



REPORT ON POWER SECTOR

TRANSMISSION AS A COUNTER-BALANCE TO EVOLVING REGIONAL BALANCE OF POWER

26 NOVEMBER 2024



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EXECUTIVE SUMMARY

Energy supply shows healthy growth in YTFY25: recent months of weak demand to be offset by a frigid winter and base effects in remainder of FY25

Energy supply is expected to grow by a mere ~3% y/y in Nov'24, below the YTFY25 level of ~5.3% y/y. This is as a prolonged period of above normal monsoons has offset strength seen in Q1. The remaining part of FY25 will see fair energy demand owing to a cold winter in the North and favourable base-effects for industrial demand towards the end of Q4. The power demand peak for FY25 has likely already occurred in May'24, when it reached a startling 250 GW. Given the long-term drivers of both energy and power demand, such as data centres, green molecules, and electric vehicles, remain intact, we are likely to see robust growth beyond what is charted out by the NEP

The grid is painted in fresh coats of green as renewable additions attain a new record helped by a fresh gust of wind additions and burgeoning ESS tenders

30 GW has been added to the installed base (net basis) in the past 12 months, of which ~75% has been renewables. Along with the storied rise of solar, important sub-plots include the resurgence in wind additions after a glut of several years, and a meteoric rise in ESS. This evolution has been accomplished by a preponderance of RTC, FDRE, and WSH tenders. Indeed, a third of tenders in 8MFY25 having a storage element ingrained in them (FY24: 23%, FY20: 5%). At the same time, a word of caution needs to be put out regarding several RE projects which are awaiting PPA and appropriate evacuation infrastructure, as these lacunae could put the pace of additions in jeopardy

Dominance of renewable supply in North and South away from demand centres in the West could realign powerflow maths

A lion's share of incremental renewable supplies till Mar'32 will get added in the North (particularly solar rich Rajasthan and Ladakh) and South (in the windy coastal areas of TN, Karnataka, and AP). This will literally tilt the balance of power away from the West as its share in installed capacity dips from 33% now to 25% by Mar'32. This is even as it remains an important consumer of energy and a secondary driver of the national peak. An obvious consequence of this will be the increased need for transmission capacity with the West as the focal point. Further, since several renewable power hubs lie in remote deserts which do not have much existing evacuation infrastructure, significant greenfield expansions are necessary

Doubling pace of annual additions of the transmission network in the medium term needed to achieve effective integration of renewable capacities

Of the 114,687 ckm of transmission lines and 776 GVA of substations to be added between Apr'22-Mar'27, about 28% of the former and 20% of the latter have been commissioned as of Oct'24. Achieving the remainder by Mar'27 would entail a doubling of annual addition pace for both these items – a formidable task given only half such projects have even entered the construction phase. Most significant transmission capacities are expected to be added in the North-West corridor, followed by the West-South corridor, with minimal additions in other corridors by Mar'27. The targets set for the Apr'27-Mar'32 period are less stiff and expected to be achievable given historical addition pace

Funding diversity needed to fulfil the hefty capex needed to achieve transmission goals; while debt will be funded by banks, FIs, and bonds, InvITs can help fund equity portion

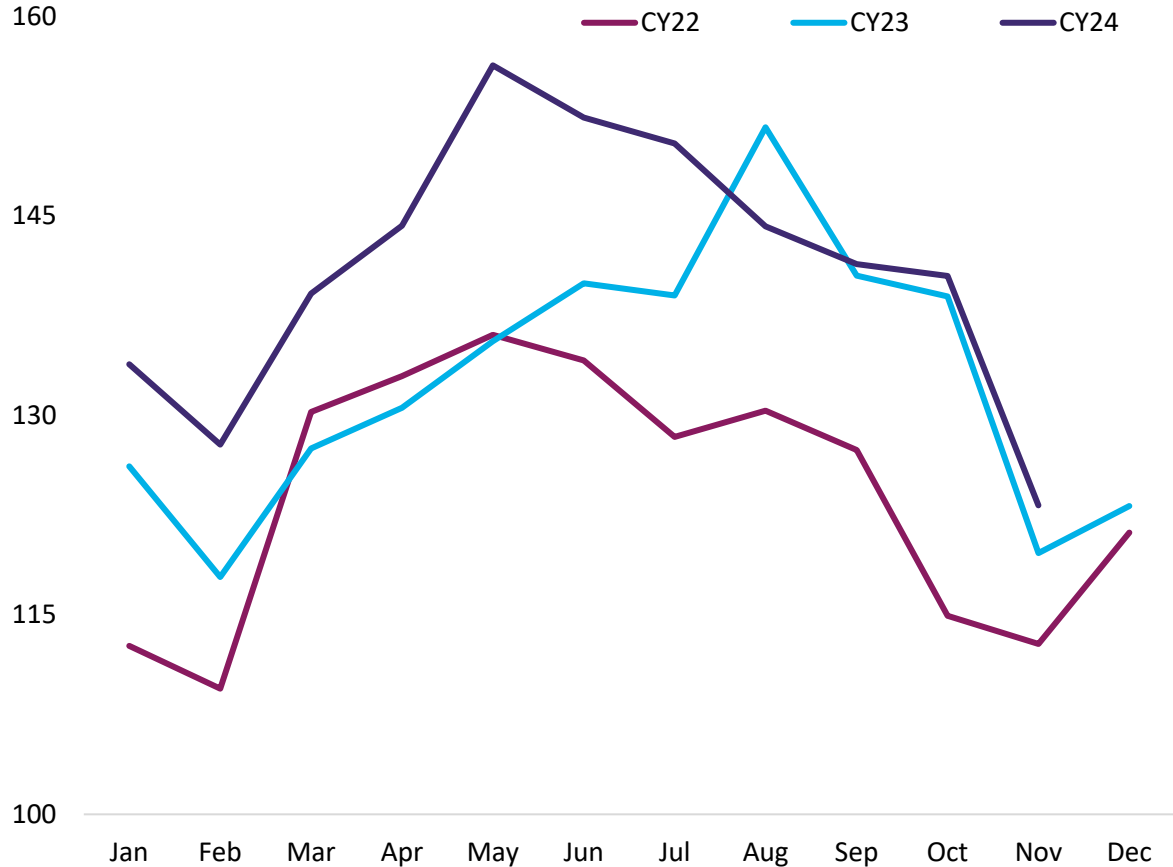
Given these towering aims, a significant capital outlay of over Rs. 8.2 trn is needed, of which three-fourths will channel into ISTS and the remainder towards InSTS. ~40% of this quantum would be needed over the next 30 months. Given such projects are largely debt funded, an incremental ~Rs. 2.3 trn of debt will be raised by Mar'27. Given the current outstanding transmission book of key FIs is ~Rs. 850 bn, this opportunity is big enough to be partaken by banks and bond markets too. Finally, almost Rs. 1 trn in equity needs to be raised in the medium term: while some of this will come from Budget outlays and internal accruals, the large operational base of transmission assets in the country brings InvITs into the picture as an effective means of recycling capital. Indeed, only such a holistic approach encompassing multiple modes of funding can ensure integration of 500 GW of RE by 2030

LONG-TERM STRENGTH OFFSETS NEAR TERM DAMPNESS

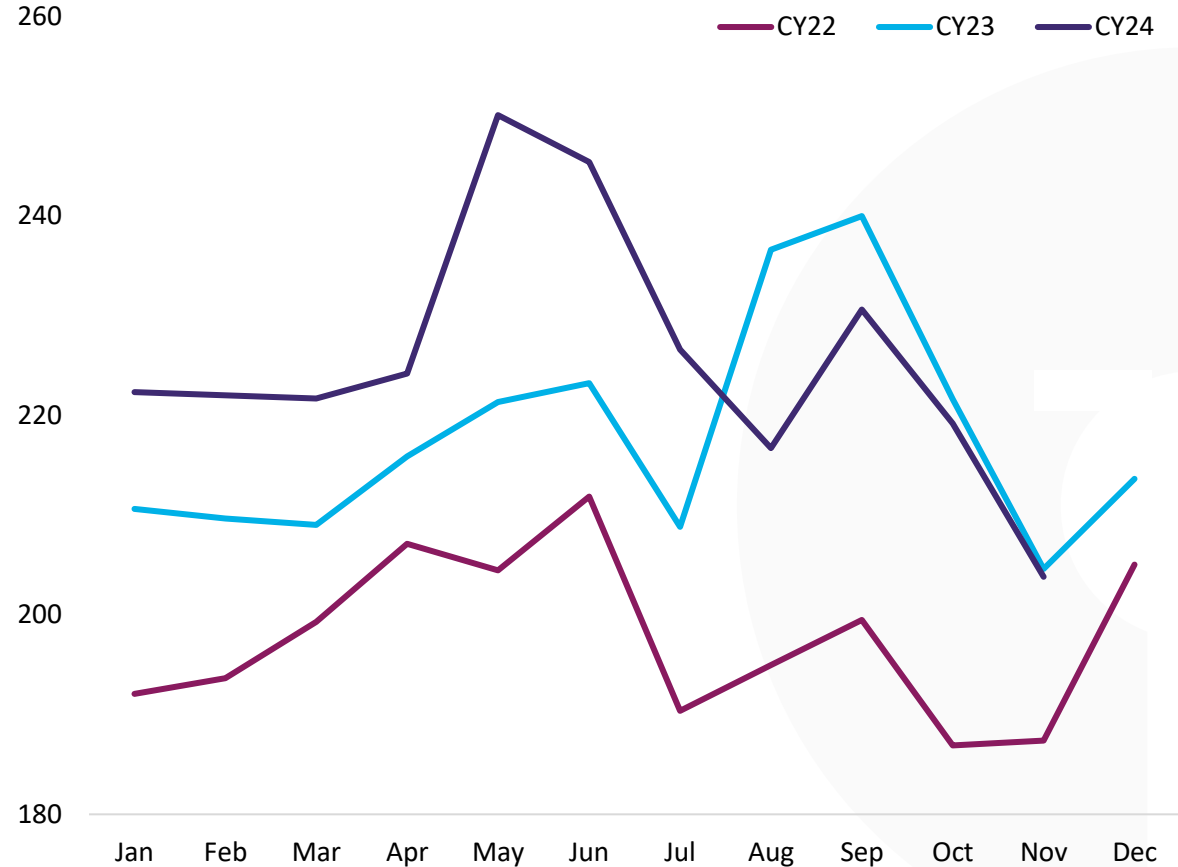


ELECTRICITY GROWTH: WILL A COLD WINTER OFFSET A RAINY MONSOON?

