STANDING COMMITTEE ON ENERGY

10

(2024-25)

EIGHTEENTH LOK SABHA

MINISTRY OF NEW AND RENEWABLE ENERGY

PERFORMANCE EVALUATION OF SOLAR POWER PROJECTS IN THE COUNTRY

TENTH REPORT

सत्यमेव जयते

LOK SABHA SECRETARIAT
NEW DELHI

September, 2025/Bhadrapad, 1947 (Saka)

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MINISTRY OF NEW AND RENEWABLE ENERGY

PERFORMANCE EVALUATION OF SOLAR POWER PROJECTS IN THE COUNTRY

Presented to Hon'ble Speaker on 4th October, 2025

Presented to the Lok Sabha on _____

Laid in the Rajya Sabha on _____

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NEW DELHI

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REPORT

CONTENTS

COMPOSITION OF THE STANDING COMMITTEE ON ENERGY (2024-25)

LOK SABHA

Shri Shrirang Appa Barne - Chairperson

2. Shri Shyamkumar Daulat Barve
3. Shri Jagadish Chandra Barma Basunia
4. Shri Devusinh Chauhan
5. Shri Shahu Shahaji Chhatrapati
6. Captain Brijesh Chowta
7. Shri Malaiyarasan D.
8. Shri Chandra Prakash Joshi
9. Dr. Shivaji Bandappa Kalge
10. Dr. Kirsan Namdeo
11. Shri Nilesh Dnyandev Lanke
12. Shri Dulu Mahato
13. Shri Ramprit Mandal
14. Smt. Bijuli Kalita Medhi
15. Shri Jagdambika Pal
16. Shri Kunduru Raghuveer
17. Smt. Shambhavi
18. Shri Chandubhai Chhaganbhai Shihora
19. Dr. Shrikant Eknath Shinde
20. Shri Abhay Kumar Sinha
21. Smt. Dimple Yadav

RAJYA SABHA

22. Shri Gulam Ali
23. Shri Birendra Prasad Baishya*
24. Dr. Laxmikant Bajpayee
25. Shri Ajit Kumar Bhuyan
26. Shri R. Dharmar
27. Shri N.R. Elango
28. Shri Javed Ali Khan
29. Shri Harsh Mahajan
30. Smt. Mamata Mohanta
31. Shri Rajeev Shukla

SECRETARIAT

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2.	Shri Kulmohan Singh Arora	Director
3.	Shri Ajitesh Singh	Deputy Secretary
4.	Ms. Madhumita	Assistant Committee Officer

**Shri Birendra Prasad Baishya ceased to be Member of the Committee consequent upon his retirement from Rajya Sabha on 14th June, 2025. He has been re-nominated as a Member of the Committee w.e.f. 24th July, 2025.*

INTRODUCTION

I, the Chairperson, Standing Committee on Energy, having been authorized by the Committee to present the Report on their behalf, present this Tenth Report of the Committee on the subject 'Performance Evaluation of Solar Power Projects in the Country' pertaining to the Ministry of New and Renewable Energy.

2. The Committee held a briefing on the subject with representatives of the Ministry of New and Renewable Energy and Solar Energy Corporation of India Limited on 3rd April, 2025. Thereafter, the Committee held discussion with representatives of the NHPC Limited, SJVN Limited, Solar Energy Corporation of India Limited and NTPC Green Energy Limited on 20th May, 2025. On 4th June, 2025, the Committee held discussion with representatives of the Adani Green Energy Limited, Tata Power Renewable Energy Limited and Azure Power. Further, the Committee held discussion with representatives of the Ministry of Power and Power Grid Corporation of India Limited on 23rd July, 2025.

3. The Committee took evidence of representatives of the Ministry of New and Renewable Energy on 5th August, 2025. The Committee wish to express their thanks to all the representatives of the above mentioned Ministries and Organizations for appearing before the Committee and furnishing the desired information in connection with the issues relating to the subject.

4. The Report was considered and adopted by the Committee at their Sitting held on 8th September, 2025.

5. The Committee place on record their appreciation for the assistance rendered to them by the officials of the Lok Sabha Secretariat attached to the Committee.

6. For the facility of reference and convenience, the observations and recommendations of the Committee have been printed in bold letters in Part-II of the Report.

New Delhi;
9th September, 2025
Bhadrapad 18, 1947 (Saka)

Shrirang Appa Barne
Chairperson,
Standing Committee on Energy

REPORT

PART I
NARRATION ANALYSIS

Chapter I
Introductory

1.1 As per the Ministry of New and Renewable Energy (MNRE), the National Solar Mission (NSM), launched in January 2010, is one of the eight core missions under India's National Action Plan on Climate Change (NAPCC), which was introduced in June 2008. The mission aimed to establish India as a global leader in solar energy by creating conducive policy conditions for the rapid diffusion of solar technology across the country.

1.2 NSM was designed to harness the solar potential of India through clearly defined targets. The original goals included deploying 20,000 Mega Watt (MW) of grid-connected solar power by 2022, promoting indigenous solar manufacturing capabilities, especially in solar thermal, and facilitating off-grid solar applications targeting 1000 MW by 2017 and 2000 MW by 2022. Additionally, it sought to install 15 million square meters of solar thermal collector area by 2017, scaling to 20 million sq. meters by 2022, and deploy 20 million solar lighting systems in rural areas by 2022.

1.3 Recognizing the growing importance of Renewable Energy (RE), the government scaled up its ambitions on 1st July 2015, increasing the target for grid-connected solar power from 20,000 MW to 1,00,000 MW, aligning with India's first Nationally Determined Contribution (NDC) under the Paris Agreement. Status of achievement of various targets under the National Solar Mission upto 2022 is mentioned in the table below:

Targets	Progress on Deliverables
1,00,000 MW of solar power by 2022.	Up to 31.03.2022, around 53,996.54 MW capacity was installed.
To create favourable conditions for developing solar manufacturing capability in the	MNRE consistently bringing out policies for developing and facilitating Solar Photo Voltaic (PV) manufacturing ecosystem in the country. i. Production Linked Incentive (PLI) Scheme for High Efficiency Solar PV

country.	Modules. ii. Domestic Content Requirement (DCR) in schemes of MNRE. iii. Preference to 'Make in India' in Public Procurement. iv. Imposition of Basic Customs Duty on import of Solar PV cells & modules with effect from 01.04.2022. v. Discontinuation of Customs Duty Concessions with effect from 02.02.2021.
20 million sq. m. solar thermal collector area by 2022	Up to 2016-17, 11 million sq. meters of solar thermal collector area was installed. The specific scheme ended in 2016-17 and since then it is implemented through market mode.
2 Giga Watt (GW) of off-grid solar applications, including 20 million Solar lights by 2022	As on 31.03.2022, aggregate capacity of 1.55 GW was installed under off-grid programme, which included: Solar Home Lights: 17,23,479; Solar Lamps: 84,59,119 and Solar Street Lights: 9,34,941; Total: 11.12 million

1.4 At CoP 26 in November 2021, the Hon'ble PM announced the 'Panchamrit' goals for India which included:

(i) Non-fossil energy capacity to reach 500 GW by 2030

(ii) 50% of electricity capacity from non-fossil sources by 2030

(iii) Projected carbon emissions to reduce by 1 billion tonnes by 2030

(iv) Emissions intensity of GDP to reduce by 45% by 2030 (vs. 2005)

(v) Net-zero by 2070

1.5 As per MNRE, the total installed non-fossil fuel-based energy capacity in the country is about 243 GW and about 186 GW capacity is under implementation and 69 GW capacity is under bidding, as on 30.06.2025. The details are given in the table below:

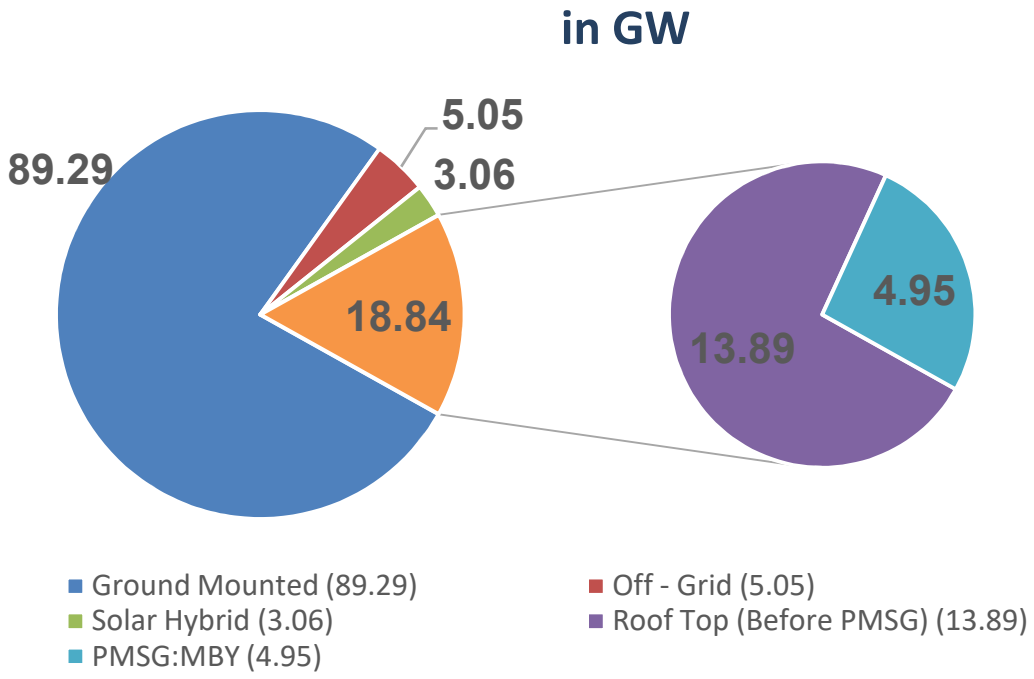
Sector	**Installed capacity (GW)**	**Under Implementation (GW)**	**Tendered (GW)**	**Total Installed/ Pipeline (GW)**	**Targeted Capacity by 2030 (GW)**
Solar Power	116	128*	62	306	292
Wind Power	52	30	---	82	100
Bio Energy	12	---	---	12	15

Hydro	54	22	---	76	78
Total RE	**234**	**180**	**62**	**476**	**485**
Nuclear Power	9	6	7	22	15
Total Non-Fossil Fuel	**243**	**186**	**69**	**498**	**500**

*Includes Hybrid/Round the Clock (RTC)

1.6 MNRE has furnished that as per the 'Renewable Capacity Statistics 2025' of International Renewable Energy Agency (IRENA), India has the third-largest installed capacity in renewable energy and the third-largest in solar, after China and USA (December 2024).

1.7 Out of the 116 GW Solar capacity installed, the share of different components viz. Ground Mounted, Off-Grid, Solar Hybrid and Rooftop Solar [before and after PM Surya Ghar:Muft Bijli Yojana (PMSG:MBY)] has been shown in the chart below:



1.8 As per MNRE, India has achieved its target of 50% installed capacity from non-fossil sources, as out of the total installed capacity of 485 GW, 243 GW is from non-fossil sources (June, 2025). However, when it comes to actual generation of electricity, the Ministry's data shows that the non-fossil sources contribute only around 26%. This is because the RE based generation is inherently intermittent and non-dispatchable in nature.

1.9 MNRE has furnished details with regard to its budget and expenditure in solar sector during the last five years, as given in the table below:

Financial Year	Budget Estimates	Revised Estimates	Actuals
2021-22	3727.78	3499.87	2732.86
2022-23	5205.79	4980.46	3881.27
2023-24	7452.31	6041.56	4834.07
2024-25	18394.75	13239.78	12238.46
2025-26	24224.36	-	-

1.10 A table showing the State-wise/UT-wise installed solar capacity (as on 31.07.2025) has been attached at **Annexure-I.**

Chapter II
Evaluatory Mechanism for assessing Solar Plant Performance

Solar Potential of India

2.1 In 2014, the National Institute of Solar Energy (NISE) released India's first Solar potential map, estimating a total Solar capacity of 748.98 Giga Watt peak (GWp). This initial assessment was based on a set of assumptions, including the utilization of 3% of the country's wasteland for solar installations and a standard solar module efficiency of 15%.

2.2 Recognizing the need for more accurate and context-specific data, NISE has upgraded its methodology for solar potential assessment. In collaboration with the National Remote Sensing Centre (NRSC), Indian Space Research Organisation (ISRO); the revised assessment employs high-resolution geospatial data and integrates a broader range of parameters, such as Land use and land cover, Topography (slope and aspect), Proximity to infrastructure, and Solar irradiance. Unlike the earlier approach of fixed 3% wasteland utilization, the updated methodology identifies suitable land parcels based on a combination of parameters mentioned above enabling more accurate estimation of ground mounted solar potential of the country. As per the Ministry of New and Renewable Energy (MNRE), the reassessment study of solar potential in the country is under way in NISE and the report is under finalization.

Mechanism for assessing Solar Plant Performance

2.3 According to MNRE, the performance evaluation of utility-scale solar PV power plants is conducted through standardized methodologies to assess Generation performance (energy yield, efficiency), long term reliability (annual degradation & safety), and economic aspects. The expected energy yield is estimated by using softwares like PV System, PVSOL, System Advisor Model (SAM) by National Renewable Energy Laboratory (NREL) in USA etc., based on the design parameters and site specific environmental conditions. The Alternating Current (AC) output energy of the power plant is measured at the inverter level or at the feeding point using energy meter. The performance and long-term reliability of the PV power plant is assessed against the warranty by measuring various parameters such as Energy yield, Performance Ratio (PR), Capacity Utilization Factor (CUF), and degradation rate as per the applicable standards. For the performance and health check-up of PV power plant

various tools are used in the field including I-V tracer, Electro-Luminescence (EL) camera, Infrared (IR) camera, Insulation Resistance Tester, etc.

2.4 To assess the PV performance of a plant in more detail, several of the world's research institutes/standard bodies are working on PV Plant Rating. Institutes like IECRE, PI Berlin, NREL, and Fraunhofer Institute for Solar Energy Systems (Fraunhofer ISE) have already taken initiative in this regard and working on methodologies. NISE is also working to develop PV Plant Rating Framework with focus on Indian conditions. The development of framework will incorporate the following parameters:

- Generation performance v/s design performance
- Design, installation, & safety aspects
- Operations & Maintenance (O&M) issues
- Long-term degradation analysis
- Financial aspects, regulatory compliance, and environmental impact

2.5 NISE is developing a methodology for PV power plant rating based on Risk Priority Number (RPN). It involves rating a failure mode's severity, probability of occurrence, and likelihood of detection on a numeric scale for a particular PV power plant. Work is also going on to estimate the plant rating based on Cost Priority Number (CPN). Currently, NISE is in the process of finalising the PV Plant Rating Guidelines. Preliminary work with identification of various plant rating parameters and their impact on overall plant performance (financial & physical) is ongoing. Each parameter will be given a specific weightage based on the significance of the parameter in overall performance and health of the plant. The final rating will be calculated using the weightage factors for these parameters on a scale of 1-10. A preliminary draft framework for this has been prepared and is provided at **Annexure-II**.

2.6 The Ministry of Power has notified 'Guidelines for Tariff Based Competitive Bidding (TBCB) Process' for long-term procurement of solar power from grid connected solar power projects with or without energy storage. Under these guidelines, the concerned State Agencies/Central Government's Renewable Energy Implementing Agencies (REIAs) issue tenders for selection of solar power developers and subsequent to the completion of bidding process, the concerned agencies enter into long-term Power Purchase Agreement (PPA) with the successful bidder. As per TBCB guidelines, the project developers are mandated to maintain a minimum prescribed standard of plant performance, known as Capacity Utilization

Factor (CUF) for entire PPA period. In case of shortfall in maintaining the CUF, the project developers are liable for penalty. Therefore, the project developers generally maintain the minimum prescribed CUF to avoid loss of revenue as well as levy of penalty. This mechanism also helps in monitoring the functioning of solar power projects.

Factors affecting Solar Plant Performance

2.7 Azure Power, an independent sustainable energy solution provider and RE producer for the last 17 years in India, has identified key factors affecting the performance of Solar power plants, as given in the table below:

S.No.	Category	Key Factors
1	Resource	- Solar irradiation viz. Global Horizontal Irradiance (GHI) and Direct Normal Irradiance (DNI) - Seasonal & temperature variability - Dust & soiling - Shading & terrain
2	Equipment	- Module efficiency & degradation - Inverter reliability - Tracking systems - Technological upgradations - Operations & Maintenance (O&M) practice
3	Regulations & Offtake	- Deviation Settlement Mechanism (DSM) Regulations - Reactive Power requirements - Energy Offtake Payments - Connectivity Regulations
4	Ecological & Community	- Land acquisition & social acceptance - Water usage for cleaning - Biodiversity & cultural sensitivities - Local employment and Rehabilitation & Resettlement (R&R) issues

Deviation in Solar Irradiation & Other Climatic Factors

2.8 With regard to the existing solar irradiation in different parts of the country, a representative of the Ministry of New and Renewable Energy, during the Sitting of the Committee on 05.08.2025, furnished as below:

"Except North East, the rest of the places are fine. Solar insolation is high in Leh Ladakh. There is also some portion of Andhra Pradesh and Tamil

Nadu where it is quite high. Even if we leave that portion aside, solar insolation is high in our major part of the country. It is only a little low in the bordering Nepal and North area. Solar insolation is low in North Uttar Pradesh, Uttarakhand, Punjab."

2.9 To address the concerns regarding deviation in solar irradiation, temperature, and precipitation from Long Term Average (LTA) values and their potential implications on solar plant performance, NISE has initiated the development of an India-specific solar radiation database, including Typical Meteorological Year (TMY) datasets. These are based on recent high-resolution satellite data, validated through the Solar Radiation Resource Assessment (SRRA) network, to better reflect current climatic conditions. This effort aims to improve the accuracy of energy yield assessments during project planning and reduce reliance on global datasets, which may not fully capture regional climate variability. The outcomes may help address performance risks and inform future stakeholder discussions on long-term planning and risk-sharing mechanisms.

Land Acquisition related Issues

2.10 Apart from deviations in solar irradiation, the country faces significant land and infrastructural challenges in realizing its solar capacity. One of the primary issues, according to MNRE, is the high land requirement for utility-scale solar installations, typically around 4–7 acres per megawatt. To harness the full potential, over 1.4 to 2 million hectares of land would be needed, which raises concerns given India's limited availability of surplus land. Much of the land suitable for solar projects overlaps with agriculturally productive or ecologically sensitive areas, creating competition with food security and conservation priorities. Also, land is a State subject. The acquisition of land for solar projects is governed by the policies of the concerned State Governments. The compensation/lease charges vary from State to State and depends on District Level Committee (DLC) rates. Additionally, fragmented land ownership and legal hurdles make acquisition slow and complex, further delaying project timelines.

2.11 SJVN Limited has furnished that the chief causes for delay in implementation across Solar projects are as under:

- Arranging large land parcels at single location where grid connectivity is available is the major hurdle and also very time consuming.

- Non-availability/late availability (beyond 2027) of grid connectivity on ISTS for large projects at locations where large land parcels are available.
- Even after detailed due diligence of land revenue records, forest and other related issues are cropping up leading to litigations at later stage.
- Delayed land acquisition and subsequent delayed project development has led to breach of stipulated timelines and forfeiting of Bank Guarantees (BGs).

2.12 As per MNRE, the simplest way to expedite availability of land for RE projects is for State Governments to identify large tracts of Government land for development of RE projects. Utilizing Government land can streamline the land acquisition process and reduce delays in project implementation. Accordingly, the Ministry has been requesting the State Governments to identify suitable Government land for installation of RE projects. In case of lack of availability of sufficient Government land, private lands could also be identified. However, it is important to ensure fair and timely compensation in such cases, so that not only the acquisition of land is expedited, a conducive environment is also created for development of RE parks/projects in a time bound manner. The State Governments have also been requested for the same.

2.13 The Chairman, NGEL, during the Sitting of the Committee on 20.05.2025, has furnished the following with regard to dealing with land acquisition issues:

"In the model we have come up with, we have taken steps to move forward by forming a joint venture (JV) with the State Government, we are doing joint ventures with Rajasthan, Andhra Pradesh, Madhya Pradesh, Maharashtra and Chhattisgarh. There will be participation ranging from 26 percent to 49 per cent, the State will help with the land."

Other Issues

2.14 Beyond land constraints, inadequate grid infrastructure in solar-rich but remote regions hinders efficient transmission and integration of solar power. The intermittent nature of solar energy also poses reliability challenges, especially in the absence of widespread energy storage solutions. Environmental and social impacts, such as disruption to local communities and ecosystems, and water usage for panel maintenance in arid zones, also need careful management. The issues related to

transmission, storage and domestic manufacturing in solar sector has been dealt with in detail in the subsequent chapters

2.15 Azure Power has suggested the following measures for easing the process of Solar development in the country:

- Greater standardization of policies across States would help reduce uncertainty.
- Enhancing ease of doing business through clear timelines and processes is beneficial.
- A single-window clearance mechanism could streamline project execution.

