

**Techno India NJR Institute of Technology,
Udaipur**

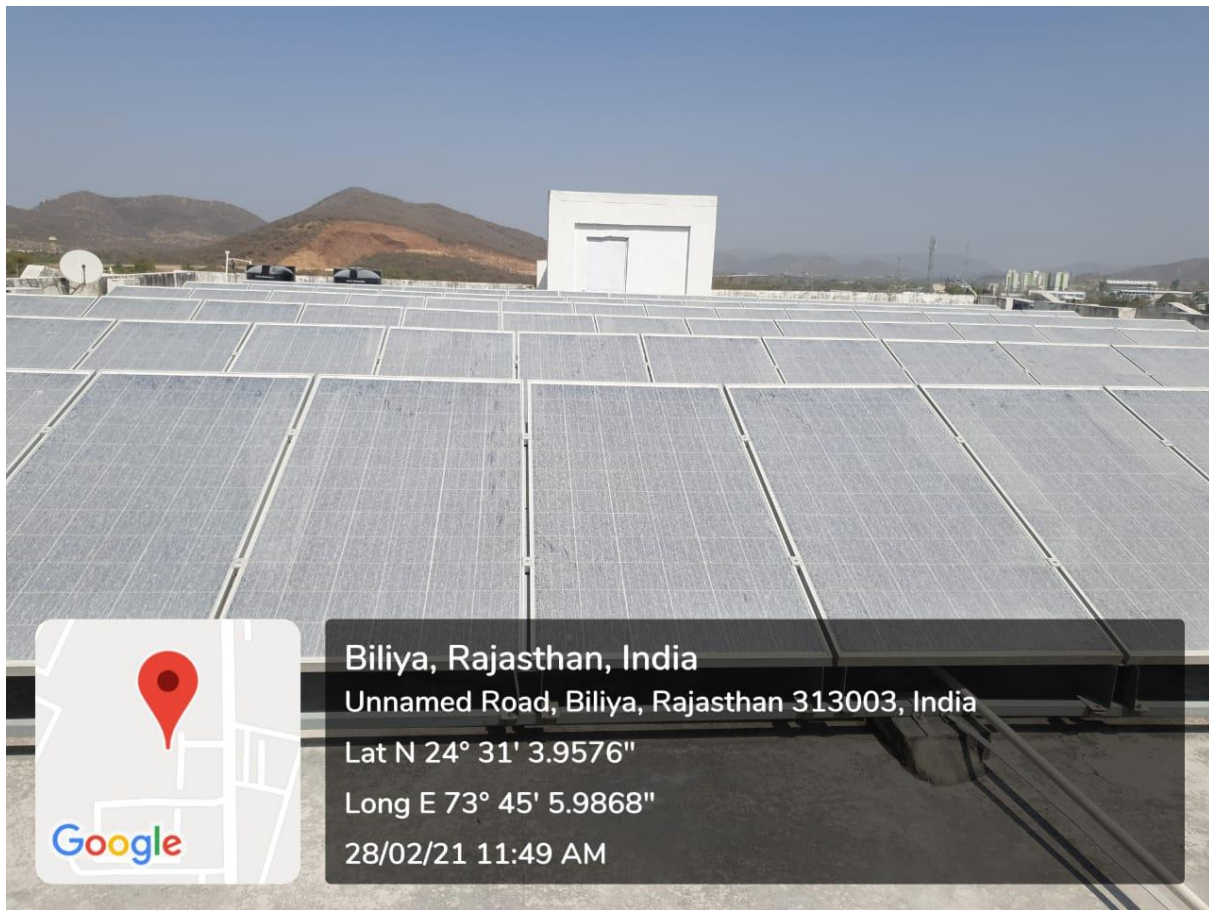
NAAC

7.1.2

**The Institution has facilities for alternate sources of energy
and energy conservation measures**

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50 KW ON-Grid Solar Plant at Techno India NJR



Biliya, Rajasthan, India
Unnamed Road, Biliya, Rajasthan 313003, India
Lat N 24° 31' 3.9576"
Long E 73° 45' 5.9868"
28/02/21 11:49 AM

पंकज सोनवाल
TECHNO INDIA NJR INSTITUTE OF TECHNOLOGIES

BY: Rajkumar Soni

Teaching Associate/Research Engineer at Techno NJR

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Chapter 1 Glossary

Photovoltaic	The physical effect of direct Conversion of light (sunlight) to electrical energy
PV Cell	The smallest photovoltaic (PV) element that generates electricity from light.
PV Module	A collection of interconnected PV cells, encapsulated between protective materials such as glass and back sheet (Poly Vinyl Fluoride) or glass and glass, and mounted in an aluminium frame. This is a hermetically sealed unit.
String	Multiple PV modules connected in series electrically
Array	Several strings of modules with the same orientation and tilt angle, located together.
Inverter	An electronic device that converts direct current electricity into alternating current electricity suitable for feeding directly into the electrical grid or to normal AC loads.
Insolation	It is a measure of solar radiation energy received on a given surface area in a given time. It is commonly expressed as average irradiance in watts per square meter (W/m^2) or kilowatt-hours per square meter per day ($kWh/(m^2 \cdot day)$) (or hours/day)
Solar Irradiation	The total electromagnetic radiation emitted by the Sun
STC	“Standard Test Conditions” - Incident Solar Irradiance of $1000 \text{ Watts}/m^2$, at a spectral density of AM1.5 and cell temperature of $25^\circ C$
Mounting Structure	Device used to hold modules in place, at desired angle & direction
Power Evacuation	Power generated from Solar PV Power Plant is transmitted to a point (substation) where it is distributed for consumer use.

