

Energy Policy Challenges in India Integrating 175 GW Renewables

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Outline

- Status of renewable energy and its characteristics
- Few technical and economic aspects of grid integration in the Indian context
- Addressing distribution sector concerns/challenges and looking at the medium-long term transformation imperative.

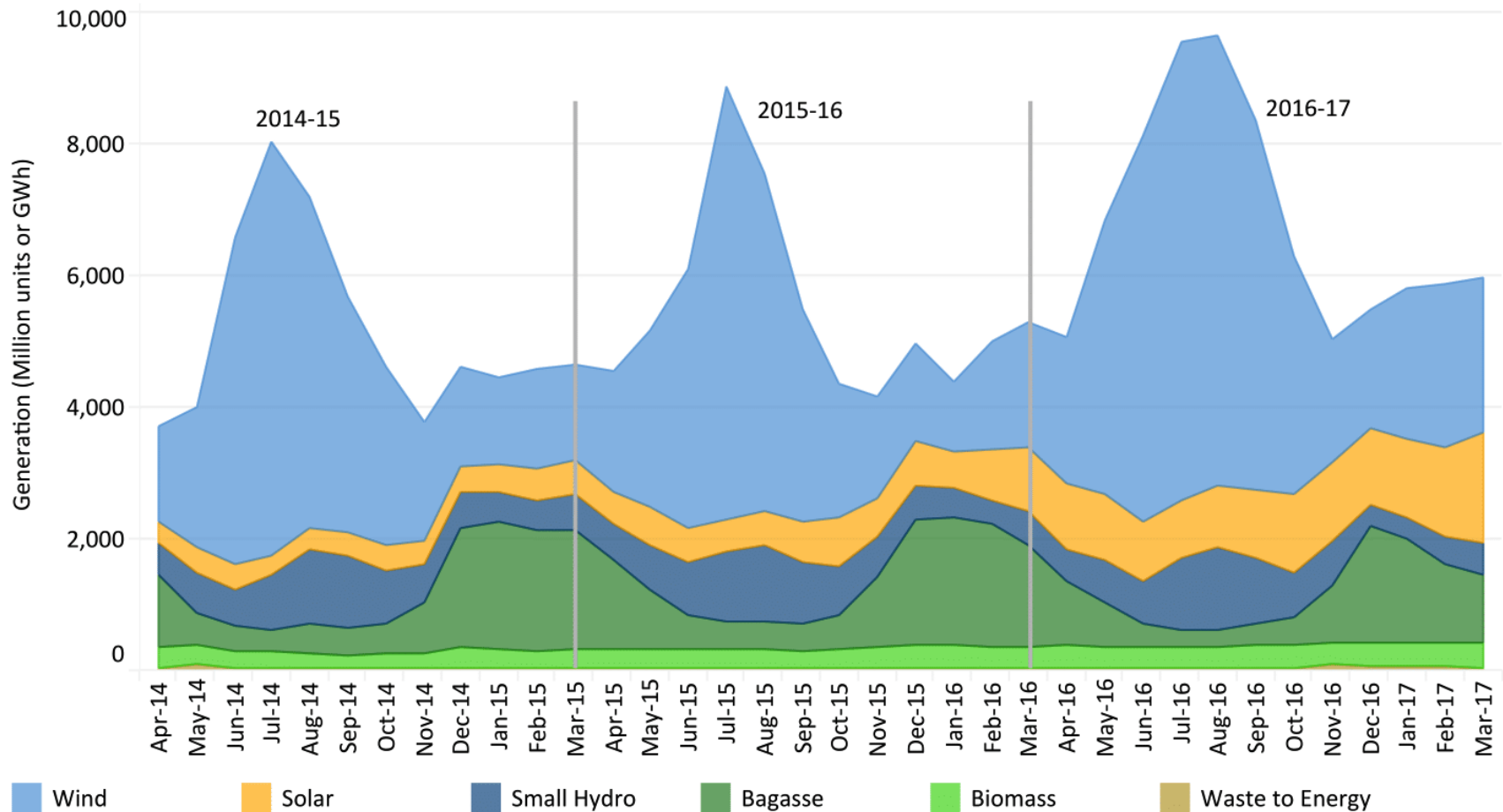
Important context

- Electricity is in the Constitution's concurrent list
 - i.e. both the Central and State governments can legislate on it; Independent regulators at both levels.
- At times, both have quite different priorities, constraints and capacities.
 - Centre: Climate Change & intl. negotiations, energy security, foreign policy, macro-economic policy...
 - State: Energy Access, consumer tariffs, subsidies, grid operation...
- Renewable Energy – Strong legal and policy push by Centre, states following lead **albeit reluctantly** and slowly at times. **Main concern being high price.**

