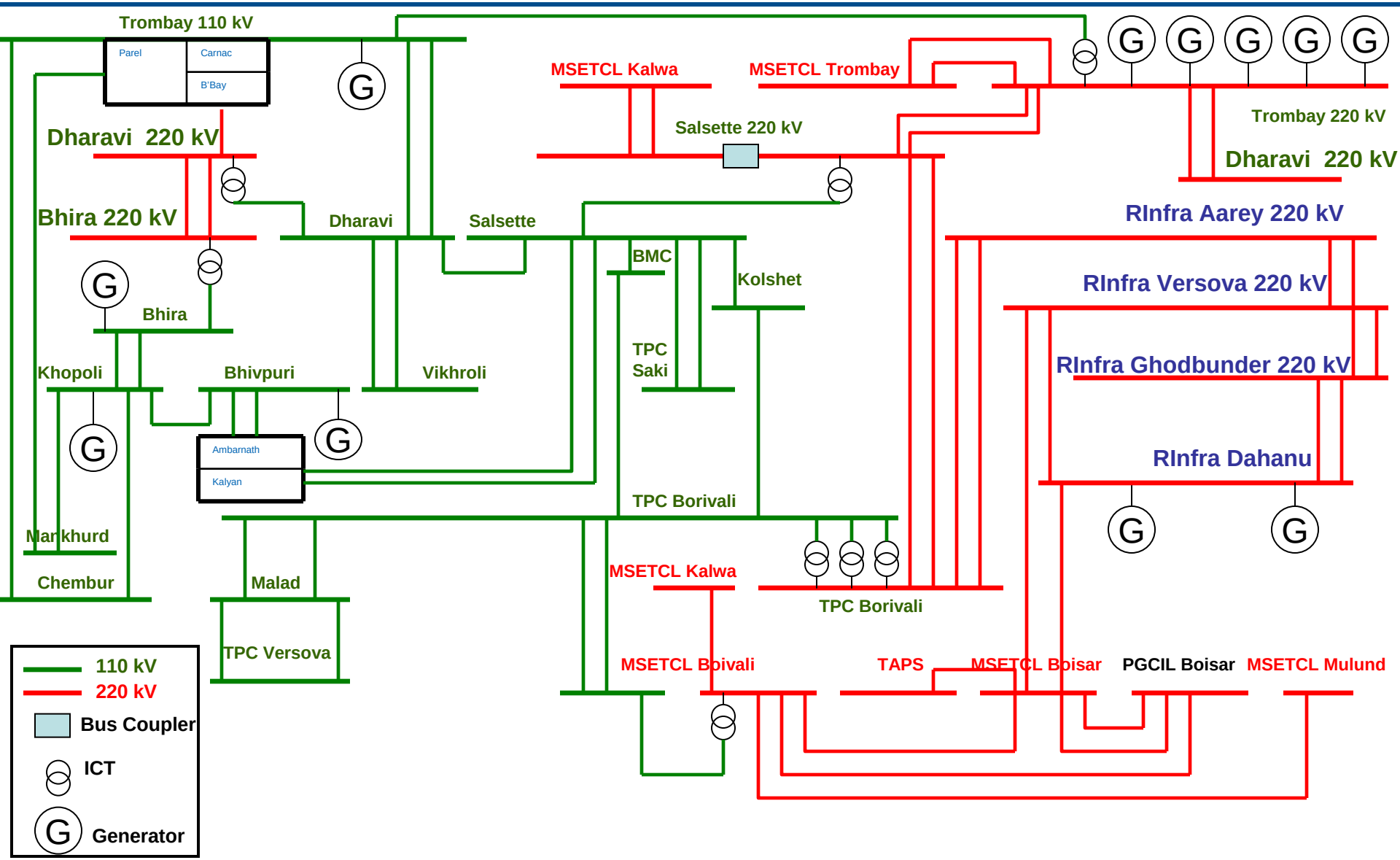
Grid Disturbance in Mumbai

Date:25/11/2010

Reliance Infrastructure Ltd.

