

Day 2

Solar Energy Overview & Future Potential

Topics to be covered today

- Basics of solar energy and photovoltaics
- Future potential of solar globally and in India
- Comparing solar with other renewables

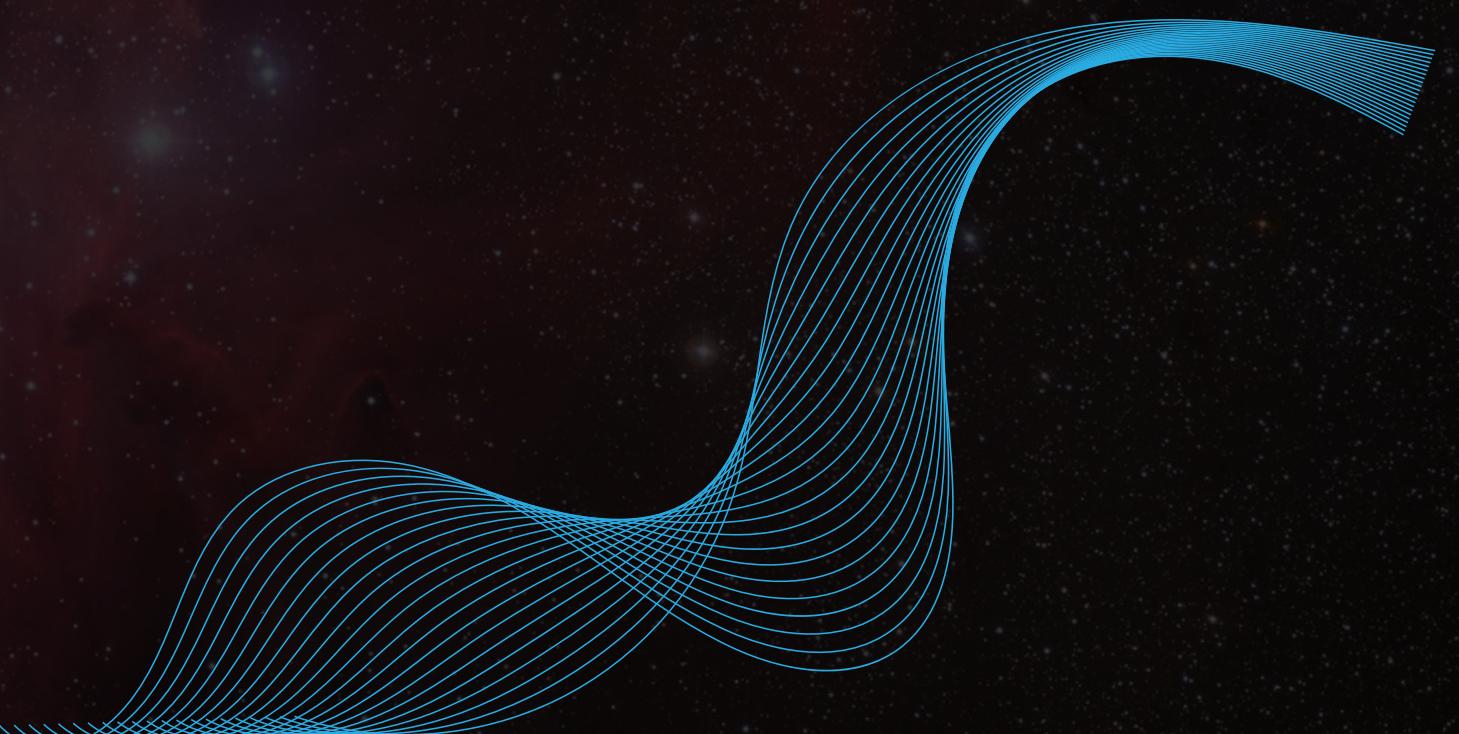


Introduction to Solar Energy



Solar energy is a clean, abundant, and renewable source that plays a central role in India's mission to achieve energy security and climate goals. It converts sunlight into usable electricity using photovoltaic (PV) or thermal technologies.

