BHARAT COKING COAL LIMITED

A Mini Ratna Company
(A Subsidiary of Coal India Limited - A Maharatna Company)Only
Producer of Prime Coking Coal in India
CIN - U101011972G01000918

PROJECT REPORT :-

25 MW (AC) SOLAR PV POWER PLANT AT BCCL BHOJUDIH COAL WASHERY, PURULIA DISTRICT, WEST BENGAL

Under the Supervision of:-
Mr. Saurabh Kumar Ojha
(Deputy Manager, Civil Department.
Koyla Bhawan, BCCL, Dhanbad)

06/01/24

Submitted By:-
Md Taarique Anwar
USN:-

National Institute of Technology Agartala

Agartala, Tripura

DECLARATION

I hereby declare that the project entitled "**25 MW (AC) SOLAR PV POWER PLANT AT BCCL BHOJUDIH COAL WASHERY, PURULIA DISTRICT, WEST BENGAL**" is an authentic record of my own work carried out at Bharat Coking Coal Limited, Dhanbad , Jharkhand as requirements of 28 days training for the award of degree of B.Tech Civil Engineering, National institute of Technology Agartala, under the guidance of Saurabh Kumar Ojha Sir, Assistant Manager (Civil), CED,HQ, from 08/12/2023 to 06/01/2024.

Date: 06.01.2024

(Signature of student)
Md Taarique Anwar

Certified that the above statement made by the student is correct to the best of our knowledge and belief.

Under the Supervision of:
Mr. Saurabh Kumar Ojha
(Deputy Manager, Civil Department,
Koyla Bhawan, BCCL, Dhanbad)

06/01/24

ACKNOWLEDGEMENT

The sense of achievement that accompanies the successful conclusion of this trainingexperience would be remiss without acknowledging the invaluable contributions of several individuals. I take this opportunity to extend my sincere appreciation to those who have been instrumental in supporting and guiding me through this transformativejourney.

At the forefront is my industry guide and mentor, **Mr. Saurabh Kumar Ojha, Deputy Manager (Civil),CED,HQ**. His vision and execution were pivotal in imparting practical knowledge of the industry. Despite his demanding schedule, Mr. Kumar not only shared invaluable insights but also cultivated an ideal learning environment. This training report stands as a testament to his teaching, encouragement, and the insightfulinputs he generously provided.

I extend my heartfelt gratitude to the Head of the Civil Department for their remarkablesupport throughout the training period. Their guidance significantly contributed to shaping my understanding and honing my skills.

Lastly, I would like to express my gratitude to the **National Institute of Technology, Agartala** for facilitating the necessary arrangements and granting permission for my industrial training at BCCL Dhanbad, a subsidiary of the esteemed Maharatna Company Coal India Limited. Special thanks also go to my parents for their unwaveringencouragement and continuous support throughout this enriching journey.

MD TAARIQUE ANWAR
REGISTRAION NO.-21UCE090
CIVIL ENGINEERING DEPARTMENT
NIT AGARTALA,TRIPURA

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TOPICS:-

1. Introduction of the Organization:

COAL INDIA LIMITED:

Coal India Limited (CIL) is an Indian state-controlled coal mining company headquartered in Kolkata, West Bengal, India and the world's largest coal miner with revenue exceeding 624, 15 billion (FY 2012). It was formerly owned entirely by the Union Government of India, under the administrative control of the Ministry of Coal. It is involved in coal mining and production industry. In April 2011, CIL, was conferred the Maharatna status by the Union Government of India and ranked as one of India's most valuable company by market value

Coal India Limited (CIL) has signed a Memorandum of Understanding (MoU) with Solar Energy Corporation of India Ltd. (SECI) for setting up of solar power plants of total 1000 MW capacity in different parts of the country. Solar projects will help CIL to reduce its consumption of conventional energy and also enable to move to the greener form of energy.

Coal India Limited was formed in 1975 as Coal Mines Authority Limited, in 1975 it was charged to Coal India Limited. It has 8 Subsidiaries Headquarters in different states.

1. Bharat Coking Coal Limited (BCCL) (Headquarter-Dhanbad, Jharkhand)

2. Central Coalfields Limited (CCL) (Headquarter Ranchi, Jharkhand)

3. Western Coalfields Limited (WCL) (Headquarter-Nagpur. Maharashtra)

4. Eastern Coalfields Limited (ECL) (Headquarter- Sanctoria, Asansol, West Bengal)

5. Central Mine Planning and Design Institute Limited (CMPDIL) (Headquarter-Ranchi, Jharkhand)

6. Northern Coalfield Limited (NCL) (Headquarter- Singrauli, Madhya Pradesh)

7. South Eastern Coalfield Limited (SECL) (Headquarter- Bilaspur, Chhattisgarh)

8. Mahanadi Coalfield Limited (MCL) (Headquarter- Sambhalpur, Odisha)

9. CIL Navikarniya Urja Limited (CNUL) (Headquarter - Kolkata, West Bengal)

10. CIL Solar PV Limited (CSPV) (Headquarter - Kolkata, West Bengal

BHARAT COKING COAL LIMITED (BCCL):

Bharat Coking Coal Limited (BCCL) is a subsidiary of Coal India Limited with its headquarters in Dhanbad. India. It was incorporated in January, 1972 to operate coking coal mines (214 in number) operating in the Tharia and Kaniganj Coalfields, taken over by the government of India on 16th Oct, 1971.

Mining was in Jharia and Raniganj Coalfields within the leasehold of Bharat Coking Coal Limited and Eastem Coalfields Limited are faced with problems of fire and subsidence due to the centuries old history of mining. In the past, coal seams of good quality occurring at shallow depth were mined unscientifically, leaving small stooks (coal pillars) in the underground workings. The operators extracted as much coal as possible without supporting or stowing the mined-out workings the mines were operated in small leaseholds and later closed due to economic and other reasons: Some of these workings either caught fire or became unstable/suhsidence prone later. The magnitude of the problems compounded manifold with the growth of habitation over these areas and is now a matter of serious concern.

History of fire in Jharia Coalfield (JCF) dates back to 1916. Since then, a number of other fires were reported. According to the investigation made after Nationalization, 70 fires were known to exist in BCC covering an area of 17.32 SQ KM. It was estimated that about 37 million tons of good quality prime coking coal was destroyed and about

1864 million tons coal has been blocked due to these fires Subsequently 7 more fires were also identified. These 77 fires were spread over in 41 collieries of BCCL Efforts were made to address the issue and 10 fires were successfully liquidated and others were controlled.