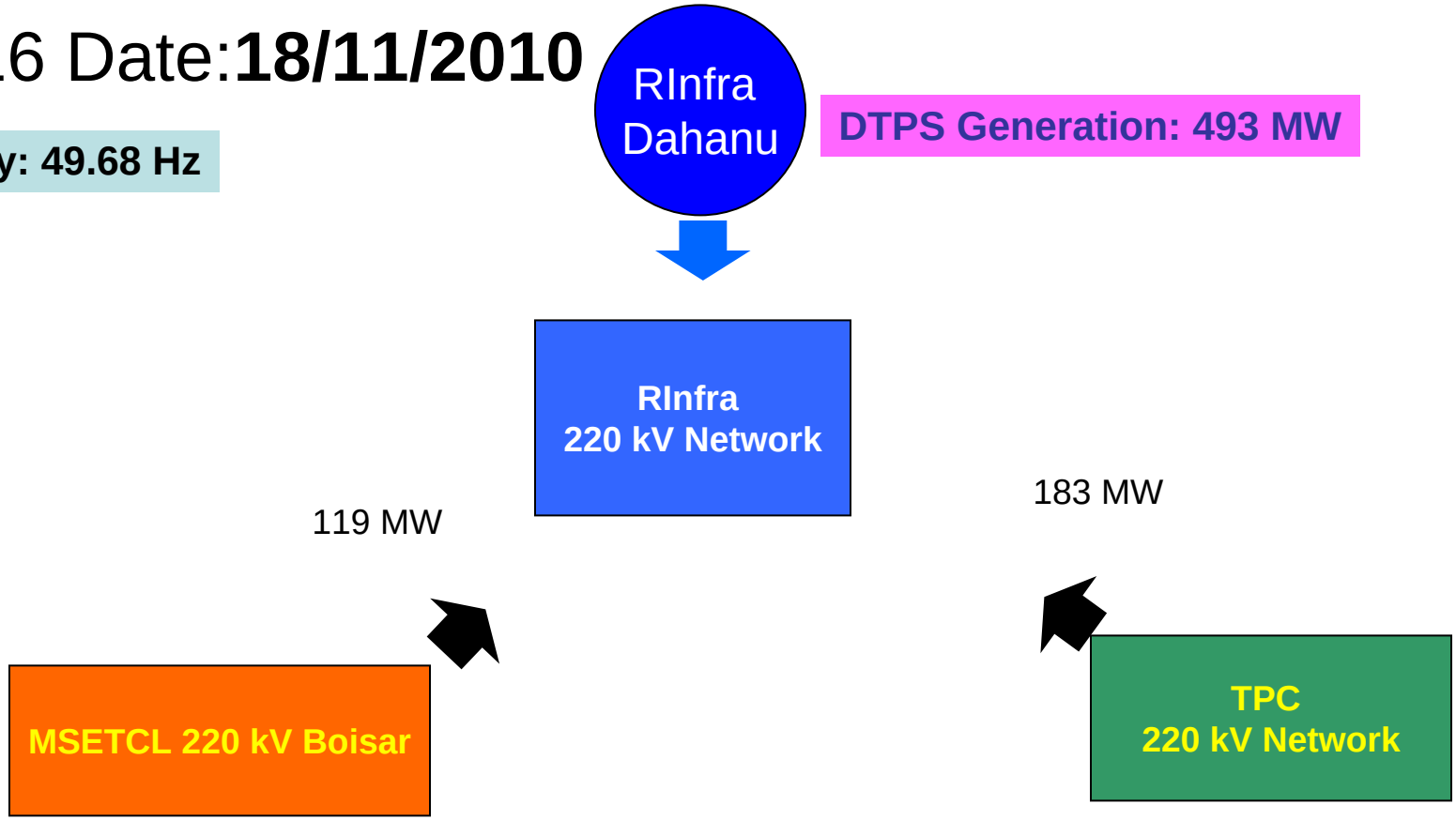
Transmission Network for Mumbai



Grid Disturbance: 18/11/2010

@ 17:39:16 Date:**18/11/2010**

Frequency: 49.68 Hz

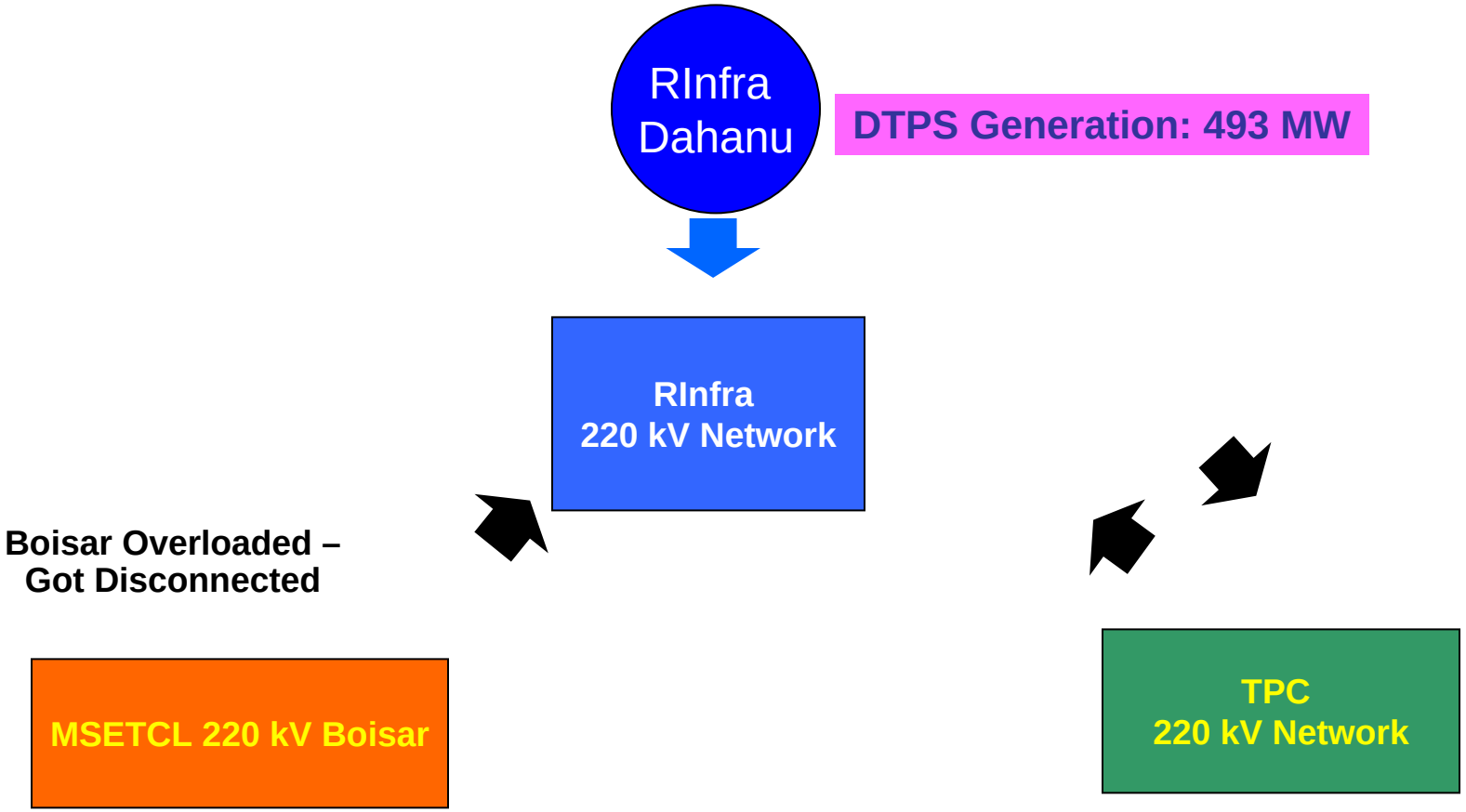


@ 17:39:17

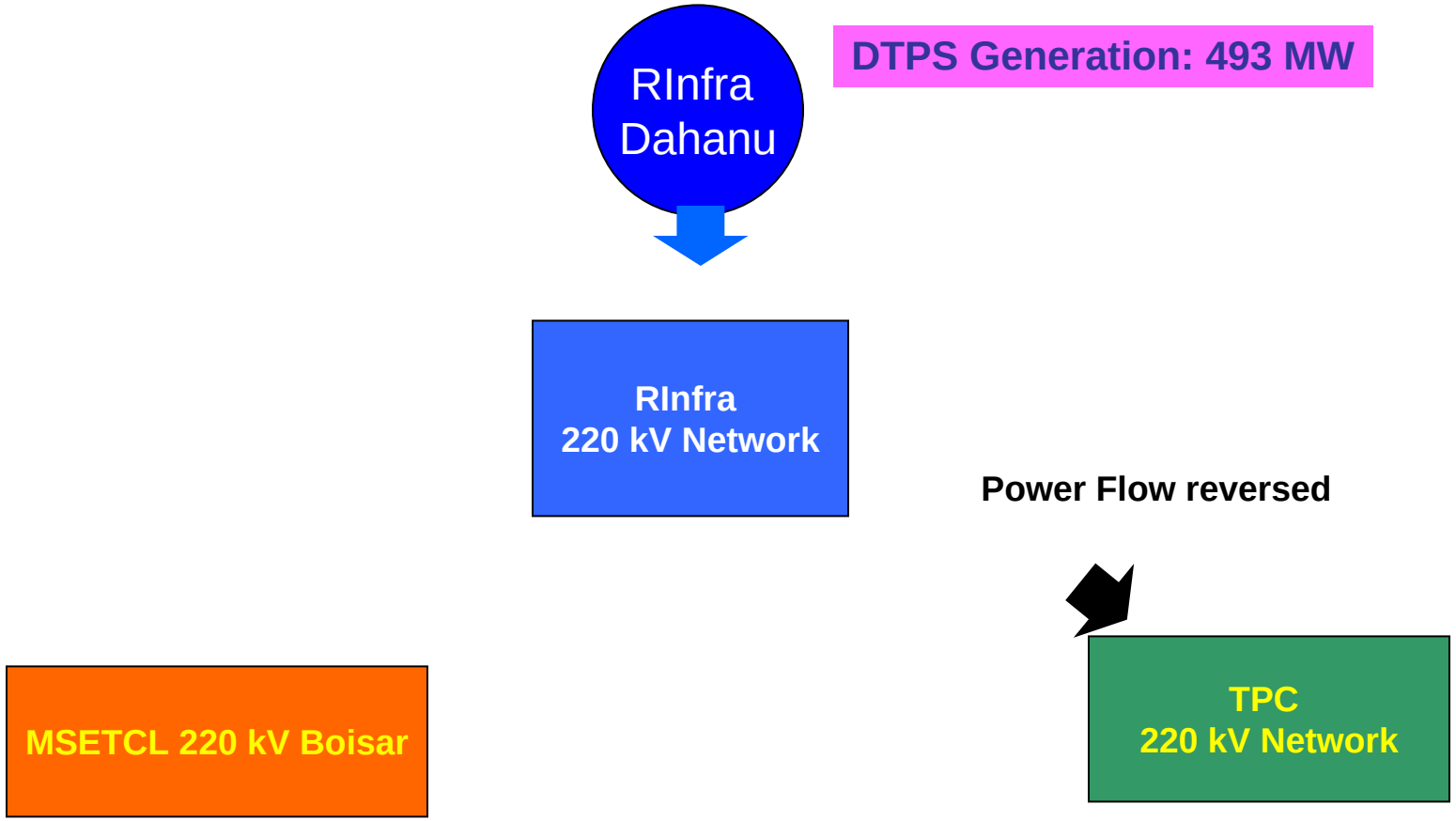
Trombay-Salsette -1 Tripped

Heavy jerk experienced with a voltage dip

Subsequently Trombay-Salsette -2 Tripped

