

5th April 2020

***Pan-India lights switch off for
9 minutes @ 9 PM***

Impact on Indian grid Operation

Run-up to the event

Internal meeting between NLDC and RLDCs on 03rd April, 2020 on various measures to be taken for the secure and reliable grid operation

Discussions with high level officials of Ministry of Power on 03/04 April, 2020 to ensure smooth grid operation in support of the PM's call in coordination with all power sector stakeholders

Emergency FOLD meeting between pan-India SLDC, RLDC and NLDC through video conferencing at 1130 hours on 4th April 2020

- Advisory issued for reliable & secure system operation during the lighting load switch off on 05th April 2020 at 21:00 hrs for nine (9) minutes

Interactions with all major generators and regional entities such as NTPC , NHPC, THDC, SJVN, SSP ,TEESTA ,SASAN, CGPL etc. on 4th April 2020

Elaborate mock exercise on hydro ramping was carried out on 4th April 2020 night and 5th April 2020 morning.

Internal review meeting on 05th April, 2020 regarding preparedness and actions

Continuous monitoring by MOSP and Secretary (Power) during the event !

Advisory



General guidelines

Estimate of Demand Reduction (State-wise/Region-wise)

• 12 – 14 GW

All communication channels and links including telephones to be available at all LDCs

Scheduled interchange to be maintained

RRAS instructions to be given by NLDC/RLDCs as per real time conditions

HVDC set-points to be toggled for inter-regional transmission margins availability

Strengthening of control room staff at all LDCs

All entities to ensure black-start facilities in healthy condition

Only domestic home lights in the houses have to be put off voluntarily. No street lights, common area places, hospitals and other essential services have to switch off their lights.

Generation and Frequency Control

All clocks synchronized to IST

Hydro to be conserved during evening peak; to be replaced with thermal and gas

After evening peak, thermal would be reduced to technical minimum with increase in hydro till 2055 hrs