CIL NAVIKARNIYA URJA LIMITED (CNUL):

CIL Navikarniya Urja Limited (CNUL), a wholly owned subsidiary company of Coal India Limited was incorporated on 16th of April,2021 to venture into new business area of New and Renewable Energy (Non-Conventional) segment including Solar, Wind, Small Hydro, Biomass, Geo-Thermal, Hydrogen, Tidal, etc., along with other prevalent technologies/emerging technologies for development of non-conventional/clean & renewal energy Business. Parent company Coal India Limited (CIL) is the state-owned coal mining corporate came into being in November 1975 is at the forefront of the nation's coal production in the Indian energy sector. CIL alone produces around 83% of country's entire coal output. In a country where 69% of the total electricity generation is coal based, CIL virtually empowers the nation's power sector. Around 80% of CIL's total supplies are catered to power sector

ADMINISTRATIVE AREAS: [There are 13 areas in BCCL)

Administrative Area		NAME
Area No. 1.	-	Barora Area
Area No.3.	-	Block II Area
Area No.2.	-	Govindpur Area
Area No. 4.	-	Katras Area
Area No.5.	-	Sijiua Area
Area No.6.	-	Kusunda Area
Area No.7.	-	Putki Balihari Area
Area No.8.	-	Kustore (abolished)
Area No.9.	-	Bastacola Area
Area No.10.	-	Lodna Area
Area No.11.	-	Eastern Jharia Area
Area No.12.	-	Chanch Victoria Area
Area No.13.	-	Western Jharia Area

We underwent our training at the KNTA Headquarter, BCCL and Karmatand Township. The duration of our training was 4 weeks duration from 03-11-2023 to 02-12-2023.

Contract for construction of this multi storey building has been awarded to MCL-KSIPL(JV)

2. WHY THIS PROJECT IS REQURED TO COAL INDIA

1.1 INTRODUCTION

The Ministry of Coal has ambitious plans to contribute significantly to the country's renewable energy requirements, considering both the responsibility to reduce carbon emissions and future sustainability of the coal companies. All coal subsidiaries have been directed to achieve net zero emissions within the stipulated schedule. It is important to note that these coal subsidiaries possess adequate internal resources to support this transition to sustainable parties.

Ministry of Coal

Coal Ministry CPSEs to achieve 7,281MW Renewable Energy Capacity by 2027

CIL and NLCIL to set up large solar parks in Gujarat and Rajasthan

1600 MW renewable capacity created till March 2023

Coal India actively setting up large scale solar power plants on de-coaled land

Posted On: 03 AUG 2023 4:59PM by PIB Delhi

In line with the Panchamrit commitment of the Prime Minister, the Ministry of Coal has advised all its CPSEs to diligently draft net zero plan for the coal mining sector. As per the national commitment, Coal PSUs have meticulously prepared three years action plan outlining specific renewable targets. Accordingly, Coal India Ltd (CIL) , its subsidiaries and NLCIL have planned to install 3000MW and 3,731 MW of renewable energy capacity respectively. SCCL has also planned to install 550MW. This ambitious plan aims to achieve a total renewable energy capacity of over 7,281MW by 2027.

Presently, approx. 1600 MW renewable capacity has already been created till

March 2023, (CIL- 11, NLCIL- 1360, SCCL-224) and 1,769 MW has awarded for this financial year i.e. 2023-24. Out of this, CIL has awarded 399 MW and NLCIL has awarded 1370 MW. An additional 2,553 MW capacity (1110 of NLCIL + 1443 CIL) is scheduled to be awarded in the next financial year i.e. 2024-25.

CIL and NLCIL are planning to establish large solar parks in Gujarat and Rajasthan. CIL has already signed an agreement for its maiden venture into solar power for the sale of 100 MW to GUVNL, Gujarat and also entered into joint venture with RRVUNL for setting up of a solar park of 1190 MW. NLCIL has already awarded 300 MW solar power plant work to M/s Tata Power Limited and expected to be completed within 18 months, supplying power to Rajasthan. Furthermore, NLCIL has also awarded a tender of 300 MW for a solar park and another 300 MW solar park likely under green shoe option to be set up in Gujarat.

Additionally, both CIL and its subsidiaries are actively setting up large-scale solar power plants on its de-coaled land and overburden dumps. They are also equipping all houses in the coal subsidiary companies with rooftop solar facilities. NCL has entered into Joint venture with the Government of UP to establish a 1500 MW floating solar power plant in Rihand reservoir.

The Ministry of Coal has ambitious plans to contribute significantly to the country's renewable energy requirements, considering both the responsibility to reduce carbon emissions and future sustainability of the coal companies. All coal subsidiaries have been directed to achieve net zero emissions within the stipulated schedule. It is important to note that these coal subsidiaries possess adequate internal resources to support this transition to sustainable practices.

3. ABOUT THE PROJECT:-

- The envisaged 25 MW (AC)/ 37.5 MW (DC) solar Power plant will be established through EPC contractor at Bhojudih Coal Washery, BCCL, Purulia District, West Bengal, India.
- The produced energy will be utilized for captive consumption of the different Consumer Points located at Jharkhand State. The total 25MW may be connected to DVC owned 132/33 KV substation at Patherdih, Chasnalla, Jharkhand which is around 15 Km from the proposed project site. M/s DVC has already given consent for connectivity in this regard.
- All approvals, permits and clearances required for setting up of the Project (including transmission infrastructure, connectivity and addition of bays including all accessories and land registration if required) and those required from State Government and local Bodies shall be in the scope of the successful bidder. The responsibility of getting the grid connectivity shall entirely be of the Successful Bidder.
- CNUL (on behalf of BCCL) now issues this Tender for selection of EPC-cum-O&M contractor for the entire EPC work for the Project as well as O&M of the Project for 5 years after the project Commissioning date (COD) (to be executed through BCCL after awarding work by BCCL. CNUL will be responsible up to the award of the work to the selected EPC Contractor. Post-award activities, such as signing of contract agreement, contract execution, payment and other activities will be under BCCL's scope.