ENERGY SUPPLY (BU)



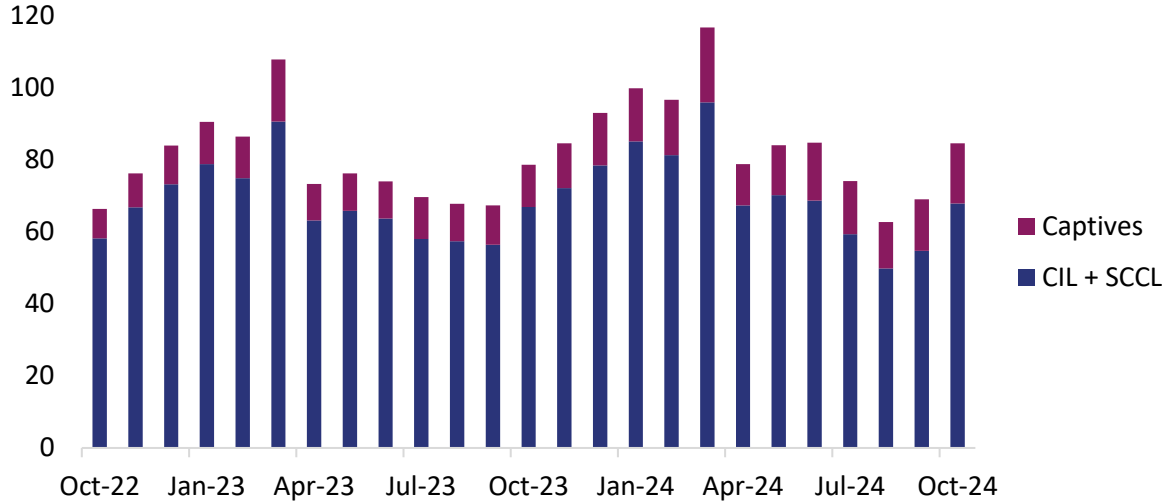
PEAK POWER DEMAND (GW)



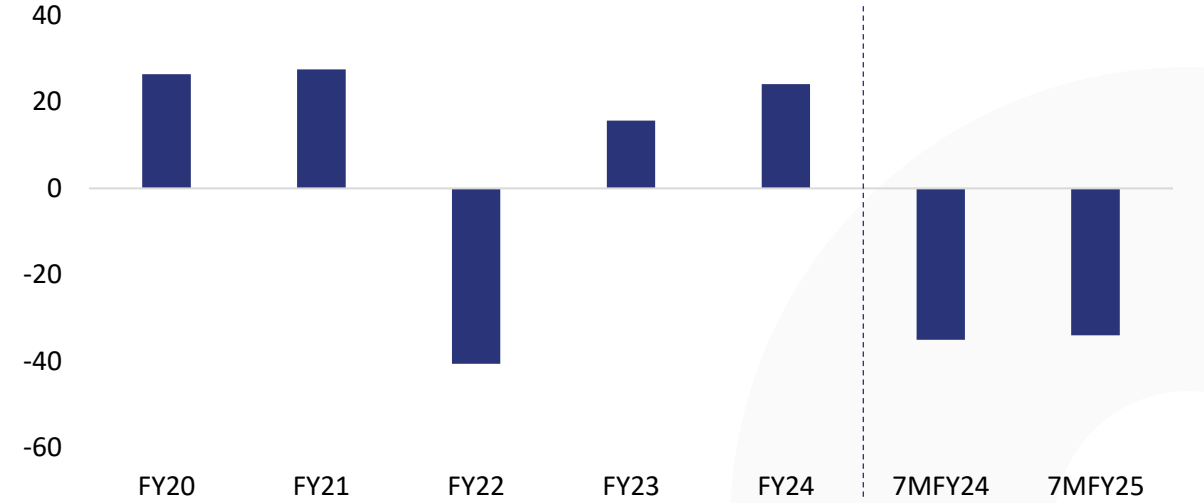
- After a solid Q1FY25 due to polls and heatwave, a bountiful monsoon led to a dip in demand in Q2. Q3 is seeing recovery with the festive season boosting energy supply. Accordingly, we expect a growth of ~6% y/y in FY25 for energy supply – the slowest pace in the post pandemic era
- Peak demand reached a record 250 GW in May'24. In FY25, the peak was reached in Q1 rather than Q2 – only the 3rd time this has occurred since FY07

AMPLE COAL PRODUCTION REDUCES IMPORT DEPENDENCE

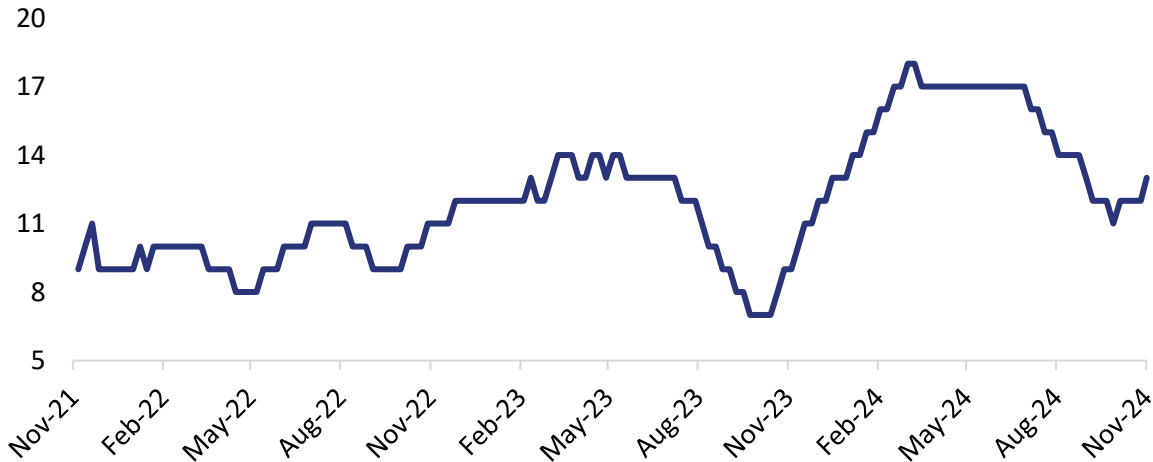
COAL PRODUCTION (mn tonnes)



ACCRETION TO RESERVES FROM DOMESTIC SOURCES (mn tonnes)



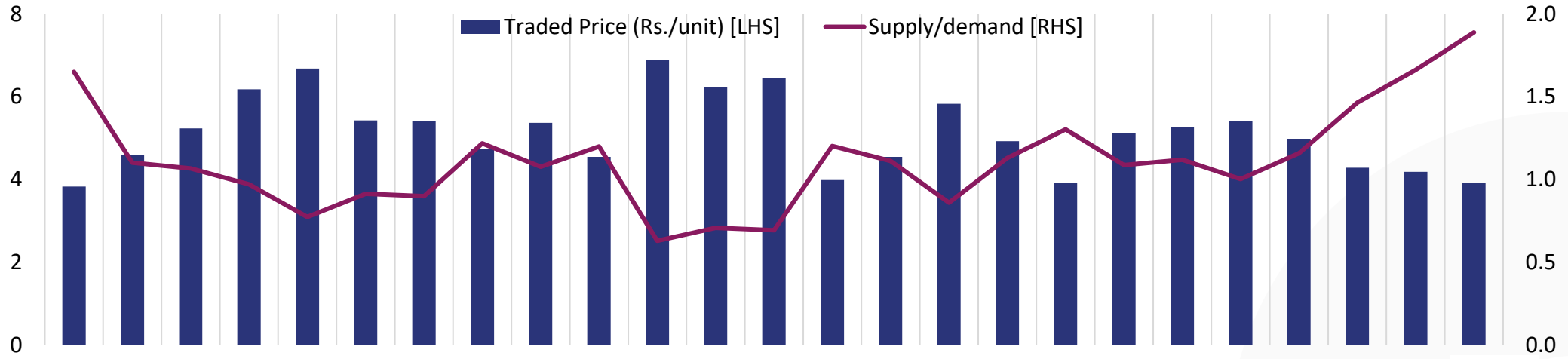
COAL STOCK AT THERMAL PLANTS (days)



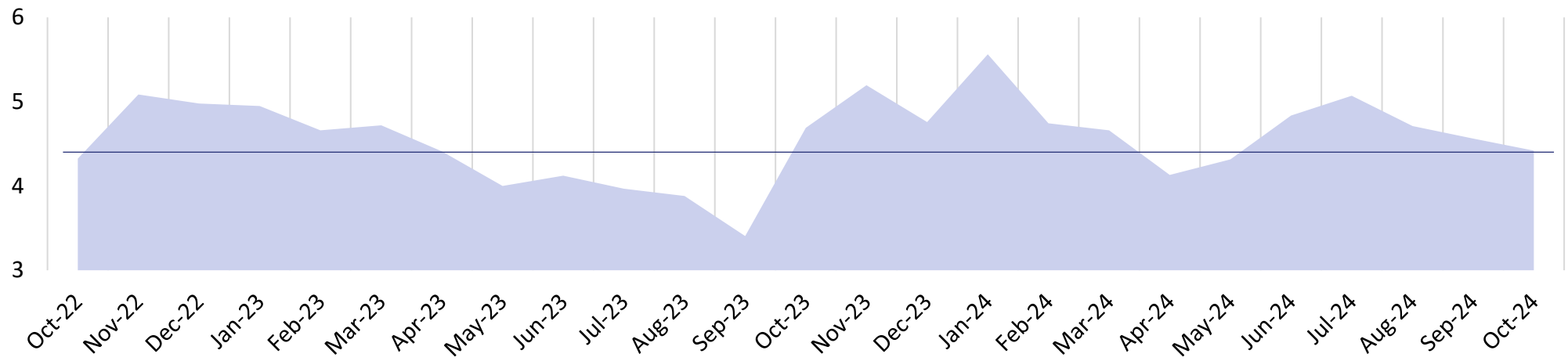
- Coal production in 7MFY25 is up 6% y/y despite above normal monsoon owing to excellent production in captives. At the same time, despatches are only up 5.5%, which means the stock at the miners has gone up
- Despatches to power sector are now broadly in line with historical averages at ~82%, down from high levels seen in FY23. Even so, stock at thermal plants has improved to 13 days (though below normative of 21 days)
- Accordingly, imports of thermal coal plunged by about a third in Oct'24, and reached a 15-month low

