Renewable Energy in India

Driving New Businesses & Innovations

26th August 2021

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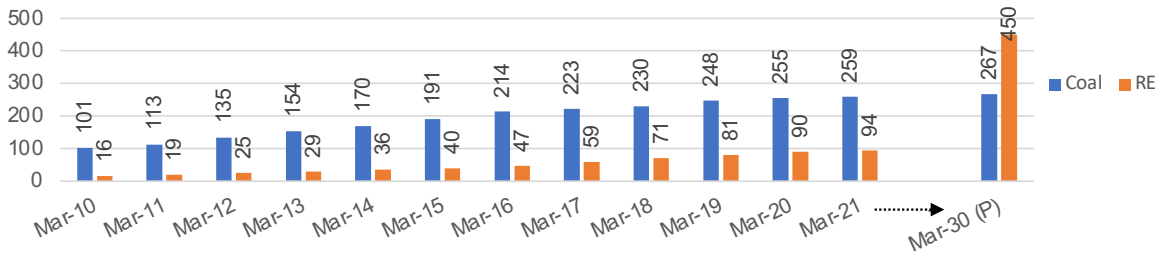
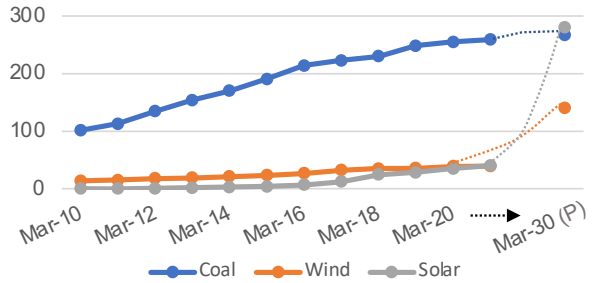
India's Energy Transition – In A Few Pics

Coal - based Thermal Power vs RE Installed Capacity (GW)



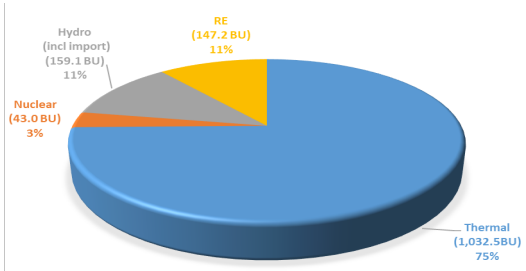
Source: Energy statistics India 2021

Coal – Wind – Solar Year-wise Installed Capacity (GW)



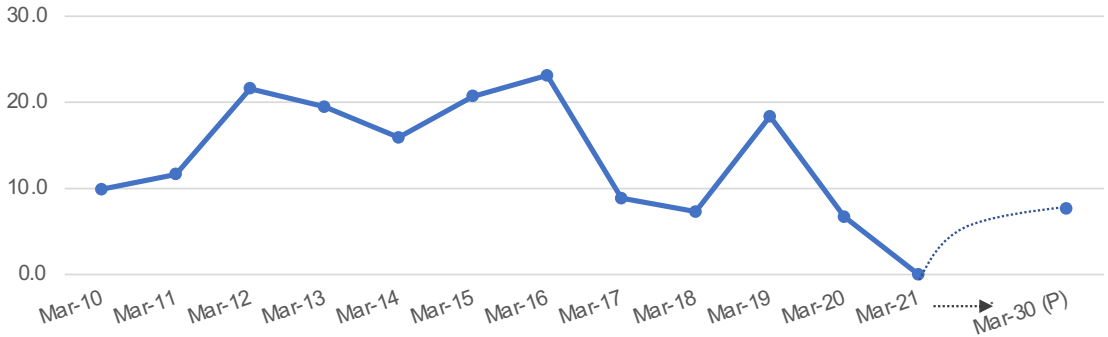
Source: MNRE annual report

Source wise Energy Generation



Source: CEA – Monthly renewable generation report – March 2021

Coal-based Thermal Power Addition (GW)

