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**Session :** INDIA @ 100 in 2047: Vision for the Indian Power System

# An overview of the challenges in reaching the 2030 solar PV target in India

***Presented By***

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# INTRODUCTION

Policies plays a major role in achieving the energy targets

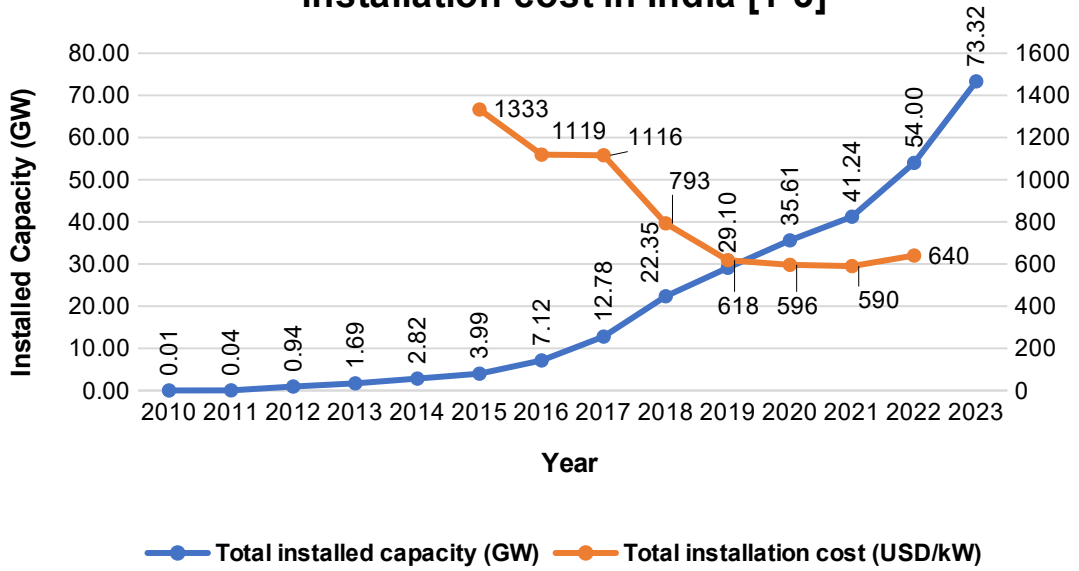
Jawaharlal Nehru National solar mission (JNNSM), 2010

National Solar Mission (NSM), 2015

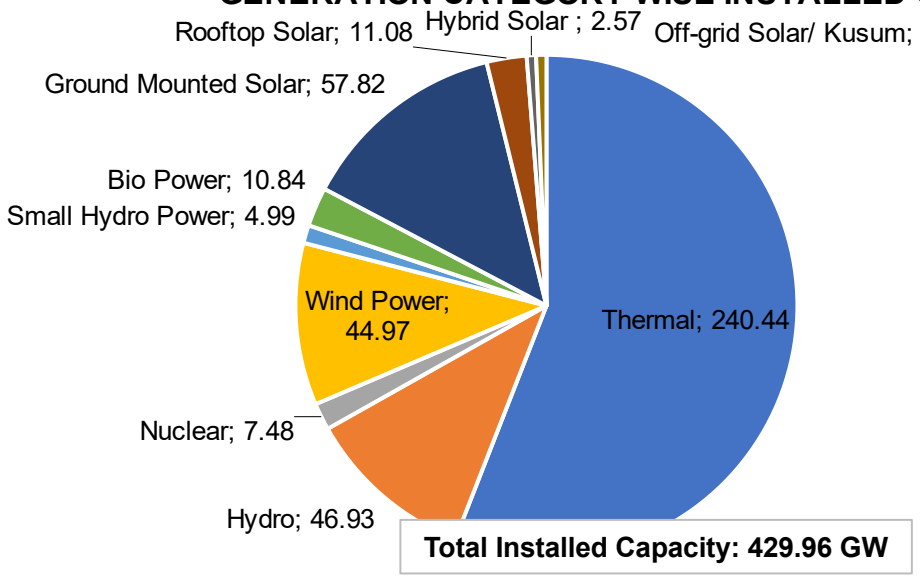
**74.31 GW** Solar PV Installed Capacity.

Contributes to 17.28 % of total installed capacity & 40.81 % among all renewable based sources.