BALANCE CLEARLY IN FAVOUR OF CONSUMERS IN POWER EXCHANGE

**SPOT PRICE
(Rs./UNIT)
VS.
SUPPLY-DEMAND
IN DAM**



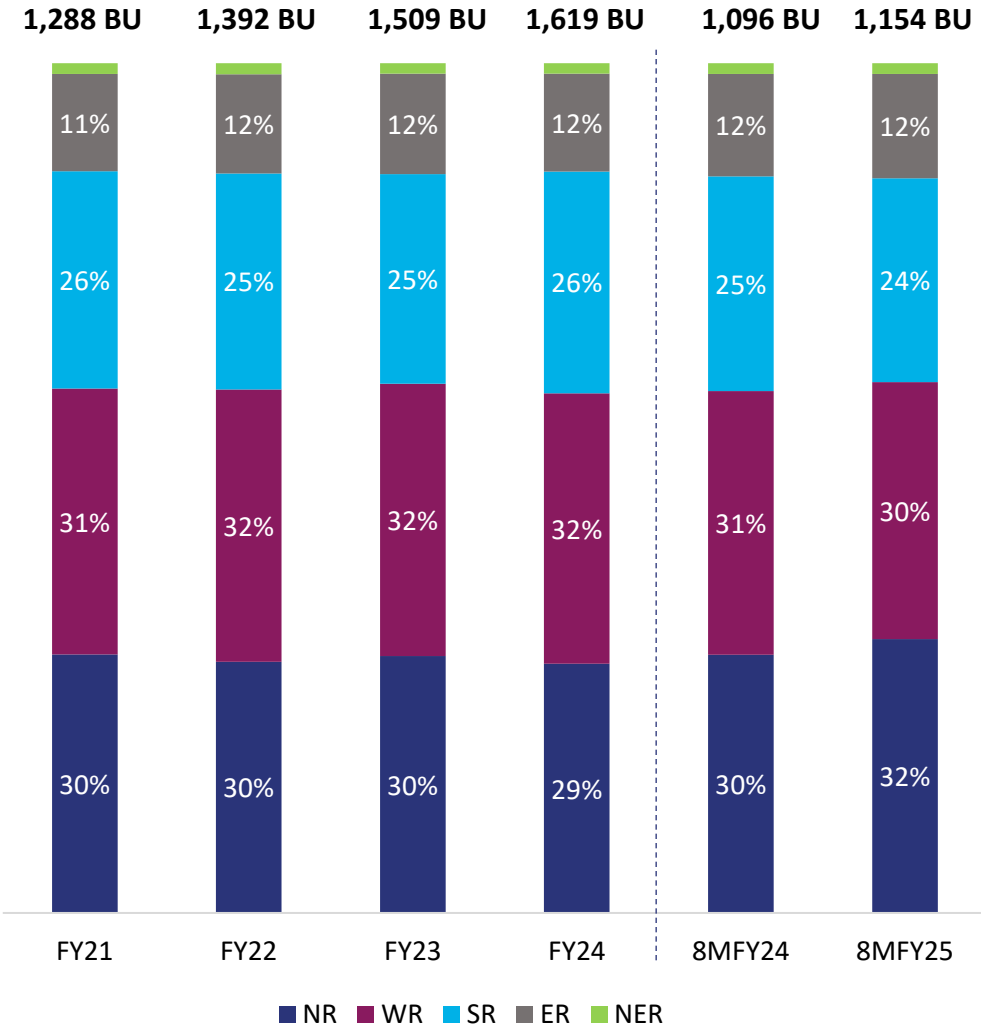
**VOLUME IN DAY
AHEAD MARKET
(DAM) (TWh)**



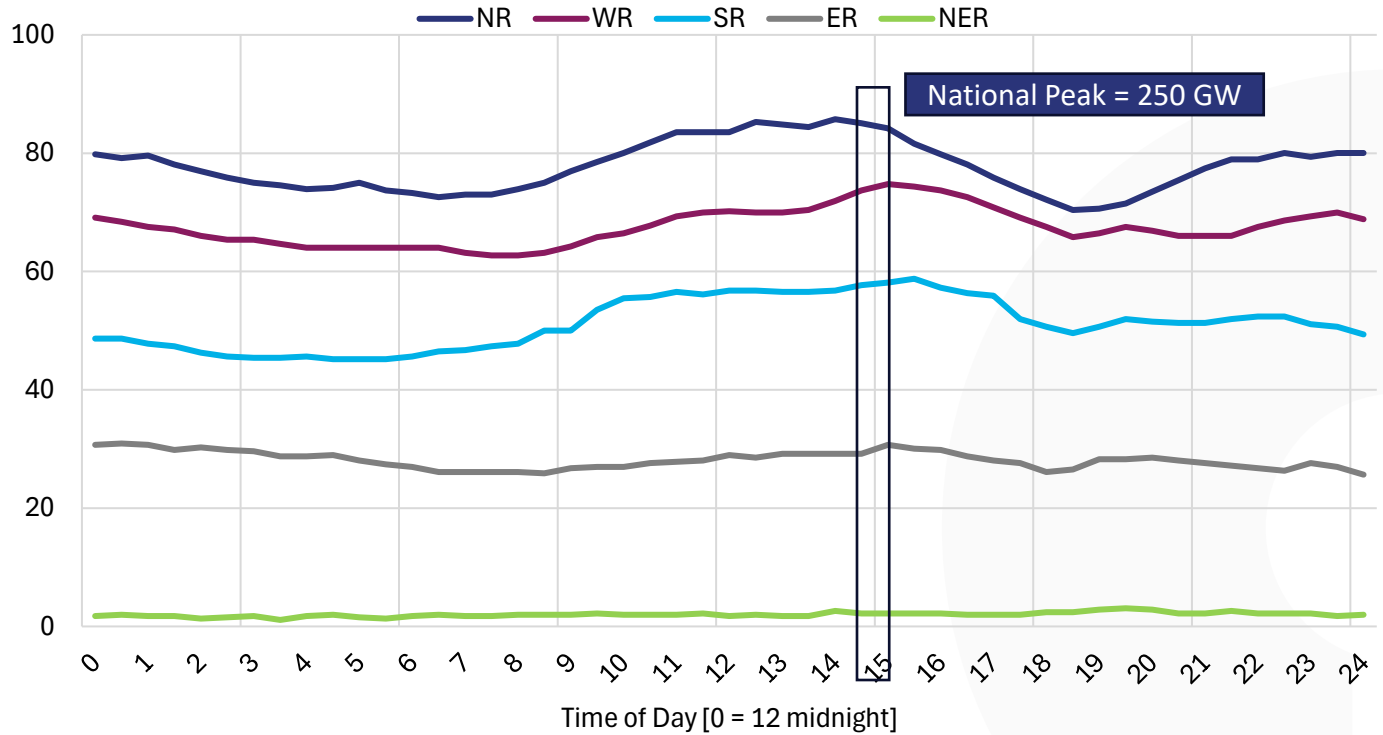
- Due to improving coal supplies at thermal plants and bountiful monsoons boosting hydro output, supply side attained strength in Q2FY25
- Demand remained on the weaker side in Q2FY25 due to cooling impact of monsoons and slow industrial activity. This mean supply supply/demand was at highest level in atleast 2 years

NR DRIVES THE NATIONAL PEAK WITH THE WR'S HELP

REGION WISE ENERGY SUPPLY



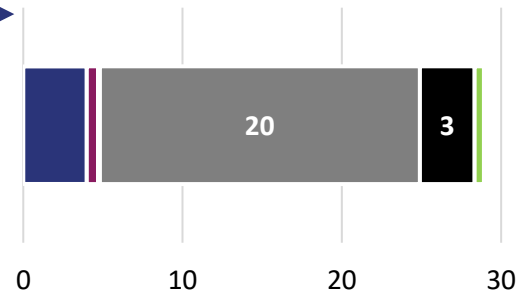
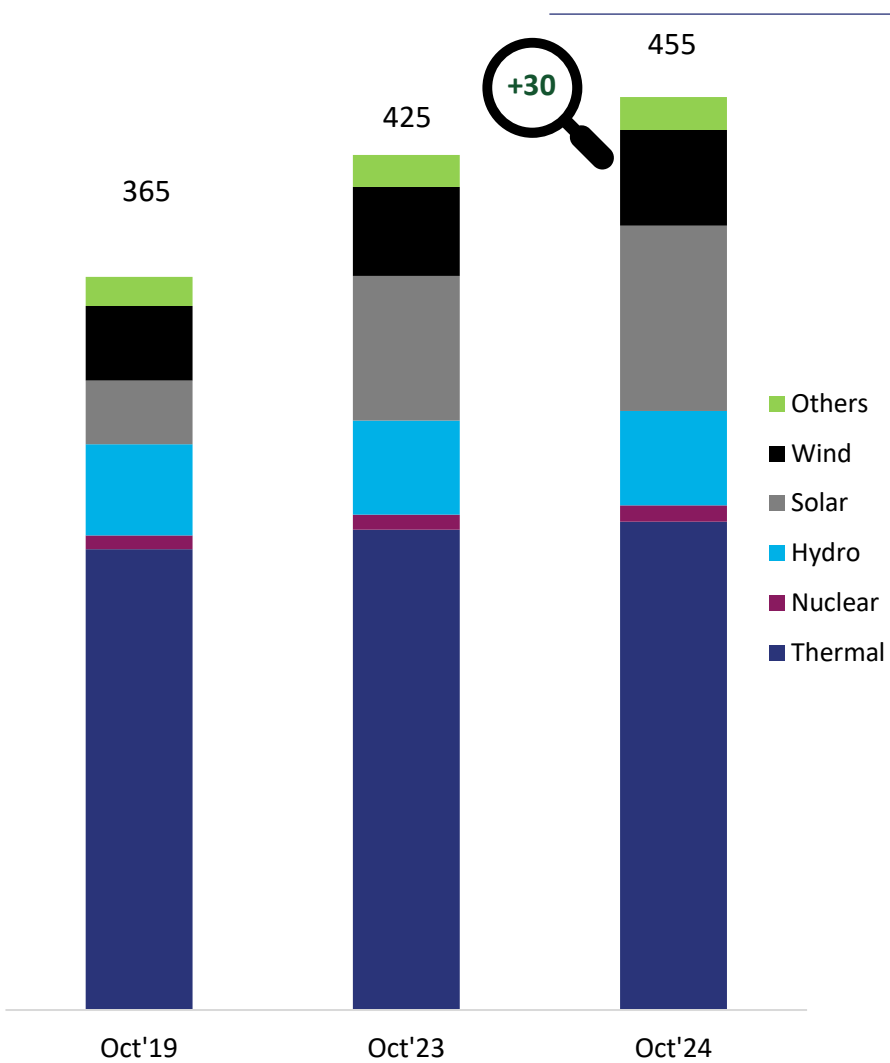
REGION WISE PEAK POWER DEMAND (GW)¹