Chapter III
Major Schemes/Programmes/Initiatives in Solar Sector

3.1 To achieve the target of 292 GW of Solar Power by 2030, the Ministry of New and Renewable Energy (MNRE) is implementing a number of schemes/programmes. Some of the major schemes/programmes have been discussed below:

(i) PM Surya Ghar:Muft Bijli Yojana (PMSG:MBY)

3.2 PMSG:MBY, launched in February 2024, targets to achieve installation of rooftop Solar for one crore households by 2026-27, with a total outlay of Rs. 75,021 crore. It aims to add 30 GW capacity in residential sector and 15 GW in Government and Commercial & Industrial (C&I) sector and generate 1 lakh crore units of electricity.

3.3 MNRE has furnished that the following measures have been taken to achieve the targets under PMSG: MBY:

- Online process from registration to disbursal of subsidy [details of Central Financial Assistance (CFA) by Centre and additional financial assistance by States at **Annexure-III**] directly in the bank account of the residential consumer through National Portal.
- Availability of collateral free loan from nationalized banks at concessional interest rate of repo-rate plus 50 bps i.e. 6.75% for the present with tenure of 10 years.
- Simplified the regulatory approval process by waiving technical feasibility requirement and introducing auto load enhancement upto 10 kilo Watt (kW).
- Simplified process for registration of vendors to ensure sufficient and qualified vendors are available.
- Capacity building and training programmes being conducted for creating skilled manpower.
- Creating awareness about the scheme, through awareness and outreach program such as print advertising in leading newspapers, TV commercial campaigns, Radio campaigns across FM stations including regional channels, etc., in the country.
- Regular monitoring of the progress of the scheme at different levels including with states/DISCOMs at the level of State Ministers and Secretaries.
- Conducting regional meetings.

- Monthly meeting being held at Ministry with vendors and by REC Limited in all states.
- Established grievance redressal mechanism for timely resolution of grievances. A Call Centre with telephone number 15555 is operational in 12 languages.

3.4 As per MNRE, till 30.06.2025, more than 50 lakh applications have been submitted on the National Portal and 16.4 lakh households have been installed with rooftop solar. A Budget Estimate (BE) of Rs. 20,000 crore has been allocated to PM Surya Ghar:Muft Bijli Yojana for the financial year (FY) 2025-26. The increase in the budget for FY 2025-26 is attributed to the higher target of 35 lakh residential installations (10.5 GW).

3.5 One new component of PMSG:MBY is Utility Led Aggregation (ULA Model) under which the distribution utility (DISCOM) or the State Government or some other State designated entity can install rooftop solar projects on behalf of individual residential sector households. The utility (DISCOM) may mobilize resources from the respective State Government, its own internal resources, contributions made to it for this purpose under Corporate Social Responsibility (CSR) or any other resources mobilized for providing rooftop solar to households under ULA Model.

3.6 During the Sitting of the Committee on 23.07.2025, the Additional Secretary, Ministry of New and Renewable Energy, furnished the following with regard to the Utility Led Model:

"Utility led model is a new module of this. Where there are small houses and their requirement is one or two kilowatts, which already have subsidized power, for which it is not economically viable to make any additional payment, because if they are getting power supply at a very low rate, then utilities can do the installation at their own level, that is an already program. Many states have given their proposals on this. We hope that work will start immediately in 7-8 states. According to that, the numbers are likely to increase significantly in this."

3.7 Another component of PMSG:MBY is Government Building Solarization under which Central Public Sector Undertakings (CPSUs) have been designated as Scheme Implementation Partners (SIPs). As SIPs, the targets given to CPSUs for Solarization of buildings of Ministries and States and their progress (April, 2025) have been given in the table below:

CPSU	**No. of Ministries/Departments/States/UTs**	**Progress**

	allotted	
SECI	12 Ministries	25.37 MW of Bids have been finalised and 93.88 MW of Bids are under process
NTPC Ltd.	-	165 MW capacity identified: • commissioned - 6 MW • Under-construction - 128 MW • Permission pending for PPA - 30 MW
NHPC Ltd.	8 Central Ministries/Departments and 5 States/UT (UT of J&K, Haryana, Sikkim, Nagaland and Manipur)	Engaged in implementation of ~100 MW Roof Top Solar capacity. Status is as under: • Under Operation at NHPC Locations – 4.08 MW • Under Construction at NHPC Locations – 7.68 MW • Under Tendering for States and Central Ministries – 86.55 MW
SJVN Ltd.	18 Union Ministries/Departments and 3 States (Arunachal Pradesh, Himachal Pradesh, Punjab)	• The total feasible capacity identified is approximate 67 MW among which 55 MW of capacity is under different stage of implementation i.e. Tender issued, under bid evaluation & execution etc. The balance capacity of 12 MW is under base line study stage. • Under this scheme, SJVN is also Solarizing its own buildings, with 230 kW capacity awarded and 80 kW already implemented.

With regard to its overall progress, MNRE has furnished that a total of 1174.21 MW of rooftop solar capacity has been installed on 44,998 Government buildings (as on 21.04.2025).

3.8 With regard to a query about the repair and maintenance issues under PMSG:MBY, MNRE furnished as below:

"Under PM Surya GharYojna, registered vendors have to provide the services to the consumers for repairs/maintenance of the Rooftop Solar (RTS) plant free of cost for 5 years period from the date of commissioning of the

plant. Non-performing/ under-performing system component will be replaced/repaired free of cost in this period. The consumer is also provided with the warranties given by the respective Original Equipment Manufacturers (OEMs) on the system components for any future replacement of malfunctioning components. In all cases, the vendors are bound to adhere to the minimum technical specifications provided in the scheme in their installations. Further, all installed systems undergo inspections by the DISCOMs to ensure compliance with scheme guidelines before the release of CFA. Vendors register with the DISCOMs/ REC (the NPIA) and submit Bank Guarantee (BG) depending upon the category of vendor i.e. National/ Multi State/ State level. DISCOMs/REC can take action against vendors in case of non-compliance of scheme guidelines including forfeiture of BG and deregistering, etc. Provision of Brand Owners and Channel Partners w.r.t vendor registration has been introduced for increasing the pace of the rooftop Solar installations with maintaining the quality and standards of installations."

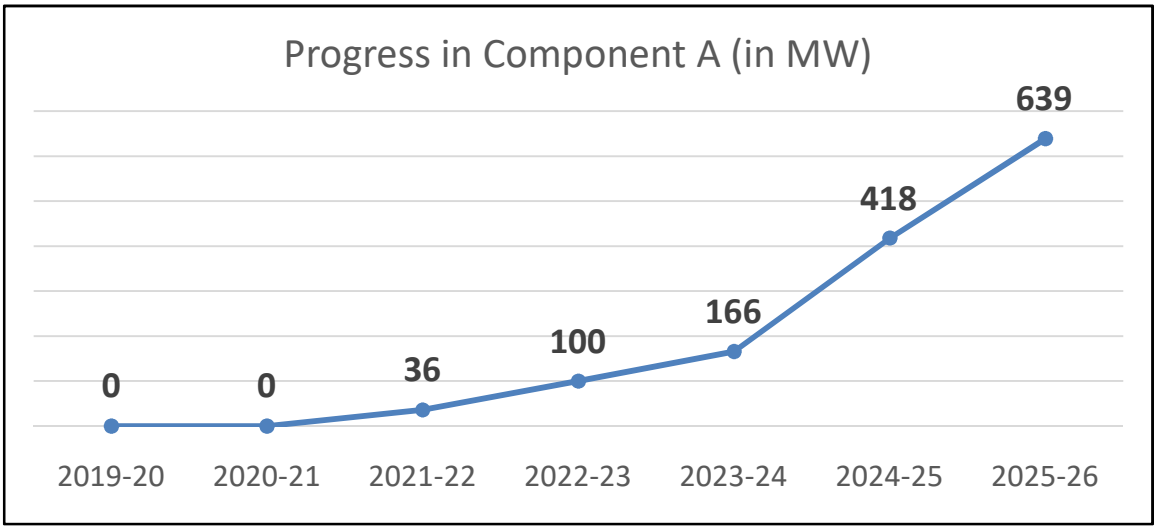
(ii) Pradhan Mantri Kisan Urja Suraksha Evam Utthaan Mahabhiyaan (PM-KUSUM)

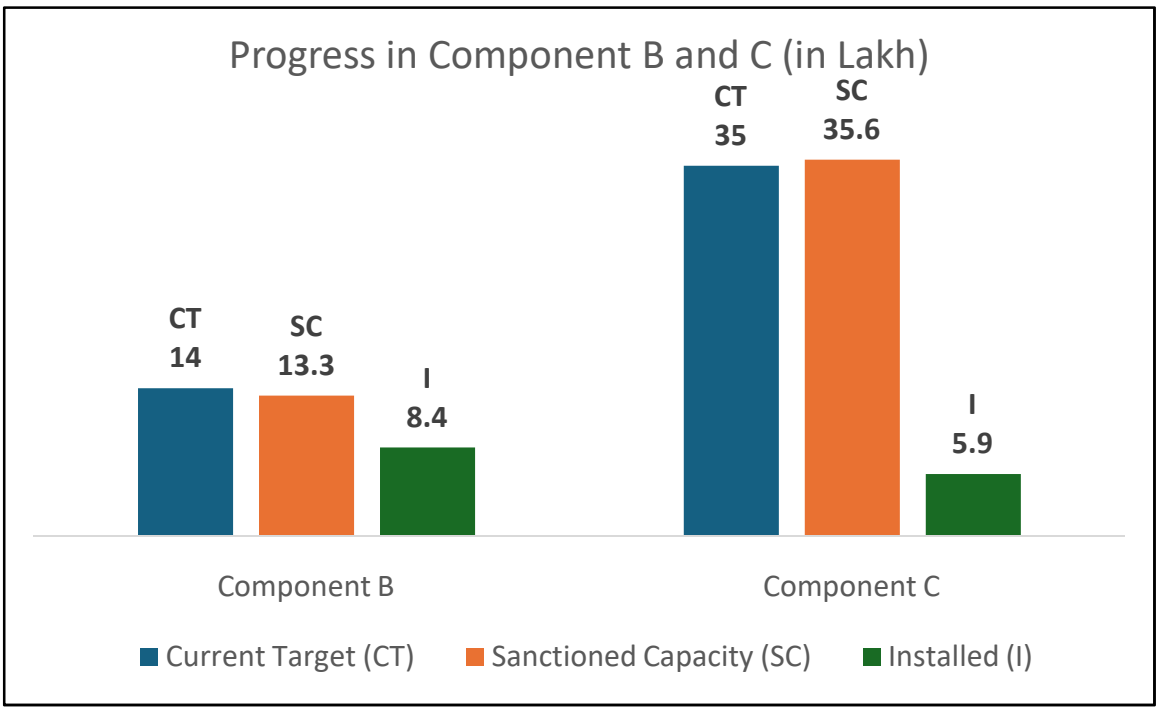
3.9 PM-KUSUM was launched on 8th March 2019 with a total central financial outlay of Rs. 34,422 crore. The scheme aims to add a renewable energy capacity of 34.8 GW and is valid till 31st March, 2026. The scheme has three components under which the Central Government provides some financial assistance as mentioned in the table below:

COMPONENT A	**COMPONENT B**	**COMPONENT C**
Installation of 10,000 MW of decentralized ground-mounted grid connected Solar power plants of size up to 2 MW on barren/ fallow/marshy/grassland.	Installation of 14 lakh standalone Solar Agriculture Pumps to replace diesel pumps in off-grid areas	Solarisation of 35 lakh existing grid-connected Agriculture Pumps, including Feeder level Solarisation
Performance Based Incentives @ Rs. 0.40 per unit for five years provided to DISCOMs	30% Central assistance to all states; 50% Central assistance to North-eastern States, hill states and Islands	30% Central assistance to all states; 50% Central assistance to North-eastern States, hill states and Islands
Institutional loans under Agriculture Infrastructure Fund (AIF)		

3.10 MNRE has furnished that to educate and support farmers, the scheme includes awareness campaigns in local languages, collaboration with Kisan Vikas Kendras (KVKs), training for officials and farmers, simplified application processes, and financial assistance through subsidies and loans under AIF. The farmers can be empowered with the knowledge of being able to earn lease rent under Component A and C and also de-dieselise their farms through installation of Solar pumps under Component B.

3.11 The progress (as on 30th June, 2025) under the three components of PM-KUSUM has been shown in the graphs below:





3.12 The State/UT-wise progress under the three components of PM-KUSUM has been given in **Annexure-IV**.

3.13 When asked about the provisions for repair and maintenance under PM KUSUM, MNRE furnished as below:

"For the maintenance of the Solar power plants and Solar water pumps installed under the PM KUSUM, the following provisions are there in the scheme:

- *Component A and Component C [Feeder Level Solarisation (FLS)] Beneficiary/developer and DISCOMs sign a Power Purchase Agreement (PPA) for 25 years. This allows the developers to maintain and operate the system for 25 years.*
- *Component B and Component C [Individual Pumps Solarisation (IPS)] for Solar pumps, it is mandatory for the vendors to provide O&M for 5 years from the date of installation. In case of any failure of Solar pumps, the vendors are bound to provide the necessary service and maintenance for five years.*

Non-compliance of services may lead to liquidity damages, as per tender conditions. Further, the Ministry/State Government reserves the right to debar the vendor up to a period of five years in case the installed systems are not as per standard, non-functional on account of poor quality of installation, or non-compliance of Annual Maintenance Contract (AMC)."

3.14 When asked about the chief causes for delay under PM-KUSUM, a representative of the Ministry of New and Renewable Energy, during the Sitting of the Committee on 05.08.2025, furnished as below:

"In component B and component C, which involve individual pumps installation total target was to install 49 lakh pumps. We have completed almost 14 lakh pumps till now. If you see, the progress has happened over the last one and half and two years because the uptake of the scheme has increased in the States. The issues were State related like land aggregation and State level tendering issue. Then of course in 2021-22 COVID related issues were there. So, what we have done is, in 2024, we have relaxed the guidelines as far as all the components are concerned. In this, Agriculture Infrastructure Fund (AIF) financing is also available at about 6 percent. In component A, we have a 10000 MW of sanction, but the progress has started happening only in the last one year. If you see only we have done 639 MW because the scheme construct itself is on performance based, generation based incentive, the 40 paise that we give to the discoms, there should be some farmer aggregation and land aggregation, there were initial issues. Only certain states like Maharashtra and Rajasthan could do that aggregation and then they were able to set up these projects. So, that is the problem that we face in component A."

3.15 On a specific query about the planning of the Ministry of New and Renewable Energy to enhance Central Financial Assistance (CFA) for higher capacity solar pumps under PM-KUSUM, a representative of the Ministry during the Sitting of the Committee on 05.08.2025, furnished as below:

"Hon'ble Chairman has asked about PM-KUSUM Yojana that what are you doing to cover 10-15 HP pump, so in our current scheme there was subsidy up to 7.5 HP, but installing 10 HP and 15 HP pumps was not prohibited. The subsidy limit was only on 7.5 HP. When the scheme will be revised, in the future we will try to bring it up to 10 HP."

(iii) Development of Solar Parks

3.16 The scheme was introduced by MNRE with an objective to facilitate the Solar Project Developers to set up projects in a Plug and Play Model. In such Solar Parks, all infrastructural support including developed land, power evacuation facilities and water are provided to developers for setting up of Solar Projects. Solar Energy Corporation of India Limited (SECI) is the implementing agency and the scheme ends in March, 2026. The CFA under the scheme is Rs. 20 lakh/MW for developing common infrastructure and Rs. 25 lakh for Detailed Project Report (DPR). As of March 2025, the status of development of Solar Parks in the country is given in the table below:

Target Capacity	**Capacity sanctioned**	**Solar projects commissioned**
40 GW	39.96 GW (55 Parks in 13 States)	12.2 GW in 24 Parks

3.17 The State-wise list of developed and partially developed Solar Parks is given at **Annexure-IV**.

3.18 As per MNRE, apart from schemes/programmes, the Government has taken several other steps for better implementation of Solar Projects as given below:

(i) MNRE has issued Bidding Trajectory for issuance of RE power procurement bids of 50 GW/annum by Renewable Energy Implementing Agencies (REIAs) [REIAs: Solar Energy Corporation of India Limited (SECI), NTPC Limited, NHPC Limited, SJVN Limited] from FY 2023-24 to FY 2027-28.

(ii) Foreign Direct Investment (FDI) has been permitted up to 100 per cent under the automatic route.

(iii) To boost RE consumption, Renewable Purchase Obligation (RPO) followed by Renewable Consumption Obligation (RCO) trajectory has been notified till 2029-30. The RCO which is applicable to all designated consumers under the Energy Conservation Act 2001 will attract penalties on non-compliance. RCO also includes specified quantum of consumption from Decentralized Renewable Energy sources.

(iv) Standard Bidding Guidelines for tariff based competitive bidding process for procurement of Power from Grid Connected Solar, Wind, Wind-Solar Hybrid and Firm & Dispatchable RE (FDRE) projects have been issued.

(v) Electricity (Rights of Consumers) Rules, 2020 has been issued for net-metering up to five hundred Kilowatt or up to the electrical sanctioned load, whichever is lower.

(vi) Standard & Labelling (S&L) programs for Solar Photovoltaic modules and Grid-connected Solar Inverters have been launched.

(vii) "The Electricity (Late Payment Surcharge and related matters) Rules (LPS rules) have been notified.

(viii) Electricity (Promoting Renewable Energy Through Green Energy Open Access) Rules, 2022, has been notified on 6th June 2022 with objective of ensuring access to affordable, reliable, and sustainable green energy for all. Green Energy Open Access is allowed to any consumer with contract demand of 100 kW or above through single or multiple single connection aggregating Hundred kW or more located in same electricity division of a distribution licensee.

(ix) Green Term Ahead Market (GTAM) has been launched to facilitate sale of Renewable Energy Power through exchanges.

(x) Government has issued orders that power shall be dispatched against Letter of Credit (LC) or advance payment to ensure timely payment by distribution licensees to RE generators.

(xi) Government has set up thirteen Renewable Energy Management Centers (REMCs) for better forecasting and real time monitoring of RE generation as well as to assist the grid operator to manage variability and intermittency of Renewable Power.

3.19 As REIA, the work done by each PSU in solar energy sector is given in the paragraphs below.

(i) <u>Solar Energy Corporation of India (SECI)</u>

3.20 Originally incorporated in 2011 as a not-for-profit organization under Section 25 of the Companies Act, 1956, SECI transitioned into a commercial entity in 2015 under Section 3 of the Companies Act, 2013. SECI was initially incorporated to implement the National Solar Mission, its mandate was later broadened to develop all RE segments, setting up of own RE projects, sale of power, developing manufacturing ecosystem etc.

3.21 SECI facilitates the development of Renewable Energy (RE) projects across the country by issuing tenders for the selection of RE developers on a pan-India or State specific basis. The selection of successful bidders is carried out through a tariff based competitive e-bidding process. Following the selection, SECI enters into a 25-year Power Purchase Agreement (PPA) with the awarded developers for the procurement of power generated by these projects. Additionally, SECI signs back-to-back 25-year Power Sale Agreements (PSA) with DISCOMs and other buying entities to supply the procured power.