**Historical solar PV installed capacity and installation cost in India [1-3]**




**GENERATION CATEGORY WISE INSTALLED CAPACITY (GW) [4]**



# BACKGROUND OF THE STUDY


## Historical challenges faced in reaching the solar PV targets [5]:

- **Technological Barriers** (Low conversion efficiency, Intermittent nature, Operation in high temperature leading to component failure)
- **Economical Barriers** (High investment cost)
- **Environmental Barriers** (Emissions in manufacturing process, recycling of e-waste)
- **Social Barriers** (Lack of social awareness)
- **Auxiliary Barriers** (Dust deposition and cleaning)

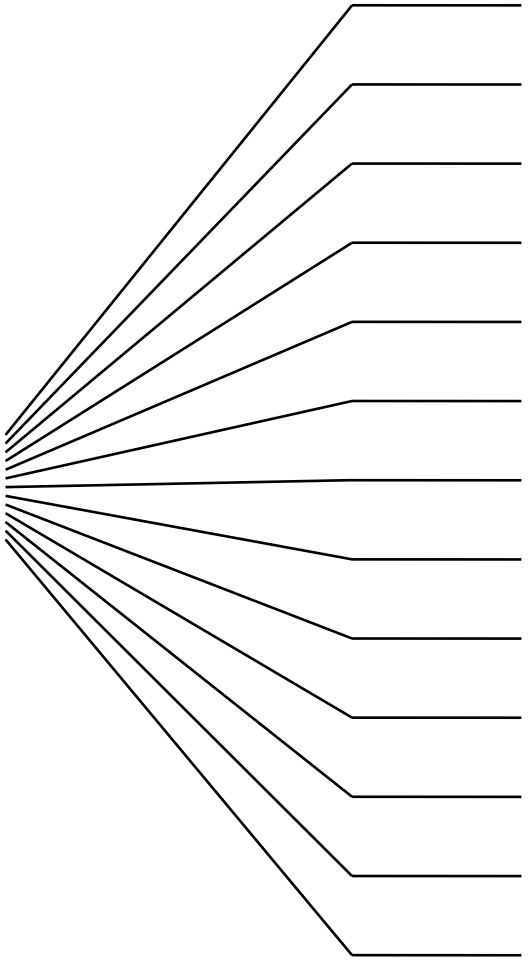
# RELEVANCE OF THE STUDY

**Energy targets of India:**

- 500 GW of renewable energy by 2030 consisting of 280 GW from solar PV
- Net zero target by 2070

**Future Challenges**

**Several stakeholders of solar PV:**



Solar PV Manufacturers (Raw material to panel)

Suppliers/ Distributors/ Retailers

Consumers (Residential, Commercial, Industrial)

Government & Regulatory Bodies (Role of policy, regulations, incentives etc.)

Grid Operators/ DISCOMs (Grid management)

Operations and Maintenance providers (Performance monitoring & maintenance)

Research and Development Agencies (Academic & research organisations)

Insurance Providers (Cover risk from solar PV projects)

Environmental Agencies

Certification and Standard Bodies

EPC Contractors (Project execution & Quality assurance)

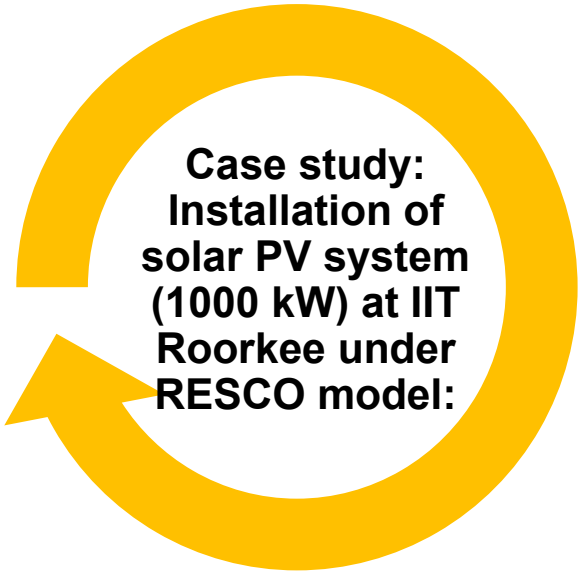
Investors and Financiers

Project Developers (Plan, Design and implement)

# CHALLENGES ASSOCIATED WITH STAKEHOLDERS

## 1 Challenges associated with government and regulatory bodies [6]:

- Development of sustainable models for rooftop solar PV which is economical viable, compatible, and possible.
  - RESCO model
  - CAPEX model
- Concern in acquiring suitable land for solar PV projects to support development of large-scale PV projects.
- Limitations in the financial resources, which can impact their ability to provide significant incentives, subsidies, or funding for solar projects.
- Tackling the recycling of PV panel waste after its end of life will be an issue for government and regulatory bodies.