- NR has seen strong share of energy supply in 8MFY25. SR saw a smaller share in 8MFY25 based on extensive monsoons. A colder than expected winter could keep share of NR high due to heating demand
- Typically, the NR is the largest contributor to the national peak. However, the national peak typically occurs when one of the other regions, usually WR joins the NR near its own peak

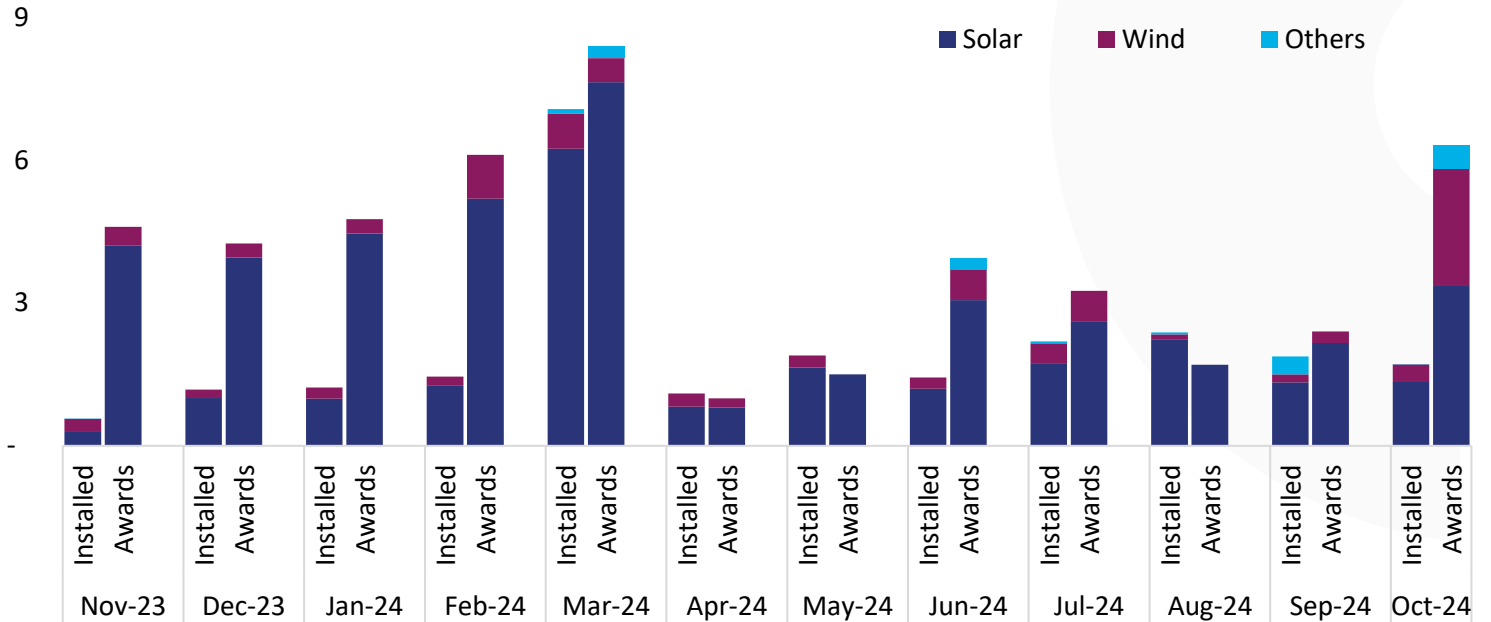
RECORD ADDITIONS DRIVE RENEWABLES ABOVE 200 GW

INSTALLED CAPACITY (GW)



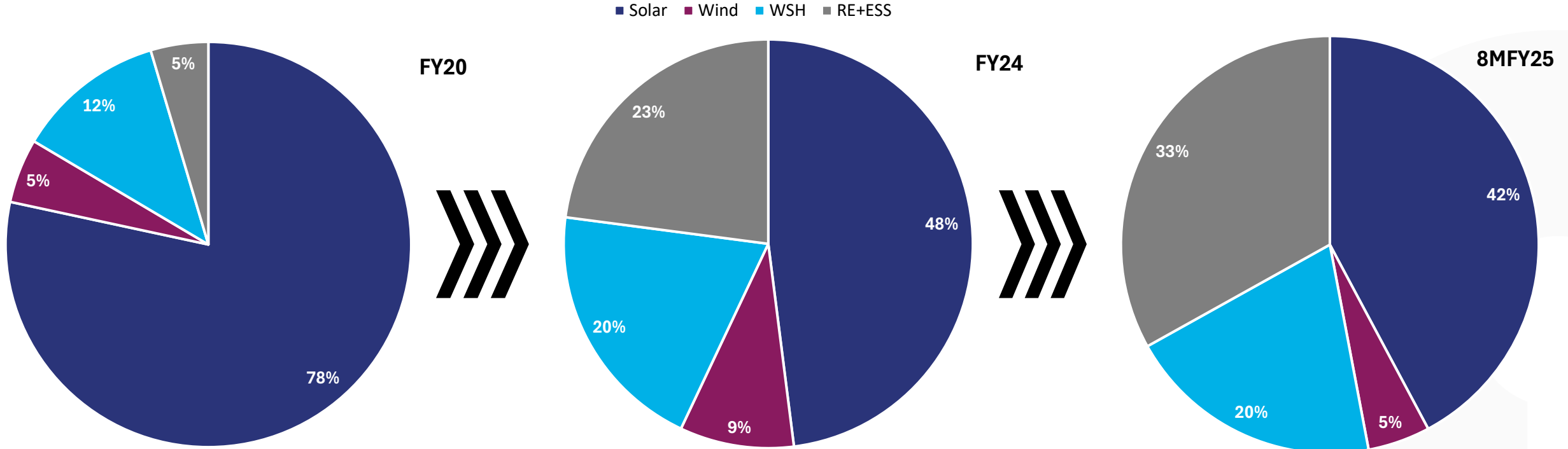
- Over 75% additions in the past 12M have been of renewables, with solar alone forming 20 GW
- A strong pipeline exists, and we continue to expect cumulative ~50 GW of solar and wind additions in FY25 and FY26
- Wind has seen a recent pickup with increasing puissance of RTC and FDRE contracts – awards in Oct'24 were at a high

RENEWABLE - AWARDS AND INSTALLATION (GW)



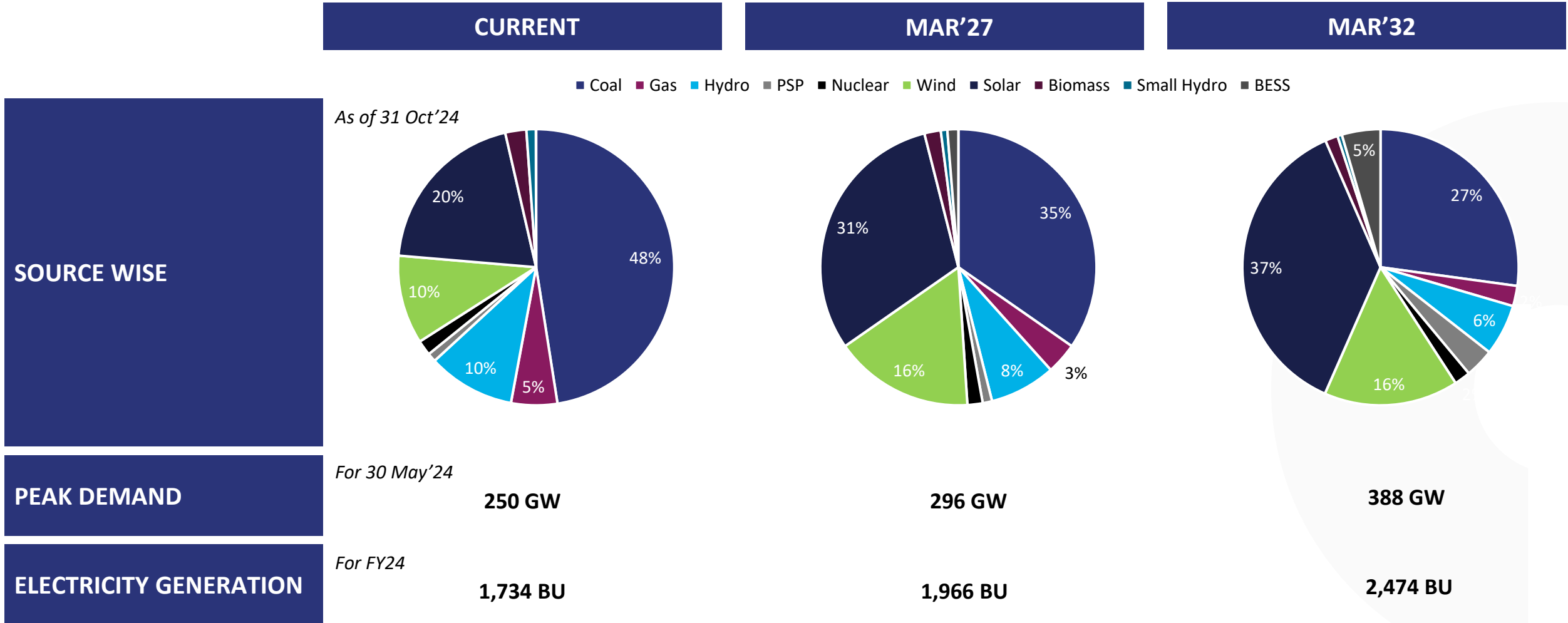
GREATER PRIORITY IS BEING GIVEN TO STORAGE BASED PROJECTS

