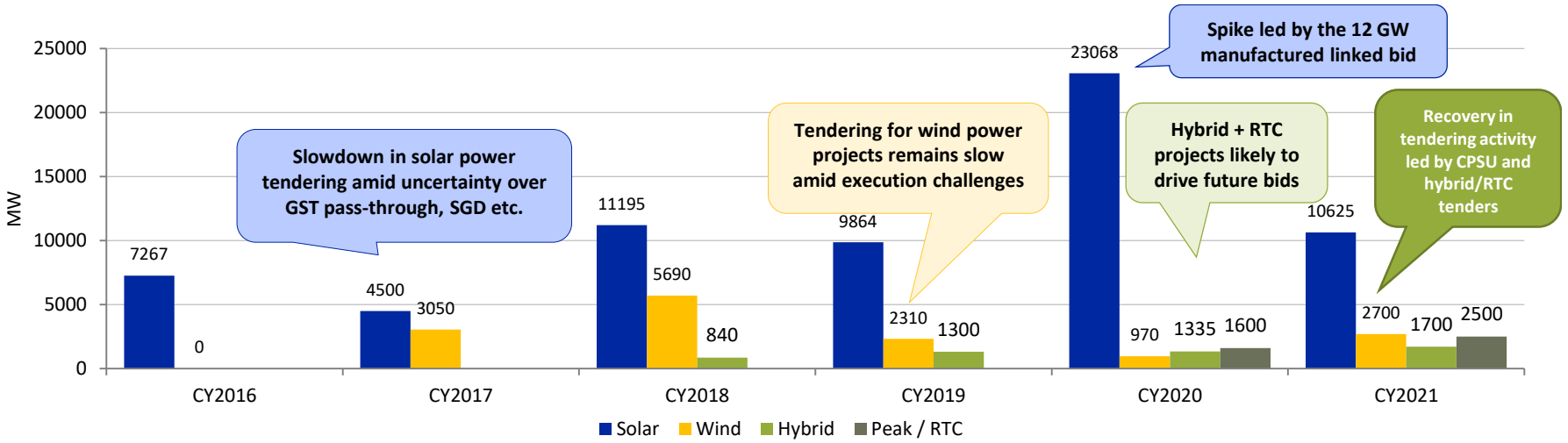
Bidding Trends & Capacity Estimates

Project pipeline remains strong at over 55 GW

Strong project pipeline; share of hybrid & RTC tenders on the uptick

Exhibit 5: Year-wise RE capacity tendered / awarded

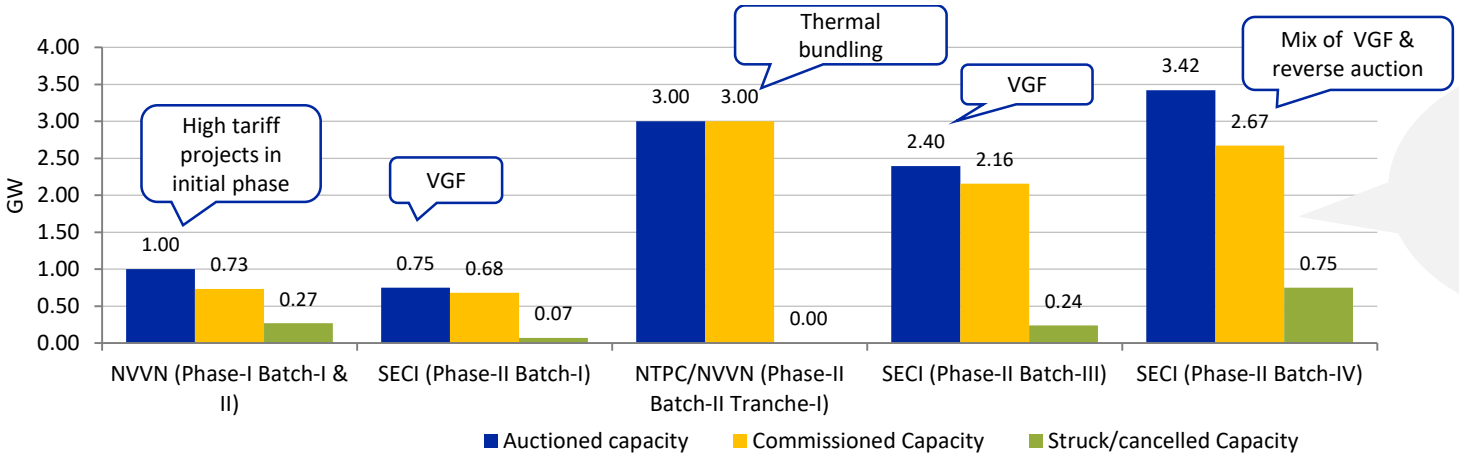


Source: ICRA Research, MNRE, SECI, SERCs

Over 55 GW of project pipeline to provide a strong visibility on RE capacity addition; improved progress in signing of PPAs/PSAs is a positive for commissioning of these projects

87% of the solar capacity awarded under phase I & II of NSM is commissioned

Exhibit 6: Capacity awarded and commissioned under phase I & II of National Solar Mission (NSM) by SECI/NTPC/NVVN



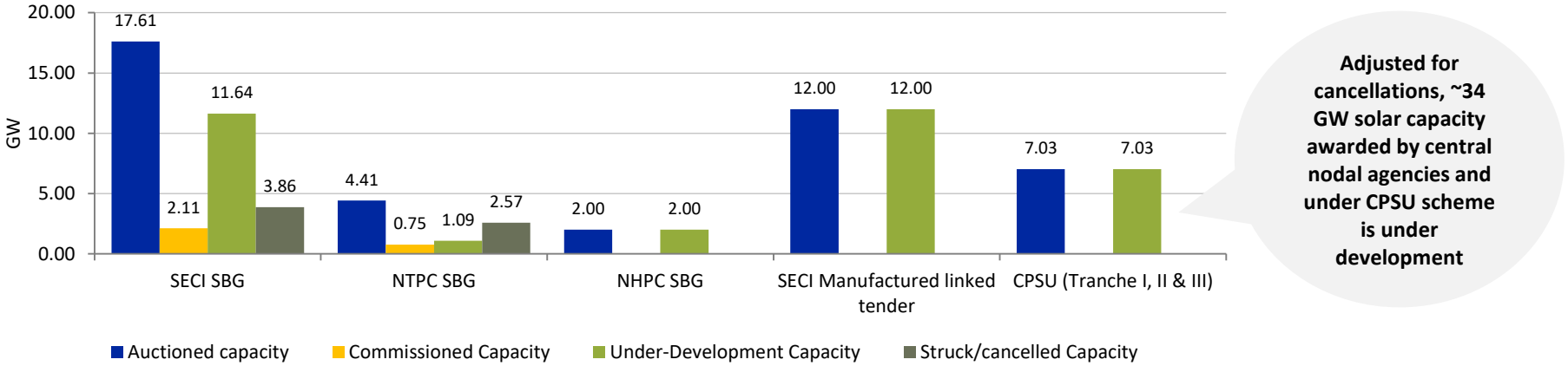
Out of the 10.57 GW awarded under phase I & II of NSM by SECI/ NTPC /NVVN, 9.24 GW is commissioned and the balance 1.33 GW is cancelled or struck

Source: ICRA Research, SECI, NTPC & CEA

- The phase I of NSM involved setting up 1000-MW projects under the solar photovoltaic (PV) and solar thermal route. The phase II of NSM was implemented across multiple batches comprising projects via various routes such as bundling (with thermal power), viability gap funding (VGF), and reverse auction. Out of 10.57 GW awarded by SECI/NTPC/NVVN under phase I & II of NSM, 87% of the capacity is commissioned and the balance capacity is struck or cancelled. Post the Phase-II Batch IV scheme, the solar sector moved to bids based on standard bidding guidelines (SBG).

