MINUTES OF THE 91st MEETING OF FORUM OF REGULATORS (FOR)

Venue : Pune
Date /Day : 8th June 2024 ; Saturday
Time : 10 am followed by lunch
List of Participants: Appendix-I

1. At the outset, Chairperson, MERC, Shri Sanjay Kumar, warmly welcomed the members of the Forum of Regulators and expressed delight in MERC hosting the 91st FOR Meeting in Pune, a historic and culturally important city in Maharashtra adding that MERC takes great pride in pioneering many landmark initiatives over the past 18-20 years He noted that the platform of FOR and its periodic meetings, support healthy and strong knowledge-sharing initiatives. Furthermore, he proposed that the Forum in accordance to its mandate needs to undertake a comprehensive review of the regulatory processes over a period of, say, 20 years to assess whether we have achieved our mandates, analyse what has not been achieved and work out a plan to take up all such activities which are innovative in a phased manner This study can help in charting out a roadmap for future regulatory initiatives that can be adopted. Shri Sanjay Kumar concluded his address with warm wishes to all for a pleasant stay in the city.

2. Subsequently, Chairperson, FOR/CERC, Shri Jishnu Barua, in his inaugural remarks, expressed gratitude on behalf of the members of the Forum to the Chairperson, MERC, for graciously hosting and facilitating the stay. Reflecting on the previous meeting conducted in Delhi, he highlighted the progress achieved since then. He updated the Forum regarding the Working Groups for Accelerating the Development of Hydro Power for Grid Stability and the simplification of the Supply Code. He provided insights into Maharashtra's power sector, highlighting MERC's progressive mandates and its commendable role in shaping the power sector of the state and of the country. Moving forward, he expressed heartfelt appreciation for the Chairperson, Joint ERC J&K, and Ladakh, Shri Lokesh Dutt Jha, for his contributions as he will be demitting office by the end of June 2024. With a commitment to advancing a progressive, sufficient, efficient, and resilient power sector, Shri Barua concluded his remarks.

   Thereafter, the agenda items were taken up.

AGENDA ITEM 1: NEED FOR FLEXIBILITY IN SYSTEM OPERATION FOR RE INTEGRATION - MINIMUM TURN DOWN LEVEL FOR THERMAL STATIONS

3. The Executive Director, Grid-India, presented an outline of the necessity for system flexibility to integrate renewable energy (RE) in light of increasing RE penetration, which is expected to increase further in the near future. It was highlighted that the current daily load variation requirement is around 75 GW per day, necessitating 75 GW of flexible resources that can flex up and down on a daily basis. The presentation further covered aspects of energy transition in the Indian power system, key flexibility attributes such as minimum turndown level, ramp rate, minimum up and down time, flexibility service providers, the role of thermal generators in providing requisite flexibility, and way forward. The presentation in this context is attached as **Annexure-I**.

4. It was highlighted that for inter-State generating stations, a minimum turn-down level of 55% has been specified in IEGC to enable flexible operation in the wake of RE integration into the system. This has also been supported with a corresponding compensation mechanism for the deterioration of heat rates, auxiliary energy consumption and oil support. Representative of Grid-India apprised the Forum that many States are yet to implement the matching provisions of minimum turn down level for intra-state thermal generating stations. Some States have specified a minimum turn--down level up to 55% but have not provided any compensation mechanism for intra-state generators to recover their cost due to heat rate deterioration, auxiliary consumption, or oil support. It was highlighted during the meeting that on a number of instances where even pit head cheaper inter-state generating stations are being backed down by the system operator to accommodate renewable energy. In view of the ambitious RE integration targets by 2030, it was emphasised that the intra-State generating stations also need to be enabled to run at a minimum turn-down level of 55% on lines of inter-state thermal generating stations.

5. During the discussion, Chairperson, KERC enquired about the role that Demand Side Management (DSM) can play in achieving the required flexibility, to which it was informed that the northern, western, and southern regions already meet their maximum demand during the day through solar power by shifting their load to the solar hours.

6. Chairperson, TNERC emphasised that battery storage and pump storage projects would also play a critical role in providing flexibility, necessitating aggressive advancement towards these technologies.

7. After detailed deliberation, the Forum decided to refer the issue of flexibility to the WG on RE Policy for further discussion on the role of intra-state entities in providing flexibility support and thereafter provide recommendations to the Forum. Further, Grid India was also requested to undertake further studies on this aspect. The WG on RE policy to examine the status of minimum turn down level of intra-State generating stations in various States, commensurate compensation mechanism for such flexible operation and make recommendations to FOR for consideration.

AGENDA ITEM 2: STATUS UPDATE OF FOR WORKING GROUPS (WG)

a) WG ON HARMONIZATION OF RULES AND REGULATIONS

8. The Chairperson of the WG / Chairperson, GERC gave a brief summary of the decisions of the WG in its previous meetings and informed the consultants assisting the FOR WG to present an update (**Annexure- II**) as under:

   i. The Forum was updated on the recommendations on Consumer Rules (Smart Metering, Reliability Indices, CGRF rules), LPS Rules and Amendments on Captive Power Plants provisions. The legal and regulatory requirements of smart pre-paid meters were also discussed with reference to the provisions of the EA 2003 and the relevant provisions of the CEA metering Regulations.

   ii. Chairperson, GERC / Chairperson of the WG explained the techno-commercial aspects of the smart meters. Some of the members raised concerns about issues in the implementation of smart meters in rural areas, specifically with respect to communication issues. It was also clarified that the provision of EA 2003, read with CEA Regulations 2022, mandates the installation of a smart pre-payment or pre-payment meter (subject to the availability of the communication network). However, timelines for the implementation of pre-payment smart meters need to be relaxed, considering ground-level issues and provisions of Section 55 of EA 2003.

iii. The Forum also discussed the possibility of retrofitting (to convert existing meters into smart meters), which can result in optimal use of existing meters and save investments in new meters, and also address the issue of shortfall in the supply of smart meters. This was in view of the fact that, as against the estimated requirement of 25 crore smart meters, there is an availability of only around 7 crore smart meters. The Forum also discussed about recommending MoP to consider retrofitting arrangement under RDSS to enable Discoms to avail the benefits of the scheme. Additionally, the Forum suggested that the FOR Technical Committee may take up the task of developing a methodology for the retrofitting arrangement.

iv. With regard to the establishment of CGRF, it was discussed that flexibility is required in establishing CGRFs based on a number of complaints received at the sub-division/ division level and that the licensees may be allowed to cluster sub-division/ divisions while establishing CGRF. The Forum agreed to recommend MoP for suitable modifications in the Rules for providing flexibility to the utilities in establishing CGRF based on a number of complaints received at the sub-division/ division level.

v. With regard to verification authority and the verification process for Captive Power Plants, the Forum discussed that the FOR-Model Regulations need to be aligned with the Supreme Court judgement dated 9 October 2023, after which the State Captive Regulations/Orders should be modified. Further deliberations would be necessary to cover various implementation aspects of the verification process for intra-state and inter-state captive transactions.

vi. The Forum also discussed the Late Payment Surcharge Rules and their amendment. It was discussed that most of the provisions of LPS rules are expected to be adopted by SERCs in their tariff regulations to ensure effective implementation of these Rules. The Forum also decided to send recommendations to MoP to include the term 'trader' in the definition of defaulting entities in the MoP Rules.

9. After discussion, the Forum decided on the following action points:

a. FOR Model Regulations may be aligned with the Supreme Court judgment dated 9 October 2023, after which the State Captive Regulations/Orders should be

modified. The Working Group to further deliberate on developing a draft CPP verification methodology.

b. Recommendations to MoP for modifications in the Rights of Consumer Rules / LPS Rules

i) Relaxation in timelines for implementation of pre-payment smart meters considering ground-level issues and provisions of Section 55 of EA 2003.

ii) Retrofitting (to convert existing meters into smart meters) which can result in optimal use of existing meters and save investments in new meters, and also address the issue of shortfall in the supply of smart meters.

iii) Provide flexibility to the utilities in establishing CGRF based on the number of complaints received at the sub-division/ division level.

iv) Include the term 'trader' in the definition of defaulting entities in the LPS Rules.

c. Standing Technical Committee may look into the issue of retrofitting arrangements for converting existing electronic meters to convert as smart meters.

b) WG ON RE RELATED POLICY AND REGULATORY MATTERS

10. The Chairperson of the WG / Chairperson, KERC gave a brief summary of the decisions of the WG in its previous meetings and requested the consultants assisting the FOR WG to present an update, which was (**Annexure- III**) as under:

a. The Forum was updated on various aspects of Virtual Net Metering (VNM) and Group Net Metering (GNM), such as consumer categories covered, minimum and maximum capacity, Ownership Model, applicability of different charges, system enhancement-related aspects, energy settlement, and treatment of surplus power.

b. It was further highlighted that the existing FOR Model Regulations on Distributed Energy Resources need to be modified to include concepts such as VNM, GNM, Behind the Meter (BTM), and Gross

Metering. The WG had also decided to retain the existing structure of the FOR-Model Regulations, 2019 while modifying and updating the appropriate sections in accordance with the decisions of the WG. Further, it was proposed to introduce a new chapter for Peer-to-Peer trading, while replacing the existing chapter on Independent Distributed Renewable Energy Systems (IDRES).

11. The Forum noted the recommendations of the WG and requested the WG to finalize the FOR-Model Regulations on DRE based on the recommendations.

AGENDA ITEM 3: DEMAND SIDE MANAGEMENT.

12. The representative of PRAYAS delivered a presentation **(Annexure-IV)** on Accelerating the adoption of Demand-Side Management (DSM) in India. The presentation majorly covered topics on the benefits of DSM in a high RE system, the current status of implementation of DSM regulations across states and suggestions for enhancing the role and success of DSM.

13. Chief (RA), CERC informed the Forum that FOR had framed the Model DSM Regulations in 2010 when there was a power deficit situation prevalent at that time. However, as the situation in India has significantly changed since then and India has transitioned from a power deficit to a power surplus, it necessitates an update to the Model Regulation to align with the current realities of increased generation capacity, high penetration of renewable energy (RE) and the increased role of demand response.

14. After discussions, the Forum decided that the issue of updating the Model Regulations on Demand Side Management be referred to the FOR WG on Viability of Discoms.

AGENDA ITEM 4: REFERENCE FROM SERCs

(a) CURTAILMENT OF POWER TRADING MARGIN FOR LONG-TERM PURCHASE - REFERENCE FROM TERC

15. Chairperson, TERC informed the Forum that the current trading margin of seven paise/kWh for long-term purchases is relatively high and should be reduced to two paise/kWh. Referring to the 85th FOR meeting minutes, Chief (RA), CERC, highlighted that the standard bidding guidelines, as notified by the MoP/MNRE, fix the trading margin at seven paise. This margin is ultimately imposed on the distribution companies (Discoms) and is deemed incorrect. Instead, the margin should be negotiable between SECI and the Discoms and mutually agreed upon, subject to State Commission approval. This stance was also communicated to MoP and MNRE. It was also highlighted that the CERC Regulation on Trading Margin has specified that for transactions under short-term contracts and contracts through power exchanges up to one year, the Trading Licensee shall charge a trading margin of not less than zero (0.0) paise/kWh and not exceeding seven (7.0) paise/kWh: Provided that in contracts where escrow arrangement or irrevocable, unconditional and revolving letter of credit as specified in clause (10) of Regulation 9 is not provided by the Trading Licensee in favour of the seller, the Trading Licensee shall not charge trading margin exceeding two (2.0) paise/kWh. However, for long-term purchases, no ceiling has been specified, and the same is left to be decided mutually between the license and the seller.

16. After detailed deliberations, the Forum decided that SECI may be requested to make a presentation on Risk Assessment in subsequent meetings to further explore this issue.

(b) APPLICABILITY OF TARIFF FOR THE CONSUMERS CHARGING ELECTRIC VEHICLE AT EV CHARGING STATION – REFERENCE FROM CSERC

17. Chairperson, CSERC informed the Forum about a Ministry of Power (MoP) letter dated June 13, 2023, addressed to the Chief Secretaries of all States/UTs, directing that the

tariff for electricity supply to EV charging stations in the State should be a single-part tariff and should not exceed the Average Cost of Supply (ACoS).

18. To this effect, Chief (RA), CERC stated that the Forum of Regulators (FOR), in its report on 'Regulatory Framework for Energy Storage and Electric Vehicles' had recommended that the tariff for LT EV charging stations should not exceed 110% of the ACoS of discoms, and for HT EV charging, the rate should not be higher than the HT industrial tariff. It was also highlighted that MoP has also recommended that EV charging tariffs should not exceed the ACoS, until March 30, 2025, and that it should be a single-part TOD tariff.

19. In this regard, the FOR Secretariat had conducted a comparison of the current practices across various States vis-à-vis the recommendations of FOR and MoP which indicated that most States are within the recommended ceiling, although some States exceed it. Additionally, a few States have a two-part tariff and a non-ToD tariff.

20. The Forum noted the same and also decided that the compilation may be circulated to all the SERCs along with the minutes for their reference and further action at their end.

AGENDA ITEM 5: AUDITED ACCOUNTS OF FOR FOR FY 2023-24

21. The Joint. Chief (RA), CERC apprised the Forum about the salient features of the FOR Annual Accounts for F.Y. 2023-2024, after which the Forum approved and adopted the Audited Accounts.

AGENDA ITEM 6: CONFIRMATION OF MINUTES OF THE 90TH FOR MEETING HELD ON 5TH APRIL 2024

22. The Joint Chief (RA) apprised the Forum regarding the action taken on the agenda items discussed during the 90th FOR meeting. Thereafter, the Forum confirmed the minutes.

CONCLUSION

23. Chairperson, Telangana ERC, had offered to host the next FOR meeting in Hyderabad, Telangana, dates of which would be communicated in consultation with the FOR

Secretariat. Thereafter, Chairperson, Madhya Pradesh ERC offered to host the meeting in October 2024.

24. The Forum felicitated Shri Lokesh Dutt Jha, Chairperson, JERC (JKL), as he would be demitting office by the end of June 2024. Chairperson, JERC (JKL) reflected on his journey from May 2019 to the present, which included the transition from undivided Jammu and Kashmir to the formation of the UTs of J&K and Ladakh. He thanked the Forum for giving him an opportunity to gain valuable knowledge and experience in the electricity sector through interactions with the FOR, CERC, and the Ministry of Power. He fondly recalled his first meeting at CERC in New Delhi around June/July 2019, where he initially felt out of place but was welcomed warmly by colleagues from FOR and CERC, forming a close-knit and supportive group.

25. At the close, the Secretary of FOR/CERC expressed satisfaction with the outcomes of exhaustive meeting, during which much was learned from the presentations and discussion. He remarked on the commendable work of the WGs based on the updates received. He thanked the Chairperson, MERC, on behalf of the members for the meticulous arrangements for the meeting and reiterated his thankfulness to the Chairperson, FOR/CERC, for his guidance and supervision, all the Chairpersons and members of the State Regulatory Commissions for their participation, and the officers and staff of the FOR Secretariat for their contributions.

****

Appendix – I

LIST OF PARTICIPANTS OF THE 91ST FORUM OF REGULATORS ("FOR") MEETING HELD ON 08TH JUNE, 2024 AT PUNE

S. No.	NAME	ERC
01.	Shri Jishnu Barua Chairperson	CERC/FOR – in Chair.
02.	Justice (Shri) C.V. Nagarjuna Reddy Chairperson	APERC
03.	Shri R.K. Joshi Chairperson	APSERC
04.	Shri Kumar Sanjay Krishna Chairperson	AERC
05.	Shri Amir Subhani Chairperson	BERC
06.	Shri Hemant Verma Chairperson	CSERC
07.	Shri Anil Mukim Chairperson	GERC
08.	Shri D.K. Sharma Chairperson	HPERC
09.	Shri Alok Tandon Chairperson	JERC for State of Goa & UTs
10.	Shri Lokesh Dutt Jha Chairperson	JERC for UTs of J&K and Ladakh
11.	Shri Rengthanvela Thanga Chairperson	JERC for Manipur & Mizoram
12.	Shri P. Ravi Kumar Chairperson	KERC
13.	Shri S.P.S. Parihar Chairperson	MPERC
14.	Shri Sanjay Kumar Chairperson	MERC
15.	Shri Viswajeet Khanna Chairperson	PSERC
16.	Shri K.B. Kunwar Chairperson	SSERC
17.	Shri M. Chandrasekar Chairperson	TNERC
18.	Shri T. Sriranga Rao Chairperson	TSERC
19.	Shri D. Radhakrishna Chairperson	TERC
20.	Shri Arvind Kumar Chairperson	UPERC

21.	Dr. M.V. Rao Chairperson	WBERC
22.	Shri Gajendra Mohapatra Chairperson In-charge	OERC
23.	Shri M.L. Prasad Chairperson In-charge	UERC
24.	Shri Mahendra Prasad Member	JSERC
25.	Shri B. Pradeep Member	KSERC
26.	Shri Hemant Kumar Jain Member	RERC
27.	Shri Harpreet Singh Pruthi Secretary	FOR/CERC
28.	Dr. Sushanta Kumar Chatterjee Chief (Regulatory Affairs)	CERC
SPECIAL INVITEES		
29.	Shri Arun Goyal Member	CERC
30.	Shri Ramesh Babu V Member	CERC
31.	Shri Surendra Jagannathji Biyani Member	MERC
32.	Shri Anand Madhukar Limaye Member	MERC
FOR SECRETARIAT		
33.	Ms. Rashmi Somasekharan Nair Joint. Chief (RA)	CERC
34.	Shri Ravindra Kadam Sr. Adv. (RE)	CERC
OTHERS / GUESTS		
35.	Shri S.C. Saxena Executive Director	GRID India
36.	Shri Saif Rehman Chief Manager	GRID India
37.	Shri Ajit Pandit Consultant	Idam Infra-USAID-SAREP
38.	Shri Anant Sant Consultant	Idam Infra-USAID-SAREP
39.	Ms. Shweta Kulkarni Fellow	Prayas (Energy Group)
40.	Shri Aditya Chunekar Fellow	Prayas (Energy Group)
41.	Ms. Ann Josey Fellow	Prayas (Energy Group)

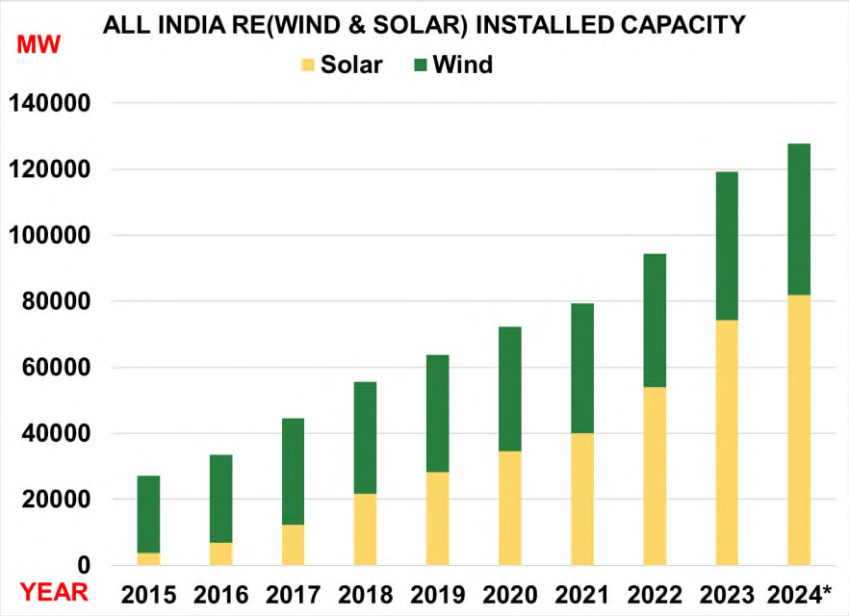
Need for flexibility in in system operation for RE integration

8th June 2024

Outline

- Energy Transition in Indian Power System
- Growing Need for Flexibility
- Key Flexibility Attributes
- Flexibility Service Providers
- Role of Thermal Generators in providing requisite Flexibility
- Thermal Flexibilization – Key Initiatives
- Way Forward

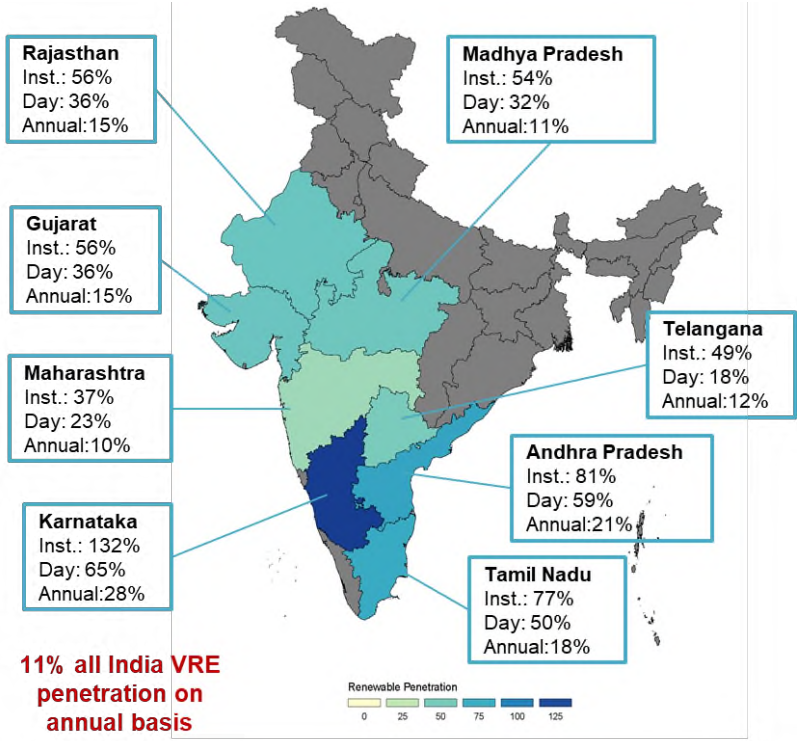
Ongoing Clean Energy Transition in India