e-TENDER NOTICE

Description of work	Estimated Cost of Work (Including GST) (In INR)	Earnest Money (In INR)	Period of Completion (In Days)
Design, Engineering, Procurement & Supply, Construction & Erection, Testing, Commissioning, Associated Transmission System and Comprehensive O&M for 5 Years of 25 MW (AC) Solar PV Power Plant at Bhojudih Coal Washery, BCCL, Purulia District, West Bengal, India.	Rs. 141,91,00,000.00 (inclusive of Supply cost, Work Cost and NPV of O&M cost for 5 years)	Rs. 50,00,000	Total contract period: 2190 Days a) From date of commencement to COD: 12 Months (i.e. 365 days) b) Operation and Maintenance of Project: 1825 Days (i.e. 5 years) from COD

4. DETAILS PROJECT REPORT (DPR)

Coal India Limited (CIL) has signed a Memorandum of Understanding (MoU) with Solar Energy Corporation of India Ltd. (SECI) for setting up of solar power plants of total 1000 MW capacity in different parts of the country. Solar projects will help CIL to reduce its consumption of conventional energy and also enable to move to the greener form of energy.

SECI, under the administrative control of Ministry of New and Renewable Energy (MNRE) is working with a mission to build 'Green India' through harnessing abundant solar radiation and to achieve energy security for the country.

SECI carried out a joint site survey with officials of BCW and BCCL during 17-18 Oct 2019 for assessing the feasibility of the Solar PV Project on the land offered by BCCL, located at Bhojudih Coal Washery site in the Purulia District, West Bengal. It was informed that about 100 acres of land is available at Gosaidih Mouza at Purulia district, West Bengal. Based on the available land about 25 MW of Solar PV project can be established in the proposed site.

