affected from TPC end. TPC-D did not charge the feeders as per priority resulting into off-supply to Hinduja Hospital, Swastik Hospital etc. TPC has given priority to its consumers and discriminated AEML.

ii. On 5 April 2020, AEML had shared a list of critical feeders to TPC. In 2014, similar incident had occurred, and the Committee appointed by the State Government had recommended that there should not be any discrimination by the Transmission Licensees towards any Distribution Licensee while reconnecting the loads.

18.9 Representative of TPC reiterated its submission as made out in its replies and stated that:

i. As per SLDC's instructions, Hydro Units were picked up but same could not be synchronized with the grid.

ii. At 47.9 Hz, the Islanding System operated but the system didn't survive. At 47.7 Hz, AEML system was islanded from TPC system. But TPC Islanding System could not survive as the rate of frequency decline (df/dt) was very high (upto 3 Hz per second). Islanding System can survive if the df/dt is upto 1.

iii. Rate of frequency decline was so high that before breaker operation could complete, the frequency dropped significantly.

iv. On the Commission's query as to whether such frequency decline was the rarest event, TPC replied that it is a significantly high df/dt and TPC has approached IIT to get this phenomenon examined by them.

v. Since 1997, there is no failure of Mumbai Islanding System. Initial analysis of TPC suggest that islanding system works effectively in generation rich system. In past Islanding events, the embedded generation was around 80 to 90% of the load. However, in present event, almost 60% of power was from outside Mumbai and also almost 1000 MW availability was dropped at Kalwa Substation. TPC-G generation was picking up, but the system changes were so rapid in its transient state that Islanding System could not operate successfully.

vi. Considering the fact that embedded generation capacity is reducing over the time, Mumbai demand is increasing, and more and more power being received from outside Mumbai, review of existing Islanding System and review of frequency setting needs to be undertaken.

vii. Last islanding has happened in FY 2007 but it is a matter of fact that the embedded generation is going down since FY 2012.

viii. For Unit 7, TPC had to follow up with GAIL for gas requirement. Unit 8 was out of service since last 6 months and was kept on preservative mode. Typical Start-up time is around 8 to 10 hours from the cold start. Unit 5 is also old unit and has outlived 35 years of service and hence it took time to come on bar. Start-up under total shutdown takes time as compared to start-up of the units when the power from grid is available.

ix. TPC has formed an internal committee to analyse the event and look into the technical issues in detail.

x. On query raised by the Commission, TPC stated that Automatic load shedding system exists at Trombay and there is no need for manual intervention.

xi. In 1995 also, Islanding System could not survive as fault was at Kalwa Substation. The distance from the fault location also impacts the amount of disturbance at a particular Generating Station and AEML system could survive, probably because DTPS is far away from fault location. Had the fault location been near Borivali Substation, AEML system could have faced similar problem as TPC faced.

xii. There is neither formal protocol from AEML for critical load supply nor a list of critical loads have been furnished by AEML. TPC has no intention for discriminating AEML-D's consumers.

xiii. On query from the Commission, TPC clarified that supply to Railways was restored at 11.30 am on priority.

xiv. It needs to examine as to why load trimming system at Kharghar could not operate.

xv. As the ratio of embedded generation and incoming power is changed significantly, the Islanding System needs a relook alongwith WRPC's involvement. Corridor may be strengthened, but still islanding would be an issue for meeting internal load in case of grid failure outside Mumbai.

Commission's Analysis and Rulings:

19. Under Section 2(32) of EA, the Grid has been defined as the high voltage backbone system of inter-connected transmission lines, sub-stations and generating plants. Thus, although MSLDC is the apex body for ensuring integrated operation of the power system in a State, all Generating Stations, Transmission Licensees, Distribution Licensees and other entities connected to InSTS need to operate their own plants/systems in a such manner that the grid security and reliability is maintained. Thus, Grid security and reliability becomes the collective responsibility of all the stakeholders which needs to be discharged by all concerned with due regard to the roles and

responsibility as mentioned in the Grid Code Regulations. Accordingly, it becomes important to examine as to whether all concerned entities including MSLDC have acted/responded during the grid disturbance effectively and in a timely manner consistent with their respective roles and responsibilities laid down under the Grid Code Regulations. It is necessary to find out as to what happened at individual stakeholder level and what needs to be done in future at individual stakeholder level and collectively at systems level to avoid recurrence of such event.

