

The background of the slide is a photograph of a large-scale solar photovoltaic (PV) plant. The image shows a vast field of solar panels arranged in neat, parallel rows, stretching towards the horizon. The panels are a deep blue color with visible grid lines. In the background, there is a line of green trees and a few buildings, including a prominent white structure. A tall electricity pylon with power lines is also visible on the right side of the background. The sky is a uniform, overcast grey.

Overview of 5 MW Grid-Connected Solar PV Plant – JAJRU

An aerial photograph of a vast solar power plant. The image shows numerous long, parallel rows of photovoltaic (PV) panels stretching across a landscape. The panels are a deep blue color and are separated by narrow, light-colored paths or grassy areas. The perspective is from a high angle, looking down at the rows, which create a strong sense of depth and repetition. The lighting suggests it might be late afternoon or early morning, as the shadows are long and the overall tone is slightly warm.

Introduction to Solar Power Plants

Solar power plants generate electricity by converting sunlight using photovoltaic -(PV) technology.

These plants are clean, renewable, and reduce our dependence on fossil fuels.

They contribute to lower greenhouse gas emissions and are scalable from kilowatts to megawatts.

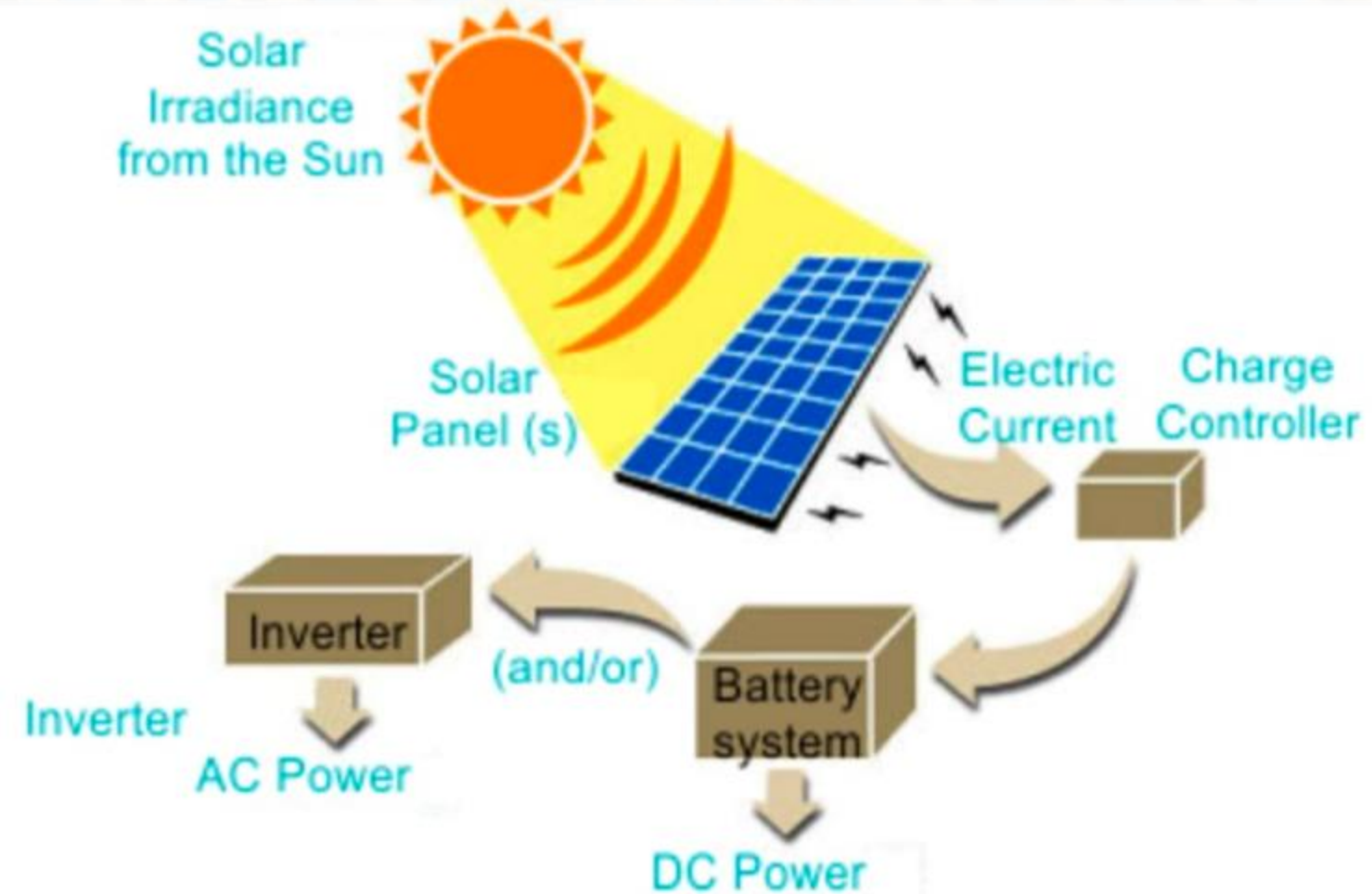
The increasing demand for green energy makes solar plants an essential part of modern energy infrastructure.



