

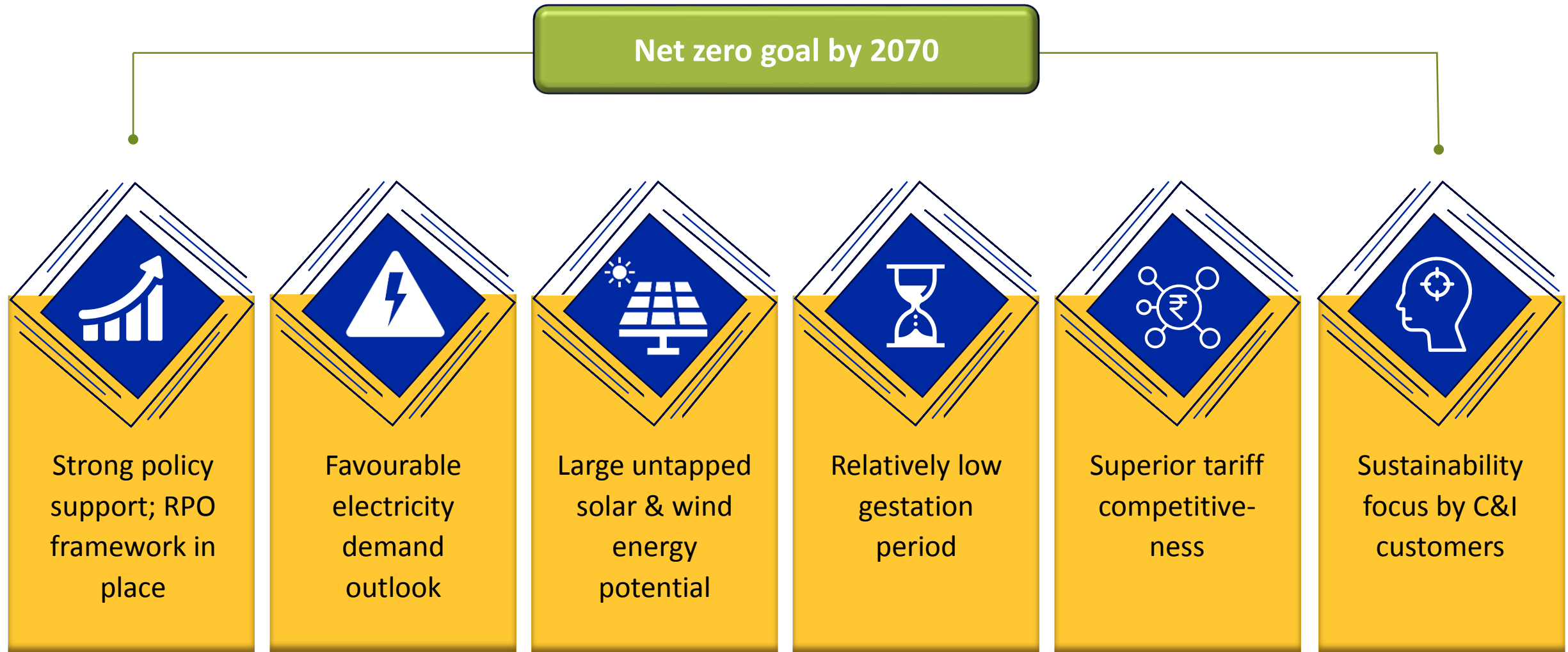


Indian Renewable Energy Sector

*Higher RE Generation and Storage to
Power Net Zero*

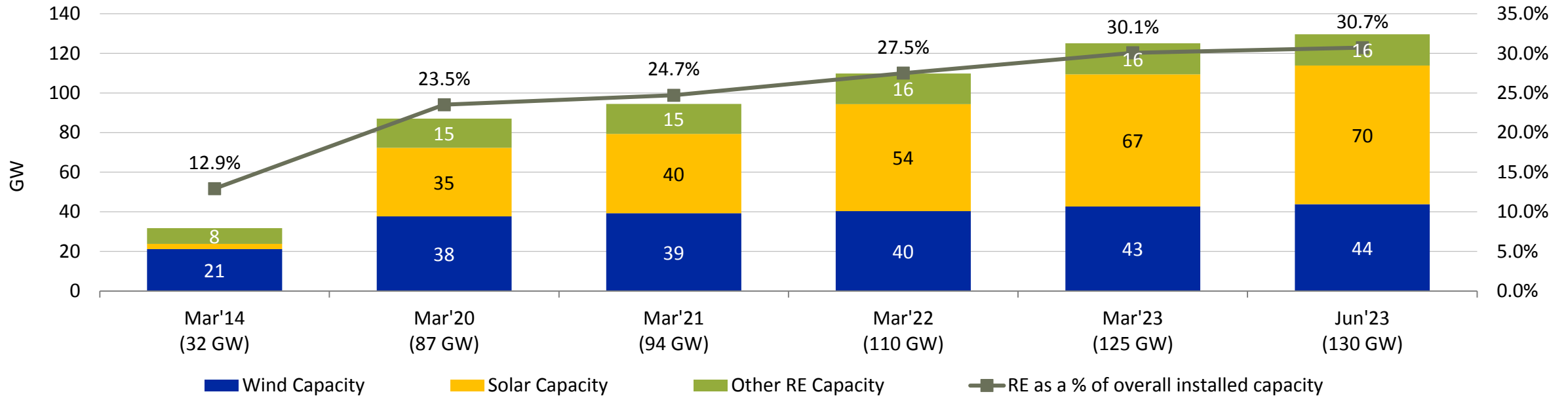
AUGUST 2023

Climate change goals driving India towards a renewable future



RE capacity up by 4x over the last 9 years

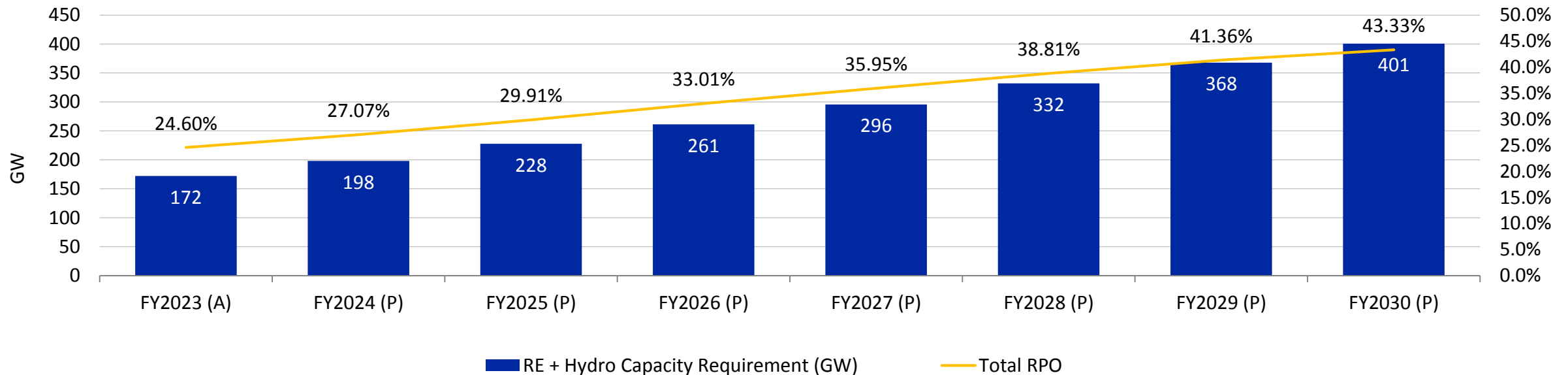
Exhibit 1: Trends in cumulative installed renewable power capacity (MW)



- The Renewable Energy (RE) based power generation capacity increased by 4 times over the past nine years and stood at 130 GW as of June 2023, constituting 31% of the overall power generating capacity, led by strong policy support and superior tariff competitiveness. The solar power segment remained the key driver of capacity addition in the RE sector contributing close to 70% of the capacity addition over the past nine years.