20. The Commission notes that in the past, when similar incidents had occurred, the studies had been undertaken by the Commission through Expert Committees to find out the primary reason for the grid disturbances and based on recommendations, glaring difficulties were rectified. However, the long-term plans for infrastructure augmentation/development seem not to have materialized in toto as was expected. Accordingly, it is necessary to examine as to whether the delay in implementation of recommendations/suggestions of the Committees had any bearing on the partial grid failure of MMR that occurred on 12 October 2020.

21. The Commission further notes that the partial grid disturbance on 12 October 2020 affected a greater part of MMR region affecting lakhs of consumers. While such grid incidences cannot be totally avoided, its frequency can certainly be minimized and the damaged in terms of period of interruption could be limited. Also, the area affected can be limited by taking immediate and proactive steps upon occurrences of such events. Further, there are certain additional provisions made for Mumbai such as Mumbai Islanding System, Standby Charges being paid for by the Mumbai consumers, infrastructure cost being paid, necessary protocols already laid down etc. Hence, it is a reasonable expectation that the consumers get reliable power without such major grid incidents. Therefore, it is necessary to identify the correct reasons behind such grid disturbances and also to find out as to whether there are any lapses on part the of any entity due to which the grid disturbance has occurred.

22. The Commission further notes all the stakeholders have submitted their own assessments for the probable reasons for the partial grid failure. Failure of Islanding System, delay in bringing the Generating Units on bar, permission for outage for 400 kV on working days when another important 400kV line was already under breakdown outage, possible inadvertent tripping by the Station operator at Kharghar Substation, delay in load management / load disconnections, inadequate load trimming etc. are some of the reasons stated by the stakeholders. However, verification of individual submissions and root cause analysis by independent experts would be necessary to find out exact reason for the incident. This analysis would also help to take appropriate (immediate and medium term) remedial measures for ensuring that such incident do not recur in future.

23. In light of the above, the Commission deems it appropriate to appoint an Independent High Level Committee to analyze the submissions of all the Parties, to find out the root cause of the incident, to examine the adequacy of protections systems/ islanding systems etc., to verify adequacy of responses of all concerned, adherence of Grid Code Regulations etc. The proposed Committee should also suggest remedial measures on immediate and medium-term basis and corrective actions to avoid such incidents in future. Such remedial measures shall also include various feasible technological option which would help to avoid such incidence. Formation of the High Level Committee, its

terms of reference for deliverables, the time frame for submission of the Report, secretarial support to the Committee shall be specified in a separate notification of the Commission.

24. Based on submissions made by the Parties during the hearing dated 21 October 2020, the Commission also notes that the Parties (such as MSLDC, MSETCL, STU, TPC etc.) have either constituted internal enquiries or internal studies to find out as to whether there had been any lapses internally or to find out technical reasons behind the incident. The Commission directs that the internal enquiries should be completed in a timebound manner fixing the responsibilities in case of serious inadvertence/lapses. Further, the studies initiated should be concluded in timebound manner with the objective to improve upon various aspects such as system protections, routine maintenance activities, design of the material/equipment being procured, training, documentation etc. The Commission directs the Parties to submit the outcome of their internal enquiries and the internal studies to the Commission and also to the High Level Committee constituted by the Commission.

25. Hence, the following order:

ORDER

1. Suo Moto Case No. 202 of 2020 is disposed off.

2. An enquiry is ordered by an Independent High Level Committee to verify and analyze the submissions of all the Parties, to find out the root cause of the incident, to examine the adequacy of protections systems/ islanding systems etc., to verify adequacy of responses of all concerned, adherence of MERC (State Grid Code) Regulations 2020 etc. The constitution of the Independent High Level Committee would be separately notified after the issue of this Order. The scope of the work and the time frame for submission of the Report shall also be specified in the above notification.

3. Upon receipt of the Report of the Committee, the Commission would take further decision in the matter in according to provisions of the Electricity Act, 2003.

4. The Commission directs the Parties to submit the outcome of their internal enquiries and the internal studies to the Commission and also to the Committee constituted by the Commission.

Sd/-	**Sd/-**
(Mukesh Khullar)	**(I.M. Bohari)**
Member	**Member**

(Abhijit Deshpande)
Secretary