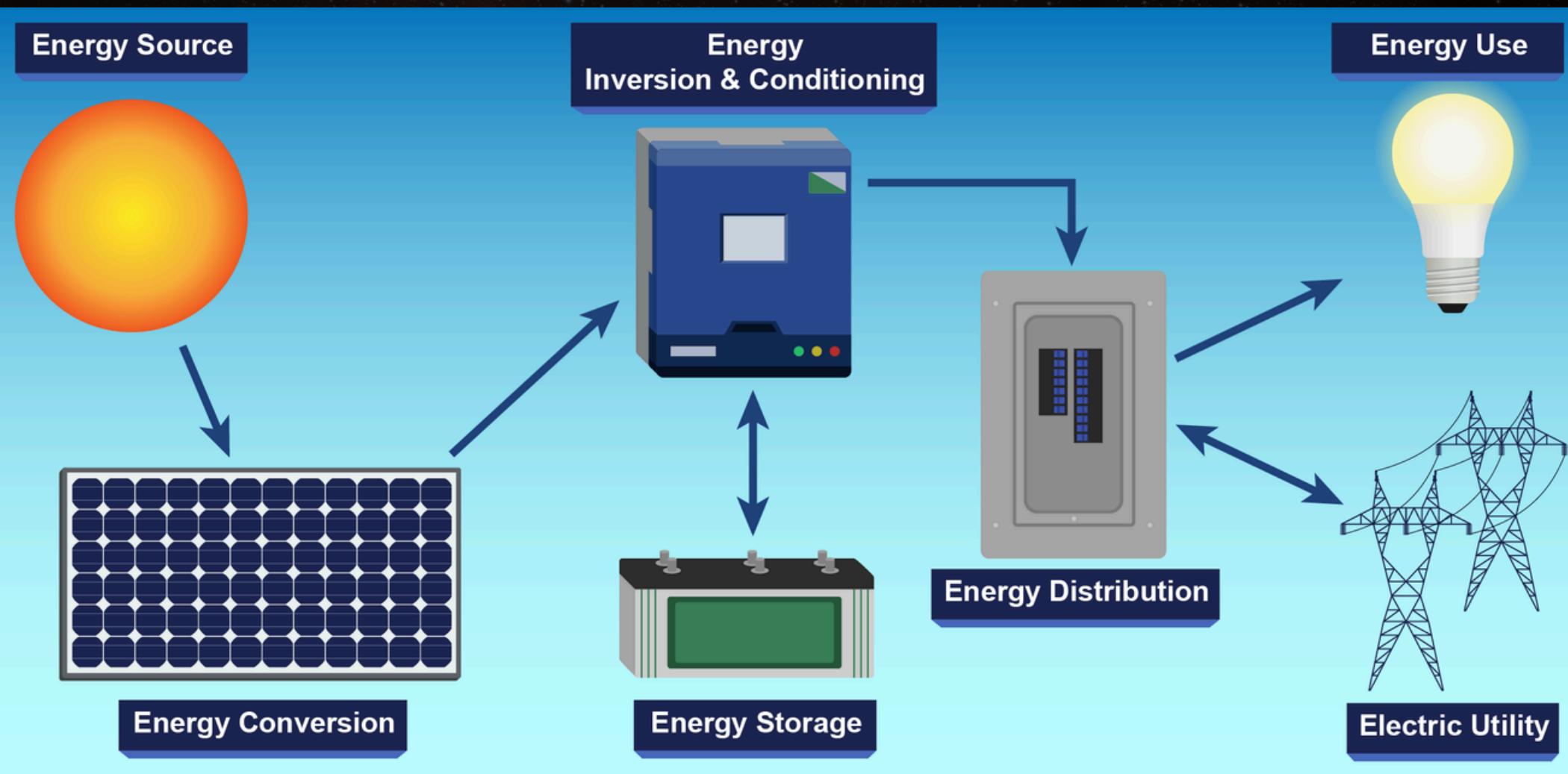
- Harnesses sunlight for electricity generation
- Clean, decentralized, and rapidly scalable
- Central to India's energy transition strategy



Basics of Photovoltaic Technology

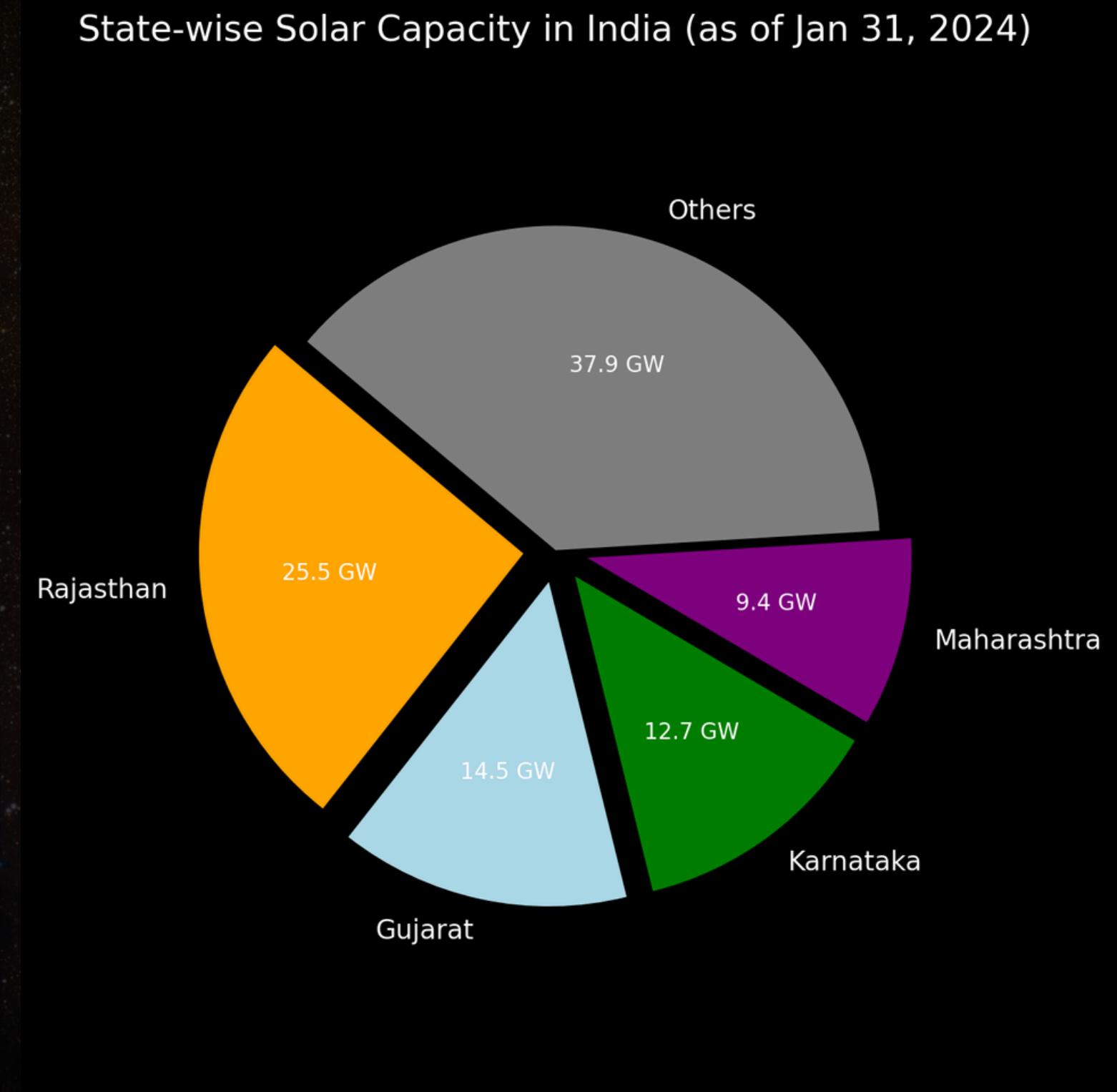
Photovoltaic (PV) technology involves solar cells converting sunlight directly into electricity. India supports both crystalline silicon and thin-film technologies across ground-mounted and rooftop segments.