Large solar project pipeline under the SBG route

Exhibit 7: Status of capacity awarded under SBG by central nodal agencies and the projects awarded under CPSU scheme



Adjusted for cancellations, ~34 GW solar capacity awarded by central nodal agencies and under CPSU scheme is under development

Source: ICRA Research, CEA, SECI & NTPC

- Under the SBG route, the central nodal agencies auctioned a total of 24.0 GW solar capacity over the past few years, with another 12 GW from manufactured linked tender and 7.0 GW from the Central PSU scheme, taking the total auctioned capacity to 43.0 GW. Adjusted for the cancellations, the capacity being developed under these schemes is 36.6 GW, wherein 2.9 GW is commissioned and balance is under-development, providing a strong pipeline for capacity addition in the solar power segment. The cancellations are due to delays in signing of PPAs/PSAs or delays in securing regulatory approvals or higher bid tariffs.

Central nodal agencies driving the solar project awards

Exhibit 8: Year wise solar capacity auctioned under central and state schemes

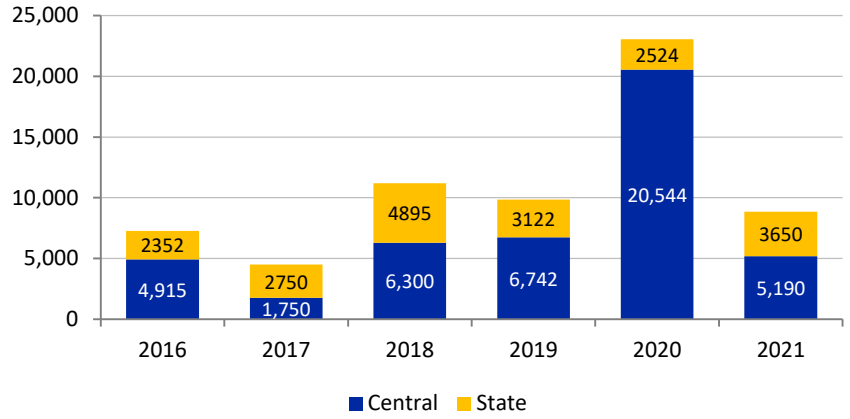
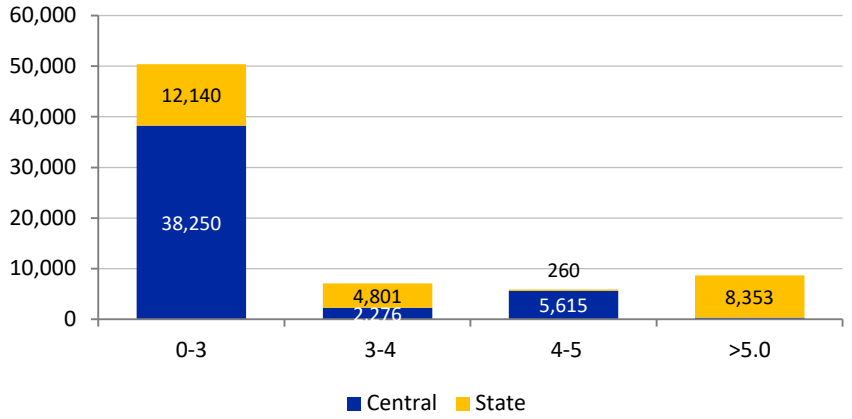


Exhibit 9: Program-wise solar capacity auctioned in different tariff bands



Source: ICRA Research, CEA, SECI, NTPC & SERCs

- Over the years, the share of solar projects awarded under the Central bidding schemes, mainly by SECI have had a higher share in the projects awarded in the solar power segment. This is also reflected in the better competitive tariffs discovered in the auctions undertaken by the Central nodal agencies. This can be attributed to the better counterparty credit quality offered by the central nodal agencies, with their ability to get payments from state distribution utilities in a more timely manner

