

Emerging issues relating to RE grid integration beyond F&S regulations

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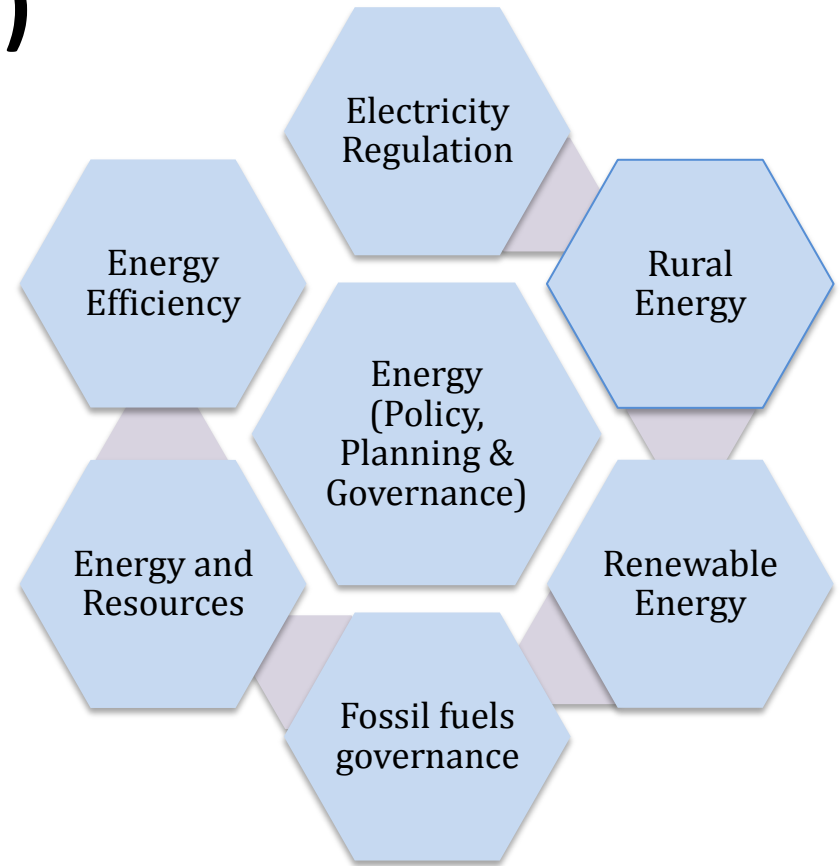
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Monday, 21st August 2017, 10:00 am – 3:00 pm, WTC, Mumbai

Prayas (Energy Group)

- Not-for-profit orgn. founded in 1994
- **Analysis based policy advocacy for promoting public interest.**
- **Focus on governance aspects & policy innovation**
- Extensive engagement with civil society groups, peoples' movements, consumers groups and media.