Hydro and gas would be ramped down from 2057 hrs

Thermal ramped up from 2105 hrs; Hydro and Gas ramped up from 2109 hrs

Automatic disconnection of wind generators over frequency of 50.2 Hz

SCED to be stopped from 1800 hrs onwards

Primary response of all generators to be in service

Hydro plants to have droop setting of 1-2%

All defense mechanisms to be healthy and in service

Voltage Control

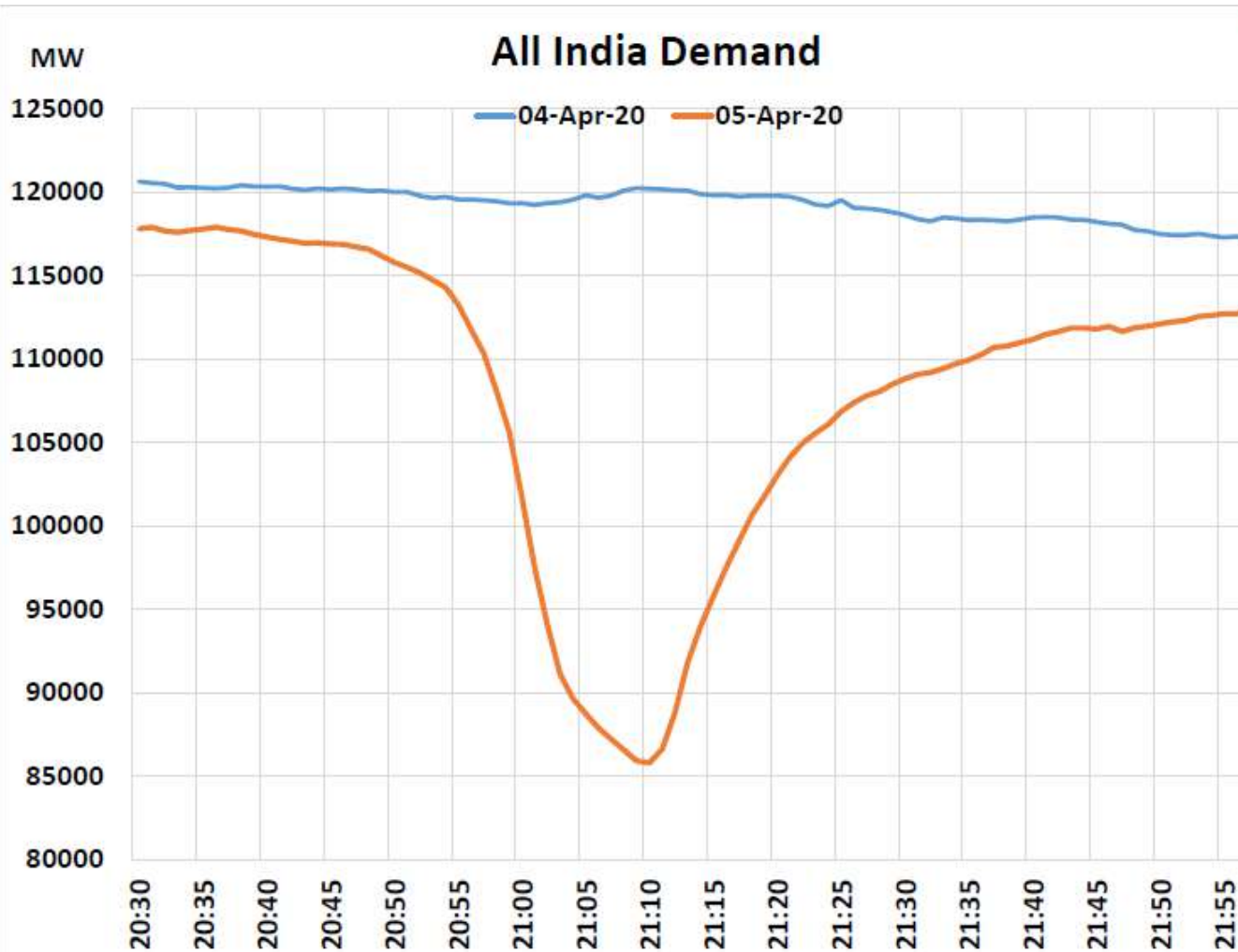
All reactors to be in service by 2000 hrs

STATCOMs and SVC in voltage control mode with reference of 400 kV

Capacitors at distribution level to be kept off

Thermal machines to regulate AVR to absorb maximum VAR as per the under excitation capability of the machine and grid voltage requirement.