Fig:- Satellite image of the proposed land parcel available at ECW

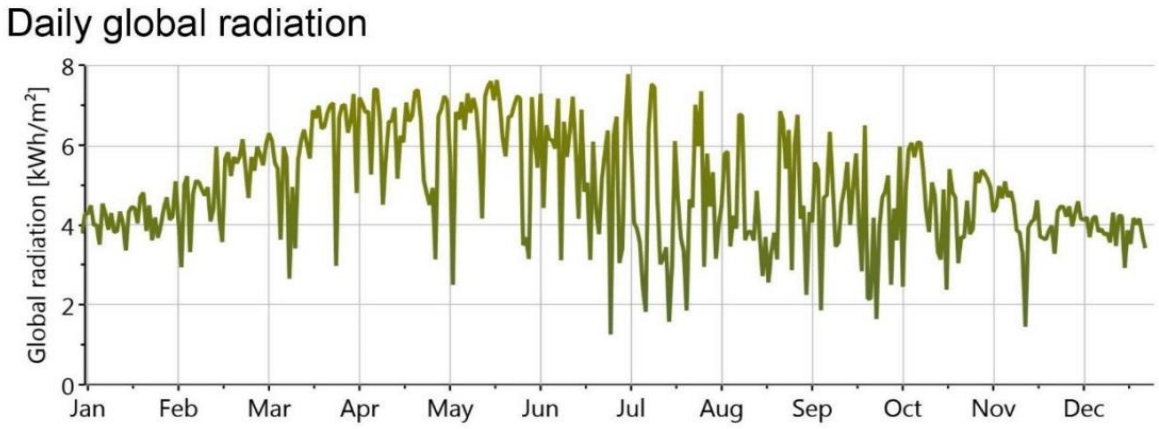


Figure 4-7:Daily Global Radiation at Horizontal Surface

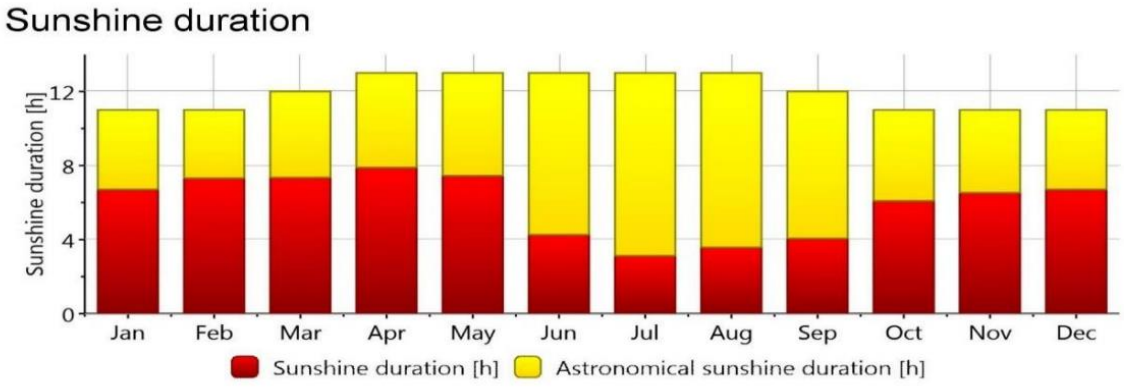


Figure 4-9: Monthly Sunshine data

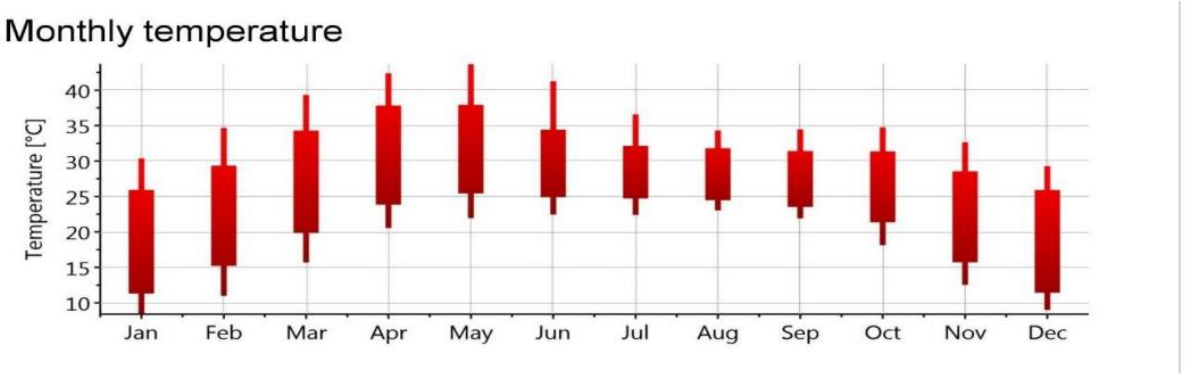


Figure 4-10: Monthly temperature

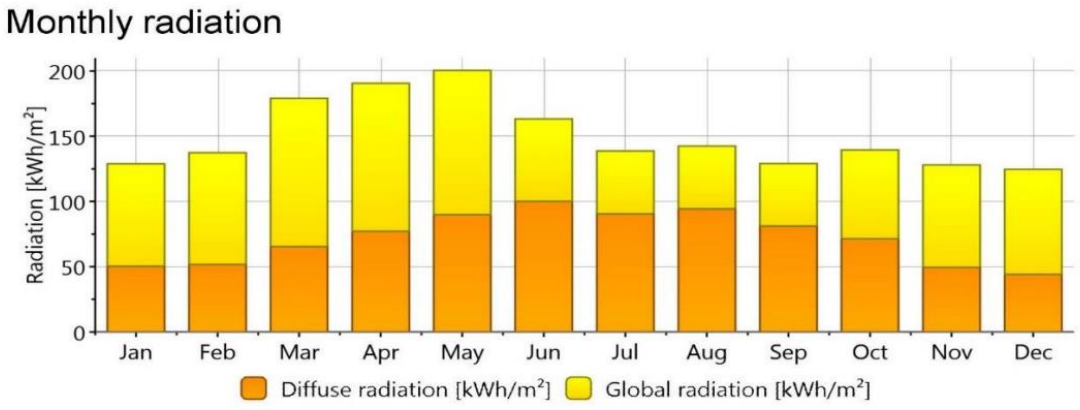


Figure 4-8: Monthly Global & Diffuse Radiation at Horizontal Surface

Air Temperature

Monthly and daily variation of air temperature according to Meteonorm 7.1 data are shown below.

Table 4-6: Monthly air temperature– Meteonorm data

Month	Air Temperature (°C)
Jan	18.1
Feb	22.0
Mar	26.8
Apr	31.0
May	31.6
Jun	30.1
Jul	28.4
Aug	28.2
Sep	27.8
Oct	26.1
Nov	22.1
Dec	18.2
Year	25.9

5. PURPOSE OF THE PROJECT:-

The primary purpose of a solar power plant, as a renewable energy project, is to harness the abundant and sustainable energy from the sun to generate electricity. By utilizing solar panels to convert sunlight into electricity, these projects contribute to reducing dependence on finite fossil fuels, decreasing greenhouse gas emissions, and promoting a more environmentally friendly energy infrastructure. The overarching goal is to advance the transition towards cleaner, sustainable energy sources to address climate change and create a more sustainable energy future.

Solar power is the conversion of sunlight into electricity, either directly using photovoltaic) PV (or indirectly using concentrated solar power) CSP (. Whereas CSP

systems use lenses or mirrors and tracking systems to focus a large area of sunlight into a small beam, thereby utilizing the solar heating effect, Photovoltaic convert sunlight into electric current using the photovoltaic effect.

6. SCOPE OF REPORT:-

SECI's role includes assessment of the proposed water body for the project and prepare a detailed project report including feasibility analysis covering Techno-commercial aspects of proposed project.

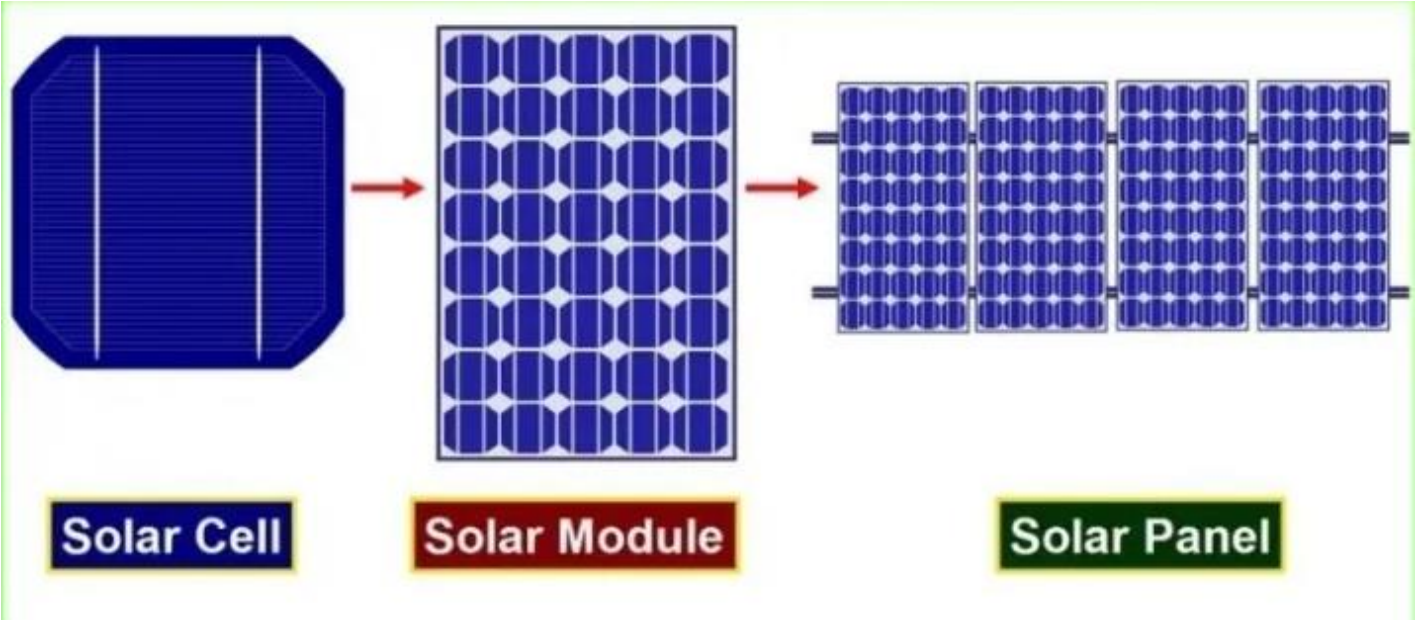
The Broad Scope of Work for the Feasibility Report are:

- Site Assessment
- Technology Assessment
- Solar Resource Assessment
- Energy Yield Assessment
- Preliminary Cost Estimates & Financial Analysis

The scope of a solar power plant refers to the range and extent of its functions and capabilities. It includes factors such as the plant's capacity, energy output, technology used, geographical location, and environmental impact. The scope can vary from small-scale installations providing power to a single home to large utility-scale plants contributing significantly to the grid. Additionally, advancements in solar technology continue to expand the scope, making solar power an increasingly versatile and sustainable energy source.