Source: CEA Installed Capacity Report (data as on Apr 2024)
https://cea.nic.in/installed-capacity-report/?lang=en

Highest Instantaneous RE penetration of ~32.4 % was recorded on 14th July 2023

Maximum Wind + Solar penetration in instantaneous MW and energy (day/year) terms



11% all India VRE penetration on annual basis

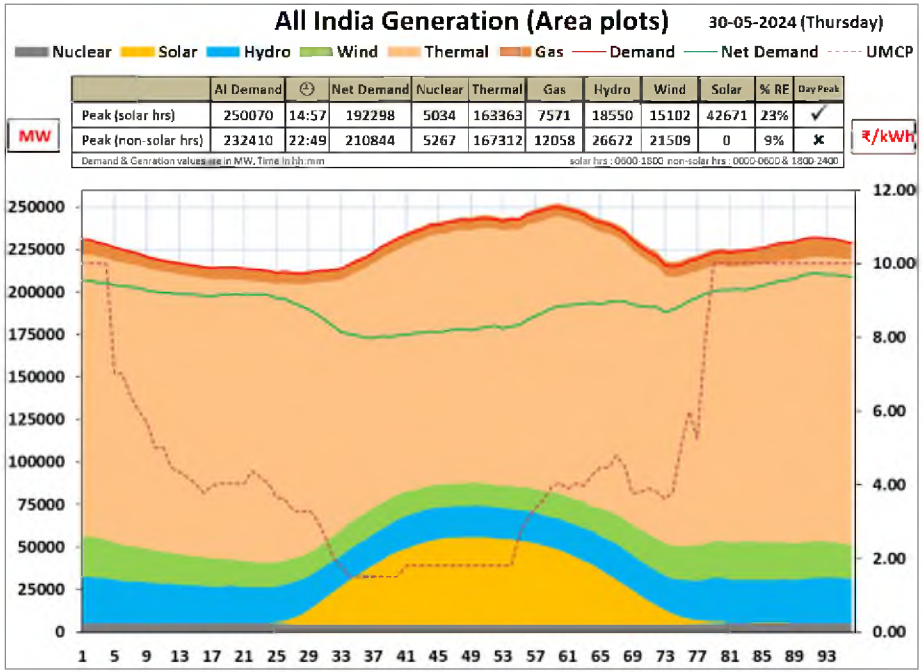
Energy Transition in India - Roadmap

ALL INDIA INSTALLED CAPACITY (MW)			
Resource	**March 2024**	**March 2030**	**% Addition**
Hydro (including PSP)	46928	59210	26%
Small Hydro	5003	18986	279%
Solar PV	81813	292566	258%
Wind	45887	99895	118%
Biomass	10940	14500	33%
Nuclear	8180	15480	89%
Coal+Lignite	218178	251683	15%
Gas	25038	25038	0%
Total	**441967**	**777358**	**76%**
BESS	0	41650 (5-hr)	

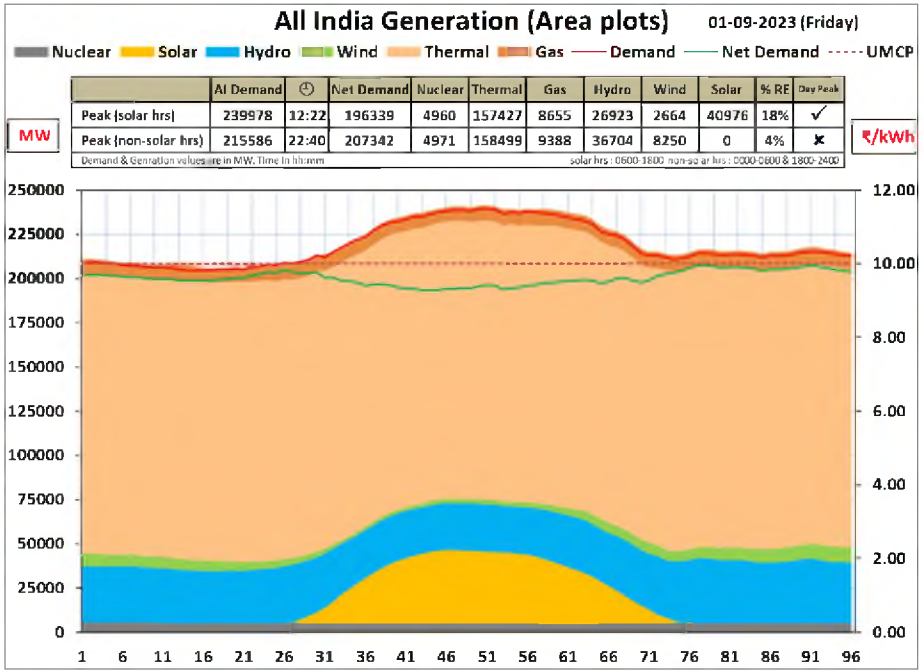
		2024	2030
	**Maximum Demand Met (GW)**	**~240#**	**334^**
	**Total Generation Installed Capacity (GW)**	**442***	**777**
	**Non-fossil Fuel Based Generation Installed Capacity (GW)**	**199***	**500**
	**Wind & Solar Installed Capacity (GW)**	**127***	**393**

Source: CEA Report On Optimal Generation Capacity Mix for 2030 (Ver 2.0)
As on Mar 2024 as per Operational Data of Grid-India
* **As on Mar 2024** from CEA Installed Capacity Report
^ 20th EPS Survey by CEA

Peak Demand Day – 2024 vs 2023

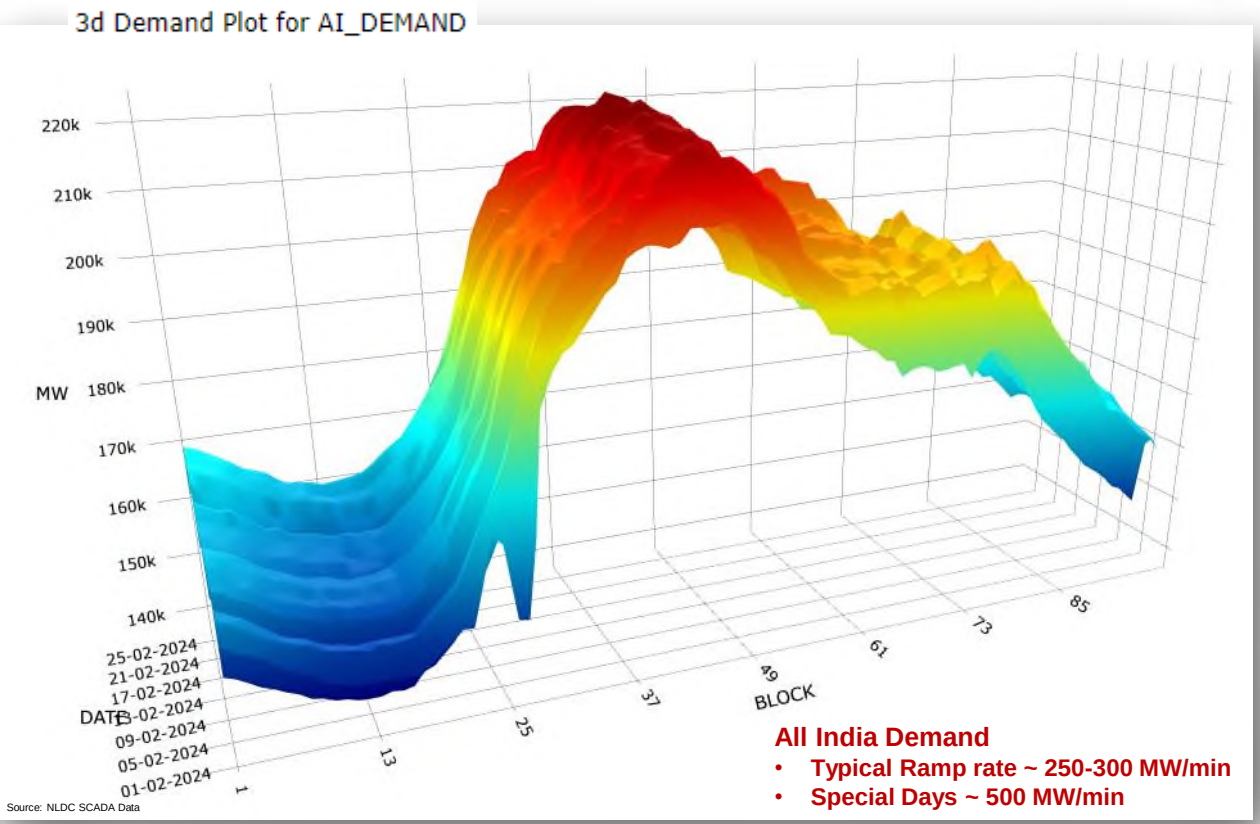


	AI Demand		Net Demand	Nuclear	Thermal	Gas	Hydro	Wind	Solar	% RE	Day Peak
Peak (solar hrs)	250070	14:57	192298	5034	163363	7571	18550	15102	42671	23%	✓
Peak (non-solar hrs)	232410	22:49	210844	5267	167312	12058	26672	21509	0	9%	✘



	AI Demand		Net Demand	Nuclear	Thermal	Gas	Hydro	Wind	Solar	% RE	Day Peak
Peak (solar hrs)	239978	12:22	196339	4960	157427	8655	26923	2664	40976	18%	✓
Peak (non-solar hrs)	215586	22:40	207342	4971	158499	9388	36704	8250	0	4%	✘

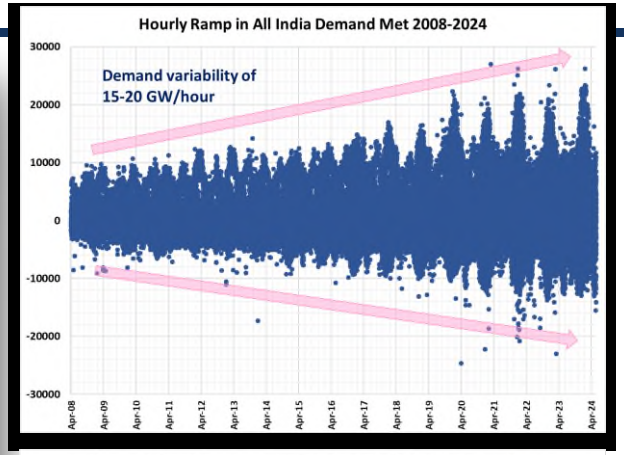
Growing Need for Flexibility – Increasing All India Demand Ramp

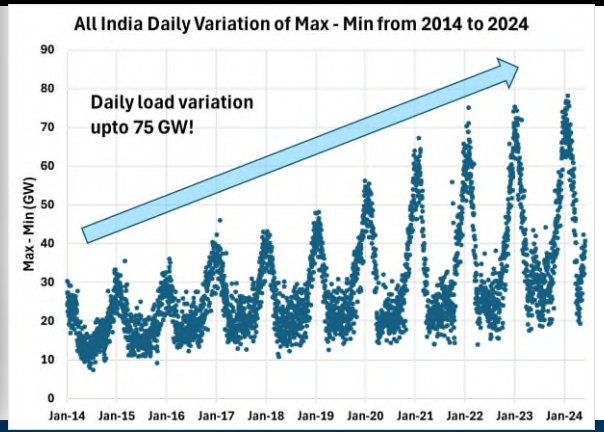


Source: NLDC SCADA Data

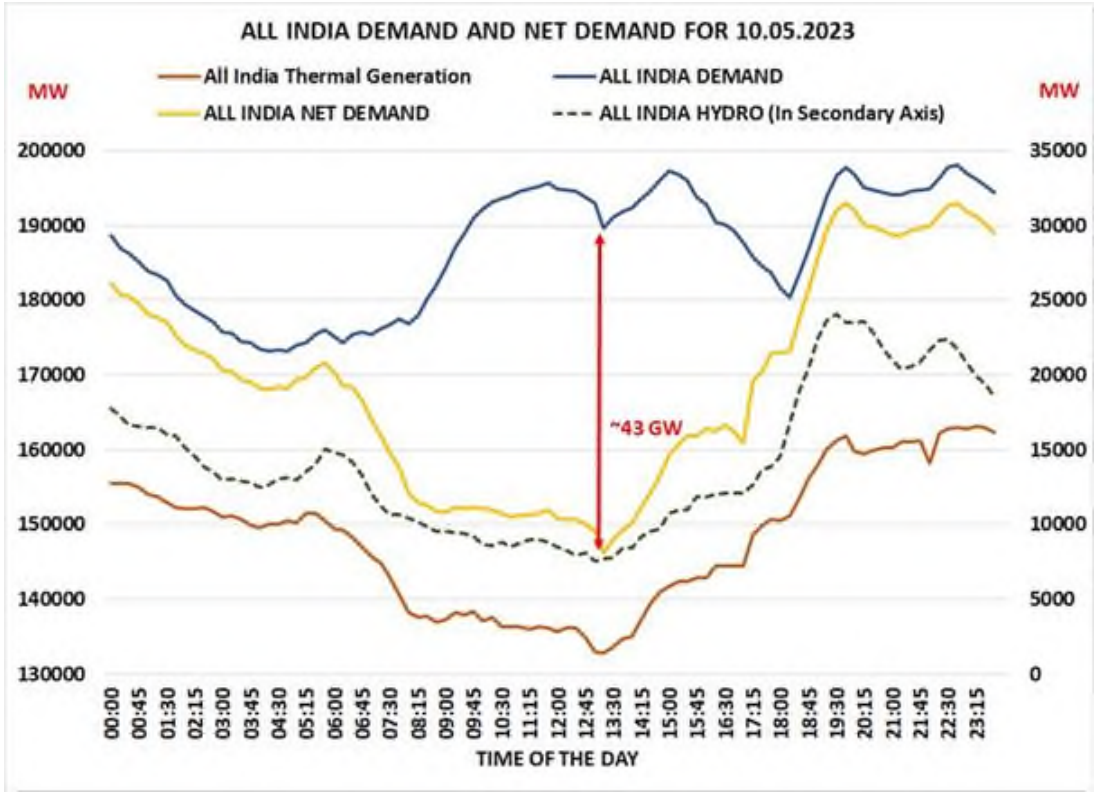
All India Demand

- Typical Ramp rate ~ 250-300 MW/min
- Special Days ~ 500 MW/min



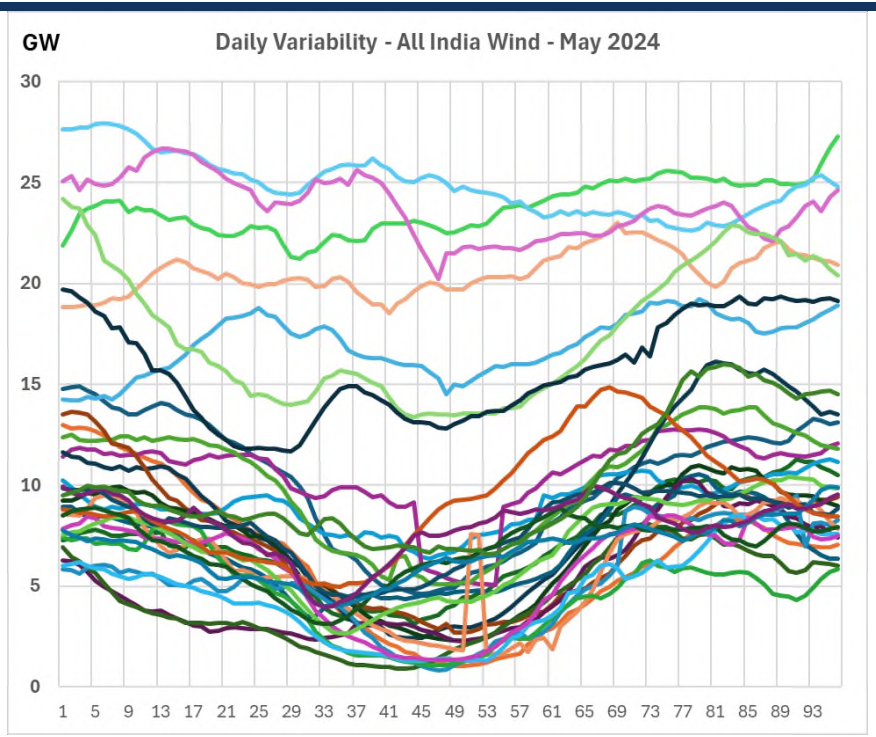


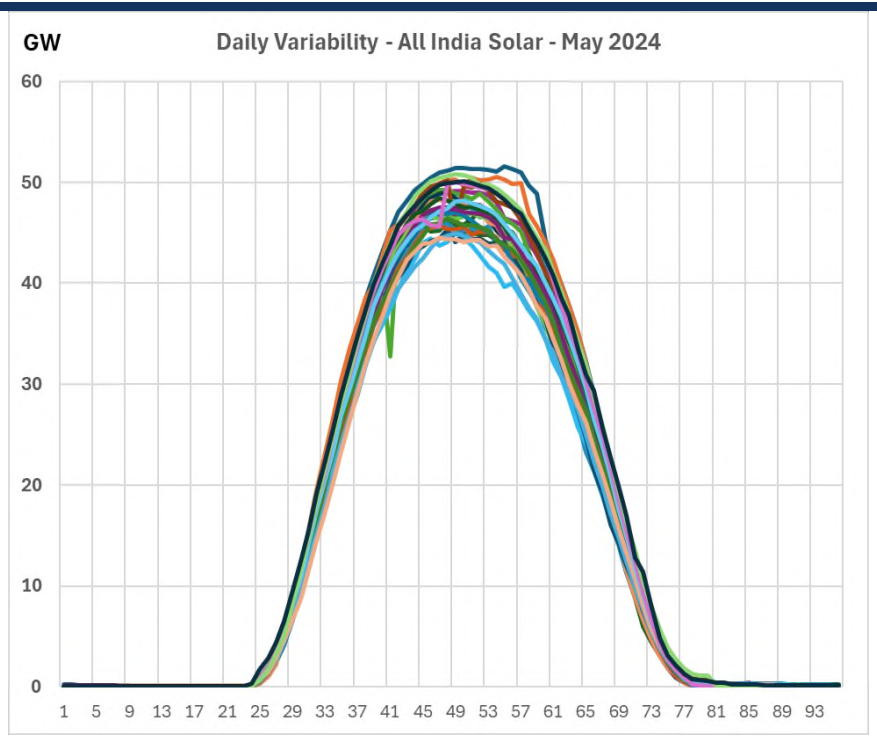
Growing Need for Flexibility – Increasing Duck Curve Belly



- Increasing "Duck Curve" Belly
- Evolution from "Duck" to "Giraffe"
- Issues in absorbing additional RE (solar) beyond a certain quantum
- Avoiding curtailment in solar hours and load shedding in non-solar hours

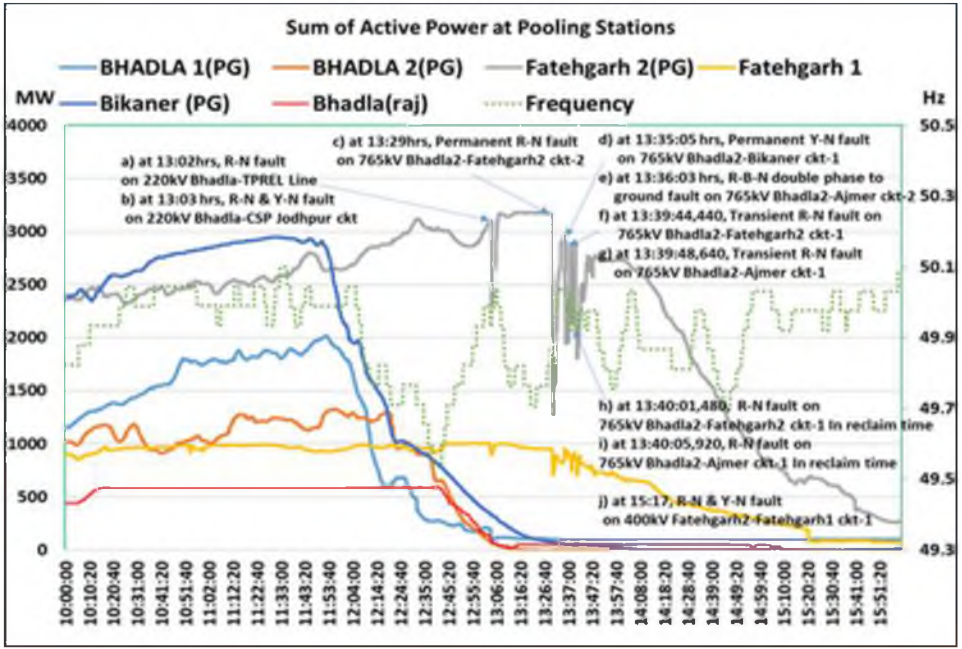
Growing Need for Flexibility – Wind and Solar Variability