All India demand during switch-off event

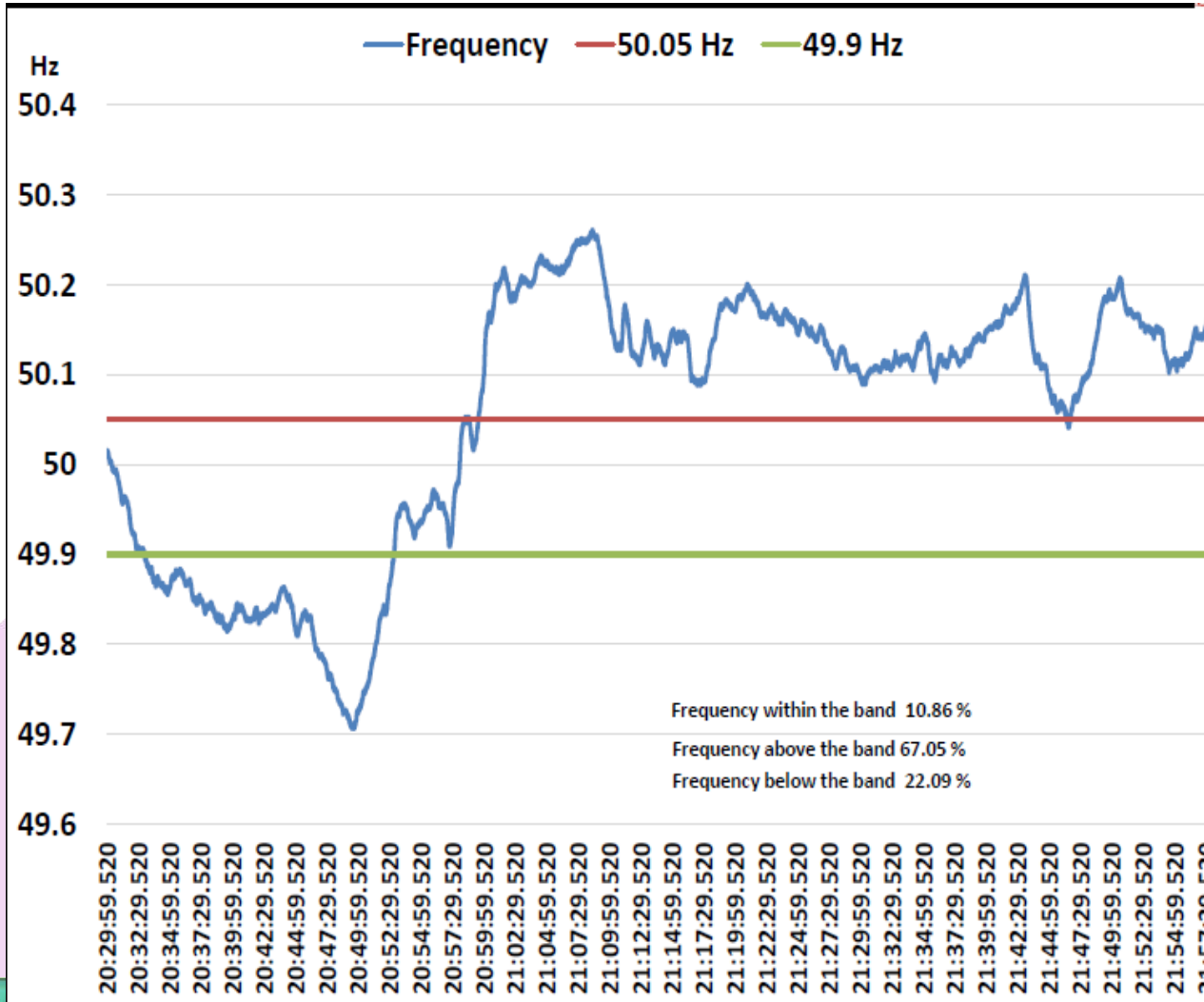


The total reduction in all India demand recorded during the event was **31089 MW**.

All India demand started reducing from **20:45 Hrs** and minimum demand of **85,799 MW** was recorded at **21:10 Hrs**.