RPO trajectory provides visibility on RE capacity requirement till 2030

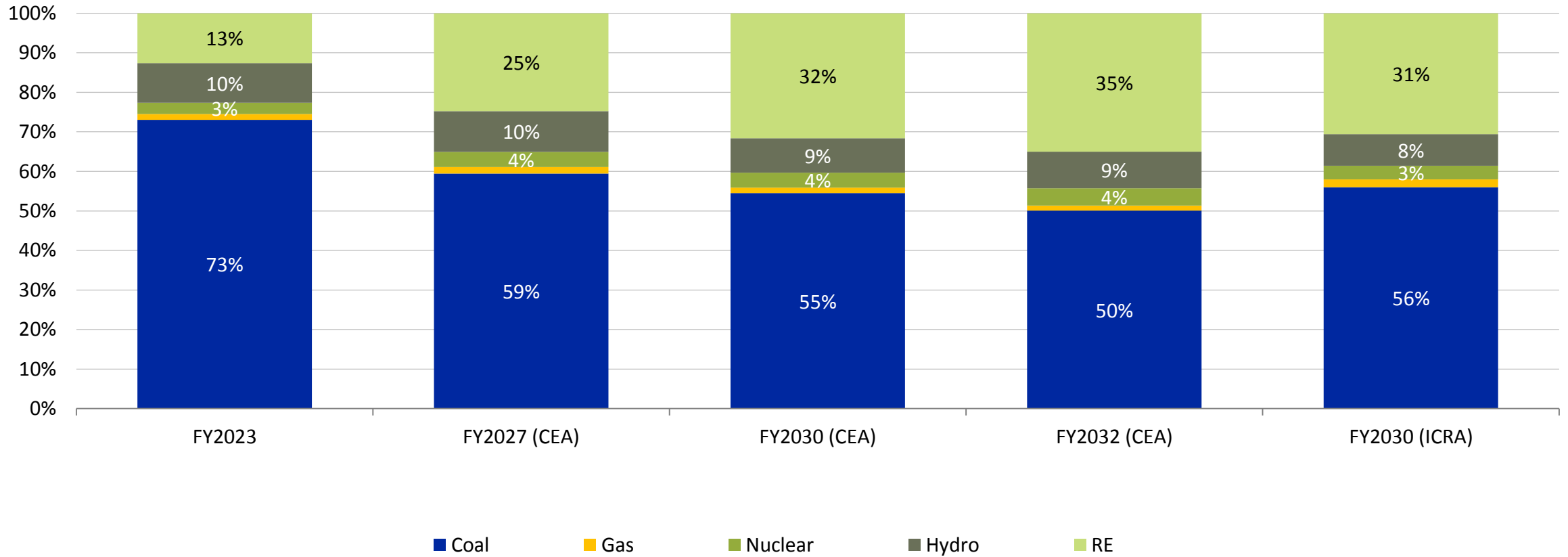
Exhibit 2: ICRA's assessment on RE capacity requirement (including large hydro) to meet the RPO trajectory approved by MoP



- The Ministry of Power notified the Renewable Purchase Obligation (RPO) trajectory till 2030, providing visibility on the RE capacity requirement for the country. The RE capacity, including large hydro, required to meet the notified RPO target of 43.3% is estimated to be ~400 GW by FY2030, considering annual demand growth of 5.0%. The capacity requirement will be higher, if the demand growth were to be higher. Further, the notification of trajectory for meeting a portion of the energy requirement through energy storage obligation (ESO) is expected to aid in promoting the development of storage capacity in the country over the next few years, which is necessary to integrate the growing the share of RE with the grid.