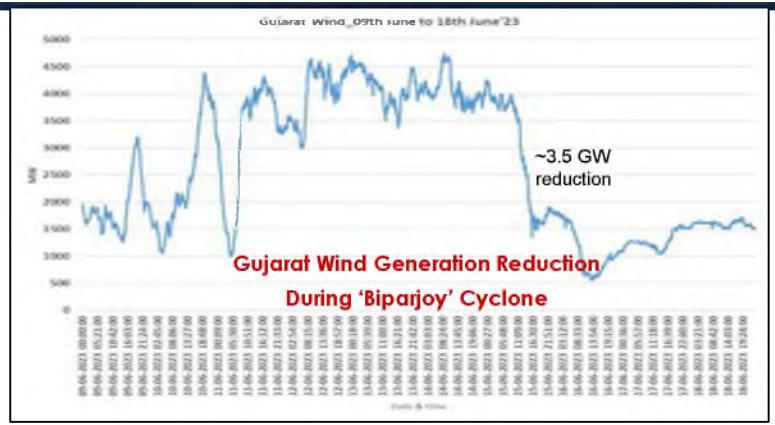


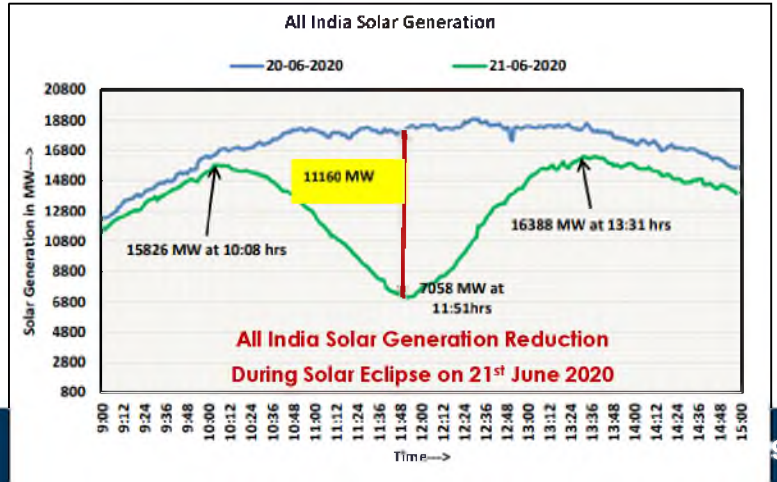
Large diurnal variation in wind & solar generation with steep ramps –
Need for balancing capability

Growing Need for Flexibility – Cloud Covers and Increase in Extreme Weather Events



Approx. 8000 MW reduction in solar generation in 1 hour due to Cloud Cover

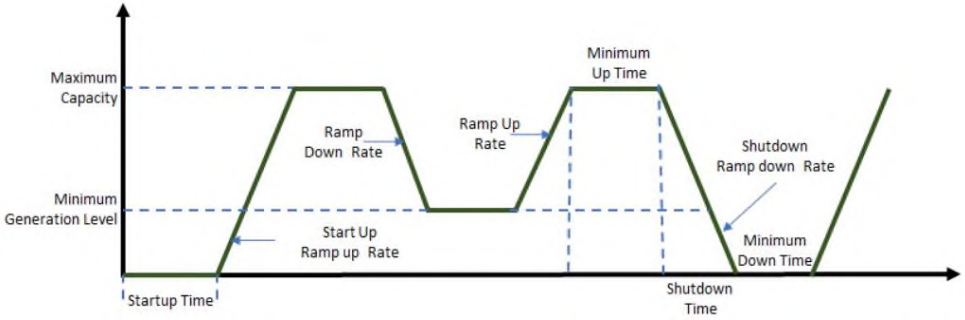




Key flexibility attributes

Minimum Turndown Level

- Minimum output (as % of capacity) that the generator can sustain continuously
- Lower MTL enables wider operating range of power plant



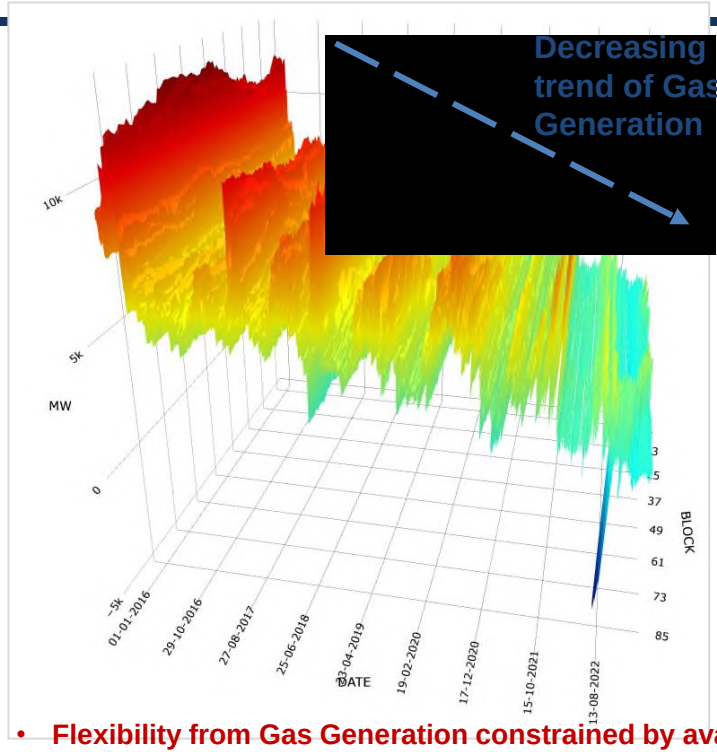
Ramp rate

- Rate at which generator can change output (as % of capacity/min)
- Faster ramp rate enables meeting net load ramping requirement

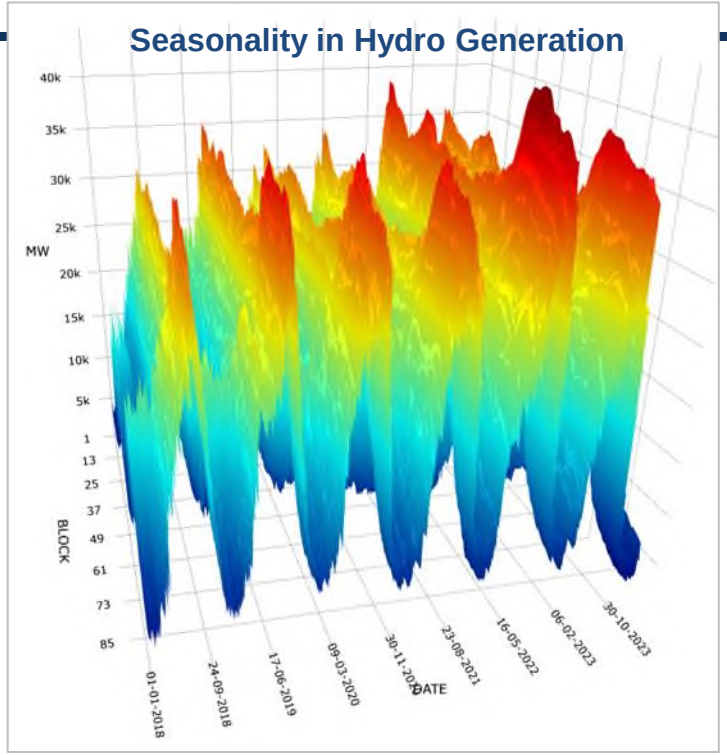
Minimum up/down time

- Min. time for which generator has to stay online before going offline and vice versa
- Lower minimum up/down times together with faster startup/shutdown time enables two-shifting operation

Flexibility Providers – Gas and Hydro Based Generation

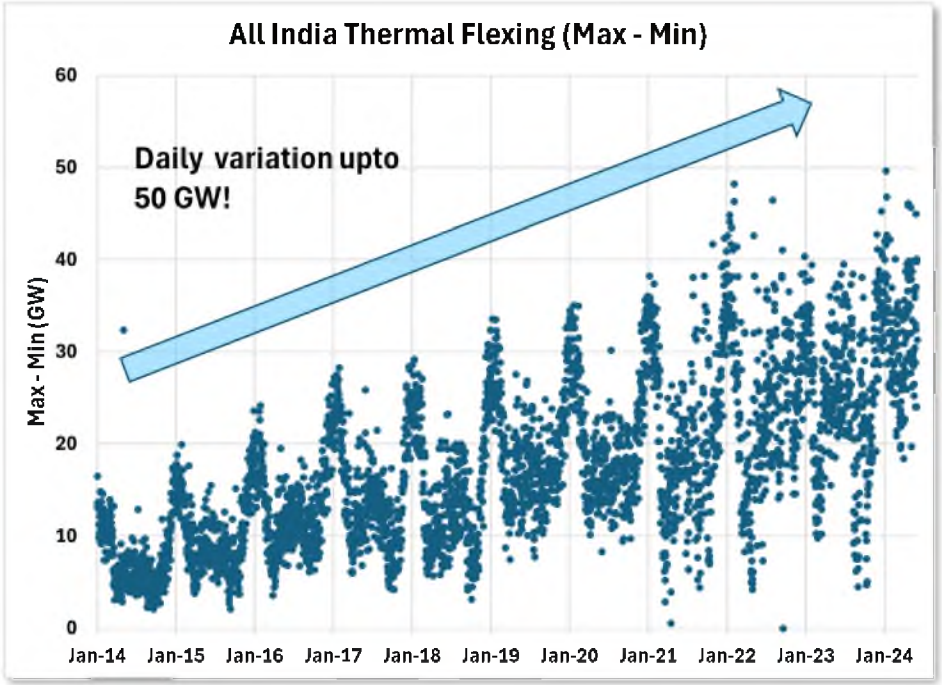


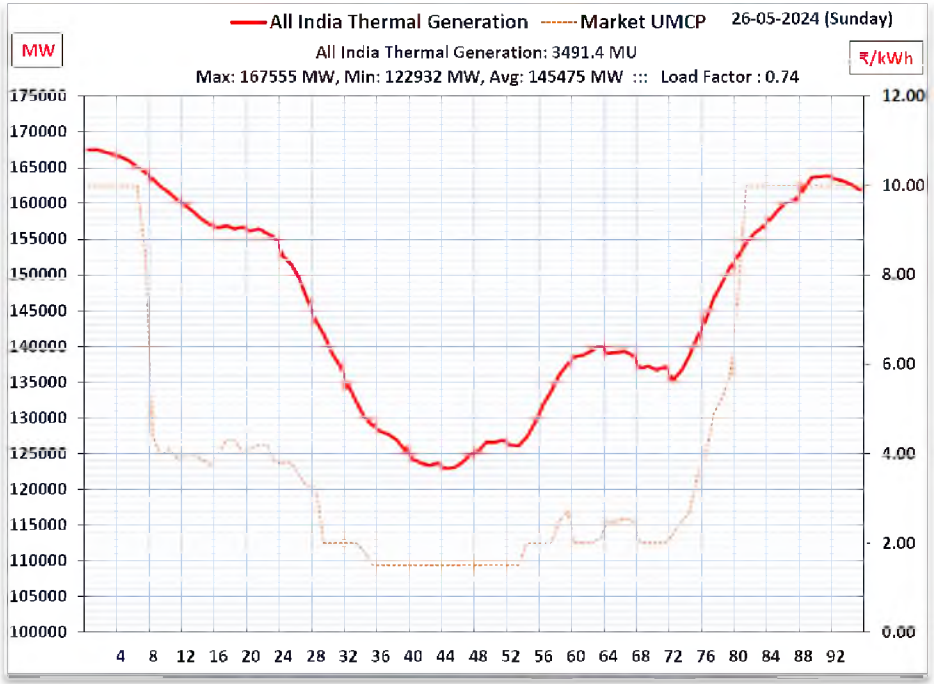
- **Flexibility from Gas Generation constrained by availability of Gas !!**
- **Limited flexibility in Off-grid Gas Stations; Limited flexibility in gas stations where open cycle operation is not possible**
- **Fuel side inflexibility on account of contractual provisions**



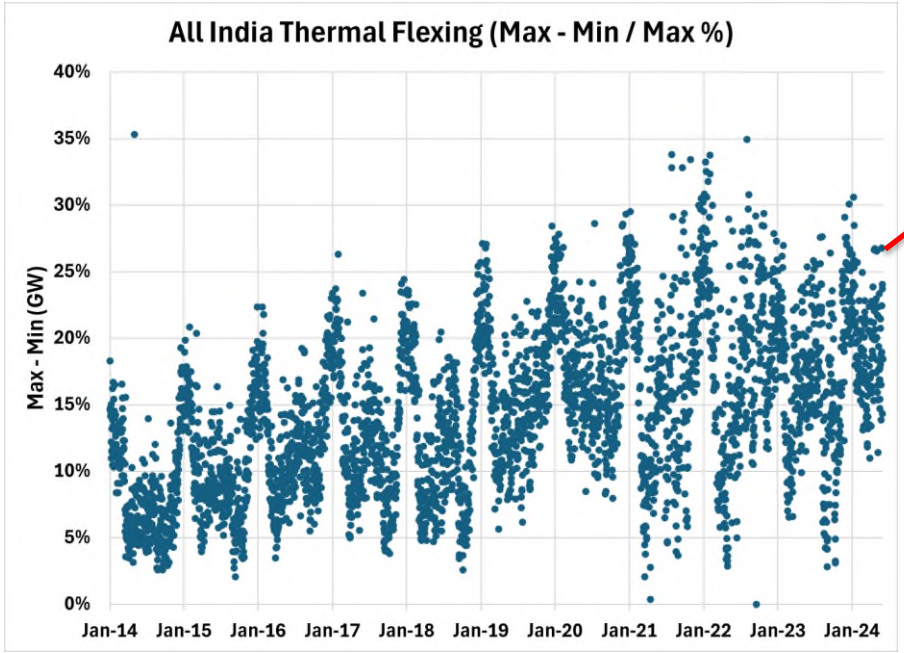
Flexibility from Hydro Generation is highly seasonal !!

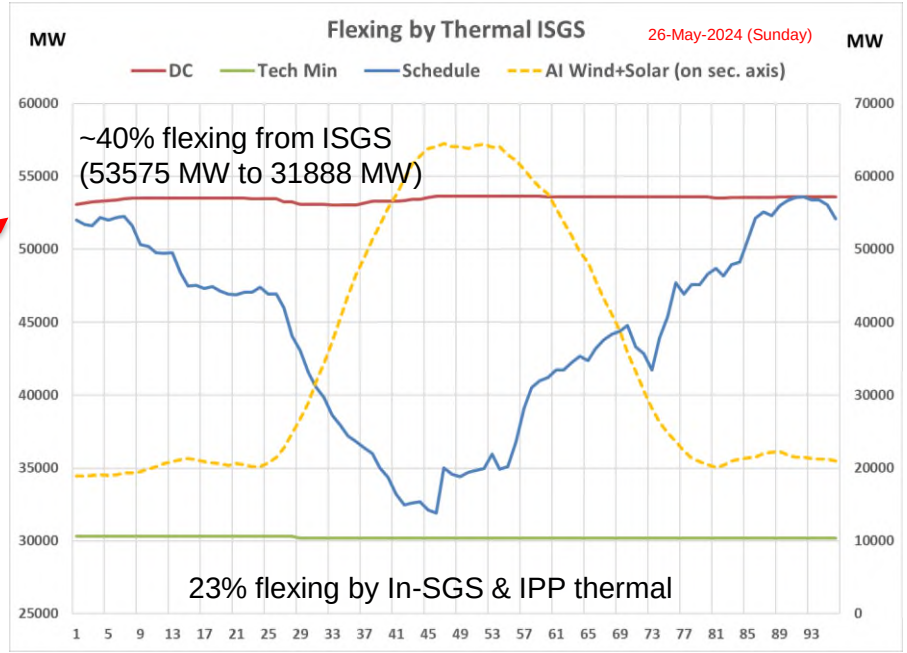
Flexibility Providers – Coal/Lignite fired Generation





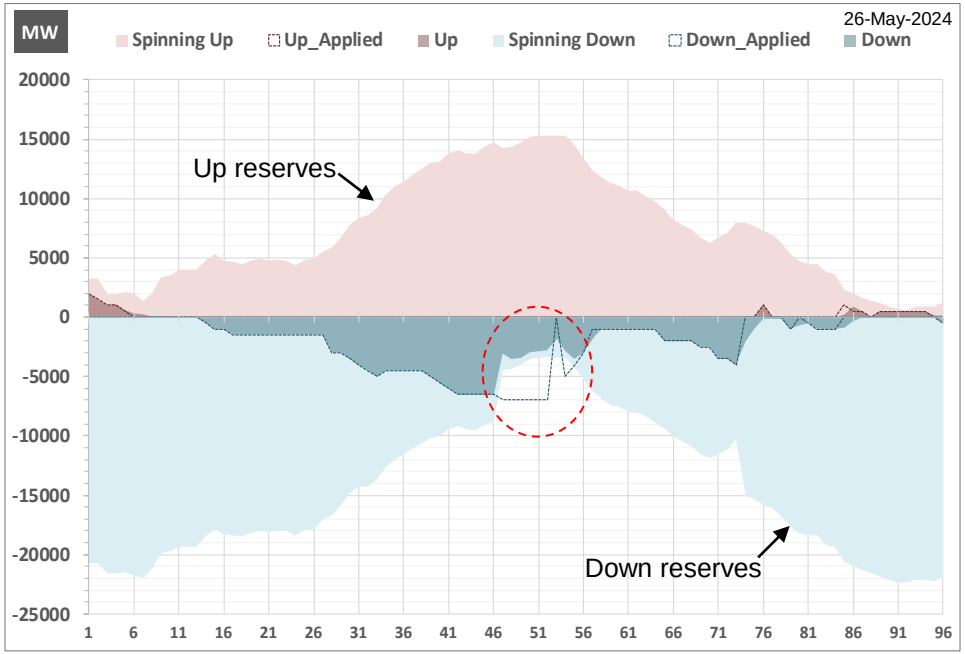
Extent of daily thermal flexing (coal-based)

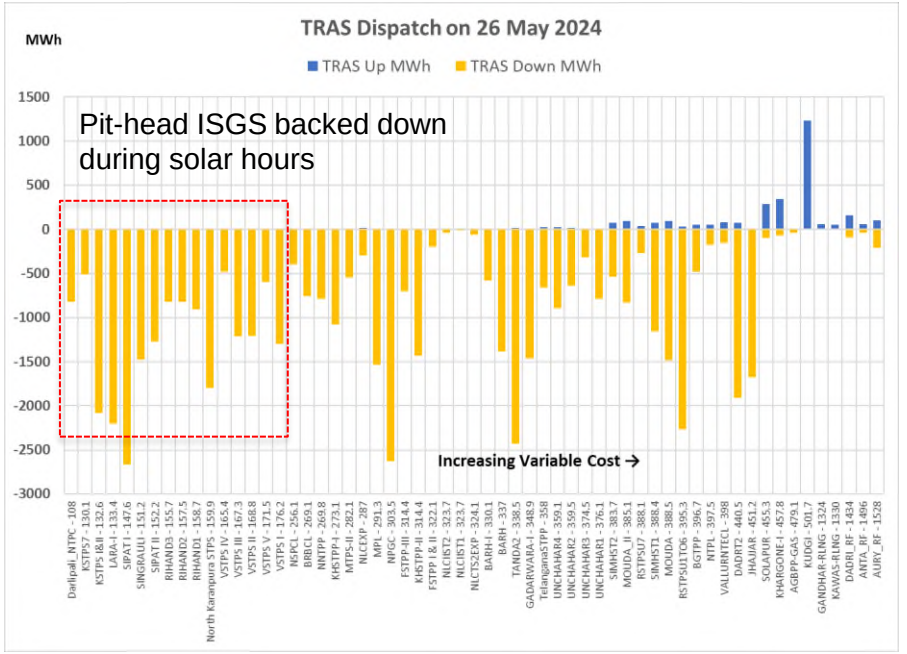




Additional 5% flexing pan-India → Enable 8.5 GW additional solar integration

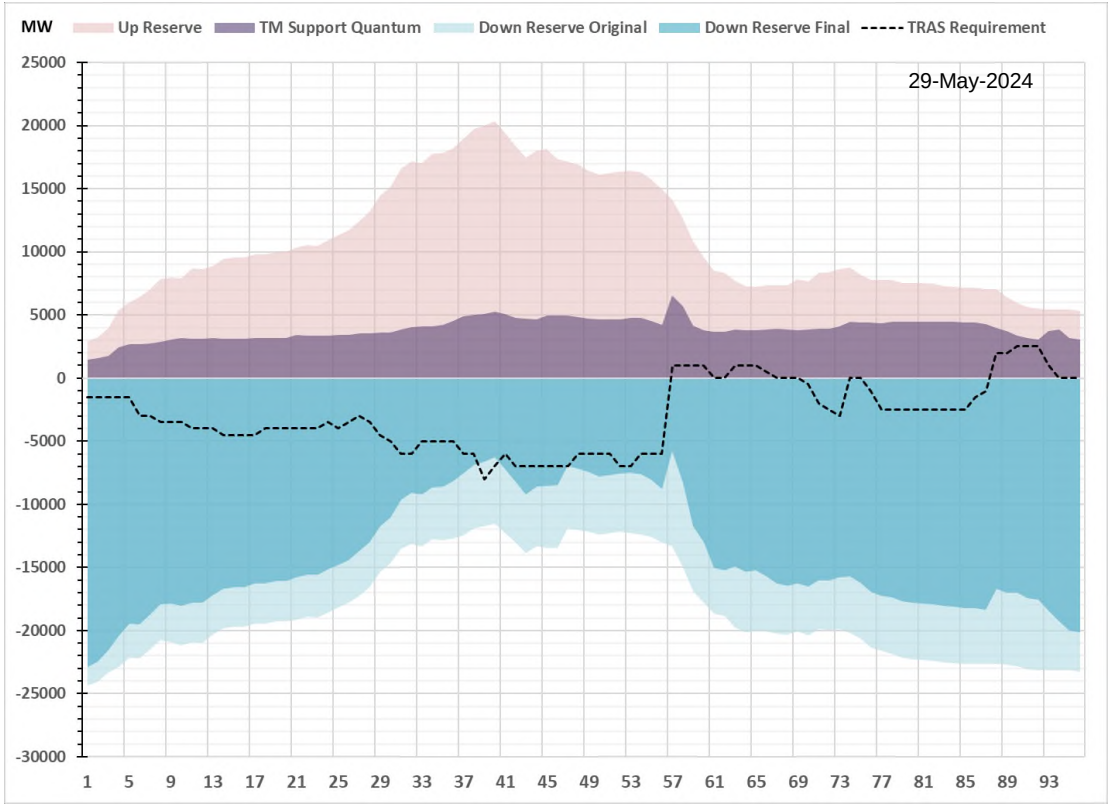
ISGS minimization under Ancillary Services