Slow progress in execution of projects awarded in the wind segment

Exhibit 10: Year wise capacity auctioned and average tariff in the wind segment

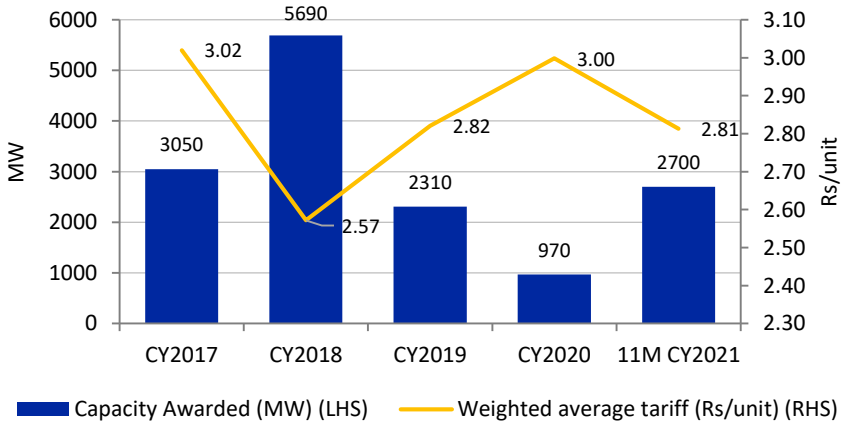
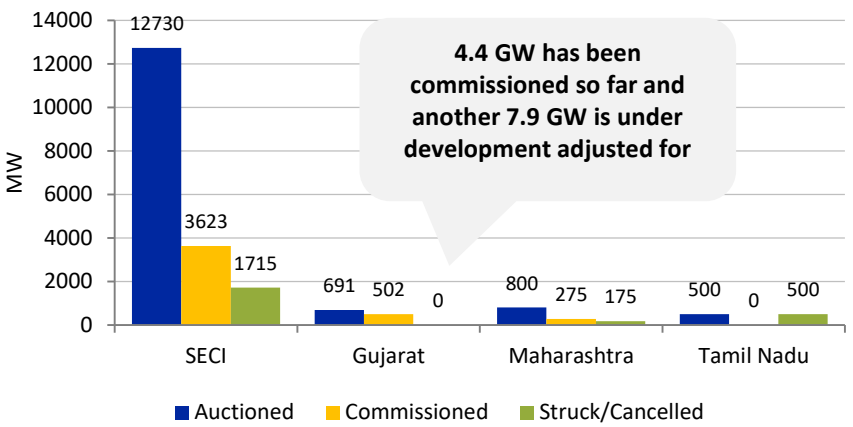