3.22 The status with regard to SECI's tendering in solar sector, as on 30.04.2025, has been given in the table below:

(In GW)

Solar Capacity awarded	45.9
PPAs signed	34.8
PPAs pending	7.7
PSAs signed	36.4
Capacity commissioned	21

3.23 Currently there are 122.7 MW of operational RE Projects through SECI's own investments as given below:

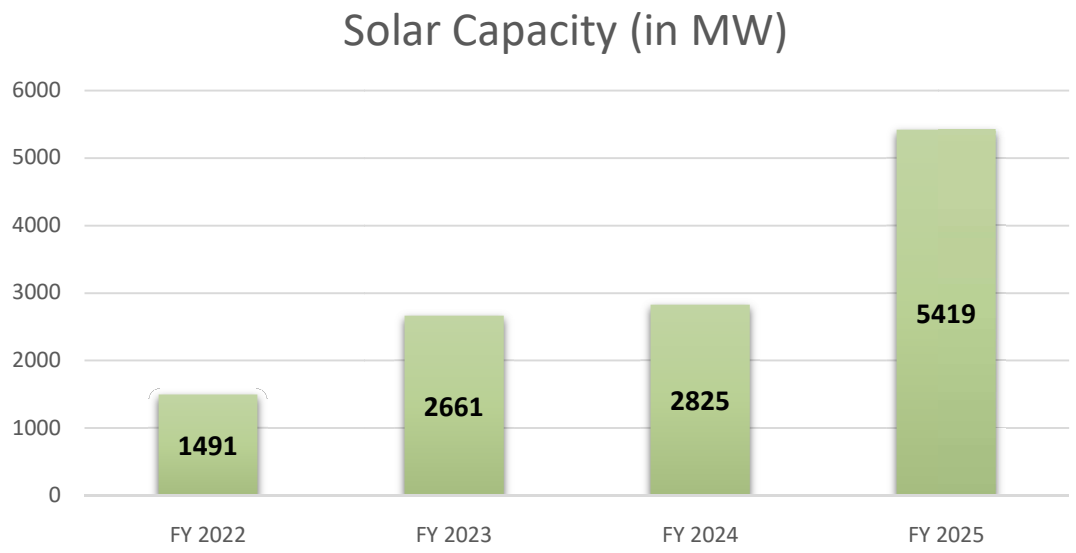
- 100 MW Solar project with 40 MW/120 MWh Battery Energy Storage System (BESS)- in Chhattisgarh.
- 1.7 MW Solar project with 1.4 MWh BESS in Lakshadweep islands.
- 10 MW Solar Project at Badi Sid in Jodhpur district of Rajasthan.
- 1 MW grid connected rooftop Solar power projects in Andaman & Nicobar Islands.
- 10 MW project has been set up at DRDO Kolar premises in Karnataka.

(ii) <u>NTPC Green Energy Limited (NGEL)</u>

3.24 NGEL, established on 7th April 2022, is a wholly owned subsidiary of NTPC Limited. It was established with the vision to spearhead NTPC's renewable energy initiatives. NGEL is responsible for developing and

operating Solar, Wind and other RE power projects across the country. The installed Solar PV capacity of NGEL Group is 5,555 MW, as on 10.05.2025.

3.25 The solar capacity added by NGEL during the last four years is given in the graph below:



(iii) NHPC Limited

3.26 NHPC has an installed capacity of 8,140 MW and the entire capacity is from renewable sources (Hydro, Solar and Wind). NHPC envisions becoming a 38,000 MW company by the year 2033–34 and 50,000 MW company by 2047.

3.27 NHPC including it's Joint Ventures (JVs)/Subsidiaries have commissioned total 6 grid connected solar projects with aggregate 319 MW capacity till date. The details has been given in a table at **Annexure-V**.

3.28 As REIA, NHPC has Commissioned 700 MW of solar power capacity and 5580 MW capacity is under implementation.

(iv) SJVN Limited

3.29 SJVN Limited, a Navratna CPSE under administrative control of Ministry of Power, was incorporated on May 24, 1988 as a joint venture of the Government of India (GoI) and the Government of Himachal Pradesh (GoHP). SJVN is now a listed Company having shareholding of 55% with Govt. of India, 26.85% with Govt. of Himachal Pradesh and rest 18.15% with public. SJVN Green Energy Ltd. (SGEL) is a wholly owned subsidiary of

SJVN Limited and was incorporated on 30.03.2022 for development of Renewable Energy Projects.

3.30 Presently, the Solar Project Portfolio of SJVN/SGEL stands at about 6632 MW. Seven Solar Power Projects with capacity totaling 716.9MW including part commissioning (320 MW) of 1000 MW Bikaner SPP are under-operation. Details of the operational Solar Power Projects of SJVN/SGEL have been given at **Annexure-V**.

3.31 The bidding targets for SJVN as REIA and their status for the last two years has been given below:

FY	**Target (MW)**	**Actual Tender Floated (including Green Shoe Option) (MW)**	**Letter of Award Issued (MW)**	**PSA & PPA Signed**	**PSA & PPA yet to be Signed**
2023-24	10000	11100	9700	5188	4512
2024-25	10800	7500	2848	-	2848
Total	**20800**	**18600**	**12548**	**5188**	**7360**

3.32 As per MNRE, the solar projects in the country are mostly developed through private investments by the Solar Projects Developers (SPDs). Some of the private companies engaged in development of solar power include Adani Green Energy Limited (AGEL), Tata Power Renewable Energy Limited (TPREL) and Azure Power. AGEL and TPREL are also involved in domestic manufacturing of Solar Cells and Modules. A brief description of the three companies are given below:

(i) <u>Adani Green Energy Limited (AGEL)</u>

- As on 31.03.2025, AGEL has an operating RE capacity of 14.2 GW, with solar capacity constituting 71% of the total RE capacity. Around 14.4% of India's solar capacity lies with AGEL. The company has a development plan of 50 GW of RE capacity and more than 5 GW of Pumped Storage Plants (PSPs) by 2030.

- AGEL has expertise in developing mega scale RE projects as given in the table below:

Year	**Place**	**RE Project**	**Capacity**
FY 2016	Kamuthi, Tamil Nadu	World's largest single location Solar project	648 MW

FY 2023	Rajasthan	World's largest Hybrid RE cluster	2,100 MW

At present, the company is developing a 30,000 MW or 30 GW RE plant in Khavda, Gujarat, which is the world's largest RE plant spread over 538 sq. km, which is a size 5 times that of Paris. The company is employing advanced technology for timely execution of the Khavda project.

(ii) Tata Power Renewable Energy Limited (TPREL)

A subsidiary of Tata Power Company Limited (Tata Power), TPREL is Tata Power's primary investment vehicle for clean and renewable energy-based power generation capacity. It has more than 5.3 GW of operating portfolio of Solar and Wind assets and aims to achieve 20 GW+ clean and green capacity by 2030. Presently, it is one of the largest Solar Rooftop EPC (Engineering, Procurement and Construction) company in India by market share.

(iii) Azure Power

Founded in 2008, Azure Power is an independent sustainable energy solution provider and renewable power producer in India with an operational capacity of around 3 GW.

3.33 As per MNRE, in respect of bids issued by the four REIAs, the quantum of bids, for which Letters of Award (LoA) have been issued but PPA has not been signed, is around 44 GW (as on 30.06.2025). The major reasons for delay in signing of PPAs /PSAs are as follows:

(i) Non-translation of Renewable Purchase Obligation (RPO) into commensurate actions on part of Electricity Distribution Companies (DISCOMs) for long-term procurement of renewable power.

(ii) Steep hike in bidding activity by Central Government REIAs from FY 2023-24 onwards.

(iii) State Utilities' expectation for decrease in renewable energy tariffs in future bids.

3.34 In order to avoid delays in signing of PPAs /PSAs in future, MNRE has furnished that the REIAs have been advised to approach the States to gather their requirement and preferably to call bids for the specific State with the concerned State's commitment. Further, State Governments have

been conveyed that the Renewable Consumption Obligation (RCO) notified under Energy Conservation Act, 2001 needs to be followed by the obligated entities and appropriate measures to be taken to meet the obligations for consumption of renewable energy as per the specified targets.

3.35 When asked about the current situation of Renewable Consumption Obligation (RCO) by States, the Ministry of Power (MoP) furnished as below:

"After the amendment of Energy Conservation Act in December 2022, MoP through its Gazette Notification, dated 20th October 2023, has specified the minimum share of consumption from non-fossil sources (Renewable Energy) for Designated Consumers (DCs) including electricity distribution licensees and other DCs which are consuming power through Open Access mode or through Captive Power Plants.

As per the notification, the year wise Renewable Consumption Obligation(RCO) targets were notified starting from 29.91% in FY 2024-25 to 43.33% in FY 2029-30. The applicability of RCOs under Energy Conservation Act is from 1st April 2024.

As per the Gazette Notification, BEE has been entrusted with the responsibility of monitoring the compliance towards RCOs. In this regard, Compliance data from all the DCs have been sought by BEE till July 31, 2025. State wise compliance level would be determined after collecting the relevant data."

Chapter IV
Transmission of Solar Energy

4.1 The National Grid consists of the transmission system for evacuation of power from generating stations, using the inter-regional links, Inter-State Transmission System (ISTS) and Intra-State transmission of the State Transmission Utilities (STUs). The National Grid is a large, meshed synchronous transmission grid where all the regional and State grids are electrically connected and operate at a single frequency.

4.2 As per the Central Electricity Authority's National Electricity Plan (Transmission), a comprehensive transmission system is planned to integrate over 500 GW of non-fossil energy capacity by 2030. This system will be implemented in phases, aligned with renewable energy (RE) capacity additions. To meet the 2030 target, transmission infrastructure for an additional 257 GW of RE is required to be connected over the next five years. The details are outlined below:

GW as of		**Existing System June 2025**	**Additional Transmission System proposed upto March 2030**
Variable Renewable Energy (VRE) (Solar + Wind)	Inter State	46	174
	Intra State	99	21
	Total	**145**	**195**
Others	Inter State	27	7
	Intra State	71	55
	Total	**98**	**62**
Grand Total		**243**	**257**

4.3 The total transmission line length and transformation capacity in June 2025 and projected capacities in March 2030 are given in the table below:

	June 2025	**March 2030**
Transmission Line length [lakh circuit kilo metres (ckm)]	4.95	6.33
Transformation capacity [Giga Volt Ampere (GVA)]	1,360	2,327

Green Energy Corridor (GEC)

4.4 GEC aims to support the evacuation and integration of RE into the grid by strengthening Intra-State Transmission System (InSTS) and Inter-

State Transmission System (ISTS). CFA is provided under the scheme for timely development of infrastructure aligned with RE capacity addition. The details about the Phase-I and Phase-II of InSTS and the ISTS under GEC are given below:

(i) Green Energy Corridor Phase-I: Intra State Transmission System (InSTS)

- 8 States covered viz. Andhra Pradesh, Gujarat, Himachal Pradesh, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan and Tamil Nadu.
- Project Cost is Rs. 10,141.68 crore , CFA for 40% (Rs. 4,056.67 crore)
- All projects completed in Karnataka, Madhya Pradesh, Rajasthan & Tamil Nadu
- Extension granted to Maharashtra, Himachal Pradesh, Andhra Pradesh and Gujarat up to June 2025; further extensions requested till March 2026.

(ii) Green Energy Corridor Phase –II: Intra State Transmission System (InSTS)

- 7 States covered viz. Gujarat, Himachal Pradesh, Karnataka, Kerala, Rajasthan, Tamil Nadu and Uttar Pradesh
- Commissioning Time is March 2026
- Project Cost is Rs. 12,031.33 crore,
  - CFA: 33% (Rs. 3,970.34 crore)
  - Balance: 67% available as loan [from Indian Renewable Energy Development Agency (IREDA)/KfW/REC Limited/Power Finance Corporation Limited (PFC)]

(iii) Green Energy Corridor Phase-II: Inter-State Transmission System for 13 GW RE Projects in Ladakh

- Sanctioned on 15.02.2024
- RE capacity is 13 GW (9 GW Solar + 4 GW Wind) + 12 Giga Watt hour (GWh) Battery Energy Storage System (BESS)
- Corridor planned: Ladakh – Himachal Pradesh – Punjab – Haryana
- Implementing Agency is Power Grid Corporation of India Limited (POWERGRID)
- Timeline is 7 years (FY 2023-24 to FY 2029-30)
- Project Cost is Rs. 20,773.70 crore
  – CFA: 40% (Rs. 8,309.48 crore)

– Balance: 60% to be arranged by POWERGRID

The targets and achievements under the different components of GEC has been given at **Annexure-VI.**

4.5 When asked about the status of implementation of Green Energy Corridor (GEC), a representative of the Ministry of New and Renewable Energy, during the Sitting of the Committee on 05.08.2025, furnished as below:

"In Green Energy Corridor Phase-I, we have completed it in four States and we have given a slight extension till June 2025 for the States Gujarat, AP, HP, and Maharashtra. But in Green Energy Corridor Phase-II, there was a delay because of delay in tendering and land acquisition. There has been uneven progress in the participating States."

4.6 As per the Ministry of Power, till April 2025, RE related connectivity applications have been received for 338 GW out of which the connectivity has been granted/agreed for 283 GW and the remaining 55 GW is under process. The major grid integration challenges has been discussed below:

(i) <u>Intermittency of Solar Power</u>

4.7 As per MNRE, the grid integration challenge for solar energy is its variability and intermittency, which complicates the task of maintaining real-time grid stability, power quality and supply demand balance. Our conventional grid infrastructure was not originally built to accommodate such high levels of variable and decentralized power flows. These fluctuations caused by changing weather and daylight conditions can lead to overvoltage, frequency deviations, congestion, and even curtailment when supply exceeds local demand or transmission capacity.

4.8 Transmission system for integration of RE capacity is planned with dynamic reactive compensation devices like Static Synchronous Compensator (STATCOM), Static VAR Compensator (SVC) etc. as per requirement. These devices provide dynamic reactive power compensation which is essential keeping in view the large-scale integration of Renewable Energy in the grid. Further, for optimizing the use of the transmission system, Central Electricity Regulatory Commission (CERC) has published a draft Regulation in March 2025. In the draft Regulations, the concept of solar and non-solar hour connectivity has been proposed which means that the transmission system utilized for evacuation of solar power during day can be utilized for evacuation of stored power from any source or the Wind power during non-solar hours. MNRE believes that the implementation of the proposed regulation will not only allow additional RE capacities to be

connected to existing ISTS substations but also enhance utilization of the transmission system and reduce the overall transmission costs to the consumers.

(ii) Right of Way (RoW) Issue

4.9 RoW compensation is paid for the diminution in land value and for damages to crops and assets arising from the laying of transmission infrastructure. The Right of Way (RoW) guidelines issued by the Government of India focus on determining compensation based on the value of land, which is influenced by the prevailing market conditions. The issues arise due to landowner resistance, high compensation demands, and lack of uniform policies across states. In urban or densely populated areas, the problem is even more severe.

4.10 To address these issues, the Ministry of Power has issued the following guidelines on compensation:

- Ministry of Power issued RoW compensation guidelines on 14.06.2024. In this regard, it is stated that the land over which a transmission line is constructed, remains with the land owner for which compensation for the tower base area shall be 200% and for Right-of-way corridor shall be 30% of the land value.
- Ministry of power has also issued supplementary guidelines on 21.03.2025 for assessing the market rate of land for the limited purpose of payment of RoW compensation for laying of Inter-state Transmission lines.

Since land is a State subject, the guidelines issued by the Ministry of Power must be formally adopted by the respective State Governments to have legal enforceability.

4.11 Talking about the difficulty due to differing RoW related compensation criteria in States like Rajasthan, the Chairman & Managing Director (CMD), Power Grid Corporation of India Limited (POWERGRID), during the Sitting of the Committee on 23.07.2025, submitted as below:

"Because of RoW issue mainly in Sikar area, we are not able to work in few locations because of high demand for compensation. Although, the Ministry of Power, Government of India, has issued guidelines in March 25 to pay the compensation of RoW and land tower base at market rate, as per the State policy we, still had to pay compensation as per the circle rate, whereas, circle rate is very less as compared to the market rate. So, we are requesting through our hon. Power Minister and the Ministry of Power to request the Government of Rajasthan to adopt Government of India guidelines. If the

compensation can be paid as per the market rate, then these balance towers will be completed at the earliest."

4.12 The Ministry of Power (MoP) has also furnished that it has requested States to adopt land policies similar to those of Gujarat and Rajasthan which grant deemed non agricultural status to land acquired for transmission substations. However, since land is a State subject, the decision rests with individual States. According to MoP, issuing central guidelines on this matter would require wider consultations with the States and other relevant Departments and Ministries of the Government of India.

(iii) Delayed Forest/Wildlife Clearance

4.13 As per MoP, transmission projects often face delays due to the need for forest and wildlife clearances, especially when lines pass through ecologically sensitive areas. Approvals involve multiple authorities and can take significant time, affecting project timelines. A key example is the case related to the Great Indian Bustard (GIB), where the Supreme Court, in Writ Petition (Civil) No. 838 of 2019, restricted overhead transmission lines in Great Indian Bustard (GIB) areas across Rajasthan and Gujarat to protect the endangered bird species. As a result, several transmission projects meant to evacuate renewable energy from Rajasthan and Gujarat have been stalled.

4.14 On being asked about the mechanism for resolution of forest related issues, the Secretary, Ministry of Power, during the Sitting of the Committee on 23.07.2025, furnished as below:

"These are linear projects, their forest clearance is done at the regional office level. In this, we and the Ministry of Environment have together made this system a little easier. What we have done is that now after getting Forest Clearance Stage One, they are given a working permission and they can build their entire line. Forest Clearance Stage Two is required when they have to charge the line, commission it. In some projects, where there are more problems, where there are long delays, normally we have to sit with the State Governments. The Hon'ble Minister has now started regional meetings with all the States. In those regional meetings, we take up all these issues from time to time. If there are some more complex issues, then we discuss it with me and the concerned Energy Secretary, Environment Secretary of the State or the Chief Secretary. Normally, it does not have to come to the Central Government level and most of the problems are solved at the State Government level itself."

4.15 The CMD, POWERGRID, during the same Sitting, furnished as below:

"Forest issues are delayed because of various issues such as assessment of trees, counting of the number of trees. That process is very lengthy although we are monitoring these projects through Project Monitoring Group (PMG) portal and Pro-Active Governance and Timely Implementation (PRAGATI) portal."

4.16 Talking about the major transmission related challenges in evacuating RE, a representative of the Ministry of Power during the Sitting of the Committee on 23.07.2025, furnished as below:

"Renewable projects are highly concentrated in Gujarat and Karnataka creating heavy transmission dependence and necessitating costlier HVDC lines for evacuation over long distances typically more than 700 kilometres. So, these are the major transmission challenges. The project delays are largely due to project clearances, forest and wildlife clearances, tower erection manpower shortage, and delay in equipment supplies."

4.17 On a query about the Inter State Transmission System (ISTS) charges and the issues related to its waiver, the Ministry of Power submitted as below:

"Determination of Inter-State Transmission System (ISTS) charges comes under purview of Central Electricity Regulatory commission (CERC). Government of India issues policy recommendations for development of power sector including renewables from time to time. The policy decision of 'waiver' of ISTS charges was one such measure where the ISTS charges of those Distribution licensees and Open Access consumers consuming RE from projects connected to ISTS are cross-subsidised by other Distribution Licensees and Open Access Consumers. CERC has notified the Central Electricity Regulatory commission (Sharing of Inter State Transmission Charges and Losses) (Fourth Amendment) Regulations, on 26.06.2025, which has provisions related to ISTS charges waiver also. As per these Regulations for Renewable Energy Generating Station (REGS) ISTS charges waiver was 100% till 30th June, 25. The waiver would be reduced in a step of 25% yearly thereafter. As per CERC (Sharing of Inter State Transmission Charges and Losses) (First Amendment) Regulations, notified on 7th February, 2023 the ISTS charges are to be shared among the entities who draw power through ISTS, which does not include generators. Thus, RE developers are not responsible for payment of ISTS charges, instead the procurers like distribution licensees are responsible for payment of ISTS charges.

Due to the 'waiver' of ISTS charges the transmission cost of the States buying RE from outside their boundaries – like Maharashtra, Delhi, Telangana, etc. – is majorly borne by other States, particularly hydro rich

states in North-Eastern Region and hilly states. Even states with substantial RE potential have been sourcing power from outside their boundary to shift the burden of transmission costs onto other states. The affected states have been raising objections to this unfair cost-sharing structure which is increasing their consumer tariffs.

The continuation of ISTS waiver has resulted in excess concentration of RE in a few regions like Rajasthan and Gujarat, leading to grid instability potentially threatening the grid and extremely high cost of ISTS expansion required for evacuating the RE to distant load centres. The current average ISTS charges are around 65 paise per unit, and its phased introduction at 25% annually is manageable. RE projects in areas with slightly lower capacity utilization factors but located near load centers would remain cost-effective due to reduced transmission costs. Presently a major portion of RE capacity is connected to the Intra State Transmission system (InSTS) network, indicating that most renewable development has occurred without relying on ISTS waivers.

The gradual withdrawal of ISTS waivers will encourage more geographically balanced RE development across states, simultaneously reducing overall transmission costs for the citizens of the country."

4.18 With regard to ISTS waiver and its impact on the development of Intra-State Transmission System, the Additional Secretary, Ministry of New and Renewable Energy, during the Sitting of the Committee on 23.07.2025, furnished as below:

"As far as the intra-State transmission system is concerned, there are two things in it. As long as the ISTS waiver was there, the focus of all the developers was to get ISTS connectivity, so there was a lot of pressure on it. Development was also not happening in the rest of the States. Now that the waiver is ending, awareness has come in the States. We have seen that many States have started focusing on intra-State transmission lines of their respective States. For example, Rajasthan has tried to take out about 36 gigawatts from its State system. Karnataka and other states have also started doing the same. For hand holding, intra-State transmission plan is being made for the next ten years so that at least there is visibility and they can move forward."