- Converts solar radiation into electricity
- Used in rooftop, utility-scale, and off-grid applications
- Efficiency typically ranges between 15–22%



Solar Energy in India – Current Status

State-wise Solar Capacity in India (as of Jan 31, 2024)



As of January 31, 2024, India has achieved an installed solar capacity of 73.31 GW, contributing significantly to the national goal of 500 GW non-fossil capacity by 2030.

- 73.31 GW installed (utility + rooftop + off-grid)
- Leading states: Maharashtra, Rajasthan, Gujarat, Karnataka
- Solar accounts for over 40% of India's total renewable capacity

Annual Progress in 2023-24

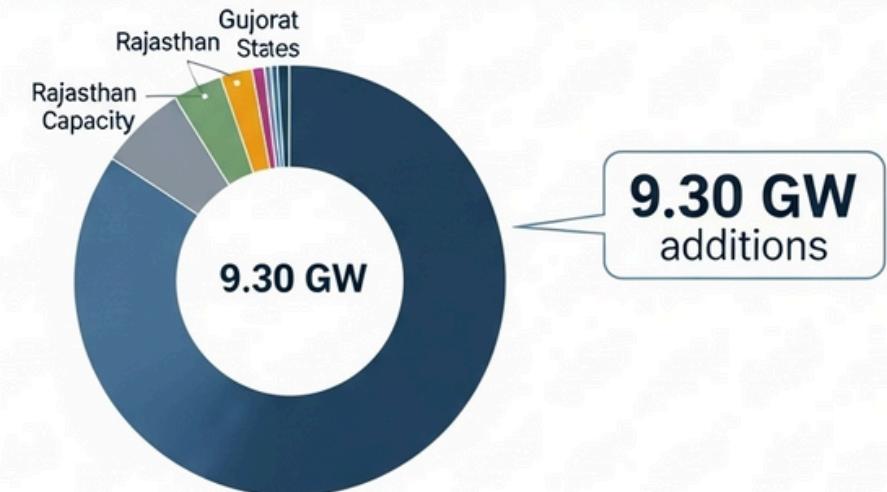
During 2023-24, India added 9.30 GW of solar capacity. Most of this came from large-scale ground-mounted projects under various central and state schemes.

- 9.30 GW solar capacity added in FY 2023-24
- Rajasthan and Gujarat led capacity additions
- Boosted by reverse auctions and policy initiatives

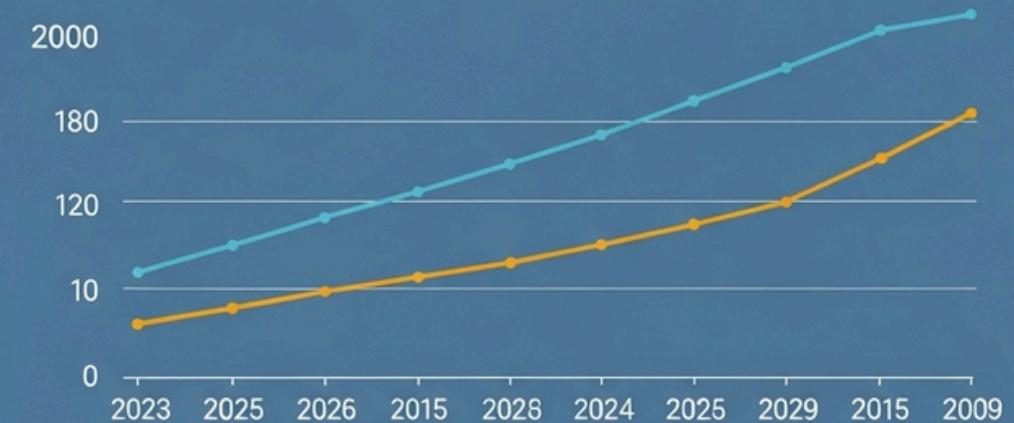
9.30 GW solar capacity added in FY 2023-24