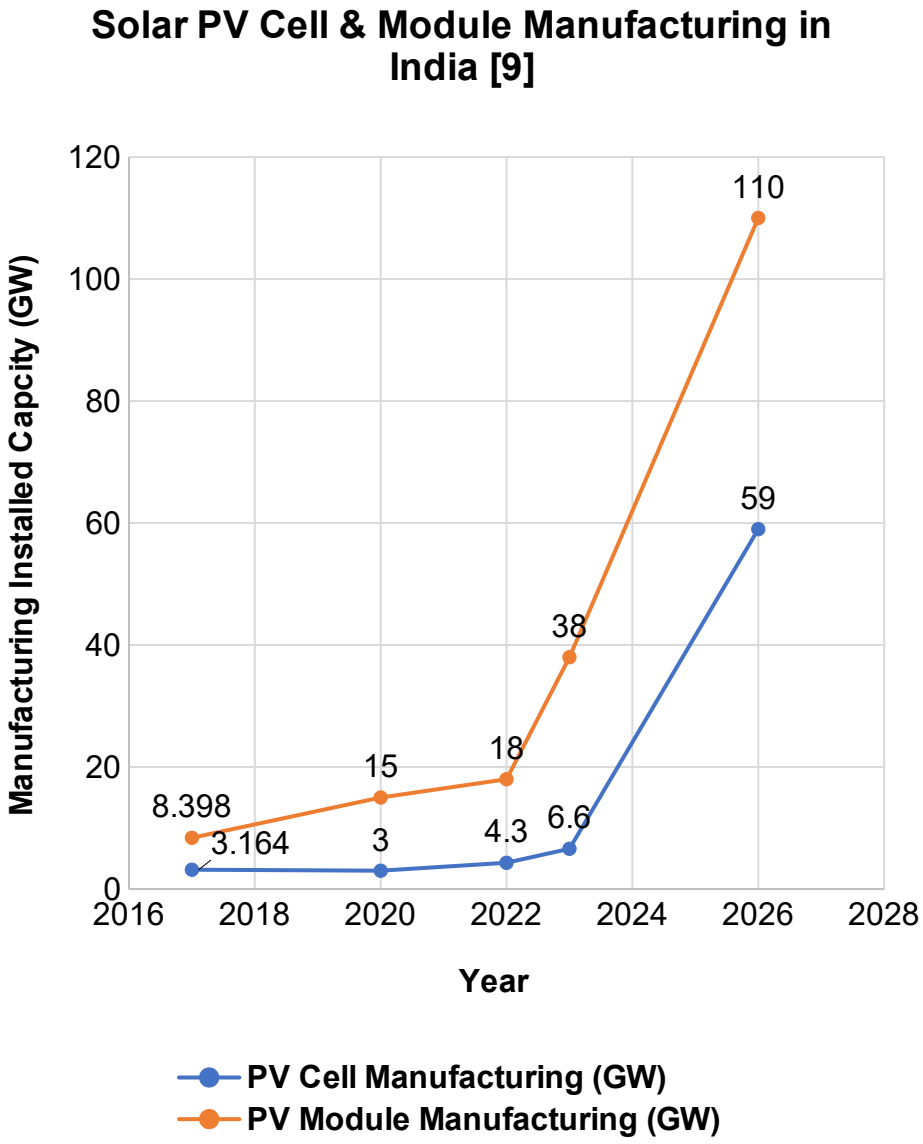

- • Space Required – 6000 $m^2$
- • Mode - RESCO
- • Tariff – Rs 1.899/ unit
- • Term – 25 Years Fixed Tariff
- • Current tariff – Rs 5.4 / unit
- • Saving - Rs 3.51/ unit
- • 1000 KW Solar Produces 14 Lakh units annually
- • Annual Savings in Electricity – Rs 49.14 Lakh
- • Additional Savings – Reduction in Peak Demand

## 2 Challenges associated with solar PV developers [7`]:

| | | | | |
|---|---|---|---|---|
| Lack of **effective communication** between PV developers and manufacturers. | Challenge in the operational and maintenance that require diligent **monitoring and management** throughout the entire lifespan of solar installations. | Challenges due to the **ever-changing market conditions** and the unpredictable nature of solar power demand. | Delays in securing the required **permits and approvals** can result in significant project delays. | **Imposition of Custom Duties** (e.g. BCD) is a challenge for solar PV developers, affecting project economics and viability. |

# 3 Challenges associated with solar PV manufacturers [8]:

- Manufacturers are constantly facing the challenge of reducing production costs due to **intense price competition** with international manufactured PV panels.
- **Ever-changing nature of solar PV technology** requires manufacturers to stay up to date with advancements, presenting both an opportunity and a challenge.
- **Shortage of skilled workers** in solar manufacturing is also a critical challenge, along with an underdeveloped supply chain, adds to the complexity of the situation.
- Factors such as global supply chain disruptions, geopolitical events, and the ongoing COVID-19 pandemic introduce **uncertainties that affect the availability and cost of raw materials**.



