



REPORT ON POWER SECTOR

UTILITY BEYOND UTILITIES: HARNESSING NON-UTILITY SOLAR

15 JANUARY 2025



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EXECUTIVE SUMMARY

A momentary pause in H2CY24's electricity consumption trajectory precedes an era of sustained growth

CY24 energy supply exhibited ~6% y/y growth, characterized by H1's robust 10% expansion amid a scorching summer, followed by H2's subdued 2% growth attributed to an above-normal monsoon. The trend of exacerbated inter-quarter volatility and peaky demand determined by weather rather than industry use played out for another year. Region-wise trends reflect these dynamics with the North, which sees the most extreme weather clocking an impressive 10% y/y growth in energy supply in CY24, well-above industry dominated South and West regions.

CY24 marked a pivotal juncture for renewables, surpassing the symbolic 200 GW threshold in installed capacity, with solar energy demonstrating exceptional growth

Notwithstanding the blip in energy demand, installed capacity registered a healthy 8% y/y growth in CY24. Notably, renewables spearheaded this expansion, with solar and wind additions reaching ~24.5 GW and ~3.2 GW respectively, exceeding CY23's pace by a factor of two. *Solar, in particular, exhibits a trajectory consistent with our forecast of 50 GW of capacity additions across FY25 and FY26.* Conversely, thermal capacity additions, following a respectable FY24, have decelerated in 9MFY25, casting doubt on the feasibility of achieving the FY25 targets

Going beyond utility solar: increasing share of rooftop and off-grid solar underscore a secular evolution

A defining characteristic of solar additions in CY24 was the substantial 25% share of non-utilities, surpassing historical precedents. Rooftop solar installations surged by 4.6 GW, reflecting a remarkable 53% y/y growth, while off-grid solar witnessed a 197% expansion. This escalating prominence of the non-utility segment can be attributed to a combination of factors, including a low initial base, supportive government policies stimulating both residential and commercial & industrial sectors, and enhanced affordability of distributed solar solutions.

Tariff differentials drive C&I sector towards decentralised power solutions

C&I entities collectively constitute three-fourths of the installed rooftop capacity. This ecosystem flourishes due to the inherent disparity between elevated C&I grid tariffs and reduced tariffs procured from third-party IPPs/captive plants. While several states have acknowledged the erosion of market share within their respective DISCOMs and implemented a series of open access charges, key states such as Gujarat, Karnataka, Rajasthan, and Tamil Nadu still offer a substantial 20% cost advantage for utilizing open access renewable power. Furthermore, captive arrangements enhance the economic appeal by exempting consumers from additional surcharges and cross-subsidy levies, thereby maintaining viability across most states

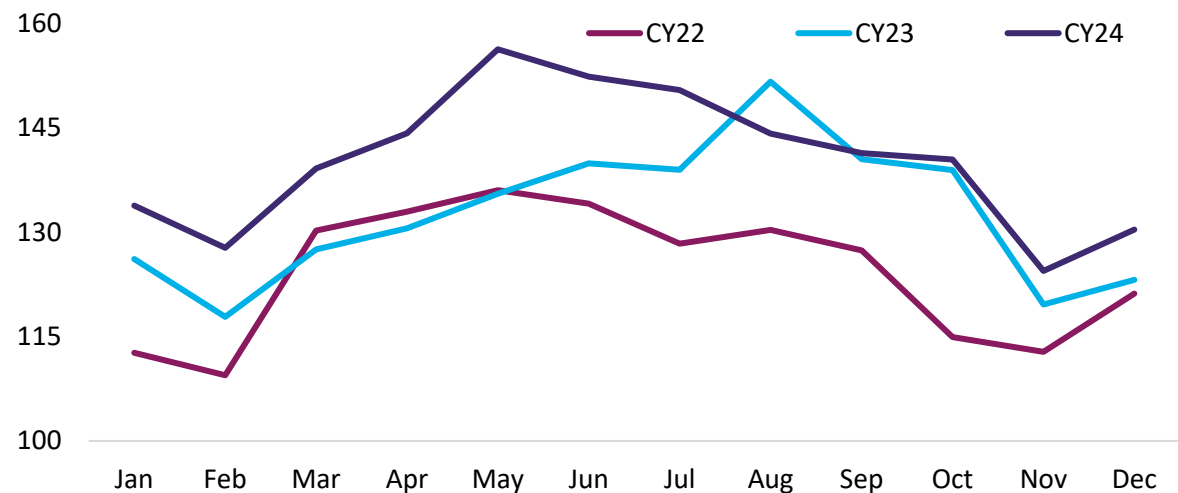
Residential to become largest segment in rooftop solar, photosynthesised by PM-SGMBY and vibrant ecosystem

Residential rooftop installations may surpass other segments if the PM-SGMBY achieves its ambitious 30 GW target. This initiative, characterized by a substantial capital cost subsidy that accelerates payback periods by 4-5 years, has demonstrated early promise. The scheme possesses the potential to catalyze a Rs. 1.2 trn ecosystem, with manufacturers of essential components, including modules, inverters, mounting equipment, and electrical components, anticipated to be primary beneficiaries alongside project developers and EPC players. The latter are, on their part, cashing in on this expansive opportunity through the capex model (where customer finances and owns the farm) to take advantage of subsidies.

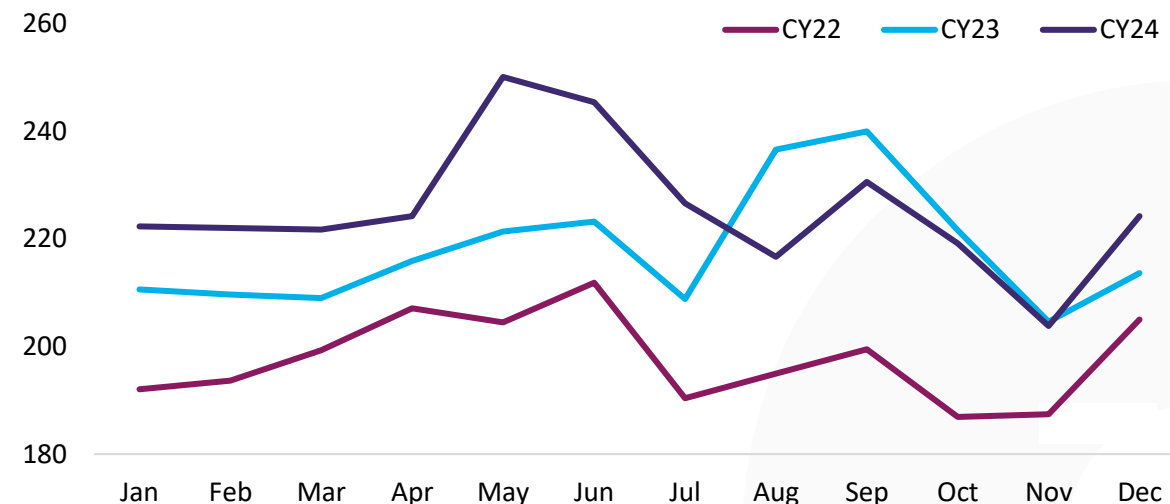
Both C&I and residential non-utility solar segments exhibit distinct drivers stemming from policy impetus. Declining module and EPC costs, coupled with cheaper cells expanding off-grid potential, facilitate solar adoption. Non-utility solar is poised for significant growth, with annual additions anticipated to reach ~20 GW through FY27. A judicious mix of utility and non-utility sources will democratise green energy security.