Subsequently, from **21:10 Hrs**, the demand started picking up and settled around **114400 MW** at **22:10 Hrs**.

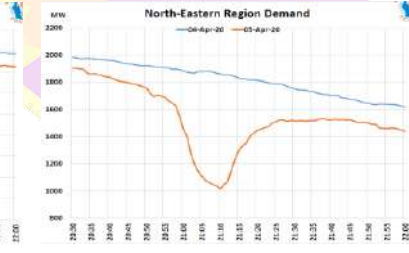
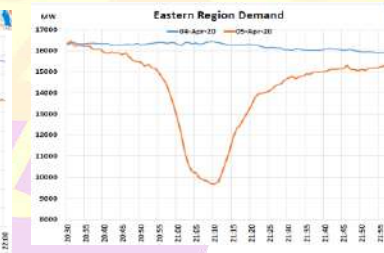
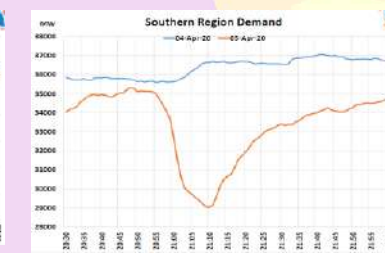
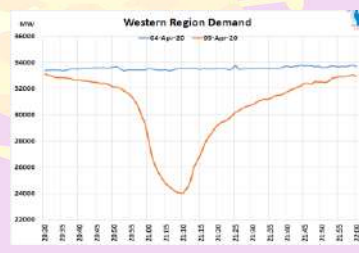
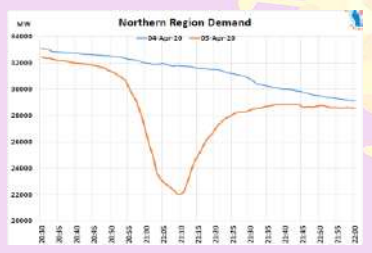
Frequency profile during switch-off event