Full utilization of down reserves in ISGS – including pit head stations

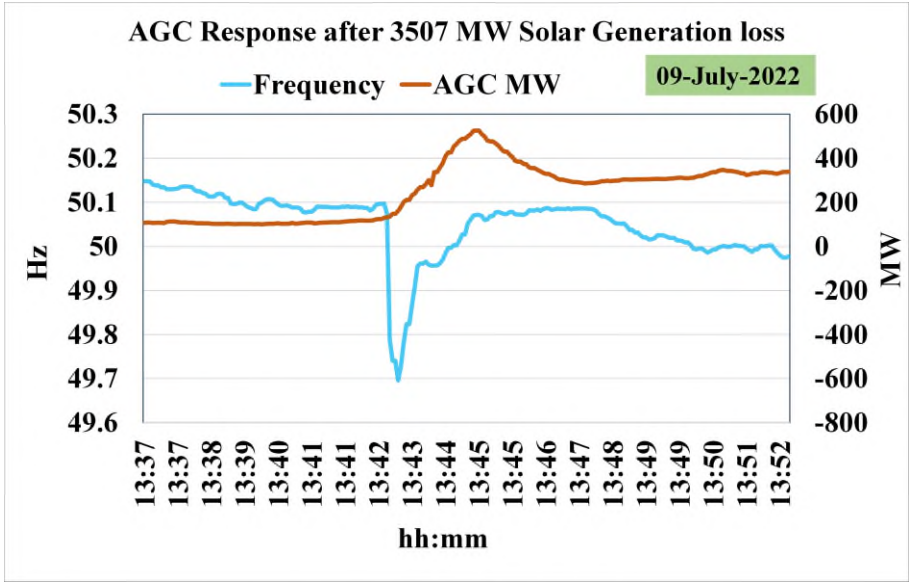
Supporting unit MTL through SCUC –
Impact on down reserves



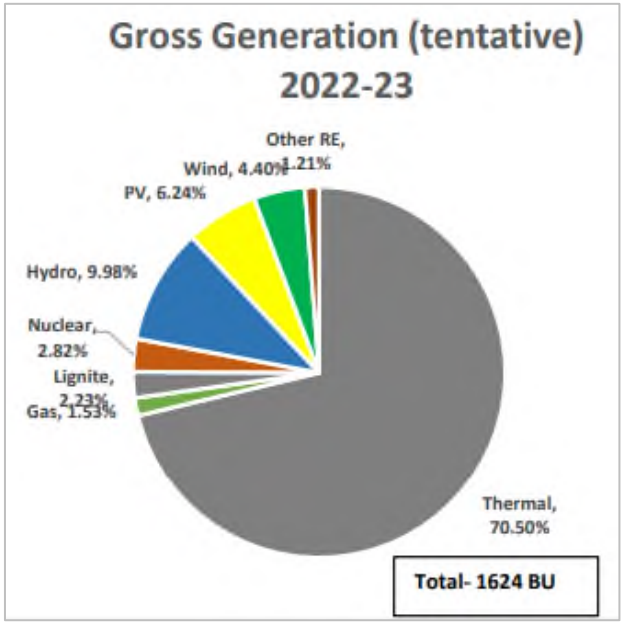
- Coal & gas units being supported through SCUC to maintain adequate reserve during non-solar peaks
  - Schedules incremented upto MTL through SCUC/TRAS
  - Equivalent quantum backed down in other stations to balance system
- Reduction in down reserves due to backing down of other generators
  - Likelihood of shortfall of down reserves during solar hours on some days
- Lower Minimum levels would mitigate this issue
  - More down reserves due to larger operating range
  - Reduction in SCUC support quantum

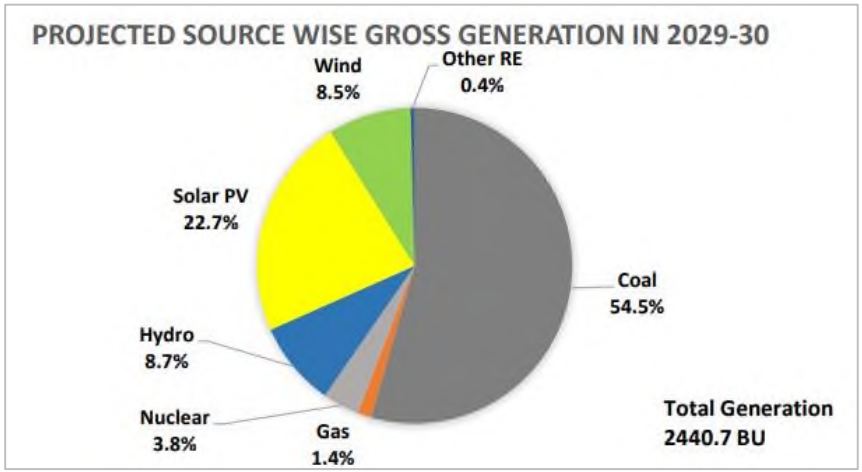
Flexibility under Automatic Generation Control (AGC)

- 70 coal, gas & hydro power plants pan-India with 67 GW capacity participating in Secondary Reserves Ancillary Services (SRAS) through AGC
  - Signals sent every 4 seconds from NLDC to power plants for AGC regulation
- Coal-based units providing higher ramp rates for operating under AGC through changes at power plants and NLDC
  - Ramp rate of 40 sub-critical units increased from 1% MCR/minute to 2% MCR/minute
  - Ramp rate of 20 super-critical units increased from 1% MCR/minute to 1.5% MCR/minute
- Combined ramp rate of up to 200 MW/minute provided under AGC regulation by power plants during contingencies



Role of Thermal Generation in Providing Flexibility

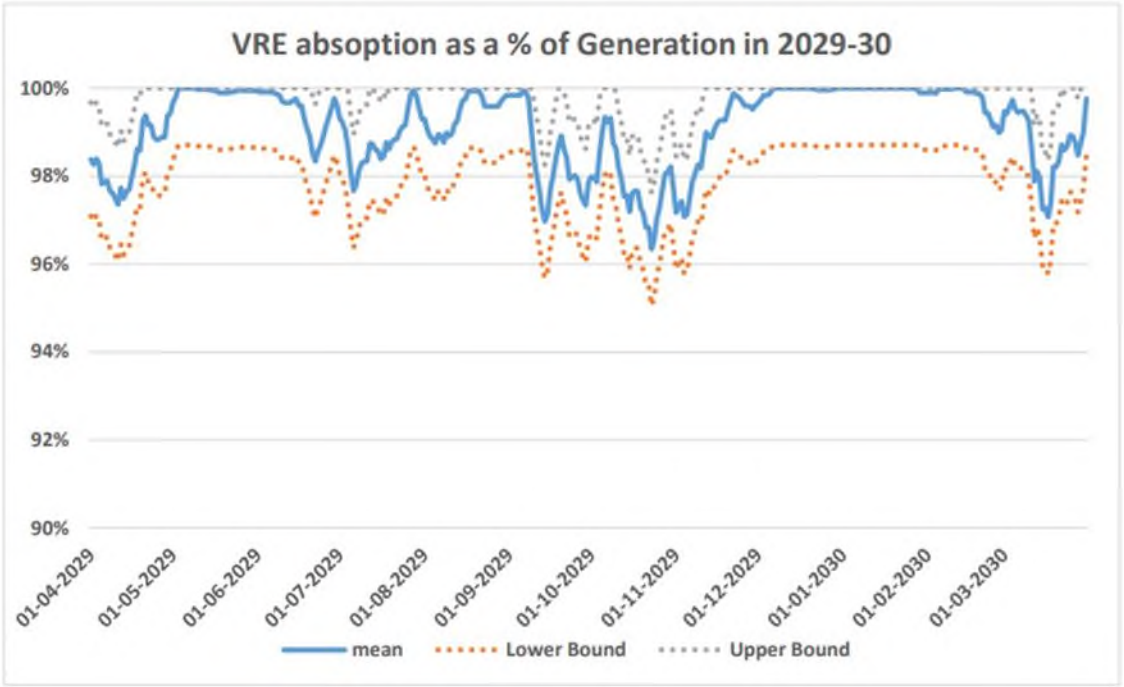




Thermal Generation to remain a major source of generation and thus, a major flexibility provider also in 2030 !!

Source: CEA Report On Optimal Generation Capacity Mix for 2030 (Ver 2.0)
https://cea.nic.in/wp-content/uploads/notification/2023/05/Optimal_mix_report__2029_30_Version_2.0__For_Uploading.pdf

Role of Flexible Thermal Generation in Facilitating RE Integration



CEA's Optimal Generation Capacity Mix Studies for 2030 (Ver 2.0)

RE absorption on maximum VRE day in 2029-30 is likely to be around 98.2%

During the high RE period, RE absorption is likely to decrease to as low as **95%** on some days during 2029-30

Minimum power level constraint of thermal generators (55% in studies) is one of the major reasons for the same

Additional BESS to absorb this power is also not found to be economical

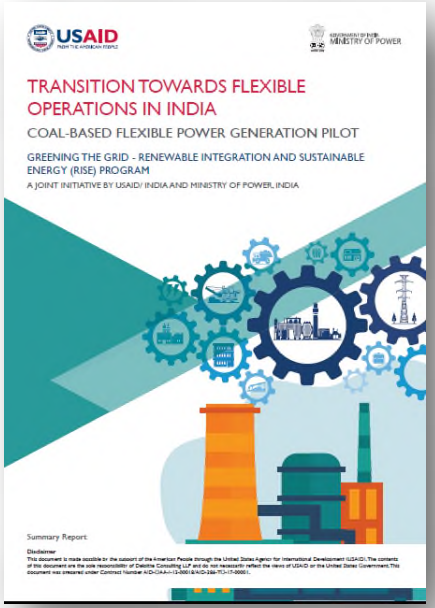
~0.78% RE curtailment in 2029-30 with Min power level of 55%

- Curtailment reduces to 0.25% at 40% Min Power level

Source: CEA Report On Optimal Generation Capacity Mix for 2030 (Ver 2.0)
https://cea.nic.in/wp-content/uploads/notification/2023/05/Optimal_mix_report__2029_30_Version_2.0__For_Uploading.pdf

Recent Pilot Initiatives

- USAID-GTG-RISE Pilot on Coal-based Flexible Generation in Gujarat
  - Two (2) units of Gujarat State Electricity Corporation Limited (GSECL) Ukai thermal power station (Unit # 4, 200 MW and Unit #6, 500 MW).
  - Unit Flexibility Assessment Tests were conducted in March, 2020 to study the response pattern of the units for:
    - Different load ramping rates [at 1%/minute and 3%/minute]
    - Low load operation [test was conducted at 40% Technical Minimum]
- Similar pilots conducted at other TPPs by CEA, IGEF, DEA

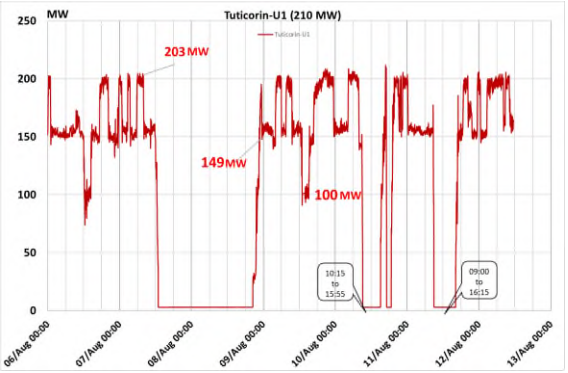


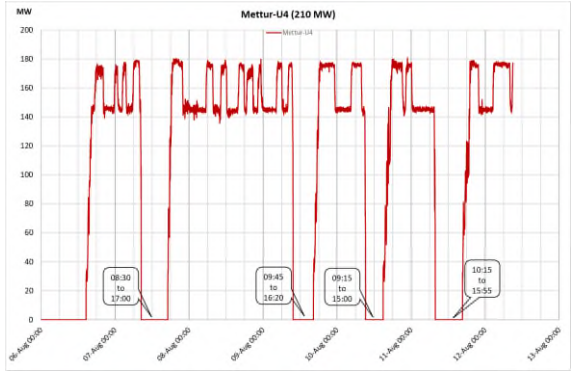
https://www.gtg-india.com/wp-content/uploads/2020/10/USAID-GTG-RISE-Pilot-on-Coal-based-Flexible-Generation_Summary-Report-Revised.pdf

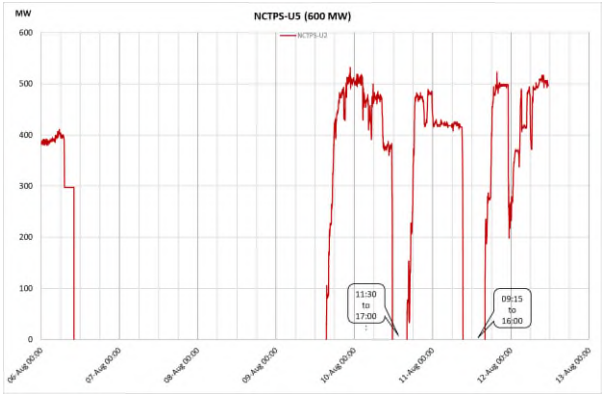
Studies/Pilot tests conducted with help of OEMs and under international cooperation

Sl. No.	Name of Plant	Unit Size (MW)	Unit No.	COD	Utility	Agencies involved	Remarks
1	Dadri	500	2	25/01/2010	NTPC	IGEF, BHEL, CEA	Conducted in June 2018. Achieved 40% load (2.5 hrs) & 0.86% ramp up and 0.5% ramp down at 40% load
2	Mouda	500	2	29/03/2013	NTPC	BHEL, CEA	Conducted in May 2019. Achieved 40% load (1hr.) & 0.85% ramp up and 0.9% ramp down
3	Sagardighi	500	3	14/12/2015	WBPDCL	BHEL, CEA	Conducted in June 2019.Achieved 40% load (1hr.) & 1.1% ramp up and 0.67% ramp down.
4	Ukai	500	6	5/3/2013	GSECL	USAID, BHEL, CEA	Conducted in March 2020. Achieved 40% load (2.5 hrs) & 1 ramp up and 1.2 ramp down
5	MRB TPS	525	1	30/06/2011	MPL	IGEF, BHEL, CEA	Conducted in July,2021. Achieved 40% load & 0.95% ramp up and 0.38% ramp down. 40% load (1hr.)
6	DSTPS	500	1	29/07/2011	DVC	IGEF, BHEL, CEA	Conducted in March,22, 40 % achieved (1.5hrs), less than 1% ramp up and ramp down.
8	Ramagundem TPS	500	7	25/03/2005	NTPC	DEA ,BHEL , CEA	Conducted in Feb,23, 40 % achieved , less than 1% ramp up and ramp down.
7	Raichur TPS	210	3	30/03/1991	KPCL	DEA ,BHEL , CEA	Conducted in March,23, 40 % achieved with 1% ramp up and ramp down.

Recent Pilot Initiatives – 2 Shift Operation of Thermal Units



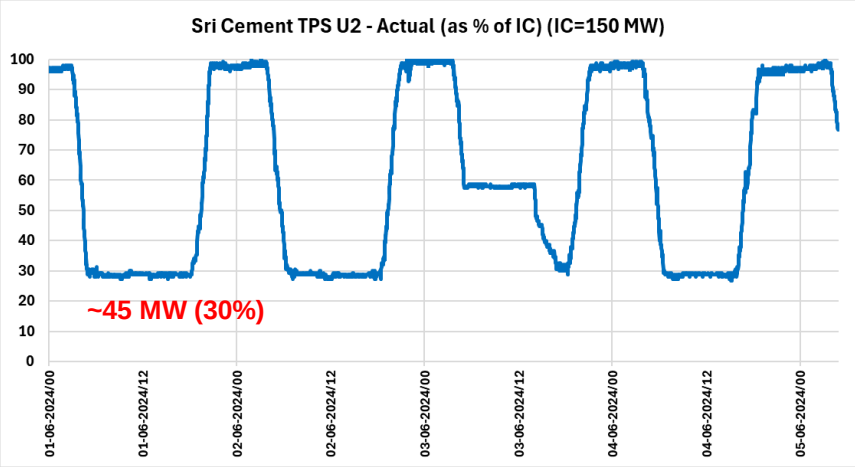


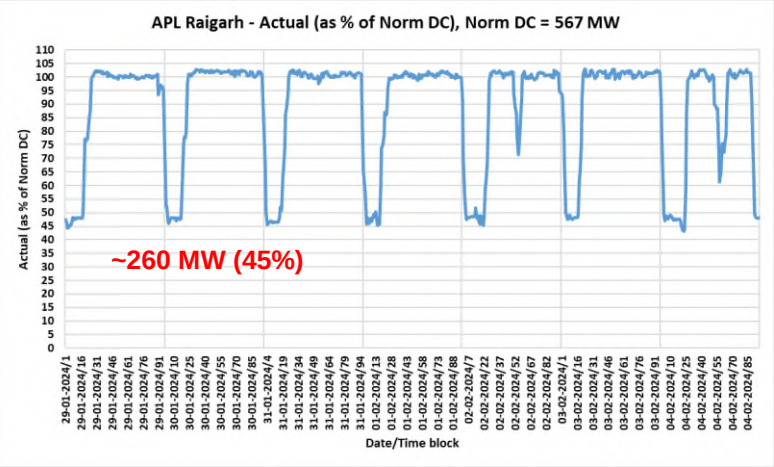


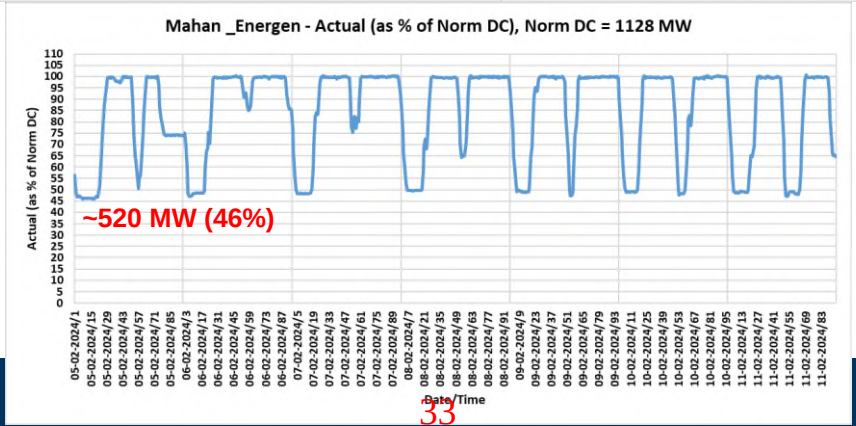
- Two shift operation was started by TANGEDCO, Tamil Nadu in April 2022
- Pilot is being continued in about all 210 MW units of TANGECO to accommodate the renewable generation
- Units are running at full load during evening peak hours; being operated for 16 hrs in a day from 5 pm to 11 am, daily in hot startup mode
- Operational issues, equipment condition and other safety related issues are being monitored meticulously during the two shift operation periods

Source: Flexiblization of Coal-Fired Power Plants
https://cea.nic.in/wp-content/uploads/news_live/2023/03/Flexibilisation_of_Coal_Fired_Power_Plant__A_Roadmap_for_Achieving_40_Technical_Minimum_Load.pdf

Flexible operation by IPPs



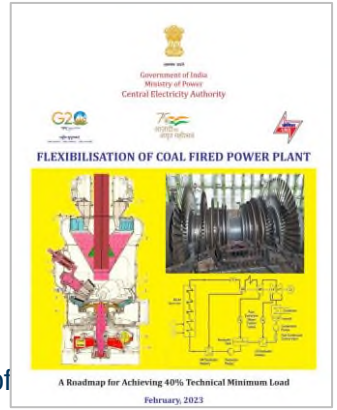




Thermal Flexibilization – Regulatory Initiatives

- **CERC Grid Code – 4th Amendment, Regulations 2016**
  - ❑ Reduction of conventional thermal generation (Central Generating Station) to the **55% level**

  Following incentivization for the operation of thermal plants at Lower Operational Levels also introduced in the amendment (continued in **IEGC, 2023**)
  - ❑ Compensation for the Increase in Heat Rate Degradation
  - ❑ Compensation for Auxiliary Energy Consumption Degradation
  - ❑ Start-up fuel cost over and above seven (7) start/stop in a year



- **CERC (Terms and Conditions of Tariff) Regulations, 2019**
  - ❑ Incentivized generators to provide ramping capability beyond the threshold of 1% and to penalize in case of terms of return on equity (continued in **TCT Regulations, 2024**)

- **CERC (Indian Electricity Grid Code) Regulations, 2023**
  - ❑ Mandate for minimum ramp rate of **1% per minute** by coal-based generators and **3% per minute** by gas-based generators

- **Central Electricity Authority (Flexible Operation of Coal-based Thermal Power Generating Units) Regulations, 2023**
  - ❑ Specified **Minimum Power Level of 40%** for Thermal Generating Units
  - ❑ Requires thermal generators to be **capable of providing 1%–3% ramp rate**

- **Central Electricity Authority – Phasing Plan for Implementation of 40% Technical Minimum Level, Dec 2023**

Minimum Turndown Levels in selected states (1)

State	MTL guideline	Source
Uttar Pradesh	55%	UPERC MOD Regulations, 2021
Haryana	55%	HERC TCT Regulations, 2019
Rajasthan	72%	Enquiry from SLDC
Punjab	75% (50% for IPPs)	Enquiry from SLDC
Maharashtra	55%	MERC Grid Code, 2020
Madhya Pradesh	55%	MPERC Grid Code, 2024
Gujarat	As per OEM guideline	Enquiry from SLDC

Minimum Turndown Levels in selected states (2)

State	MTL guideline	Source
Andhra Pradesh	55% (>500 MW) 71.4% (<=500 MW)	Minutes of 210th OCC meeting of SR
Karnataka	55% (40% for two units)	
Tamil Nadu	60-80%	
Telangana	58-67%	
West Bengal	70%	Minutes of 214th OCC meeting of ER
Odisha	55-60%	

Way Forward

- Implementation of 40% Technical Minimum Level as per Phasing Plan
- Incremental costs (O&M) due to flexibilization to be addressed (especially at the state level) through a suitable regulatory mechanism
- Ensuring reserves within the state through SCUC by SLDCs, as being done at National level
  - At present, revival of units from RSD left to discoms/procurers
- Studies for exploring the possibility of two-shift operation of existing thermal generating units as per the grid requirement
  - Design of new thermal units to allow 2-shift operation on a regular basis
  - Specifying metrics for Minimum Up/Down Time, Startup Time etc.
- Adaptability and willingness of generation utilities to embrace and prepare for the future as more units are subjected to low load and cyclic operations.
  - Capacity building, knowledge dissemination, and executive exchanges

Thank You !!

