The need and importance of a new framework and long term perspective for transmission planning

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Context: India has made strong commitments to scale up renewable energy (RE), with an ambitious target of 175 GW of RE by 2022. It is very likely that even higher targets would be envisaged for 2030, mainly to take advantage of the low cost discovery (Rs 2.5-2.75/kWh) and fixed price long term contract nature of wind and solar power. The Secretary, MNRE recently suggested a target as high as 500 GW RE by 2030[i]. Similarly, a draft report from CEA[ii], *'Optimal Generation Capacity Mix for 2029-30'* is projecting a RE capacity of 450 GW by 2029-30. This would generate 913 BU accounting for 36.4% of the total generation. Beyond large national targets and low price discovery, states will firstly have to commit to such large targets since ultimately they manage power procurement and are responsible for reliability and affordability. However, unless comprehensive analytical and coordination work on various aspects such as optimal long term generation and transmission capacity planning, grid integration of renewables including the need for flexibility such as storage, financial health of the DISCOMs, supply quality etc. is undertaken, the sector could lose out on maximising the benefits of low cost wind and solar.

Ambitious solar targets for Rajasthan: In addition to the push to increase RE targets from GoI, a high share of RE may potentially turn out to be a low-risk and economically viable choice for the state, given the fall in solar and wind prices. The draft policy lists a target of 50 GW by 2025-26 which includes 25 GW in the state by 2022. This is an extremely ambitious target and should be supplemented by comprehensive production cost simulations which can model system dispatch in these years (2022 and 2026) and determine how this amount of solar generation can be reliably integrated into the Rajasthan system considering its load profile, load growth and existing and future system flexibility. Such a modelling exercise can bring out the value of various aspects that have implications for transmission planning. Some of these are noted below.

- The importance of the solar feeder and KUSUM approach of day time supply to agriculture in helping solar adoption.
- The need and importance of procuring seasonal, short term 'peaking' power for short durations for system reliability. This needs to be factored in transmission planning.
- Flexible coal operation with lower PLFs will likely become a norm given RE and demand variability.
- Lower PLFs, higher flexibility needs, stricter environmental norms, higher costs for new generation capacity coupled with uncertainty of coal costs can make the lumpy and long gestation investments in coal highly risky and open to high cost lock-in.
- Batteries are likely to play a significant role and have significant value for the system in addressing diurnal shortages/variations and absorbing economical solar/RE.

Implications for transmission planning: In such a high renewable energy scenario, transmission planning would undergo a paradigm shift since most of the incremental capacity addition would be from solar and wind power. Some of the likely changes which would need to be considered are noted below.

- Rajasthan presently has an installed RE capacity of 8,153 MW (July, 2019). Within this, solar capacity is 3708 MW and this may grow to around 25,000 MW by 2022 and 50,000 by 2026 (as per the draft policy). This translates to planning for an annual incremental addition of 7.5 GW/year from 2020-2026. The location of new wind/solar resources along with their generation profile is likely to be quite different from existing generation resources. In addition, there is potential of exporting solar power to other states. These factors need to be considered in the transmission planning process.
- Generally, renewables with lower CUFs (20-30%) will incur higher transmission investments and costs. However, some RE resources like solar PV can be co-located with load (rooftop solar and solar feeders) leading to lower or different transmission needs. Also the highly modular and short gestation period of renewables gives the procurer and planner more optionality. Hence the location, utilisation and voltage level connectivity of renewables will have to inform transmission planning.
- Policy/Regulation may introduce seasonal tariffs and expand the scope of the ToD regime to smaller DISCOM consumers. Similarly, the ToD slots themselves may significantly change over time if the story of plentiful and cheap solar PV plays out. This coupled with the expansion of the solar feeder program to cover majority of the irrigation load can potentially make significant change in system load profiles and shift in peak load times.
- Another factor is battery energy systems. If deployed at scale, they will incentivise much higher utilisation of transmission infrastructure and make diurnal load shape variations less worrisome. The draft CEA report mentioned earlier also projects a national Battery Energy Storage capacity of 34,000 MW/136,000 MWh by 2029-30. Higher solar + battery deployment can reduce peak load and make the load shape flatter with associated implications for transmission planning, investments, utilisation and pricing. Analysing the load shape will also be very important since with larger penetration of batteries, the peak reduces and the resulting peak is for longer time, thereby reducing the value of further storage which is needed for more hours.
- Apart from these factors, the recent '*MoP and MNRE's Five Year Vision Document for Power & Renewable Energy Sector',* dated 1st July, 2019 notes a number of challenges and goals for the transmission sector.