4.19 When asked about the development of a single window clearance system for all connectivity related matters, the MoP furnished as below:

"An application portal for connectivity already exists and is integrated with the National Single Window System, in line with Department for Promotion of Industry and Internal Trade (DPIIT) guidelines."

Chapter V
Storage of Solar Energy

5.1 In its Report on 'Optimal Generation Mix 2030' which was published in April 2023, the Central Electricity Authority (CEA) has talked about the inherently intermittent and non-dispatchable nature of renewable energy (RE) based generation. As per CEA, the coal-based generation is inherently inflexible in nature due to which multipronged approach including use of Pumped Storage Plant (PSP)/Pumped Storage Hydropower (PSH) and Battery Energy Storage System (BESS) would be needed to ensure secure and reliable operation of the grid.

5.2 As per this report, the energy storage required by 2029-30 is likely to be 60.63 GW (18.98 GW PSP and 41.65 GW BESS) with storage of 336.4 Giga Watt hour (GWh) (128.15 GWh from PSP and 208.25 GWh from BESS).

5.3 During the Sitting of the Committee on 23.07.2025, the Chairperson, Central Electricity Authority (CEA), submitted the following with regard to current storage capacity and the storage target for future:

"We have also issued an advisory in storage that all the REs that are coming in future should have at least 10% storage. Of course, it is an advisory right not. But, it will be needed if we need some more stability into the grid. Storage is not only coming from batteries, it is also coming from hydro pump storage, so a lot of interest has been seen in that area as well. Right now our capacity is around 5 or 5.5 gigawatts, we are thinking of increasing it to around 50 gigawatts in a certain time. These tractions are coming in storage, which will be helpful in RE integration.

5.4 When asked about the cost of storage system in India, a representative from Solar Energy Corporation of India Limited (SECI), during the Sitting of the Committee on 20.05.2025, furnished as below:

"You know that solar power used to cost Rs 5 per unit, now it is around Rs 2.5. Wind power was expensive, but now the rates are coming down. Battery energy storage system is not coming to India because its rates are very high. Now SECI is working on it and taking help from the Government of India on how to reduce its rates so that the grid is stable. The cost of setting up a solar project is about Rs 4.5 to 5 crore per megawatt. If we set up a base in which there is no production of electricity, only storage is done and it gives electricity for four hours, then it costs about Rs 10 crore per megawatt hour. Right now the base is so expensive that even after installing it with solar,

buyers are not found. Therefore, it has to be reduced only then the grid will be stable.

5.5 During the same Sitting, the Chairman, NTPC Green Energy Limited (NGEL) also gave his inputs on the cost of storage system as below:

"The price of BESS is also the same as the price of solar modules, earlier the price of solar was up to Rs 15, which has now come down to Rs 2.5 per stand-alone at generating point. Similarly, the price of battery is also likely to come down a lot and it is coming down. Today it has come down to around 7 rupees per kilowatt hour. Its biggest impact is that we can take two cycles of it for storage in a day or use one cycle, because in the renewable sector it mainly depends on what is its capital cost and what is the interest rate. It depends on that. Suppose if we use two cycles of battery, then even today it is coming for around Rs 4 or Rs 4.5 per kilowatt hour. If we do only one cycle, then the same cost becomes 7 to 8 rupees per kilowatt hour. On top of that, power input has to be given. That cost is still, even today, around Rs 8, Rs 9 or Rs 10 per kilowatt hour. The cost also depends on where it is located. If its price comes down, the economy of scale will increase. Hopefully, this should come down when Make in India comes. When this cost comes closer to five rupees or six rupees per kilowatt hour, it will be a very pleasant matter for us. Sir, that is why a lot of tenders are being done for BESS. We are also doing it. But, today it is very much import based. Right now it is not manufactured much in India, mainly for the grid stage."

5.6 MNRE has furnished that the following initiatives have been taken by the Government to promote Energy Storage Solutions (ESS):

(i) The Ministry of Power (MoP) is implementing the scheme for Viability Gap Funding (VGF) for development of 4,000 MWh Battery Energy Storage Systems (BESS) providing the budgetary support of Rs 3,760 crore. Due to fall in BESS prices, 13,200 MWh BESS capacity, has now been planned to be supported within the sanctioned VGF budget. Under the scheme, MoP has designated CPSUs, including Solar Energy Corporation of India Limited (SECI), NTPC Limited, NHPC Limited, and SJVN Limited as BESS Implementing Agency (BIA) for implementation of CPSU component of the VGF scheme.

(ii) The Ministry of Heavy Industries (MHI) administers the National Programme on Advanced Chemistry Cell (ACC) Battery Storage under the Production Linked Incentive (PLI) scheme. With a total

outlay of Rs. 18,100 crore, the scheme targets 50 GWh capacity, out of which, 10 GWh capacity have been earmarked for Grid Scale Stationary Storage (GSSS) applications. The bidding documents for earmarked capacity for GSSS applications have been finalized by MNRE.

(iii) CEA has issued an 'Advisory on co-locating Energy Storage Systems with Solar Power Projects to enhance grid stability and cost efficiency' where CEA has advised to incorporate a minimum 2-hours co-located Energy Storage Systems, equivalent to 10% of the installed solar project capacity, in future solar tenders.

(iv) The Ministry of Power has issued guidelines to promote the development of pumped storage projects (PSP). CEA has issued Guidelines for Formulation of Detailed Project Reports for pumped storage projects.

(v) The Ministry of Power has issued Guidelines for Tariff Based Competitive Bidding Process for Procurement of Firm and Dispatchable Power from Grid Connected Renewable Energy Power Projects with Energy Storage Systems.

(vi) The Ministry of Power has issued National Framework for promoting Energy Storage Systems to support its development and deployment.

(vii) The Ministry of Power has issued guidelines for Procurement and Utilization of Battery Energy Storage Systems as part of Generation, Transmission and Distribution assets, along with Ancillary Services.

(viii) CERC (Sharing of Inter State Transmission Charges and Losses) (Fourth Amendment) Regulations dated 26.06.2025 provided 100% ISTS charges waiver for co-located Battery Energy Storage System (BESS) Projects commissioned on or before 30th June, 2028 provided that the power from such BESS projects is consumed outside of the state. Further for the promotion of PSPs, 100% ISTS waiver is provided for Hydro PSP Projects for which the construction work has been awarded on or before 30th June 2028.

(ix) ESS have been made eligible by CERC to provide Secondary Reserve Ancillary Service and Tertiary Reserve Ancillary Service, under certain conditions.

(x) Electricity (Rights of Consumers) Amendment Rules, 2022 on replacing diesel generator (DG) sets with renewable energy with battery storage have been issued.

5.7 As BIA, the CPSUs have taken several measures to develop the country's storage capacity. The work done by SECI, SJVN, NHPC and NGEL has been detailed in the subsequent paragraphs:

(i) SECI

5.8 To address the challenges related to intermittent and variable nature of RE, SECI has developed innovative models such as hybrid tenders and round-the-clock (RTC) tenders. Additionally, to cater to the specific demands of various DISCOMs, SECI has introduced tenders for Peak Power, standalone Battery Energy Storage Systems (BESS), and Firm and Dispatchable Renewable Energy (FDRE), among others. These have been elaborated below:

- Hybrid Power: Solar and Wind power, being variable in nature, present challenges in ensuring a stable energy supply. However, the hybridization of these two technologies helps mitigate variability while optimizing the utilization of land and transmission infrastructure.
- Round-the-clock Power: These tenders integrate RE sources with energy storage solutions to ensure a consistent and reliable power supply. They are designed to meet part of the round the clock power requirements of off-takers through renewable energy.
- Assured Peak Power supply: These tenders help address challenges related to grid stability and peak demand management. Projects established under these tenders enable DISCOMs to meet electricity demand during peak hours, thereby ensuring a reliable and consistent power supply.
- Energy Storage systems: The integration of energy storage systems into India's power sector is essential for optimizing the utilization of RE infrastructure. This initiative will equip DISCOMs and grid operators with flexible storage capabilities to address their requirements effectively.
- Firm and Dispatchable RE: SECI has developed tenders that offer Firm and Dispatchable Renewable Energy (RE) power to DISCOMs and buying entities based on their demand profiles. Till April 2025, 830 MW of projects were awarded under the different tenders for Firm and Dispatchable RE power.

- Solar with Storage: The projects will be used for meeting peak energy demands of buying entities. Till 30.04.2025, SECI awarded 3200 MW of solar projects with 1600 MW/5200 MWh storage.

According to SECI, since these projects incorporate additional components, they tend to be more complex than conventional renewable energy projects. As a result, securing buy-in from DISCOMs requires sustained engagement. Consequently, the process of creating awareness and aligning DISCOMs with the objectives tends to be time-intensive.

(ii) SJVN Limited

5.9 As BIA, SJVN has been allocated BESS capacity of 1500 MWh. The PSU has furnished that Uttar Pradesh Power Corporation Ltd. (UPPCL) has agreed to purchase this BESS capacity. The selection of BESS Developers for setting up of 375 MW/1500 MWh Standalone BESS in Uttar Pradesh is under process.

5.10 With regard to PSP, SJVN has furnished that presently no PSP of SJVN is under operation. To accelerate the development of PSPs in India, a meeting was held under the Chairmanship of Hon'ble Minister of Power and New & Renewable Energy in March, 2022, wherein10 Pumped Storage Projects totaling 13,190 MW were identified by the Government for carrying out due diligence by SJVN. Out of 10, 2 PSPs totaling 4,620 MW (Jalvara PSP 2220 MW in Maharashtra & Karnataka and Darzo Lui PSP 2400 MW in Mizoram) were found promising for carrying out further studies. Further, an MoU for Kotpali PSP (1800 MW), Chhattisgarh has been signed recently. A total expenditure of Rs. 32,000 crore is expected to be incurred on developing these three PSPs. With their commissioning, SJVN will have storage capacity of 38,520 MWh (6420MWx6hours) energy storage/day.

5.11 SJVN has furnished that PSP/PSH currently dominates the global energy storage landscape, but Battery Energy Storage Systems (BESS) are rapidly growing. PSH is the world's largest battery technology, accounting for over 94% of the world's long duration energy storage capacity, well ahead of lithium-ion and other battery types.

5.12 On being asked whether a common platform can be designed for storage and other RE related issues, SJVN submitted as under:

"A common platform for all Power CPSEs including all common issues, challenges related to O&M, R&D etc. along with details related to storage capacities, batteries, RE etc. would be quite helpful."

(iii) NHPC Limited

5.13 NHPC, as BIA, has been allocated BESS Capacity of 1500 MWh. The development of the said BESS capacity is envisaged to be taken up through selected developers from Private sector/Public Sector companies. NHPC has floated tenders for entire 1500 MWh capacity as under:

- 125 MW/ 500 MWh (4-hour single cycle) – for Kerala: electronic Reverse Auction (e-RA) completed, consent of Buying Entity under exploration.

- 500 MW / 1000 MWh (2-hour double cycle) – for Andhra Pradesh: Technical Bids under evaluation

The above allocated 1500 MWh BESS capacity is anticipated to be commissioned by March-2027.

5.14 NHPC has furnished that it is pursuing 18 PSPs of total installed capacity of 19,060 MW in various States. The details regarding the status of PSP projects are given in the table below:

	No. of projects	**Capacity (MW)**
Projects under Survey & Investigation	6	7140
New Initiatives	12	11920

The company has formed a joint venture with the Andhra Pradesh Power Generation Corporation (APGENCO) to develop PSPs as below:

Company (Date of Incorporation)	**Promoters & Share**	**Projects / Power Stations**
APGENCO NHPC Green Energy Limited (ANGEL). (23.01.2025)	NHPC: Andhra Pradesh power Generation corporation (APGENCO) 50:50	**Pumped Storage Projects in Pipeline** • Rajupalem (800MW) • Gadikota (1200 MW) • Deenapalli (750MW) • Aravetipalli (1320MW) • Yaganti (1000 MW)

5.15 Further, as REIA, NHPC has facilitated award of 14,900 MW of FDRE, Wind-Solar hybrid, Solar and Solar with storage. As part of MNRE bidding trajectory, 1200 MW (Solar with storage) of RE projects are under tender stage.

5.16 With regard to the cost of BESS that is being implemented by NHPC, the CPSU submitted as under:

"NHPC as BIA has floated two tenders for establishment of standalone BESS capacity - In case of 125 MW/ 500 MWh (4-hour single cycle) for Kerala, the cost of BESS system as indicated by different bidders varies in the range of ₹ 4.27 crore / MW to ₹ 5.75 crore / MW for different sites.

Further, In case of 500 MW/ 1000 MWh (2-hour double cycle) for Andhra Pradesh the cost of BESS system as indicated by different bidders in the said tender varies in the range of ₹ 1.50 crore/MW to ₹ 3.50 crore/MW for different sites.

The cost for the BESS capacity quoted is dependent on many factors such as system capacity, configuration and connectivity voltage etc."

(iv) NTPC/NGEL

5.17 NGEL has furnished that it has secured capacities in several Solar + BESS and standalone BESS tenders floated by SECI & NHPC and has also floated its own tenders for energy storage services. A 5 MW Solar + 12 MW BESS project at Great Nicobar Island is currently awaiting land allocation from the Andaman & Nicobar Administration. As these projects are currently in various stages of execution or tendering, no expenditure has been incurred yet. NTPC/NGEL has also been allocated five PSPs having installed capacity of 4800 MW and DPR for these projects is under progress.

5.18 NGEL is exploring to set up additional solar with storage near its operational solar plants to align with Ministry of Power's initiatives of utilization of transmission infrastructure in non-solar hours. For this, NGEL is in the process of exploring the availability of additional land near its solar projects. NGEL has furnished that the tariff for such power shall be considerably high and therefore, the commercial viability and interest from DISCOMs for procurement of such power needs to be ascertained.

5.19 When asked about the impact of storage system on Capacity Utilization Factor (CUF) of solar plants, NTPC has furnished as below:

"In absence of energy storage system, Project level CUF of Solar projects is in the range of 20-30%. This can be improved up to 30-45% by installation of additional Solar and BESS."

5.20 Apart from CPSUs, the private sector is also engaged in developing storage capabilities in BESS and PSPs, case in point, is the Tata Power Renewable Energy Limited (TPREL) which expects to commission 2.8 GW

of PSP capacity by 2029 at Bhivpuri and Shirwata in Maharashtra. The target of the company by the year 2031 is 4.9 GW PSP Capacity.

5.21 TPREL has furnished that sequential approvals for Environment & Forest clearances with multiple State/central agencies usually add around 12-18 months to timeline for implementation and has therefore, requested for a single window clearance system for high-impact storage projects to expedite PSPs for grid stabilization.

Chapter VI
Domestic Capabilities in Advanced Technology, Manufacturing and Skilling

Domestic Manufacturing of Solar Equipments

6.1 As per the Ministry of New and Renewable Energy (MNRE), the future of solar energy hinges on advancing solar cell efficiency to reduce costs and land requirements per mega watt. India is the second largest producer of solar modules, after China. The installed domestic manufacturing capacities, as on 30.06.2025, and expected capacities by 2030 in respect of polysilicon, ingots, wafers, solar glass, solar cells and solar modules, are as follows:

Item	Installed domestic manufacturing capacity (in GW/ GW equivalent for GW of Solar modules)	Expected Cumulative Installed Capacity by 2030 (in GW)
Polysilicon	No commercial production capacity	-
Ingots & Wafers	~2 GW	-
Solar Glass	~ 15 GW	~ 50
Solar Cell	~ 27 GW	~ 100
Solar Module	~ 91 GW	~ 150

6.2 When asked about the planning for sourcing silicon/polysilicon for manufacturing of polysilicon, MNRE furnished as below:

"As on 30.06.2025, there is only around 2 GW of ingot manufacturing capacity in the country and there is no commercial production of polysilicon in India, for use in manufacturing of Ingots. Accordingly, as of now, MNRE has not issued any policy for mandating domestic sourcing of polysilicon."

6.3 With regard to import of solar equipments that are used in making solar panels, MNRE has furnished that for financial year 2024-25, the import was as follows:

Item	Import (in million US Dollars)
Polysilicon	0.03
Wafer	156.55
Solar Glass	645.44
Solar Cell	1,641.25
Solar Module	2,151.75

6.4 With regard to domestic manufacturing and import of solar equipments, the Secretary, Ministry of New and Renewable Energy, during the Sitting of the Committee on 03.04.2025 submitted as below:

"In fact, the capacity is gradually increasing, whether it is the first wafer plant, we are moving towards self-reliance in cells and modules to some extent. If we look at the major solar module manufacturing countries, in this, China is ten times more than India in manufacturing. Therefore, we have to work a lot on this. If we look at solar PV modules, PV cells or solar glass, which are important components, then the present installed capacity, as against the estimated cumulative installed capacity to be there by 2030, we have set a target of doubling in PV modules, four times in PV cells and more than three times in solar glass. Some policies also have a role in this, which have promoted solar PV manufacturing.

6.5 Talking specifically about the manufacturing capability in solar cells and modules, the Additional secretary, Ministry of New and Renewable Energy, during the Sitting of the Committee on 23.07.2025, furnished as below:

"In the country, we currently have 91 GW of module manufacturing capacity in solar manufacturing, already available in our approved list of models and manufacturers. Our module manufacturing capacity is more than our requirement. A lot of it is also being exported, so at present we have about 25 GW of installed manufacturing capacity for cells and 25 GW of capacity is in the pipeline, which is likely to be commissioned in a year."

6.6 MNRE has furnished that the Government has taken steps to promote domestic manufacturing in solar sector, which inter-alia include:

(i) <u>Production Linked Incentive (PLI) Scheme for High Efficiency Solar PV Modules</u>

The scheme aims to achieve manufacturing capacity of Giga Watt (GW) scale in High Efficiency Solar PV modules. The scheme has an outlay of Rs. 24,000 crore. Under the scheme, the provision of PLI is for five years post commissioning, on manufacture and sale of High Efficiency Solar PV modules. PLI depends upon Sales, Quality and Local Content. The scheme is being implemented under two tranches:

- Tranche-I: Letter of Awards (LoAs) issued - 8737 MW full integration; likely outgo: ~Rs. 4,500 Cr; projects under implementation

- Tranche-II: LoAs issued - 39,600 MW full/partial integration; likely outgo: ~Rs. 14,007 Cr; projects under implementation

Regular monitoring and facilitation under the scheme is provided by both the Government of India and the States. The successful bidders have projected an investment of approx. Rs. 1.1 lakh crore and direct employment of around 43,000 people, as a result of this scheme. The status of projects awarded under the scheme, till February 2025, are given below:

Companies selected	12
Companies started production	6
Companies manufacturing Module	5
Companies manufacturing Cell	2
Companies manufacturing Ingot-Wafer	1*
Investment	Rs. 41,000 crore
Direct Employment	11,650

*Adani Group has commissioned a manufacturing capacity of 2 GW worth of Ingots and Wafers at its Gujarat Plant

(ii) Domestic Content Requirement (DCR): Under some of the current schemes of MNRE, namely CPSU Scheme Phase-II, PM-KUSUM Components B & C, and PM Surya Ghar: Muft Bijli Yojana, wherein government subsidy is given, it has been mandated to source Solar PV cells and modules from domestic sources.

(iii) Imposition of Basic Customs Duty on import of Solar PV cells, Solar PV modules, Solar Inverters and Solar glass.

(iv) Anti-Dumping Duty

(v) Exemption of Custom Duty on capital goods for manufacture of Solar Cells and Modules: The Government has exempted customs duty on import of the goods specified in List 41 of the notification No. 30/2024-Customs dated 23.07.2024, for the manufacturer of Solar PV cells and modules.

(vi) Approved List of Models & Manufacturers (ALMM): Only the models and manufacturers included in ALMM List-I (of solar PV modules) are eligible for use in Government Projects/ Government assisted Projects/ Projects under Government Schemes & Programmes/ Open Access / Net-Metering Projects, installed in the country, including

Projects set up for sale of electricity to Government under the Guidelines issued by Central Government under section 63 of Electricity Act, 2003 and amendment thereof. The word "Government" includes Central Government, State Governments, Central Public Sector Enterprises, State Public Sector Enterprises, and Central and State Organizations / Autonomous bodies.

6.7 MNRE has furnished that the Government has taken following steps in the field of Quality control, testing and standards for Solar equipment/systems**:**

(i) Quality Control Order (QCO), 2025 for SPV products i.e., Solar PV Modules, Storage Batteries, and SPV Inverters has been issued by MNRE. Additionally, it introduces standards for the determination of efficiency of SPV Inverters. Under this QCO, a condition is introduced to set minimum efficiency for Solar PV modules.

(ii) Quality Control Order for Solar Water Heating Systems i.e., Solar Flat Plate Collector, All Glass Evacuated Tubes Solar Water Heating System and Storage Water Tank for All Glass Evacuated Tubes Solar Water Heating Systems has been issued by MNRE.