SHARE OF TENDERS BY TYPE



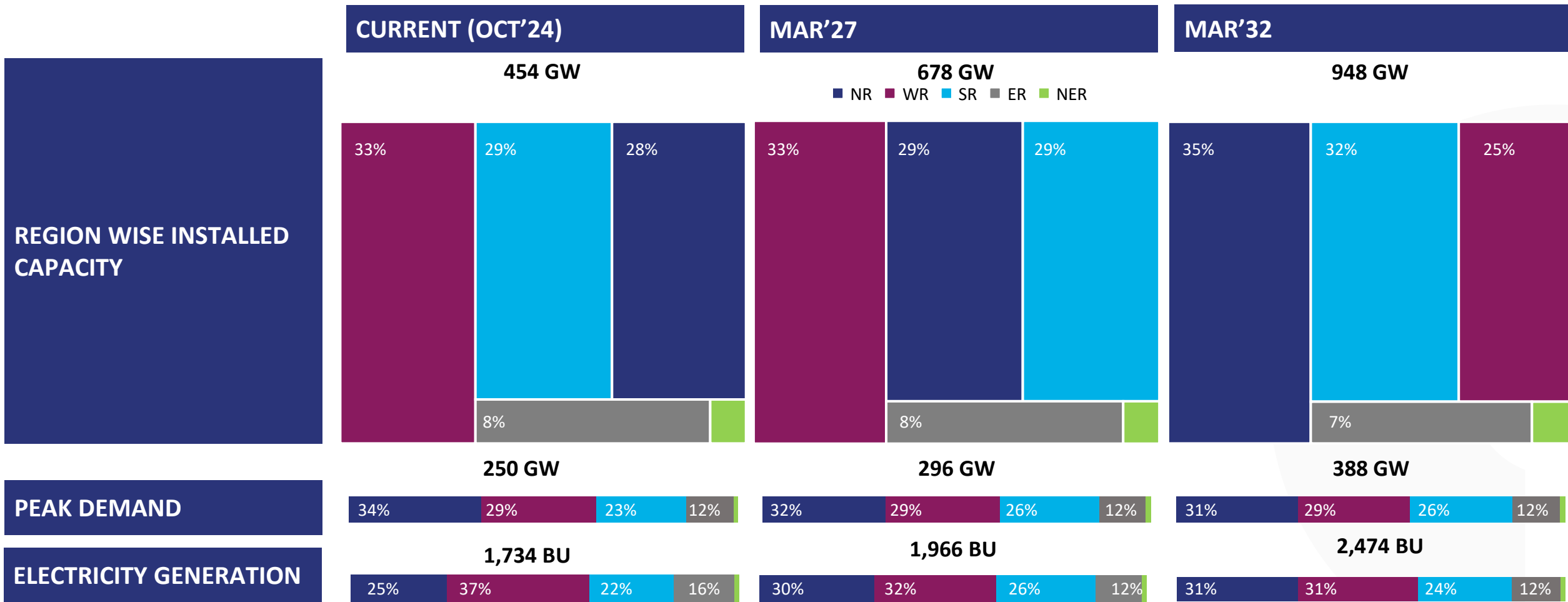
The share of tenders involving storage has increased even further to 1/3 of all in 8MFY25

CAPACITY MIX TO FURTHER TILT IN FAVOUR OF RENEWABLES AND STORAGE



- As per the latest iteration of the NEP, installed capacity will grow at a handsome 10.4% CAGR between now and Mar'32 – this will outpace demand growth owing to low CUF of renewables. Maximum growth will be seen in storage and solar, with wind also going stronger than the slump seen in the past decade (13.5% CAGR vs. 8.0% CAGR in past decade)
- Peak demand of 388 GW is expected (up from 366 GW earlier estimated). An additional 70 GW of demand could come on top of this just from Green Molecules

NORTH, SOUTH TO DOMINATE CAPACITY ADDITIONS IN THE NEXT DECADE



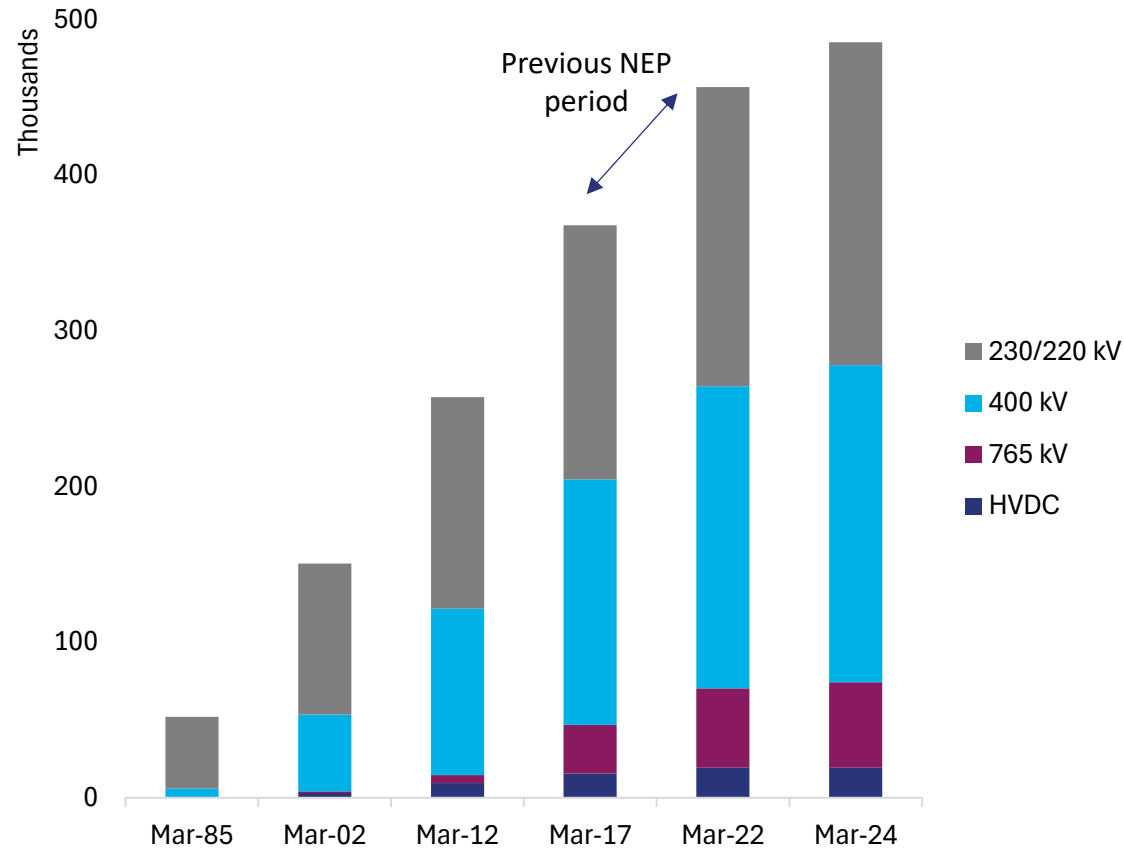
- Breaking a dominance of decades, NR and SR are set to overtake WR in installed capacity by Mar'32. This is due to ample solar installations in NR (especially Rajasthan and Ladakh) and wind installations in SR (TN, Karnataka, and Andhra Pradesh)
- The gap between installed capacity and generation is set to grow in the WR by Mar'32, with deficits in ER and NER as well. This necessitates better transmission infrastructure to conduct power from NR and SR to these regions

RENEWABLE RISE, REGIONAL REASONS TO DRIVE TRANSMISSION

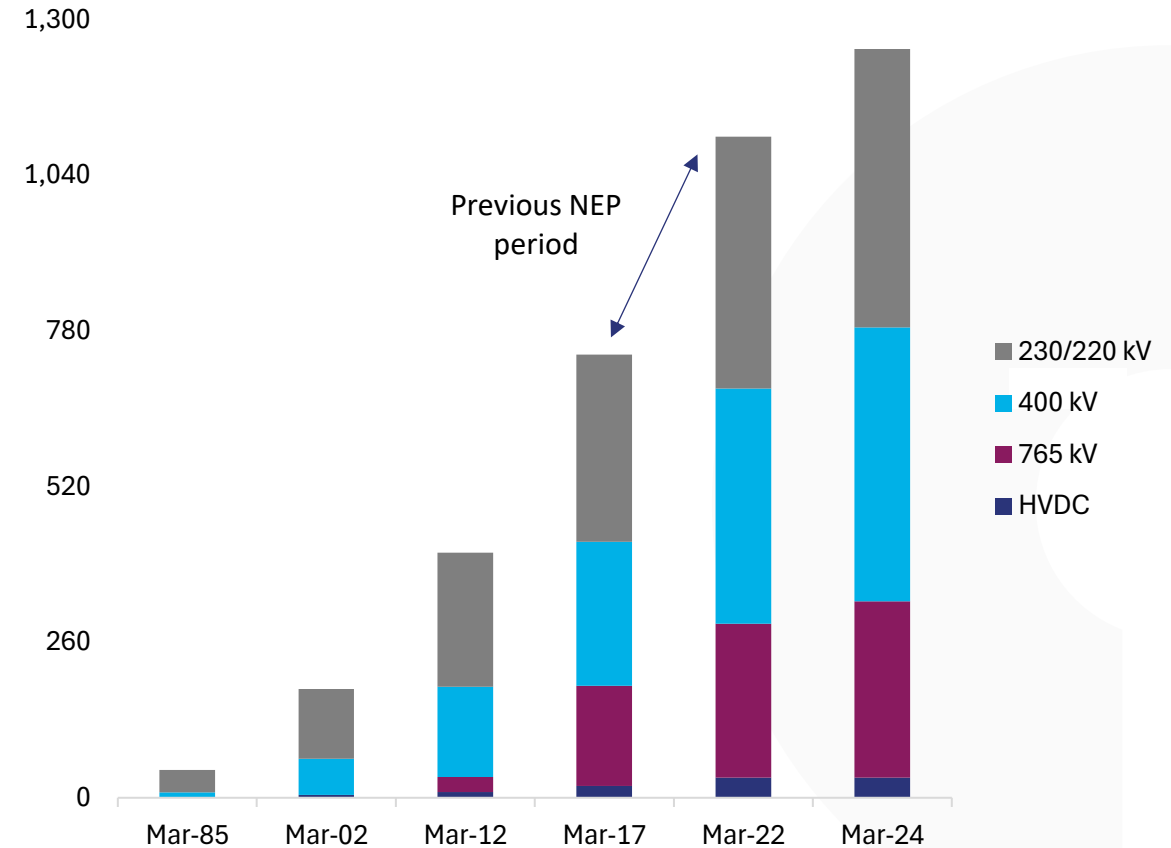


TRANSMISSION SHOWS STEADY GROWTH, MOVE TOWARDS HIGHER CAPACITY

TRANSMISSION LINE LENGTH (ckm)