Key challenges faced by Power Transmission Sector

- *Risks associated with planning of transmission projects aligned to the upcoming RE projects*
- *Long gestation period of transmission projects as compared to RE projects*
- *Allocation of transmission cost for RE projects*

Goals

- *Advance planning for transmission system for the generation capacity addition including RE*
- *Facilitate scaling up of renewable energy and reduce/eliminate curtailment*

- *Reduce state level congestion while simultaneously improving capacity utilization*

This underscores the urgent need and importance of a new framework for transmission planning.

Some possible **strategies/action points** that could be considered are listed below.

- ***New multi-stakeholder process and long term perspective plan:*** The RVPNL has commissioned some transmission studies, reviews and plans in the recent past[iii]. While such plans seem to be in place until 2027, there is a need to have longer term perspective plan. As we have seen earlier, this is now of vital importance considering the changes underway in the sector. Hence there is a need to set in place a dynamic and multi-stakeholder transmission planning process which takes into cognizance the need for planning for a high renewable energy share future. This process should draw on the modelling studies and should produce a 10/15-year perspective transmission plan[iv] which would be revised on a three year rolling period. This is especially important given the time lag in transmission and RE generation project gestation periods. We have already experienced delays in wind projects in Gujarat and Tamil Nadu due to inadequate transmission infrastructure. Given the increasing norm of connecting larger RE projects to the ISTS system and equivalent investments in the western region[v], closer coordination with generators and ISTS system planners would be necessary. Such a process would enable consideration of inputs and strategies by DISCOMs and various RE developers on issues such as location, connection voltage, procurement strategies, wind/solar mix etc. This would be informed by detailed modelling studies as noted below.

- ***Detailed Modelling Studies:*** There is a need to conduct more long term capacity expansion and production cost modelling based simulations and studies which include inter-state and intra-state transmission constraints. This would need appropriate transmission system data.
  Further, such simulations should be run with different scenarios which vary some wind and solar properties (like location, generation profile, voltage level, and wind/solar mix) building on tools such as Multi-criteria Analysis for Planning Renewable Energy (https://mapre.lbl.gov/). This can pointedly show the value of these renewables to the system. This can inform and lead to a more structured and rigorous RE procurement and transmission planning approach which is based on the best value to the system rather than just on the least generation cost. Since the model output shows the times with energy surplus and shortage, this can be used to trade with other states/consumers, subject to adequate transmission capacity. Similarly, the higher ramp requirements and frequent shutdown of plants can lead to opportunistic contracts with other states / regions. The ***multi-stakeholder process*** mentioned above would provide necessary inputs/data and assumptions for carrying out these studies.

- ***Battery Pilots:*** Prices of battery energy storage systems have fallen drastically and are predicted to further reduce in the years to come. Electric storage is a very modular system and allows for use in

multiple applications and can play a vital role in avoiding transmission congestion, improvement of power supply quality, modernizing the grid and possibly even assisting in islanding of critical areas. Hence it is critical to initiate procurement of grid scale battery storage systems on pilot basis. RRECL can consider applying to the PSDF for such projects to begin with. This could be possibly first thought of for areas where transmission congestion/system reliability is a key concern.

The multi-stakeholder process and modelling studies could be initiated in a couple of months and could aim for development of first draft perspective plan within subsequent one year.

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[i] https://www.saurenergy.com/solar-energy-news/india-plans-establish-500-gw-re-capacity-2030-mnre-secretary
[ii] http://cea.nic.in/reports/others/planning/irp/Optimal_generation_mix_report.pdf
[iii] http://mercadosemi.in/complete-system-study-of-transmission-network-of-rvpnl.php
[iv] CEA's most recent perspective plan looking out to 2036 is here - www.cea.nic.in/reports/others/ps/pspa2/ptp.pdf; Similarly their Transmission Planning Criteria Manual is here - cea.nic.in/reports/others/ps/pspa2/tr_plg_criteria_manual_jan13.pdf
[v] https://mercomindia.com/pgcil-blueprint-solar-wind-evacuation-western/