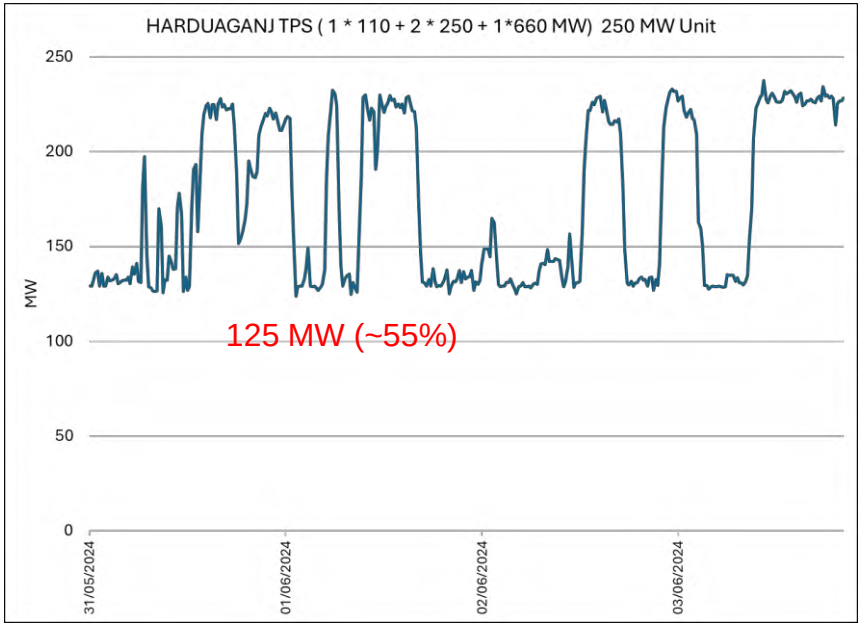
https://grid-india.in/

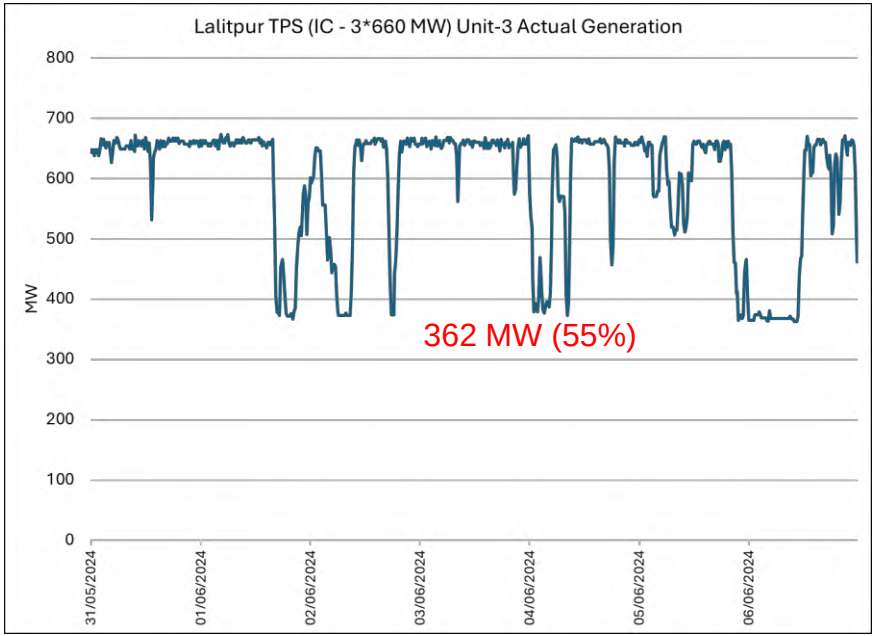
Likely increase in tariff considering capital investment of Rs. 30 crores, increase of O&M cost, variable cost and EFOR cost

Unit Size (MW)	Loading (%)	Coal price Rs 2000.00 per ton	Coal price Rs 3300.00 per ton	Fixed Tariff increase (Paisa/kWh)		EFOR compensation (Paisa/kWh)	Total tariff (fixed & variable) increase (Paisa/kWh)	Total tariff (fixed & variable) increase (Paisa/kWh)	Proposed total tariff (fixed & variable) increase (Paisa/kWh)
		Variable Tariff increase (Paisa/kWh)	Variable Tariff increase (Paisa/kWh)	due to increased O&M cost	due to increased capital cost		Coal price Rs 2000.00 per ton	Coal price Rs 3300.00 per ton	
200	<55 to 50	13.68	22.57	6.70	7.68	1	29.06	37.95	33.51
	<50 to 45	17.78	29.34	10.42	7.68	1	36.88	48.44	42.66
	<45 to 40	21.89	36.11	14.88	7.68	1	45.45	59.67	52.56
500	<55 to 50	14.66	24.20	4.57	3.07	1	23.30	32.84	28.07
	<50 to 45	18.30	30.19	7.11	3.07	1	29.48	41.37	35.43
	<45 to 40	21.53	35.52	10.16	3.07	1	35.76	49.75	42.76
660	<55 to 50	11.17	18.42	4.12	2.56	1	18.85	26.10	22.48
	<50 to 45	15.27	25.20	6.40	2.56	1	25.23	35.16	30.20
	<45 to 40	18.74	30.92	9.14	2.56	1	31.44	43.62	37.53
800	<55 to 50	10.65	17.57	3.70	1.92	1	17.27	24.19	20.73
	<50 to 45	14.86	24.52	5.76	1.92	1	23.54	33.20	28.37
	<45 to 40	18.58	30.65	8.23	1.92	1	29.73	41.80	35.77

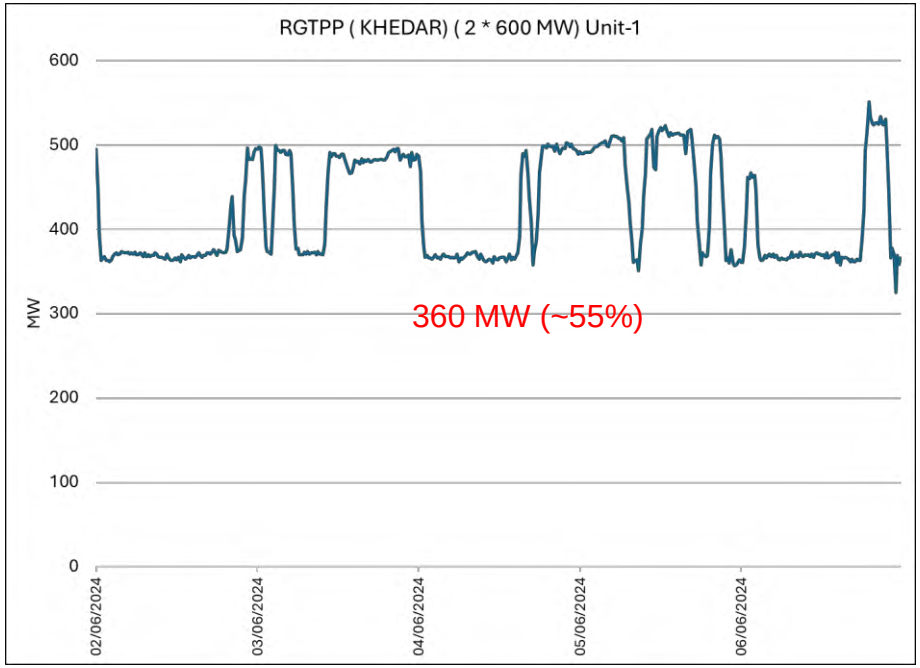
Source: CEA

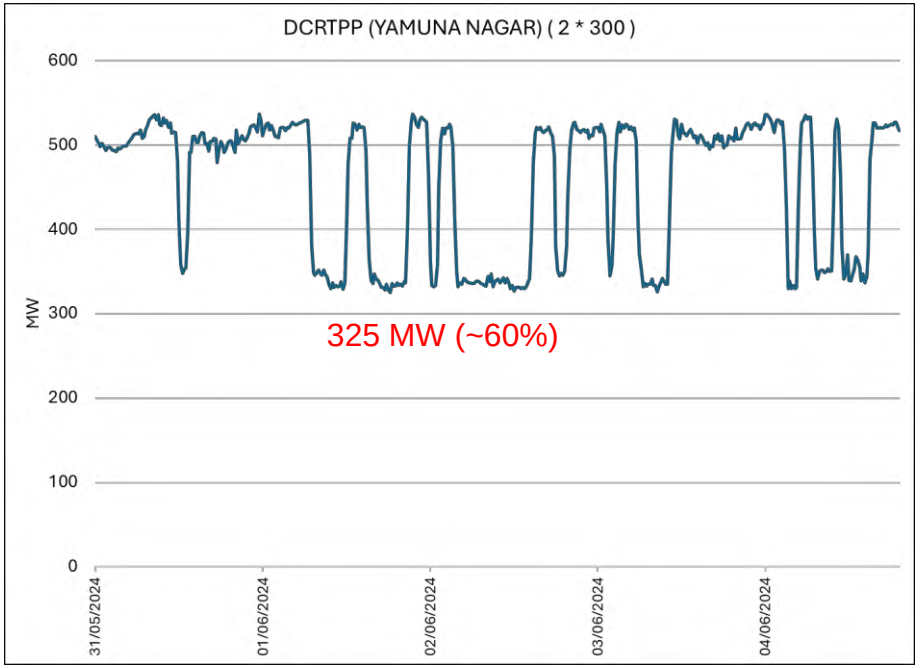
Plots of SGS/IPP Operation – Uttar Pradesh



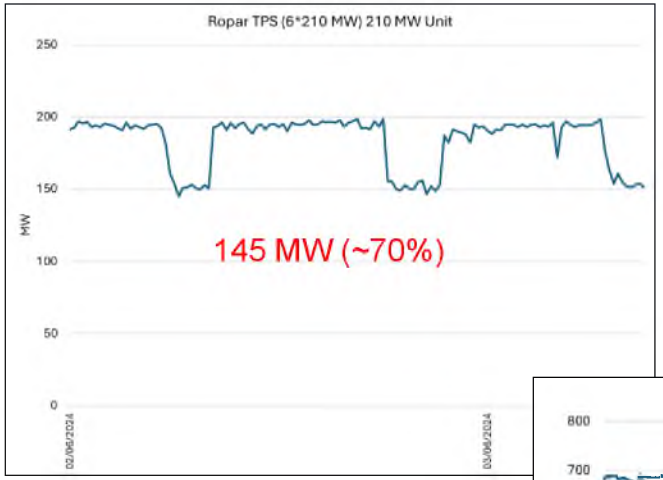


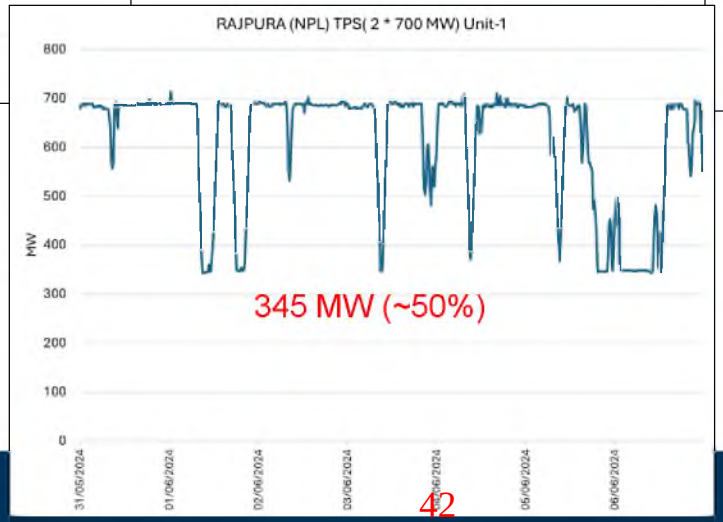
Haryana

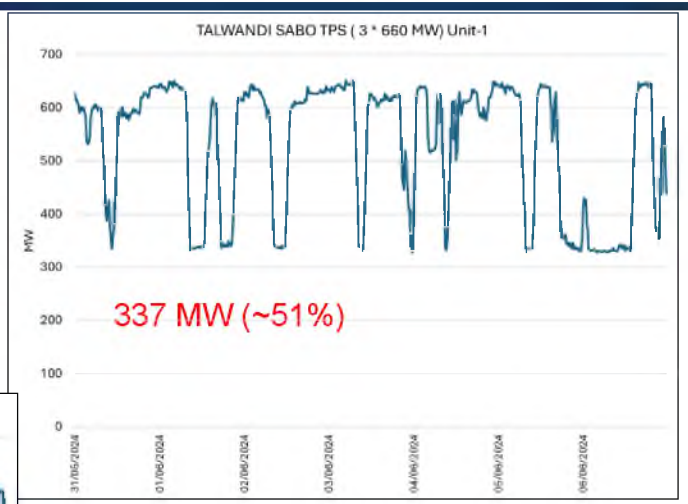

RGTPP (KHEDAR) (2 * 600 MW) Unit-1
600
500
400
300
200
100
0
MW
360 MW (~55%)
02/06/2024
03/06/2024
04/06/2024
05/06/2024
06/06/2024


DCRTPP (YAMUNA NAGAR) (2 * 300)
600
500
400
300
200
100
0
MW
325 MW (~60%)
31/05/2024
01/06/2024
02/06/2024
03/06/2024
04/06/2024

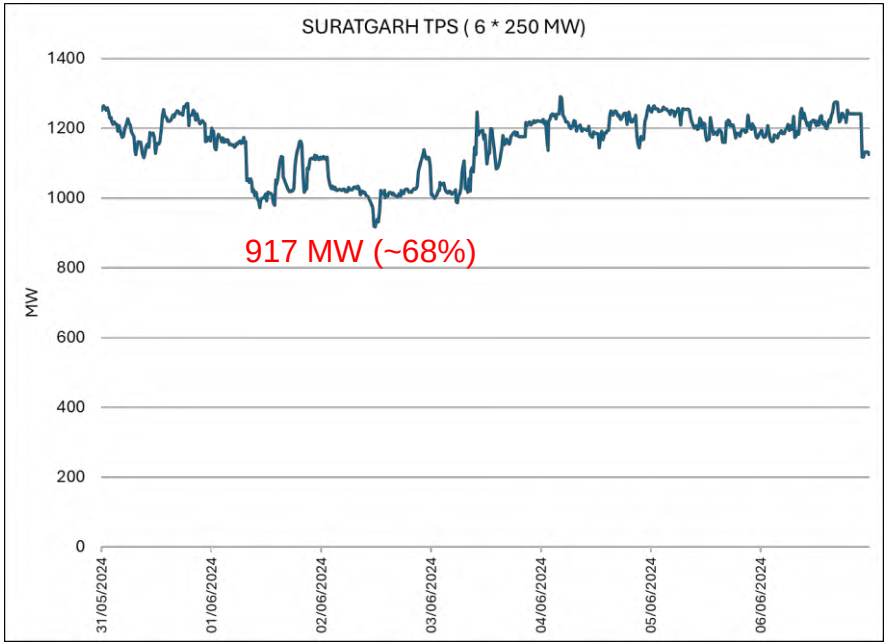
Punjab

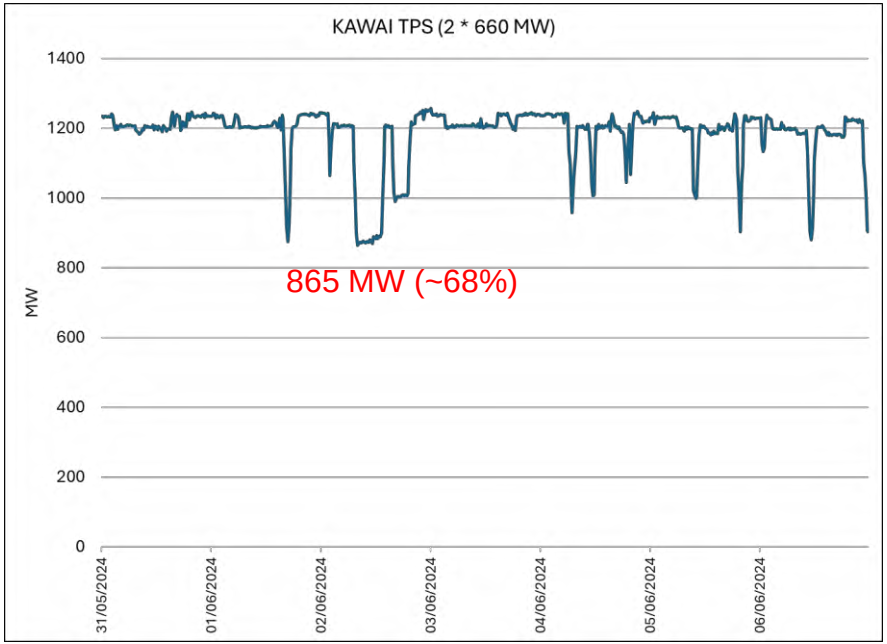

Ropar TPS (6*210 MW) 210 MW Unit
MW
250
200
150
100
50
0
145 MW (~70%)
02/06/2024
03/06/2024


RAJPURA (NPL) TPS(2 * 700 MW) Unit-1
MW
800
700
600
500
400
300
200
100
0
345 MW (~50%)
31/05/2024
01/06/2024
02/06/2024
03/06/2024
05/06/2024
06/06/2024

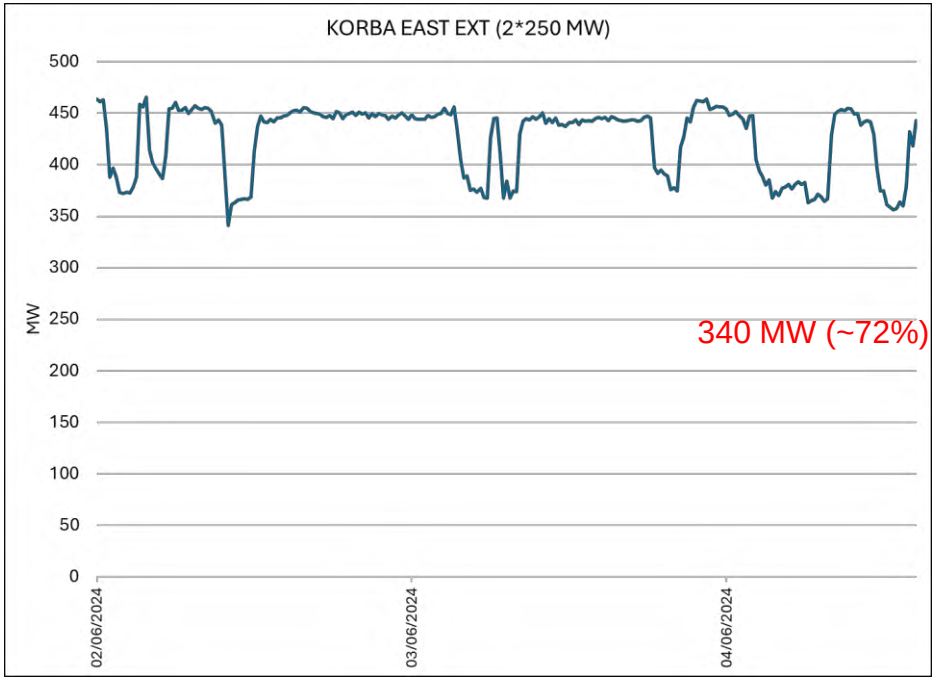

TALWANDI SABO TPS (3 * 660 MW) Unit-1
MW
700
600
500
400
300
200
100
0
337 MW (~51%)
31/05/2024
01/06/2024
02/06/2024
03/06/2024
04/06/2024
05/06/2024
06/06/2024