JAJRU Solar Plant – Overview

- Located in Jajru (Haryana) , This solar plant has an installed capacity of 5 MW.
- It is designed to generate clean electricity and reduce carbon footprint in the region.
- The plant uses photovoltaic technology and follows standard solar PV design structure.
- It is expected to produce approximately 7.437 million units of electricity annually.

Energy Conversion of solar cell



An aerial photograph of a large-scale solar farm. The image shows numerous rows of solar panels, which appear as blue rectangular grids, laid out in a precise, repeating pattern across a landscape. The panels are tilted at an angle, and the rows are separated by narrow, grassy paths. The perspective is from directly above, looking down at the array, creating a strong sense of depth and repetition. The overall color palette is dominated by the blue of the panels and the green/brown of the ground between them.

Working Principle

The core of a solar plant's operation lies in the photovoltaic effect. When sunlight strikes a solar panel, it excites electrons within silicon cells, producing DC electricity. This DC power flows through strings and SCBs, then reaches an inverter.

The inverter converts it to AC, which is further stepped up by transformers and sent to the grid.

This process ensures the power becomes usable and distributable.



Flow Path Overview

The energy flow follows this path:

Solar Panel → String → SCB → Inverter → ACDB → Transformer → Grid.

Solar Panels

Solar panels consist of multiple silicon cells (60-72) that absorb sunlight and generate DC electricity. Each panel typically produces 30–40V. These panels are mounted at specific angles for maximum sunlight exposure.

Formation of Strings

Multiple panels are connected in series to form a “string,” which increases the voltage to around 700–1000V DC. For example, 24 panels at 29V each produce approximately 700V in one string. This is an efficient way to aggregate power.

String Combiner Box (SCB)

SCBs collect DC output from multiple strings and combine them into one cable by T connector. They contain fuses, surge protection devices, and isolators to ensure safety and prevent faults. The combined output is then sent to the inverter.



Inverter

Inverters convert the DC electricity from SCBs into AC electricity. They also include MPPT (Maximum Power Point Tracking) to optimize power output based on sunlight conditions. The AC output is typically at 415V or 690V.



AC Distribution Box (ACDB) and Protection

The ACDB receives the AC output from the inverter. It includes key protection and control components such as MCBs, MCCBs, isolators, and relays. It plays a vital role in isolating faults and ensuring the safe routing of power. From here, the power flows to step-up transformers for voltage elevation.

Transformers and Grid Connection

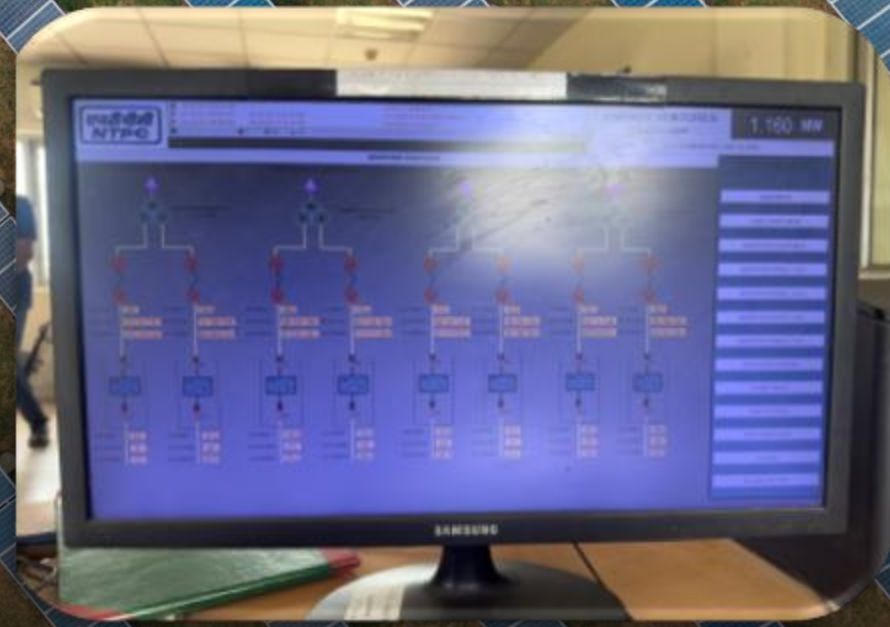
Step-up transformers are used to raise the AC voltage from 415V/690V to grid-compatible levels like 11kV or 33kV. This step is necessary to transmit power efficiently over long distances. The transformer output is connected to a switchyard or substation for onward distribution to the grid.

Cabling and Electrical Pathways

DC cables carry current from panels to SCBs and inverters, while AC cables run from the inverter to the transformer and grid. These cables are often routed underground or through protected trays.

SCADA System and Plant Monitoring

SCADA (Supervisory Control and Data Acquisition) systems allow for centralized monitoring and control of plant operations. They provide real-time data on energy output, panel voltage, string performance, temperature, and fault conditions. SCADA enables remote access and enhances operational efficiency through early fault detection.





THANK YOU

5 मेगावाट सोलर पावर स्टेशन
गाँव जाजर, फरीदाबाद (हरियाणा)

Sincere thanks to :

AGM S.S Narula Sir

&

Sir Prashant