RE prices, targets and rapid deployment

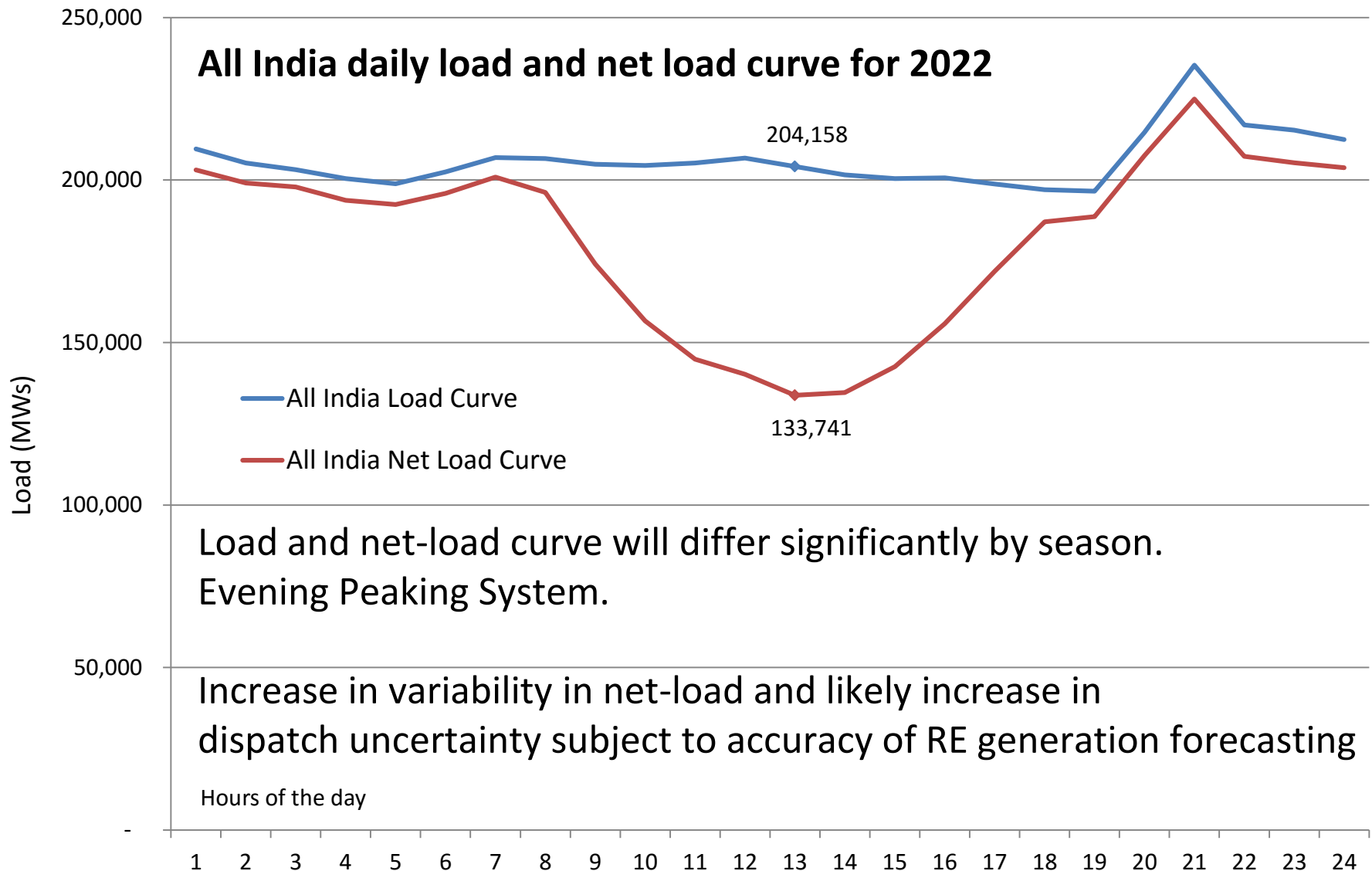
- Direct generation price no longer seems a concern
 - Solar PV (Rs 2.44 - 2.97/kWh, i.e. US cents 3.8 - 4.6/kWh)
 - Wind (Rs 2.64 - 3.42/kWh, i.e. US cents 4.1 - 5.3/kWh)
 - New coal power projects – Rs 4-5/kWh
- RE Capacity and annual Generation
 - 2017: 60 GW (18%) and 82 TWh (6.5%)
 - **2022: 175 GW (33%) and 327 TWh (21%)**
- **~ 3.5 x increase** in speed of deployment (~32 GW in last five years (2012-17), 115 GW expected in next five (2017-22))
 - Significant implications for policy-regulation; esp. grid integration