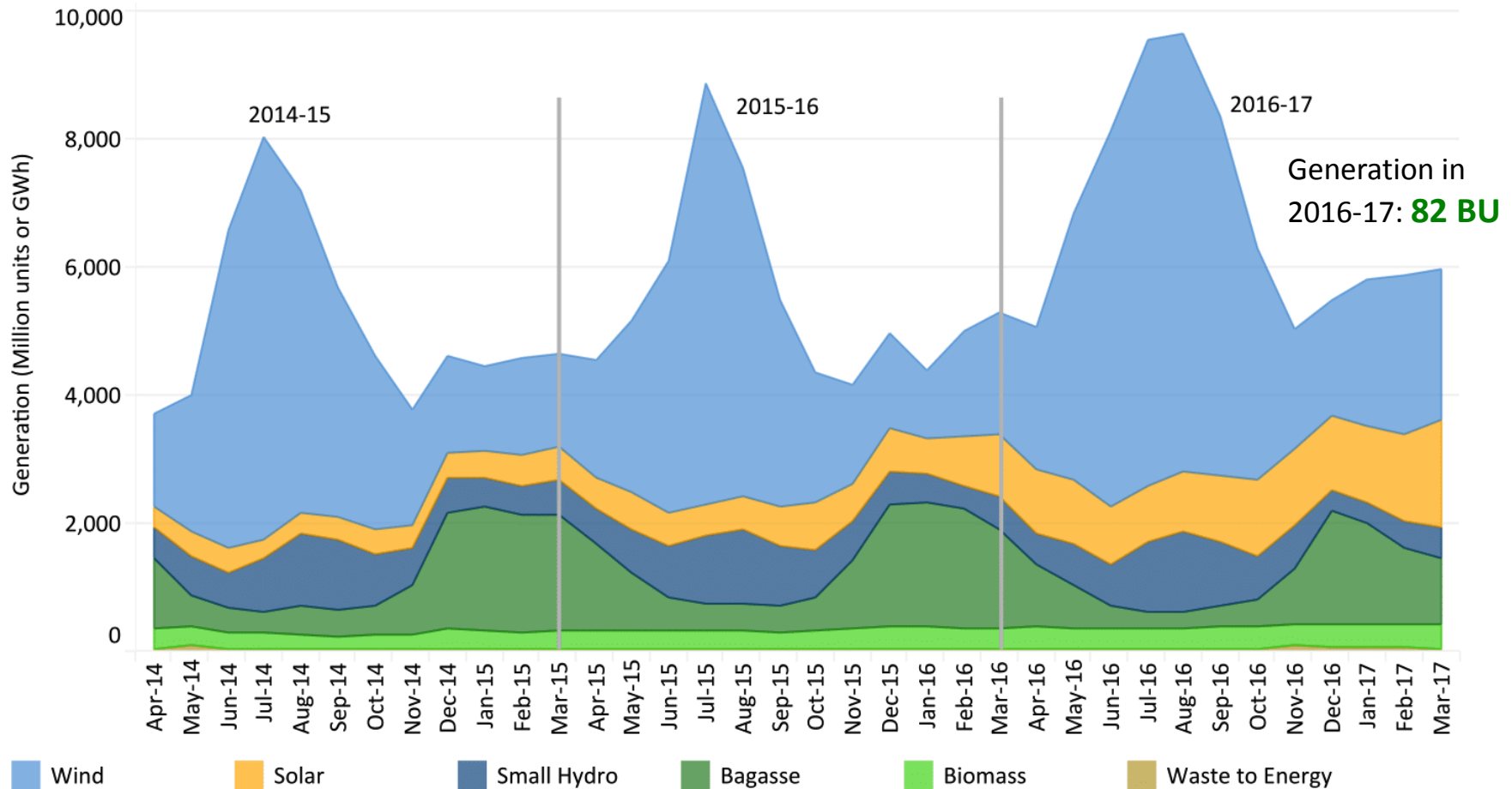
Presentation outline

- Sharply rising share of renewables (wind/solar)
- Implications of RE grid integration for various stakeholders
- Challenges and issues for discussion

Inevitability of the sharply rising RE share

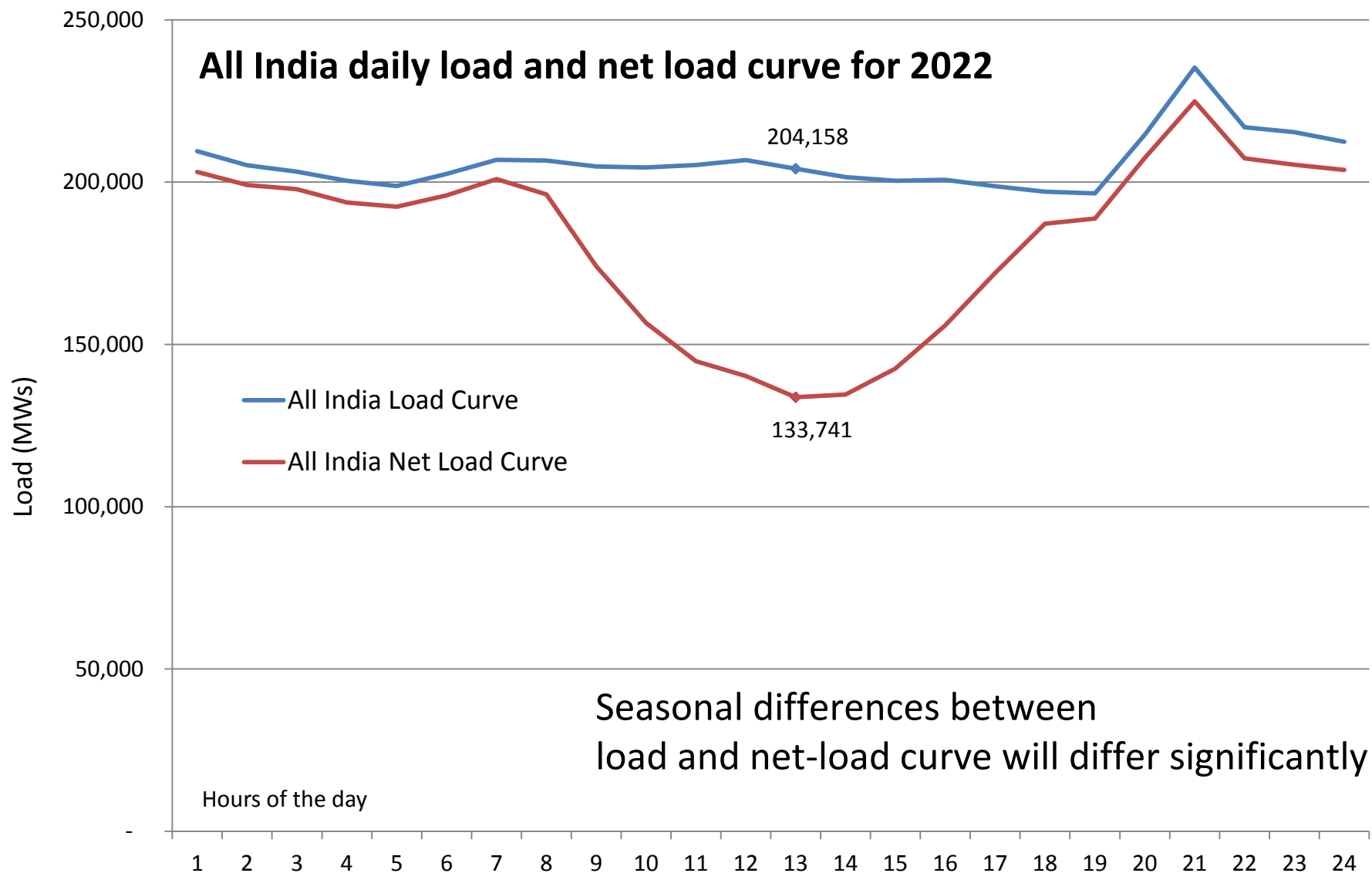
- Low solar PV (Rs 2.44/kWh), wind (Rs 3.46/kWh) prices
 - Internationally even lower records solar PV (Rs. 1.75/kWh) and wind (Rs. 1.95/kWh)
 - All predictions for further reducing costs in the long run.
- 175 GW by 2022
 - RE capacity share to increase from 18% to 33% in 2022.
 - RE generation share to increase from 6.5% to 21% in 2022.
- **~ 7.5x increase** in speed of deployment and associated sectoral complexity; needed policy-regulatory response.
 - ~50 GW (2002-17), 115 GW (2017-22)