ELECTRICITY CONSUMPTION TAKES A RAIN CHECK IN H2CY24

ELECTRICAL ENERGY SUPPLY (BU)



PEAK POWER DEMAND (GW)



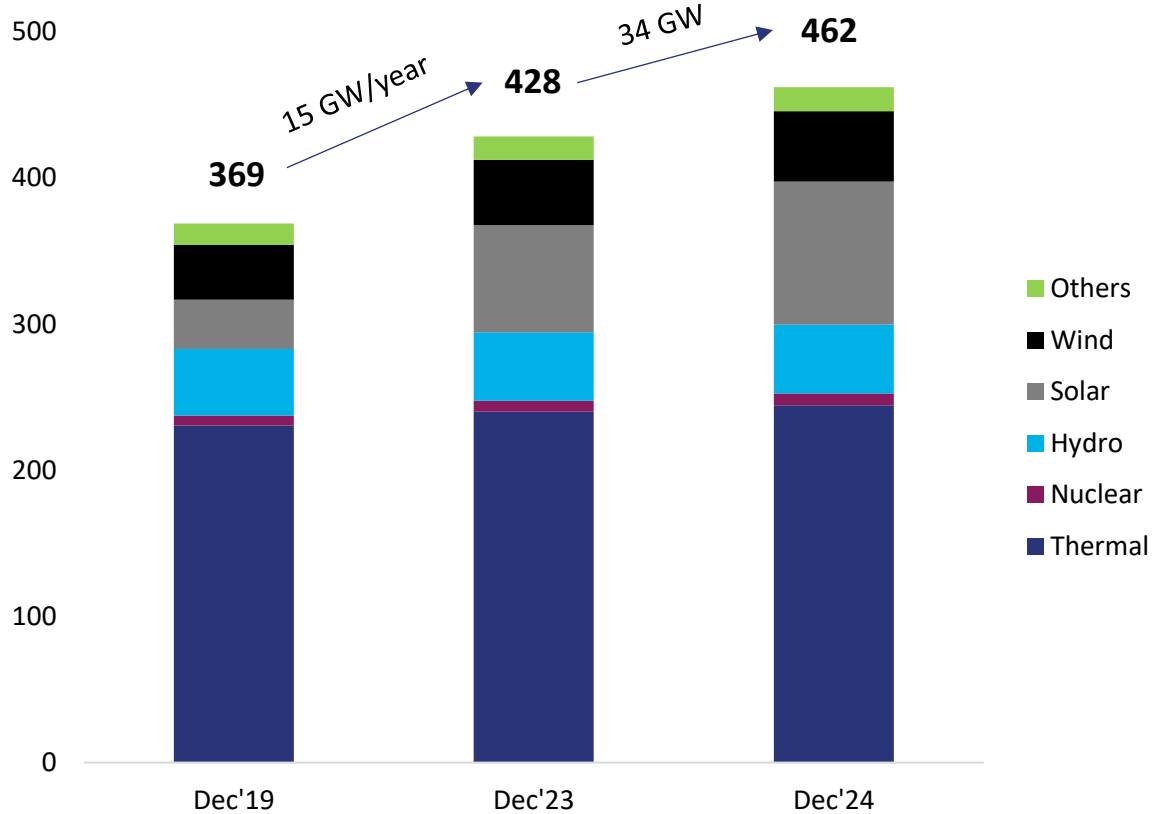
REGION WISE TRENDS IN ELECTRICAL ENERGY SUPPLIED

Region	Energy Supply in CY24 (BU)	1Y CAGR	3Y CAGR	5Y CAGR
North	517	10.4%	7.7%	5.5%
West	523	1.7%	7.3%	6.3%
South	422	2.8%	6.6%	4.4%
East	198	5.8%	7.1%	6.1%
North East	20	5.0%	4.8%	4.8%
Total	1,680	5.0%	7.2%	5.5%

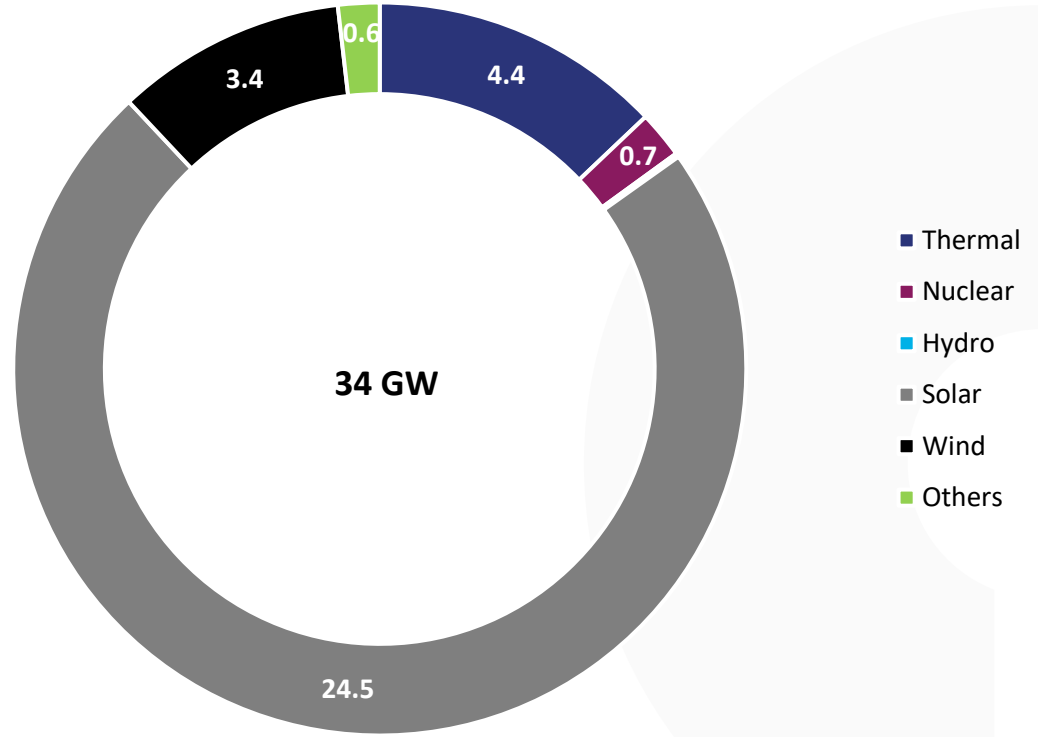
- A weak Q2FY25 owing to virulent monsoons impacting construction & industrial activity was only partially compensated by a festive resurgence in Q3FY25. Consequently, thermal PLF has been lower than anticipated
- Demand for power could improve in Q4FY25 due to cold winter in Northern Region. These trends highlighting weather extremities were already visible in CY24, when the North saw outpaced growth in energy supply
- Industry dominated South and West regions saw languid growth reflecting the moderation in IIP. This could see a pickup in Q4 on a low base

RENEWABLE ADDITIONS SOAR IN CY24 AS SOLAR REACHES TOWARDS THE SUN

INSTALLED CAPACITY (GW)



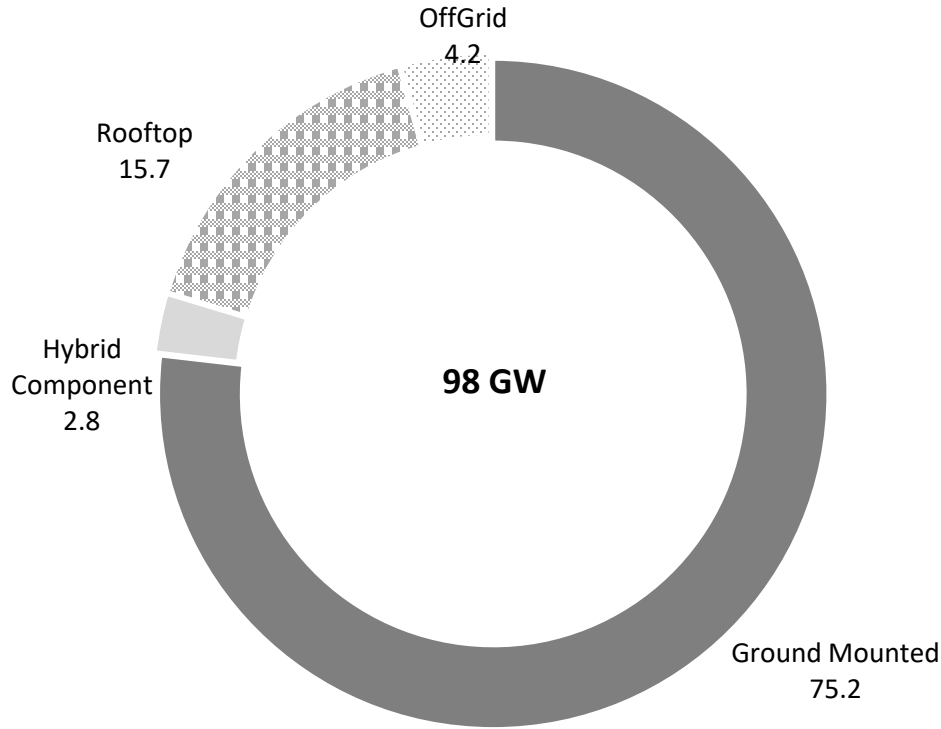
NET ADDITIONS IN CY24 (GW)