RE Generation characteristics: Seasonality



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

RE Generation characteristics: Diurnal variation



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

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Scheduling generation and pricing deviations

- Forecasting, scheduling and deviation settlement regulations
 - Operational at regional level, states yet to implement.
 - 10-15% error band with no penalty; reducing tolerance over time.
 - Deviation settlement of intra-state projects with inter-state transactions.
- Possible system benefit charge: to cover funding deficit of state imbalance pool.
 - To address combination of RE's balancing costs, cost of additional reserves, backing down cheaper thermal power.
 - Need to strictly differentiate between RE and load variability.
 - Spread cost to all consumers or re-assign to RE generators.

Minimising RE integration costs

- National/Regional coordination of scheduling-dispatch
 - Increase balancing area; regional cooperation can minimise area control error due to RE.
 - sharing/banking of generation resources across states
- To integrate more RE, critical for system to respond appropriately
 - Schedule based accounting in states; intra-day trading, flexible coal operation, ancillary services, better demand forecasting by DISCOMs etc. These needed for effective grid operation, irrespective of RE.
- New technical requirements for wind/solar generators (LVRT, reactive power support, regulation of active power etc.) to support grid operation/ancillary services.

Low capacity value (wind/solar)- evening peaking system

- Curtailment very likely at high RE shares, esp. with surplus situation in many states
 - strongly linked to wind/solar mix and its prices. Need to value RE beyond mere generation price to include system value (eg: capacity value, need for reserves)
 - Future of RE targets (RPO) and its solar and non-solar categories
 - Compensation important as RE has single part tariffs unlike coal. Compensation for grid unavailability or backing down (for non grid security/safety reasons)
- Future of must run status
 - possible two part tariff for wind and solar similar to pricing of large hydro. Principle to apportion between fixed and variable tariff?
 - Will be aligned with national schedule based accounting system
- For more info on value of wind/solar see, Deshmukh R. et al, 2017. Cost and Value of Wind and Solar in India's Electric System in 2030

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Innovative policies addressing DISCOM concerns

- Agricultural power supply is 'Achilles Heel' of Indian power sector. Solution to address this needs to ensure
 - Reduced cost and subsidy for DISCOM / state
 - Improving farmer satisfaction though day time reliable supply
- Our suggested approach, being adopted in Maharashtra on large scale. Deployment of distributed, grid connected solar plants to meet ag load cost effectively.
 - Even better for grid integration: change in load shape – load following generation.
 - Averaging effect from geographical spread.