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# Challenges associated with Distribution Companies (DISCOMs) [10]:

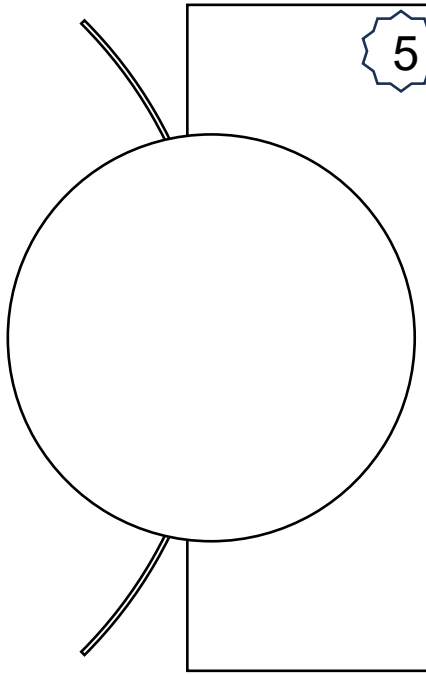
DISCOMs face significant challenges related to consumer dynamics, particularly the differences in payment structures between residential and C&I consumers.

Channelization of private investment in the distribution sector is a challenge for state-owned DISCOMs.

DISCOMs perceive solar PV rooftop as a challenge leading to revenue loss and financial implications.

Requirement in improving the infrastructure: DISCOMs would need to upgrade Distribution System Operators (DSO) and implementing Virtual Power Plants.

Integrating small-scale, distributed solar installations presents additional challenges for DISCOMs as they navigate the changing landscape of renewable energy adoption.



## 5 Challenges associated with Grid Operators [11]:

- Maintaining the grid stability in terms of voltage stability, output power prediction, frequency response and reactive power support.
- Large-scale solar projects may also necessitate transmission and distribution upgrades to ensure optimal power flow and reliability.
- It is crucial for grid operators to engage in accurate long-term planning and capacity expansion to accommodate the increasing solar PV capacity.
- In protecting PV systems from various faults, the conventional protection standards need to be updated.
- Additionally, it is essential to develop strategies that address grid resilience and security challenges, such as cyber threats and extreme weather events, to ensure a strong and dependable energy infrastructure.

## 6 Challenges associated with solar PV consumers [12]:

- The high initial costs are a big problem that might stop people, especially those who live in homes, from using solar energy.
- People are hesitant to buy solar PV systems because they are worried about how much maintenance they will need and how long they will last.
- Not much information of solar energy benefits. It is crucial to educate consumers about the environmental, financial, and energy security benefits of solar PV.

# CONCLUSION & RECOMMENDATIONS

1. Policy uncertainties, land acquisition, supply-demand imbalances, and concerns about grid stability are some major challenges hindering the solar PV growth in the country.
2. It is crucial to adopt a collaborative approach involving multiple stakeholders, enhancing communication and collaboration within the solar industry for effectively addressing challenges in a comprehensive manner.
3. In addition, it is crucial to prioritize the development of expertise in the solar industry to tackle the issue of a lack of experienced workers.
4. It is crucial for policymakers to suggest and execute robust policies and regulatory frameworks that cover the entire manufacturing supply chain to enhance domestic manufacturing.
5. Available options are to provide low-interest rates, free land and reduced electricity tariffs to support domestic manufacturing. The Production Linked Incentives (PLI) scheme is a significant development that can provide incentives to the solar manufacturing industry, making it a positive step forward.
6. It is crucial to consider trade policies, technological advancements, and domestic support mechanisms to promote a strong and competitive solar PV manufacturing industry in India.
7. Investing in advanced grid management technologies is crucial for grid operators to ensure a stable and reliable power supply. Also, Hybrid power plants that combine solar PV and wind are emerging as a promising solution, offering a continuous supply of power and a higher capacity factor.

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# THANK YOU

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