Workshop - Optimization of Levelized Cost of Green Energy

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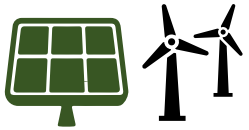
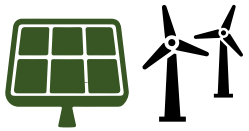
Introduction – About ReNew Power

- ReNew Power, established in 2011, is one of **India's leading renewable energy company** in terms of total energy generation capacity.
- In October 2019, ReNew Power became the **1st RE company in India (and 10th globally) to cross 5 GW of installed capacity.**
- **Vertically Integrated** Contracted Independent Power Producer with Diverse Execution Capabilities
- Portfolio : **~2.8x capacity growth** vs industry growth of 1.6x (FY 2017-21)
- Aspirational goal of **18 GWs by FY 25;** No new external equity needed for 18 GW goal

Portfolio:



Commissioned asset base → **7 GW+**



Pipeline (to be commissioned) → **3 GW+**

Key areas of work:

- Utility scale wind
- Utility scale solar
- Utility scale firm load following RE power
- Utility Power portfolio optimization
- B2B solutions
- Hydropower project & Energy Storage
- ISTS & Power Distribution / Retail

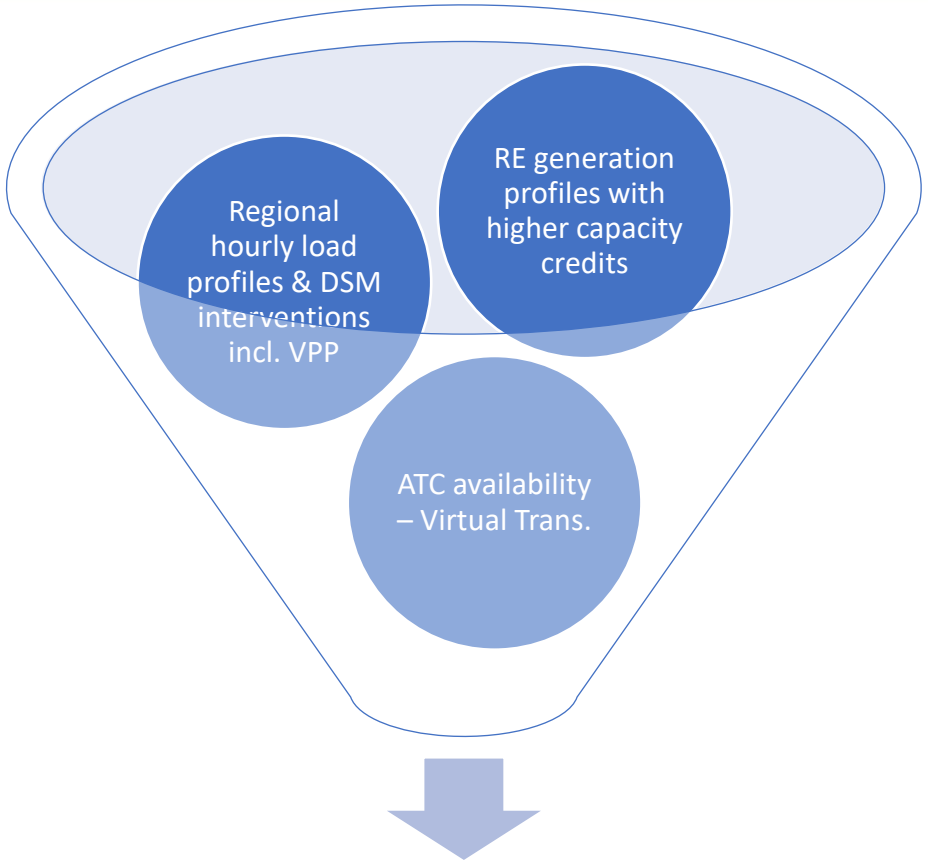
Context

- India's target to commission and integrate 500 GW RE by 2030
- With the VRE sources achieving "grid parity", the variability issue needs to be addressed at an optimal cost
- With passage of time, RE generation may loose must run status
- Just like in hydro projects (where spillage minimization is prioritized), RE curtailment also needs to be minimized
- Resource adequacy studies will ensure optimized LCOE for utilities
- Demand side interventions, load assessment and development of firm and load following RE products will be key