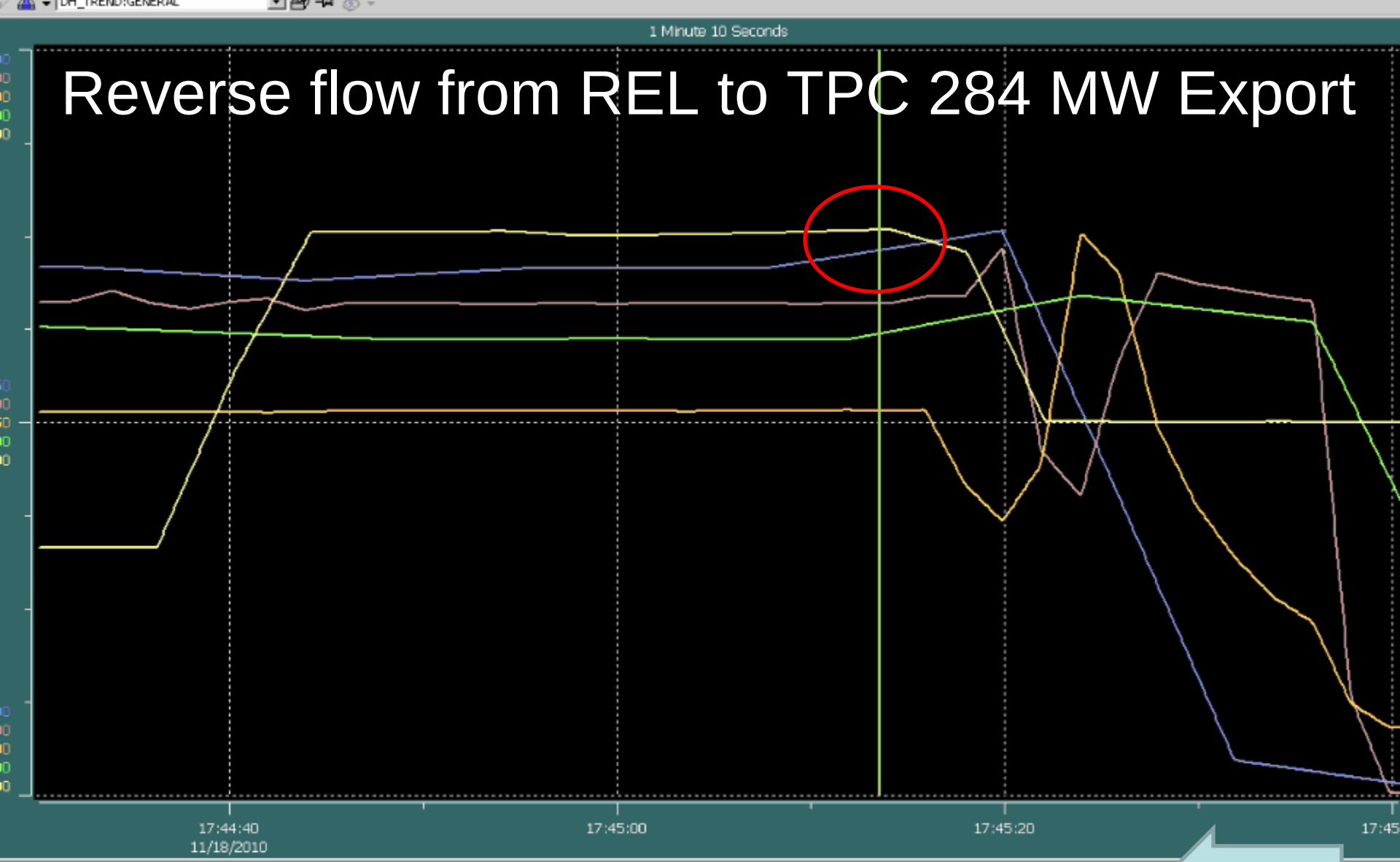


MSETCL Borivali ICT Trips. TPC Boivali fed by Boisar and DTPS
Boisar Interconnection Trips on overloading.
Frequency begins to deep. Load shedding at RInfra initiated at 48 Hz



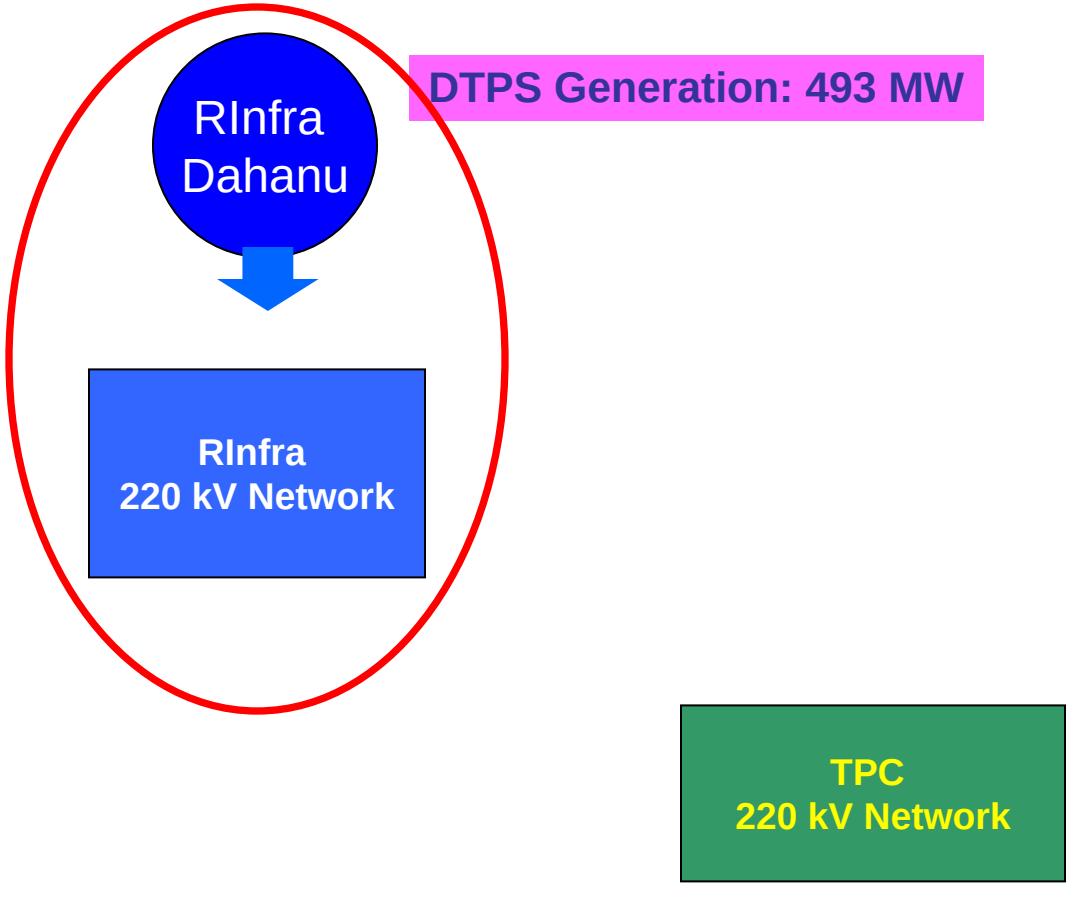
Power flow Reversed. Aarey Borivali now exporting power
Frequency begins to dip. Load shedding at RInfra initiated at 48 Hz (400MW + load Sheded)