(iii) Quality Control Order for Solar direct current (DC) Cable has been issued by Department for Promotion of Industry and Internal Trade (DPIIT).

(iv) MNRE in coordination with Bureau of Indian Standards is developing Standards for various Solar Energy products and systems. Non-compliance of the Quality Control Order issued under Bureau of Indian Standards (BIS), Act shall be liable to penalty as per the BIS Act.

(v) Bureau of Energy Efficiency (BEE) is implementing Standard and Labeling Programmes for Solar PV Module and Grid-Connected Solar Inverter up to 100 kW capacity.

6.8 Tata Power Renewable Energy Limited (TPREL) has furnished that it has 34 years of Cell+Module manufacturing experience. Presently, it has a manufacturing capacity of 4.8 GW Cell+Module facility in Tamil Nadu and Karnataka. The 4.3 GW Cell+Module Mono PERC capacity has been recently commissioned in Tamil Nadu.

Domestic Capabilities in Solar Technology

6.9 As per MNRE, India is increasingly focusing on innovations like floating Solar installations on reservoirs and agri-voltaics that combine

farming with Solar energy, and more efficient Solar technologies such as perovskite and bifacial panels to improve efficiency and land use. Some of the most promising developments are :

(i) Tandem and Perovskite Solar cells combine different materials (like silicon and perovskite) to absorb more of the Solar spectrum. These perovskite cells have achieved lab efficiencies of over 26% and tandem cells have achieved efficiencies of over 30%, significantly higher than conventional silicon cells, but challenges remain in terms of long-term stability and commercial scalability. Research is underway at institutions such as IIT Bombay, supported by government funding through MNRE.

(ii) Bifacial Solar modules, which generate electricity from both sides of the panel by capturing reflected sunlight, are closer to commercial maturity. These can boost energy yields by 10–20% and are especially effective in high-reflectivity regions such as Rajasthan and Gujarat. Indian manufacturers have begun producing bifacial modules, and field trials are being conducted under Indian conditions. Government tenders by SECI have also started recognizing and supporting this technology, indicating growing market acceptance.

(iii) Precision Solar cells, which integrate features like nano coatings, micro-trackers, and Artificial Intelligence (AI)-based optimization. These technologies are still in early research & development (R&D) phases in India but show potential for enhancing performance through smart energy management. Some IITs and startups are exploring Internet of Things (IoT) integration and predictive maintenance systems to optimize Solar output in real time.

6.10 NTPC Green Energy Limited (NGEL) has furnished that it has adopted latest technology in Solar Energy sector as below:

Technology	Earlier	Now
Solar PV Modules	Polycrystalline Modules with Efficiency 13-15%.	Mono PERC and Bifacial Modules with Efficiency 19-23%
PV Module Wattage	180 to 250 Watt-peak modules	Large format modules 540 to 670 Watt peak
Inverters	Lower Capacity KW to 1 MW	3 MW to 5 MW Central Inverters

Mounting and Tracking Systems	Fixed or Manual Seasonal Tilt	Automated Tracking Systems (Khavda)
Module Cleaning System	Manual water-based cleaning	Automated Robotic dry cleaning
Monitoring Systems	Limited Site-Specific Monitoring	Remote monitoring with Artificial Intelligence (AI)/Machine Learning (ML) analytics with cloud storage
Maintenance	Handheld Thermography	Drone-based thermography and inspections

6.11 Similarly, Adani Green Energy Limited (AGEL) has furnished that it is employing automated solutions, such as Solar powered Robotic cleaning solution to provide waterless cleaning of module & improved performance, at its Khavda RE plant.

6.12 Tata Power Renewable Energy Limited (TPREL) has furnished that it has fully automated, future-ready lines upgradable to next-gen TOPCon technology having international quality and certified operations and is enlisted in ALMM.

Domestic Manufacturing of Transmission Equipments

6.13 The Ministry of Power (MoP) has furnished that the Government recognizes the critical need for timely availability of key materials and equipment such as Cold Rolled Grain Oriented (CRGO) Steel, Static Synchronous Compensators (STATCOMs), High Voltage Direct Current (HVDC) equipment, sub-sea cables etc. to meet India's energy transition goals. Manufacturing many of these components requires advanced technology and large capital investments. Historically, production has been concentrated in a few countries with technological leadership and economies of scale. In the transmission sector, discussions with HVDC Original Equipment Manufacturers (OEMs) reveal that domestic content in high value portion of HVDC substations is currently negligible, primarily due to absence of domestic manufacturing industry in high technology components like high power semiconductors, thyristor valves, converter transformers, etc.

6.14 As per MoP, the major challenges in developing domestic capabilities in transmission sector include high investment requirements, import dependency for Cold Rolled Grain Oriented (CRGO) steel, lack of advanced

technology, and inadequate testing infrastructure. To address these gaps, MoP is actively engaging with Original Equipment Manufacturers (OEMs) and industry associations to explore ways to strengthen the domestic supply chain for transmission equipment. Based on industry feedback, suitable support measures would be identified to promote local manufacturing. Some of the recent developments in this direction are given below:

(i) The Ministry of Steel has included CRGO steel used in transformers and reactors under the PLI scheme for specialty steel, to support domestic production of a key raw material.

(ii) The Ministry of Electronics and Information Technology has launched Design Linked Incentive Schemes for local manufacturing of semiconductors in India which can cover high power semiconductors required by the power sector also.

(iii) A Clean Tech Manufacturing initiative has been announced in the Budget 2025–26, covering Solar PVs, Electric Vehicle (EV) components, electrolyzers, wind turbines, transmission equipment, and grid scale batteries. NITI Aayog, the nodal agency for implementation of this budget announcement, has highlighted that an Inter Ministerial Committee under the Cabinet Secretariat will oversee this initiative.

6.15 MNRE has furnished that while RE is mostly evacuated through High Voltage Alternating Current (HVAC) systems, High Voltage Direct Current (HVDC) systems are planned where required based on transmission distance and power volume. HVDC construction takes about 5 years, and RE developers have been informed to align their commissioning with the HVDC timelines. To address the shortage of power transformers, the following steps have been taken:

- Central Electricity Authority (CEA) Relaxation (26.06.2023): Dynamic Short Circuit (DSC) test requirements for certain 220 kV to 765 kV class transformers have been deferred to projects with bid invitations after 31.08.2025, easing procurement timelines.
- Tariff Based Competitive Bidding (TBCB) Project Planning: Projects are staggered to avoid bunching and planned in phases to manage transformer supply constraints. Project timelines have been extended from 18 to 24/30 months for better execution and tariff discovery.
- Make in India (MII) Relaxation: Ministry of Power (02.07.2024) exempted four HVDC projects from minimum local content

requirements for terminal equipment, allowing Class-II suppliers to participate, expanding vendor base and easing supply constraints.

6.16 When asked about the import dependency with regard to HVDC equipments and the difficulty in procuring the same, the Secretary, Ministry of Power, during the Sitting of the Committee on 23.07.2025, furnished as below:

"You had expressed concern about HVDC, in which we are completely dependent on imports. There are a total of three companies in the world outside China, GE, Hitachi and Siemens, which manufacture HVDC equipment. Currently they have a lot of orders. This is a big reason why they have not only started quoting much higher prices, but have also started taking about five years to supply. If you plan and sanction a new HVDC project today, it is taking five years. There are some options in this, on which we can work. One of them is how we can further encourage the Make in India scheme."

6.17 With regard to the manufacturing target and job creation target by the year 2030, a representative of the Ministry of New and Renewable Energy, during the Sitting of the Committee on 05.08.2025, submitted as below:

"Renewable energy manufacturing capacity is estimated to reach 175 gigawatts by 2030. After that, growth will slow down. Renewable energy job creation is expected to be nearly 3.8 million jobs. The creation of ten million jobs is the estimate by International Renewable Energy Agency (IRENA). So, these are the pathways we foresee for renewable energy in a developed India."

<u>Skilling of Manpower in Solar Sector</u>

6.18 As per MNRE, the country has trained professionals in RE Sector including manufacturing however, in view of the above targets, it needs to be further augmented. MNRE is implementing capacity building and skill development programmes to create skilled workforce for design, installation, operation and maintenance etc. in RE sector to facilitate employment opportunities.

6.19 Under the Human Resource (HR) Development Programme of MNRE, the following measures are being undertaken:

(i) Short term Training Programmes in Solar Energy sector, as below:

- Suryamitra – Solar PV technician

- Varunmitra – Solar water pumping technician

(ii) The National Renewable Energy Fellowship (NREF) for higher studies and research

(iii) Lab upgradation support for enhancement of Renewable Energy based infrastructure

(iv) National Renewable Energy Internships (NREI)

(v) Renewable Energy Chair

6.20 In FY 2024-25, around 864 people have been trained as Suryamitras. The cumulative number of people trained and employed at the end of FY 2024-25 is given below:

Skill Development Programme	**No. of Skilled Manpower**	
	Cumulative * Trained	**Cumulative** Employed**
Suryamitra (Solar PV Technician)	57,372	30,266 (53%)

**FY 2015-16 onwards; ** FY 2023-24 onwards*

6.21 As per MNRE, till July 2025, around 1,27,799 number of persons have been trained under PM Surya Ghar:Muft Bijli Yojana. Further, Skill Council of Green Jobs under Ministry of Skill Development has trained and certified around 1,24,691 number of candidates in Solar energy, including 59,982 number of Solar technicians.

6.22 To create adequate RE professionals through training/skilling to meet the 2030 RE targets, following steps are planned:

(i) Establish RE-Hub at National Institute of Solar Energy (NISE) and five RE start up Incubators in collaboration with Industry.

(ii) Develop 100 training Institutes as specialized RE Institutes from amongst the pool of ITIs and other existing Institutes.

(iii) Develop industry aligned training courses.

(iv) Focus on hands on experience through "On Job Trainings".

(v) Policy and Ecosystem Push to develop opportunities for Entrepreneurs.

(vi) Focus on skilling in manufacturing, storage and emerging areas such as Green hydrogen, Geo thermal, Agro-PV, floating Solar, etc.

(vii) Enhance Public Private Partnership in skilling/trainings.

6.23 As per the Ministry of Power, with rising power demand and rapid grid expansion, there is a growing need for skilled manpower in transmission projects. This gap is more evident as transmission capacity is set to double over the next decade, and renewable energy projects, often completed faster, require timely matching infrastructure.

6.24 To address this shortage, Power Grid Corporation of India Limited has launched skill development initiatives for unemployed youth by setting up training centres in key areas such as Malda (West Bengal), Banka (Bihar), Bassi (Rajasthan), and Rajgarh (Madhya Pradesh). Encouraged by the success of these centres, new facilities are being established at Rourkela (Odisha) and Hosur (Tamil Nadu) to further strengthen the skilled workforce in the Extra High Voltage and Ultra High Voltage transmission sector.

6.25 Talking about the progress of its skill development initiative, the CMD, Power Grid Corporation of India Limited, during the Sitting of the Committee on 23.07.2025, has furnished as below:

"So far we have trained about 100 skilled manpower at Malda and 97 have been trained at Banka. At these two stations, 54 and 53 people are under training. Apart from this, at Bassi, which was functional in May 2025, 40 skilled manpower are getting trained. Similarly, at Itarsi, Rajgarh, 40 are getting trained. Out of 197 which have been trained, 109 have already got the job in transmission line. They are working for construction of transmission line. We are also in the process of setting up centres at Rourkela and Hosur."

<u>Solar Waste Management</u>

6.26 When asked about the policies for Solar panel recycling and waste management, MNRE furnished as below:

"The Ministry of Environment, Forest and Climate Change has notified the E-Waste (Management) Rules, 2022 on 2nd November, 2022. Management of Solar PV modules /panels/ cells has been added in Chapter V of the said rules. As per these rules, every manufacturer and producer of Solar photo-voltaic modules or panels or cells shall:

(i) ensure registration on the portal;
(ii) store Solar photo-voltaic modules or panels or cells waste generated up to the year 2034-2035 as per the guidelines laid down by the Central Pollution Control Board in this regard;
(iii) file annual returns in the laid down form on the portal on or before the end of the year to which the return relates up to year 2034-2035;
(iv) ensure that the processing of the waste other than Solar photo-voltaic modules or panels or cells shall be done as per the applicable rules or guidelines for the time being in force;
(v) ensure that the inventory of Solar photo-voltaic modules or panels or cells shall be put in place distinctly on portal; and

(vi) comply with standard operating procedure and guidelines laid down by the Central Pollution Control Board in this regard."

PART –II
OBSERVATIONS/RECOMMENDATIONS OF THE COMMITTEE

Achievement of 'Panchamrit' Goal

1. The Committee acknowledge the efforts of the Ministry of New and Renewable Energy (MNRE), Ministry of Power (MoP) and other stakeholders in achieving the 'Panchamrit' goal of 50% installation of power capacity from non-fossil sources in June, 2025. The five 'Panchamrit' goals, announced in 2021 for promotion of non-fossil energy sources and reduction of carbon emissions, are to be achieved by March, 2030. MNRE has furnished to the Committee that, as on 30th June, 2025, out of the total installed capacity of 485 GW, around 243 GW came from non-fossil sources which is around 50% of the total installed capacity. Therefore, the Committee would like to appreciate all the stakeholders for achieving this target, well before time. With regard to the installation of solar power, the Committee note that the installed capacity is around 116 GW (June, 2025) while the target by 2030 is 292 GW. This means that around 176 GW of solar energy is expected to be installed in the next five years, for it to contribute to the larger goal of 500 GW installed capacity from non-fossil sources. The Committee expect that MNRE and other stakeholders would take appropriate measures to achieve the targeted installation of solar power and would apprise the Committee in this regard. The Ministry has furnished a detailed breakup of the planned solar capacity by 2030, with 128 GW under implementation phase and 62 GW under tendering stage (June, 2025). This means that the total planned solar capacity by 2030 is around 306 GW, well beyond the target of 292 GW. This is noteworthy. However, the Committee note several challenges in implementation of renewable energy projects (including solar energy) viz. delays in land acquisition and connectivity approvals as well as lack of storage facilities and domestic manufacturing. Therefore, the Committee expect the Ministry of New and Renewable Energy and other stakeholders to diligently follow the planned roadmap to remove the above-mentioned constraints and achieve the targets on time.

Reassessment of Solar Potential

2. The Committee note that the total solar potential of the country is 748.98 Giga Watt peak (GWp), as per the assessment study carried out by National Institute of Solar Energy (NISE) in 2014. NISE has informed the Committee that it has recently carried out a reassessment of the country's solar potential, using high-resolution geospatial data and integrating a broader range of parameters, such as land use and land cover, topography (slope and aspect), proximity to infrastructure, and solar irradiance. As per the submissions made before the Committee, the said reassessment is under final stages and the updated potential would soon be released. The Committee are of the view that for realizing the full potential of any resource, having up-to-date data of its existing potential is an important component. Given the scale at which solar projects are being developed in the country and the changing realities related to module efficiency, other technical specifications and climate change, the reassessment of solar potential is paramount. The Committee acknowledge the use of latest technological tools in determining the current solar potential of the country. The Committee anticipate the results to be published at the earliest, with an observation that they may be apprised with the findings of the reassessment exercise.

<u>Mechanism for Rating Solar Power Plants</u>

3. The Committee note that presently, there is no foolproof mechanism to assess the performance of solar power plants. The Ministry of New and Renewable Energy has informed the Committee that National Institute of Solar Energy (NISE) is in the process of finalizing Photo Voltaic (PV) plant rating guidelines. However, the research work related to identification of plant rating parameters and their impact on overall plant performance is still under preliminary stages. The Committee have been informed that NISE is working to develop a Risk Priority Number (RPN) to assess the probability of a plant's failure and its detection chances on a numeric scale. Similarly, a Cost Priority Number (CPN) is also being developed. The Committee note that various research institutes of the world have already taken several initiatives in this direction and are working on developing methodologies to assess solar plant performance. The Committee agree that developing an evaluatory framework for solar plants is

challenging as it needs careful examination of the multiple factors affecting solar plant including designing, construction, solar power generation as well as the long term maintenance and degradation. Further, the Committee note that currently, the plant performance is assessed on its generation performance, long-term reliability and economic aspects, using various software. However, the Committee are also of the view that having a reliable evaluation mechanism is essential for the policy makers, developers and investors to make an informed decision, which in turn, encourages optimum utilization of solar potential as well as land and other resources. Therefore, the Committee would like the Ministry of New and Renewable Energy and National Institute of Solar Energy (NISE) to complete the draft solar Plant Rating Framework at the earliest so that the related pilot projects and field tests can be completed on time.

<u>Regional Imbalance in Solar Power Development</u>

4. The Committee note regional imbalance in the development of solar power in the country. Out of approx. 119 GW of total solar power installed (as on 31st July 2025), the installation in eight North-Eastern States and four Himalayan States/Union Territories (UTs) (Ladakh, Jammu & Kashmir, Himachal Pradesh and Uttarakhand) constitute around 0.3 GW and 1.2 GW respectively. Similarly, the Eastern States of Bihar, Jharkhand, Odisha and West Bengal, and Island UTs of Andaman & Nicobar Islands and Lakshadweep have solar capacity of 1.6 GW and 0.04 GW respectively. This means that these four regions together contribute only around 3.14 GW i.e. 2.6% of the total solar capacity. The Committee also note variation in solar irradiation between different regions of India, whereby the highest radiation is received by the Western and Southern States of the country viz. Rajasthan, Gujarat, Madhya Pradesh, Maharashtra (central/eastern), Andhra Pradesh, Telangana and Tamil Nadu. However, as per the submission of the Ministry of New and Renewable Energy, apart from North-East areas, bordering areas to Nepal, Northern areas of Uttar Pradesh, Uttarakhand and Punjab, rest of India receives good insolation. Ladakh receives very high insolation but the installed capacity is too low at 11 MW or 0.01 GW. The Committee understand the difficulties being faced in installing solar projects in Himalayan

region, North-East areas and Islands due to difficult terrain and large forests/ecological biodiversity. The Committee understand that most schemes/programmes of the Ministry are demand-based and States, along with the public/private developer, have to install solar capacity to receive the Central Financial Assistance (CFA) from the Central Government/Ministry. The Committee are also of the view that transmitting solar and other renewable energy from high producing Western and Southern areas to rest of the country, is both costly and has reduced efficiency due to energy losses on the way. The Ministry of Power has furnished that gradual withdrawal of Inter-State Transmission System (ISTS) waivers will encourage more geographically balanced renewable energy development, as earlier due to ISTS waivers, the transmission charges were cross - subsidized and majorly borne by the hydro rich States of North-East and hilly areas. The Ministry of New and Renewable Energy has also furnished that due to waivers, the developers had increasingly sought inter-State transmission connectivity. However, since the gradual removal of waiver has been announced, the States have started focusing on strengthening their intra-State transmission infrastructure. In light of the above-mentioned advantages of having a regionally balanced solar capacity, the Committee expect the Ministry and other central agencies to promote the development of solar energy in areas having low solar capacity vis-à-vis potential, by handholding such States/UTs through supportive policies, timely CFA release, regular monitoring of projects and constant engagement for early detection and timely resolution of the various issues being faced by such States/UTs.

<u>Land Acquisition related Issues and Creation of a Single Window Clearance Mechanism</u>

5. Land Acquisition is one of the major issues affecting the timely development of solar projects, especially the utility-scale projects. The Ministry of New and Renewable Energy has furnished that utility-scale solar installations typically require around 4–7 acres per megawatt and to harness the full potential, around 1.4 to 2 million hectares of land would be needed. The Committee agree with the Ministry's view that much of the land, suited for solar projects, overlaps with agriculturally productive or ecologically sensitive

areas, creating competition with food security and conservation priorities. Added to this, are the legal hurdles associated with compensation/levy charges. Land is a State subject and the compensation/levy charges vary from State to State and depends on District Level Committee (DLC) rates. The Committee note that for any guideline of the Central Government to be applicable in States, the concerned States have to formally adopt it. The Ministry of New and Renewable Energy has furnished that it has been requesting State Governments to identify large tracts of Government land, and in their absence, suitable private land, for installation of renewable energy projects. The Committee note that PSUs like NGEL (a subsidiary of NTPC), NHPC Limited, SJVN Limited etc. are forming Joint Ventures (JVs) with State Governments to develop solar plants. The Committee understand that such arrangements enable easier coordination with States in resolving land and other issues, thereby reducing litigations and saving pre-construction delays. Several Organisations which appeared before the Committee have requested for a single window clearance mechanism for timely resolution of land related issues. The Committee, in consonance with the suggestion of the Organisations, recommend creation of a 'single window clearance mechanism', bringing all stakeholders of Centre and State level at one place for easy identification of land related issues and their time bound resolution.