Sub-station	The place where the generated power from solar is synchronised with utility grid and metered.
Control Room	A conductor with one or more strands bound together, used for transmitting electrical energy.
Efficiency	The ratio of the output to the input of any system.
Junction boxes	Inputs of several strings are connected to this box and taken as single output
Current	A flow of electricity through a conductor measured in Amps.
Voltage	The rate at which energy is drawn from a source that produces a flow of electricity in a circuit; expressed in volts It is the difference of electrical potential between two points of an electrical or electronic circuit, expressed in volts. It is the measurement of the potential for an electric field to cause an electric current in an electrical conductor.
Lightning Arrestor	Device used to protect all the components from lightning strikes
Earthing	Described as a system of electrical connections to the general mass of earth
Transformer	An electrical device by which alternating current of one voltage is changed to another voltage
Grid	A system of high/low tension cables by which electrical power is distributed throughout a region

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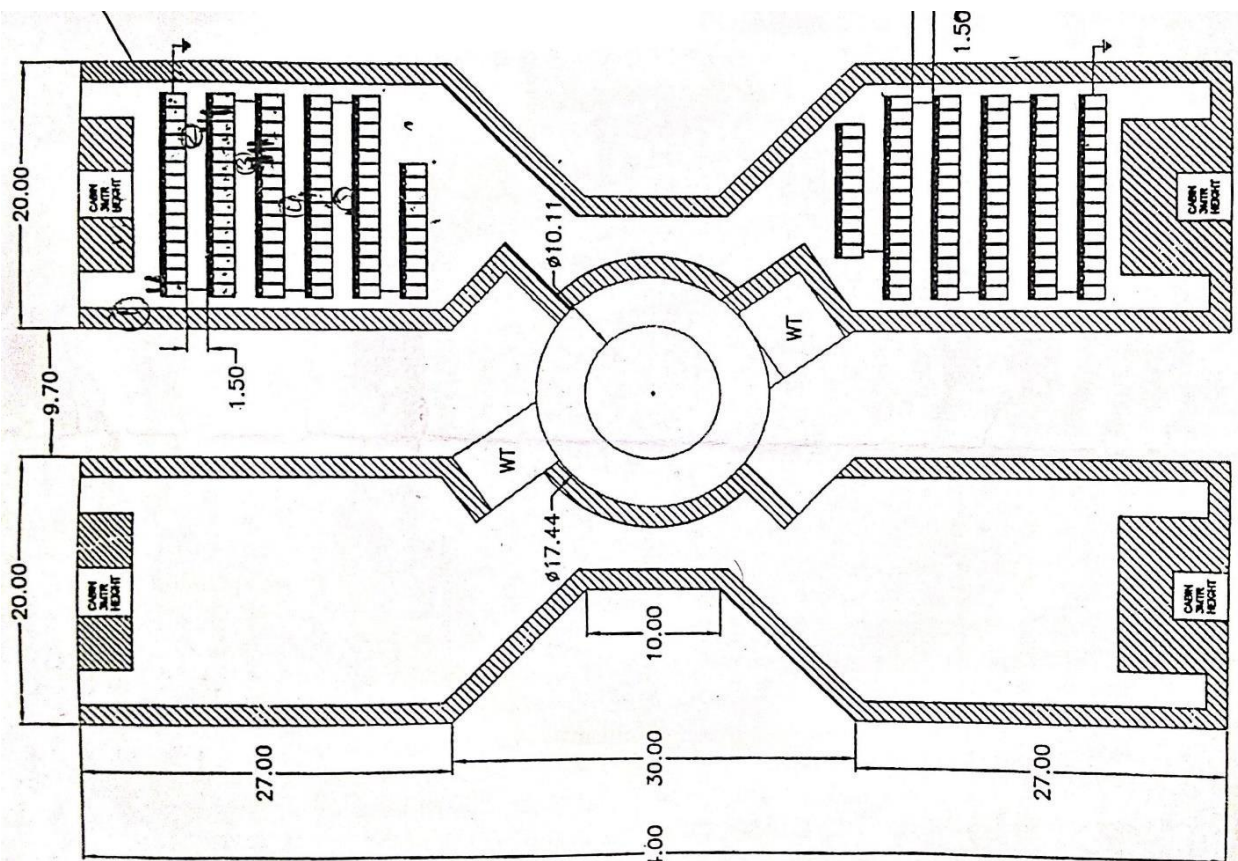
Chapter 2 Introduction

SECI has been entrusted by MNRE for implementation of a Large-scale Grid connected Rooftop pilot projects, with 30% subsidy support from National Clean Energy Fund (NCEF). This program is being successfully implemented across 16 big and small cities, and projects for around 19.00 MW have been sanctioned in 3 phases.

Installation of 50 KW Grid-Tied Solar Rooftop Plant at Techno India NJR Institute of Technology. Its occupies total rooftop space is 1080 square meter. A total load of college is approximate 120 KW and 50 KW of power sending back to grid or RSEB (Rajasthan State Electricity Board) from the Solar plant in form of renewable energy.