Exhibit 11: Status of wind projects awarded by SECI and state discoms

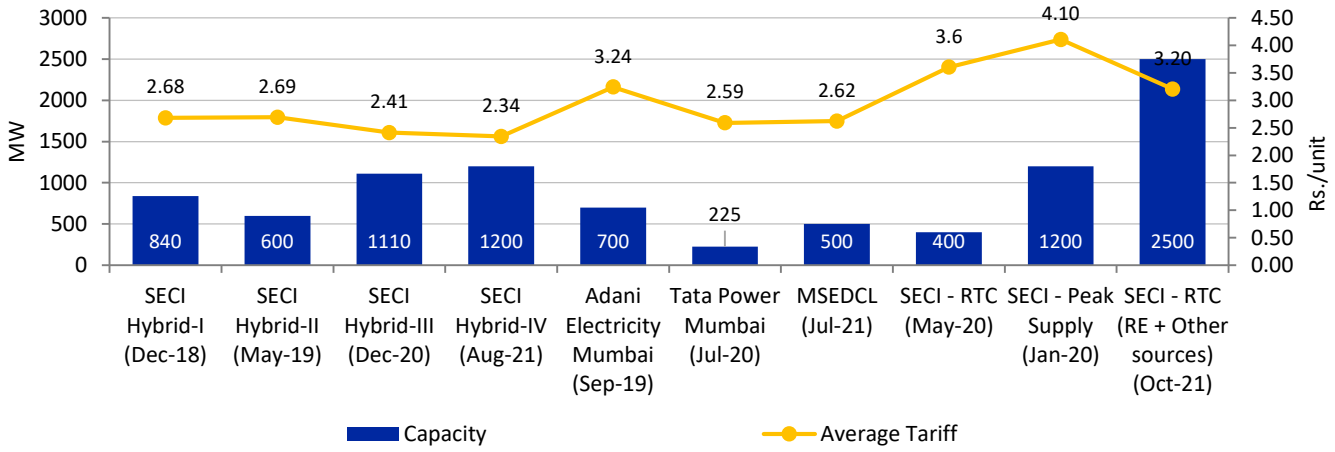


Source: ICRA Research, CEA, SECI and SERCs

- While the overall wind project awards so far remain large at 14.7 GW, the actual execution on ground is slow with only about 4.4-GW commissioned so far against the 11.0 GW to be commissioned as per the timelines provided under these bids. This is owing to delays in execution caused by land acquisition issues, delays in transmission connectivity, financing challenges amid concerns over the viability of the bid tariffs and delays in signing of PPAs/PSAs as well as delays in securing approvals from regulators. This apart, the developers are also facing challenges given the limited options for procuring WTGs, with most OEMs being under financial stress. As a result, about 2.4 GW capacity is struck and likely to be cancelled, leaving 7.9 GW under execution.

Share of project awards in the hybrid segment expected to go up…

Exhibit 12: Movement in scheme wise tendered capacity awaiting signing of PPAs/PSAs



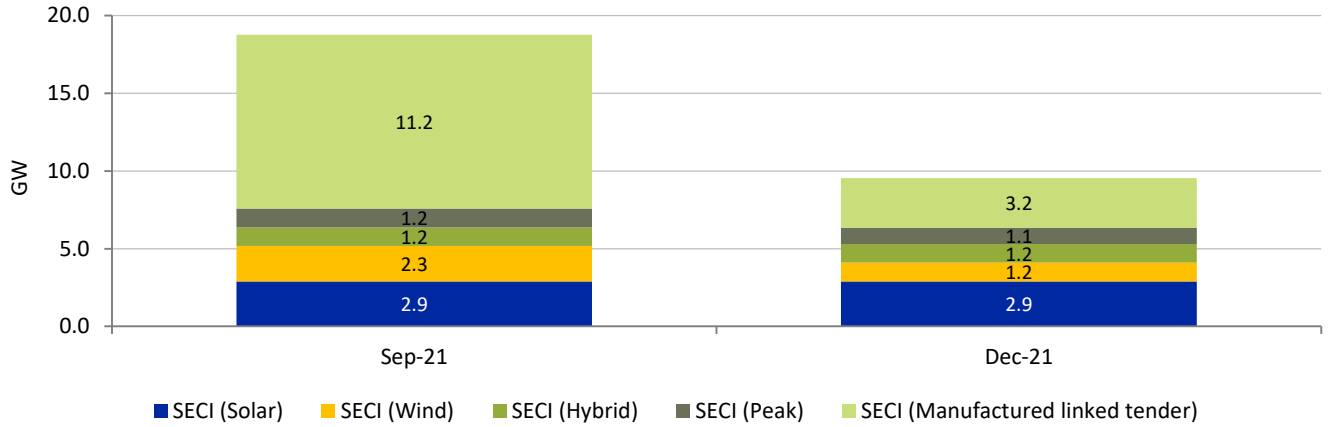
Hybrid segment witnessed project awards of 5.2 GW over the past three years. This apart, another 4.1 GW has been awarded for supply of RTC / Peak power. Successful demonstration of these projects would improve the adoption of hybrid projects and enable efficient integration of RE with the grid

Source: ICRA Research, SECI & SERCs

- The competitive tariffs discovered under the hybrid and hybrid plus RTC/peak tenders are a big boost for the renewable energy sector, given that the availability of round-the-clock (RTC) or peak period supply from RE projects reduces the risk of variability and enables an efficient grid integration for renewables. The focus of the RE tenders is likely to move from standalone wind and solar power projects to hybrid projects along with a component of storage for meeting RTC and peak demand requirements. This is expected to happen over the medium term, based on performance demonstration of hybrid projects bid out so far, reduction in battery costs and demonstration of viability of pumped hydro projects.