Share of RE plus hydro in generation mix to reach ~40% by 2030

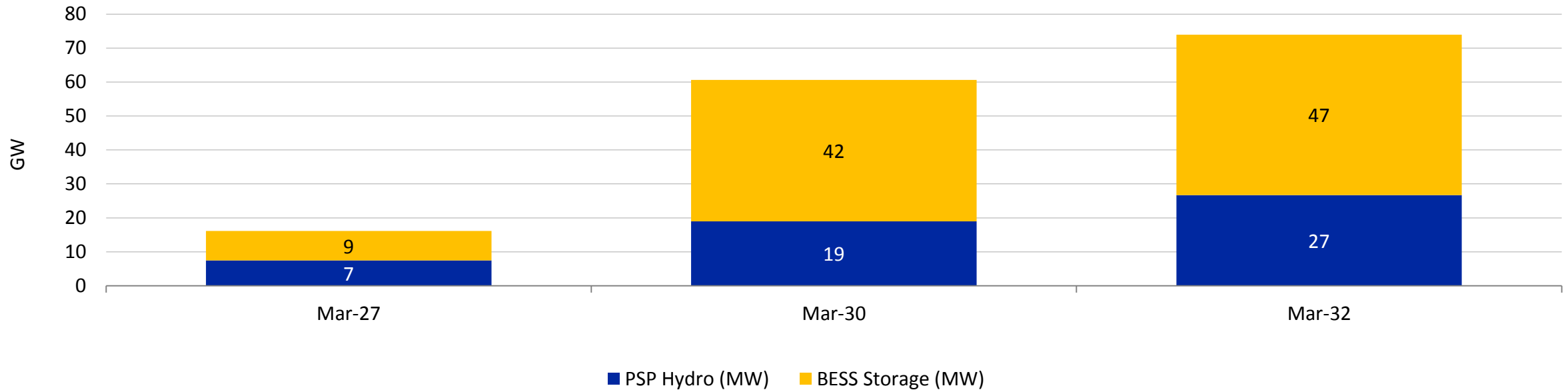
Exhibit 3: Projected power generation mix as per the NEP released by CEA and ICRA's estimate



Source : ICRA Research, CEA; estimate by CEA for Mar-2027 and March-2032 is as per the National Electricity Plan; estimate for Mar-2030 is as per the optimal generation mix report (Version 2.0) released by CEA

NEP projects storage capacity addition of over 8 GW yearly through PSP and BESS

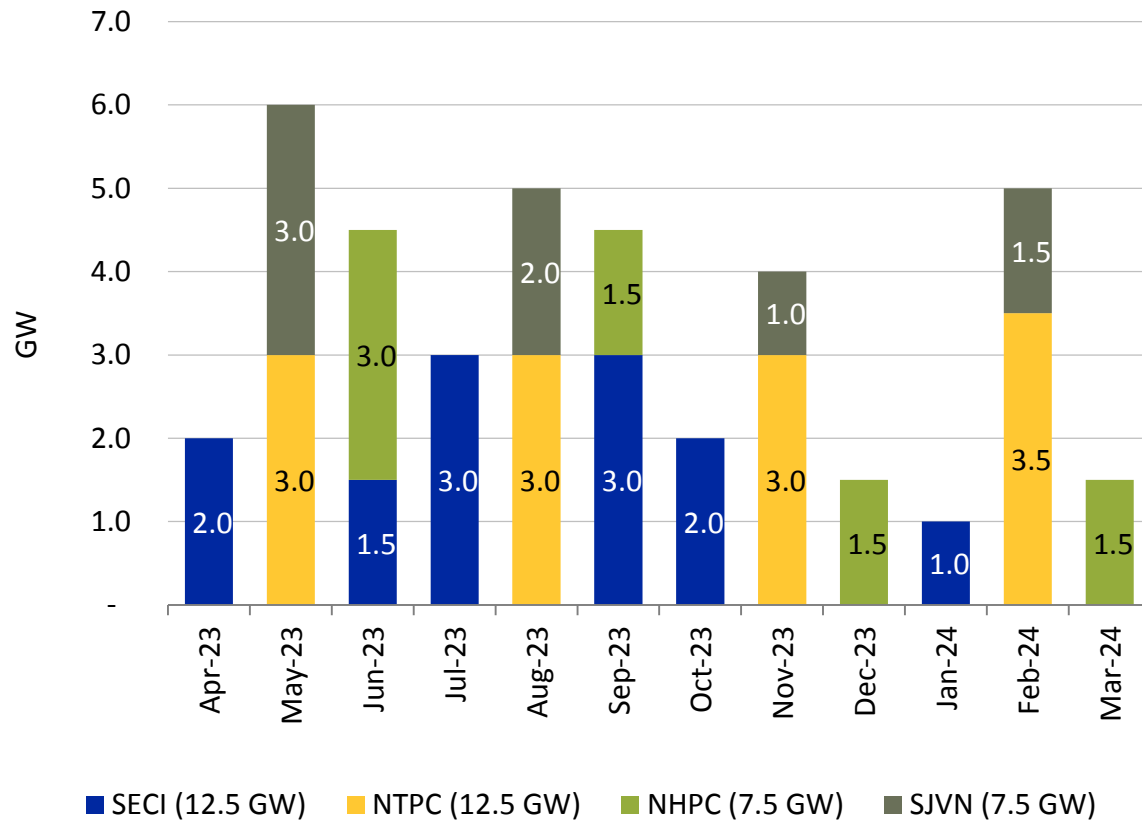
Exhibit 4: Projected storage capacity as per the NEP released by CEA