In grid-connected rooftop or small SPV system, the DC power generated from SPV panel is converted to AC power using power conditioning unit and is fed to the grid either of 33 kV/11 kV three phase lines or of 440/220 Volt three/single phase line depending on the capacity of the system installed at institution/commercial establishment or residential complex and the regulatory framework specified for respective States.

These systems generate power during the day time which is utilised fully by powering captive loads and feed excess power to the grid as long as the grid is available. In case, where solar power is not sufficient due to cloud cover etc., the captive loads are served by drawing power from the grid.

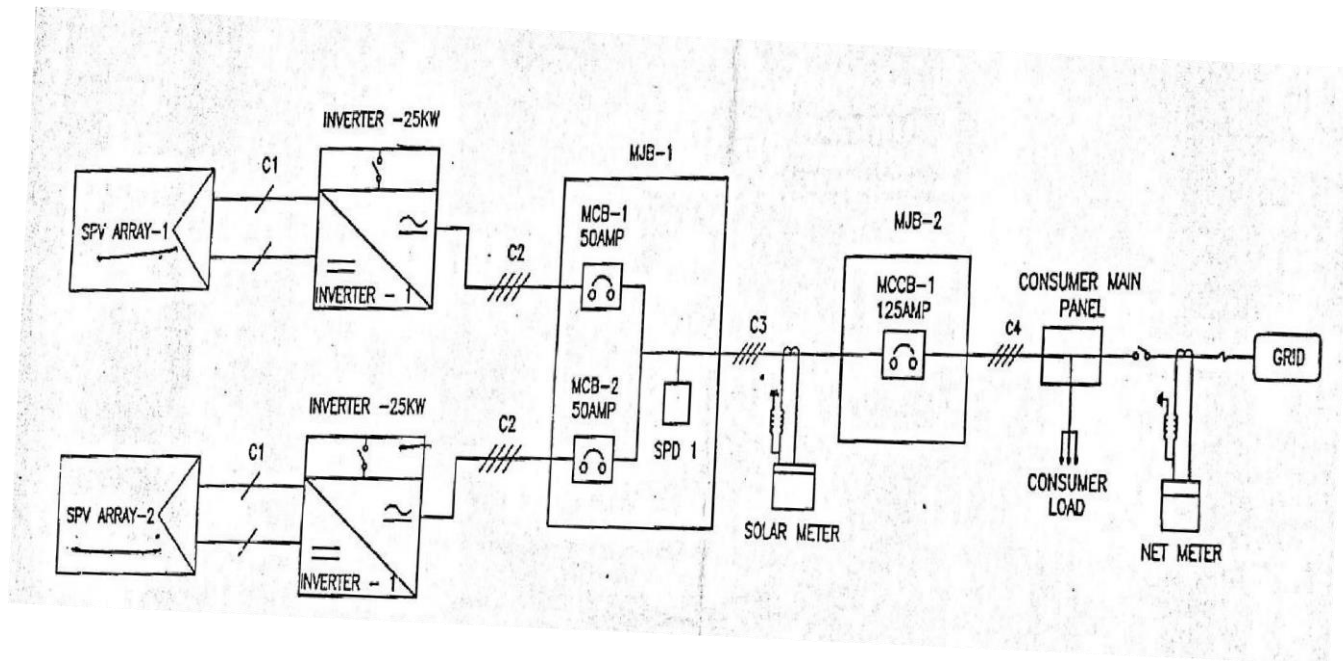


A total number of solar panel is 170 and two grid-tied type inverters each is 25 KW. Connections of all solar panel are in the manner of that 17 panels are connected in series, this is one string of 17 panels and we have 5 strings, which makes a total number of the panel is 85.

$$(17 \text{ panels in series}) * (5 \text{ strings}) = 85 \text{ panels}$$

The output of all 5 strings goes to one 25 KW inverter. As it is the other output of remaining 5 strings goes to another 25 KW inverter.

The single line diagram of the plant shown below:



As shown in SLD (Single Line Diagram) There are two SPV (Solar Photovoltaic) arrays each containing 85 solar panels going to two set of inverters each of 25 KW rating after than output of each inverter which is in form of Alternating Current (AC) are combining in the MJB1 (main junction box) with protecting of 50 A rating of MCBs. C1, C2, C3 and C4 are types of cables used.

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All ratings and specification of each equipment are shown below:

Sr. No.	Ratings/ Specifications
1.	SPY Array 1: 300Wp- 85 Nos. – 17X5 Strings 1Nos.
2.	SPY Array 2: 300Wp- 85 Nos. – 17X5 Strings 1Nos.
3.	Inverter 1: INVT, 25 KW X 1Nos.
4.	Inverter 1: INVT, 25 KW X 1Nos.
5.	MJB 1: MCB -1 (4P, 50 Amp-1Nos.)
6.	MCB -2 (4P, 50 Amp-1Nos.)
7.	SPD-1 (3 Phase AC, 320V)
8.	MJB 2: MCCB -1 (4P, 125 Amp-1Nos.)
9.	C1: 1CX2(R/B) 4sq.mm, CU. Solar Cable
10.	C2: 4CX10 sq.mm, CU. Cable
11.	C3: 3.5CX50 sq.mm, AL. Armoured Cable
12.	C4: 3.5CX50 sq.mm, AL. Armoured Cable