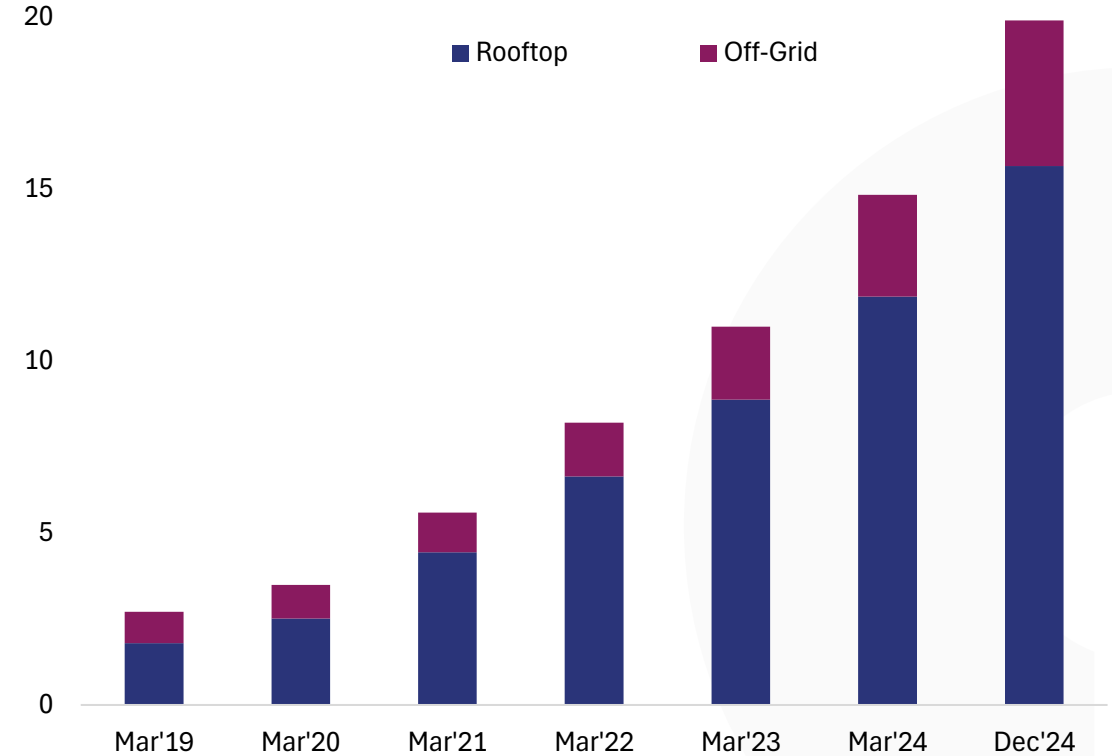
- Over 85% additions in CY24 were of renewables, with solar alone forming 73%. A strong pipeline exists, and we continue to expect cumulative ~50 GW of solar and wind additions in FY25 and FY26. Wind additions doubled to 3.4 GW of addition in CY24, with Gujarat, Karnataka, and Tamil Nadu accounting for 98% of this capacity
- Thermal saw net additions of only 4.4 GW, with some of the latest plants being added in Jawaharpur and Ghatampur. Gross addition target of 11.3 GW in FY25 looks steep considering additions till now in 9MFY25

NON-UTILITY SOLAR ADDITIONS ARE OCCUPYING MORE OF THE PIE

INSTALLED SOLAR CAPACITY DEC'24 (GW)



GROWTH IN KEY NON-UTILITY SEGMENTS (GW)



- A surge in non-utility (rooftop + off-grid) solar was seen. Of the 24.5 GW added in CY24, 6 GW (25%) came from non-utility sources, well above their share in installed capacity. Rooftop solar saw a 4.6 GW rise in CY24, a meteoric 53% y/y growth, while off-grid solar saw 197% rise
- The increasing share of the non-utility segment is owing to a mix of low base, favourable government policies driving both the residential and C&I segments, and better affordability of distributed solar solutions

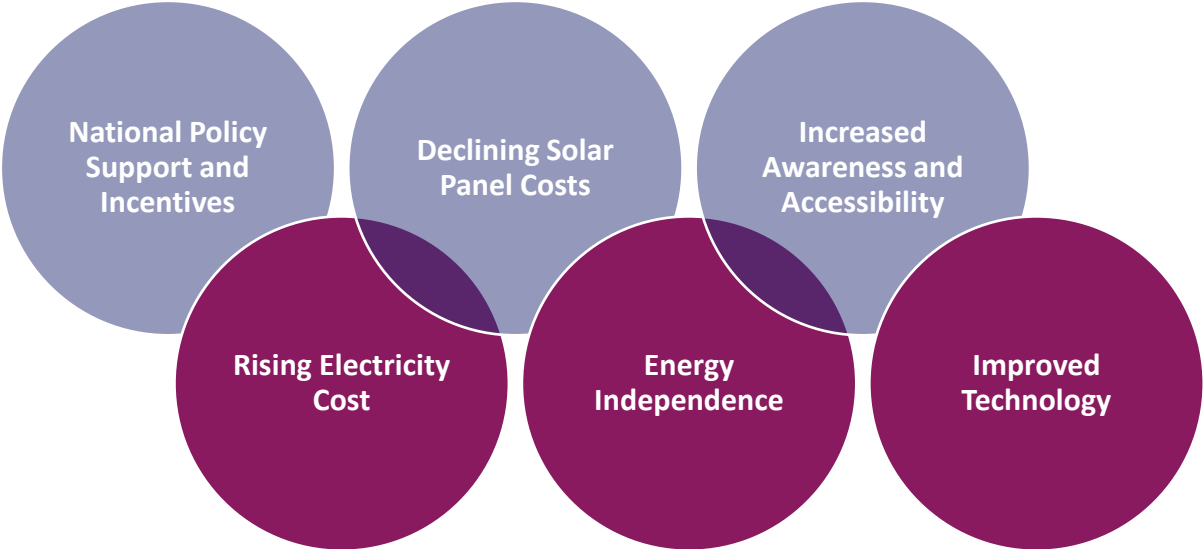
NEW BUSINESS MODELS BEHIND THE FILLIP IN NON-UTILITY ADDITIONS

UTILITY	GRID CONNECTION	OWNERSHIP	MOUNTING	USE CASE
YES	YES	NON-CAPTIVE	GROUND	<i>Provides a lion's share of electrical energy requirements to wide range of consumers through grid</i>
	YES	NON-CAPTIVE	FLOATING	<i>Emergent area to take advantage of select sites with high potential (cooling of water improves PLF)</i>
NO	DEPENDS	CAPTIVE/ GROUP CAPTIVE	ROOFTOP / GROUND	<i>Used by C&I segment where they need access to reliable, low-cost, and quality green power</i>
	YES	NON-CAPTIVE	ROOFTOP / GROUND	<i>Used by third party producers to directly sell power to industries, enabling C&I segment to avoid high tariffs</i>
	YES	RESIDENTIAL	ROOFTOP	<i>Used by households to offset their energy bills and possibly sell power to the grid</i>
	ANY	AGRICULTURE/OTHERS	ANY	<i>Small self-sufficient installations for solar pumps or for micro-grids</i>