RE Generation: Seasonality



Wind and small hydro linked to monsoon; bagasse picks up post monsoon

RE Generation: Diurnal variation



Source: CEA, 19th EPS, net load curve assumes 175 GW in place considering a typical day

Addressing RE grid integration

- First step to integrate intermittent RE – Forecasting, Scheduling & Deviation Settlement Mechanism regulations; but more challenges/actions needed.
- What are the major implications for the DISCOMs, coal and RE generators, regulators, policy makers, grid planning/operation?
 - Understanding implications and quantifying it
 - Institutional/stakeholder responsibility
 - What are the additional costs, if any for integration and principles for sharing such costs.

Broader implications

- Increase in variability in net-load
- Likely increase in dispatch uncertainty subject to accuracy of RE generation forecasting
- A significant number of actions needed, irrespective of increasing RE share

Implications for solar and wind generators

- New technical requirements for wind/solar generators (LVRT, reactive power support, regulation of active power etc.) to support grid operation (already mandated by CEA)
- Possibility of curtailment as share of RE increases, especially with surplus situation in some states
 - Compensation for backing down, important since RE has single part tariffs unlike coal
 - MNRE wind bidding guidelines: compensation on account of grid unavailability or backing down (for non grid security/safety reasons)
 - MoP proposal: Compensation depending on reason for curtailment (Transmission constraint, grid security, low system demand)

Implications for coal generators

- Need for increased flexible coal operation due to more cycling (lower technical minimum operation, startups, shut down, ramping etc.)
 - May need retrofiting for some plants; higher fixed costs
 - Marginal increase in heat rates and auxiliary energy consumption leading to increased fuel costs in case of significant part load operation
- Decrease in Plant Load Factor (PLFs)
 - Implications differ depending on position in the merit order
 - Retirement for some units/plants with very low PLFs?

Implications for regulators and policy officials

- Future of must run status; possible two part tariff for wind and solar?
 - Already discussed in 58th FoR meeting and the SAMAST report
 - Could be on similar lines like central regulations for large hydro
 - How to apportion between fixed and variable tariff
- Is there a case for better national and regional coordination of scheduling and dispatch?
 - Esp. with existing use of Power Exchanges, Ancillary services mechanism, Sharing of ISGS, Regional coordination of scheduling, push for 'MERIT' in combination with DEEP to optimize their power procurement across states.

Implications for regulators and policy officials..2

- Compensating conventional generators for flexibility
 - Suggested in the SAMAST report
- Moving to 5-minute scheduling
 - Mentioned in FoR model DSM regulations; SAMAST report
- Future of RPO; solar and non-solar categories
 - Capacity value of incremental solar may decrease
 - Should future RE targets include attributes such as their implications for grid integration (such as contribution to peak demand/capacity value etc.)
- LDC autonomy and Institutional strengthening considering increasing system complexity
- Better data management and analysis to understand implications of RE