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Chapter 3 Project Summary

1.	Name of the Company	Techno India NJR Institute of Technology
2.	Proposed Project Location	RIICO Industrial Area, Kaladwas
3.	District Name	Udaipur
4.	State	Rajasthan
5.	Proposed Power Plant capacity	50KWp
6.	Technology	Solar Photovoltaic
7.	Location of place on Earth	(i) Latitude: 24.5176° N (ii) Longitude: 73.7516° E
8.	Average annual solar isolation	6.16 kWh/m ² /day
9.	Type of Module proposed	Mono Crystalline
10.	Type of Inverter proposed	String
11.	Total Inverter capacity	25 KW

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Chapter 4 Selection of PV Technology

Science of Silicon PV Cells

- Scientific base for solar PV electric power generation is solid-state physics of semiconductors
- Silicon is a popular candidate material for solar PV cells because:
 - It is a semiconductor material.
 - Technology is well developed to make silicon to be positive (+ve) or negative (-ve) charge-carriers – essential elements for an electric cell or battery
 - Silicon is abundant in supply and relatively inexpensive in production
- Micro- and nanotechnologies have enhanced the opto-electricity conversion efficiency of silicon solar PV cells



Polycrystalline Solar Panel

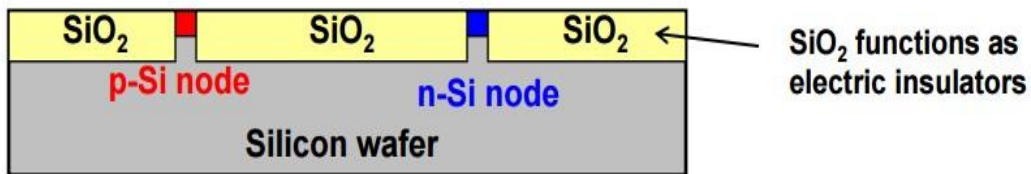
Working Principle of Silicon Solar PV Cells

Photovoltaic material of device converts:



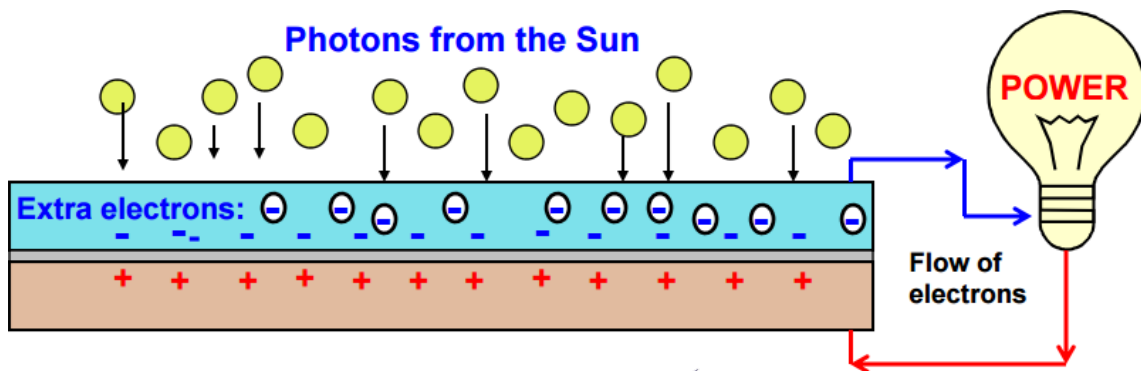
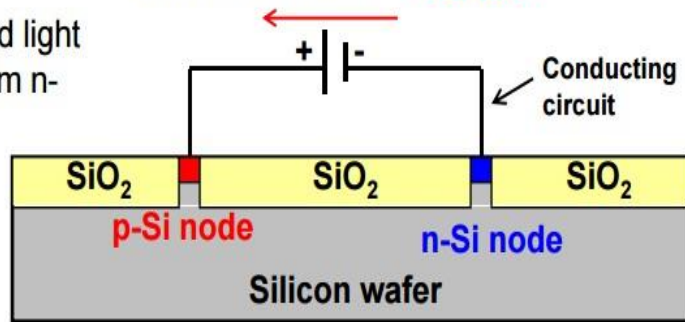
Silicon solar photovoltaic cells = a device made of semiconductor materials that produce electricity under light

- A **p-n junction** is created in silicon by a **doping process**.



Flow of electrons → **current, i**

- The **photons** from the exposed light prompted electrons flowing from n-junction to the p-junction → **Electric current flow**.



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Common Solar Cell Materials

Single Crystalline	Polycrystalline (Thin films)
<p>Silicon (Si):</p> <ul style="list-style-type: none"> Single crystalline Polycrystalline silicon Amorphous silicon (non-crystalline Si for higher light absorption) <p>Gallium arsenide (GaAs)</p>	<p>Cadmium telluride (CdTe)</p> <p>Copper indium diselenide (CIS)</p>

Approximate Achievable Conversion Efficiencies

Single Si	15 – 25%
Poly Si	10 – 15%
A-Si	5 - 10

GaAs	25 – 30%
CdTe	7%
CIS	10

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Chapter 5 Solar Panel Connections

As for showing in single line diagram, there is one string of 17 panels and we have such 5 strings, which makes a total number of the panel is 85. In one string 17 panels connected in series.



Series connection

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Specification of the single solar panel:

Topsun[®]

Topsun Energy Ltd.
An ISO 9001, ISO 14001 & OHSAS 18001 certified company

RS No 892, Nr 66kV GEB Sub Station, Jagudan Cross Road,
At & Po - Linch, Ta & Dist - Mehsana, Gujarat - 384435
E-Mail: marketing@topsunenergy.com; Web: www.topsunenergy.com.