<u>Performance of Solar related Schemes/Programmes</u>

6. With regard to the implementation of solar energy related schemes/programmes of the Ministry of New and Renewable Energy (MNRE), the Committee note that there has been slow progress under most of the schemes/programmes viz. Pradhan Mantri Surya Ghar:Muft Bijli Yojana (PMSG:MBY), PM-KUSUM and the scheme related to the development of Solar Parks, as described in the paragraphs below:

6.1 PM Surya Ghar:Muft Bijli Yojana aims to establish rooftop solar for one crore households by 2026-27. However, as per information furnished by the Ministry, till June 2025, around 16 lakh installations have been made. This means that around 84 lakh installations i.e. 84% of the installations are yet to be made in just two

years of 2025-2027. The Committee have identified lack of awareness as the major cause for slow adoption of the scheme. Though the Ministry has been undertaking awareness and outreach programmes through print, radio, television as well as electronic media, the Committee are of the view that unless States and their DISCOMs come fully onboard, the widespread progress would be difficult to come by. The Committee therefore, desire that the Ministry engage closely with States/DISCOMs to design awareness campaigns that suit the distinctive features of the State concerned. This may build trust among the States and their consumers, thereby paving way for capital investment and providing space for installation of solar panels at the anticipated scale.

6.2 The Committee note that PM-KUSUM, which is aimed at solarization of the agriculture sector through its three components, has seen extensive delays. In particular, under Component-A and Component-C, the progress has been 6.4% and 16.9% respectively (as on 30th June, 2025). Under Component-B, the progress has been comparatively better at 60%. The Ministry of New and Renewable Energy has furnished that it has undertaken several measures to simplify guidelines under different components of PM-KUSUM to ease their implementation in States. Further, the Ministry has submitted that the scheme has gained momentum in the last one or two years, after States like Maharashtra and Rajasthan understood the true potential of the scheme and provided the developers with the required land. The Committee note that the scheme is set to expire in March 2026. Till then, the Committee expect the Ministry to closely monitor its implementation in States and make timely interventions, where needed, to ensure that atleast the projects which can be completed within the given timeline is not unnecessarily delayed. The Committee have desired that the Central Financial Assistance (CFA) under component-B be expanded for higher than 7.5 horse power (HP) capacity pumps as this capacity is proving inadequate in drawing power in water deficient areas, particularly the Western States of the country. The Ministry of New and Renewable Energy has furnished that it will try to bring solar pumps up to 10 HP capacity under the CFA component in the next version of PM-KUSUM. The Committee recommend that, till any decision is being taken to provide CFA for

more than 7.5 HP solar pumps, alternative mechanism may be explored for meeting the agricultural water demands in such water deficient areas.

6.3 Similarly, a Solar Park is aimed at facilitating the solar project developers to set up projects in a plug and play model, whereby all infrastructural support including land, power evacuation facilities and water are provided to developers for setting up of solar projects. The scheme aims to add 40 GW of solar power by March, 2026. The Committee note that almost the entire capacity of 40 GW has been sanctioned through 55 solar parks in 13 States. However, the commissioned capacity is only around 12.2 GW (till March, 2025), which means that around 27.8 GW i.e. 70% capacity is still to be developed in one year of 2025-26. Therefore, the Committee would like to highlight the need to accelerate the completion of the sanctioned capacity. Further, the Committee would like to recommend that the Ministry of New and Renewable Energy should regularly interact with the solar park developers to understand and help them in resolution of issues that are causing delays in setting up of solar parks.

<u>Pending PPAs</u>

7. The Committee note that in respect of bids issued by the four Renewable Energy Implementing Agencies (REIAs - SECI, NHPC Ltd., SJVN Ltd. and NTPC Ltd./NGEL), Power Purchase Agreement (PPA) has not been signed for around 44 GW (as on 30.06.2025). The reasons cited by the Ministry of New and Renewable Energy (MNRE) for pending PPAs include non-translation of Renewable Purchase Obligation (RPO) into commensurate actions by Electricity Distribution Companies (DISCOMs) for long-term procurement of renewable power, steep hike in bidding activity by the REIAs from 2023-24 onwards and State Utilities' expectation for decrease in renewable energy tariffs in future bids. The Ministry has furnished that to address delays in PPA signing, it has advised REIAs to closely work with the States to understand about their renewable energy requirement and accordingly issue bids to meet their requirement. Further, the States have been asked to diligently follow their Renewable Consumption Obligations (RCOs) to avoid penalties under Energy Conservation Act, 2001. The Ministry of Power has submitted

that the Bureau of Energy Efficiency (BEE) has been entrusted with the task of monitoring RCO compliance by States. Accordingly, compliance data from all the Designated Consumers (DCs), including DISCOMs, have been sought by BEE till July 31, 2025. As the date is over, the Committee expect that all the RCO data may have been received, if not, an advisory be issued to all States for time-bound collection of RCO data and after collection, State-wise determination of RCO compliance status should be ensured. The final result of the RCO compliance study may also be shared with the Committee.

RoW Issue in Transmission Projects

8. The Ministry of Power has furnished that presently, the country has a transmission capacity to integrate the existing installed capacity of 243 GW of non-fossil power. For the remaining 257 GW, the Ministry has planned to develop transmission capacity by 2030 through various schemes and programmes. In technical terms, the transmission line laid and transformation capacity developed up to June 2025, are 4.95 lakh circuit kilometers (cKM) and 1,360 mega volt ampere (MVA) respectively. This needs to be further extended up to 6.33 cKM transmission line and 2,327 MVA by March 2030. The Committee note that the Ministry of New and Renewable energy is implementing Green Energy Corridor (GEC) in two phases for addition of transmission lines and transformation capacity through Intra-State Transmission (InSTS) and Inter-State Transmission (ISTS) networks. However, the Committee would like to highlight that there has been consistent delays under this scheme. The Phase-I of GEC, which is being implemented in 8 States, had been given extension up to June, 2025 in four States of Gujarat, Andhra Pradesh, Himachal Pradesh and Maharashtra and further extension has been sought by these States till March 2026. Similarly the delay in Phase-II has been reported on account of delay in tendering and land acquisition. As per the submissions made before the Committee, the issues related to compensation for Right of Way (RoW) has emerged as the major cause for delay in laying of transmission lines. The Committee note that RoW compensation is paid for the diminution in land value and for damages to crops and assets arising from the laying of transmission infrastructure. To address this issue, the Ministry of Power has issued guidelines for RoW compensation at 200% of land value for the tower base area and 30% for RoW corridor. Further, for the limited purpose

of payment of RoW compensation for laying of Inter-state transmission lines, the Ministry of Power guidelines suggest payment at market rate. The Committee realize the limitation in implementation of the above guidelines in States as, land being a State subject, their approval is needed for the guidelines to be legally enforceable. In this regard, the Committee would like the Ministry of Power to take up the matter of RoW compensation with each State to understand the prevailing RoW issues in detail and also encourage the States to adopt its recent guidelines on RoW compensation for effective transmission of non-fossil power, particularly the solar power.

<u>Delays in Forest and Wildlife related Clearances</u>

9. The Ministry of Power (MoP) has furnished that transmission related projects often face delays due to the need for forest and wildlife clearances, especially when lines pass through ecologically sensitive areas. As per the Ministry, the forest and wildlife related approvals involve multiple authorities and can take significant time, affecting project timelines. The Committee note the case of Great Indian Bustard (GIB), in which as per the Supreme Court order, the laying of overhead transmission lines in GIB areas across the States of Rajasthan and Gujarat have been restricted to protect the endangered bird species. To deal with the delays in getting forest and wildlife clearances for setting up transmission lines, the Ministry of Power has furnished that it, along with the Ministry of Environment, Forest and Climate Change, has devised a mechanism whereby after getting Forest Clearance Stage I, the transmission company gets a working permission to lay the entire transmission line. Thereafter, Forest Clearance Stage II is needed during the commissioning of the project. For more complex issues, the Ministry has submitted, that usually discussions with State Government is needed. The Secretary, Ministry of Power has furnished that he/she sits with the Secretaries of the relevant departments of the State Government to work out the issues. The Chairman & Managing Director, Power Grid Corporation of India Limited (POWERGRID) has also agreed that forest and wildlife related clearances involve lengthy processes due to which transmission projects are often delayed. The POWERGRID has furnished that it is monitoring such clearances through Project Monitoring Group (PMG)

portal and Pro-Active Governance and Timely Implementation (PRAGATI) portal. While the Committee acknowledge the measures taken by both the Ministry of Power and POWERGRID in easing the forest and wildlife related clearances for transmission projects, the Committee are also of the view that, a dedicated portal, exclusively for all transmission related matters, onboarding all the authorities involved in forest and wildlife related clearances, would be more helpful in timely resolution of the issues facing the transmission sector.

<u>Inadequate Storage Capacity</u>

10. The Committee note that variability/intermittency is one of the biggest issues with renewable energy in general, and solar energy in particular. This can be assessed by the gap that exists between the installed capacity and actual generation of renewable energy. While the installed capacity of renewable energy has reached 50% of the total installations, its contribution in actual generation, measured by the Capacity Utilization Factor (CUF), is only around 26%. This makes it unreliable for meeting the peak power demands of the country and its variable nature also leads to under-utilization of resources like land, transmission infrastructure etc. The Committee note that to deal with these issues, storage devices viz. Pumped Storage Plants (PSPs) and Battery Energy Storage Systems (BESS) are employed to store additional renewable energy during day-time/favourable weather conditions, for its use during peak demands and non-solar hours. However, the Committee note that storage capacity in the country needs to be revisited. The Central Electricity Authority (CEA) has furnished that, against the 243 GW of installed capacity of renewable energy, the current storage capacity ranges between 5 to 5.5 GW. Further, the CEA in its Report on 'Optimal Generation Mix 2030' has estimated that the required energy storage capacity by 2029-30 is 60.63 GW (18.98 GW PSP and 41.65 GW BESS). Based on the submissions made, the Committee observe that the main reason for slow development of storage system in India is its high cost, which makes it unattractive for developers as well as buyers. The Committee note that the Government has formulated policy measures like guidelines on drafting storage related Detailed Project Report (DPR),

storage related tendering, co-location of storage with solar projects etc., to facilitate storage development in the country. Further, support in the form of Inter-State Transmission System (ISTS) waiver and Viability Gap Funding (VGF) is being provided for storage related projects. The Committee expect these measures to create a favourable ecosystem for large-scale production of domestic storage capacities. The Committee are of the view that as the production of storage devices gain some scale, the cost would slowly come down. However, given the huge gap between the existing capacity and target, the Committee recommend that the storage systems should be given due consideration in future tenders. Apart from the above measures, the Committee feel that the premier research institutions should also be encouraged to undertake storage related research & development (R&D) by making provision for dedicated capital grants for the same. If done properly, this would lead to indigenization of storage technology which will ultimately lead to reduced prices of storage devices.

Innovative Models and Tenders

11. Solar Energy Corporation of India Limited (SECI) has informed the Committee that it has developed innovative models such as hybrid tenders and round-the-clock (RTC) tenders to deal with the intermittency challenges of renewable energy. Additionally, to cater to the specific demands of various DISCOMs, SECI has introduced tenders for Peak Power, and Firm and Dispatchable Renewable Energy (FDRE), among others. Further, the Ministry of Power (MoP) has issued Guidelines for Tariff Based Competitive Bidding (TBCB) process for procurement of FDRE from grid Connected renewable energy projects with Energy Storage Systems (ESS). The Committee appreciate SECI, the Ministry of New and Renewable Energy and the Ministry of Power for promoting innovative models that are aimed at meeting the specific power requirements of different consumers. However, the Committee are of the view that, apart from solar-wind hybrid, other tenders viz. RTC, Peak Power and FDRE are still at nascent stage in terms of their share in the total tenders issued and the number of buyers participating in such tenders. As they involve storage, cost is also an issue. SECI, itself has submitted that since these

projects incorporate additional components, they tend to be more complex than conventional renewable energy projects and securing buy-in from DISCOMs would require sustained engagement. The Committee recommend that SECI should engage actively with DISCOMs and other buying entities and make them aware of the benefits of innovative tenders, especially highlighting their capability in meeting specific demands of the buying entity.

<u>Status of Domestic Manufacturing in Solar Sector</u>

12. The Committee note that the country has achieved self-sufficiency in solar modules with an existing manufacturing capacity of around 91 GW (June, 2025). The Committee would like to appreciate the Ministry of New and Renewable Energy and other stakeholders for their efforts in developing domestic capabilities in solar module production. However, the Committee would also like to highlight the slow pace of development of other solar equipment, in particular polysilicon, ingots & wafers. In case of polysilicon, which is a critical component in development of solar panels, the country has no manufacturing capability at present. With regard to ingots & wafers, recently a 2 GW facility has been commissioned in Gujarat. In absence of adequate domestic production of these components, the country is heavily dependent on imports from countries manufacturing polysilicon, ingots & wafers. Therefore, the Committee would like the Ministry of New and Renewable Energy to facilitate the solar manufacturing industry to take up/expand manufacturing of solar equipment in the entire value chain of the sector. The Committee are of the opinion that, like the 'Production Linked Incentive (PLI) Scheme for High Efficiency Solar PV Modules', which boosted solar module production, a dedicated scheme/programme exclusively for polysilicon, ingots & wafers and solar glass may be formulated to encourage the domestic manufacturers to take up their production. The Ministry of New and Renewable Energy has submitted that to improve efficiency and reduce land usage in solar sector, innovations such as floating solar installations on reservoirs and agri-voltaics that combine farming with solar energy, and more efficient solar technologies such as perovskite and bifacial panels are being encouraged. The Committee note that most of these

technologies are currently in R&D stage and therefore, would like the Ministry to adequately support these initiatives till commercial production.

<u>Inadequate Manufacturing of Transmission related Equipment</u>

13. The Ministry of Power has furnished that it recognizes the critical need for timely availability of key materials and equipment such as Cold Rolled Grain Oriented (CRGO) Steel, Static Synchronous Compensator (STATCOMs), transformers, High Voltage Direct Current (HVDC) equipment and other transmission related equipment to meet India's energy transition goals. The Committee note that India has been lagging in manufacturing of these equipment due to the need for large capital, advanced technology and adequate testing infrastructure. However, given the country's focus on developing transmission infrastructure to evacuate the bulk renewable energy capacities, the Committee believe that there is an urgent need to promote domestic manufacturing of key transmission equipment. The Ministry of Power has informed the Committee that the Ministry of Steel has included CRGO steel, that is used in transformers and reactors, under the Production Linked Incentive (PLI) scheme for specialty steel to support its domestic production. Similarly, the Committee have learnt that the Ministry of Electronics and Information Technology (MeitY) has launched Design Linked Incentive Scheme for local manufacturing of semiconductors in India which can cover high power semiconductors required by the power sector also. The Committee, while recognizing these efforts, would also like to highlight that these are just the initial schemes and a lot of work needs to be done before the actual production starts and achieves a reasonable scale. The Committee would like the Ministry of Power to keep a close tab on the progress of these schemes and regularly engage with the Ministry of Steel and MeitY so that the demand of CRGO steel and semiconductors in power sector can be appropriately communicated and timely met. The Committee note that a 'Clean Tech Manufacturing Initiative' has been announced in the Budget 2025–26 which covers solar photo voltaics, transmission equipment and grid scale batteries, apart from other components. NITI Aayog, the nodal agency for implementation of this budget

announcement, has highlighted that an Inter Ministerial Committee under the Cabinet Secretariat will oversee this initiative. This is a welcome step and given the provision of an Inter Ministerial Committee, which will have representations from a number of Ministries/Departments, the Committee feel that the Inter Ministerial Committee will have the wherewithal to design and promote a comprehensive manufacturing ecosystem related to the critical components mentioned above. The Committee expect the work on 'Clean Tech Manufacturing Initiative' to begin soon.

Lack of Domestic Capability in HVDC

14. The Committee note that with regard to certain transmission equipment related to High Voltage Direct Current (HVDC), the country is completely dependent on imports. HVDC based transmission lines and transformers are required for transmission of power over long distances. The Committee recognize that HVDC development requires huge investment and high end technology due to which, in other parts of the world also, the manufacturing capacity is extremely skewed and only a handful of manufacturers have the requisite facility for producing HVDC equipment. This has resulted in higher prices and long waiting periods of up to five years for delivery of HVDC equipment. The Committee are of the view that extensive research and development (R&D) in HVDC technology is the need of the hour. The Committee would like the Ministry of Power and Power Grid Corporation of India Limited to chalk out a detailed plan and provide adequate capital for HVDC related R&D as well as training of manpower in HVDC related technology. The Ministry of Power has submitted that it has relaxed local content clauses and discussions are going on with various manufacturers to localise these systems. The Committee would like the Ministry to take regular feedback from the industry in order to chalk out adequate support measures for them.

Need for Skilled Manpower

15. The Committee note that both the Ministry of New and Renewable Energy and Ministry of Power have recognized the need for skilled manpower to achieve the renewable energy related targets on time. The Ministry of New and Renewable Energy has furnished

that it has been providing short-term training to individuals as technicians in different renewable energy sectors. As per the information provided by the Ministry of New and Renewable Energy, around 57,372 people have been trained as 'Suryamitras' (solar technicians) in financial year 2024-25. Under PM Surya Ghar:Muft Bijli Yojana, around 1,27,799 individuals have been trained till July, 2025. Apart from short-term training, the Ministry of New and Renewable Energy is also providing fellowships for higher studies and support for renewable energy based lab upgradations. The Committee note that the Ministry of New and Renewable Energy have come out with a detailed plan to develop skilled workforce by 2030. This. The Committee are of the view that the above plan is quite comprehensive, however, the key lies in its timely implementation. The Committee expect the Ministry of New and Renewable Energy to begin working on the modalities of its training programme at the earliest. With regard to skilling of manpower in transmission sector, Power Grid Corporation of India Limited (POWERGRID) has furnished that it has launched skill development initiatives for unemployed youth by setting up training centres in key areas of the country. However, the Committee note that this is a recent initiative as only around 200 people have been trained till June 2025, which is low compared to the actual workforce required. The Committee therefore, would like to recommend the Ministry of Power and POWERGRID to accelerate their pace of skill development initiatives in order to train adequate number of individuals in the critical transmission sector to meet the transmission related targets by 2030.

New Delhi;
9th September, 2025
Bhadrapad 18, 1947 (Saka)

Shrirang Appa Barne
Chairperson,
Standing Committee on Energy

Annexure-I

Ministry of New and Renewable Energy						
State-Wise (Location based) installed capacity of Solar Power as on 31.07.2025						
S.No.	**State / UTs**	**Ground Mounted Solar**	**RTS (including PM-Surya Ghar Yojana)**	**Hybrid Solar Comp.**	**Off-grid Solar/KUSUM**	**Solar Power Total**
		(MW)	**(MW)**	**(MW)**	**(MW)**	**(MW)**
1.	Andhra Pradesh	5006.34	428.6		88.34	5523.28
2.	Arunachal Pradesh	1.27	6.68		6.9	14.85
3.	Assam	126	107.9		9.44	243.34
4.	Bihar	196.06	193.8		21.28	411.14
5.	Chhattisgarh	998.91	146.2		390.73	1535.84
6.	Goa	1.95	57.7		1.49	61.14
7.	Gujarat	15025.13	5835.3	871.11	173.01	21904.55
8.	Haryana	267.76	889.6		1019.65	2177.01
9.	Himachal Pradesh	203	62.9		34.58	300.48
10.	Jammu & Kashmir	2.49	42.2		29.8	74.49
11.	Jharkhand	21	93.04		86.32	200.36
12.	Karnataka	9054.03	755.4	212.25	39.16	10060.84
13.	Kerala	323.21	1444.2		24.93	1792.34
14.	Ladakh	6	5			11.00
15.	Madhya Pradesh	4865.23	627.7		102.04	5594.97
16.	Maharashtra	7982.71	3745.4		1608.71	13336.82
17.	Manipur	0.6	10.2		6.08	16.88
18.	Meghalaya		0.21		4.07	4.28
19.	Mizoram	22	3		6.39	31.39
20.	Nagaland		1		2.17	3.17
21.	Odisha	574.5	106.8		42.34	723.64
22.	Punjab	886.27	503.4		81.76	1471.43
23.	Rajasthan	27821.74	1710	1980	805.45	32317.19
24.	Sikkim	0.52	5.12		1.92	7.56
25.	Tamil Nadu	9621.08	1132.5		70.4	10823.98
26.	Telangana	4360.49	633.5		8.71	5002.70
27.	Tripura	5.57	12.2		11.34	29.11
28.	Uttar Pradesh	2776.34	382.5		324.72	3483.56
29.	Uttarakhand	541.05	273.71		20.96	835.72
30.	West Bengal	240.35	67.13		13.14	320.62
31.	Andaman & Nicobar Islands	25.05	5.6		0.27	30.92
32.	Chandigarh	6.34	71.7		0.81	78.85
33.	Dadra & Nagar Haveli and Daman & Diu	14.3	105.6			119.90
34.	Delhi	9.84	341.3		1.46	352.60

35.	Lakshadweep	2.45	1.6		2.52	6.57
36.	Puducherry	1.03	67.8		0.18	69.01
37.	Others				45.01	45.01
	Total Megawatt (MW)	**90990.61**	**19876.49**	**3063.36**	**5086.08**	**119016.54**

Annexure-II

Draft Framework for PV Power Plant Rating

1. Objective

To develop a performance-based rating methodology of Solar PV power plants in India to:

- Promote operational excellence.
- Benchmark best practices.
- Support policy incentives and investment decisions.