Achieving firm load following RE

- Starting with solar-wind hybrid (co-located), the trend is to move towards “Round the clock” albeit with minimum CUF mandates
- Oversizing and blending with Hydro / BESS are options to achieve the RTC profile
- However, “time block” wise (meaning MW based) firm RE profile design having load following characteristics is needed to optimize LCOE
- Co-located RE generation sources shall give way to multi-location utilizing the “capacity credit” of varied RE profiles with the load profile of beneficiary state
- Region based RTC RE product design utilizing the complementarity in load curves shall help optimize LCOE

Achieving firm load following RE

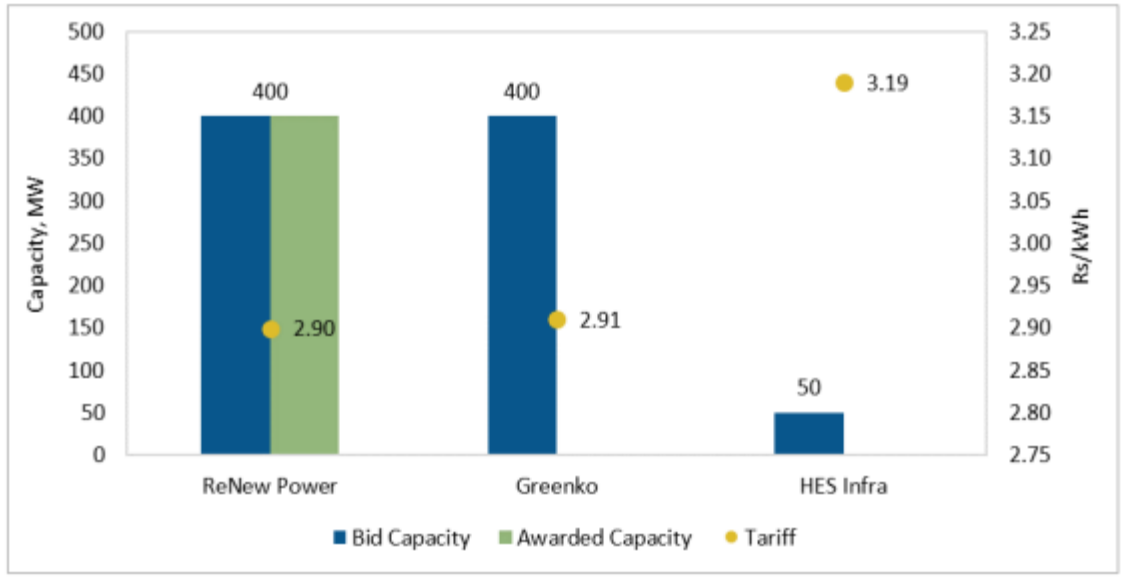


Round the Clock RE with optimized LCOE

- Pan-India supply-demand analysis to identify complementarity in demand
- Capacity credit identifications of multiple location wind / solar
- Virtual transmission to help create a “copper plate” scenario – facilitates optimal RE resources utilization
- Improve RE forecasting (DA / ID)
- Integration with markets necessary (RTM) – to mitigate forecasting errors
- Flat RE profiles NOT needed – increases LCOE