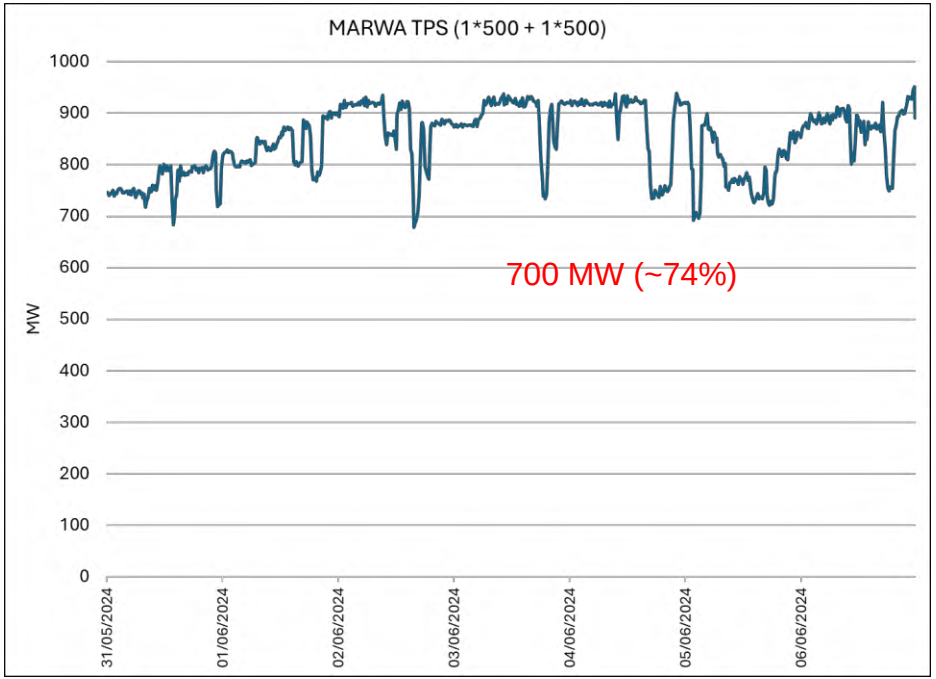
Rajasthan


SURATGARH TPS (6 * 250 MW)
1400
1200
1000
800
600
400
200
0
MW
917 MW (~68%)
31/05/2024
01/06/2024
02/06/2024
03/06/2024
04/06/2024
05/06/2024
06/06/2024

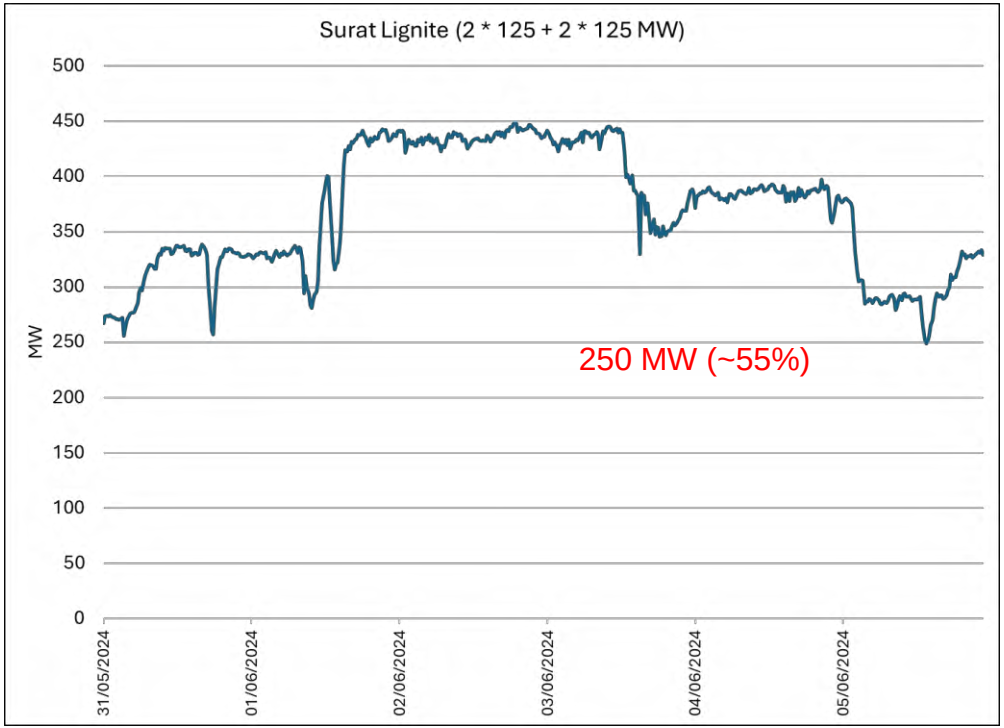

KAWAI TPS (2 * 660 MW)
1400
1200
1000
800
600
400
200
0
MW
865 MW (~68%)
31/05/2024
01/06/2024
02/06/2024
03/06/2024
04/06/2024
05/06/2024
06/06/2024

Chhattisgarh

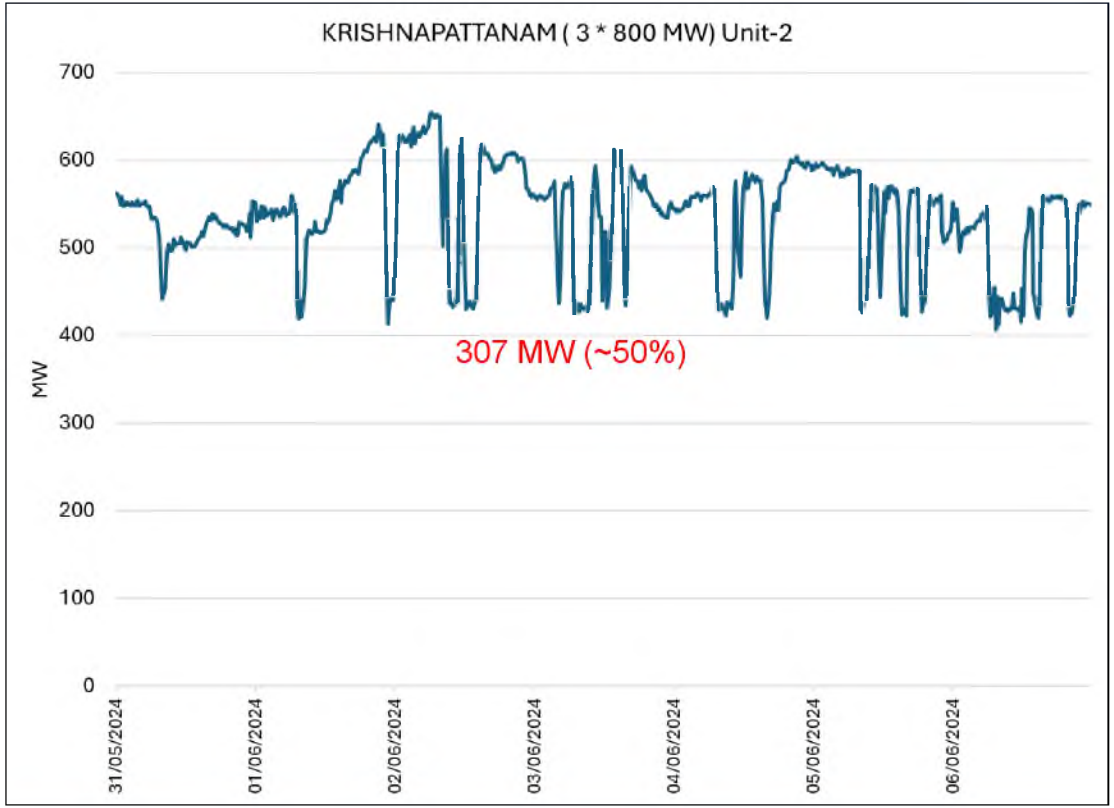




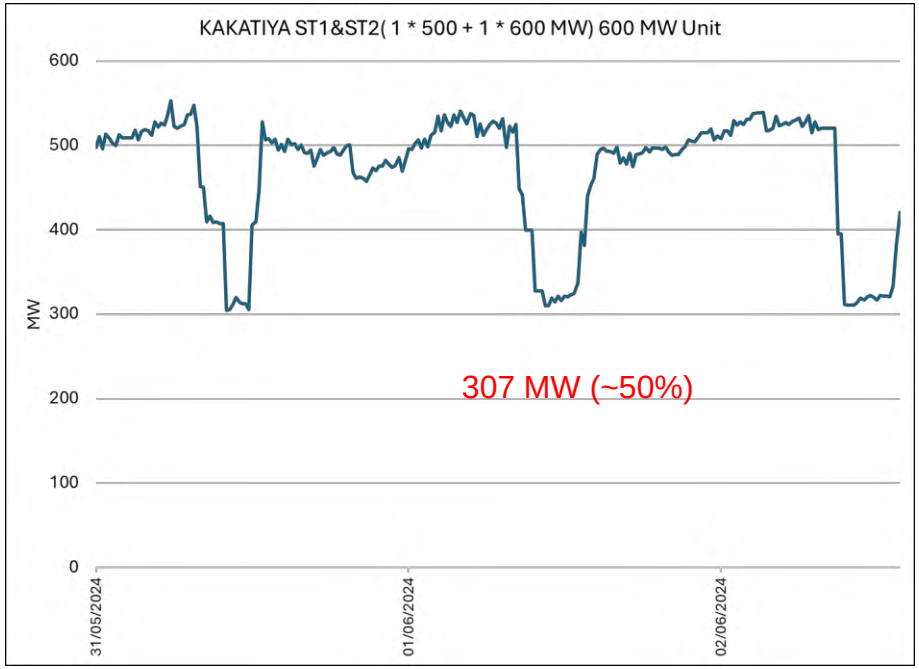
Gujarat

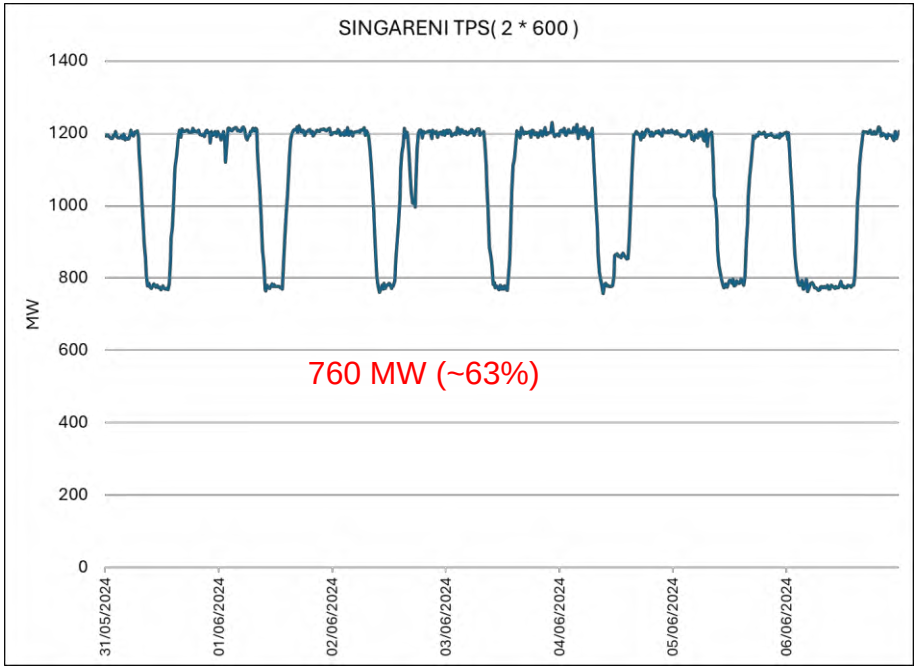

Surat Lignite (2 * 125 + 2 * 125 MW)
500
450
400
350
300
250
200
150
100
50
0
MW
250 MW (~55%)
31/05/2024
01/06/2024
02/06/2024
03/06/2024
04/06/2024
05/06/2024

Andhra Pradesh

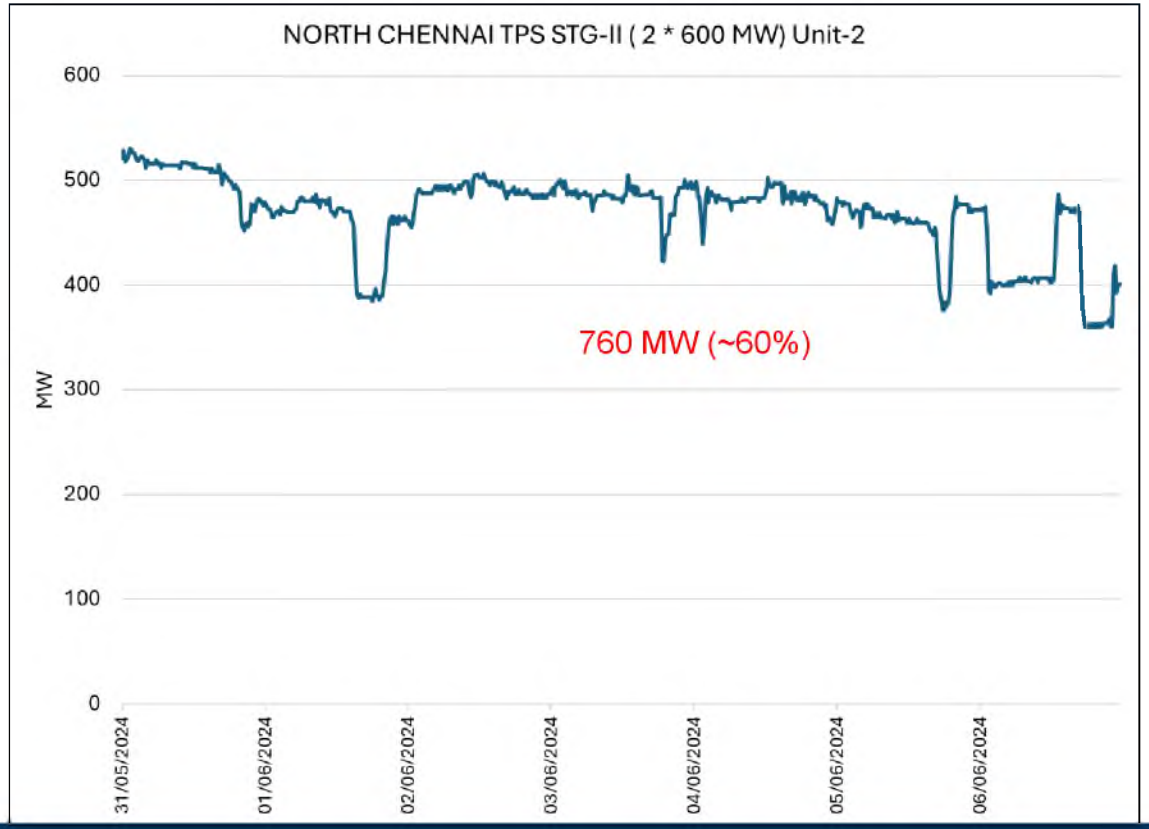


Telangana


KAKATIYA ST1&ST2(1 * 500 + 1 * 600 MW) 600 MW Unit
600
500
400
300
200
100
0
MW
307 MW (~50%)
31/05/2024
01/06/2024
02/06/2024


SINGARENI TPS(2 * 600)
1400
1200
1000
800
600
400
200
0
MW
760 MW (~63%)
31/05/2024
01/06/2024
02/06/2024
03/06/2024
04/06/2024
05/06/2024
06/06/2024

Tamil Nadu


NORTH CHENNAI TPS STG-II (2 * 600 MW) Unit-2
600
500
400
300
200
100
0
MW
760 MW (~60%)
31/05/2024
01/06/2024
02/06/2024
03/06/2024
04/06/2024
05/06/2024
06/06/2024

ADDITIONAL FIXED COST DUE TO INCREASE CAPEX

Source: CEA

a) **Capital Expenditure for retrofit:** One-time expenditure to be incurred in retrofitting of various measures to make the plant capable of low load operation.

i. In case of old units (commissioned before 01.01.2004) which have not upgraded their plant control and instrumentation system previously, capex requirement may be around Rs 30 crores for each unit.

ii. An estimated capital investment of around Rs 10 crores will be required for each unit commissioned on or after 01.01.2004 and except units covered under para (iii).

iii. As per the OEM few measures are required to be implemented for regular 40% load operation of subcritical units though the same (40%) was demonstrated during PG test. Considering above it is proposed a capital investment of Rs.6 crores may be allowed to the subcritical generating units where investment approval received on or after 01.01.2011

iv. Unit will be eligible for increased fixed tariff irrespective of actual operation once measures are implemented and exhibits desired low load operation. Considering five (5) years payback period the impact has been estimated.

v. Power plant may be penalized proportionally (Fixed cost) for not exhibiting low load operation at least 85% of time when asked for.

Unit Size (MW)	Recovery period (years)	Capital cost (Rs Cr)	Increased in fixed charge per annum (Rs. Cr.)	Capital cost (Rs Cr)	Increased in fixed charge per annum (Rs. Cr.)
200	5	30	7.65	10	2.55
500	5	30	7.65	10	2.55
660	5	30	7.65	10	2.55
800	5	30	7.65	10	2.55

Unit Size (MW)	Recovery period (years)	Capital cost (Rs Cr)	Increased in fixed charge per annum (Rs. Cr.)
200/250	5	6	1.53
500	5	6	1.53
600	5	6	1.53

ADDITIONAL FIXED COST DUE TO INCREASE IN O&M COST

b) O&M cost due to increased Life Consumption: Flexible operation also leads to a higher rate of deterioration of plant's components

i. As flexible operation is new in India no reliable data is available regarding actual life consumption or damaged. In other country also no such assessment has been done a as cost of flexible power is being kept under ancillary services and price is market based which may be high or less compared to actual.

ii. USAID-Intertek Study: An estimate of the increase in O&M Cost due to reduction in life of components at Ramagundam, Jhajjar TPS of NTPC and Ukai of GSECL. The study was based on the five to ten-year historical cost data of the units (all the costs are at 2017 levels for NTPC & 2018 for GSECL Units). No two units have the same costs due to variation in factors affecting the costs like coal, age of plant, operating practices, operator's skill and design.

iii. Engie Lab estimates: the capital expenditures and additional maintenance result in a 0.3% to 4.3% cost impact versus the total costs of a unit. The absolute non-fuel costs over a 10-year period are approximately But this estimate is based on the current level of flexibilization,(55% and above).

iv. Considering above the increase in annual O&M cost has been proposed as 9%, 14% and 20% at 50%, 45%, 40% loading respectively as increase in O&M costs shall depend on level of flexibilisation.

Capacity (MW)	Loading (%)	O&M cost Increase (%)
200	<55 to 50	9.00
	<50 to 45	14.00
	<45 to 40	20.00
500	<55 to 50	9.00
	<50 to 45	14.00
	<45 to 40	20.00
660	<55 to 50	9.00
	<50 to 45	14.00
	<45 to 40	20.00
800	<55 to 50	9.00
	<50 to 45	14.00
	<45 to 40	20.00

Source: CEA

INCREASE OPERATIONAL COST

***Operational Expenditure (OPEX)*:**

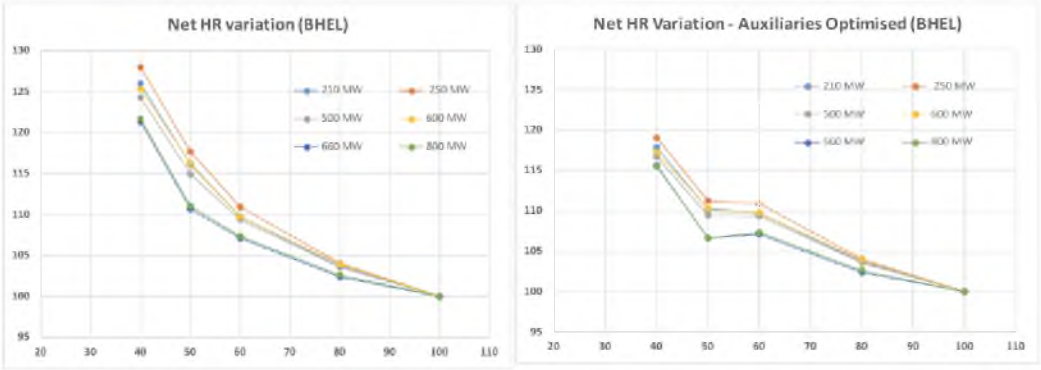
i. Cost due to increase in Net Heat Rate
ii. Cost due to Increased Life Consumption (damage costs)- considered under fixed part
iii. Cost due to additional oil consumption for additional EFOR

Source: CEA

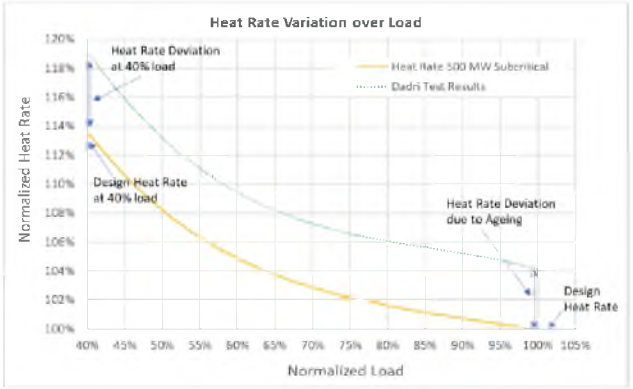
2. OPERATIONAL EXPENDITURE (OPEX)

i. INCREASE HEAT RATE

Heat Balance study



Efficiency captured during flexibilisation test



Source: CEA

After analyzing the HBD report of major OEMs (BHEL/GE/Siemens) and actual test report of low load operation unit size wise NHR degradation is given in table.

The study conducted by CEA indicates the impact of low load operation at 40% on variable part of tariff is around 16% for subcritical units (200/500MW) and around 15% for supercritical units(660/800MW).