Model No. : TEL 24P300

ELECTRICAL RATINGS

Nominal Ratings at STC (1000 W/m² Spectrum AM 1.5G at 25°C)
All values are nominal unless designed as tested

P_{mp} : 300	W_p
Voltage at Max Power (V _{max}) : 36.0 V	Open Circuit Voltage (V _{oc}) : 44.0 V
Current at Max Power (I _{max}) : 8.48 A	Short Circuit Current (I _{sc}) : 9.09A
By-pass Diode Rating : 20 A	Series Fuse Rating (Recommended) : 15 A
System Voltage : 1000 VDC	
Application Class : A	

CE **RoHS** 2011/65/EU **SGS** IEC 61215 EN 61730 Periodical Inspection

EN IEC 61215 : 2005 ; EN IEC 61730-1/2 : 2004/2007; IEC 61701

WARNING
ELECTRICAL HAZARD

- This module produces electricity when exposed to light.
- Follow all applicable electrical safety precautions.
- **ONLY** qualified person should install or perform maintenance work on these modules.
- **BE AWARE** of dangerous high DC voltage, when modules are connected in series.
- **DO NOT** handle or install modules when they are wet.
- **DO NOT** damage or scratch the rear surface of the modules.

Warranty voids if rear surface is scratched, damaged or Junction Box Terminations are tampered

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According to solar panel electrical ratings:

The Voltage at Max Power (V_{max}) is 36V, Current at Max Power (I_{max}) is 8.48A and Max peak power is 300W. So 17 panels of such ratings connected in series which add up voltages of all panels:

$17 \times 36 = 612 \text{ V}$ and 8.48 A (because current is common in series)

Finally, this 612 V and 8.48A is the output of one string. Five strings output connected to one 25KW Grid-Tied Inverter.

Connections are showing in fig:



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Chapter 6 Solar Panel Mounting Structure



Module mounting structures play a very important role in the efficient working of a solar power plant. While most of the components of balance of system (BOS) such as inverter DC cables junction boxes transformers, etc. are readily bought from the equipment suppliers the workmanship of an EPC contractor is reflected mainly through module mounting structures and wiring management

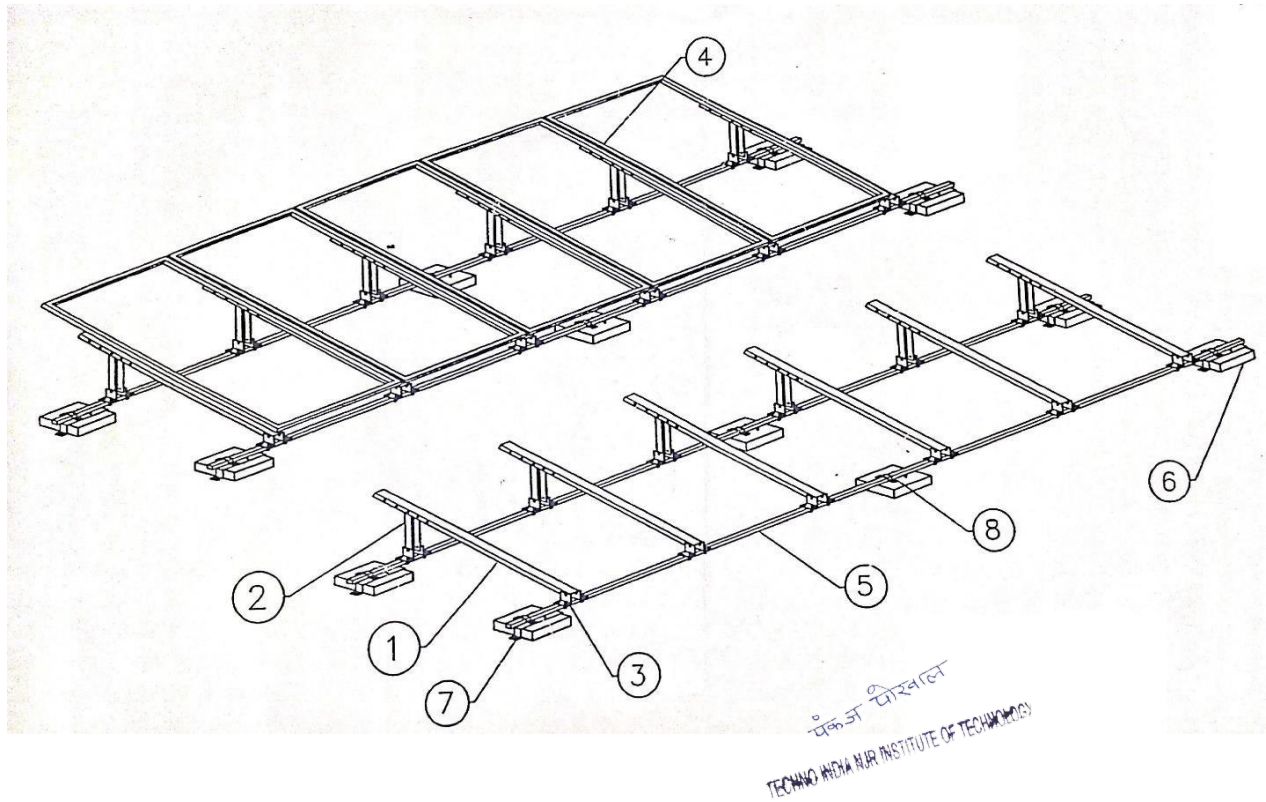
The Recent installation of a solar project in India has adopted various module mounting structure design which includes the structures made of galvanised iron as well as aluminium structures. Some of the projects have adopted a combination of steel structure and aluminium structure wherein vertical legs are

made off hot dipped galvanised steel and rest of the members are made off extruded aluminium structure. Typically module mount structure comprises of following components:

1. Vertical rail (Rafters)
2. Vertical posts
3. Purlin (Horizontal rail)
4. Tilt bracket
5. Mounting clips
6. Cable tray

The mounting structure should consider local site conditions such as wind speed, rainfall & temp. While selecting module mounting structures. As the solar plant is expected to be designed for a 25 years lifetime, it is important for a project developer to ensure that the mounting structure remains until the lifetime of the project. Mounting structure life is high effected by corrosion and it is important that structure galvanization should be sufficient to protect it from corrosion. The typical structure galvanization thickness is kept of the order of 100-120 microns. In the case of purlin, the structure can be an old formed steel with a lesser galvanization thickness of the order of 80 microns.

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1. Module Mounting 'C' Channel-50x72x50x2mm-1600mm Long
2. Vertical Support 'C' Channel-50x65x50x2mm-500mm Long
3. Support 'L' Clamp
4. Aluminum 'T' Clamp
5. Base Pipe
6. Rcc Base
7. Rcc Base Fitting Clamp
8. Base Pipe Fitting Clamp

All Dimensions Are In M.M
Material : M.S (Hot-dip galvanized)

Typically the vertical posts are of C-section, however recent design use sigma section as well in order to add strength and durability. Some of the structure design use tubular/square section which is good to provide connectivity with a rafter. The

tubular section/ square section allow a U-bolt and saddle connection to hold rafter. The purlin is lighter members in the structure on which modules are mounted. Many structure design use Z section purlins so that the bottom flinch of the Z section can be used for carrying the DC cables along with it. The purlin is typically the rate of 2 mm thickness pre-galvanized sheet to protect the purlin from corrosion. It is advisable to use snake tray to carry DC cables rather than carrying the cable in the purlin the nuts & bolts use to connect structure member should be made of stainless steel in order to avoid corrosion. The modules are mounted on the structure with the help of module clips which is typically design for a panel thickness of about 50 mm. spring loaded hardware allows clips to be installed before the panel is installed. The module structure should be grounded properly and the structure leg should have a provision of grounding stake.

A good structure design can significantly reduce structure weight per MW. It should have an integrated wiring management system so that cables can run through perforated sections it's important to carry out on-site pull-out test in order to decide the structure foundation death.

Many times the structures are design to accommodate single axis/double axis tracking system which makes the structure design complicated. Mounting of modules of the structure should be done by torque wrenches so that it does not put excessive pressure on modules. Finally, structure design should have adequate provisions to accommodate thermal expansion so that sagging in the structure does not occur.