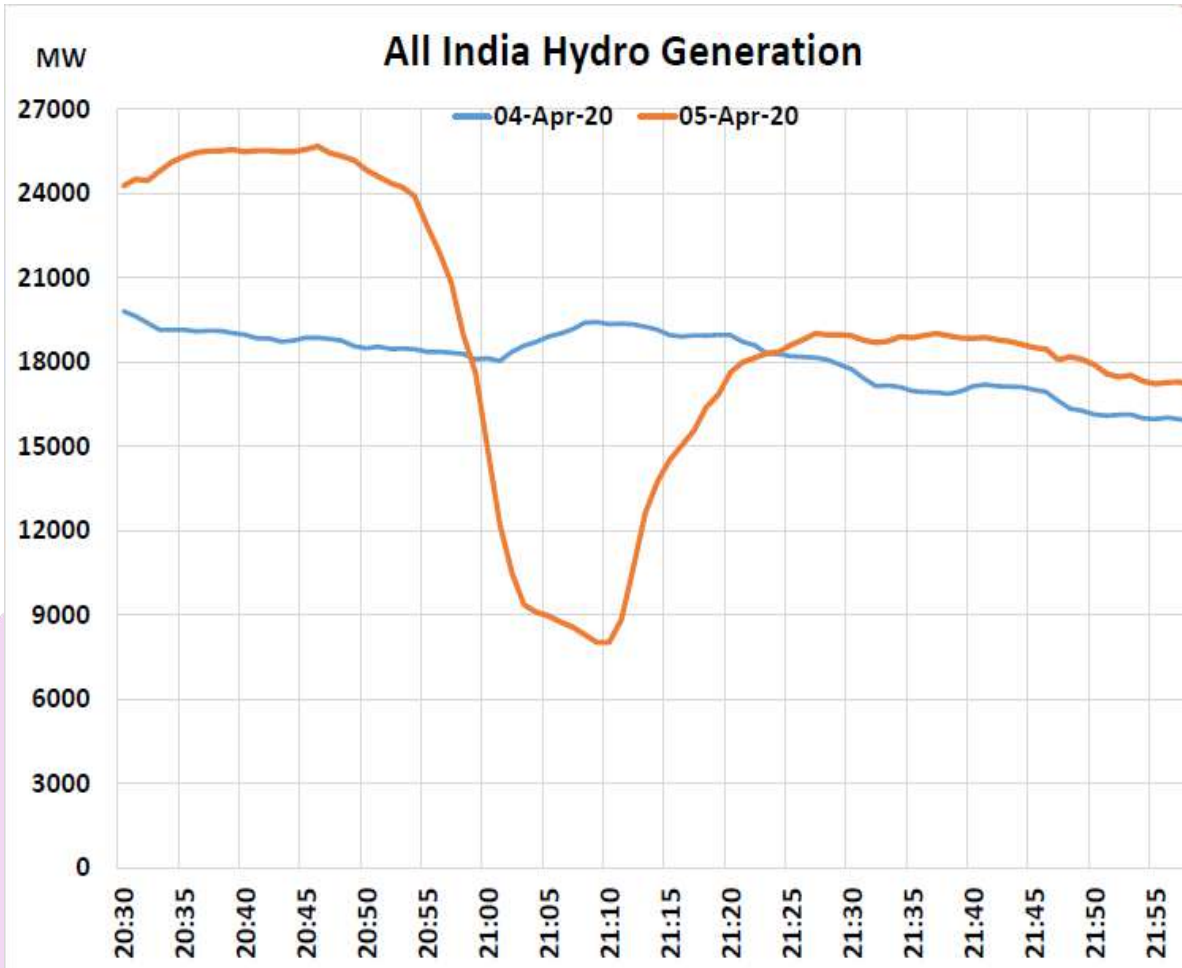
Grid Frequency during the event remained in the range of **50.26 Hz to 49.70 Hz** with maximum and minimum frequency of **50.259 Hz** and **49.707 Hz** recorded at **21:08 Hrs** and **20:49 Hrs** resp.