7. SOLAR PHOTOVOLTAIC TECHNOLOGIES:-

The basic building block of a PV system is the PV cell, which is a semiconductor device that converts solar radiation into direct-current (DC) electricity. PV cells are interconnected to form a PV module, typically up to 50-300 Watts (W). The PV modules combined with a set of additional application-dependent system components (e.g. inverters, batteries, electrical components, and mounting systems), form a PV system. These PV systems are highly modular, i.e. modules can be linked together to provide power ranging from a few watts to tens of megawatts (MW). The solar cell is a simple semiconductor p-n junction diode. When sunlight strikes a PV cell, the photons get absorbed by the semiconductor material and excite the electrons from valence band to conduction thus leaving behind a positive charge called hole. The electrons and holes get separated by the junction potential making p-region as positive charged and n-region as negatively charged. The charges create potential difference among the two ends of the solar cell and generate electric current upon connecting to the external circuit. The complete process is called as photovoltaic effect and the cells are called photovoltaic (PV) cells. The electricity output of the solar cells per unit radiation is known as solar cell efficiency. Present day solar cells are made up of different materials and the efficiencies are ranging between 10-23% for terrestrial applications. The solar cells for space applications are highly expensive which are made up of multi junction technology with the efficiencies between 36-42%.



There are several types of Photovoltaic cells. However, more than 90% of the solar cells currently made worldwide consist of wafer-based Silicon. These wafer-based silicon solar cells are approximately 200 μm thick. Depending on the silicon wafer nature there are two variants in solar cells, called as mono crystalline and multi (or poly) crystalline solar cells.

Figure 5-18: Mounting Structure

Concluding a 25MW solar power plant involves several key steps:

1. *Project Planning:* Ensure all necessary permits and approvals are obtained. Develop a detailed project plan outlining construction timelines, budget, and resource requirements.

2. *Site Preparation:* Clear the site and prepare the ground for solar panel installation. Ensure proper grading and foundation work.

3. *Solar Panel Installation:* Install solar panels according to the project specifications. Ensure alignment for maximum sunlight exposure.

4. *Inverter Installation:* Set up inverters to convert DC power generated by solar panels into usable AC power for the grid.

5. *Electrical Infrastructure:* Establish the necessary electrical infrastructure, including transformers, switchgear, and transmission lines, to connect the solar power plant to the grid.

6. *Testing and Commissioning:* Thoroughly test all components of the solar power plant to ensure proper functionality. Commission the plant after successful testing.

7. *Monitoring System:* Implement a monitoring system to track the performance of the solar power plant. This helps in identifying and addressing any issues promptly.

8. *Grid Connection:* Connect the solar power plant to the electrical grid, following all safety and regulatory procedures.

9. *Documentation and Compliance:* Complete all required documentation, including compliance with environmental and safety standards.

10. *Maintenance Plan:* Develop a comprehensive maintenance plan to ensure the long-term efficiency and reliability of the solar power plant.

11. *Training:* Provide training for the operations and maintenance staff to handle routine tasks and troubleshoot issues.

12. *Handover:* Complete the handover process, officially transferring the solar power plant to the owner or operator.

13. *Monitoring and Optimization:* Continuously monitor and optimize the performance of the solar power plant to maximize energy production.

14. *Community Engagement:* Consider engaging with the local community,

8. COMPONENT OF SOLAR PV SYSTEM:-

Components that are present in a typical photovoltaic system are:

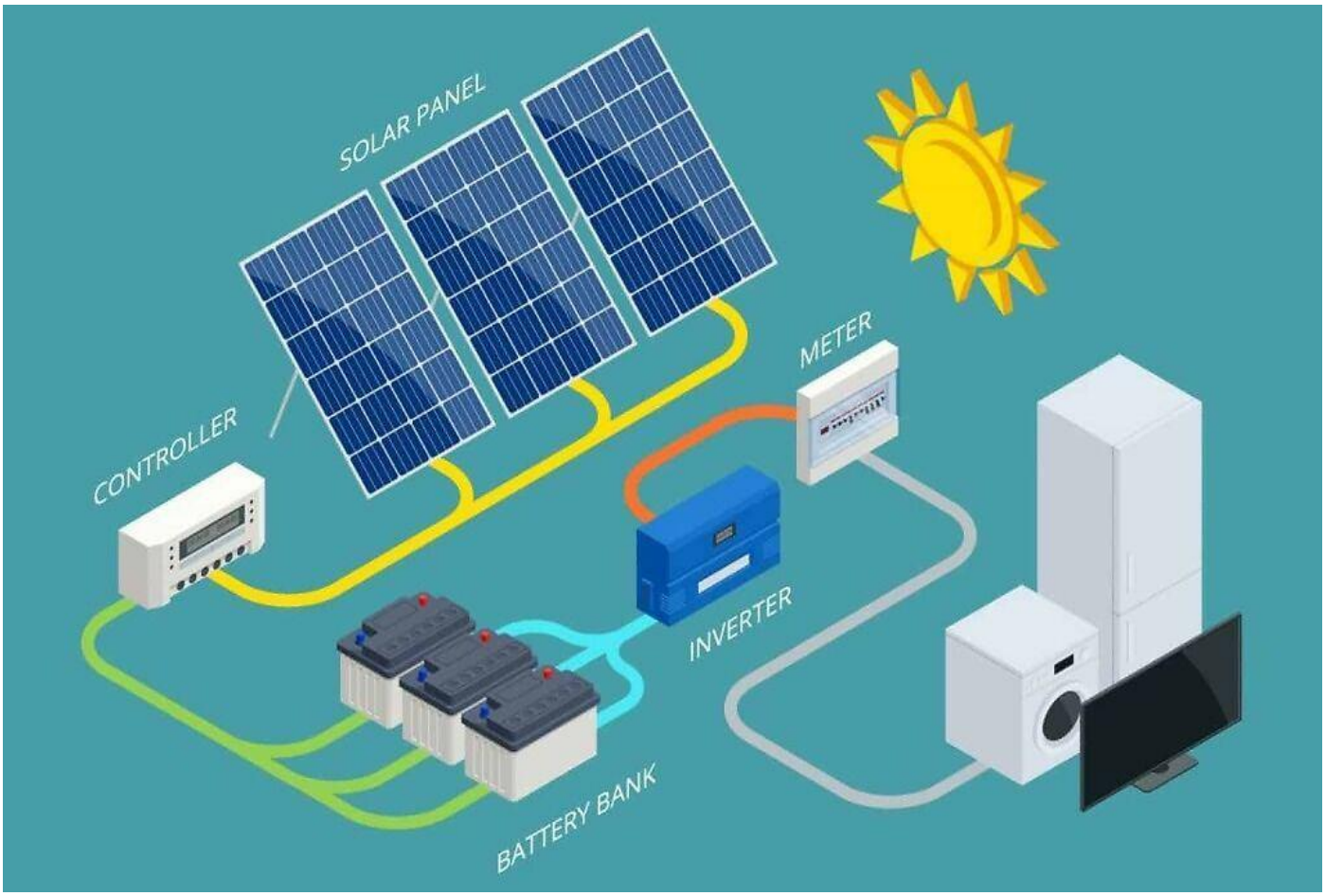
- **Solar panels**
- Electrical connections between solar panels
- Output power lines
- **Power inverter** (converts DC electricity to AC electricity)
- Mechanical mounting equipment
- Charge controller
- Wiring
- **Batteries for energy storage**
- Electrical meter (for grid-connected systems)
- Overcurrent and surge protection devices
- Power processing equipment
- Grounding equipment