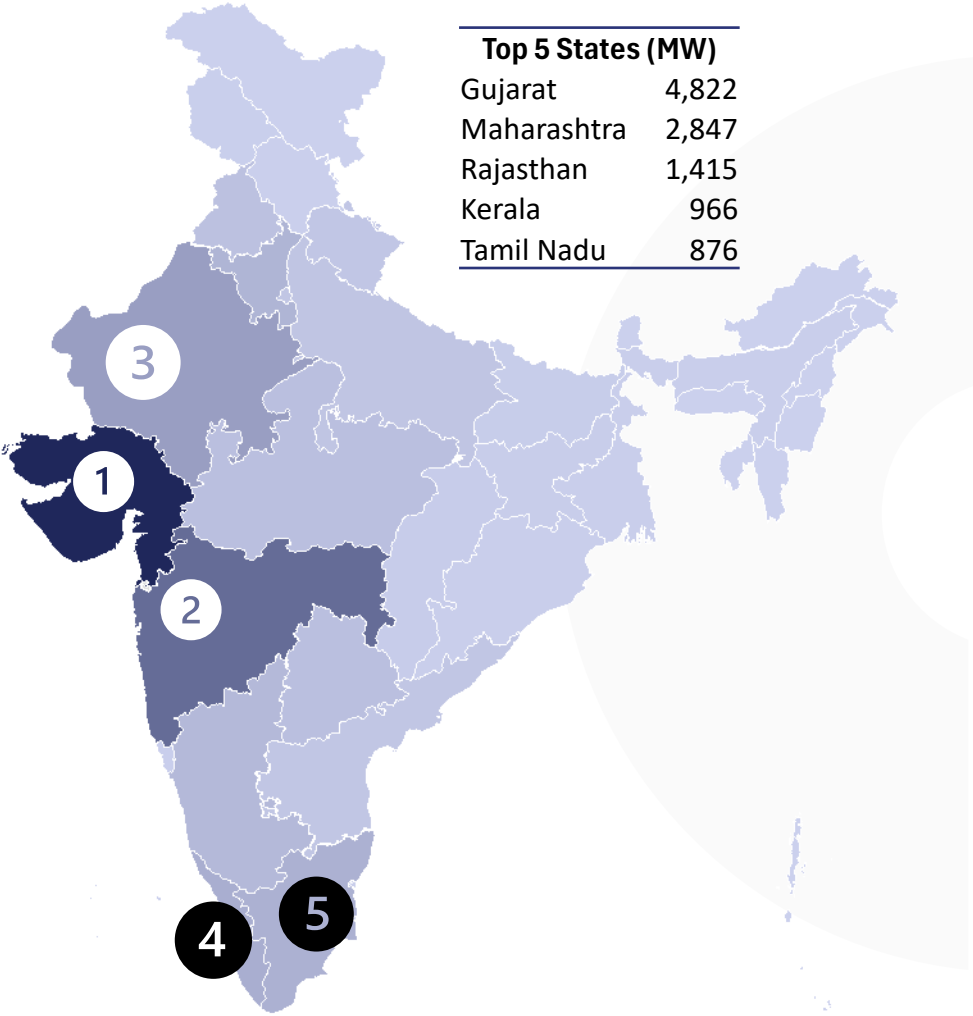
NON-UTILITY SEGMENTS FOCUS ON ENERGY SELF-RELIANCE, TARIFF ARBITRAGE, AND UTILISING GOVERNMENT SCHEMES

ROOFTOP SOLAR'S GROWTH DRIVEN BY STRUCTURAL AND STATE LEVEL FACTORS

STRUCTURAL DRIVERS OF ROOFTOP SOLAR



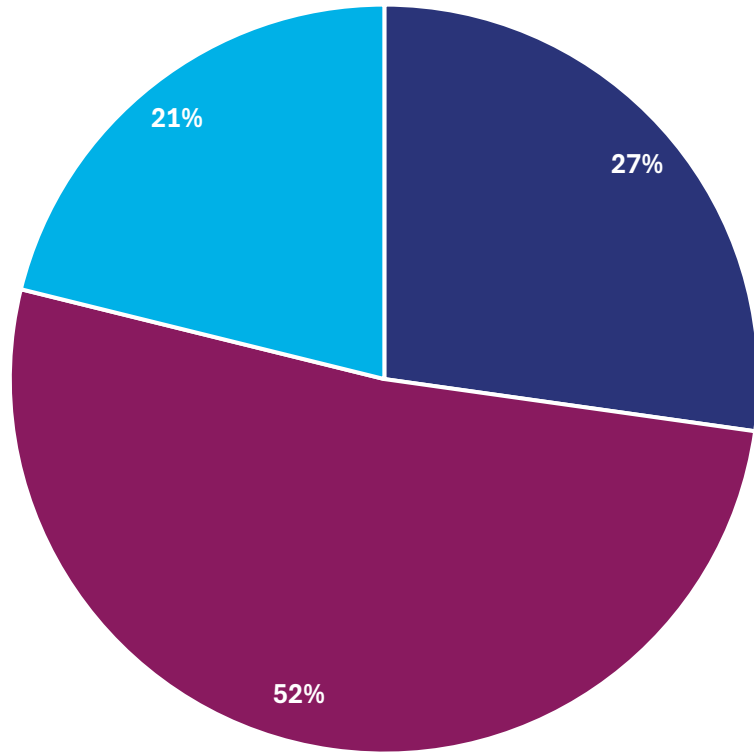
STATEWISE SOLAR ROOFTOP INSTALLATIONS – DEC'24



Top 5 states account for 70% of solar rooftop installed capacity. Proliferation depends on extent of industrialisation, C&I tariff differential, state-level schemes, and metering regime

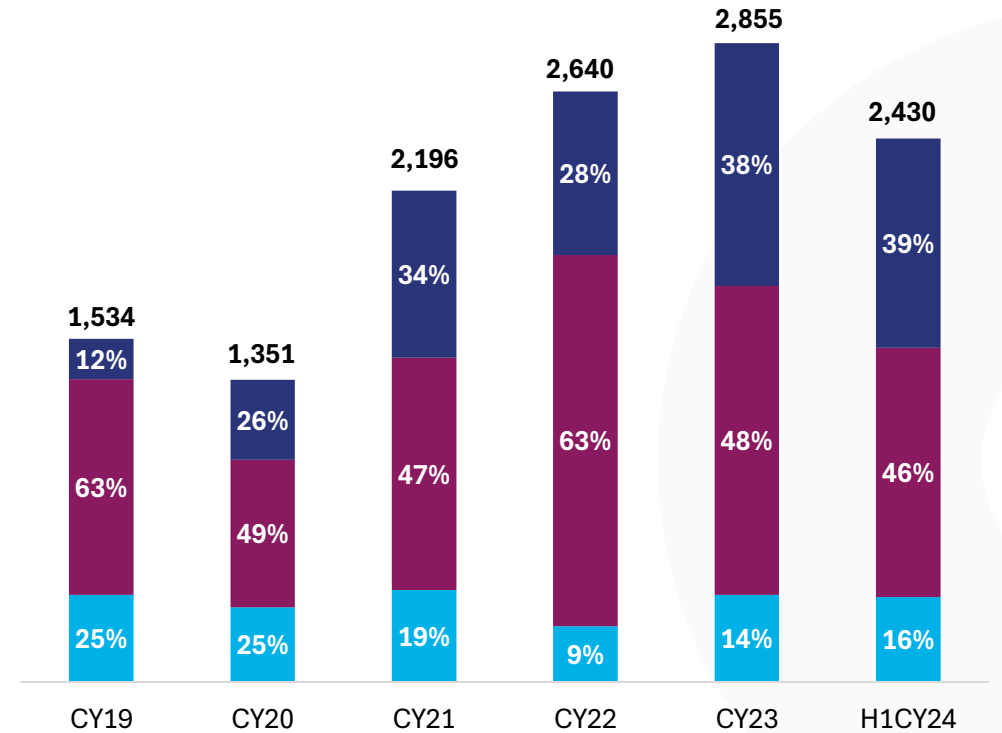
ROOFTOP SOLAR: C&I RULES BUT RESIDENTIAL IS RISING