Significant progress in signing of PPAs/PSAs by central intermediate procurers

Exhibit 13: Movement in scheme wise tendered capacity awaiting signing of PPAs/PSAs



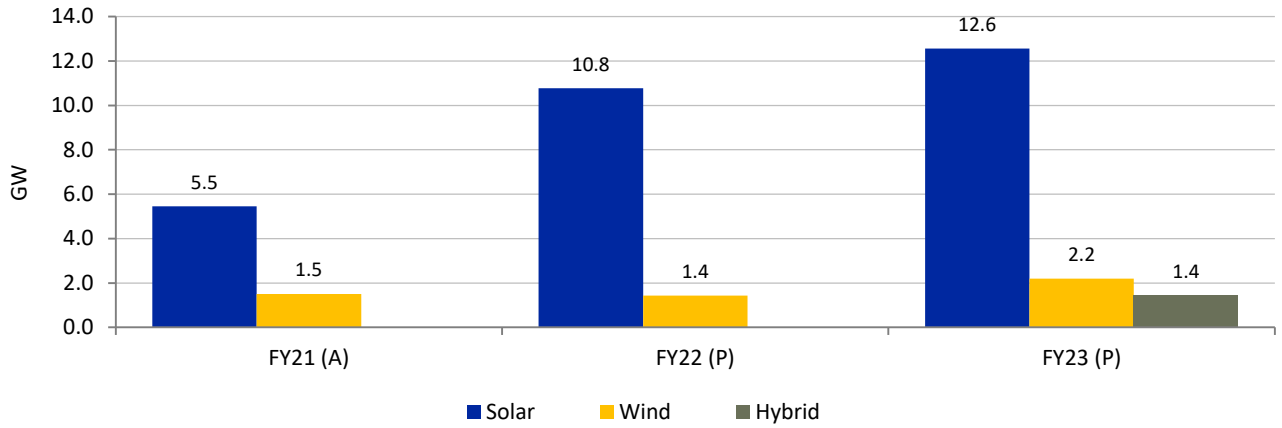
Projects awaiting signing of PPAs/PSAs has come down sharply from 18.8 GW as of Aug'21 to 9.6 GW as of Dec'21 led by signing of PPA/PSA for close to 9 GW under the solar manufacturing linked tender

Source: ICRA Research, SECI

- Out of the capacity tendered by the Central nodal agencies, PSAs are pending to be signed for 9.6 GW (excluding the recent 2.5 GW RTC tender by SECI) comprising 6.1 GW solar power capacity, 1.2 GW hybrid capacity, 1.2 GW in the wind segment and 1.1 GW from the peak supply tender. This has come down from 18.8 GW since Aug'21 led by the progress achieved by the SECI in signing of PSAs/ PPAs for the manufacture-linked tender, wherein PPA/PSAs have been signed for close to 9 GW out of the 12 GW. This was also aided by the reduction in the tariff by the winning developers. The progress in PSA /PPA signing is a positive for the sector and would support the capacity additions in the sector over the next few years.

RE capacity addition expected for FY22 revised upwards to 12.5 GW and estimated at 16 GW for FY23

EXHIBIT 14: Projected RE generation capacity in FY2022 and FY2023



Source: ICRA Research, CEA; P: Projected

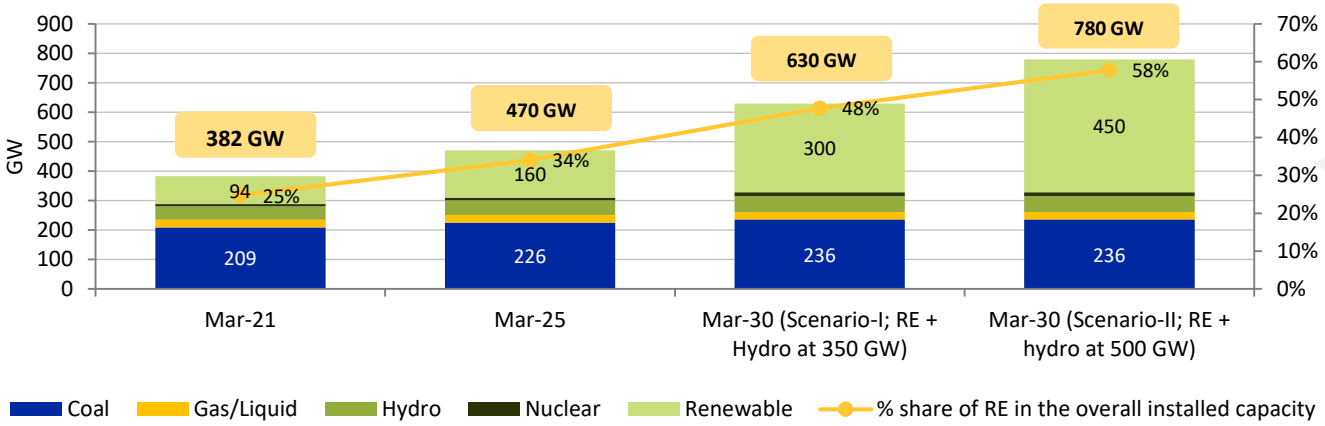
ICRA's RE capacity addition estimate for FY22 is revised upwards to 12.5 GW from 11 GW earlier led by higher than expected growth in the solar segment with the developers making use of the duty free window on imported modules