Reverse flow from REL to TPC 284 MW Export

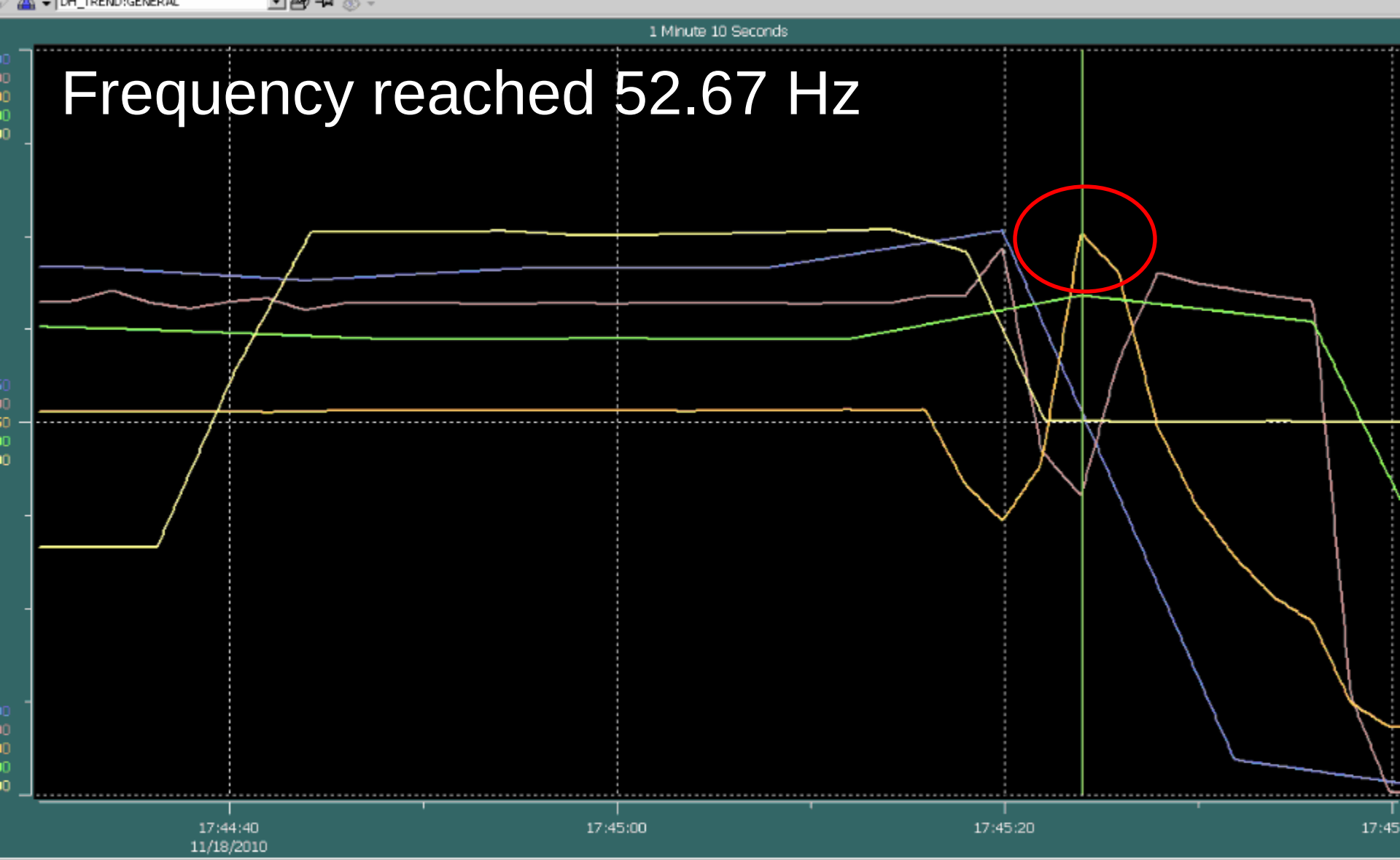


45 Minutes | 11/18/2010 5:45:05 PM

S	T	Object Na	Object Descripti	Aspect	Propert	Log Na	Current Valu	Low Ra	High R	Ruler Time	Ruler Value	Mean V	Min Val	Max Val
		ActPow	DGT1 ACTIVE PO	Control	Value.V	Log1	248.28	-1.00	350.	11/18/2010 05:45:13 PM	255.59	200.60	4.51	264.64
		ActPow	DGT2 ACTIVE PO	Control	Value.V	Log1	245.62	-1.00	371.	11/18/2010 05:45:13 PM	244.23	229.93	0.00	272.01
		Bus1freq	BUS 1 FREQUENC	Function	In.IOVal	Log1	50.04	44.0	55.0	11/18/2010 05:45:13 PM	49.68	49.20	45.00	52.27
		Dahanu_Ad	IMP/EXP MVAR	Applicati	gIMP_E	Log1	-30.94	-150.	100.			-4.26	-49.35	44.92
		Voltage	BUS 1 VOLTAGE	Control	Value.V	Log1	222.44	0.00	350.	11/18/2010 05:45:13 PM	216.79	216.86	139.80	234.50
		IMP_EXP	IMP/EXP	Function	In.Value	Log1	-295.74	-550.	550.	11/18/2010 05:45:13 PM	284.11	132.80	-184.73	284.50



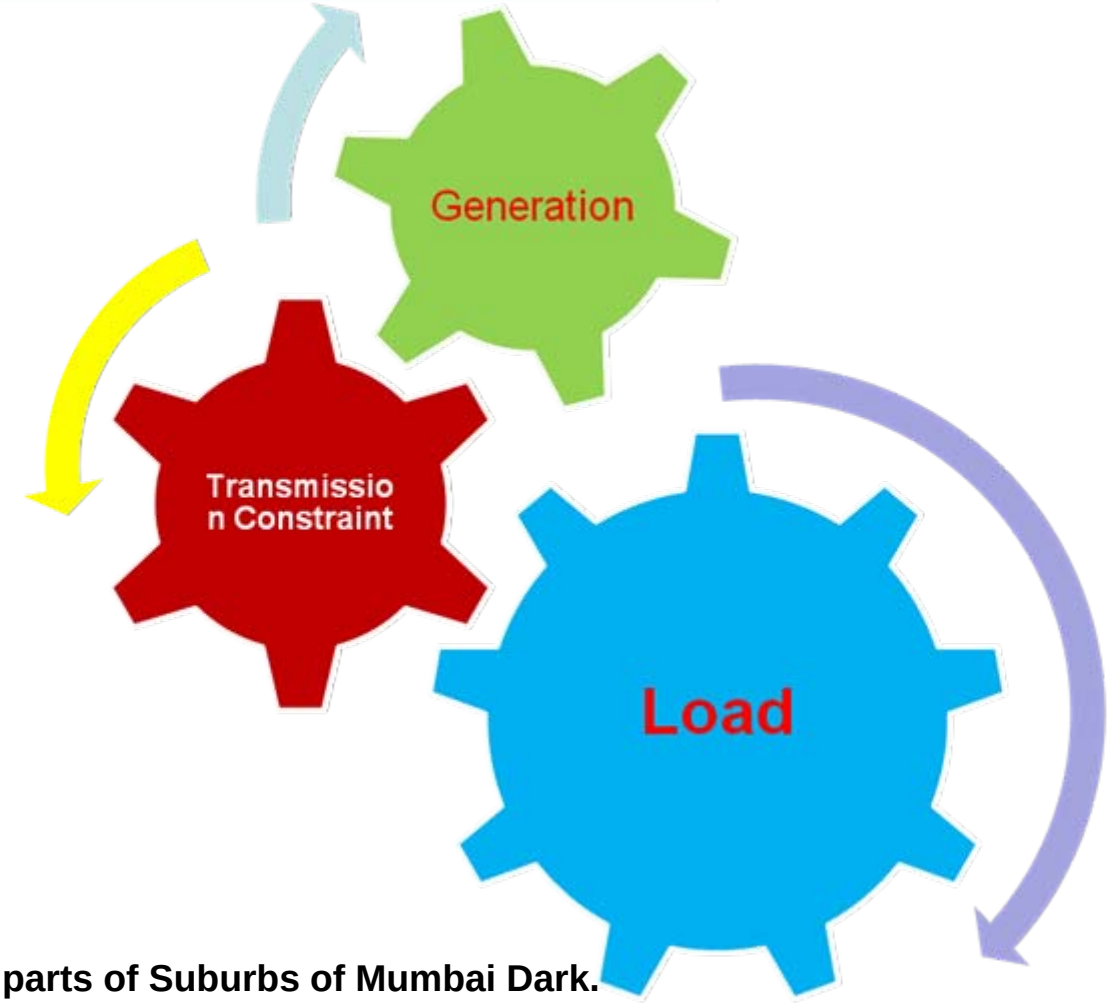
DTPS and RInfra-T forms an independent Island. DTPS feeding balance load of RInfra Frequency Shoots above 52 Hz.