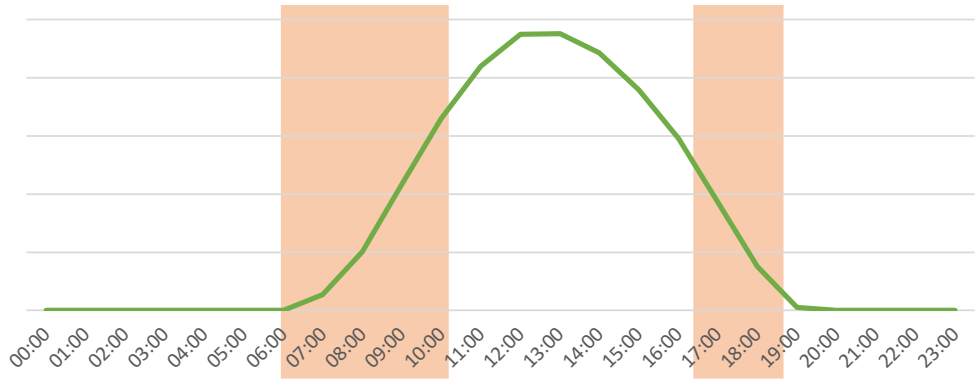


Source: CEA Report on optimal capacity mix 29-30 (Jan 20)

- Solar and wind capacities have been driven by a combination of sustainability commitments and dropping prices.
- Solar Prices have fallen from Rs 16 per Kwh in 2010 to around 2.3 - 2.4 Rs/kwh in recent auctions
- Swanson's law for prices of solar modules – 20% drop in prices for every doubling of capacity.
- RE installed capacity has just crossed the 100GW mark and we target to achieve 450GW by 2030
- Grid parity achieved. Solar and wind power today is cheaper than coal.
- Deep de-carbonisation of the power sector now looks possible with clean technologies.
- A clean power sector is the "Crown" of our energy transition.
- Need to replicate this in transportation and wean India off its crude oil dependency.
- PM's Speech on 75th Independence day – "*To make India self-reliant in Energy*" by the 100th independence day.

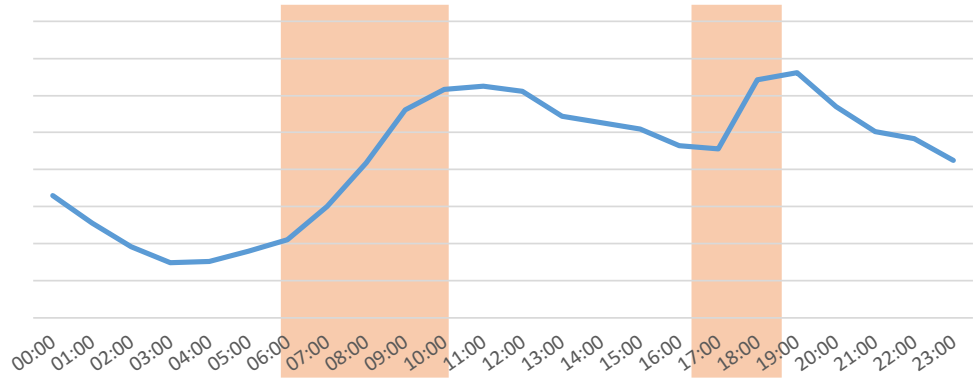
Handling Intermittency of Variable RE – The Challenge