Region-wise demand reduction during switch-off event

Time (Hrs)	Demand (MW)						Reduction w.r.t. All India Demand at 20:45 Hrs
	NR	WR	SR	ER	NER	All India	
20:45	31791	32474	35012	15815	1796	116887	0
20:50	31339	32113	35109	15452	1761	115775	-1113
20:55	30148	31462	35019	14928	1693	113251	-3637
21:00	26683	28091	32688	12752	1453	101667	-15220
21:10	22061	24010	29034	9679	1015	85799	-31089
21:15	24956	26992	30665	11879	1303	95795	-21092
21:30	28433	30777	33394	14689	1515	108808	-8080
21:45	28633	32403	34096	15140	1523	111796	-5092
22:00	28544	32944	34647	15231	1437	112803	-4084



Hydro generation profile during switch-off event

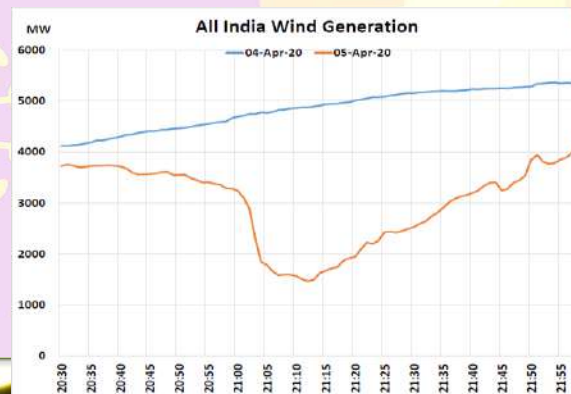
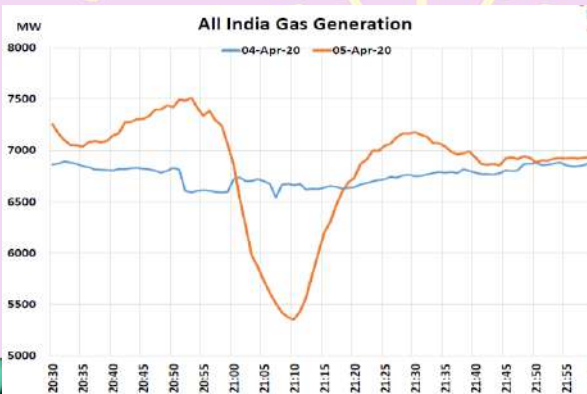
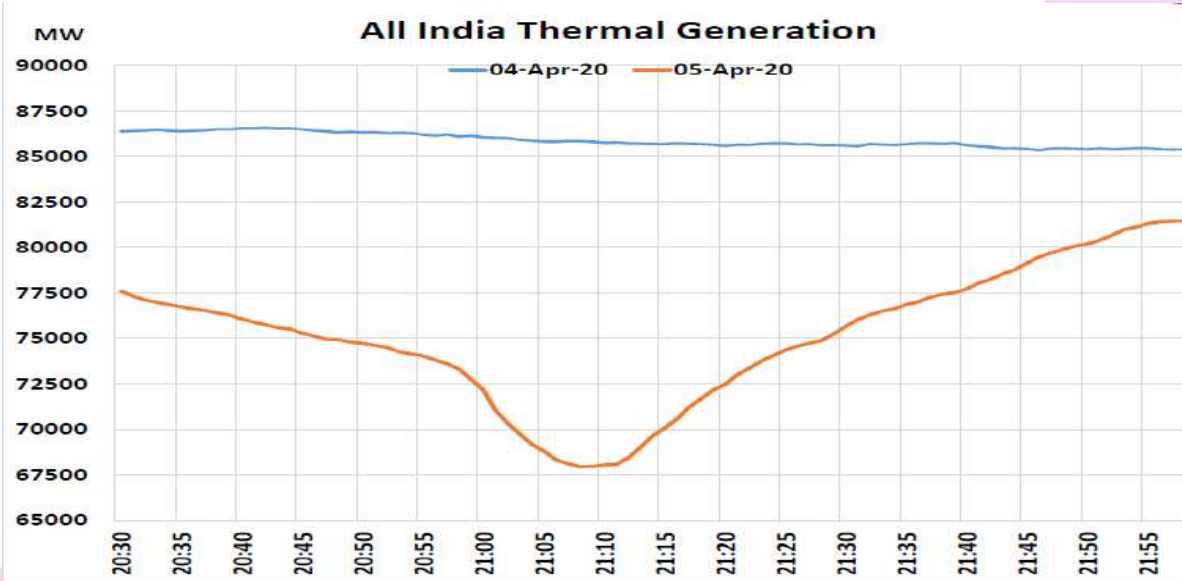