Implications for DISCOMs

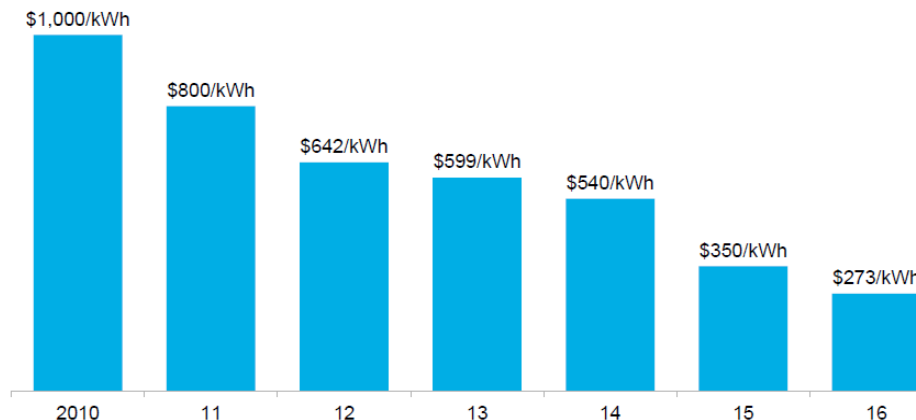
- Need for use of tools such as production cost models for better capacity expansion planning, esp with rising RPO and surplus situation
- Increased fixed costs for inflexible plants if retrofitted
- Increased variable cost: higher heat rates from cycling
- Retirement of coal plants with low PLFs?
- Valuing renewable energy beyond mere generation price to include system value (for ex: distance from Tx lines, contribution to peak demand/capacity value, need for reserves etc.)

Declining cost of electric batteries

- Hawaii: 28 MW solar, 20 MW/100 MWh battery – 11 cents/kWh (**Rs 7.15/kWh**)
- Arizona: 100 MW solar, 30 MW/120 MWh battery – 9 cents/kWh (**Rs 5.9/kWh**)
- Implications of low cost electric storage for grid operation.
 - Combining battery with wind/solar
 - System level battery for various applications

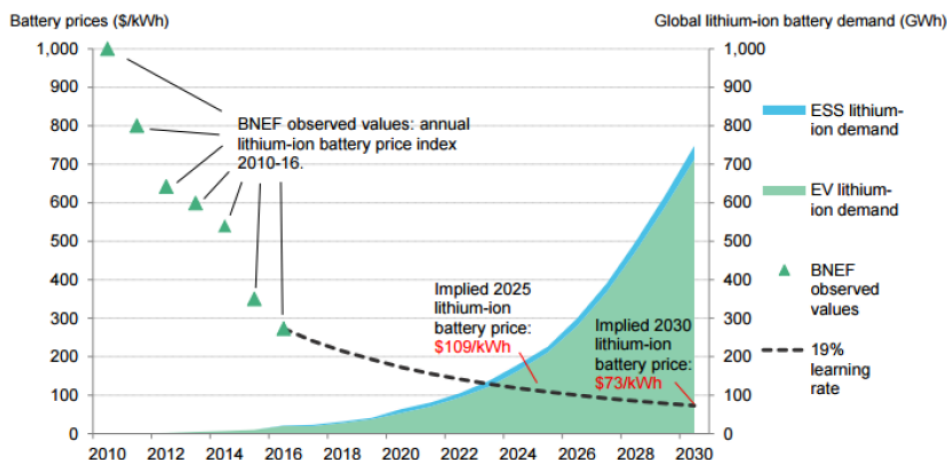
Lithium-ion battery pack prices are down 73% since 2010

BNEF 2016 battery pack price survey results



Lithium-ion battery pack prices will drop another 75% by 2030

Lithium-ion battery price forecast



- Need for a lot of pro-active and innovative changes in policy-regulation and continued deliberations, greater coordination between GoI and states and among sector stakeholders to overcome emerging challenges of grid integration.