Rajasthan and Gujarat led capacity additions

Boosted by reverse auctions and policy initiatives



**9.30 GW
additions**

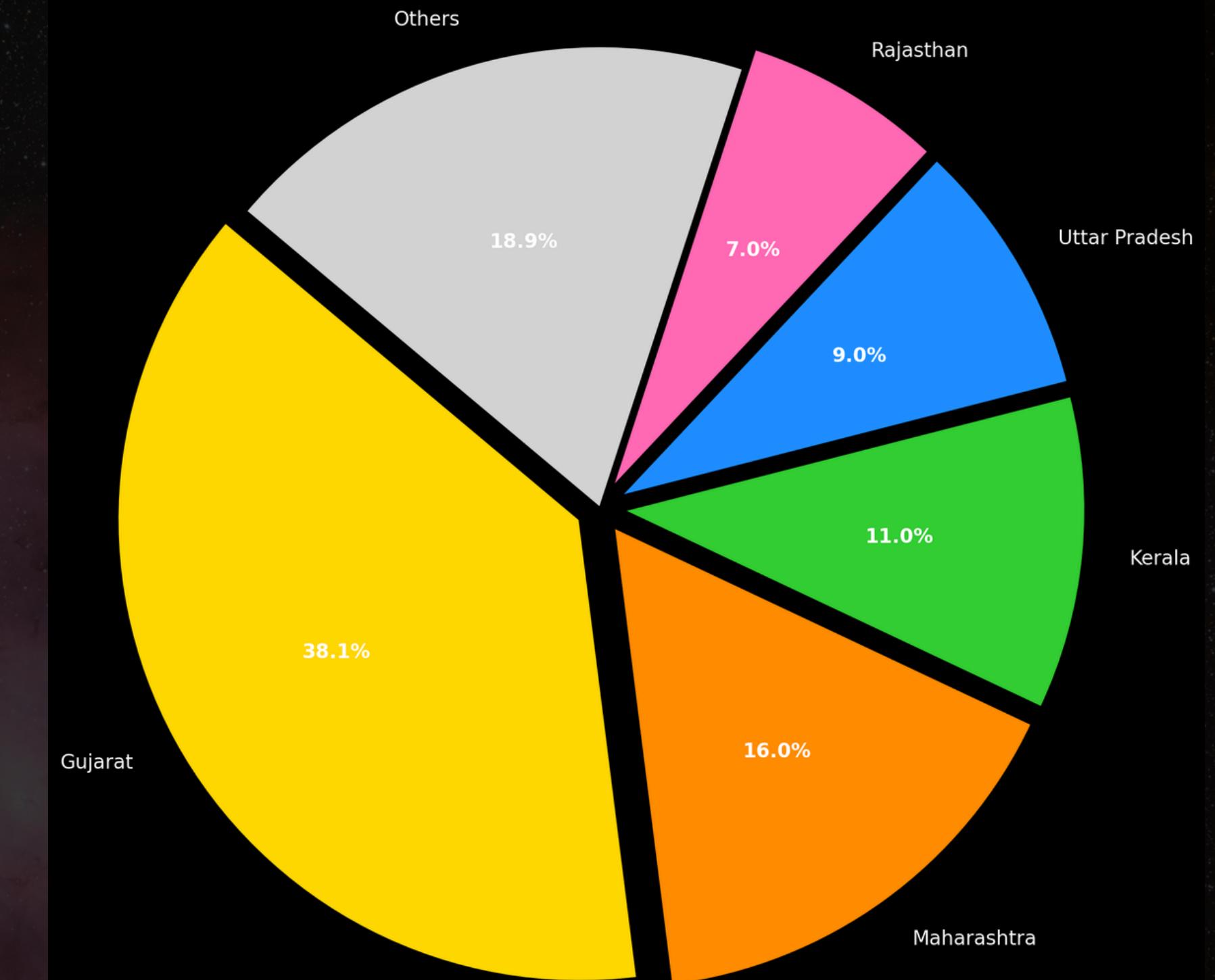


Rooftop Solar Sector

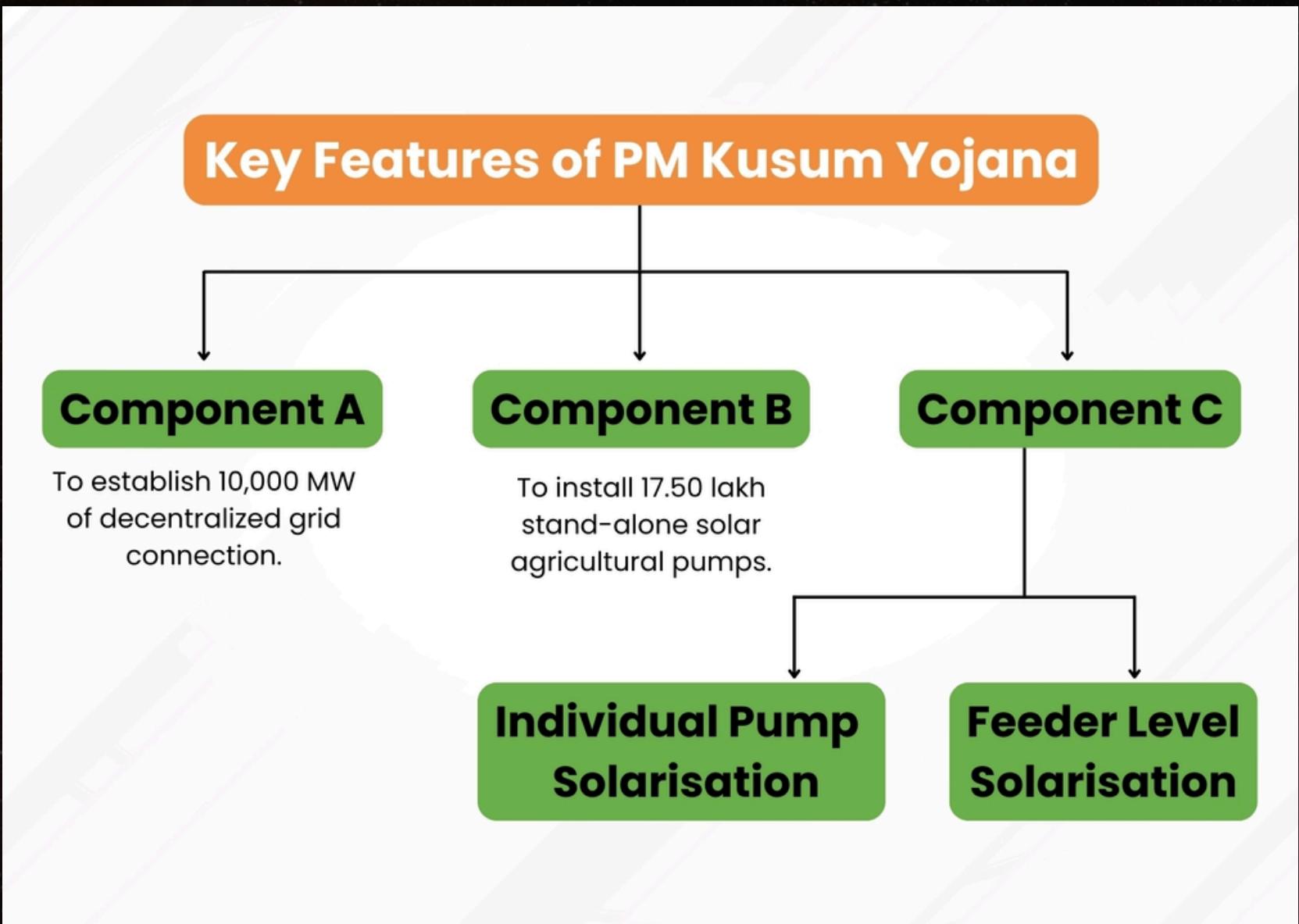
The rooftop segment saw an increase of 1.92 GW in 2023–24, driven by residential schemes and net metering reforms. Yet, it still lags behind utility-scale growth.

- Total rooftop solar: ~11.08 GW
- Residential sector growth via DISCOM-based models
- Challenges: Financing, awareness, and DISCOM approval delays

Top 5 States by Rooftop Solar Installations (2024)



Key Initiatives – PM-KUSUM



The PM-KUSUM scheme aims to solarize agriculture by targeting 30.8 GW through solar pumps and decentralized systems. In 2023-24, over 1.5 lakh pumps were installed.

Key Points :

- Three components: Standalone pumps, feeder-level solarization, grid-connected pumps
- Promotes farmer income security and energy independence
- 1.53 lakh pumps installed in FY 2023-24

Solar Parks & Ultra Mega Projects



Under the Solar Parks Scheme, India has sanctioned 50 parks with a total capacity of 37.99 GW. Projects like Bhadla and Pavagada have become global showcases.

- 10+ GW already commissioned in solar parks
- Facilitates land acquisition and grid connectivity
- Reduces transaction costs for developers