Chapter 7 Grid-Tied Solar Inverter



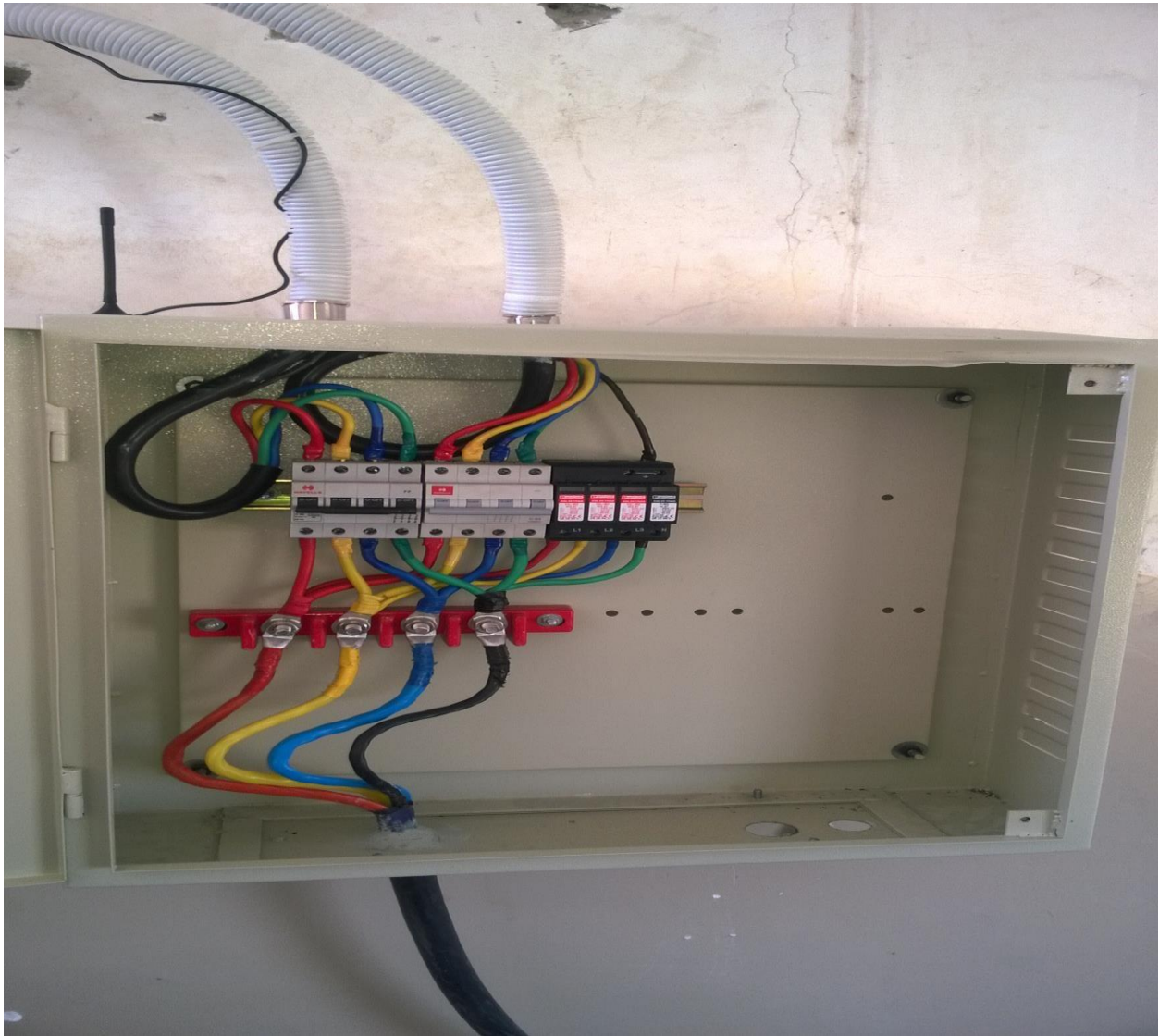
A solar grid-tied inverter converts the DC output of PV modules into AC power suitable for transmission on the power grid, or use it for your own consumption, often deploying reactive power to meet new grid codes. It must always optimise the power output via MPPT (maximum power point tracking) and additionally monitor both the system and grid connection. In practice, each solar inverter installed in solar power plants needs to connect an array or string of PV modules to the power grid. The more efficient the inverter, the better the LCOE (levelized Cost of Electricity) generated by the system. An on-grid solar inverter is composed of a DCDC module, a DC-AC module and a control module. DC-DC module is built with a MOSFET, an inductor and a transformer, and functions to provide a stable DC output through rectifying and filtering the unstable DC power produced by PV modules; DC-AC module includes an IGBT array and an output filter circuit to convert the DC output of DCDC module into an AC output suited for transmission on power grid. The control module is the core of the whole system. It has a DSC, a voltage sensor, a current sensor, and a driver that drives MOSFET and IGBT module. DSC calculates the maximum power point of PV module array based on signals collected by sensors including PV modules' voltage and current, power grid's voltage and current, as well as phase. And accordingly, it sends out instructions to the driver which drives DC-DC and DC-AC modules. Furthermore, DSC is able to find out abnormal conditions such as transmission failure of the power grid and take measures such as cutting off the connection between inverters and grid to prevent "island effect" occurrences on the power grid. Additionally, the control module has an interface for

external display showing PV modules' status and input/output voltage and current and integrates an RS232/RS485 communication interface to connect with control centres of solar power plants, so that real-time monitoring of solar panels and inverters can be implemented.



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Each inverter is of 25KW rating and converting DC to AC and output of each adding in junction box shown in fig:



How does it work?

PV Grid Connected Inverters operate at a lower, safer voltage from the PV array while having the advantages of reliability,

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flexibility and improved energy yield. Using lower voltages on the PV side means there are lower voltages in your roof eliminating high voltage hazards and giving peace of mind to installers and service personnel. By using short multiple strings of panels, PV Grid Connected Inverters make sure that there are more paths for electricity to flow, which ensures minimal power loss due to varying environmental or panel conditions.