Utilities may use more advanced systems for generating substantial quantities of electricity such as:

- **Single axis** or **double axis** tilting systems
- Automatic cooling and cleaning systems
- Fuel cell, battery or other type of power storage systems
- Transmission lines

9. SOLAR SECTOR OVERVIEW

The envisaged 25 MW (AC)/ 37.5 MW (DC) solar Power plant will be established through EPC contractor at Bhojudih Coal Washery, BCCL, Purulia District, West Bengal, India


SOLAR PANEL
METER
CONTROLLER
INVERTER
BATTERY BANK

.


REDMI NOTE 8
AI QUAD CAMERA

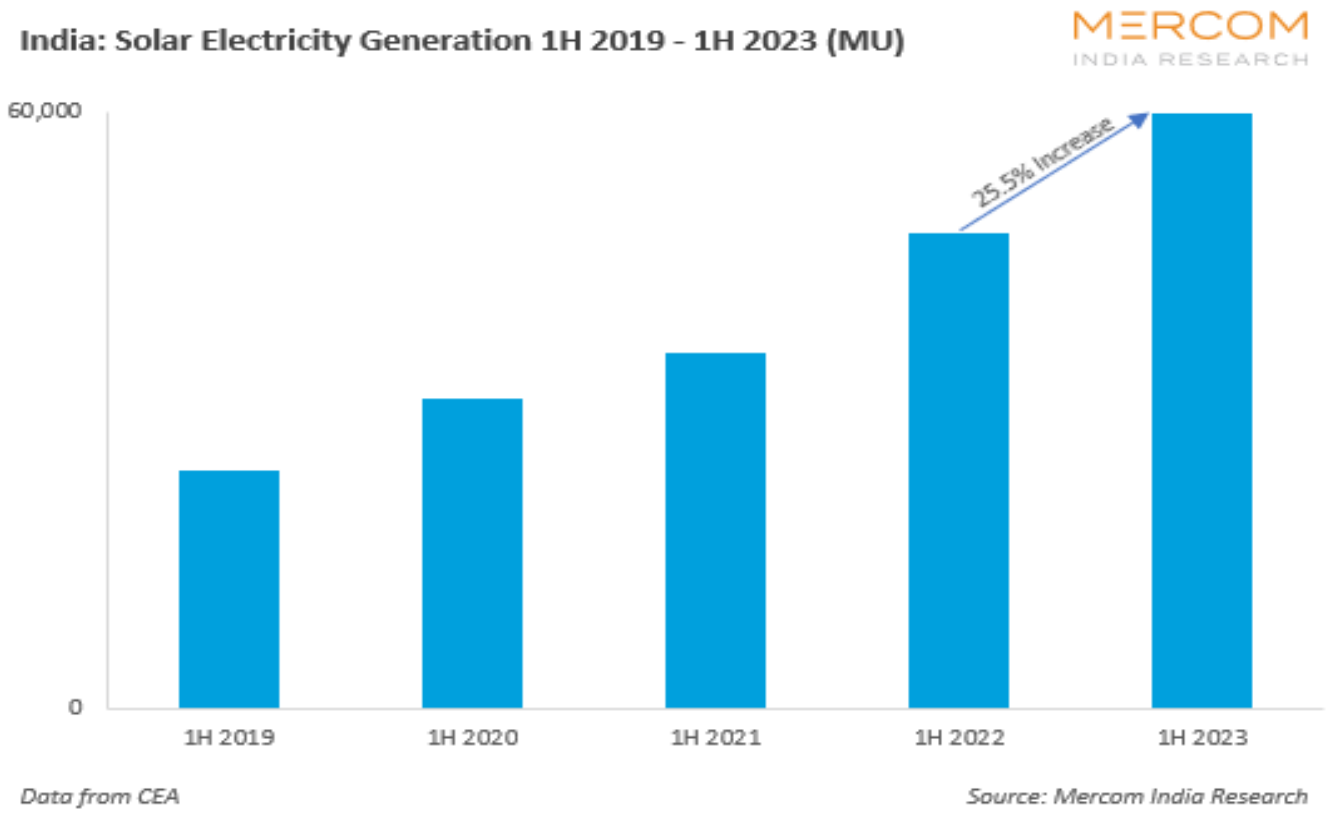

33 cm

10. CONCLUSION

In conclusion, the establishment of a 25MW solar power plant involves meticulous planning, efficient execution, and compliance with regulatory requirements. From site preparation and solar panel installation to grid connection and ongoing monitoring, each step is crucial for the successful operation of the plant. Emphasizing sustainability, community engagement, and adherence to safety standards contributes to the long-term viability of the solar power project. Continuous monitoring and optimization ensure maximum energy production, marking the culmination of a sustainable and impactful venture in the renewable energy sector.