SHARE OF SEGMENTS IN SOLAR ROOFTOP AS OF JUN'24 (MW)



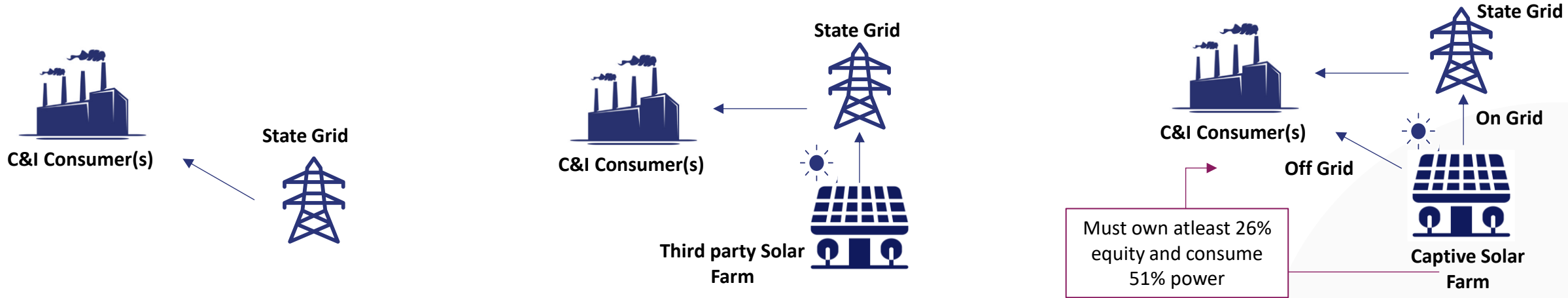
- Residential
- Industrial
- Commercial

INCREMENTAL SOLAR ROOFTOP CAPACITY ADDITION (MW)



- Share of residential segment is steadily rising and is expected to reach a crescendo in the medium term due to capex policy support by the Union, especially in States with high residential tariffs and favourable net metering policies
- In the C&I segment itself, medium, small, and micro enterprises (MSMEs) are likely to aggressively adopt solar in coming years. MSMEs have a rooftop solar potential of around 18 GW, but less than 1 GW has been tapped due to a lack of low-cost financing

C&I SEGMENT'S GROWTH CONTINGENT ON STATE LEVEL POLICIES FOR OPEN ACCESS



Typically, C&I customers are charged between Rs. 4-20/unit

This is much higher than those for other consumers and purchase tariff

Additional amounts charged are to cross-subsidise other consumers

Solar tariffs range from Rs. 2.5-3/unit typically

Additional Open Access Charges:

- + Transmission Charges
- + Standby Charges
- + Wheeling Charges
- + Banking Charges
- + Other Fees & Charges
- + Additional Surcharge
- + Cross-subsidy Surcharge

Solar tariffs range from Rs. 2.5-3/unit typically

Additional Captive Charges:

- + Transmission Charges
- + Standby Charges
- + Wheeling Charges
- + Banking Charges
- + Other Fees & Charges

- C&I tariff and additional open access/captive charges vary significantly across states, thus viability differs considerably
- In key states such as Gujarat, Karnataka, Rajasthan, and Tamil Nadu there is a 15-20% advantage in open access tariffs
- In other states such as Maharashtra, Andhra Pradesh, and Telangana, high additional charges make open access unviable
- Green Open Access Rules allow for 100 kW plants instead of 1 MW for other types of plants

POLICY SUPPORT TO MAKE RESIDENTIAL SEGMENT HUGE

- The residential sector is expected to become the largest segment in the rooftop space in the next few years. The driver of this will be the PM-SGMBY. Within 10 months of PM-SGMBY, 0.72 mn installations have been achieved. This marks a ten-fold increase in monthly installations
- Growth will be accelerated if net metering benefits are extended to sub-1-kW consumers, low-cost financing is provided to the end consumer, and if problems of adequate space is addressed through high Wp panels

PM SURYA GHAR: MUFT BIJLI YOJANA

30 GW Capacity Addition

- ✓ Central financial assistance to Residential rooftop solar
- ✓ Free electricity upto 300 units/ month to 10 mn households
- ✓ Outlay of Rs. 750 bn will result in electricity of 40 BU/year

CAPACITY	SUBSIDY
Up to 2 kW	Rs. 30,000 per kW
2-3 kW	Rs. 30,000 per kW up to 2 kW and Rs. 18,000 per kW for additional capacity
Above 3 kW	Rs. 78,000 per kW
RWAs / GHS	Rs. 18,000 per kW for common facilities up to 500 kW capacity

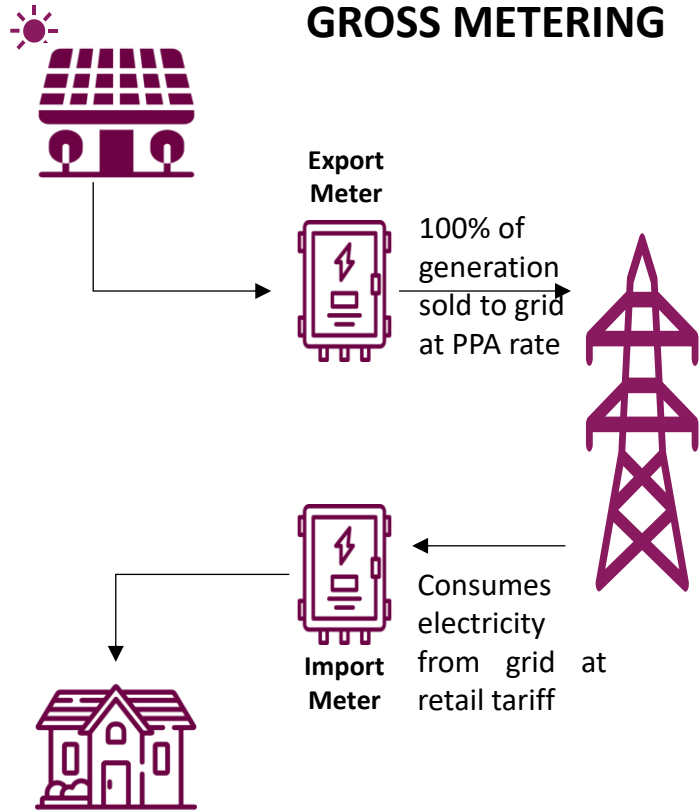
PAYBACK PERIOD (YEARS) FOR RESIDENTIAL CUSTOMERS

(Assuming Capital Cost of Rs. 50,000/kW)