THANK YOU

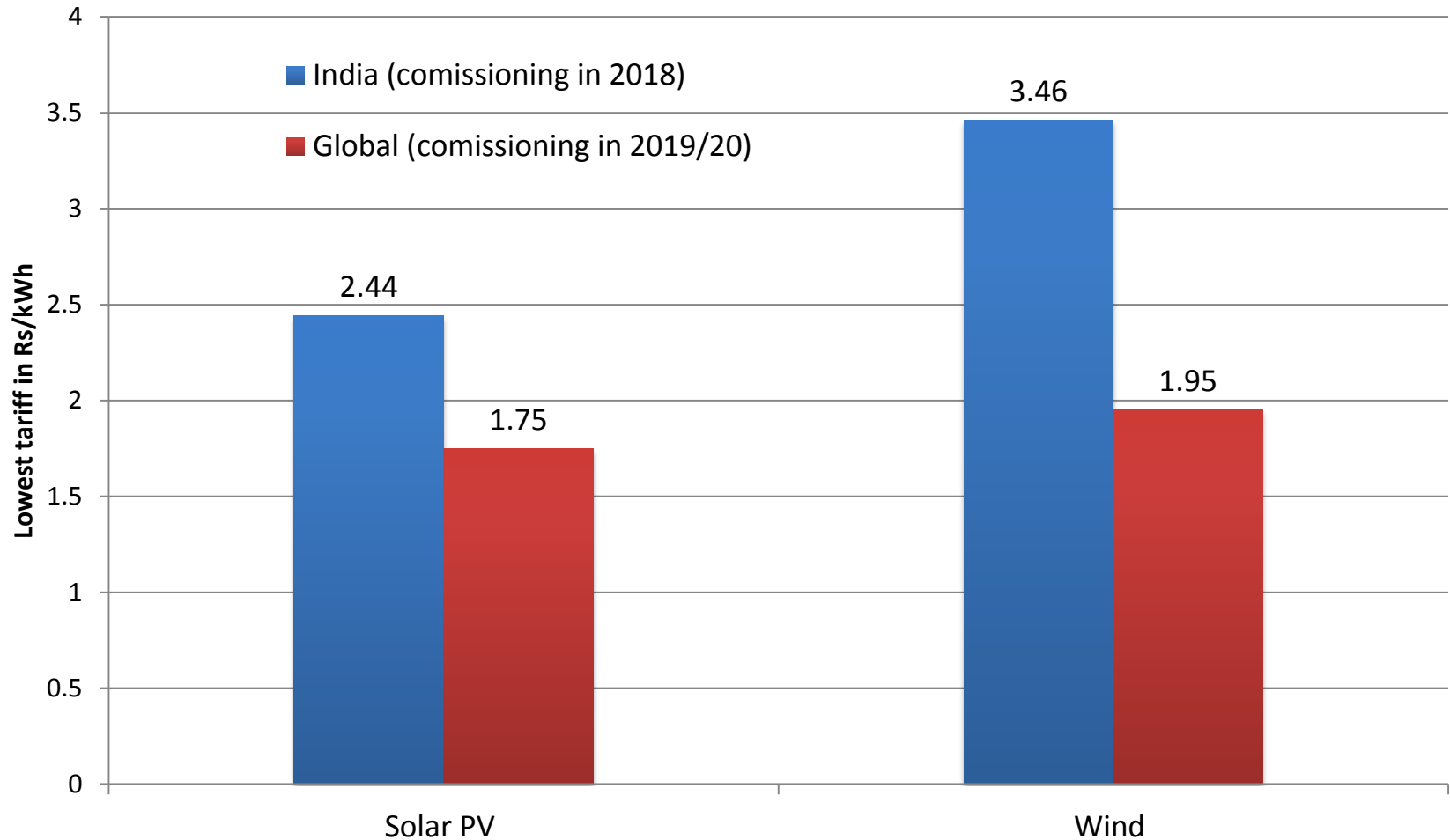
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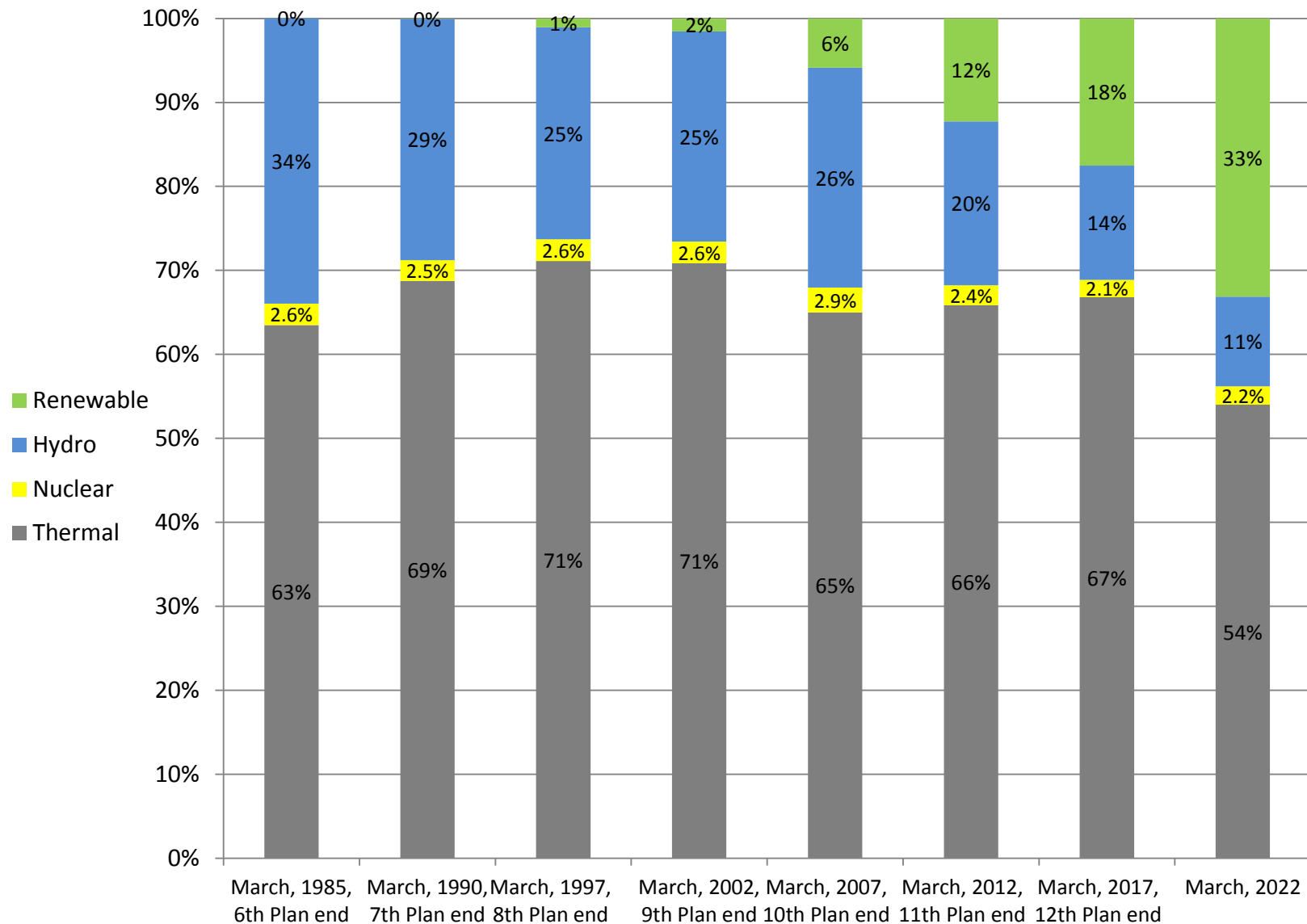
EXTRA SLIDES

