Overcoming Barriers to Flexibility in the Generation Fleet



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Outline

Changing Power Sector Scenario Emerging Energy Landscape in India Moving towards Green Energy....increasing RE Landscape Scenario in 2022 THIN THE SALE AND AND AND AND AND AND Impact of Variable Renewable power **Barriers of Flexibilisation Operationalisation through reserves** Flexibilization: Benchmarking and Preparation Compensation for added costs

Compensation for added costs & Market Redesign

Changing Power Sector Scenario



Source: MOP, CEA

- **1.** Government's focus on attaining affordable "24x7 Power for All" by 2019.
- 2. Energy Sector growing at a CAGR of ~7%-8%.
- 3. Big push to Renewable Energy- to grow from ~66GW presently to 175GW by 2022.

Demand, Capacity Mix & Growing renewables



Growth in Demand (~44%), Capacity (~53%), Renewables share (~175%)

Moving towards Green Energy....increasing RE Landscape

Renewables (installed Capacity over the years in GW-Actual and

emission reduction Going for addition of 100% Supercritical Coal Fired Plants with 4-5% efficiency gain, and each 1% efficiency gain shall reduce the CO₂ emissions by 2.5%. Change in Energy mix with high thrust of Renewable **Energy Additions (175 GW** by 2022). **Upgradation/Installation of Emission control** equipments. **Energy efficiency initiatives**

India: Pathways for



Promoting Renewable Energy

Nationally India's Intended **Determined Contribution (INDC)** aims to base 40% of the total installed generation power capacity on non-fossil fuel by 2030 with resources international support on transfer technology and financing.This includes Government of India's ambitious target of achieving 175GW of RE the 2022 bv vear

India has committed to reduce its emission intensity per unit of GDP by 33% to 35% below 2005 levels by 2030 under INDC (Intended Nationally Determined Contributions)

.....India to have 175 GW of Renewable Energy by 2022

Emerging Energy Landscape in India

Coal to remain the mainstay in India's energy mix



Preparation and management of Flexible Operation of Fossil based plants will be a critical factor for survival in the Changed Business Environment and will need Realignment of Strategies .

All India Demand Vs Net demand from Coal on a typical day in 2022

Flexibilisation: Why Bother? July 19th likely day when Peak to Off-Peak is maximum Or Why should I get ready? ...What to do? Grid Evolution, Cycling Baseload **Impacts of Plant Cycling on** Damage Rates and the ultimate **Costs of providing power** Critical risks of process safety, increased costs, higher probability of equipment failure and reduction in unit life associated

with cycling will need effective management

Building a Business Case for Flexibilisation



Impact of Variable Renewable power



The Variability, Uncertainity, and the Geographically Confined VRE will be challenging for the grid operators as well as generators.

Impact on System

- Difficulty in load frequency control
- Difficulty in scheduling of tertiary reserves
- Requirement of enhanced transmission network and its under utilisation
- Increase in requirement of ancillary services and hence increased system operation cost
- Increase in transmission cost due to all above factors



Impact on existing Plant

- Lower PLF due to ducking of load curve
- High ramping requirement
- Two shifting and cycling of plants
- Increased forced outage and O&M cost
- Equipments life time reduction
- Poor heat rate and high Aux. Power



Barriers to Flexiblisation





Compensation for added costs from increased cycling of thermal generation



S.NO	Unit Loading as % of Installed Capacity of Unit	Increase in SHR(for supercritical unit)	Increase in SHR(for subcritical unit)	% degradation of APC
1	85-100	Nil	Nil	Nil
2	75-84.00	1.25	2.25	0.35
3	65-74.99	2	4	0.65
4	55-64.99	3	6	1

Compensation for Oil for additional start-ups

The compensation so computed shall be borne by the entity who has caused the plant to be operated at schedule lower than corresponding to Normative Plant Availability Factor up to technical minimum.

	Example	W	vho pays?			
Singrauli (2000MW)						
S.N	I. BENEI	FICIARY	Share (MW)			
1	Uttar	Pradesh	821			
2	Uttara	ikhand	98			
3	Rajast	han	462			
4	Delhi		150			
5	Punjal	b	209			
6	Harya	na	200			
7	Himac	hal	4			
8	J&K		6			
9	Chanc	ligarh	1			



Operationalisation of flexibility through Reserves



Flexibilization: Benchmarking and Preparation

...for what level?



Choosing which units to flex?

Units on base load-Energy supply sources stacking to meet the total state energy need are classified as sources that will always have demand and hence shall run on max. allocated share ... base load operation. Flexible Units on low load & evening peak- Daily in the evening generation from Solar would come to zero and this energy need would be satisfied by units on merit, who would run on min. load and support his evening need + portion of the demand peak. Flexible Units-Daily start & peaking-If the peak is not met by the low load and peaking units up in the merit order, then new sources shall be started daily till the balance peak need is met.

> Maintenance schedule ... Retrofits/R&M..

Retiring of old Units

Market Redesign-To support Flexiblisation

The present market mechanism and operational rules affect access to thermal flexibility.

The present Merit order scheduling is based on variable cost and ignores the efficiency, environmental and other system level costs .

DSM not market responsive



Incentivization of Costs to cover the true cost of cycling

Demand side management

- TOD
 - Peaking Tariff
- The Proposed DSM-Features
 - Market responsive prices
 - Factoring Value of Lost Load (VOLL)
 - Interplay of Prices in various market segments Time value of Electricity
 - Geographical Location and Transmission Congestion
 - Time-of-day variability
- Increasing Ancillary Products to cover
 - Ramp Rates
 - Fast Start Ancillary service
 - Capacity Markets

Conclusion



- > Large-scale RE has been successfully integrated into grids world over
- Regulation will have to play a major role in integration of RE for the sake of promoting Green Energy
- > Enabling Market and operational rules to access to thermal flexibility
- There should be a farsighted policy in picture to ensure the grid stability and reduction of over all system operation cost (grid as well as generating units) in long run by reducing the extent of cycling on coal based generating stations as far as possible.
- > International cooperation is necessary, particularly from the RE rich countries .
- > Wider participation of fossil plants is necessary for managing the flexibility requirement.
- Training and capacity building of operators is important to minimise the Impact of cycling and operating at minimum load levels.

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