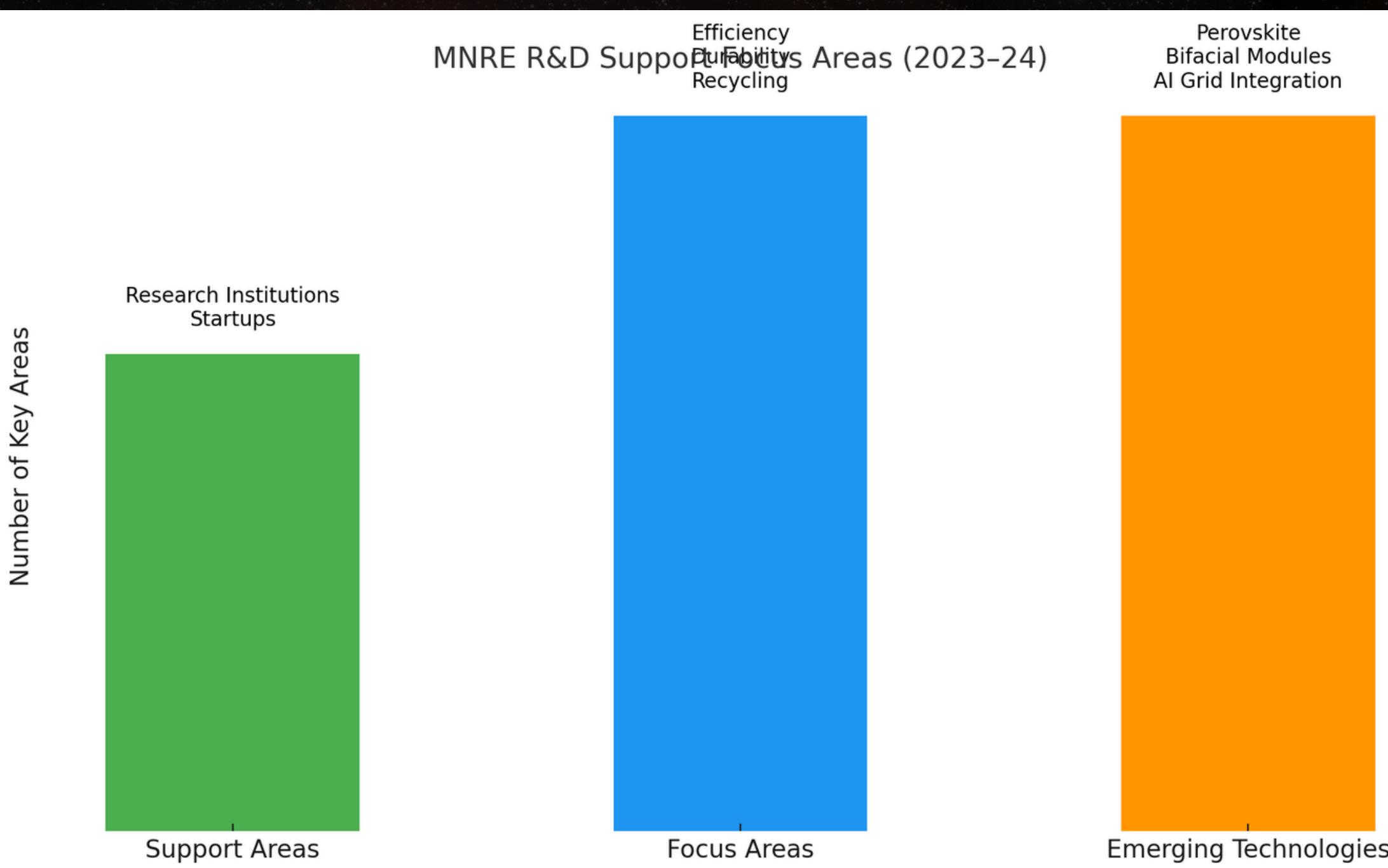
Solar R&D and Innovation

MNRE supported multiple R&D projects in 2023–24, focusing on efficiency improvements, recycling of PV modules, and integration with battery storage.

Support to research institutions and startups

Focus areas: efficiency, durability, recycling

Emerging tech: perovskite, bifacial modules, AI grid integration



International Solar Alliance (ISA)



India continues to lead the International Solar Alliance, promoting solar deployment across 110+ member countries, especially in Africa and Asia.