2. Key Rating Parameters

Rating will be based on technical, operational, environmental, and compliance metrics. Weightage may be assigned as follows:

Category	Parameter
Plant design	Site selection, system sizing, module selection, Inverter selection, array configuration, Balance of System (BoS), Energy yield estimation, civil and structural design, electrical design
Engineering, procurement, and construction (EPC)	Environmental, Social, Health and Safety, Performance warranty of the power plant
Performance	CUF (Capacity Utilization Factor), PR (Performance Ratio), Energy Yield
Quality & Reliability	Equipment quality, Warranty adherence, Downtime, Operations and Maintenance (O&M) effectiveness
Regulatory Compliance	PV module: Availability of BIS certificate, IS 14286, IS/IEC 61730, IEC 62804, IEC 61701 and any other certificate as per the requirement of owner, Inverter: Availability of BIS certificate, IS 16221 (Part 2), IS/IEC 61683, IS 16169:2019, IS 17980 and any other certificate as per the requirement of owner, Grid connectivity norms, Inverter behaviour.
Environmental Compliance	Waste disposal, Land use, Water usage, Biodiversity impact
Innovation & Data Transparency	Data Real-time **r**eporting, Supervisory Control and Data Acquisition (SCADA)/Internet of Things (IoT) use, Predictive maintenance

3. Rating Methodology:

Each of the above parameters will be given a weightage factor based on the its role in overall physical and financial health of the PV power plant. The final PV plant rating will be decided based on these parameters on a scale of 1-10.

4. Implementation Roadmap:

- **Consultation with different stakeholders:** The procedure will be circulated among different stakeholders for their comments and thereafter it will be incorporated in the methodology.
- **Pilot Projects & Field Testing:** The methodology will be tested in real-world scenarios by applying it to existing or new PV power plant, for which NISE is already doing some field testing.
- **Standardization & Regulatory work:** After validation of the procedure, NISE will work with MNRE and BIS for developing the standard (IS) for the same.
- **Stakeholder meetings at NISE to enhance the outreach and adoption of the rating system by PV Industry:** The methodology will be embedded into financing and risk assessment frameworks used by banks and investors for evaluating project bankability. NISE will also develop training materials, arrange workshops, and online courses to educate various stakeholders.

Annexure –III

1. Central Financial Assistance (CFA) by the Central Government under Pradhan Mantri Surya Ghar:Muft Bijli Yojana (PMSG:MBY):

Sr. No.	Type of Residential Segment	CFA	CFA (Special Category States)
1.	Residential Sector (first 2 kWp)	Rs 30,000/kWp	Rs 33,000/kWp
2.	Residential Sector (additional 1 kWp)	Rs 18,000/kWp	Rs 19,800/kWp
3.	Residential Sector (above 3 kWp)	No additional CFA	No additional CFA
4.	GHS/RWA etc, for common facilities for up to 500 kWp(@3 kWp per house)	Rs 18,000/kWp	Rs 19,800/kWp

2. Additional Financial Assistance by 15 States/UTs under Pradhan Mantri Surya Ghar:Muft Bijli Yojana (PMSG:MBY):

S. No	State/UT	Subsidy
1.	Uttar Pradesh	Rs 15,000/kW up to 2 kW
2.	Haryana	Up to Rs 25,000/kW up to 2 kW (only for poor families)
3.	Uttarakhand	Rs 23,000/kW for upto 1 kW; Rs 17,000/kW upto 3 kW
4.	Goa	50% till 10 kW, 10% till 30 kW
5.	DNH & DD	Rs.10,000/kW up to 3 kW
6.	Ladakh	Rs. 20,000 /kW upto 2 kWp; Rs. 10,000/kWp for additional 1kW
7.	Delhi	Rs. 2,000/kW upto 5 kW, generation-based incentive
8.	Assam	Rs. 15,000/kW up to 3kW; capped at Rs. 45,000
9.	Odisha	Rs 50,000/kW for upto 2kW and 10,000 for extra 1 kW i.e 60,000 upto 3kW
10.	J&K	Rs 3,000/kW upto 3kW
11.	Lakshadweep	Rs 45,000/kW upto 2kW, Rs 27000 for next 1kW
12.	A & N Islands	Rs 45,000/kW upto 2kW, Rs 27000 for next 1kW
13.	Mizoram	Within AMC Area: Rs 12,000/kW, Up to 100 KM: Rs 14,000/kW, up to 200 KM: Rs 16,000/kW, Beyond 200 KM, Rs 18,000/KW. Subsidy up to 10 kW for all cases.
14.	Rajasthan	Rs 17,000 per system upto 5 kW
15.	Nagaland	Rs 50000/- upto 3 KW

Annexure –IV

1. State-wise progress under PM-KUSUM (31.07.2025)

(i) State-wise progress under Component-A of PM-KUSUM

State Name	Total Sanction (MW)	Total Installed (MW)
Assam	2	0
Chhattisgarh	330	7
Goa	50	0
Gujarat	500	0
Haryana	158	16.61
Himachal Pradesh	100	100
Madhya Pradesh	1,790	52.13
Maharashtra	260	4
Odisha	90	0
Rajasthan	5,250	457.25
Tamil Nadu	14	3
Telangana	1,450	0
Tripura	5	0
Uttar Pradesh	1	1
Total	**10,000**	**640.99**

(ii) State-wise progress under Component – B of PM-KUSUM

State Name	Total Sanction (Nos.)	Total Installed (Nos.)
Andaman and Nicobar	34	0
Arunachal Pradesh	700	604
Assam	4,000	0
Goa	900	100
Gujarat	18,212	12,016
Haryana	1,97,655	1,61,073
Himachal Pradesh	1,270	959
Jammu and Kashmir	5,000	2,955
Jharkhand	52,985	36,346
Karnataka	26,365	2,388
Kerala	8	8
Ladakh	1,400	0
Madhya Pradesh	59,400	7,325
Maharashtra	5,55,000	4,23,379
Manipur	450	150

State Name	Total Sanction (Nos.)	Total Installed (Nos.)
Meghalaya	2,735	98
Mizoram	1,700	40
Nagaland	265	65
Odisha	16,441	5,713
Puducherry	72	0
Punjab	18,000	15,993
Rajasthan	1,62,914	1,06,831
Tamil Nadu	5,187	4,260
Telangana	20,000	0
Tripura	11,114	5,082
Uttar Pradesh	1,07,266	66,468
Uttarakhand	3,685	1,477
Total	**12,72,758**	**8,53,330**

(iii) State-wise progress under Component – C (Individual Pump Solarization) of PM-KUSUM

State Name	Total Sanction - IPS (Nos.)	Total Solarised - IPS (Nos.)
Andaman and Nicobar	436	0
Kerala	9448	2259
Punjab	186	0
Rajasthan	2138	2,138
Tamil Nadu	5000	0
Telangana	28,000	0
Tripura	3,600	285
Uttar Pradesh	12,000	4264
West Bengal	20	20
Total	**60828**	**8966**

(iv) State-wise progress under Component – C (Feeder Level Solarization) of PM-KUSUM

State Name	Total Sanction - FLS (Nos.)	Total Solarised - FLS (Nos.)
Andhra Pradesh	2,00,000	0
Bihar	90,000	0
Chhattisgarh	10,000	0
Goa	11,000	700
Gujarat	6,97,000	1,90,723
Haryana	2899	0

State Name	Total Sanction - FLS (Nos.)	Total Solarised - FLS (Nos.)
Karnataka	6,28,588	25,886
Kerala	22,368	10,964
Madhya Pradesh	3,45,000	17,823
Maharashtra	7,75,000	3,41,884
Odisha	10,000	0
Rajasthan	4,00,000	57,995
Uttar Pradesh	3,70,000	0
Total	**35,61,855**	**6,45,975**

2. State-wise development of Solar Parks (31.03.2025):

Sl. No.	Name of State	No. of Solar Parks	Capacity Sanctioned (in MW)
1	Andhra Pradesh	5	4200
2	Chhattisgarh	1	100
3	Gujarat	7	12150
4	Himachal Pradesh	1	53
5	Jharkhand	3	1089
6	Karnataka	2	2500
7	Kerala	3	255
8	Madhya Pradesh	8	4330
9	Maharashtra	4	1105
10	Mizoram	1	20
11	Odisha	1	40
12	Rajasthan	10	10276
13	Uttar Pradesh	9	3840
Total		**55**	**39958**

Annexure –V

1. Details of operational Solar Power Projects of NHPC Ltd.

S. No.	Power Plants	Installed Capacity (MW)	State	Design Energy (MU)	Commissioning
1	50 MW Solar Power Project, Theni & Dindigul	50	Tamil Nadu	105.96	2018
2	300 MW Solar Power Plant, Bikaner, (Under CPSU Scheme)	107.14 (Out of 300 MW)	Rajasthan	749.09 (for 300 MW)	2025
3	700 KW Solar Power Plant CU Ajmer (By NHPC REL)	0.7	Rajasthan	1.53	2024
4	65 MW Solar Power Plant Kalpi (By BSUL)	65	Uttar Pradesh	148.38	2024
5	88 MW Floating Solar Power Plant Omkareswar (By NHDC)	88	Madhya Pradesh	204.58	2024
6	8 MW Solar Power Plant Sanchi, (By NHDC)	8	Madhya Pradesh	14.716	2024
	TOTAL	**318.84**			

2. Details of operational Solar Power Projects (SPP) of SJVN Ltd./SJVN Green Energy Limited (SGEL)

S. N.	Name of Project	Present Status
1	5.6 MW Charanka SPP- Gujarat	Under Operation since March 2017 Cumulative Energy Generation: - 63.60 MU (as on 30.04.2025)
2	1.3 MW SPP at NJHPS- Himachal Pradesh	Under Operation since July 2020 Cumulative Energy Generation: - 6.22 MU (as on 30.04.2025)
3	75 MW Parasan SPP- Uttar Pradesh	Under Operation since November 2022 Cumulative Energy Generation: - 371.35MU (as on 30.04.2025)
4	75 MW Gurhah SPP in Jalaun district of Uttar Pradesh	Under Operation since December 2023 Cumulative Energy Generation: 201.78 MU (as on 30.04.2025)
5	50 MW Gujrai SPP in Kanpur	Under Operation since February 2024

	Dehat of Uttar Pradesh	Cumulative Energy Generation: 115.75 MU (as on 30.04.2025)
6	100 MW Raghanesda SPP in Banaskantha district of Gujarat.	58 MW Commercial Operation Date (COD) is 02.04.2024. 42 MW COD is 12.10.2024. Cumulative Energy Generation: 222.56 MU (as on 30.04.2025)
7	90 MW Omkareshwar Floating SPP in Khandwa District of Madhya Pradesh	45 MW COD is 07.10.2024. 45 MW COD is 30.10.2024. Cumulative Energy Generation: 108.54 MU (as on 30.04.2025)
8	1000 MW Bikaner SPP under CPSU scheme Phase II Tranche III	241.77 MW COD is 02.04.2025. 78.23 MW COD is15.05.2025. Cumulative Energy Generation: 38.16 MU (as on 30.04.2025)

Annexure-VI

1. Target and Achievement of Intra-State Transmission System (InSTS) under Green Energy Corridor Phase-I

	Target	Achievement	%
Transmission Lines (ckm)	9767	9136	93.53
Substations Capacity (MVA)	22689	21925	96.63
RE Capacity (GW)	23.2	20	86.2
CFA Disbursal (Rs. Crore) *	3164.70*	2839.104	89.71
No. of Packages	84	71	84.5

** Total Eligible CFA = Sum of grants eligible for each package calculated at 40% of DPR cost or Award cost whichever is lower*

2. Target and Achievement of Intra-State Transmission System (InSTS) under Green Energy Corridor Phase-II

	Target	Achievement	Remarks
Transmission Lines (ckm)	7919	221	Original targets as per CCEA note are 10753 ckm and 27546 MVA. However, targets have changed after revised project sanctions issued to Gujarat, Himachal Pradesh, Rajasthan and Uttar Pradesh.
Substations Capacity (MVA)	24488	-	
RE Capacity (GW)	20	-	
No. of Packages Awarded	91	64	
CFA Disbursal (Rs. Crore)	3947.34	384.246	

APPENDIX - I

STANDING COMMITTEE ON ENERGY

MINUTES OF ELEVENTH SITTING OF THE STANDING COMMITTEE ON ENERGY (2024-25) HELD ON 3RD APRIL, 2025 IN COMMITTEE ROOM C, PARLIAMENT HOUSE ANNEXE, NEW DELHI

The Committee sat from 1500 hrs to 1650 hrs

MEMBERS - LOK SABHA

Shri Shrirang Appa Barne - Chairperson

2 Shri Shyamkumar Daulat Barve

3 Captain Brijesh Chowta

4 Shri Chandra Prakash Joshi

5 Dr. Shivaji Bandappa Kalge

6 Dr. Kirsan Namdeo

7 Shri Nilesh Dnyandev Lanke

8 Shri Dulu Mahato

9 Smt. Bijuli Kalita Medhi

10 Shri Jagdambika Pal

11 Shri Kunduru Raghuveer

12 Shri Chandubhai Chhaganbhai Shihora

13 Shri Abhay Kumar Sinha

MEMBERS - RAJYA SABHA

14 Shri Birendra Prasad Baishya

15 Shri Ajit Kumar Bhuyan

16 Shri Javed Ali Khan

SECRETARIAT

1	Shri Ramkumar Suryanarayanan	Joint Secretary
2	Shri Kulmohan Singh Arora	Director
3	Shri Ajitesh Singh	Deputy Secretary
4	Ms. Deepika	Under Secretary

WITNESSES		
MINISTRY OF NEW AND RENEWABLE ENERGY		
1	Ms. Nidhi Khare	Secretary
2	Shri Sudeep Jain	Additional Secretary
3	Shri J.V.N. Subramanyam	Joint Secretary
SOLAR ENERGY CORPORATION OF INDIA LIMITED		
4	Shri Rameshwar Prasad Gupta	Chairman & Managing Director
5	Shri Sanjay Sharma	Director
6	Shri Sivakumar V. Vepakomma	Director
NATIONAL INSTITUTE OF SOLAR ENERGY		
7	Dr. Mohammad Rihan	Director General

2. At the outset, the Hon'ble Chairperson welcomed the Members of the Committee and representatives of the Ministry of New and Renewable Energy (MNRE), Solar Energy Corporation of India (SECI) Limited and National Institute of Solar Energy (NISE) to the Sitting and informed that the Sitting had been called for briefing by representatives of the Ministry of New and Renewable Energy (MNRE) and Solar Energy Corporation of India (SECI) Limited on the subject 'Performance Evaluation of Solar Power Projects in the Country'. The Chairperson also apprised them about the provisions of Directions 55(1) and 58 of the Directions by the Hon'ble Speaker.

3. During the discussion, a power-point presentation was made by the Secretary of MNRE which, *inter-alia,* included 'Panchamrit' Goals; Renewable Energy (RE) Institutional Ecosystem; Installed Capacity (as on 28th February 2025); India's RE – Past and Future; Source-wise Country Comparison; Sector-wise Capacity Status; Major Policy Reforms; Major Solar Module Manufacturing Countries and Growth of Solar Module Manufacturing Capacity in India; Key Policies to promote Solar PV Manufacturing; PLI Scheme for High Efficiency Solar PV Modules; Status of Projects awarded under Solar PLI Scheme; Company-wise progress in Solar

PLI Scheme; Steps taken to reduce imports, costs and dependency on China; Overview of Solar Parks and list of Developed Parks, Partially Developed Parks and Parks under Development; Scheme overview of PM Surya Ghar: Muft Bijli Yojana and its Progress; Key Measures with DISCOMs; PM KUSUM – An Overview and Achievements (as on 28.02.2025); Human Resource Development Scheme and Skill Development Initiatives; MNRE's Budget and Expenditure during last 3 years;; Additional subsidies by States; State Targets; Best Practices: Feeder Level Solarization in Maharashtra; Points raised in previous meetings etc.

4. The Committee, *inter-alia,* deliberated upon the following points with representatives of the MNRE, SECI and NISE:

i) Current mechanism of evaluation of solar power projects in the country;

ii) Broad framework of evaluation mechanism of other countries vis-à-vis India.

iii) Status of development of standard guidelines by NISE for performance evaluation of solar power projects;

iv) Status of ongoing assessment of solar potential in the country by NISE;

v) Major challenges facing the solar sector in the country;

vi) Intermittency of solar power and its inadequacy in meeting peak demands of the country;

vii) Inadequate storage capacity in renewable energy sector and the plans for its expansion;

viii) Issues associated with tenders for energy storage and Power Purchase Agreements (PPAs) signed by SECI;

ix) SECI's investment in solar energy and renewable energy storage system;

x) Domestic manufacturing in solar sector and the gap with China;

xi) Performance of PLI scheme and other measures to promote domestic manufacturing;

xii) Solar Park Scheme and the issue of land availability;

xiii) Progress and targets under PM Surya Ghar Yojana: Muft Bijli Yojana;

xiv) Policy changes under PM KUSUM and their impact;

xv) Skill development of human resource associated with renewable energy sector.

5. The Members also sought clarifications on various other issues relating to the subject and representatives of the MNRE, SECI and NISE responded to the same. The Committee directed the representatives to furnish within 10 days, written replies to those queries which could not be fully responded to.

The Committee then adjourned.

The verbatim proceedings of the Sitting have been kept for record.

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APPENDIX - II

STANDING COMMITTEE ON ENERGY

MINUTES OF THIRTEENTH SITTING OF THE STANDING COMMITTEE ON ENERGY (2024-25) HELD ON 20TH MAY, 2025 IN MAIN COMMITTEE ROOM, PARLIAMENT HOUSE ANNEXE, NEW DELHI

The Committee sat from 1100 hrs to 1330 hrs

MEMBERS - LOK SABHA

Shri Shrirang Appa Barne - Chairperson

2 Shri Shyamkumar Daulat Barve
3 Shri Devusinh Chauhan
4 Captain Brijesh Chowta
5 Shri Malaiyarasan D.
6 Dr. Shivaji Bandappa Kalge
7 Dr. Kirsan Namdeo
8 Shri Dulu Mahato
9 Shri Ramprit Mandal
10 Shri Jagdambika Pal
11 Shri Kunduru Raghuveer
12 Shri Chandubhai Chhaganbhai Shihora
13 Shri Abhay Kumar Sinha

MEMBERS - RAJYA SABHA

14 Shri Gulam Ali
15 Shri Ajit Kumar Bhuyan
16 Shri R. Dharmar
17 Shri Javed Ali Khan
18 Shri Harsh Mahajan

SECRETARIAT

1	Shri Ramkumar Suryanarayanan	Joint Secretary
2	Shri Kulmohan Singh Arora	Director
3	Shri Ajitesh Singh	Deputy Secretary
4	Ms. Deepika	Under Secretary

WITNESSES		
NTPC GREEN ENERGY LIMITED		
8	Shri Gurdeep Singh	CMD
9	Shri Sarit Maheshwari	CEO
NHPC LIMITED		
10	Shri Raj Kumar Chaudhary	CMD
11	Shri Rajendra Prasad Goyal	Director
SOLAR ENERGY CORPORATION OF INDIA LIMITED		
12	Shri Sivakumar V Vepakomma	Director
SJVN LIMITED		
13	Shri Ajay Kumar Sharma	Director
14	Shri Ajay Kumar Singh	CEO, SJVN Green Energy Limited

2. At the outset, the Hon'ble Chairperson welcomed the Members of the Committee and representatives of the NHPC Limited, SJVN Limited, Solar Energy Corporation of India Limited and NTPC Green Energy Limited to the Sitting and informed that the Sitting had been called for briefing on the subject 'Performance Evaluation of Solar Power Projects in the Country'. The Chairperson also apprised them about the provisions of Directions 55(1) and 58 of the Directions by the Hon'ble Speaker.

3. During the discussion, a power-point presentation was made by the CEO, NTPC Green Energy Limited which, *inter-alia,* included NGEL's Renewable Energy journey; NGEL Group overview; its operating capacity; Performance highlights; NGEL Solar Plants performance; Adoption of latest technology and best practices, etc.