However, delays arising from land and transmission connectivity issues would be key downside risks. Also, supply chain challenges for equipment procurement (modules / WTGs) would be another key challenge for RE IPPs

- The backlog of the projects awarded by the Central nodal agencies and state distribution utilities remains large with under-development capacity of more than ~55 GW. Based on this pipeline, ICRA expects the capacity addition at ~12.5 GW in FY2022 and at 16 GW in FY2023, mainly driven by the solar power segment. As discussed in our earlier note, the developers are making use of the duty-free window to import modules, leading to upward revision in our capacity estimate for FY2022 from 11 GW earlier. The contribution from the wind segment remains relatively low given the continued execution challenges. The hybrid segment is expected to contribute to RE capacity from FY2023 onwards.

Projected power generation capacity mix by 2030

EXHIBIT 15: Projected power generation capacity mix by FY2025 and FY2030



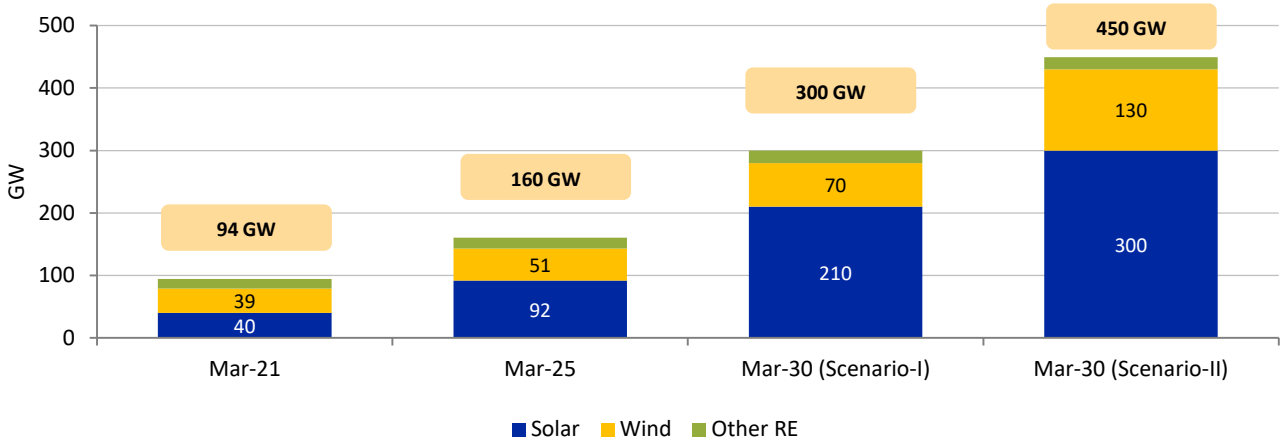
Integration of such large share of RE capacity would require storage capacity of ~40 GW with four hours of storage. This can be through a mix of battery and pumped hydro storage

Source: ICRA Research, CEA

- Based on the projects under development in the coal, hydro and nuclear power segments and the expected project pipeline, ICRA has estimated the installed capacity by FY2025 and FY2030. ICRA has considered capacity addition under two scenarios for FY2030, with the first scenario estimating the RE capacity to reach 300 GW by FY2030. In the second case, which is the optimistic scenario, the RE capacity is estimated to reach 450 GW and the overall RE plus large hydro capacity would stand at 500 GW by FY2030, in line with the target announced by the hon'ble Prime Minister. We have also considered the estimated storage requirement to meet the peak period demand, which is typically during the evening hours, when solar power is not available.