Low prices - solar and wind power

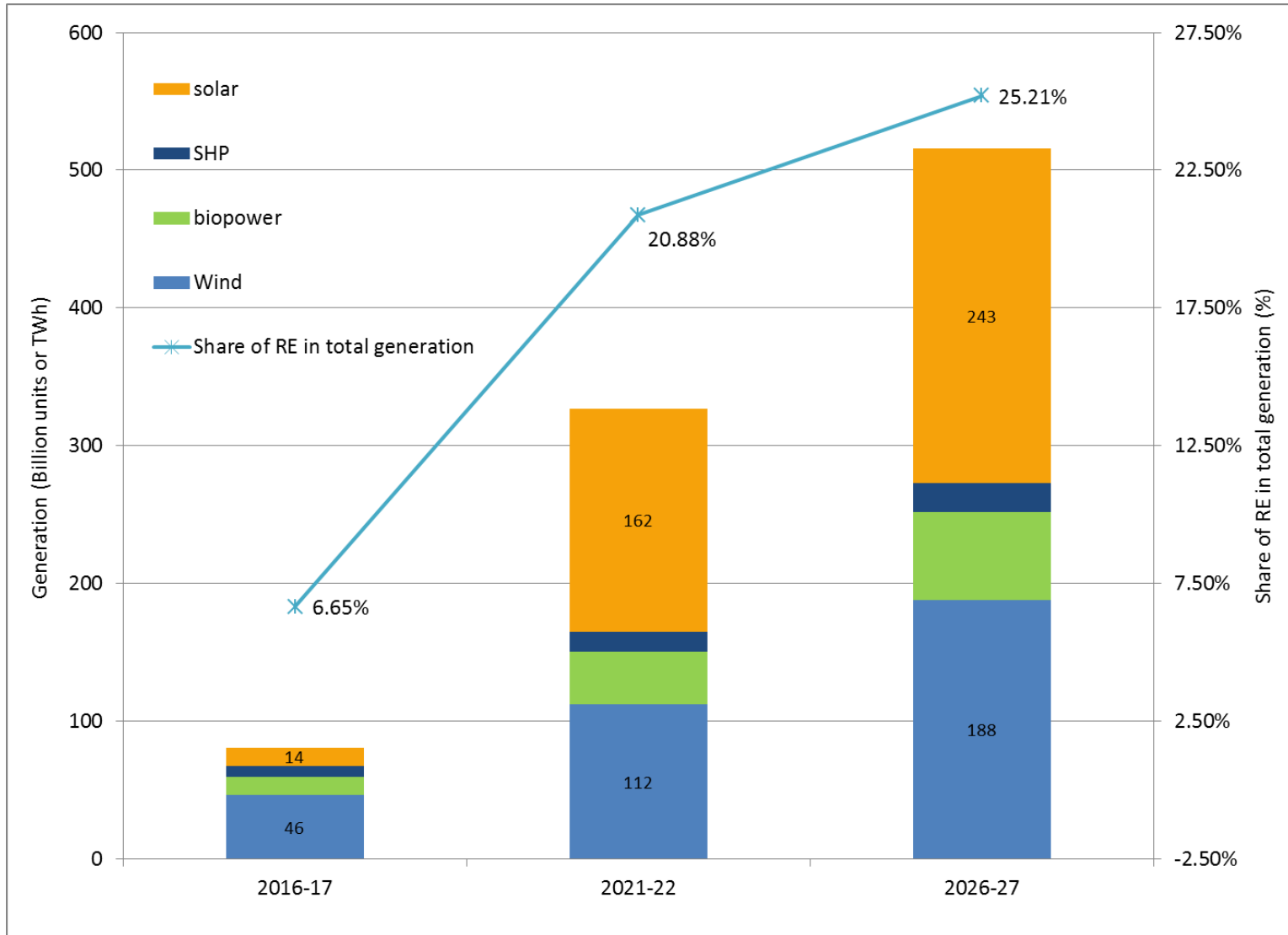
Lowest solar and wind prices (India/global)