4. Then, a representative of NHPC Limited made a power-point presentation which, *inter-alia,* included NHPC's journey since 1975; its footprints, strengths and portfolio; Financial performance; NHPC's solar plants under operation and plant-wise performance; Projects under

construction; Key initiatives by the company and NHPC as Scheme Implementing Partner in PM Surya Ghar Muft Bijli Yojana, etc.

5. Thereafter, the representatives of SJVN Limited made a power-point presentation which, *inter-alia,* included Overview of SJVN and its journey so far; Operational and Financial Performance; SJVN's future plans; SJVN's Solar Stations under operation, Solar Projects under construction and Solar Projects under pre-construction in India; Critical issues and support required in Solar Projects and recent achievements, etc.

6. Further, a representative of Solar Energy Corporation of India Limited made a power-point presentation which, *inter-alia,* included Company Status of SECI; its business models; Solar capacity under SECI tenders; Progress and challenges in SECI-awarded solar power projects; Supply of power by SECI through power trading and Power Sale Agreements (PSAs); Brief about innovative tenders; Ongoing incentive schemes of the Government; SECI's own projects; Emerging areas in renewable energy sector, etc.

7. The Committee, *inter-alia,* deliberated upon the following points with representatives of the NHPC Limited, SJVN Limited, Solar Energy Corporation of India Limited and NTPC Green Energy Limited:

i) Status of Operational and Under-Construction solar projects of the PSUs;

ii) Performance of PSUs as Renewable Energy Implementing Agencies;

iii) Status of pending PPAs and the reasons thereof;

iv) Issues related to evacuation and transmission of renewable energy;

v) Adoption of modern technology related to solar power by PSUs;

vi) Issues related to Right of Way (RoW) and fair compensation;

vii) Ongoing renewable energy related storage projects and plans for expansion;

viii) Issues faced by PSUs in developing battery storage and pump storage;

ix) Innovative tenders and the challenge of finding bidders for them;

x) Status of Government building solarization under PM Surya Ghar Muft Bijli Yojana;

xi) Performance of PLI scheme and other measures to promote domestic manufacturing;

xii) Solar Park Scheme and the issue of land availability;

xiii) Tendering experience of SECI under PM-KUSUM; and

xiv) Challenges related to recycling and safe disposal of end-of-life solar waste.

8. The Members also sought clarifications on various other issues relating to the subject and representatives of the NHPC Limited, SJVN Limited, Solar Energy Corporation of India Limited and NTPC Green Energy Limited responded to the same. The Committee directed the representatives to furnish within 10 days, written replies to those queries which could not be fully responded to.

The Committee then adjourned.

The verbatim proceedings of the Sitting have been kept for record.

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APPENDIX - III

STANDING COMMITTEE ON ENERGY

MINUTES OF FOURTEENTH SITTING OF THE STANDING COMMITTEE ON ENERGY (2024-25) HELD ON 4TH JUNE, 2025 IN MAIN COMMITTEE ROOM, PARLIAMENT HOUSE ANNEXE, NEW DELHI

The Committee sat from 1130 hrs to 1330 hrs

MEMBERS - LOK SABHA

Shri Shrirang Appa Barne - Chairperson

2 Shri Shyamkumar Daulat Barve
3 Shri Jagadish Chandra Barma Basunia
4 Shri Devusinh Chauhan
5 Shri Chandra Prakash Joshi
6 Dr. Shivaji Bandappa Kalge
7 Dr. Kirsan Namdeo
8 Shri Dulu Mahato
9 Shri Ramprit Mandal
10 Smt. Bijuli Kalita Medhi
11 Shri Jagdambika Pal
12 Smt. Shambhavi
13 Shri Chandubhai Chhaganbhai Shihora

MEMBERS - RAJYA SABHA

14 Dr. Laxmikant Bajpayee
15 Shri Ajit Kumar Bhuyan
16 Shri Javed Ali Khan
17 Shri Harsh Mahajan

SECRETARIAT

1	Shri Ramkumar Suryanarayanan	Joint Secretary
2	Shri Kulmohan Singh Arora	Director
3	Shri Ajitesh Singh	Deputy Secretary
4	Ms. Deepika	Under Secretary

WITNESSES		
ADANI GREEN ENERGY LIMITED		
15	Shri Ashish Khanna	CEO
16	Shri Raj Kumar Jain	Chief Business Development Officer
17	Shri Molay Kumar Maitra	Head, Corporate Affairs
TATA POWER RENEWABLE ENERGY LIMITED		
18	Shri Mahesh Paranjpe	Chief Operating Officer
19	Shri Sudhakar Yadav	Group Head, Corporate Affairs
AZURE POWER		
20	Shri Sugata Sircar	Group CFO
21	Shri Sankalp Kant	Senior Vice President, Strategy & Commercial
22	Ms. Kritika Baralia	Vice President, Business Development & Commercial

2. At the outset, the Hon'ble Chairperson welcomed the Members of the Committee and representatives of Adani Green Energy Limited, Tata Power Renewable Energy Limited and Azure Power to the Sitting and informed that the Sitting had been called for briefing by stakeholders in the Private Sector on the subject 'Performance Evaluation of Solar Power Projects in the Country'. The Chairperson also apprised them about the provisions of Directions 55(1) and 58 of the Directions by the Hon'ble Speaker.

3. During the discussion, a power-point presentation was made by a representative of Adani Green Energy Limited which, *inter-alia,* included Adani's Renewable Energy portfolio; Its growth in Renewable Energy Sector; Its Business Model; Breakup of its commissioned Renewable Energy capacity; Operational Performance; Investment Snapshot; Its mega Renewable Energy projects; details about its Khavda plant; Key Environmental, Social and Governance (ESG) updates and its Management overview, etc.

4. Then, a representative of Tata Power Renewable Energy Limited made a power-point presentation which, *inter-alia,* included a brief about the Tata Group; Its Generation, Transmission and Distribution assets across India; Brief about its global presence across Energy Value Chains; Capacity development in Hydro and Pumped Storage Plants (PSPs); Brief about Tata Power Renewable Energy Limited and its Renewable Energy portfolio; Its Engineering, Procurement and Construction (EPC) contracts; Manufacturing capacity; Challenges for Renewable Energy development and Support requested, etc.

5. Thereafter, a representative of Azure Power made a power-point presentation which, *inter-alia,* included Azure Power's overview; Its portfolio; Skill development initiatives; Community engagement programmes; Overview of India's Renewable Energy and Solar Industry landscape; Factors impacting Solar performance and evolving regulatory landscape; Connectivity and offtake framework, etc.

6. The Committee, *inter-alia,* deliberated upon the following points with representatives of Adani Green Energy Limited, Tata Power Renewable Energy Limited and Azure Power:

i) Capacity Utilization Factor (CUF) of operational solar projects of the above-mentioned Companies;

ii) Status of Under-Construction solar projects of the Companies;

iii) Major policy and regulatory hurdles in development and evacuation of solar power by private developers;

iv) Status of pending PPAs and the reasons thereof;

v) Delay in development of Green Energy Corridor and its impact on evacuation and transmission of renewable energy;

vi) Adoption of modern technology in development of solar power and maintenance of solar equipments by the Companies;

vii) Issues related to land acquisition, Right of Way (RoW) and fair compensation;

viii) Inter-State Transmission System Charges and the issue related to its waiver;

ix) Ongoing and planned renewable energy related storage projects and the issues related thereto;

x) Issues related to unmet Renewable Purchase Obligation (RPO) targets by State Discoms;

xi) Concerns of industry towards Deviation Settlement Mechanism (DSM) regulations;

xii) Status of solar energy related domestic manufacturing and the share of imports in solar projects of the Companies;

xiii) Training related initiatives by the Companies for the workforce engaged in renewable energy sector;

xiv) Need for uniformity in renewable energy related policies/regulations/rules at the Centre and State level; and

xv) Challenges related to recycling and safe disposal of end-of-life solar waste.

7. The Members also sought clarifications on various other issues relating to the subject and representatives of Adani Green Energy Limited, Tata Power Renewable Energy Limited and Azure Power responded to the same. The Committee directed the representatives to furnish within 10 days, written replies to those queries which could not be fully responded to.

The Committee then adjourned.

The verbatim proceedings of the Sitting have been kept for record.

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APPENDIX - IV

STANDING COMMITTEE ON ENERGY

MINUTES OF SIXTEENTH SITTING OF THE STANDING COMMITTEE ON ENERGY (2024-25) HELD ON 23RD JULY, 2025 IN COMMITTEE ROOM 'B', PARLIAMENT HOUSE ANNEXE, NEW DELHI

The Committee sat from 1500 hrs to 1700 hrs

MEMBERS - LOK SABHA

Shri Shrirang Appa Barne - Chairperson

2 Shri Shyamkumar Daulat Barve
3 Shri Jagadish Chandra Barma Basunia
4 Shri Devusinh Chauhan
5 Shri Shahu Shahaji Chhatrapati
6 Captain Brijesh Chowta
7 Shri Malaiyarasan D.
8 Dr. Shivaji Bandappa Kalge
9 Dr. Kirsan Namdeo
10 Shri Dulu Mahato
11 Shri Ramprit Mandal
12 Smt. Bijuli Kalita Medhi
13 Shri Jagdambika Pal
14 Shri Chandubhai Chhaganbhai Shihora
15 Dr. Shrikant Eknath Shinde
16 Shri Abhay Kumar Sinha

MEMBERS - RAJYA SABHA

17 Shri Gulam Ali
18 Shri Ajit Kumar Bhuyan
19 Shri R. Dharmar
20 Shri Javed Ali Khan
21 Shri Harsh Mahajan
22 Smt. Mamata Mohanta
23 Shri Rajeev Shukla

SECRETARIAT

1	Shri Ramkumar Suryanarayanan	Joint Secretary
2	Shri Kulmohan Singh Arora	Director
3	Shri Ajitesh Singh	Deputy Secretary
4	Ms. Deepika	Under Secretary

WITNESSES		
MINISTRY OF POWER		
1	Shri Pankaj Agarwal	Secretary
2	Shri Srikant Nagulapalli	Additional Secretary
3	Dr. D. Sai Baba	Joint Secretary
4	Shri Hemant Kumar Pandey	Chief Engineer
MINISTRY OF NEW AND RENEWABLE ENERGY		
5	Shri Sudeep Jain	Additional Secretary
CENTRAL ELECTRICITY AUTHORITY		
6	Shri Ghanshyam Prasad	Chairperson
POWERGRID CORPORATION OF INDIA LIMITED		
7	Shri R.K. Tyagi	CMD
8	Shri Vamsi Rama Mohan Burra	Director
9	Shri Akhilesh Pathak	ED
10	Shri Jagannath Rao	CGM
GRID CONTROLLER OF INDIA LIMITED		
11	Shri Samir Chandra Saxena	CMD
12	Shri Manoj Kumar Agrawal	ED
CENTRAL TRANSMISSION UTILITY OF INDIA LIMITED		
13	Shri Ashok Pal	COO
NATIONAL INSTITUTE OF SOLAR ENERGY		
14	Dr. Mohammad Rihan	Director General

2. At the outset, the Hon'ble Chairperson welcomed the Members of the Committee and representatives of the Ministry of Power and Power Grid Corporation of India Limited to the Sitting and informed that the Sitting had been called for briefing on the subject 'Performance Evaluation of Solar Power Projects in the Country'. The Chairperson also apprised them about the provisions of Directions 55(1) and 58 of the Directions by the Hon'ble Speaker.

3. During the discussion, a power-point presentation was made by the representative of Ministry of Power which, *inter-alia,* included Brief about the Evolution of Transmission Grid; Achievement of One Nation One Grid One Frequency; Power related characteristics of different regions of India;

Expansion of Indian Transmission System; Sector-wise Non-Fossil Generation till March 2030; Connectivity status for Non-Fossil Power by 2030; Inter-State Transmission System (ISTS) for Renewable Energy by 2030; Status of Under Construction and Under Bidding projects of ISTS; Green Energy Corridor (GEC) scheme for Intra-State Transmission System (InSTS); Project approval and Award status; Challenges and Connectivity issues; Addressing delays in Transmission projects and Way Forward, etc.

4. The Committee, *inter-alia,* deliberated upon the following points with representatives of the Ministry of Power and Power Grid Corporation of India Limited:

i) Major policies/rules guiding the Transmission Sector;

ii) Transmission related targets till 2030;

iii) Reasons for slow progress of Transmission related projects;

iv) Status of Green Energy Corridor Phase-I and II;

v) Reasons for delay in getting connectivity approvals;

vi) Issues related to land acquisition and Right of way (RoW);

vii) Existing mechanism for resolution of land and RoW related issues;

viii) Status of projects affected by Great Indian Bustard (GIB) issue;

ix) Analysis of ISTS charges and waivers;

x) Issues related to Renewable Purchase Obligation (RPO)/Renewable Consumption Obligation (RCO) by States;

xi) Domestic manufacturing capacity in transmission equipments;

xii) Need to develop domestic capabilities in High Voltage direct Current (HVDC) technology;

xiii) Resource Adequacy Plans and the extent of engagement with States;

xiv) Reasons for low storage capacity in the country;

xv) Plans to achieve storage related targets by 2030;

xvi) Lack of skilled workforce in Transmission sector; and

xvii) Performance of skilling programmes of the Government.

5. The Members also sought clarifications on various other issues relating to the subject and representatives of the Ministry of Power and Power Grid Corporation of India Limited responded to the same. The Committee directed the representatives to furnish within a week, written replies to those queries which could not be fully responded to.

The Committee then adjourned.

The verbatim proceedings of the Sitting have been kept for record.

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APPENDIX - V

STANDING COMMITTEE ON ENERGY

MINUTES OF EIGHTEENTH SITTING OF THE STANDING COMMITTEE ON ENERGY (2024-25) HELD ON 5TH AUGUST, 2025 IN COMMITTEE ROOM 'D', PARLIAMENT HOUSE ANNEXE, NEW DELHI

The Committee sat from 1500 hrs to 1645 hrs

MEMBERS - LOK SABHA

Shri Shrirang Appa Barne - Chairperson

2 Shri Shyamkumar Daulat Barve
3 Shri Jagadish Chandra Barma Basunia
4 Shri Devusinh Chauhan
5 Shri Shahu Shahaji Chhatrapati
6 Captain Brijesh Chowta
7 Shri Malaiyarasan D.
8 Dr. Shivaji Bandappa Kalge
9 Dr. Kirsan Namdeo
10 Shri Dulu Mahato
11 Shri Ramprit Mandal
12 Smt. Bijuli Kalita Medhi
13 Shri Jagdambika Pal
14 Shri Chandubhai Chhaganbhai Shihora

MEMBERS - RAJYA SABHA

15 Shri Gulam Ali
16 Shri Ajit Kumar Bhuyan
17 Shri R. Dharmar
18 Shri Javed Ali Khan
19 Shri Harsh Mahajan
20 Smt. Mamata Mohanta
21 Shri Rajeev Shukla

SECRETARIAT

1	Shri Ramkumar Suryanarayanan	Joint Secretary
2	Shri Kulmohan Singh Arora	Director
3	Shri Ajitesh Singh	Deputy Secretary
4	Ms. Deepika	Under Secretary

WITNESSES		
MINISTRY OF NEW AND RENEWABLE ENERGY		
1	Shri Santosh Kumar Sarangi	Secretary
2	Shri Sudeep Jain	Additional Secretary
3	Shri J.V.N. Subramanyam	Joint Secretary
INDIAN RENEWABLE ENERGY DEVELOPMENT AGENCY LIMITED		
4	Shri Pradip Kumar Das	CMD
5	Shri Sushant Kumar Dey	ED
NATIONAL INSTITUTE OF SOLAR ENERGY		
6	Dr. Mohammad Rihan	Director General

2. At the outset, the Hon'ble Chairperson welcomed the Members of the Committee and representatives of the Ministry of New and Renewable Energy to the Sitting and informed that the Sitting had been called for evidence on the subject 'Performance Evaluation of Solar Power Projects in the Country'. The Chairperson also apprised them about the provisions of Directions 55(1) and 58 of the Directions by the Hon'ble Speaker.

3. During the discussion, a power-point presentation was made by a representative of the Ministry of New and Renewable Energy which, *inter-alia,* included Information about achievement of 50% Non-Fossil power capacity milestone; India's Climate Commitments; Hon'ble Prime Minister's 'Panchamrit' at CoP26; India's current Renewable Energy capacity; Global Renewable Energy Scenario; India's Renewable Energy – Past and Future; Sector-wise capacity status in Giga Watt; Progress under Pradhan Mantri Surya Ghar:Muft Bijli Yojana; Progress under PM-KUSUM; Solar rich States in India; Renewable Energy in a developed India: 2030-2047 Vision; Policy Measures to promote domestic manufacturing of Solar Equipment and Current Status; Current share of domestic Solar manufacturing; Queries on Manufacturing, Storage, Tendering, Land and Training/Skilling; Green Energy Corridor – Status & Challenges; Current mechanism for evaluating the performance of Solar Projects; Performance of Utility-scale Solar Power

Projects and Guideline/Labelling mechanism on Solar related Technology Standards etc.

4. The Committee, *inter-alia,* deliberated upon the following points with representatives of the Ministry of New and Renewable Energy:

i) Issues related to variability of Solar Energy;

ii) Lack of domestic storage capability;

iii) Issue of high cost of manufacturing of storage system;

iv) High import dependency for critical raw materials in Solar Sector;

v) Performance of major schemes/programmes in Solar Sector;

vi) Possibility of including higher capacity Solar Pumps under Central Financial Assistance (CFA) of PM-KUSUM;

vii) Lack of domestic capabilities in High Voltage Direct Current (HVDC) technology;

viii) Issue of non-compliance of Renewable Purchase Obligation (RPO)/Renewable Consumption Obligation (RCO) by States;

ix) Need to simplify policies/rules related to land acquisition;

x) Issue of shortage of trained manpower;

xi) Need to encourage States to prioritize development of Renewable Energy;

xii) Issues related to pending Power Purchase Agreements (PPAs); and

xiii) IREDA's loan portfolio in Solar Sector.

5. The Members also sought clarifications on various other issues relating to the subject and representatives of the Ministry of New and Renewable Energy responded to the same. The Committee directed the representatives to furnish within a week, written replies to those queries which could not be fully responded to.

The Committee then adjourned.

The verbatim proceedings of the Sitting have been kept for record.

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APPENDIX - VI

STANDING COMMITTEE ON ENERGY

MINUTES OF TWENTY FIRST SITTING OF THE STANDING COMMITTEE ON ENERGY (2024-25) HELD ON 8TH SEPTEMBER, 2025 IN MAIN COMMITTEE ROOM, PARLIAMENT HOUSE ANNEXE, NEW DELHI

The Committee sat from 1100 hours to 1130 hours

MEMBERS - LOK SABHA

Shri Shrirang Appa Barne - Chairperson

2. Shri Shyamkumar Daulat Barve
3. Shri Jagadish Chandra Barma Basunia
4. Shri Devusinh Chauhan
5. Shri Shahu Shahaji Chhatrapati
6. Captain Brijesh Chowta
7. Shri Malaiyarasan D.
8. Shri Chandra Prakash Joshi
9. Dr. Shivaji Bandappa Kalge
10. Dr. Kirsan Namdeo
11. Shri Dulu Mahato
12. Shri Ramprit Mandal
13. Smt. Bijuli Kalita Medhi
14. Shri Jagdambika Pal
15. Shri Kunduru Raghuveer
16. Smt. Shambhavi
17. Shri Chandubhai Chhaganbhai Shihora
18. Shri Abhay Kumar Sinha

MEMBERS - RAJYA SABHA

19. Shri Gulam Ali
20. Shri Birendra Prasad Baishya
21. Dr. Laxmikant Bajpayee
22. Shri Ajit Kumar Bhuyan
23. Shri R. Dharmar
24. Shri Javed Ali Khan
25. Shri Harsh Mahajan

SECRETARIAT

1.	Shri Ramkumar Suryanarayanan	Joint Secretary
2.	Shri Kulmohan Singh Arora	Director
3.	Shri Ajitesh Singh	Deputy Secretary
4.	Ms. Deepika	Under Secretary

2. At the outset, the Chairperson welcomed the Members of the Committee and apprised them about the agenda of the Sitting. The Committee then took up for consideration and adoption, draft Report of the Committee on the subject 'Performance Evaluation of Solar Power Projects in the Country'.

3. After discussing the contents of the Report in detail, the Committee adopted the above-mentioned draft Report without any amendment/modification.

4. The Committee authorized the Chairperson to finalize the above-mentioned Report and since the Parliament was not in Session, the Committee authorized the Chairperson to present the Report to the Hon'ble Speaker, Lok Sabha, as per Direction 71 A(1) of the Directions by the Speaker, Lok Sabha.

The Committee then adjourned.

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