Typical Solar Power Generation - Daily



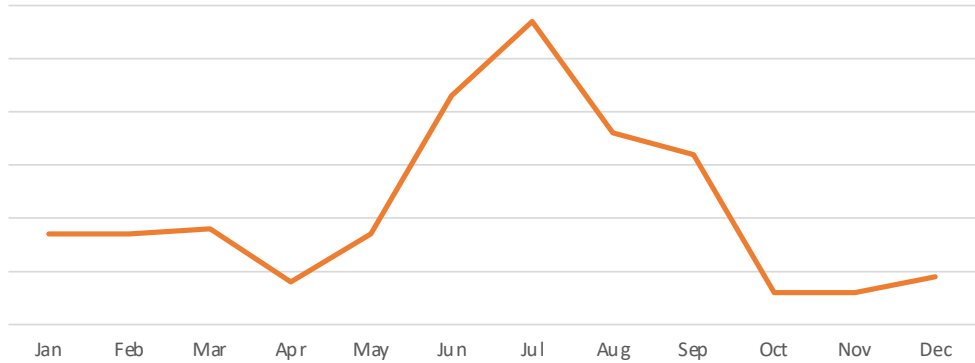
Source: IEA

All India Demand Met – An Example



Source: POSOCO – Monthly Reports 2020-21

Typical Wind Power Generation - Annual



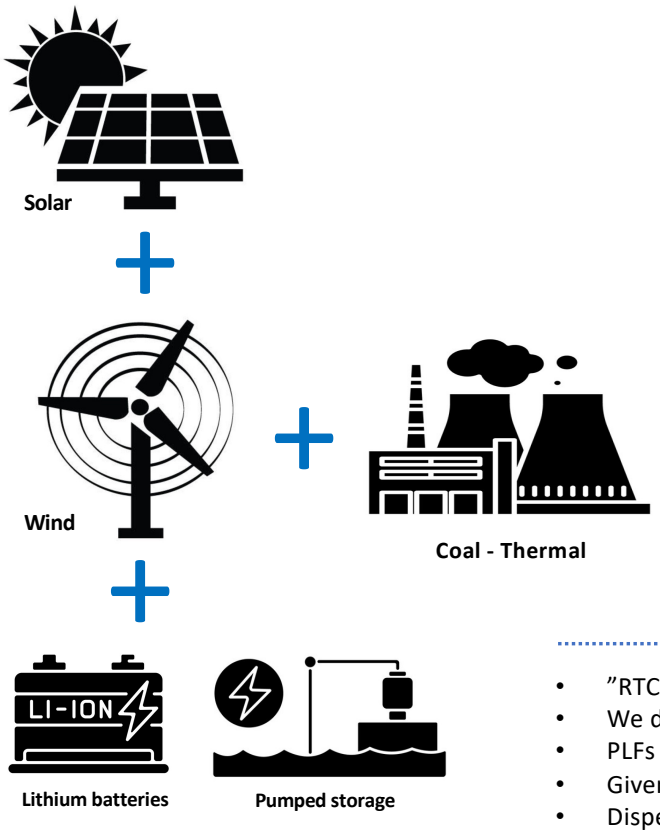
Source: NIWE - Wind Solar Hybrid Energy Production Analysis Report 2016

- Wind and solar are intermittent Variable Renewable Energy (VRE) resources.
- Both have siting restrictions – Wind more than solar - leading to concentration of capacity in resource rich areas
- *In the absence of economically viable grid level energy storage – integration of VRE into the Grid becomes a challenge*

- **Strategies**:
- Hybrid wind and solar
- Wind + solar + storage (Li batteries/pumped storage)
- Round the Clock power (solar + thermal + wind + [Storage]) – The RTC tenders

Round The Clock “Clean” Power – Is It Even Possible?

Blending Thermal + Solar + Wind + Energy Storage



The RTC Bidding Paradigm

- Thermal capacity augmented by RE sources including energy storage, if any.
- Sources of generation, may be co-located or dispersed. Dispersed injection is allowed as long as they are in the same RLDC.
- However, energy storage to be mandatorily co-located with at least one of the RE sources.
- Bids invited for a single part tariff with a 3% annual escalation for 15 years after which it would be constant.
- PPA will be signed for a committed annual energy equivalent to 100% capacity utilisation factor (CUF) of the Project, in order to ensure “Round-the-Clock” energy supply.
- Project to achieve annual CUF not less than 80% and monthly CUF not less than 70 % during the PPA duration of 25 years.
- Very still penalties for shortfall against annual and monthly CUF commitments
- Excess power can be sold on the market.
- Change of law clause for project cost variation due to statutory changes.

- ”RTC” is a misnomer – Annual CUF is 80% and not 100%
- We don’t have the despatchability of thermal – given the must run requirement
- PLFs very similar to thermal though
- Given multiple generation locations – May not a hybrid in its true sense
- Dispersed injection could mean higher land, transmission, permitting and transaction costs

Thank You

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