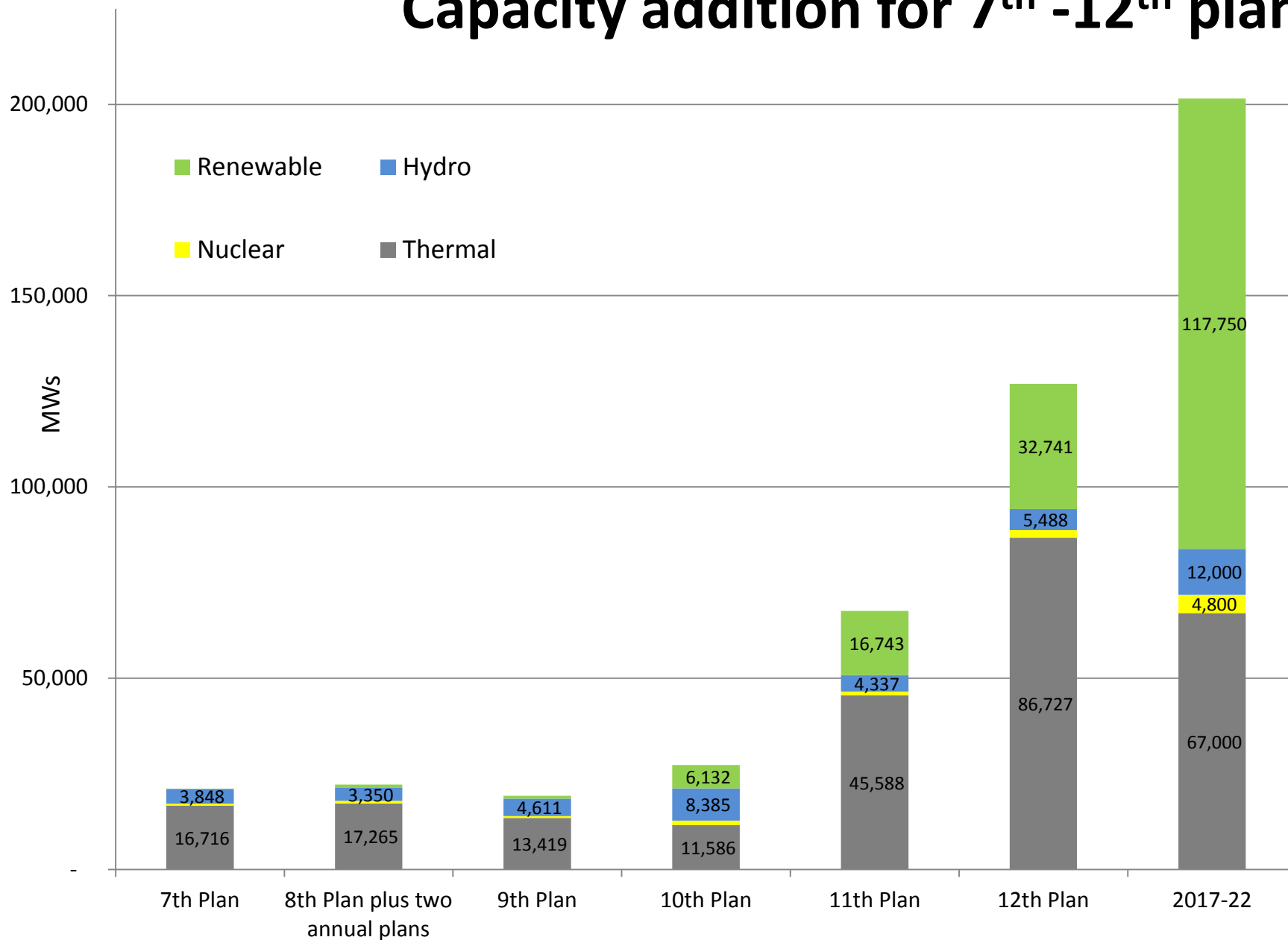
Source wise share in total capacity (1985-2017)