Easing of execution bottlenecks and availability of funding key to achieve RE capacity targets

EXHIBIT 16: Estimated mix of renewable power capacity by FY2025 and FY2030



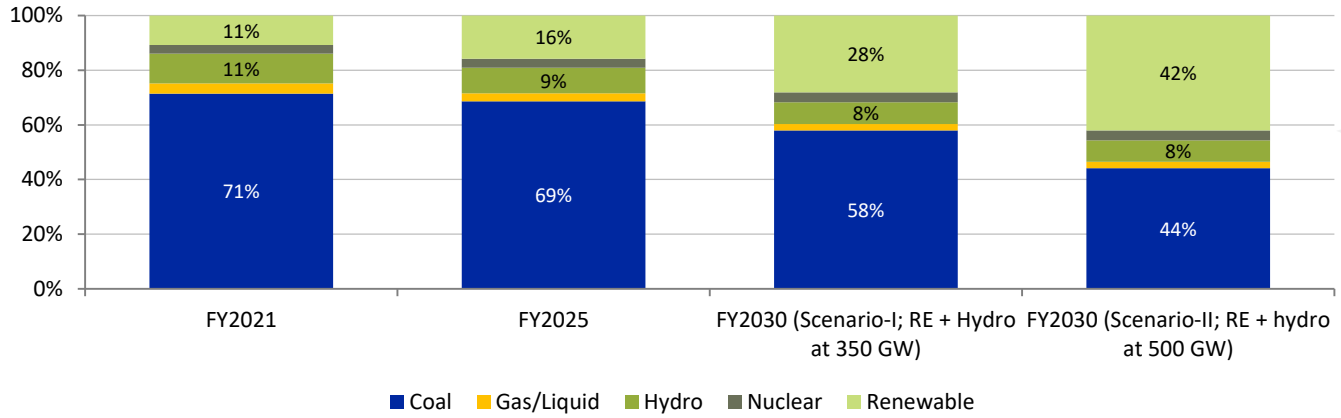
The first scenario would require annualized capacity addition of 24 GW over FY22-FY30, which is a significant jump from the current annual addition of 8-12 GW and would require easing of land acquisition bottlenecks, augmentation of transmission infrastructure and availability of adequate funding avenues. The second scenario would require annualized capacity addition of 42 GW

Source: ICRA Research, CEA

- Within the RE capacity, the capacity addition would be driven by the solar segment followed by the wind segment. The share of the solar segment within the RE capacity is expected to increase from 42% as of March 2021 to 57% as of March 2025 and further to 70% by March 2030 under ICRA's base scenario. The share of wind segment would come down to 23% as of March 2030 from 42% as of March 2021. In the optimistic scenario, the share of the solar segment would be at 67% and share of wind at 29% by March 2030. The share of other RE capacity such as small hydro and biomass is expected to remain at less than 10% in March 2030 under both scenarios.

Secular increase estimated in share of RE in electricity generation

EXHIBIT 17: Projected electricity generation mix by FY2025 and FY2030



Share of RE plus hydro to increase to 50% of all India generation, if the capacity target of 500 GW is achieved by FY2030

Source: ICRA Research, CEA and National Power Portal; ICRA has considered annual demand growth of 5.0% over FY22-30 and also considered a gradual improvement in PLF levels for solar and wind plants based on efficiency gains and use of higher AC:DC ratio for solar plants

- The rise in the installed RE capacity over the next decade is estimated to increase the share of RE power in the overall electricity generation mix from 11% reported in FY2021 to 28% in FY2030 in ICRA's base scenario. The share, including that of large hydro, would increase to 36% in FY2030 from 22% in FY2021. In the optimistic scenario, the share of RE plus hydro power is estimated to reach 50% of the generation mix by FY2030. Apart from easing challenges related to capacity addition, achieving such high level of RE share would require adequate grid infrastructure along with storage capabilities to manage the intermittency associated with the wind and solar power.