- Along with RE capacity addition, the NEP also projects an installed storage capacity of 74 GW by 2032, together providing 411 GWH of storage for integrating RE with the grid. Availability of energy storage at a competitive cost remains key for meeting the capacity targets.

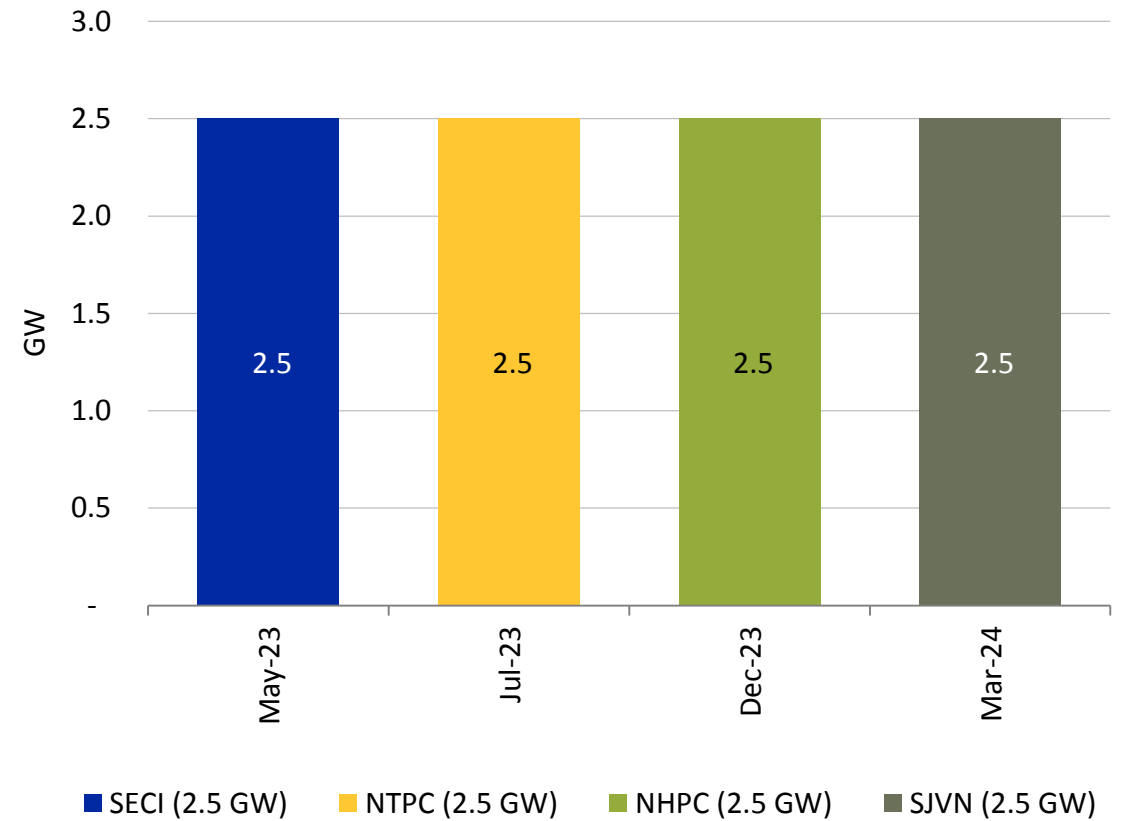
MNRE issues RE bidding trajectory to build the pipeline for the 500-GW target