Indian RE: 2016-17 & likely over next ten years



Capacity addition for 7th -12th plan

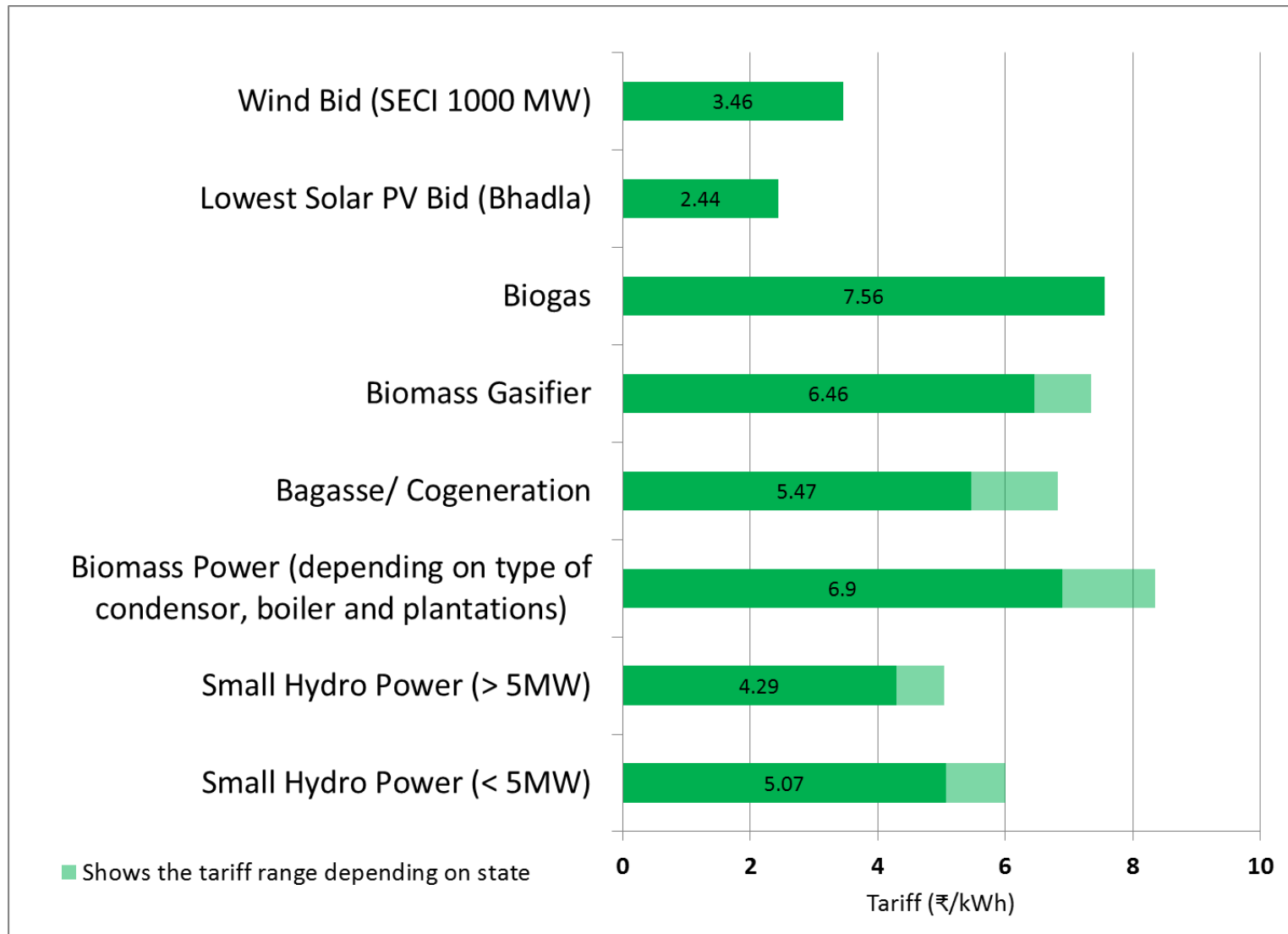


MNRE and MoP curtailment proposals

- MNRE draft wind guidelines: compensation is calculated on the basis of “Average Generation per hour during the contract year”
- Generation compensation in case of backing down is only 50% of the PPA tariff.
- MoP proposal as per news from India Ratings, May, 2017

Reason for curtailment	Curtailment	Compensation
Transmission constraints	Up to 2%	Nil
	2% to 7%	50% of energy at contracted price
	>7%	50% of energy at contracted price with review from stakeholders
Grid security	Any level	Nil
Low system demand	Any level	If curtailment is done after curtailing the conventional generators to technical minimum, then 50 paise/kWh Otherwise at the power market price in that block

Do we need separate solar / non-solar RPOs?



Global Trends

- Germany, Denmark already very reliably integrate **40% RE** on an annual basis, instantaneous RE shares are much higher.
- High and ever increasing national/state targets
 - Australia (23% by 2020)
 - California (50-60% by 2030)
 - Germany (40, 55, 80% by 2025/35/50)
 - Several smaller countries (**100% by 2050**), incl. Denmark, 48 member countries of the Climate Vulnerable Forum