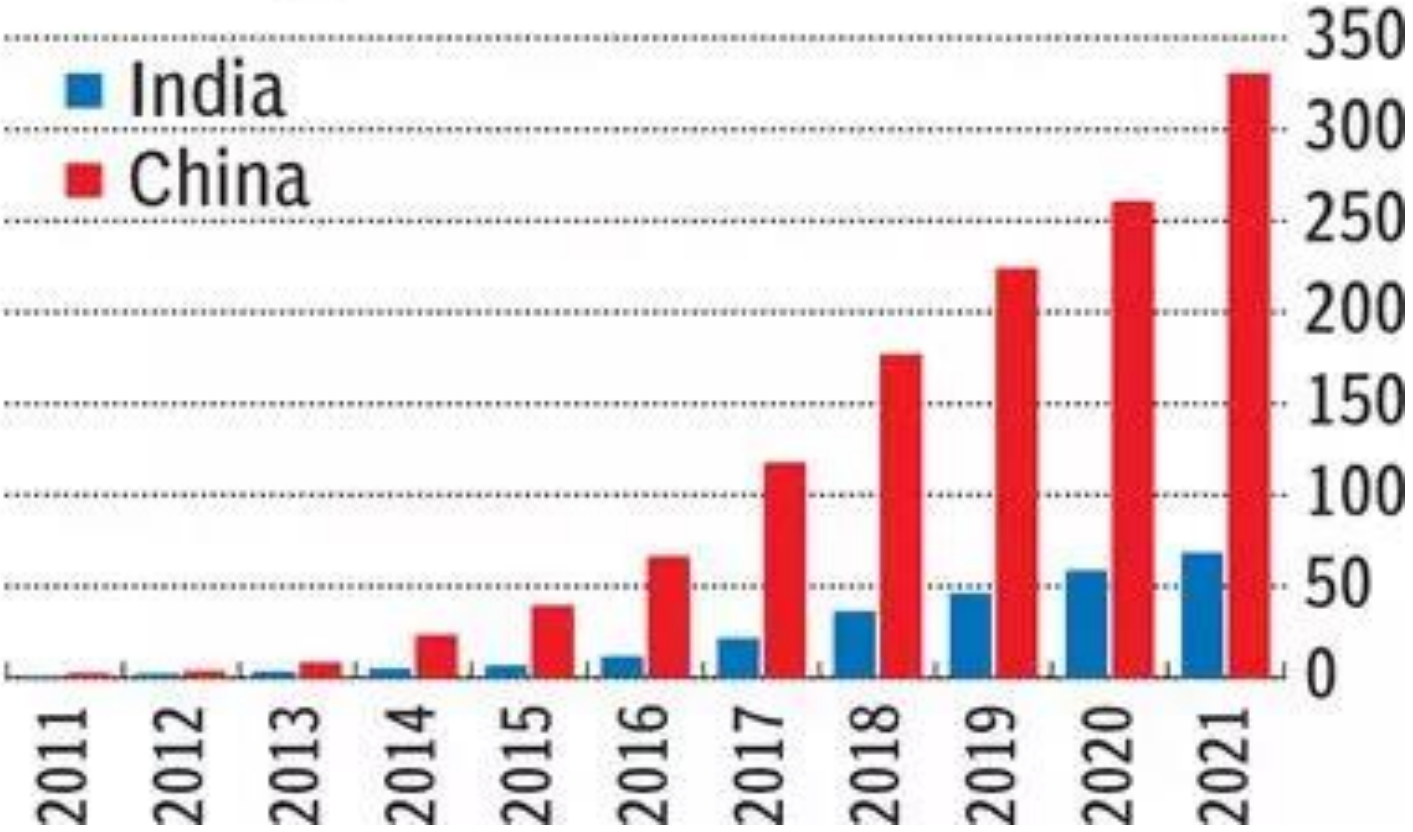
Benefits of Solar Power

- Meeting power demand
- Energy security
- Clean energy
- Reduced T&D losses
- Rapid scale-up



India, China have increased solar energy generation over past decade

Electricity generation from solar - TWh



11. PART OF RENEABLE ENERGY

Renewable energy sources include wind power, solar power, bioenergy (organic matter burned as a fuel) and hydroelectric, including tidal energy.

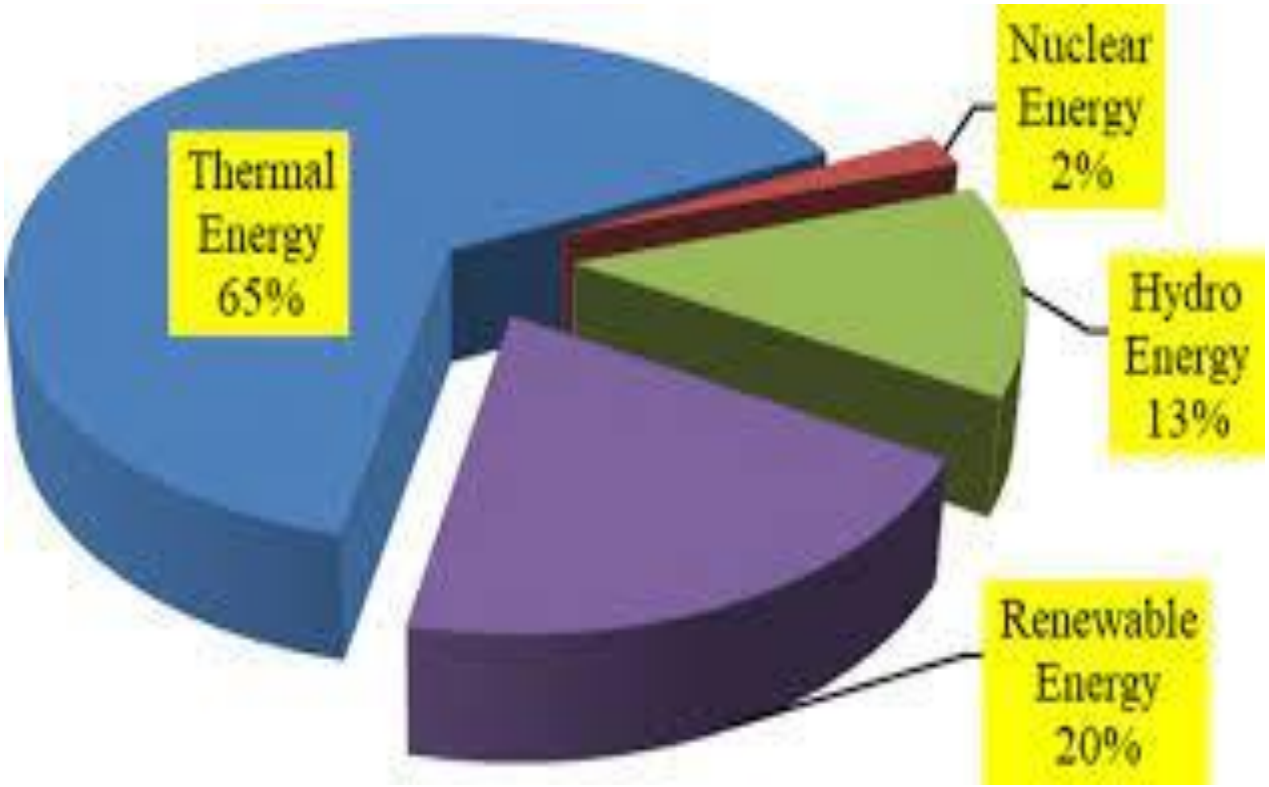
Burning fossil fuels to create electricity has long been a major contributor in the emission of greenhouse gases into our atmosphere, so these renewable sources are considered vital in the race to tackle climate change.