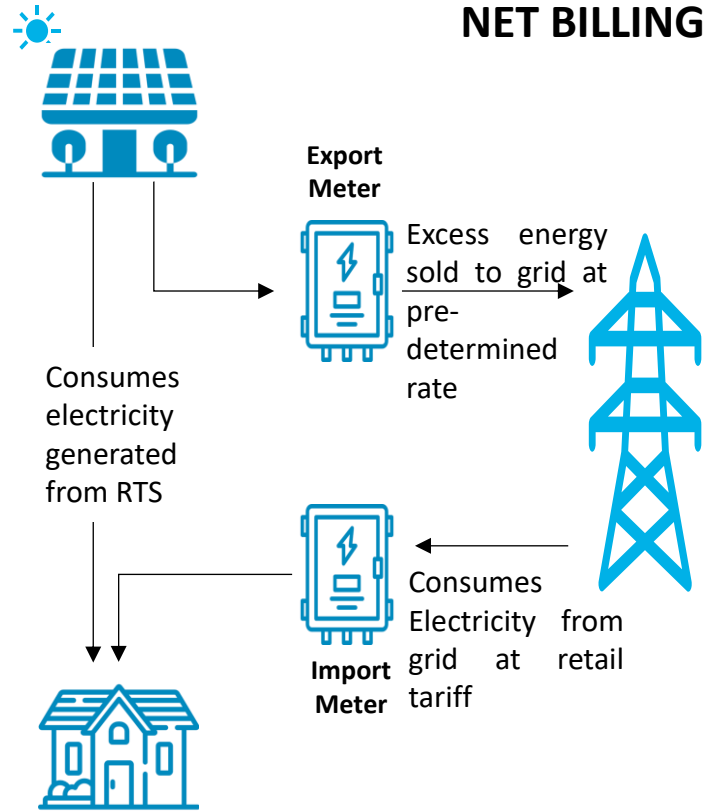
Capacity	Without Subsidy	With Subsidy
Upto 1 kW	8.5 to 9.0	3.5 to 3.8
Upto 2 kW	8.4 to 8.8	3.4 to 3.6
Upto 3 kW	8.2 to 8.6	4.3 to 4.6

BESIDES SAVINGS, SALE TO GRID GIVES ADDITIONAL REVENUE

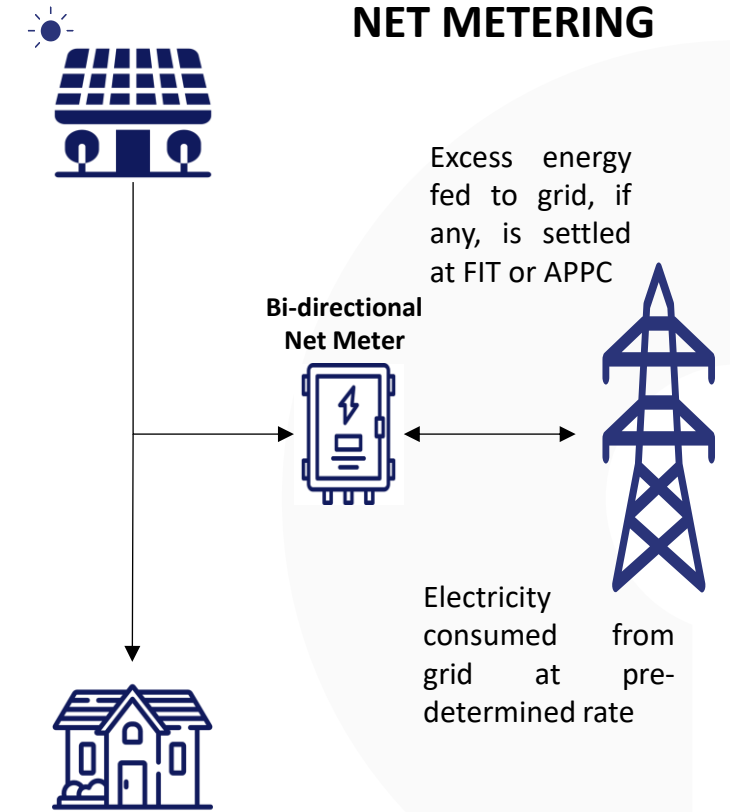
THERE ARE THREE MAIN MODELS AS PER WHICH SALE OF POWER TO GRID HAPPENS...



- Purchase tariff applied in full to consumed units as per tariff slabs
- Since feed-in tariff < purchase tariff for consumer, this always benefits the DISCOM



- Self-produced electricity is consumed first, and only balance electricity is purchased at slab rate from grid
- Sale of electricity happens at pre-determined feed in tariff which is less than purchase tariff



- Only net energy required is consumed from grid, this can take consumer to lower slab, reducing rate
- Most beneficial to consumer and least beneficial to DISCOM

STATES GRADUALLY FINE-TUNING NET METERING BENEFITS

STATE WISE NET METERING POLICIES (RESIDENTIAL)

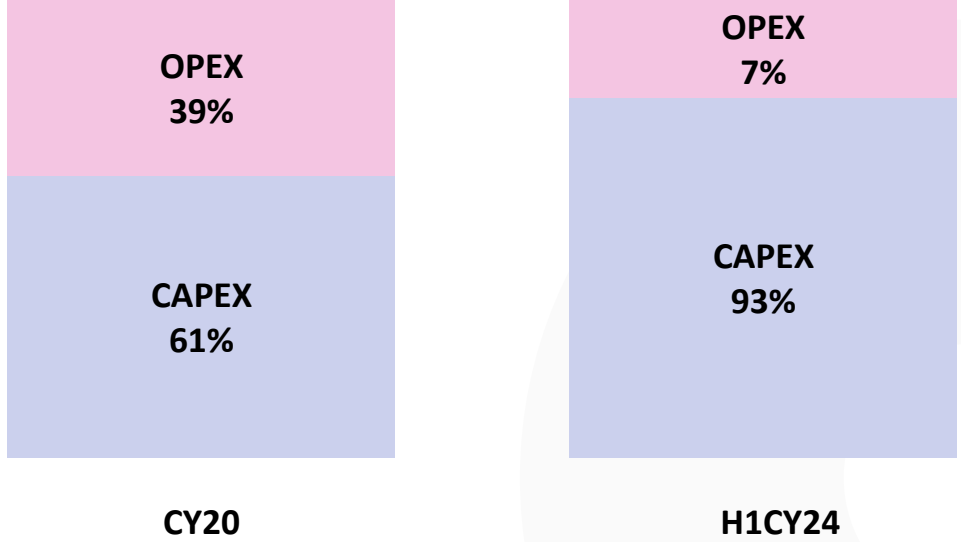
STATE	CAPACITY	BILLING CYCLE	EXEMPTIONS
Gujarat	1 kW to 1 MW	Annual	Transmission Charge, Transmission Loss, Wheeling Charge, Wheeling Loss, Banking Charges.
Maharashtra	Up to 1 MW	Annual	Wheeling Charge, Wheeling Loss
Rajasthan	1 kW to 1 MW	Upto 100 units adjusted	Banking, Wheeling and Cross subsidy charges
Kerala	1 kW to 1 MW	Annual	Banking, Electricity duty and Cross subsidy
Tamil Nadu	Min 1 kW	Annual	Wheeling and Cross subsidy
Haryana	Up to 2 MW	Annual	Electricity taxes & duty, wheeling charges, cross subsidy charges, T&D charges
Karnataka	1 kW to 1 MW	Annual	wheeling, banking, cross subsidy
Telangana	Up to 1 MW	Half Yearly	Distribution losses and charges, Electricity duty, Cross subsidy
Madhya Pradesh	Up to 1 MW	Half yearly	Banking, Wheeling, Cross-subsidy surcharges & Electricity duty
Punjab	1 kW to 1 MW	Annual	Wheeling and Cross subsidy
Delhi	1 kW to 1 MW	Annual	Wheeling, Banking, Transmission charges & Electricity tax

- States typically provide net metering benefit for residential and small C&I customers. With time, States are realising the loss to their DISCOMs and are transitioning from net to gross metering or making net metering available to smaller and smaller loads
- Typically, residential consumers who do not come under (time-of-day) ToD framework can export to grid during off-peak hours to settle energy imported from the grid during peak time