S	T	Object Na	Object Descripti	Aspect	Propert	Log Na	Current Valu	Low Ra	High R	Ruler Time	Ruler Value	Mean V	Min Val	Max Val
		ActPow	DGT1 ACTIVE PO	Control	Value.V	Log1	248.66	-1.00	350.	11/18/2010 05:45:24 PM	178.42	200.60	4.51	264.64
		ActPow	DGT2 ACTIVE PO	Control	Value.V	Log1	244.70	-1.00	371.	11/18/2010 05:45:24 PM	152.07	229.93	0.00	272.01
		Bus1freq	BUS 1 FREQUENC	Function	In.IOVal	Log1	49.91	44.0	55.0	11/18/2010 05:45:24 PM	52.27	49.20	45.00	52.27
		Dahanu_Ad	IMP/EXP MVAR	Applicati	gIMP_E	Log1	-34.97	-150.	100.			-4.26	-49.35	44.92
		Voltage	BUS 1 VOLTAGE	Control	Value.V	Log1	222.12	0.00	350.	11/18/2010 05:45:24 PM	234.43	216.86	139.80	234.50
		IMP_EXP	IMP/EXP	Function	In.Value	Log1	-297.26	-550.	550.	11/18/2010 05:45:24 PM	1.01	132.80	-184.73	284.50

DTPS turbine Tripped on Over speed- Mechanical Operation

DTPS Unit 1 trips



Demand Supply imbalance
Frequency dipped
DTPS Unit-2 tripped on UF

Major parts of Suburbs of Mumbai Dark.
Salsette Bus Coupler Closed. Restoration Operation begins

System Restoration

220 kV Network Line's Restoration

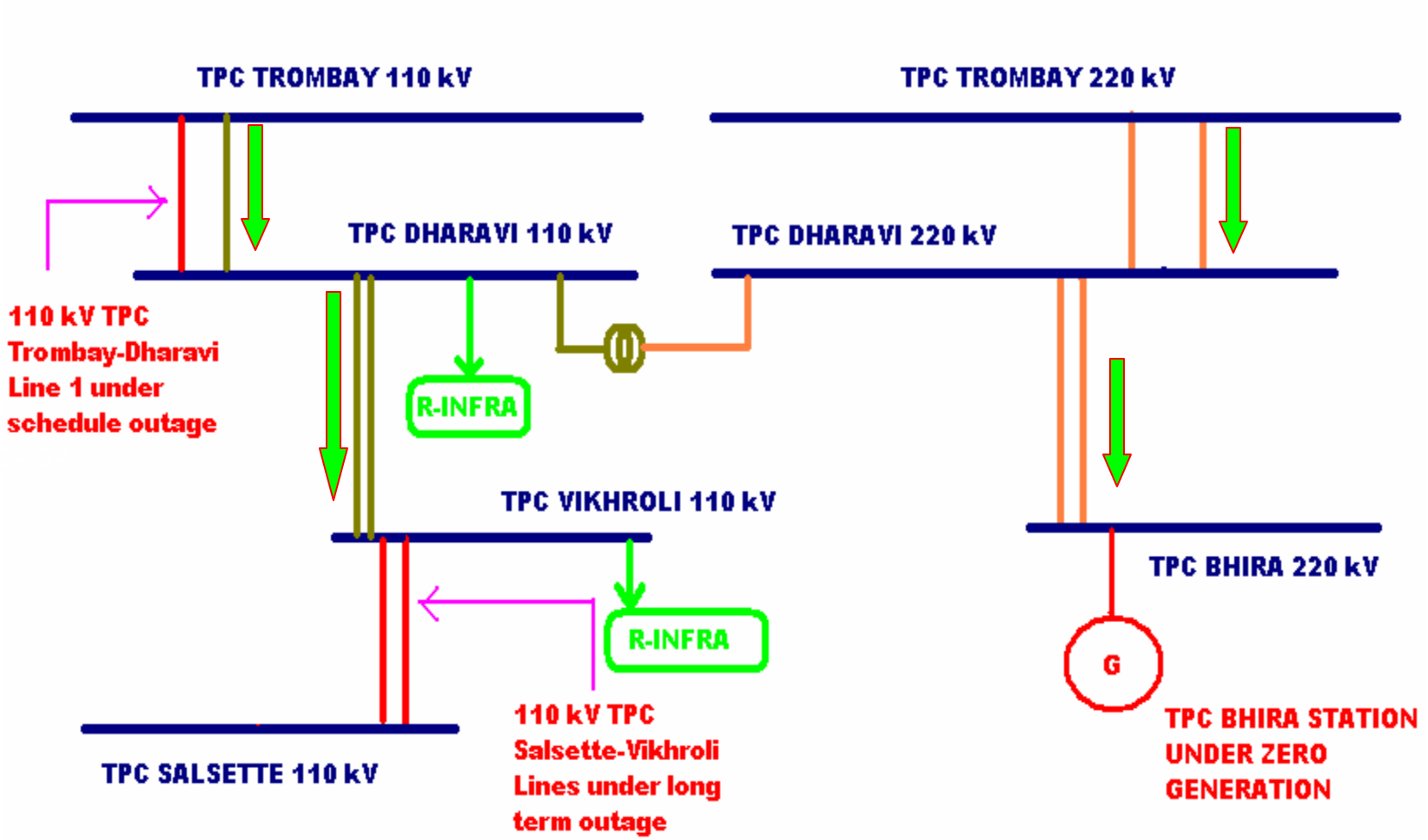
- 220 KV Bus at Aarey was charged from TPC Borivali at 17:55 Hrs
- Start Up power was extended to DTPS @ 18:04 Hrs from 220kv MSETCL Boisar – Dahanu.
- Unit -2 was synchronized @ 20:12 Hrs
- Unit -1 was synchronized @ 21:18 Hrs