Exhibit 5: Bidding calendar for solar, hybrid and RTC power projects in FY2024



Source : ICRA Research, MNRE

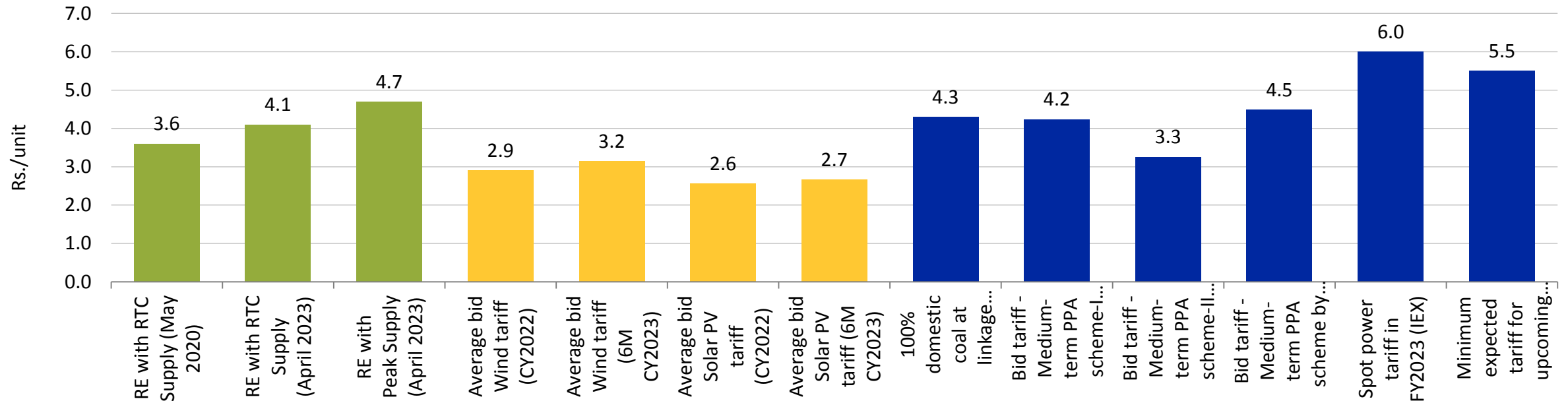
Exhibit 6: Bidding calendar for wind power projects in FY2024



Source : ICRA Research, MNRE

RE tariffs remain highly competitive vis-à-vis other generation sources

Exhibit 7: Comparison of RE bid tariffs with other generation sources



- Over the years, the solar and wind bid tariffs have been on a declining trend, led by the decline in module costs and improved module efficiencies in case of solar and expectation of higher PLFs in case of wind. As a result, these tariffs have remained highly competitive against the marginal variable cost of generation in the bottom 25% of the merit order dispatch of the state distribution utilities. Moreover, the tariffs discovered in the bids for RTC supply from RE projects remain highly competitive against the cost of generation from conventional sources. The successful demonstration of these RTC projects would provide a fillip for greater adoption of these projects, going forward.

Key challenges facing the RE segment amid the huge opportunity



Delays in land acquisition & transmission connectivity

Capital cost pressure impacting project returns

Risks to grid stability amid rising RE share and relatively high cost of energy storage