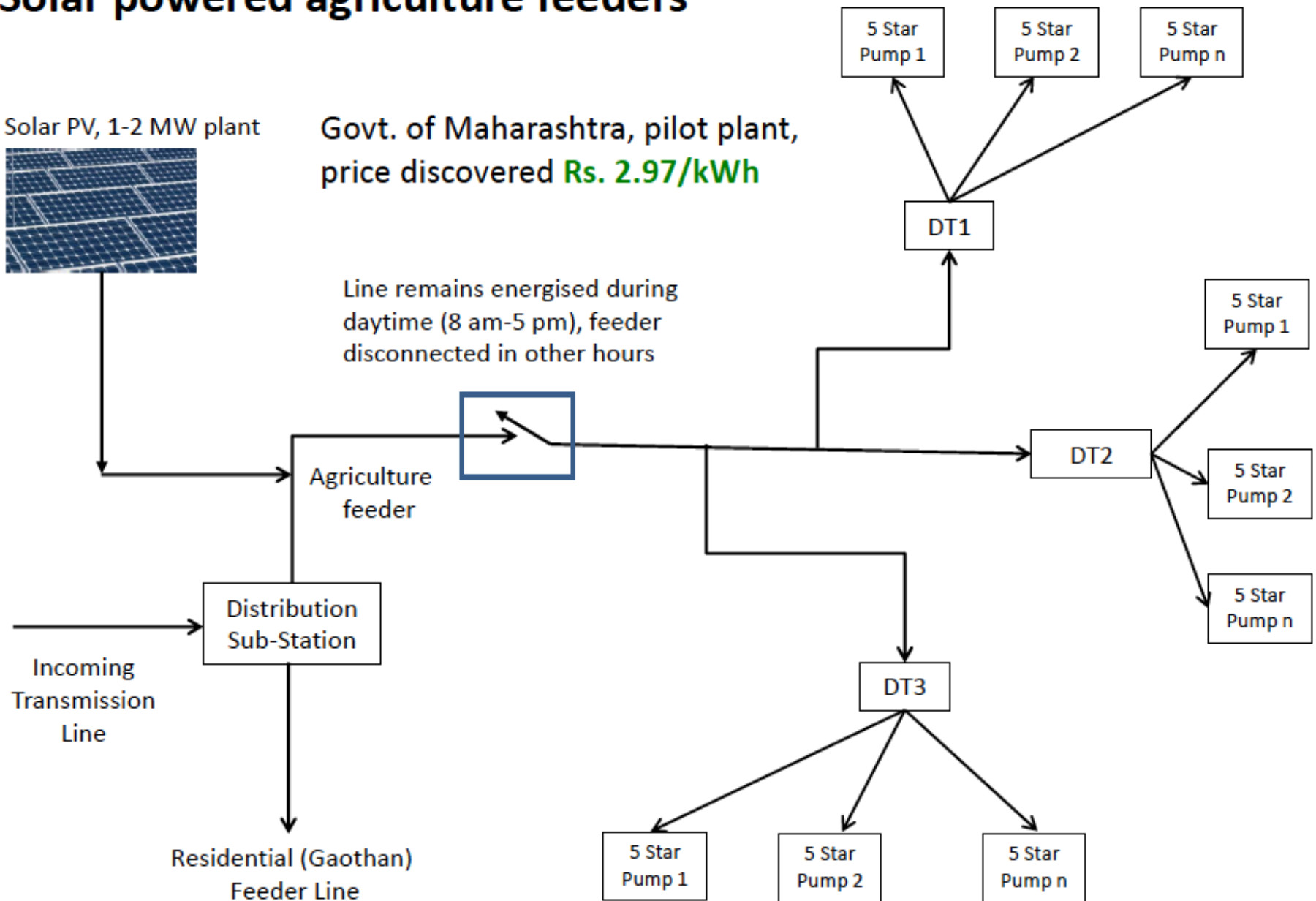
Solar powered agriculture feeders

Solar PV, 1-2 MW plant



Govt. of Maharashtra, pilot plant,
price discovered **Rs. 2.97/kWh**

Line remains energised during
daytime (8 am-5 pm), feeder
disconnected in other hours



Larger transformation imperative

- DISCOM's traditional role, political economy of sector changing
 - Old challenges remain: financial viability, poor QoS, high tariffs
 - New ones: Growing surplus, sales migration. Non-DISCOM supply options, esp. RE based becoming more economical. DISCOM may turn mainly into a wires utility for large consumers.
- Implications
 - Significant pressure to reduce inefficiencies across the value chain
 - Need for new consumer tariff designs (traditional levers of tariff and cross-subsidy will be ineffective);
 - Deepen/broaden power markets
 - Improve supply quality issues as they will become as political as tariff.
 - New challenges for addressing 'governance deficit'
- A robust grid and economically viable distribution sector is necessary for scaling up for RE.

Summary

- RE needs a broad long term vision, yet nimble policy-regulatory framework
 - Effective ongoing review and correction mechanism can bring agile responses to dynamic sectoral changes, rapid deployment
 - Significant institutional strengthening, data management etc.
 - RE planning/operation needs to take more cognizance of larger sectoral challenges, cannot remain insulated
 - For eg: surplus situation and increasing RPOs
 - Needs more consultative processes/coordination, taking states and DISCOMs concerns on board.
 - New net metering rules, gradual removal of OA concessions for RE
- Critical to understand, minimise and internalise grid integration costs to improve DISCOMs acceptance. Cost needs to be passed on to the RE sector over time and shared equitably among appropriate obligated entities.

THANK YOU

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