Distribution Restoration

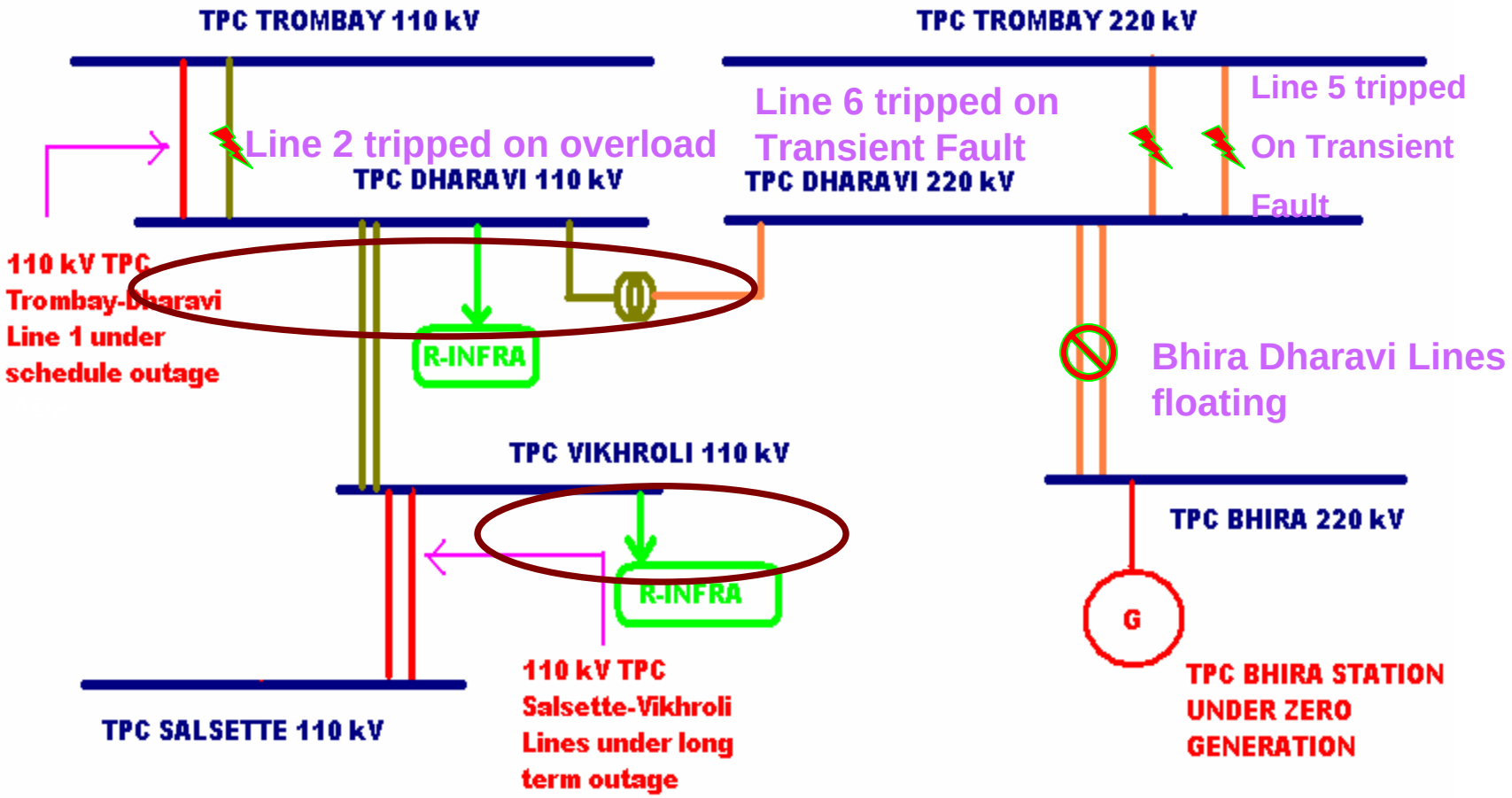
- Area-wise Restoration of R-Infra Distribution Loads carried out in phase manner
- Part of Mira, Dahisar and Ghodbunder under rotational load shedding (40 MW approx.) to avoid Overloading of PGCIL (Boisar) Lines as per the instructions from MSLDC.

Incidence 21/11/10

Scenario 1 – Pre Disturbance Scenario



Scenario 2 – During Disturbance Scenario



Key Observations

1. Tripping of 220 kV Lines

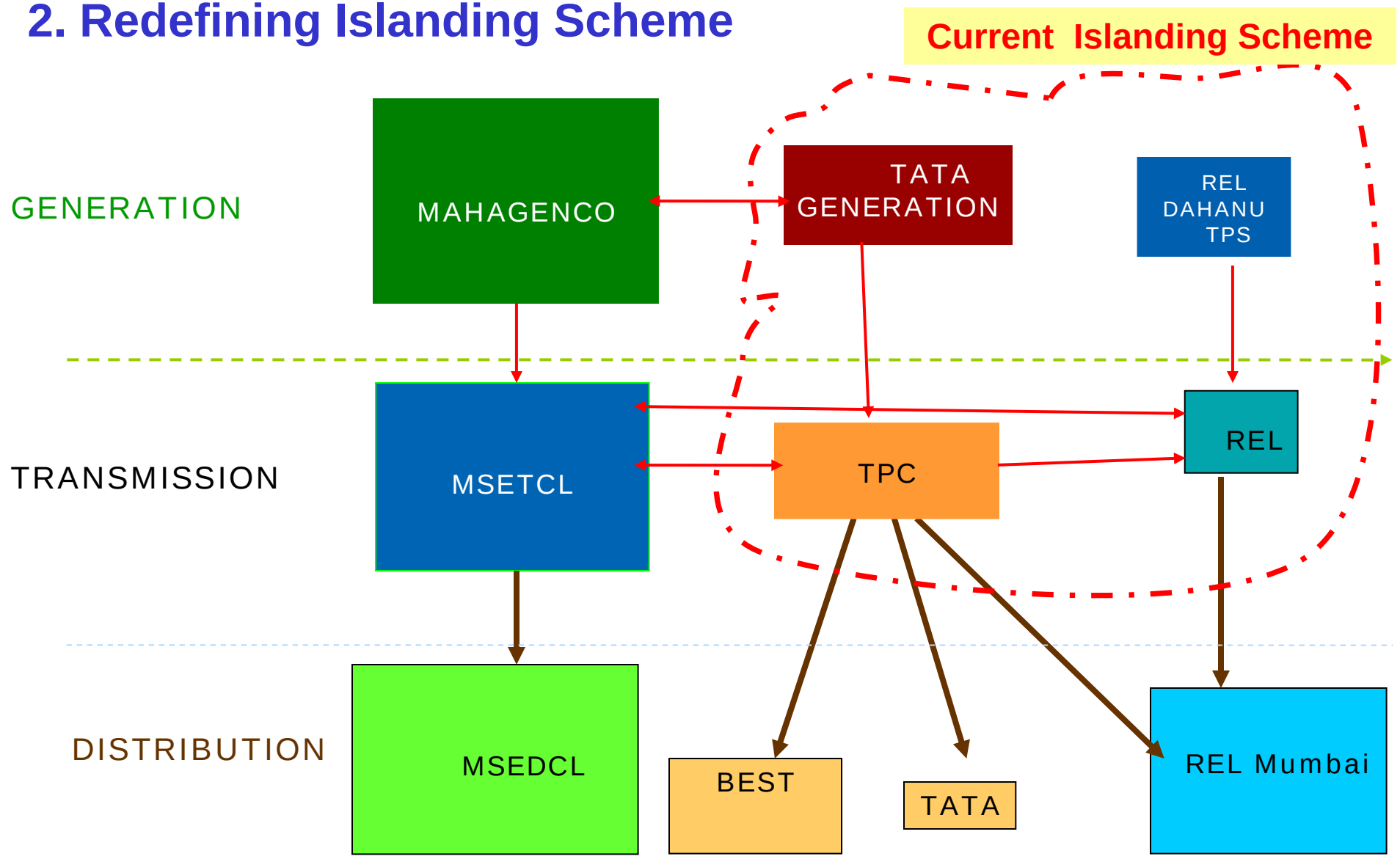
- Single Line tripping due to transients
- Single Line tripping due to faults
- Double circuit Line tripping
- Double circuit line tripping due to tower collapse