Use Case/Case Study – RTC1 and RTC 2

Figure 1: SECI RTC-1 Auction Result

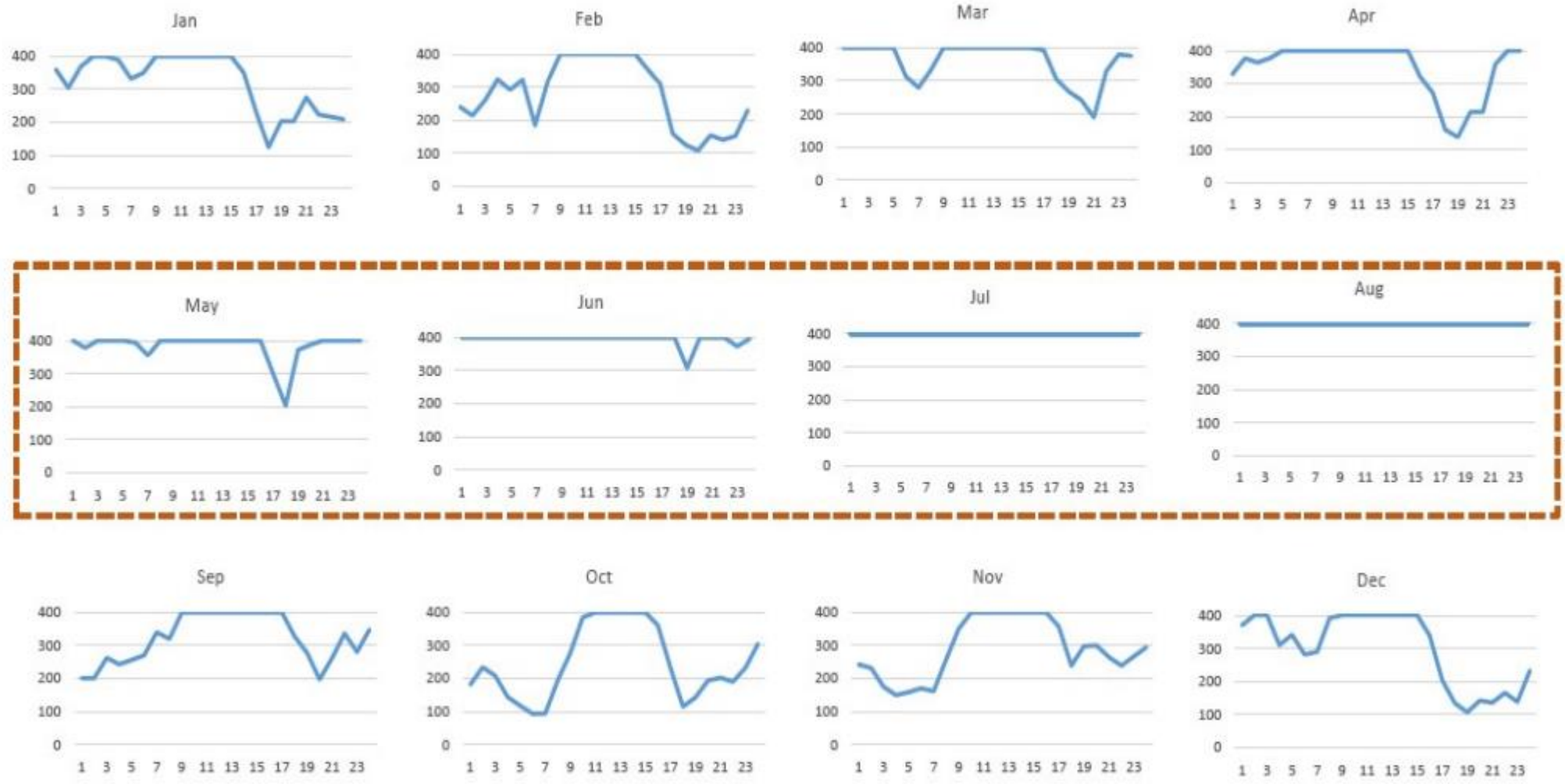


Source: JMK Research.
Note: The L1 tariff quoted is single first year tariff.

Figure 2: SECI RTC-2 Auction Result

Source: JMK Research.