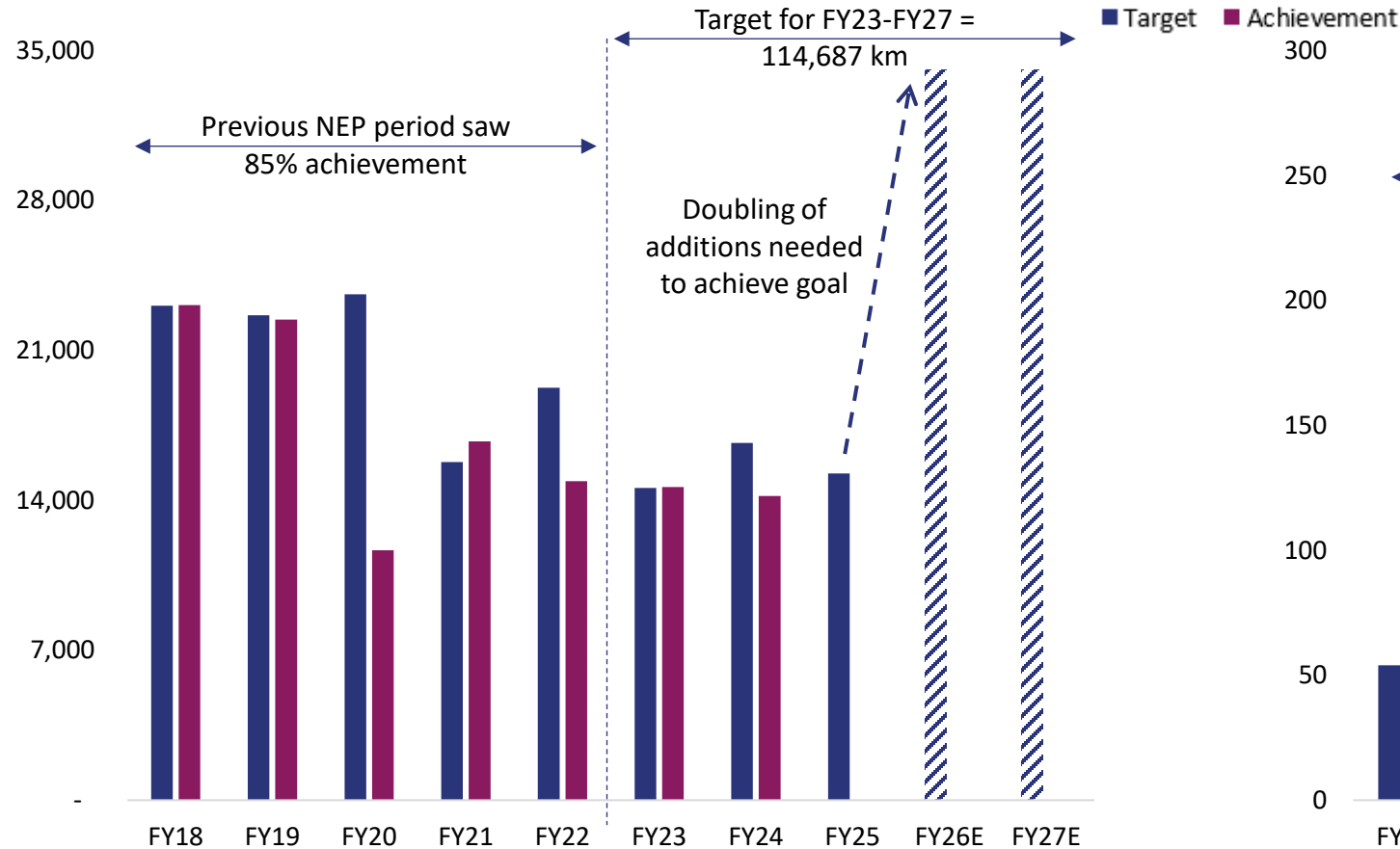
SUBSTATION CAPACITY (GVA)



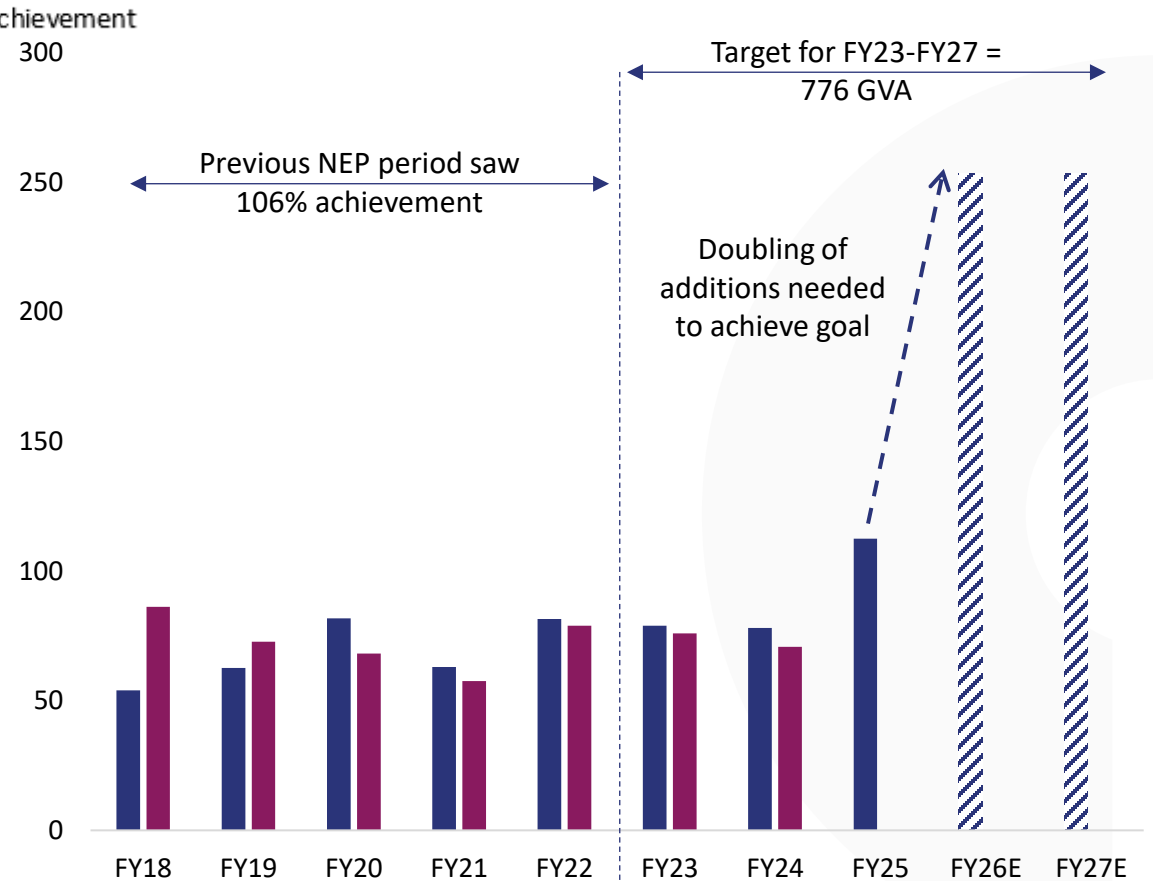
- Transmission line length has increased at a long-term CAGR pace of 6% per annum, with the rapidest growth during the FY13-FY17 NEP period. The share of higher capacity lines has gradually increased as the focus shifted to inter-regional connectivity with the concept of One Nation, One Grid, One Frequency
- Substations have outpaced this growth, exhibiting nearly a 9% growth per annum. The capacity of 400 kV substations is set to exceed that of 230/220 kV soon

SIGNIFICANT PACE UPTICK NEEDED TO FULFIL LOFTY AIMS FOR FY23-FY27

TRANSMISSION LINE LENGTH (ckm)



SUBSTATION CAPACITY (GVA)

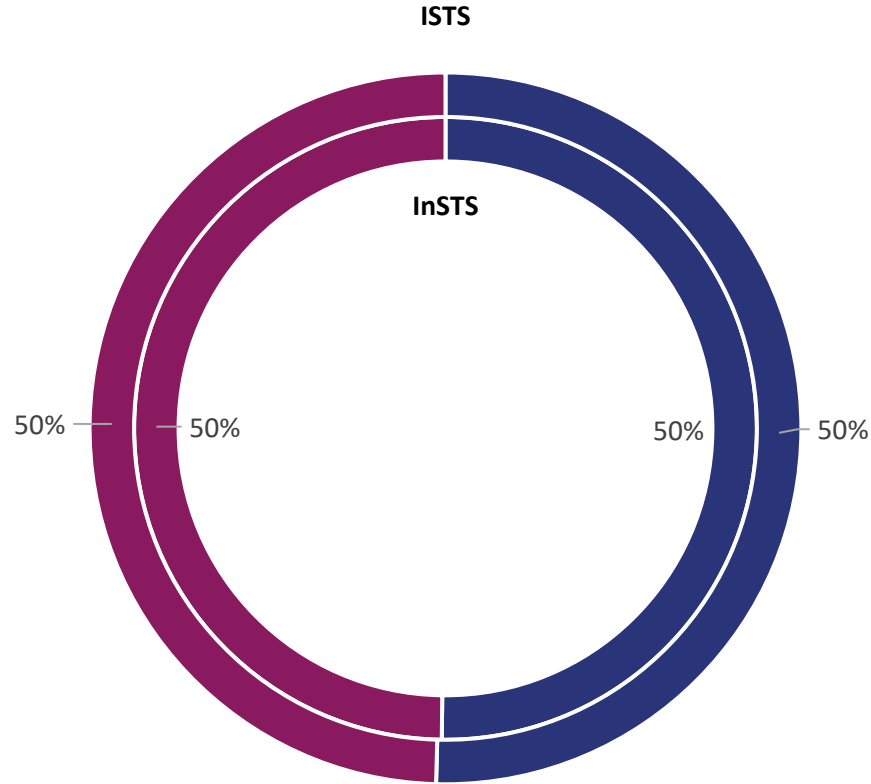


- To achieve the target set for Mar'27, annual addition pace of both line and substation capacity needs to more than double, and reach levels not seen
- In contrast the pace required to achieve Mar'32 goals (~15,000 ckm/year for lines and ~100,000 MVA for substations) seems reasonable in light of historical trends