Such occurrences should not result in total grid failure

System redundancy lost

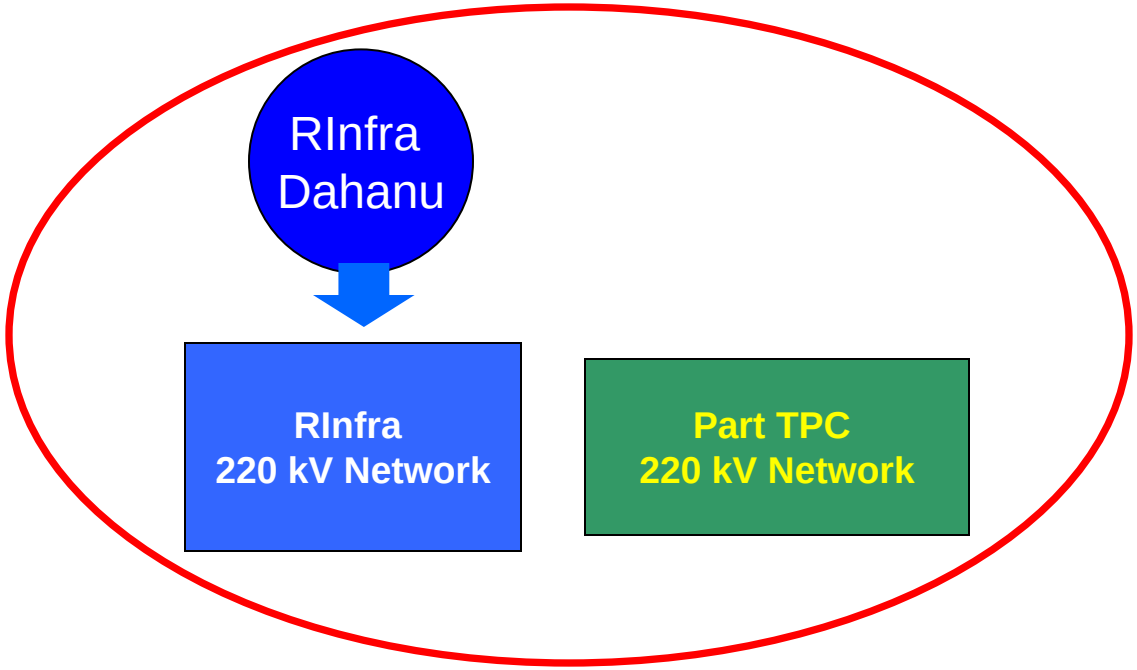
Network fragile

2. Redefining Islanding Scheme



Follow up action on the Order issued on 27th June, 2007 in Case No. 16 of 2007& Recommendations implemented.

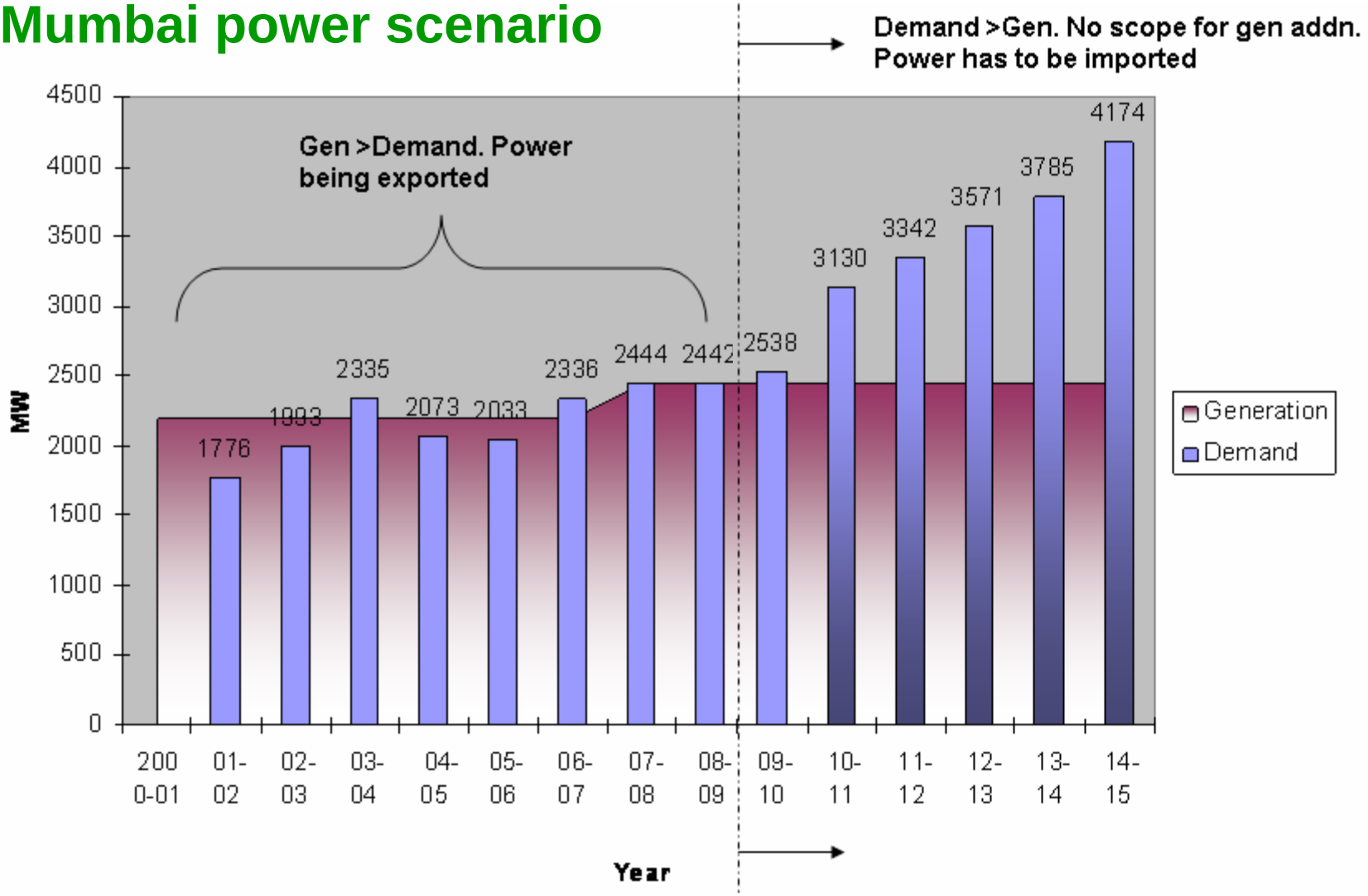
Islanding did not fail. However, the scenario is changing……