Load Following RE generation profiles - Sample

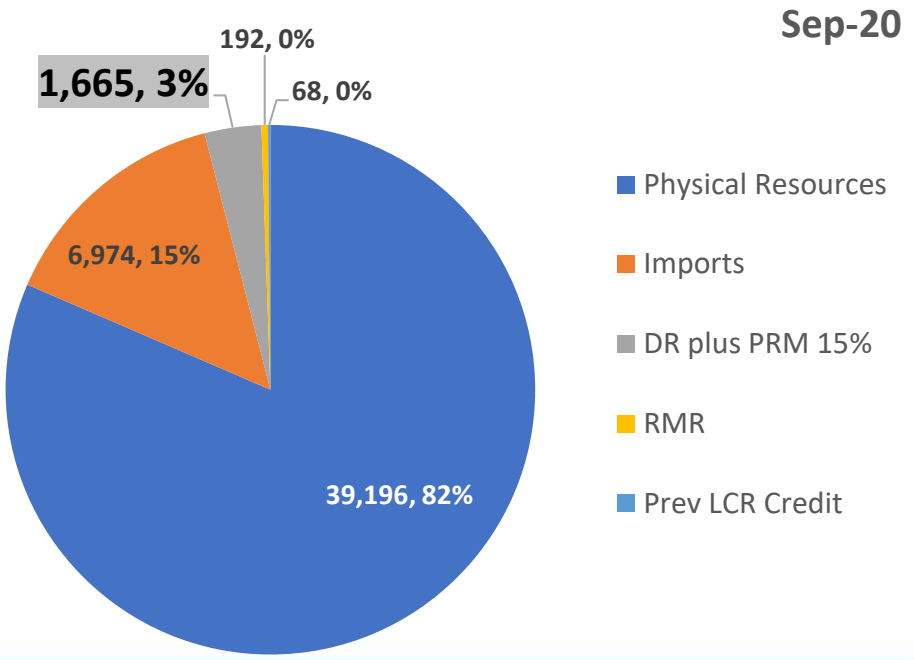


Demand Side Management – Regulatory position in California

- Decision 07-10-032 directs the utilities to "integrate customer demand-side programs, such as energy efficiency, self-generation, advanced metering, and demand response, in a coherent and efficient manner."
- Distributed Energy Resources (DERs) include customer owned generation (RTSPV), Demand Response (DR) & Energy Efficiency (EE)
- Decision (D.)17-12-003 defines DR as *reductions, increases, or shifts in electricity consumption by customers in response to their economic signals or reliability signals.*
- *Economic signals – electricity prices or financial incentives; Reliability signals – Grid under stress or vulnerable to high prices.*
- The CPUC issued a decision in 2012 directing the implementation of Rule 24, which enables direct participation by DR resources (Both Utility and 3rd Party aggregators) in the ISO wholesale (day-ahead, real-time and ancillary services) market.

Key Drivers:

- Increasing intermittency in supply (VRE) and need for RE integration (Duck curve management)
- Long term impact assessment on grid upgrades & future resource requirements



DSM – Importance for Resource Adequacy in India

Key Drivers for DSM as a dispatchable resource:

- RE Integration and attain zero carbon
- Optimal utilization of variable generation and transmission / distribution resources
- Avoid incidents of grid outage and achieve better reliability
- Energy Arbitrage during instants of high grid prices

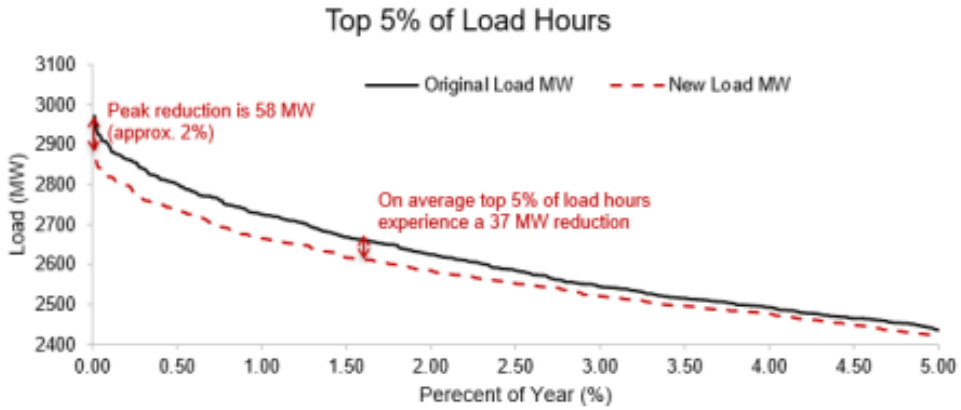
Recommendations:

- Recognize DERs as integral part of RA plan of Discom
- DR be allowed as a dispatchable resource which can participate in wholesale markets (Funded POCs may be mandated)
- Financial signals (TOU rates) could be introduced for residential consumers as well as separate TOU for EVs

NREL – BSES Study findings (Unlocking Demand Side Flexibility):

(https://www.nrel.gov/docs/fy21osti/79375.pdf)

- Peak reduction shall bring capacity savings (generation & network) as well energy savings.
- Target domestic consumers for peak reduction
- Domestic consumers are willing to participate in DR
- C&I consumers are more willing to participate in energy efficiency than DR
- Peak reduction potential - 2% (Summer) & 3.8% (Winter)



Annual load duration curve before and after TOU (only 5% of load hours shown)

Key Takeaways/ Recommendations

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Thank You

For discussions/suggestions/queries email: www.indiasmartgrid.org
www.isgw.in
Links/References (If any)

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