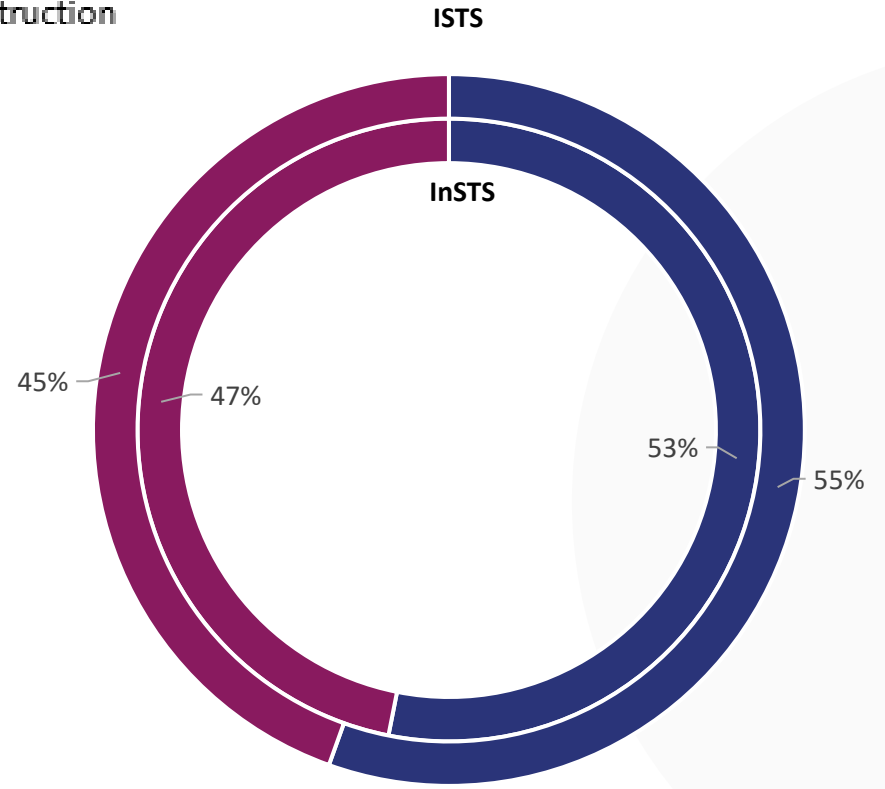
ONLY ~50% OF LENGTH ADDITION IS UNDER CONSTRUCTION

TRANSMISSION LINE LENGTH – TILL MAR'27

SUBSTATION CAPACITY – TILL MAR'27



■ Planned/Bidding ■ Construction

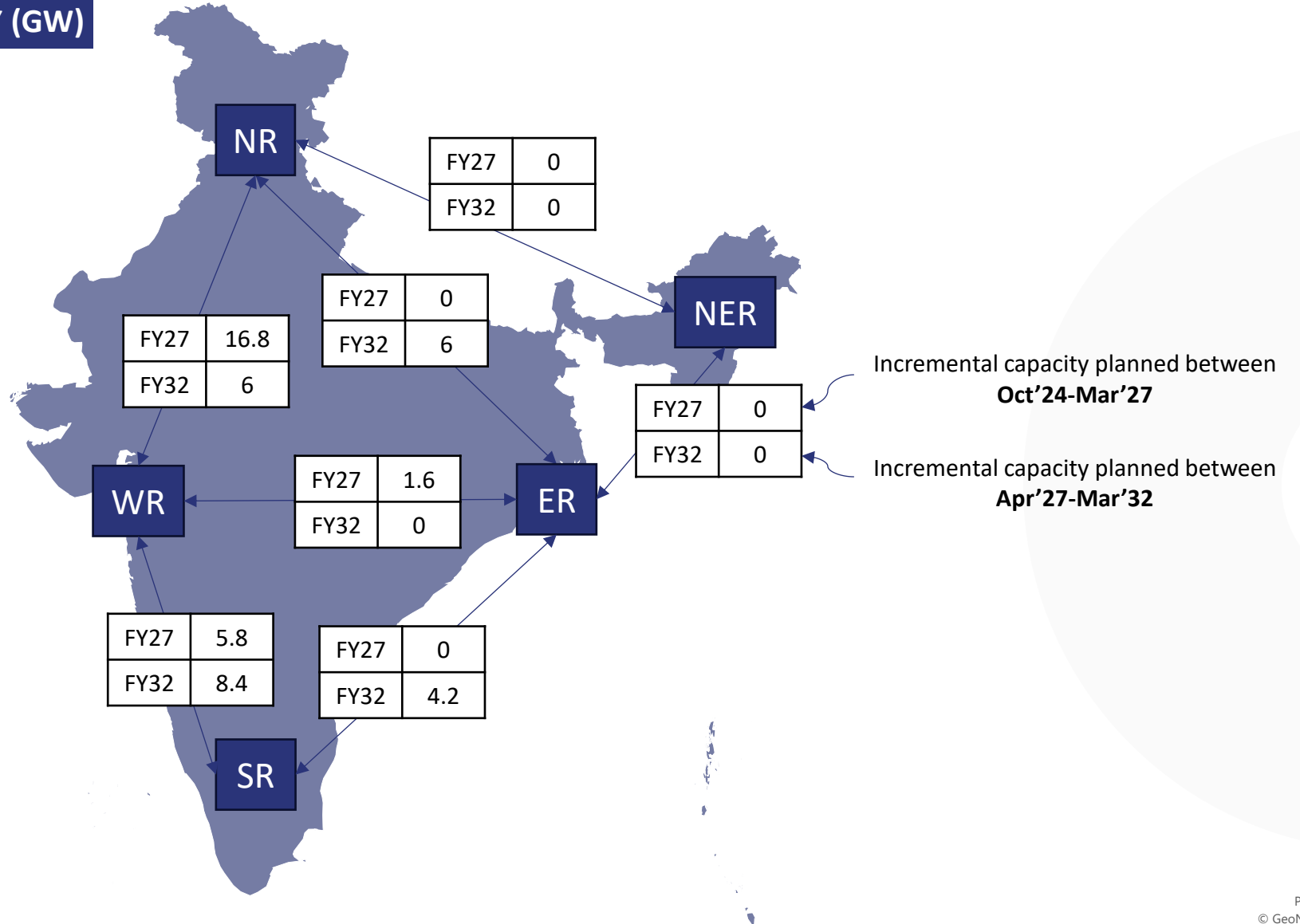


- Of the remaining length to be constructed in the plan period (FY23-FY28), about 50% is under construction. Given ~3 years time usually taken in execution of transmission line projects, a significant pickup in awarding is needed to ensure that the target is met
- A significant chunk of the ISTS projects to be executed are likely to come under the TBCB mode, boosting need for private investment

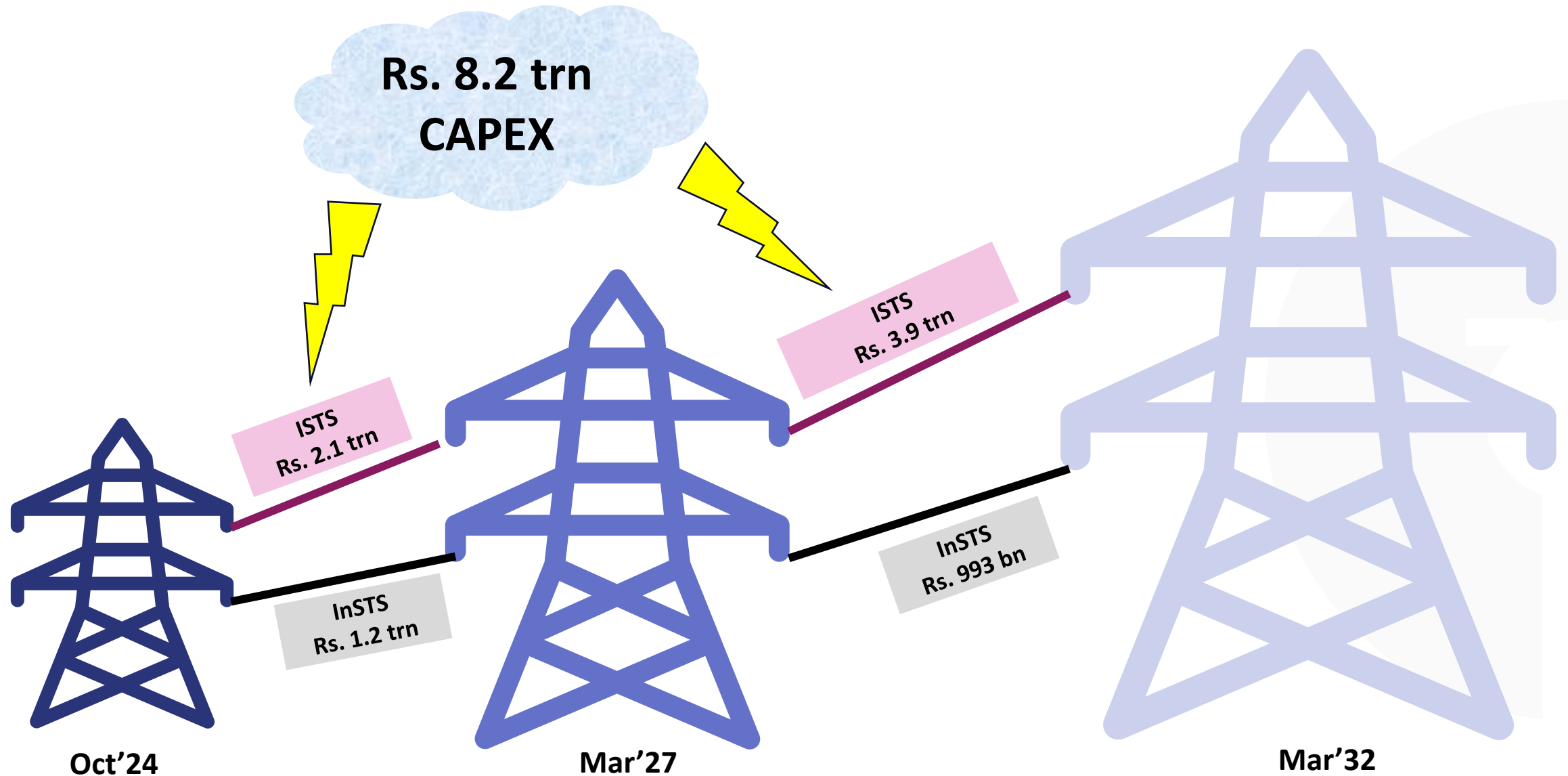
CONNECTIONS TO WESTERN REGION TO SEE MAXIMUM TRACTION