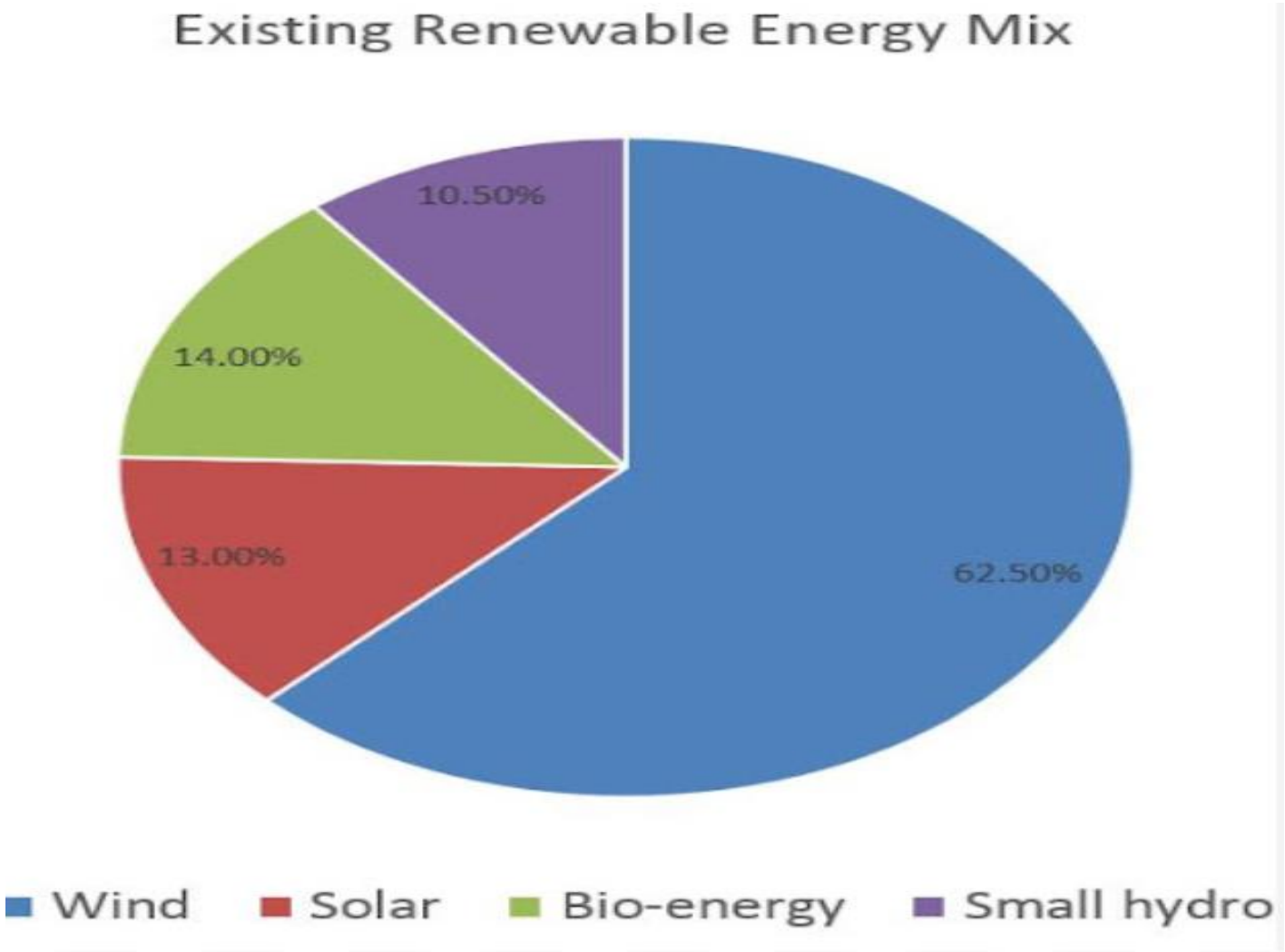
Solar

Sunlight is one of the planet's most freely available energy resources, which you'd assume would make it the number one source of renewable energy. But of course, the amount of sunlight we get can vary greatly depending on location, season and time of day.

Solar power generates electricity by capturing sunlight on solar panels in a joint chemical and physical reaction, known as the 'photovoltaic effect' (or PV).

Renewables share of electricity generation in India 2010-2022. Renewable sources accounted for 20.5 percent of India's electricity generation in 2022, up from 15.2 percent in 2010.





Grid-connected total including non-renewable and renewable

Type	Source	Share
Non-renewable	Subtotal Non-renewable	63%
Renewable	Large hydro	12.05%
	Small hydropower	1.29%
	Solar power	10.61%

Reference subject:

RCC, FOUNDATION(SOIL, STEEL), STAAD PRO SOFTWARE