CAPEX MODEL FOR MAKING SOLAR ROOFTOP GAINING PROMINENCE

ASPECT	CAPEX Model	OPEX Model
Model	Developer does EPC for the Consumer, who finances and owns the Generator	Developer builds, owns, operates, and finances the Generator Sells power to Consumer as per PPA
Capital Cost	Borne by Consumer	Borne by Third Party Developer
Ownership	Consumer	Third Party Developer
O&M	Consumer is responsible	Developer is responsible
Performance Risk	Borne by Consumer	Borne by Third Party Developer
Segment	Residential, C&I	C&I
Tax benefits	Available	Not Available
Payback period	Short	Long
LCOE for Consumer	Low	High

SHARE OF BUSINESS MODELS



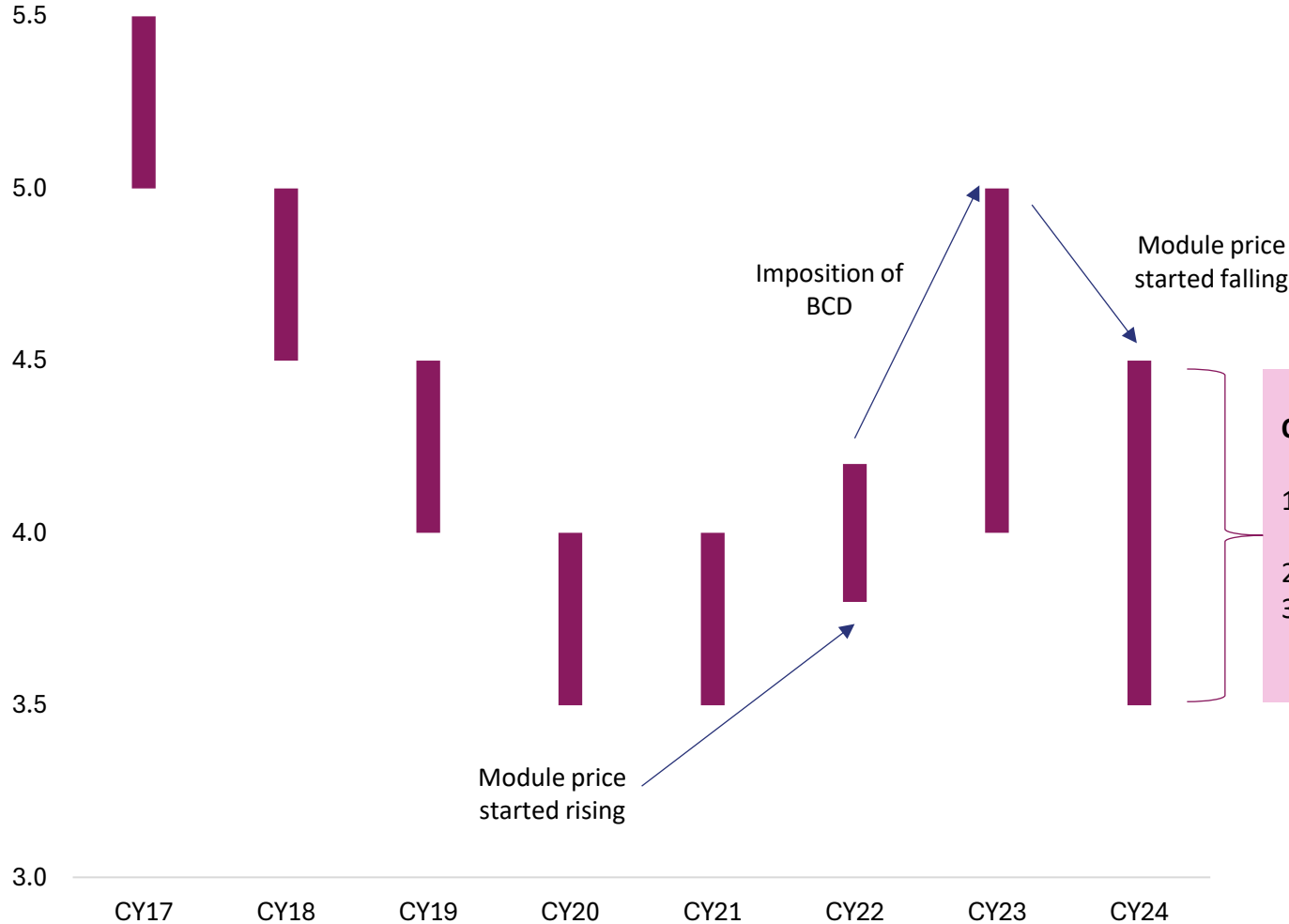
Share of OPEX model is at a 10-year low.

This is due to:

- Generous subsidies available on capital costs
- Increasing share of residential vs. C&I
- Reducing trend of EPC costs

OPEX BASED TARIFFS VARY WIDELY ACROSS STATES

TARIFF TRENDS FOR OPEX BASED PPAs (Rs./unit)



OPEX based tariffs occupy a wider range now as:

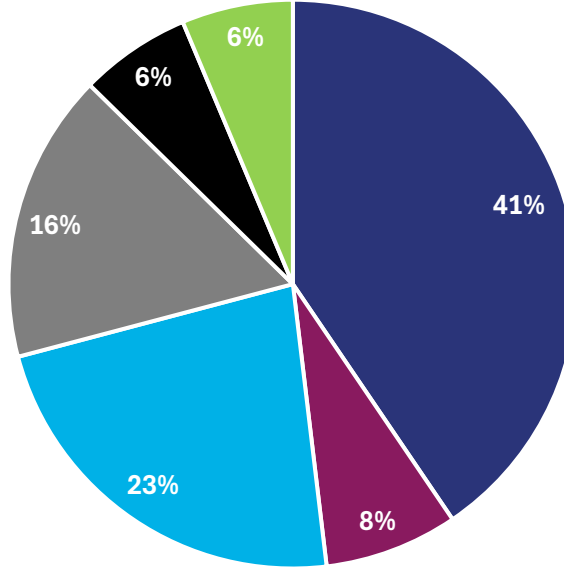
1. Even end-users of lower credit quality have options for open access through OPEX mode
2. Wider variety of end user industries present
3. Variations in open access charges state-wise have increased with increase in standby charges

COMPONENT ECOSYSTEM FOR SOLAR ROOFTOP RIPE WITH OPPORTUNITIES

ELECTRIC COMPONENTS SUPPLIERS



COST BREAKUP OF SOLAR ROOFTOP



SOLAR MODULE SUPPLIERS



- Solar modules
- Inverters
- Miscellaneous
- Mounting structure
- Electric components
- I&C and Allied