INCREMENTAL TRANSMISSION CAPACITY (GW)

- Maximum power flow is expected in the WR-NR and ER-WR corridors. This is since while West consumes a lot of power, it is moderate in renewable capacities
- In the next 3 years, maximum additions are expected in the WR-NR and WR-SR corridors, with the latter dominating in FY28-FY32

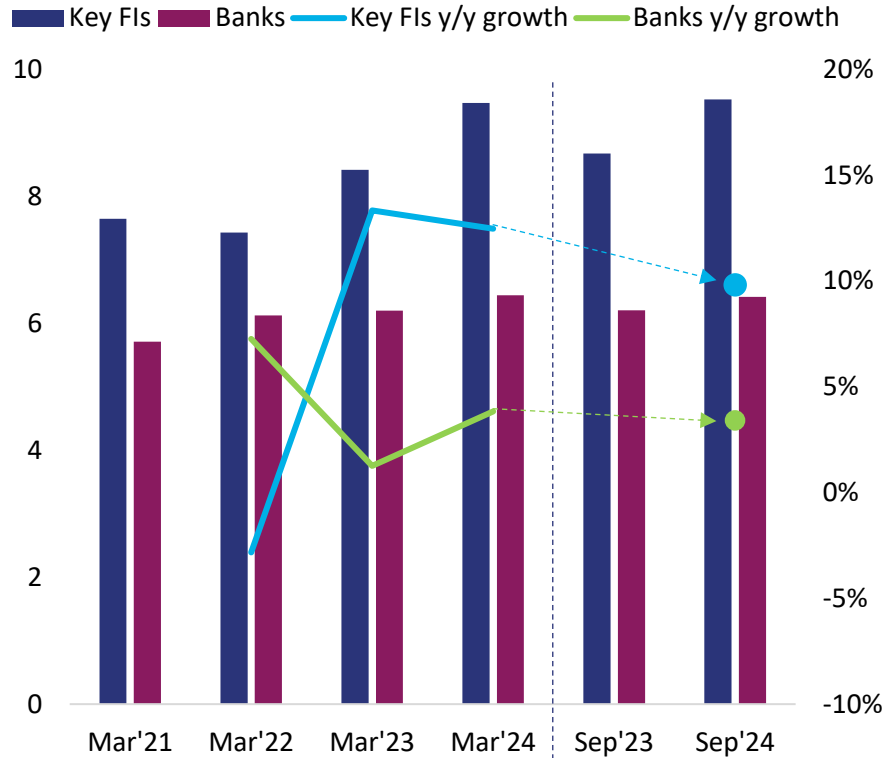


THUNDEROUS OPPORTUNITY IS TOWERING OVER THE TRANSMISSION SECTOR



KEY FI CONTINUE TO OUTPACE BANKS IN EXTENDING CREDIT TO POWER SECTOR

CREDIT OUTSTANDING TO POWER (Rs. trn.)



- Key FI credit to power sector continues to exceed that of banks, though both have seen a moderation in H1FY25 vs. past
- Strongest segment for key FI is renewable generation, with some recovering in convention power due to 80 GW addition plan
- Distribution book has grown largely based on government schemes such as RDSS/LPS

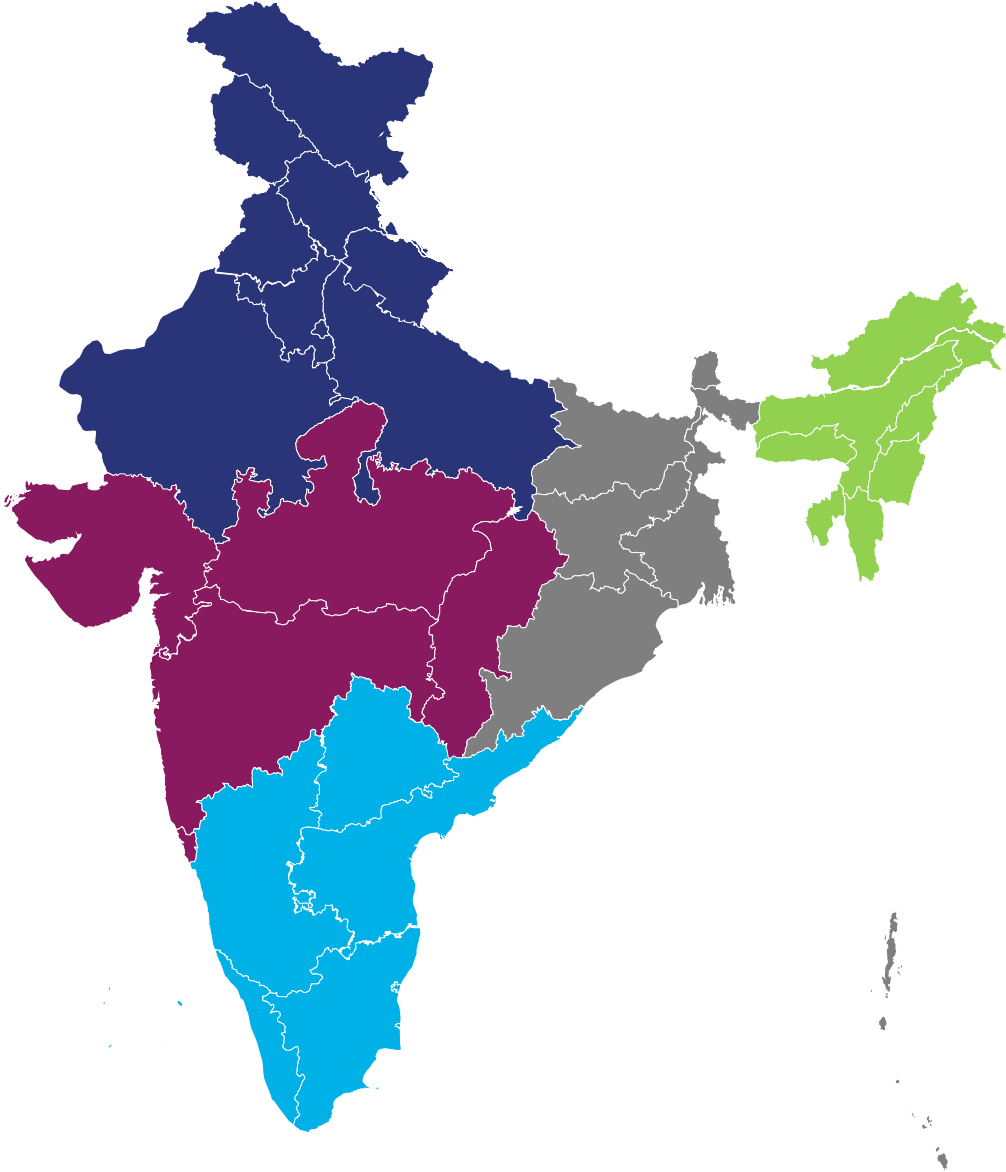
CREDIT OUTSTANDING (Rs. bn.) AND GROWTH¹ – SEGMENT WISE FOR KEY FIs



03 ANNEXURES



ANNEXURE 1: DEFINITION OF REGIONS USED



- Northern
- Western
- Southern
- Eastern
- North-Eastern

ANNEXURE 2: GLOSSARY

Item	Explanation
BESS	Battery Energy Storage System
bn	billion
BU	billion units
CAGR	Compounded Annual Growth Rate
Capex	Capital Expenditure
CEA	Central Electricity Authority
CIL	Coal India Limited
ckm	circuit kilometre
CY	Calendar Year
DAM	Day Ahead Market
ER	Eastern Region
ESS	Energy Storage System
EV	Electric Vehicles
FDRE	Firm Despatch Renewable Energy
FI	Financial Institution
FY	Financial Year
GVA	Giga-Volt-Ampere
GW	Giga-Watt
H	Half
HVDC	High Voltage Direct Current
Hydro	Hydroelectric
IEX	Indian Energy Exchange
InSTS	Intra-State Transmission System
InvIT	Infrastructure Investment Trust
ISTS	Inter-State Transmission System
kV	kilo-Volt

Item	Explanation
Item	Explanation
LHS	Left Hand Side
LPS	Late Payment Surcharge
M	Month
mn	million
MVA	Mega-Volt-Ampere
NEP	National Electricity Plan
NER	North-Eastern Region
NR	Northern Region
PPA	Power Purchase Agreement
PSP	Pumped Storage Project
Q	Quarter
RDSS	Revamped Distribution Sector Scheme
RE	Renewable Energy
RHS	Right Hand Side
Rs.	Rupees
RTC	Round-the-Clock
SCCL	The Singareni Collieries Company Limited
SR	Southern Region
TBCB	Tariff Based Competitive Bidding
TN	Tamil Nadu
trn	trillion
TWh	Tera-Watt-hour
WR	Western Region
WSH	Wind Solar Hybrid
y/y	Year-on-Year
YTD	Year-till-Date



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