Capacity (MW)	Loading (%)	Net Heat Rate Increase (%)
200	<55 to 50	10.00
	<50 to 45	13.00
	<45 to 40	16.00
500	<55 to 50	10.90
	<50 to 45	13.60
	<45 to 40	16.00
660	<55 to 50	8.70
	<50 to 45	11.90
	<45 to 40	14.60
800	<55 to 50	8.60
	<50 to 45	12.00
	<45 to 40	15.00

2. OPERATIONAL EXPENDITURE (OPEX)

iii. ADDITIONAL OIL CONSUMPTION

Based on the increased EFOR the norms for specific oil consumption and increased compensation may be allowed as per the Table.

S. No.	Specific Oil Consumption	Increased ECR (p/kWh)
1	CERC Norms (Present): 0.5 ml/kWh	2.5
2	At 0.7 ml/kWh (40-50% load)	3.5
3	At 0.8 ml/kWh (30-40% load)	4.0

In addition, due to flexible operation there would be loss of availability on account of increased maintenance requirements and increased EFOR which will make it difficult for the generator to recover full capacity charges.

Source: CEA

Compensation mechanism for Part load operation

Compensation for increase in Station Heat rate

S. No.	Unit loading as a % of Installed Capacity of the Unit	Increase in SHR (for supercritical units) (%)	Increase in SHR (for sub-critical units) (%)
1	85-100	Nil	Nil
2	75-84.99	1.25	2.25
3	65-74.99	2	4
4	55-64.99	3	6

Compensation for degradation in Auxiliary Energy Consumption

Sl. No	Unit Loading (% of MCR)	% Degradation in AEC admissible
1.	85 – 100	NIL
2.	75 – 84.99	0.35
3.	65 – 74.99	0.65
4.	55 - 64.99	1.00

Compensation based on above norms or actual, whichever is lower

Compensation for additional start/stop

Unit Size (MW)	Oil Consumption per start up (Kl)		
	Hot	Warm	Cold
200/210/250 MW	20	30	50
500 MW	30	50	90
660 MW	40	60	110

Admissible for more than 7 start/stops in a year.
Compensation based on above norms or actual, whichever is lower

Part Load Operation

- Compensation mechanism available in UP, Haryana, Maharashtra
- Petition for technical minimum provisions filed by Rajasthan SLDC before RERC in 2020 (1714/20)
  - Inputs to be taken into account in future amendments of State Grid Code

Operation of GBS under Section 11 directions

GENERATION SUMMARY - GBSs UNDER SECTION-11

For 05-05-24 (despatched u/s-11)

A. GBSs Despatched Under Section-11					
Name of the Plant	Capacity(MW)	Declared Rate u/s-11	Max. Gen(MW)	Avg. Gen(MW)	Energy Gen(MU)
SUGEN CCPP (TORRENT)	1147.5	11.92	998	751	18.0
UNOSUGEN CCPP	382.5	11.92	356	254	6.1
HAZIRA CCPP EXT	351	14	284	241	5.8
PRAGATI CCGT-III (Bawana) Gas/RLNG	1500	6.882/12.517	870	752	18.1
PRAGATI CCPP	330.4	11.28	294	288	6.9
I.P.CCPP	270	16.079	75	66	1.6
KASHIPUR CCPP (Phase-I & II)	439	14.56/14.56	181	171	4.1
FARIDABAD CCPP	432	14.24	286	185	4.5
ANTA CCPP	419	14.98	323	175	4.2
AURAIYA CCPP	663	15.31	369	222	5.33
DADRI CCPP	830	14.37	437	258	6.2
PIPAVAV CCPP	702	14.41	671	495	11.9
TROMBAY CCPP (TPC)	180	14.074	173	171	4.1
UTRAN CCPP	374	13.98	365	224	5.4
DHUVARAN CCPP Stage I	106.6	11.7	451	324	7.8
DHUVARAN CCPP (Stage II & III)	488.5	14.72/13.98			
KAWAS CCPP	656	13.30	597	233	5.6
GANDHAR(JHANORE) CCPP	657	13.24	594	260	6.2
RATNAGIRI*	1967	13.29	1189	505	12.1
URAN CCPP	672	6.76	454	335	8.0
KONDAPALLI EXTN CCPP	366	10.78	338	182	4.4
DGEN Mega CCPP	1200	10.236	1154	863.75	20.7
GODAVARI (JEGURUPADU)	235.4	13.269	0	0	0.0
TOTAL (A)	14368.9			6956	167
B. GBSs NOT Despatched Under Section-11 being Non-compliant (non-declaration of availability / ECR etc.)					
Name of the Plant	Capacity(MW)	Declared Rate u/s-11	Max. Gen(MW)	Avg. Gen(MW)	Energy Gen(MU)
GAMA CCPP	225	NA	131	129	3.1
DHOLPUR CCPP	330	NA	0	0	0.0
HAZIRA CCPP	156.1	NA	0	0	0.0
TOTAL (B)	711.1			129	3
GRAND TOTAL	15080			7085	170

* Actual (commissioned) capacity is 1327MW. Thus, actual GBSs capacity under Section-11 is 14440MW

Above MW and MU Generation are Ex-bus. Based on Daily Power Supply Position Report & SCADA data

Phasing plan for 40% MTL - CEA

Phase 1 (Jul 2024 - Jun 2026)	Phase 2 (Jul 2026 – Jun 2028)	Phase 3 (Jul 2028 – Dec 2029)	Phase 4 (Jan 2030 – Dec 2030)
• 91 units, 51080 MW	• 100 units, 46825 MW	• 101 units, 37215 MW	• 191 units, 55767 MW

https://cea.nic.in/wp-content/uploads/tprm/2023/12/Phasing_plan_Gazatte_of_India.pdf

Interim Report of FOR Working Group on Harmonization of Rules and Regulations

8 June 2024

*by the Consultant supported through USAID/SAREP

Constitution of FOR Working Group

The Forum of Regulators (FOR) in its 87th meeting dated 25 August 2023, decided to constitute a Working Group on, "Harmonisation of Rules and Regulations" for addressing the several issues that are cropping up in implementing various Rules being issued by the GoI from time to time

The Composition of WG:

a. Chairperson. Gujarat ERC- Chairperson of the WG
b. Chairperson Chhattisgarh State ERC- Member
c. Chairperson, Himachal Pradesh ERC-Member
d. Chairperson, Karnataka ERC-Member
e. Chairperson, Madhya Pradesh ERC-Member
f. Chairperson, Maharashtra ERC-Member
g. Chairperson, Orissa ERC-Member
h. Chairperson, Rajasthan ERC-Member
i. Chairperson, Tripura ERC-Member

TOR of FOR WG are:

a. Examine and analyse the issues around the implementation of various Rules and Policies being issued by the Government of India from time to time;
b. Identify areas of divergence and potential conflicts between the Rules and Policies issued by the Government of India and the Regulations issued by the ERCs;
c. Make recommendations for harmonizing Rules, Policies, and Regulations;
d. Any other matter related and incidental to the above.

FOR WG meetings on Harmonisation of Rules and Regulations

First Meeting: 1st December 2023 and Second Meeting: 9th May 2024

Following MoP Rules were considered for discussion by WG:

1. Electricity (Rights of Consumers) Rules, 2020;
2. MOP Electricity Amendment Rules (Captive Power Plants)
3. Electricity (Late Payment Surcharge and Related Matters) Rules, 2022. and its Amendments

Analysis of implementation aspects of following items were also undertaken:

1. Analysis on legal and techno commercial aspects of smart pre-payment meter or pre-payment meter
2. Best practices of the monitoring of Reliability Indices in States

- Harmonization of MOP (Rights of Consumer) Rules

Rights of Consumers Rules

- The "Rights of Consumer" rules notified by the Ministry of Power (MoP) dated 31st Dec. 2020. Further amendments dated 28th June 2021, 20th April 2022 and 14th June 2023
- These rules shall be applicable for Consumers in pursuance of -

  a) Establish clear guidelines and standards to ensure that consumers **receive reliable and quality electricity services.**

  b) Protect the rights of all categories of consumers, including residential, commercial, industrial, agricultural, and institutional consumers.

- The major focus areas of the Rules are shown below :

  ✓ Reliable Supply of Electricity
  ✓ Metering of consumer
  ✓ Billing
  ✓ Grievance Redressal
  ✓ Compensation for Discom Failures
  ✓ Ease of services (Procedure for new connections, disconnections, reconnections, etc.)
  ✓ Consumers Awareness

- Analysis on legal and techno commercial aspects of smart pre-payment meter or pre-payment meter

Context

- The WG discussed the legal and techno-commercial aspects of the mandatory installation of a smart pre-payment meter or pre-payment meter for all new connections as per the MoP Rights of Consumer Rules.
- Smart Metering with Advanced Metering Infrastructure (AMI) is an integrated system which offers several advantages over traditional meters both for the utilities and consumers.
- Some of the benefits are automatic meter reading facilities, Reduction in O&M Costs, Improvement in billing efficiency, improved service restoration, Net-metering facilities, reduced outstanding arrears, etc.

Smart Metering: Key Issues and Recommendations – 1/2

Legal Aspects

- **Discussion points**
  - The EA 2003 does not specify the type of meter to be installed, but it authorizes the CEA to prepare the Regulations for correct meters.
  - The CEA's metering Regulations, 2022, mandates to install only smart pre-payment or pre-payment meters (subject to availability of communication network).
- **Recommendations:**
- Provision of EA 2003 read with CEA Regulations, 2022 mandates installation of smart pre-payment or pre-payment meter.
- Timelines for implementation of pre-payment smart meters need to be relaxed considering ground level issues and S 55 of EA03.

Techno-Commercial Aspects of Smart pre-paid meters

- **Discussion points**
  - Techno-Commercial benefits of Smart Pre-payment meters include savings in O&M activities, such as meter reading, billing, bills distribution, printing stationary, etc,
  - Existing manpower, involved in meter reading may need to be diverted to other needful activities.
- **Recommendations:**
- Discoms should develop a comprehensive manpower reallocation plan of staff involved in meter reading tasks.
- Disconnection notice as per S 56 necessary and online disconnections may not be feasible for industrial consumers

Models adopted for installation of smart meters

- **Discussion points**
  - Cost Benefit Analysis of Smart Meters shows that implementation of pre-payment meters through CAPEX mode would entail an increased cost of Rs 75/ meter per month while that through TOTEX mode would entail an increased cost of Rs 85/ meter per month.
- **Recommendations:**
  - Increased cost may be offset against the savings on account of improved billing and collection, reduction in AT&C loss, flexibility in load management, improved consumer service/reliability of supply etc through the implementation of smart meters

Enabling retrofitting of existing meters

- **Discussion points**
  - The possibility of retrofitting (to convert existing meters into smart meters) leads to optimal use of existing meters and save investments in new meters.
- Against the estimated requirement of 25 crore smart meters, there is an availability of only around 7 crore smart meters.
- **Recommendations:**
  - Recommending MoP to consider retrofitting arrangement under RDSS to avail the benefits of RDSS by Discoms.

Smart Metering & Consumer service: Key Issues and Recommendations – 2/2

Release of new connections and modification in existing connections

- **Discussion Point**
  - Need for a mobile app and web portal for new connections as well as online tracking systems for both online and offline applications.
- **Recommendations:**
  - Need for a mobile app and web portal for new connections. Application forms to be made available free of cost at the licensee's local offices

Existing Metering / Smart Meters

- **Discussion Point**
  - The Rules mandates that new connection includes smart pre-payment meters and pre-payment meters. Further, the MOP Rules have not clarified whether replacement of existing meter would only be through smart pre-payment meter or pre-payment meter.
- **Recommendations:**
  - MOP needs to clarify, if a pre-payment meter or smart pre-payment meter would need to be used to replace the current one.

Consumer Grievance Redressal Forum (CGRF)

- **Discussion Point**
  - Requirement of CGRF at different levels such as divisions, sub-divisions, circle, zone and company level.
  - Flexibility is required in establishing CGRF based on number of complaints received at sub-division/ division level and that licensees may be allowed to cluster sub-division/ division while establishing CGRF.
- **Recommendations:**
  - Suitable Modification to be suggested to MoP for Flexibility to be provided in establishing CGRF based on number of complaints received at sub-division/ division level.

MOP Electricity Amendment Rules (Captive Power Plants)

CPP: Verification Authority and Verification Process

- **Discussion point**
  - As per the MoP Rules, CEA would be the verifying authority in case of inter-State captive generation and consumption, while as per the FOR-Model Regulations, it is the RLDCs and SLDCs who would be the verifying authorities.
  - As per WG , verification process for Captive Users (CUs) as envisaged in the CEA draft procedure would lead to extra documentation. This may burden the CGP & Captive Users.
- **Recommendations:**
  - Accounting of Energy is done by RLDC or SLDC as they are best suited to be the verifying agency.
  - FOR Model Regulations need to be aligned with Supreme Court judgement dated 9 October 2023 subsequent to which the State Captive Regulations/Orders should be modified.
  - Further, deliberations would be necessary to cover various implementation aspects of verification process for intra-state and inter-state captive transactions.

-MOP Late Payment Surcharge Rules, 2022 and Amended thereof

Late Payment Surcharge Rules

- The Ministry of Power, Notified the Electricity (Late Payment Surcharge) Rules, 2022 and further amendment dated dated 28th February 2024.
- These rules shall be applicable for payments to be made in pursuance of---

  a) Power Purchase Agreements, Power Supply Agreements and Transmission Service Agreements, in which tariff is determined under section 62 of the Act; and such Power Purchase Agreements, Power Supply Agreements and Transmission Service

  b) Agreements that become effective after these rules come into force, in which tariff is determined under section 63 of the Act.

- **These Rules have been introduced to address the persistent issue of delayed payments by distribution companies (Discoms) to Gencos and other entities in the electricity supply chain.**

LPS : Key Issues and Recommendations

Definition of Defaulting Entities

- **Discussion Point**
  - The definition of defaulting entities should also cover "Trader" as there may be possibility that traders may default in payments to the GENCOs in a timely manner.
- **Recommendations:**
- WG proposed to add "Trader" in the definition of defaulting entities

Rate of LPS

- **Discussion Point**
  - Rate of LPS is linked with SBI MCLR rate. (existing rate works out as 16.65%)
- The rates specified in the Rules are deterrent in nature to avoid accumulation of dues by the defaulting agencies and as such, the moderately high rates are justified.
- **Recommendations:**
- SERCs may update their LPS related provisions such as rate of LPS in MYT Regulations align with LPS Rules.

Payment Security Mechanism, liquidation of arrears

- **Discussion Point**
  - Requirement of provisions in the Rules related to payment security mechanism, liquidation of arrears, supply obligations of the generating companies, order of payment and adjustment towards LPS and power not requisitioned by DISCOM.
- **Recommendations:**
  - SERCs may include these provisions in their MYT Regulations or in the State Grid Code, as deemed fit.

Regulation of Access to defaulting entity

- **Discussion Point**
  - Provision of 'Regulation of access to the defaulting entity' is to be implemented by NLDC to avoid DISCOMs defaulting in payment of GENCOs and accessing the market for alternate source of power.
- **Recommendations:**
  - SERCs to operationalizee denial of access to Discoms and other defaulting intra state entities by incorporating the provision in the Regulations.

Provision on LPS in CERC Tariff Regulations, 2024

- **Discussion Point**
  - The CERC Tariff Regulations, 2024 has suitable provisions regarding LPS
- **Recommendations:**
  - SERCs needs to update their LPS provisions as specified in CERC Tariff Regulations, 2024.

- Best practices of the monitoring of Reliability Indices in States be compiled and presented.

Reliability of Supply

- The WG in first meeting discussed on the Reliability Indices (SAIFI, SAIDI, CAIDI and CAIFI) and the issues of compensation to be given by the Licensee in case of non-achievement of targets.
- It was observed that stipulation of trajectory for Reliability Indices should be preceded by automation or online monitoring of data.
- It was decided to have a compilation of the best practices of the States in monitoring Reliability Indices and have detailed discussions on this during the next meeting.

Issue-1: Computation of Reliability Indices & Unavailability of RI Data

- **Discussion Point**
  - Under SOP regulations, majority of states have provided reliability indices, the methodology for computation of these indices and compensation to be paid in case of failure to meet the set indices.
  - Implementation of SOP regulations may be an issue due to unavailability of data or availability of quality data collected through smart meters.
- **Recommendations:**
  - For implementation of reliability indices, collection of smart meter data, by distribution licensee is necessary.

    Some SERCs have linked recovery of ROE with compliance of reliability indices by distribution licensees. Similar provisions can be considered by other SERCs, subject to availability of data collected through smart meters.

    The Utilities have installed a number of functional software however, computation of reliability indices based on these data may require interaction between these software.

Issue-2: Automatic Compensation

- **Discussion Point**
  - The MoP Consumer's Rules expects automatic compensation to the consumers in case of interruption of supply.
- **Recommendations:**
  - Currently in the absence of smart meters, there is no data available for computation of automatic compensation. Smart meters shall be pre-requisites for automatic compensation.

USAID
FROM THE AMERICAN PEOPLE

THANK YOU

FOR MORE INFORMATION AND UPDATES, VISIT THE SAREP WEBSITE : https://sarepenergy.net

Annexure-III

FOR RE Working Group

8th June 2024

*by the Consultant supported through USAID/SAREP

Agenda

- Context
- Highlights of WG Meetings
- Agenda:
  - ❖ Implementation Aspects of Virtual and Group Net Metering
  - ❖ Status update of Model DRE Regulations

Context

The FOR, in its 86th meeting held on 26th June 2023 decided to constitute a Working Group for conducting a detailed examination of all RE related policy and regulatory issues.

Objective of WG: To identify and mitigate emerging issues on policy and regulatory fronts.

1. Examine and review the policies and regulations on RE at the Center and in the States in light of the target set for RE capacity addition in the country.
2. Identify and suggest measures for harmonization of RE policies and regulations.
3. Assess the impact of increasing share of RE in the overall energy mix and suggest suitable policy & regulatory measures.
4. Examine the issues involved in implementation of the distributed energy sources (group/ virtual net metering etc.) and suggest suitable measures.
5. Examine RPO targets set by the Government and SERCs for harmonization;
6. Assess and suggest measures for ensuring RPO compliance targets by the obligated entities.
7. Any other matter related and incidental to the above.

Constitution of FOR Working Group

- Chairperson, KERC - Chairperson of the Working Group
- Chairperson, RERC - Member
- Chairperson, HPERC - Member
- Chairperson, TNERC – Member
- Chairperson, MERC - Member
- Chairperson, OERC – Member
- Chairperson, APERC - Member
- Chairperson, MSERC - Member
- Member (Finance), CERC - Member
- Chief (Regulatory Affairs), CERC – Member Convenor

Highlights of WG Meetings

- As on May 31, 2024, the WG held five meetings to understand perspective and issues involved in RE policy and regulatory framework.