INVERTER SUPPLIERS

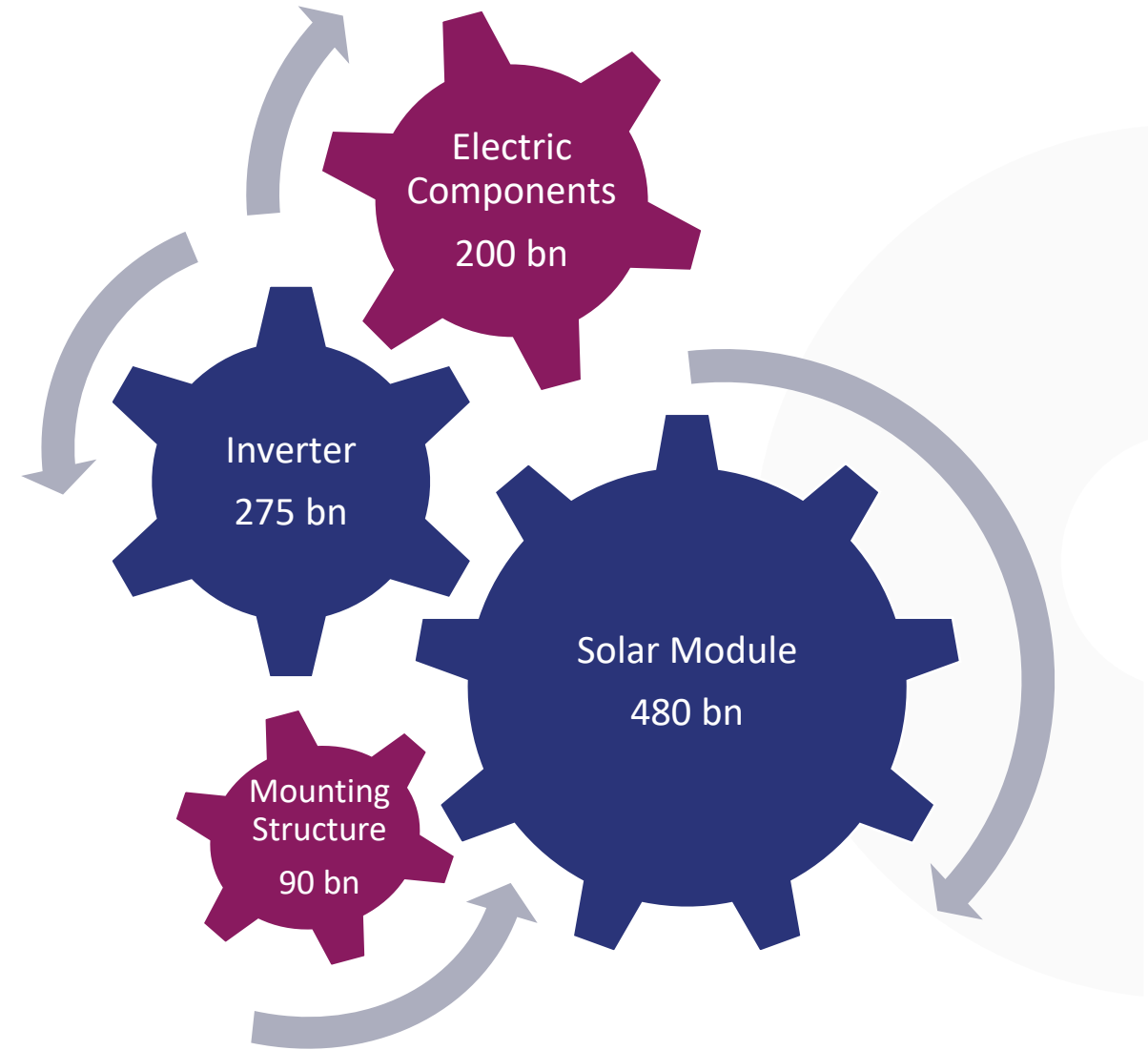


MOUNTING STRUCTURE SUPPLIERS



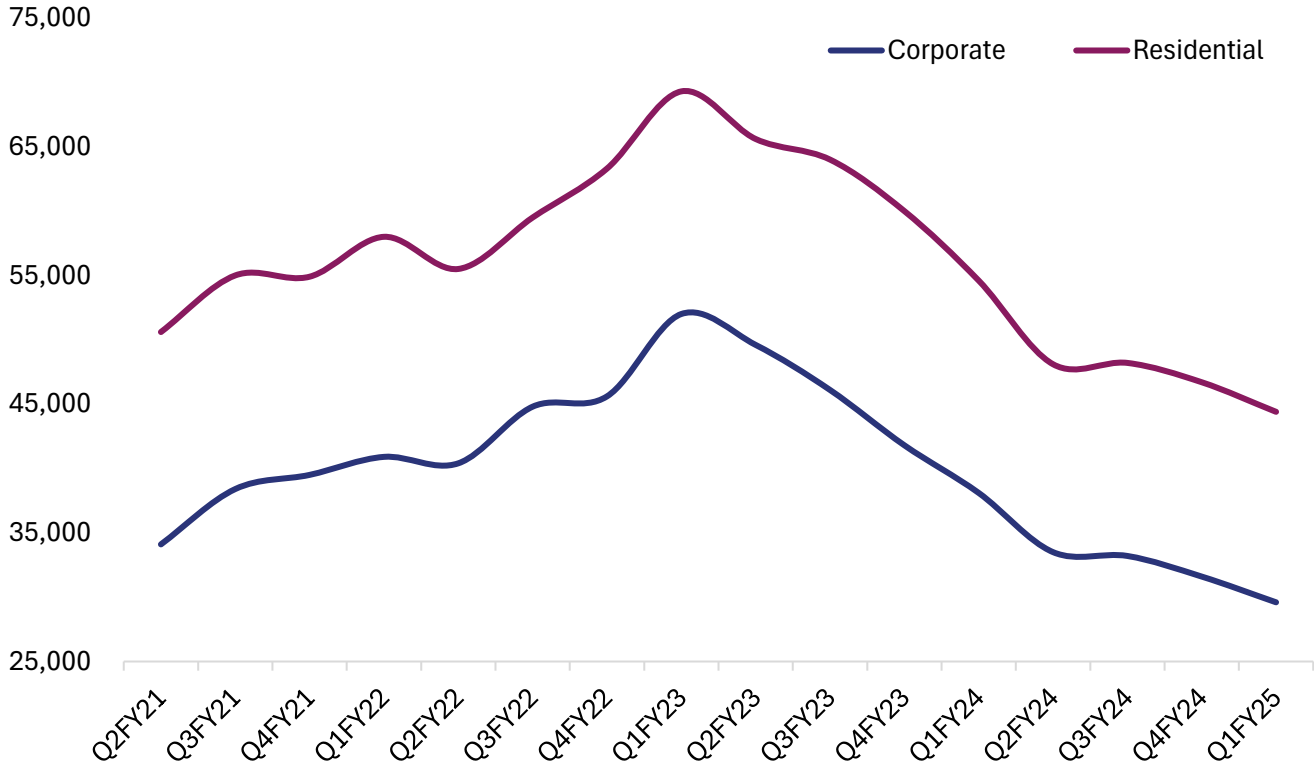
Rs. 1.2 TRN OPPORTUNITY THROUGH PM SURYA GHAR MUFT BIJLEE YOJANA

**OPPORTUNITY SIZE THROUGH
PM-SGMBY (Rs.)**



DEVELOPERS FOCUSED ON PROVIDING COMPLETE SOLUTIONS

EPC COST OF SOLAR ROOFTOP (Rs. per kW)



- Project developers are focusing on industry-wide tie-ups with financiers and equipment suppliers, offering a one-stop solution to rooftop solar
- This ensures supply chain reliability and enhanced cost dynamics

PROJECT DEVELOPERS



EPC PLAYERS



ANNEXURE



GLOSSARY OF KEY TERMS

Term	Explanation
BCD	Basic Customs Duty
BU	billion units
C&I	Commercial and Industrial
CAGR	Compounded Annual Growth Rate
Capex	Capital Expenditure
CEA	Central Electricity Authority
CY	Calendar Year
DISCOM	Distribution Company
EPC	Engineering, Procurement, Construction
FY	Financial Year
GHS	Group Housing Society
GW	Giga-Watt
H1	First Half
H2	Second Half
I&C	Instrumentation and Controls
IPP	Independent Power Producer
kW	kilo-Watt
LCOE	Levelised Cost of Electricity

Term	Explanation
M	Month
mn	million
MNRE	Ministry of New and Renewable Energy
MW	Mega-Watt
O&M	Operating and Maintenance
Opex	Operating Expenditure
PLF	Plant Load Factor
PM-SGMBY	PM Surya Ghar: Muft Bijli Yojana
PPA	Power Purchase Agreement
Q	Quarter
Rs.	Indian Rupees
RTS	Rooftop Solar
RWA	Resident Welfare Association
T&D	Transmission and Distribution
ToD	Time of Day
trn	trillion
Wp	Watt-peak
y/y	year-on-year

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