Promotes investment and knowledge-sharing

Key tool in India's global energy diplomacy

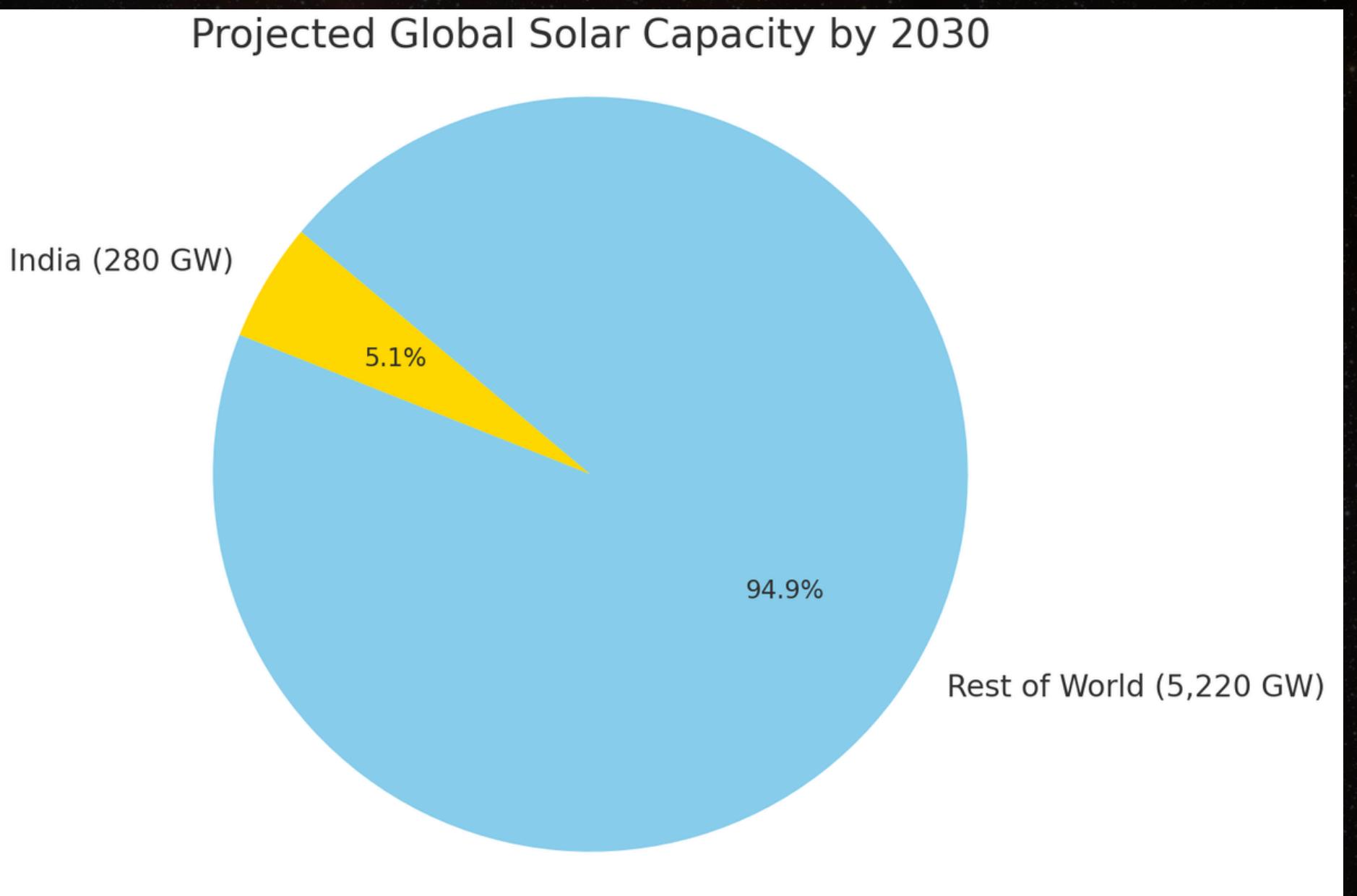
Global vs. Indian Solar Outlook

Globally, solar is expected to reach 5,500 GW by 2030. India's share of solar will continue to rise as it aims to add 280 GW by 2030—more than three times current capacity.

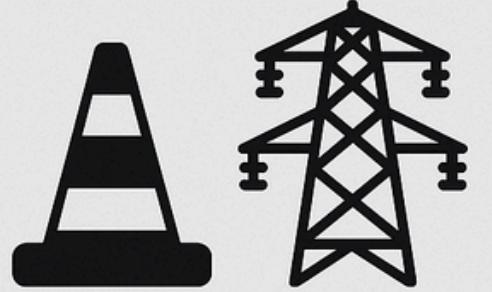
India's solar goal: 280 GW by 2030

Global cost declines: ~89% drop since 2010

India among top 5 global solar markets



Challenges & Barriers



Land and transmission bottlenecks



Delays in payments by DISCOMs



Lack of skilled workforce for solar O&M

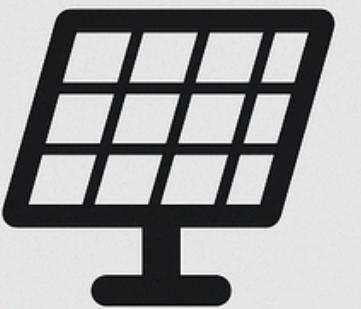
Despite progress, solar expansion faces hurdles like land acquisition, policy inconsistencies, curtailment, and low DISCOM creditworthiness.

Land and transmission bottlenecks

Delays in payments by DISCOMs

Lack of skilled workforce for solar O&M

Conclusion – The Road Ahead



**Massive capacity additions needed
(200+ GW in 6 years)**



**Prioritize rooftop,
storage, domestic
manufacturing**

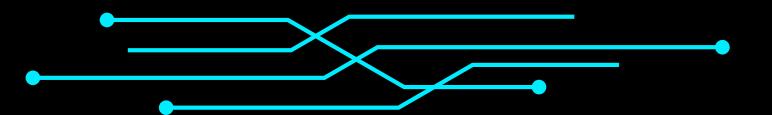


**Ensure equitable
energy access
across states**

Solar energy will be the cornerstone of India's clean energy future. Achieving 280 GW of solar by 2030 will require robust policy, innovation, and global cooperation.