Hydro generation across the country maximized by **20:45 Hrs**

Generation reduction of **17543 MW (from 25559 MW to 8016 MW)** between **20:45 Hrs to 21:10 Hrs** (matching with demand reduction of **31089 MW** during the same period)

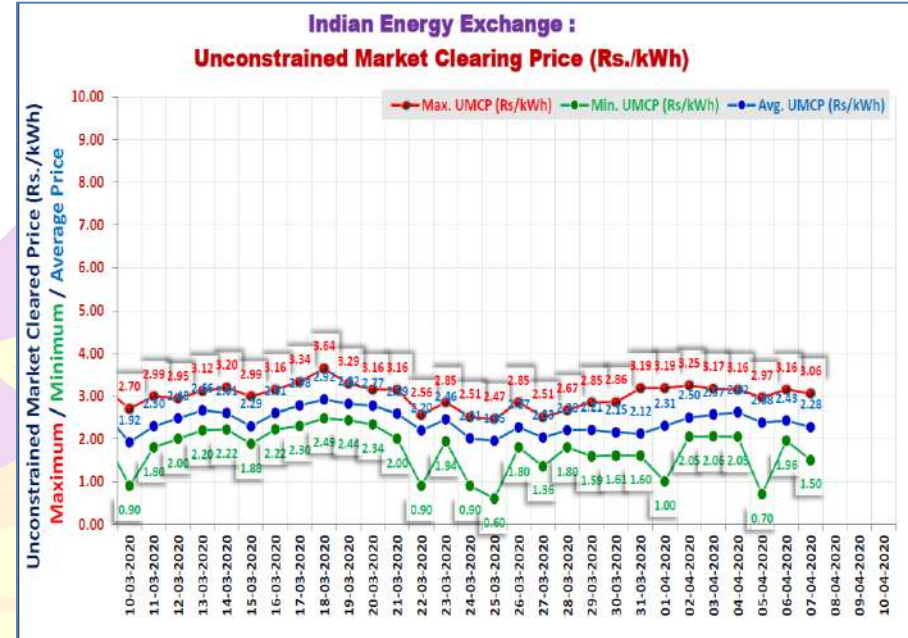
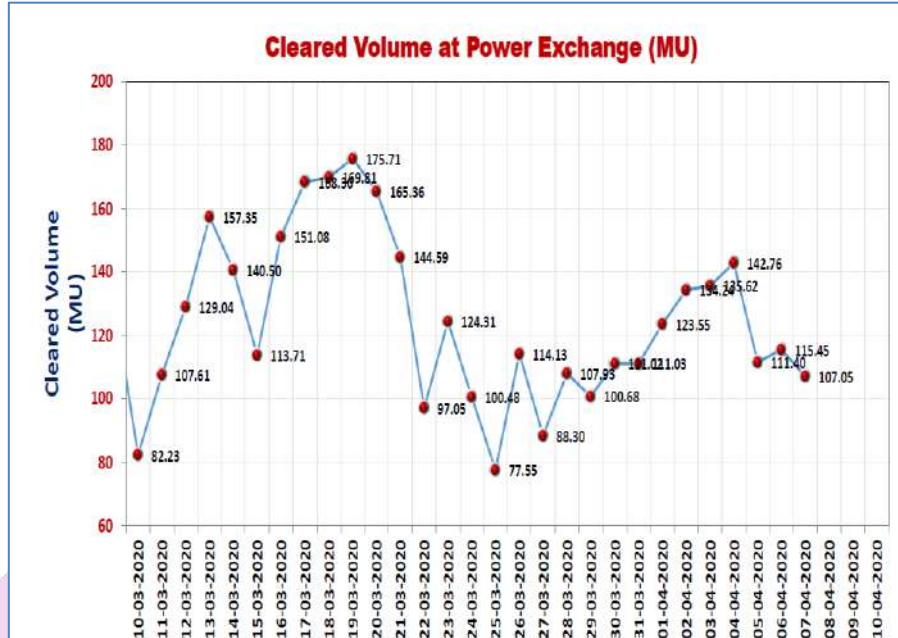
Hydro generation was again ramped up from **8016 MW to 19012 MW** from **21:10 Hrs to 21:27 Hrs** to meet the increase in demand after the event.

Thermal, Gas and Wind generation profile during switch-off event



Reduction of total **10950 MW** generation was achieved through **Thermal (6992 MW)**, **Gas (1951 MW)** and **Wind generation (2007 MW)** during **20:45 Hrs to 21:10 Hrs**.

Market volumes and prices during lockdown period



- Cleared volume went down upto 77 MU on 25th March, 2020 (1st day of lockdown)

- Minimum clearing price went upto 60 paisa/kWh on 25th March, 2020 (1st day of lockdown)

Lessons Learned and Way Forward



- Speed and Prevention is the key
 - Need to prepare for worst case
- Digital infrastructure and Digitalization of Asset Base and Way of Work
 - For maintaining business continuity
- Constant alignment and dialogue with authorities both at national and local level
- Need for continuous updation of national resilience standard/framework for power systems to withstand and respond to extreme incidents
 - Need to build robustness into technical infrastructure components to be adequate, reliable & secure
 - Need to establish specific skills, response capabilities and preparedness in people, processes and institutions
 - Need to establish collective human agency, agility and volition of people and processes to withstand unknown hazards
- Need to strengthen systems-level flexibility and adaptability through adaptive tools and technologies to support and enable effective response in dealing with uncertainty
 - Employees share mental models of systems interdependencies and have the social capital to coordinate response under pressure
 - The capacity of a system to withstand all hazards, including novel and unprecedented ones, while continuing to provide essential functions
 - Whatever may be needed to withstand unpredictable black swan events
 - An intangible emergent capacity for adaptation and transformation across multiple equilibria

“Let me not pray to be sheltered from dangers but to be fearless in facing them.” – Rabindranath Tagore.

Thank you !!