Exposure to supply chain disruptions

Risk of payment delays from customers, mainly state discoms

Vulnerable to resource availability - especially for wind power plants

Viability of solar projects linked with solar PV cell/module prices

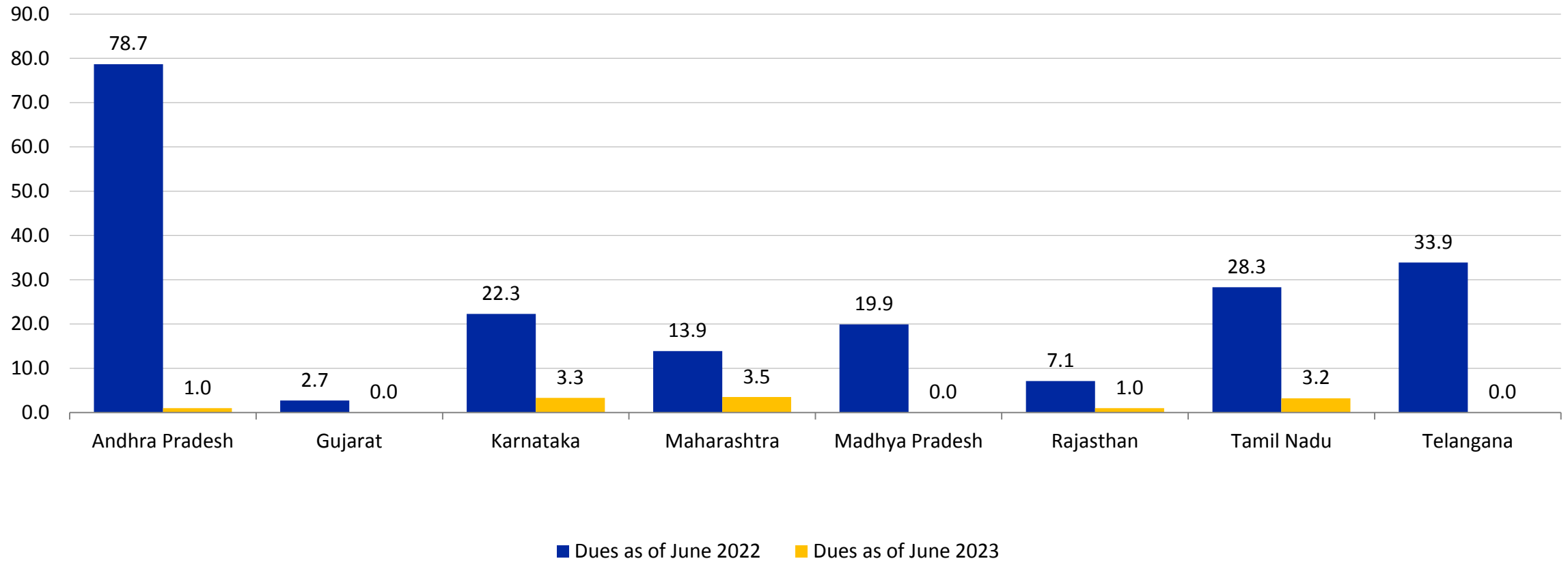
Exhibit 8: Illustrative sensitivity of cumulative DSCR of a solar power project to tariff and cell prices assuming sourcing of modules from domestic OEMs using imported cells

Cumulative DSCR		Tariff (Rs/unit)					
		2.00	2.20	2.40	2.60	2.80	3.00
Solar Cell Price (Cents/Watt)	10	0.94	1.05	1.15	1.25	1.35	1.45
	12	0.88	0.99	1.09	1.18	1.27	1.37
	14	0.83	0.93	1.02	1.12	1.20	1.29
	16	0.78	0.87	0.97	1.06	1.14	1.22
	18	0.74	0.83	0.92	1.00	1.08	1.17
	20	0.70	0.79	0.87	0.95	1.03	1.11

Source: ICRA Research; debt and equity ratio of 75:25, interest rate of 8.5% with repayment tenure of 20 years post COD, DC plant load factor (PLF) of 18.5%, DC-AC ratio of 1.5 times and degradation factor of 0.7% per year; INR-USD exchange rate of 82; O&M cost of Rs. 2.5 lakhs per DC MW with annual escalation of 5.0%; Provision for inverter replacement reserve of Rs. 15 lakhs per MW is considered to be built over a 10-year period; BCD of 25% assumed on imported PV cells; Modules to be sourced from notified OEMs under ALMM

Discoms' overdues to RE IPPs reduce under LPS scheme; sustainability remains key

Exhibit 9: Trends in dues to RE IPPs from discoms in key states



Source: ICRA Research; PRAAPTI portal; data for June 2023 as on June 19, 2023; the data excludes the dues converted into installments under the LPS scheme

ICRA's outlook for renewable energy sector remains Stable

Capacity Addition



Estimated RE capacity addition in FY2024: 20 GW

Generation Mix



RE mix in overall generation in FY2024: 14%

Payments



LPS rules likely to enable regular payments from state discoms

2030 target



Scaling up the annual addition to over 40 GW hinges on land, transmission infra and domestic RE supply chain

Storage



Storage economics key to achieve 40-50% RE share in generation



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