- Massive capacity additions needed (200+ GW in 6 years)
- Prioritize rooftop, storage, domestic manufacturing
- Ensure equitable energy access across states

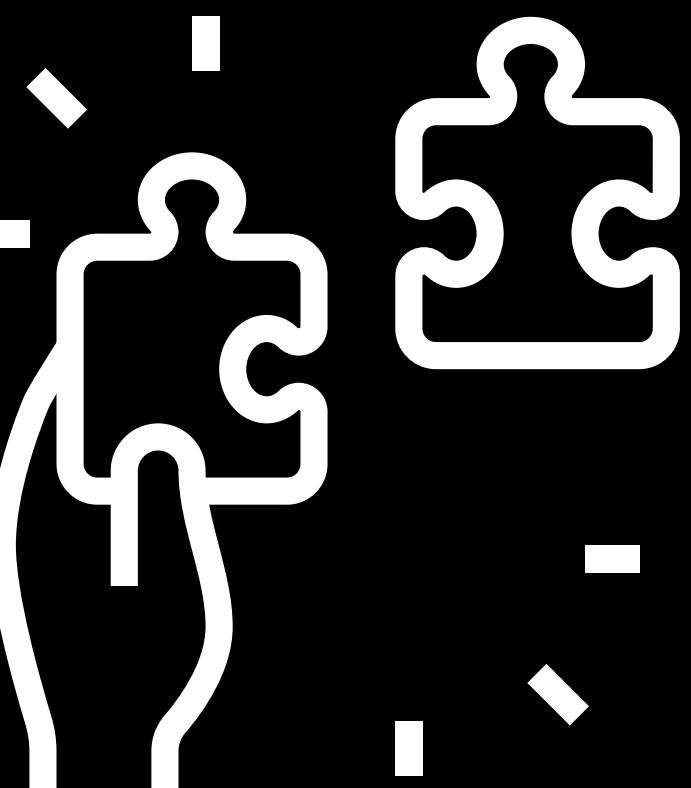
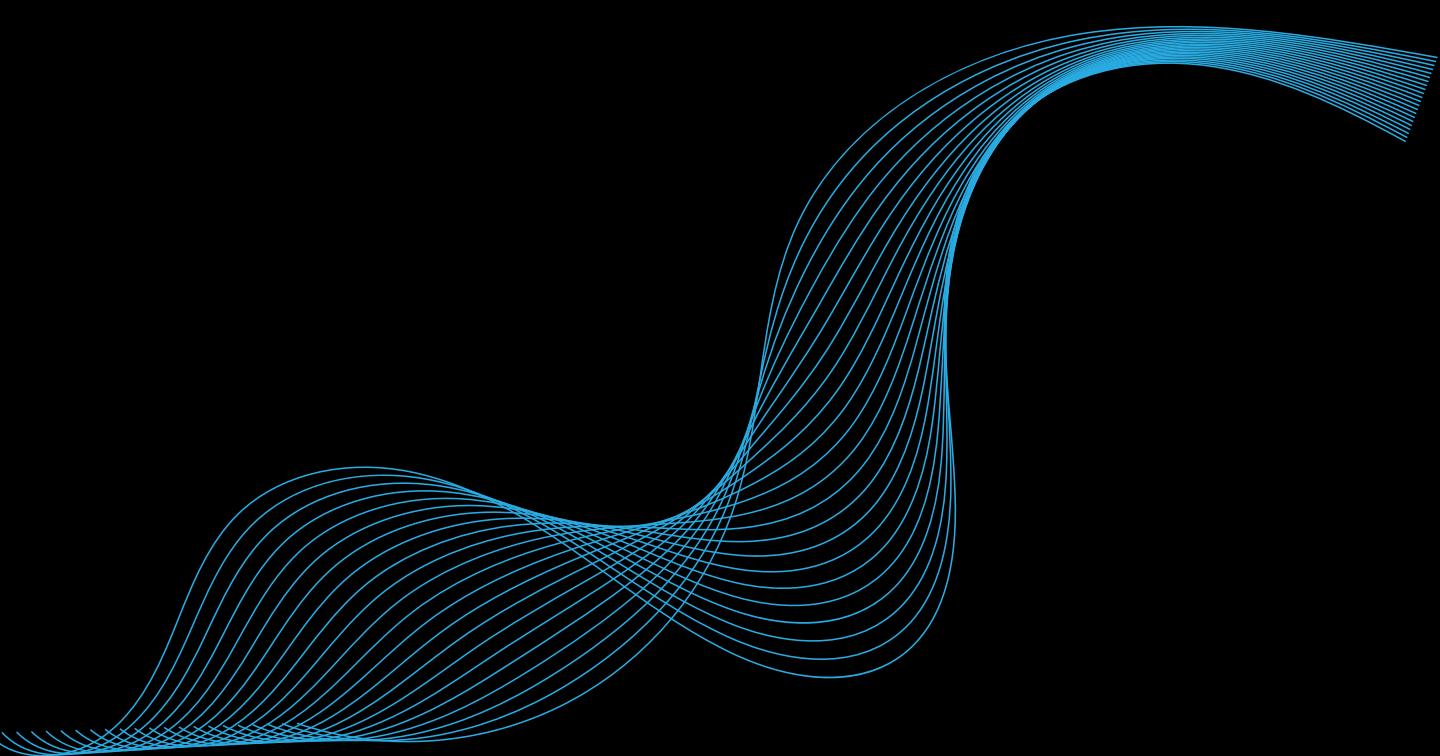
REVIEW QUESTIONS



Ques 1. Can you think of more challenges & barriers other than mentioned in the slides?

Ques 2. Apart from PM-KUSUM do you know any other government schemes?

Ques 3. Which reasons in the country are more developed in terms of solar tech and what do you think are the main cause for that?



got any doubts
regarding the
course?

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