- The key issues discussed during the WG meetings are as below:

1. Green Energy Open Access and its implementation aspects
2. Implementation aspects of Banking in case of Intra/Inter-State Green Energy Open Access
3. Green Tariff mechanism
4. Renewable Purchase Obligations and Non-fossil fuel consumption targets
5. Review of framework for net metering, gross metering, virtual net metering, group net metering
6. Updating Model Distributed Renewable Energy Regulations 2019 issued by FOR
7. Implication of non-fossil fuel obligations on RPO framework

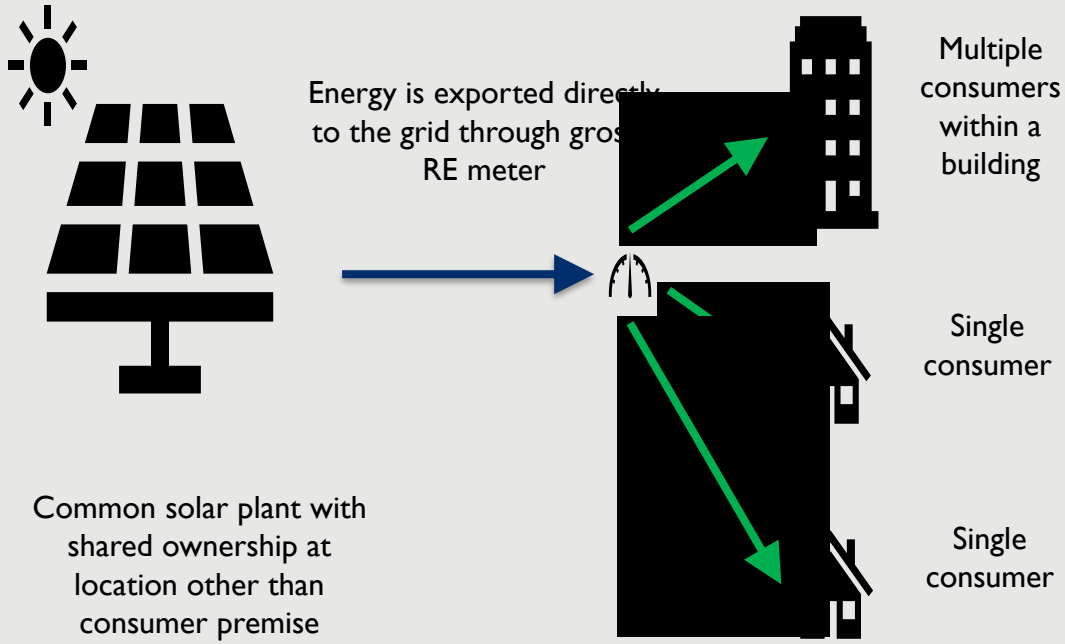
Key Issues & Recommendations

Implementation Aspects of Virtual and Group Net Metering

Implementation Aspects of Virtual & Group Net Metering (VNM & GNM)

- During 2nd working group meeting, WG members deliberated on key regulatory issues related to VNM & GNM and decided to take up VNM & GNM framework related discussions as an agenda item in upcoming meeting with the objectives of developing a Model Regulatory Framework on the same.
- During the fourth working group meeting, the members of the WG discussed and deliberated on the various aspects such as consumer categories covered, minimum and maximum capacity, Ownership Model, applicability of different charges, system enhancement related aspects, energy settlement and treatment of surplus power etc.
- This section covers issues identified and possible recommendations for further deliberations:
  - Issue-1: Consumer categories to be allowed
  - Issue-2: RE technologies to be covered
  - Issue-3: Maximum capacity of RE project & allowing multiple consumer categories
  - Issue-4: Ownership model, applicable charges and location of RE project

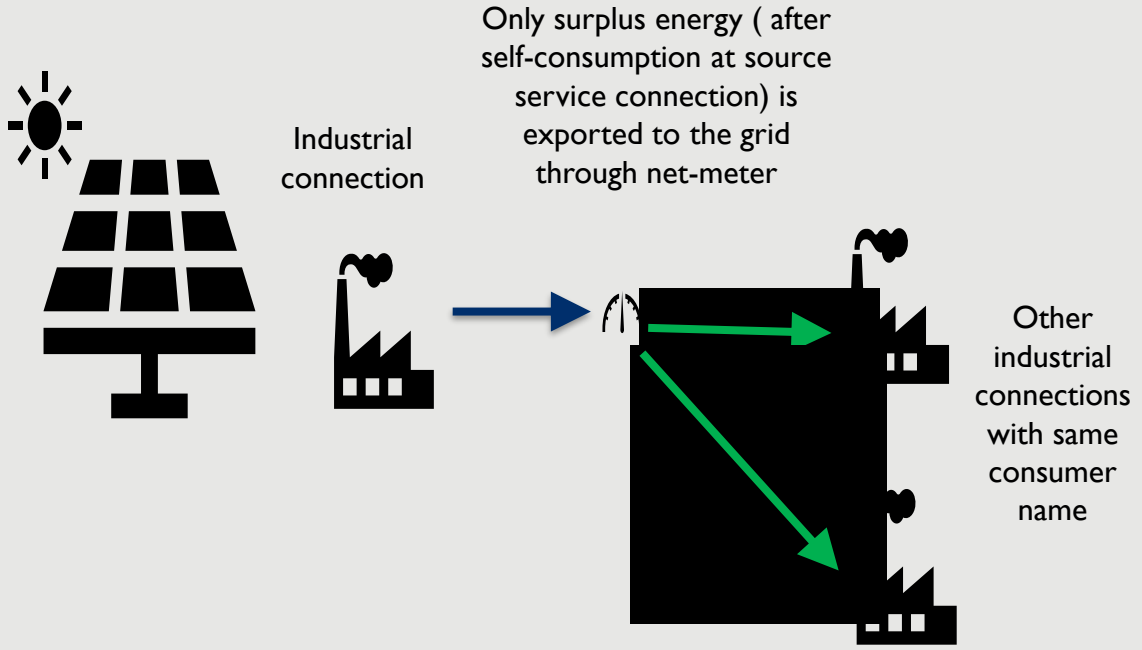
VNM & GNM Schematic & Illustration



Virtual Net Metering

Units injected into the grid are directly allotted to each of the participating consumer in the proportion specified as per the connectivity agreement

Generation	Consumer	Allocation	Units allocated
1000 kWh	1	20%	200
	2	40%	400
	3	10%	100
	4	30%	300



Group Net Metering

After self-consumption at source service connection, units injected into the grid are directly allotted to the service connections based on the priority specified as per the connectivity agreement

Generation	Connection	Consumption (kWh)	Priority	Allocated units
1000 kWh	Source connection	500	1st	500
	Other connection 1	200	2nd	200
	Other connection 2	300	4th	Nil
	Other connection 3	400	3rd	300

Framework for VNM/GNM & associated conditions – 1/3

Key issues	Discussion points	Recommendation
Which Consumer categories to be allowed for VNM & GNM?	• States who have issued VNM & GNM regulations/guidelines, have **allowed only few consumer categories** namely, **Residential, Group Housing Society and Public / Government Institutions** under **VNM framework**. • **All consumer categories are allowed** by these States to implement RTS project **under GNM framework**.	**All consumer categories should be allowed** to set up RE projects under VNM and GNM framework, subject to conditions.
Which RE technologies to be allowed?	• ERCs of Delhi, Odisha, Tripura, Chhattisgarh and Jharkhand have allowed all RE technologies as well as BESS charged by RE systems under VNM & GNM framework.	**All RE technologies including BESS** charged by RE **should be allowed** under both VNM & GNM framework.
What is the maximum capacity to be allowed for VNM & GNM?	• RE maximum capacity to allowed varies significantly from state to state. (Ex. 10 MW in Delhi, while 500kW in Odisha) • Allowing higher capacity for installation may encourage Consumers to install RE capacity higher than their requirement, however, the implications on distribution network need to be studied.	**Maximum capacity** of RE projects shall be **restricted up to total sanctioned load / contract demand** of all participating consumers/ service connections

Framework for VNM/GNM & associated conditions – 2/3

Key issues	Discussion Points	Recommendation
Should multiple consumer categories be allowed to participate in a single VNM or GNM project?	• **Allowing multiple consumer categories** (with and without TOD applicability) to jointly develop RE projects **under VNM framework can create challenges for DL** specifically in energy billing and settlement	Both **CAPEX and Third-Party Models (RESCO) are allowed** for implementation of RE projects under VNM & GNM framework. Consumers belonging to the same consumer category can install RE project jointly under VNM/GNM framework
Which ownership models should be allowed under VNM & GNM?	• Both CAPEX as well as Third Party Owned Business Models are allowed by ERCs for the implementation of RTS projects under VNM & GNM framework. • FOR in its model DRE regulations also allowed implementation of RTS project under CAPEX as well as Third Party Owned Business models.	Both **CAPEX and Third-Party Models (RESCO) are allowed** for implementation of RE projects under VNM & GNM framework.
Should open access and grid support charges be levied and where should the RE projects be located?	• Electricity generated by the projects implemented specifically under VNM framework export directly to the grid with no consumption at generation point by using the wires of Licensee to transmit power. • The WG emphasized that distance between RE project and set-off location should ideally be restricted to retain the essence of the distributed generation, and then the OA charges can be waived off.	Applicability of various OA charges for participating consumers under VNM/GNM are recommended as covered under table in next slide.

Framework for VNM/GNM & associated conditions – 3/3

Mechanism	Location of RE plant	Applicability of OA charges
Virtual Net Metering	Connected at the same feeder/DTL/sub-station as the consumers	• Nil (For all consumer categories)
	Not connected at the same feeder/ DTL / sub-station as the consumers	• Nil (For cross-subsidized consumer categories) • Wheeling Charges/Losses applicable (For subsidized consumer categories) • Wheeling Charges/Losses and CS/AS applicable (For other consumer categories)
Group Net Metering	Connected at the same feeder/DTL/sub-station as the service connections	• Nil
	Not connected at the same feeder/DTL/sub-station as the service connections	• Nil (For connection where RE plant is located) • CS and AS are not applicable being same consumer. • Wheeling Charges/losses applicable (For service connections not connected to same feeder/DTL/sub-station)

Key Issues & Recommendations

Updating Model DRE Regulations

Implementation Aspects of updating model DRE Regulations

- During 4th working group meeting, WG deliberated on Electricity (Rights of Consumer) Rules 2020 and its subsequent amendments issued by Ministry of Power, model DRE regulations issued by FOR and the regulations notified by the ERCs of the WG member states. Few key matters on which the WG discussed the following matters:
  - **Differences in the definitions such as Prosumers, Net metering, Gross metering, Net Billing**, etc. specified in FOR DRE model regulations and MoP Rules.
  - **Definitions** of metering mechanisms like **Behind the meter (BTM), Virtual net-metering (VNM) & Group net-metering (GNM), Gross metering not currently specified** in Model Regulations.
  - Specifying **upper limit to DRE project capacity** and discussion on its **alignment with capacity restriction of 500kW** provided under MoP rules for net-metering and net-billing.
  - Discussion on approaches to determine tariff for surplus power from DRE projects.

Based on discussions, following key issues were identified for further deliberations as outlined below:

1. Updating Definition / Introducing New Definition
2. Eligible consumer categories
3. Minimum & Maximum Capacity
4. Banking & Treatment of surplus / exported energy at the end of settlement period
5. Applicable charges
6. Introducing enabling provision for Peer to Peer Trading using Blockchain technology

-Thank you

Issue 2: Provisions for metering mechanisms – 2/2

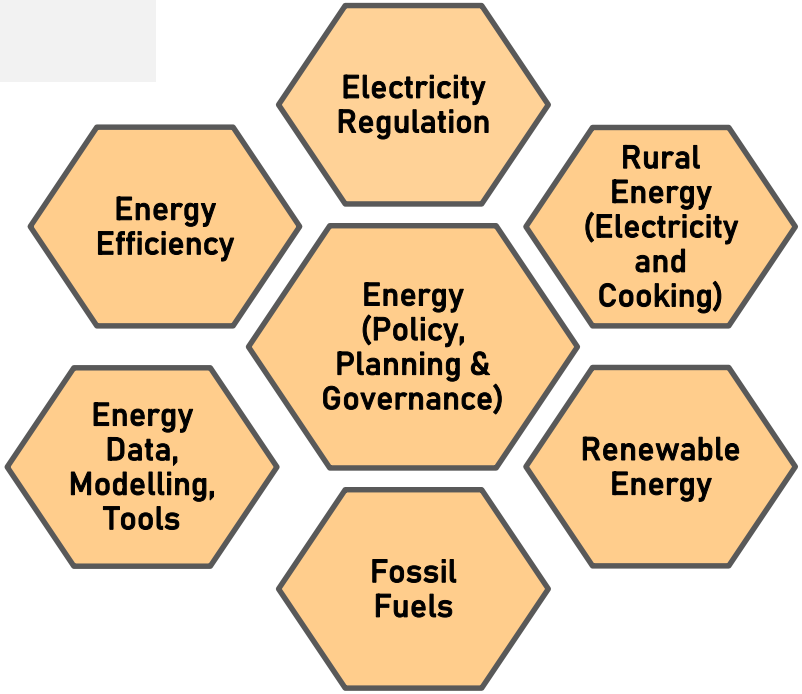
Back

Descriptions	NM	NB	GM	VNM	GNM	BTM
Eligible Consumer Categories	Domestic consumers, group housing, educational institutions or institutions run or managed by charitable organisations, government buildings, buildings belonging to local authorities	LT and HT Commercial and Industrial Consumer Categories	All Consumer Categories	All Consumer Categories	All Consumer Categories	All Consumer Categories
Ownership Model	CAPEX and RESCO	CAPEX and RESCO	CAPEX and RESCO	CAPEX and RESCO	CAPEX and RESCO	CAPEX and RESCO
Minimum Capacity	1 kW	1 kW	5 kW	5 kW	5 kW	NA
Maximum Capacity	Up to Sanctioned Load / Contract Demand	Up to Sanctioned Load / Contract Demand	Up to Sanctioned Load / Contract Demand	Total Sanctioned Load of all Participating Consumers	Total Sanctioned load of all service connections	Up to Sanctioned Load / Contract Demand
Surplus/exported energy treatment at the end of settlement period	Determine RTS capacity wise generic/reference tariff or 75% of the last discovered SECI tariff for respective energy resource (recommended by FOR WG)					NA
Applicable Charges	Exempted from charges like banking, wheeling and cross subsidy etc. for CAPEX and RESCO projects.			• If DRES and participating consumers/connections are located on the same feeder/DT/Sub-station, no charges will be applicable. • In any other scenario charges in accordance with GEOA regulations shall be levied. • Provided no charges shall be levied for cross-subsidized consumer categories. • Above conditions are for both CAPEX and RESCO projects		NA

Accelerating adoption of Demand Side Management in India

Presentation at FoR meeting on 8/06/202
Pune

Prayas (Energy Group)



- Not-for-profit organization founded in 1994
- Based at Pune
- A small group of professionals

Outline

1. What is Demand Side Management?
2. What is DSM's role in the ongoing transition in India's power sector?
3. What has happened so far and what more can be done?

What is Demand Side Management?

1. Strategy that Discoms can adopt for optimal planning
2. Energy Conservation
3. Energy Efficiency
4. Demand Flexibility
    a. Reduce load in peak times
    b. Increase load in lean times
    c. Shift load to times with high renewable energy generation.
5. DSM can be considered as a Distributed Energy Resource along with Behind-the-meter Solar and Storage

Why DSM now?

1. DSM has a long history. First program in India in 1982
2. Despite several efforts, DSM in India is stuck in low-level equilibrium trap
3. Potential to change
    a. Rapid adoption of substantial and potentially flexible loads e.g: air-conditioners, electric vehicles, electric water-heaters etc.
    b. Increasing share of variable and intermittent solar and wind sources
    c. Imminent and Imperative policy focus on climate change
    d. Evolving digitalization - Smart meters

Benefits of DSM in a high RE system

1. Production cost simulation model to quantify the benefits for Gujarat and Madhya Pradesh in 2030
2. Projected electricity demand in 2030
    a. Baseline scenario: As per the 20th Electric Power Survey (EPS) and 2022 load curve
    b. DSM scenario: Bottom-up estimates of savings through energy efficiency and shifting of entire Agriculture demand to daytime
3. Available generation sources in 2030
    a. Share of renewable energy by generation
        i. 50% in GJ (as per stated policy)
        ii. 43% in MP (as per Ministry of Power's Renewable Purchase Obligation)
    b. No new thermal capacity other than existing contracts
    c. Optimal storage capacity determined exogenously
    d. Market capacity subject to existing Transmission constraints
4. Copper plate model

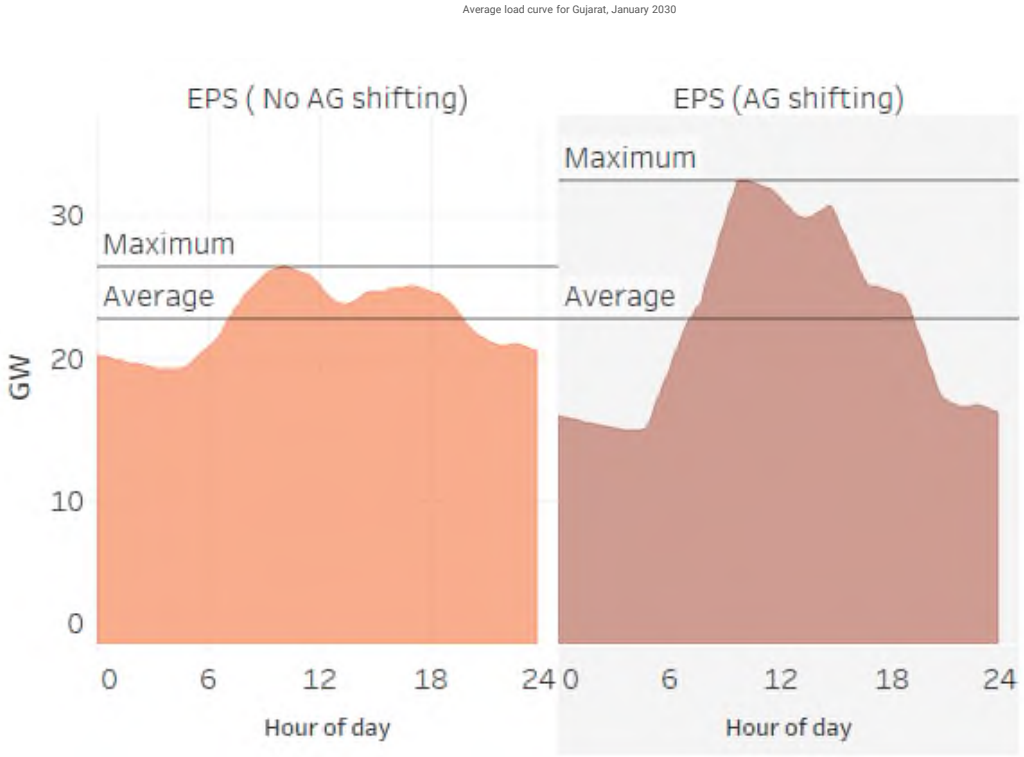
System level benefits of DSM

Energy efficiency

- Due to energy efficiency, the total demand is 10% less in GJ and 15% less in MP than the baseline scenarios.
- Reduction in investments required for new capacity.
  - ~ ₹ 41000 crore (15%) less in GJ
  - ~ ₹ 34000 crore (22%) less in MP
- Reduced Investments in distribution infrastructure cost will provide additional benefits (not quantified)
- Coal is used less in the DSM scenario resulting in savings in variable cost
  - ~ ₹ 500 crore - 4% in GJ
  - ~ ₹ 1000 crore - 6% in MP
- Reduced use of coal avoids emissions
  - ~ 8.5 million ton in GJ
  - ~ 2.2 million ton in MP

Demand flexibility

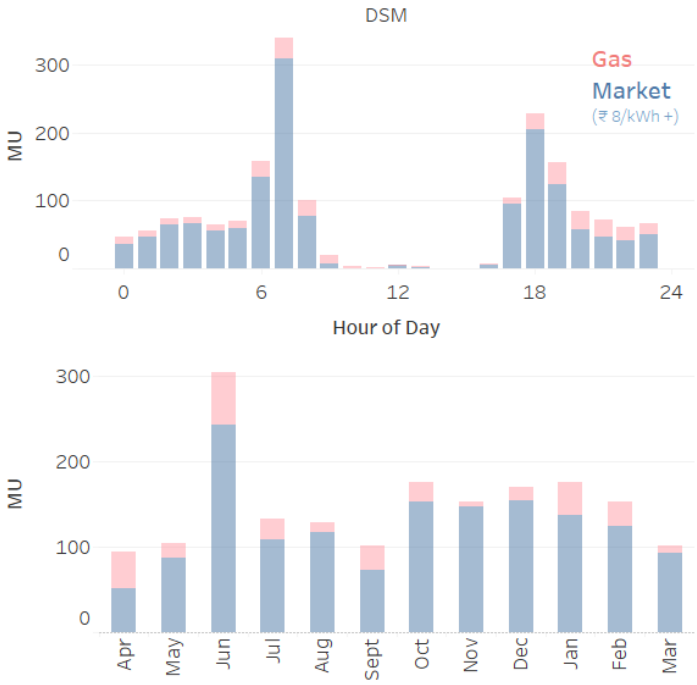
- Shifting of agriculture demand to day-time provides substantial benefits to absorption of solar.
- Curtailment of solar reduces by 21% in GJ in a scenario with entire shifting of Ag demand compared to 70% shifting.
- Chart of Demand shifting in MP and GJ



Demand flexibility (continued)

- Bottom-up DF potential and capacity expansion model required to estimate benefits of DF
- Model results show times of high power procurement which can be reduced using DF
- E.g graph in GJ showing power procurement from different sources and month of year and time of day procurement.

High cost power purchase



What has been happening in India?

- DSM Model Regulations by the FoR in 2010
- Most SERCs have adopted DSM regulations
- Pilot level DSM programs by Discoms in Ag, Municipal, and Residential Sector
- Few DR programs (~10-25 MW)
- Load Research and DSM Action Plans supported by BEE and EESL
- Capacity building programs by the BEE

Model / State DSM regulations

Provision	Responsibility	Action
Constitution of DSM cell with adequate authority and resources	Discoms	Most of the Discoms have a DSM cell. Limited data on budget, activity etc. Few SERCs have also constituted DSM Consultative Committee
Methodology for assessment of technical potential	BEE	No methodology available in public domain
Assessment of Technical potential one year before the start of MYT as per methodology developed by BEE	Discoms	No such reports available in public domain
Setting DSM targets for the Discoms	SERC	No targets by any SERC
Cost Effectiveness Guidelines	SERC	Issued by Maharashtra, Meghalaya, Haryana, and Punjab SERCs

Model / State DSM regulations (continued)

Provision	Responsibility	Action
Evaluation, measurement, and verification guidelines	SERC	Issued by Haryana and Punjab
Preparation of DSM plan, program design documents, annual implementation reports etc.	Discoms	Limited action and information
Discoms to propose method of cost recovery and SERC to approve subject to conditions	Discoms/SERC	Some DSM program costs approved in ARR. Quite a few programs funded by bilateral/multilateral institutions.

What can be done? Phase I (1 year)

1. Develop guidelines for setting targets, assess cost-effectiveness and conduct EM&V of DSM programs
2. Develop a methodology to assess the technical/economical/market potential of DSM programs

What can be done? Phase II

1. SERCs commission a study to conduct technical/economic/market potential in the state and Discom territory. It can be guided by the methodology developed by the BEE, if any
2. SERCs set a target for DSM: e.g. 2% of total annual sales in kWh, and 2% of peak demand available for DR.
3. Discoms can conduct their own programs or contract ESCOs.
4. Cost of programs passing the cost-effectiveness test can be recovered through ARR (as mentioned in the guidelines)
5. Return on equity can be increased by 25 basis points if Discoms achieve their targets

Conclusion

1. DSM can play a critical role in the ongoing transition in India's Power Sector
2. Despite several efforts, DSM in India is stuck in low-level equilibrium trap
3. Supplementary guidelines from FoR and BEE can enable implementation of the DSM regulations
4. National guiding targets and state-specific targets along with dedicated fund allocation
5. Needs a champion

Thank you!

aditya@prayaspune.org, shweta@prayaspune.org