Mumbai Islanding system needs to be relooked

Core technical team needs to be formulated

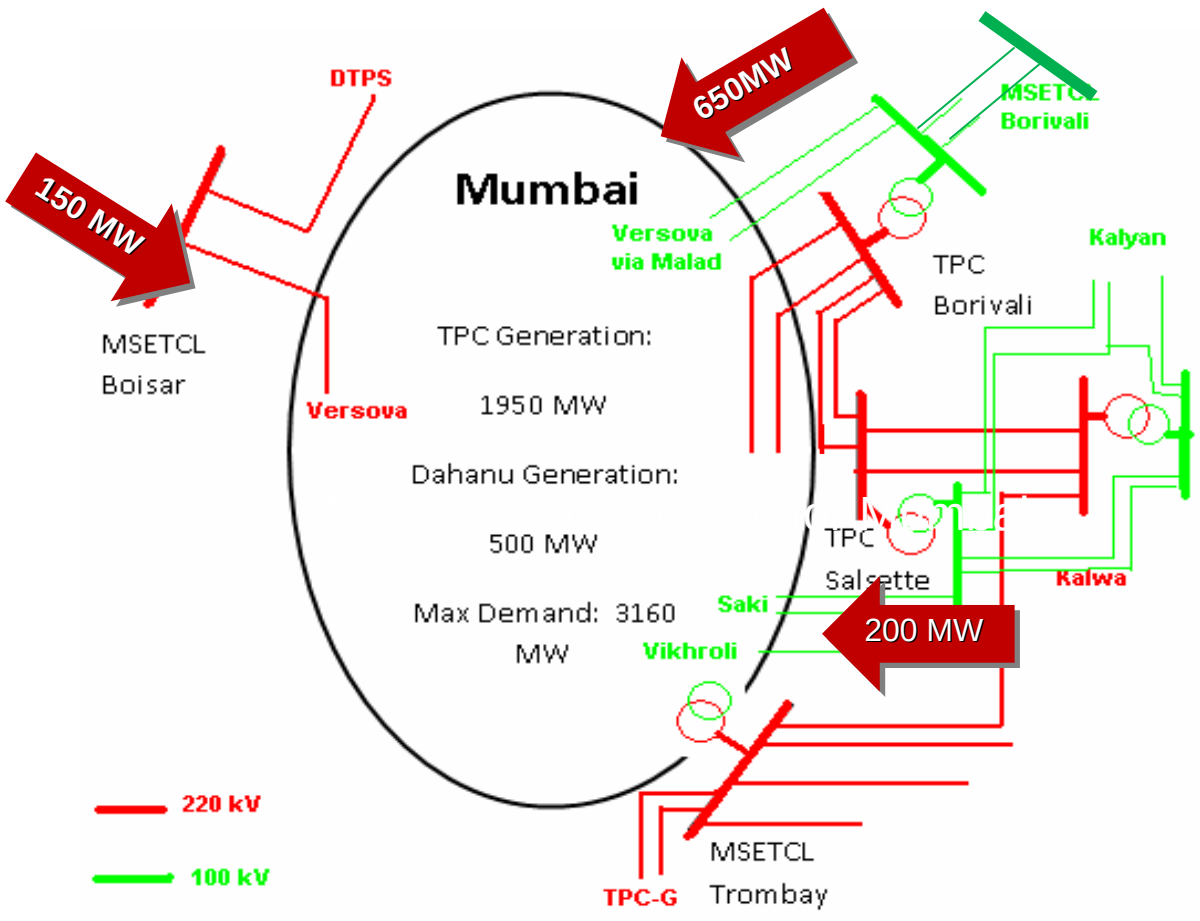
3. Mumbai power scenario



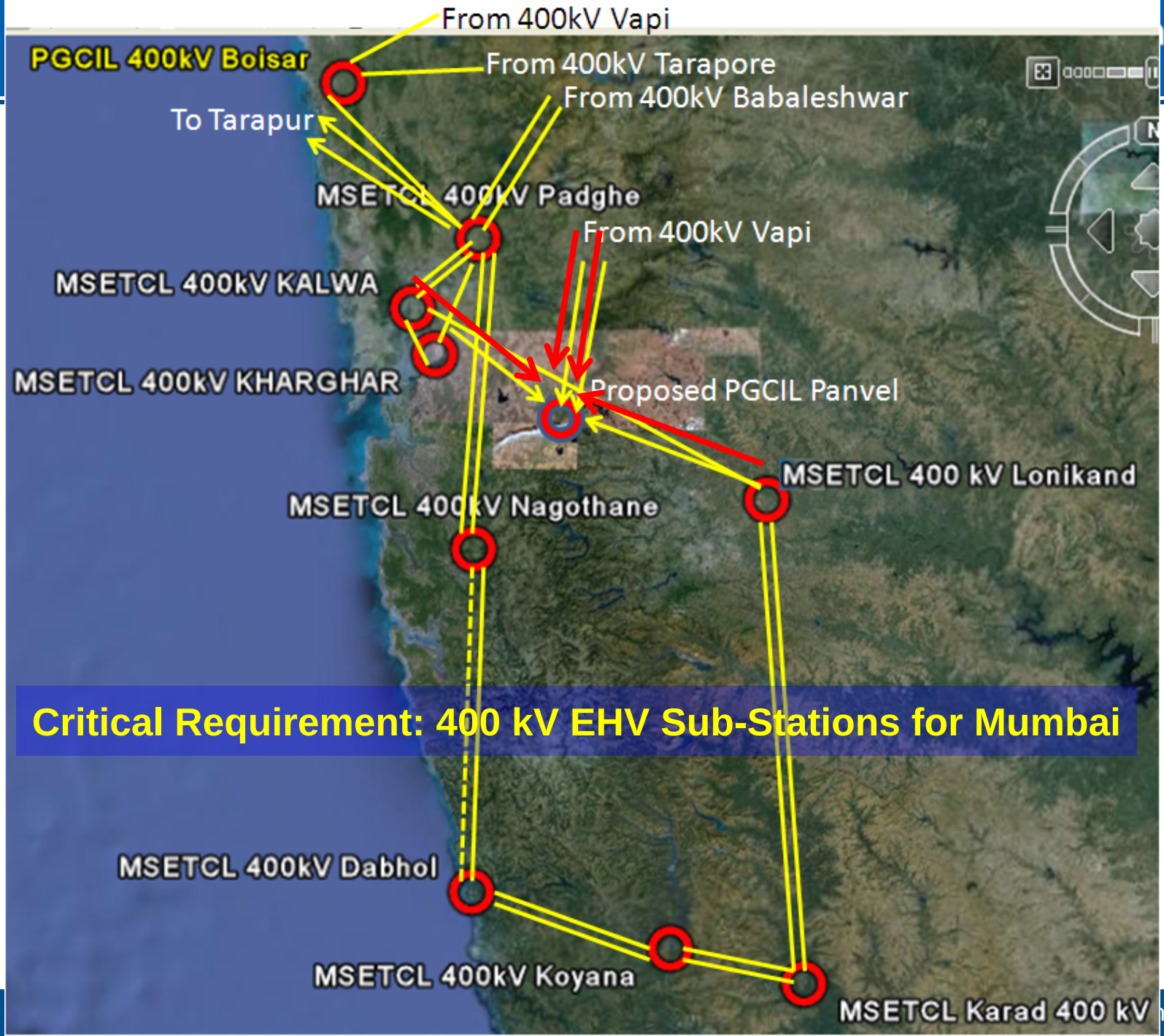
Mumbai power scenario Cond...

- Demand to continue with increasing trend YOY in the future
  - Demand-supply gap to only increase from hereon
  - Power has to be brought from outside
    - *Multiple connectivities – need of the hour!*

Concerns : Transmission Corridor



Existing capacity of transmission lines to bring power from outside Mumbai : 1000 MW.
Peak capacity usage recorded :800+ MW



Critical Requirement: 400 kV EHV Sub-Stations for Mumbai

Geographical Constraints

- Mumbai surrounded with Forests on one end and sea on the other sides
- No corridor available for Overhead transmission lines for bringing power

Solutions to build Redundancy…

Need of Multiple Grid Connectivity

(Addressed in Various forums)

Addressing to immediate Solutions

Major Lines for Bulk power (Schemes proposed)

Forward Path…

- **Islanding scheme to be revisited with Expert technical team**
- **Coordination with SLDC**
- **In-Principle Clearance from MERC for Bulk Power Schemes to Mumbai to be granted on priority**
- **Address the RoW issues in the State Co-ordination Forum and State Advisory Committee**

Thank You

25th November' 2010