ON GRID/GRID TIE SOLUTIONS

String Inverter - Single Phase

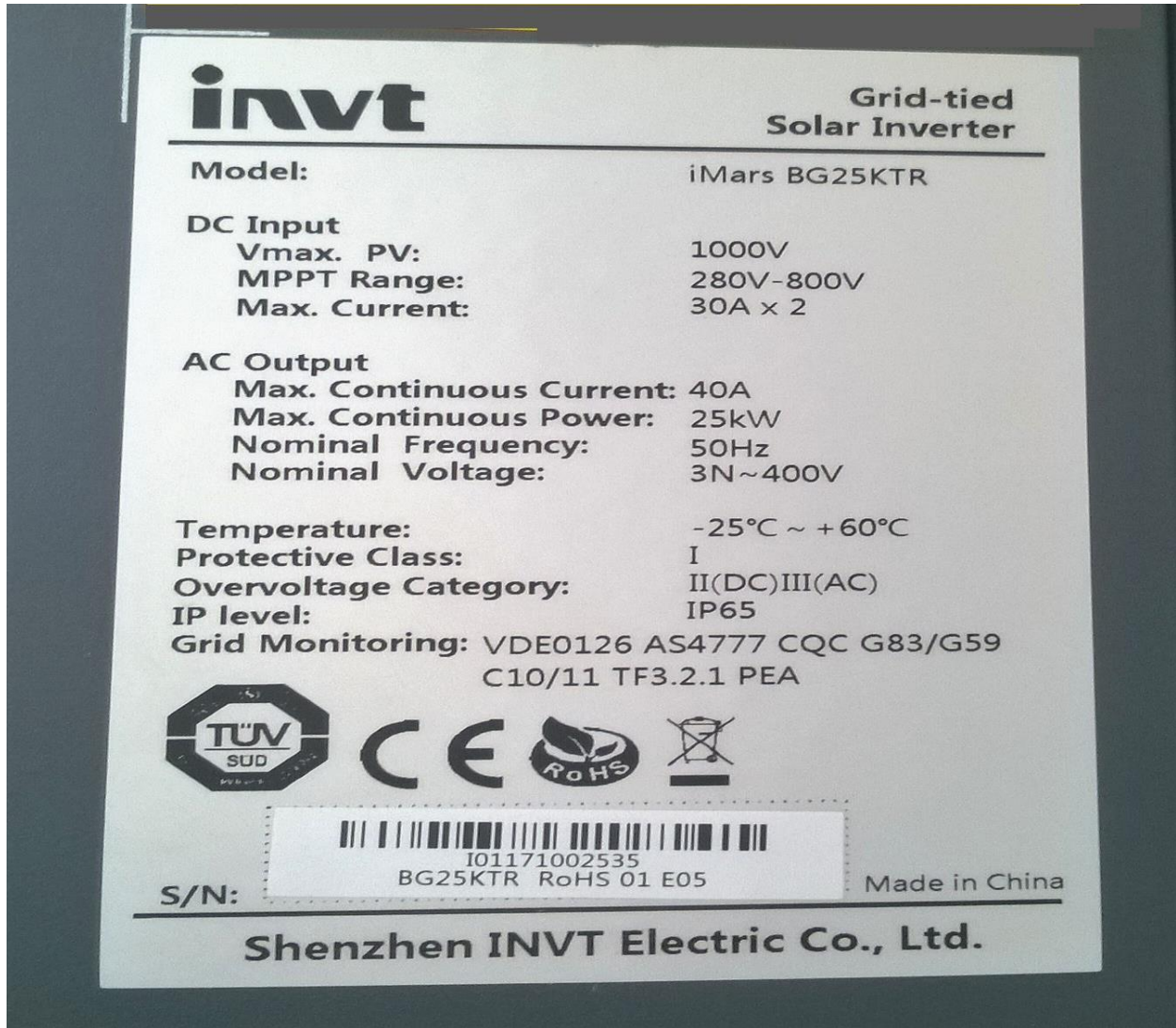
1800W_p, 2400W_p, 3300W_p
4600W_p, 5500W_p
12000W_p

Central Inverter - Three Phase

50KW_p, 100KW_p, 250KW_p, 500KW_p, 1000KW_p

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Specification of Inverter:







invt **Grid-tied Solar Inverter**

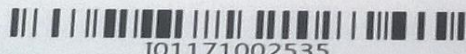
Model: iMars BG25KTR

DC Input
Vmax. PV: 1000V
MPPT Range: 280V-800V
Max. Current: 30A x 2

AC Output
Max. Continuous Current: 40A
Max. Continuous Power: 25kW
Nominal Frequency: 50Hz
Nominal Voltage: 3N~400V

Temperature: -25°C ~ +60°C
Protective Class: I
Overvoltage Category: II(DC)III(AC)
IP level: IP65
Grid Monitoring: VDE0126 AS4777 CQC G83/G59
C10/11 TF3.2.1 PEA

S/N:  I01171002535
BG25KTR RoHS 01 E05 Made in China

Shenzhen INVT Electric Co., Ltd.

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Chapter 8 SPV Monitoring System



As the name suggests, a monitoring system continuously reviews the critical aspects of a product and reports on the progress of each component. Think of it as an automated, software version of a supervisor. Solar power plants, especially large solar farms, today have sophisticated monitoring systems. These systems enable solar power plant operators to streamline operations and monitor the critical activities on a continuous basis.

Solar monitoring makes certain that your solar panels are working properly by tracking the power output of your system. With solar monitoring, you gain 24/7 peace of mind that your panels are working as efficiently as possible. Importantly, you'll also gain the ability to view how much money your solar system is actually saving you in energy costs. Solar monitoring gives you real-time visibility into the number of kilowatt hours of electricity your solar panels are producing at any given moment in time.

Monitoring solar panel output is a great tool to continually track how well your solar power system is working. It's an easy way to see the amount of energy you've produced and follow the proper power output of your solar panel system. Solar monitoring software allows you to easily view how many kilowatt hours of electricity your solar panels are producing at any given moment in time. In the unlikely event something was to go wrong with your system — a faulty wire or panel, for example — your solar monitoring system will pinpoint the specific issue so that you can resolve the problem quickly and efficiently. Solar monitoring also provides you quick and easy ways to track how much money your solar system is saving you in energy costs.

Solar monitoring can tell you if your panels are working properly and how good of a job they're doing. With solar monitoring, you're able to see how much your system is generating, when it's producing the energy and whether your system is over producing or underproducing. **Monitoring your solar panel output** helps you make the necessary adjustments to be certain your system is working properly. Not only are solar

monitoring systems able to tell you how much energy your panels are currently producing, but they can also keep you informed about many your panels have produced over time, giving you a sense of how much energy and money you've saved.

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Chapter 9 Earthing

Basically, there are 3 types of earthing in a solar plant - DC, AC and LA.



AC Earthing:

AC earthing is a standard one as you have in any commercial/Industrial Earthing. The list of earthing will be as follows.

- 1) Earthing for your ACDB Panel
- 2) Earthing for your Transformer and other switchgear panels/equipment's

DC Earthing:

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The DC Earthing is done to basically ground the Metallic body of your panel and prevent people from getting electrocuted in case of an accident

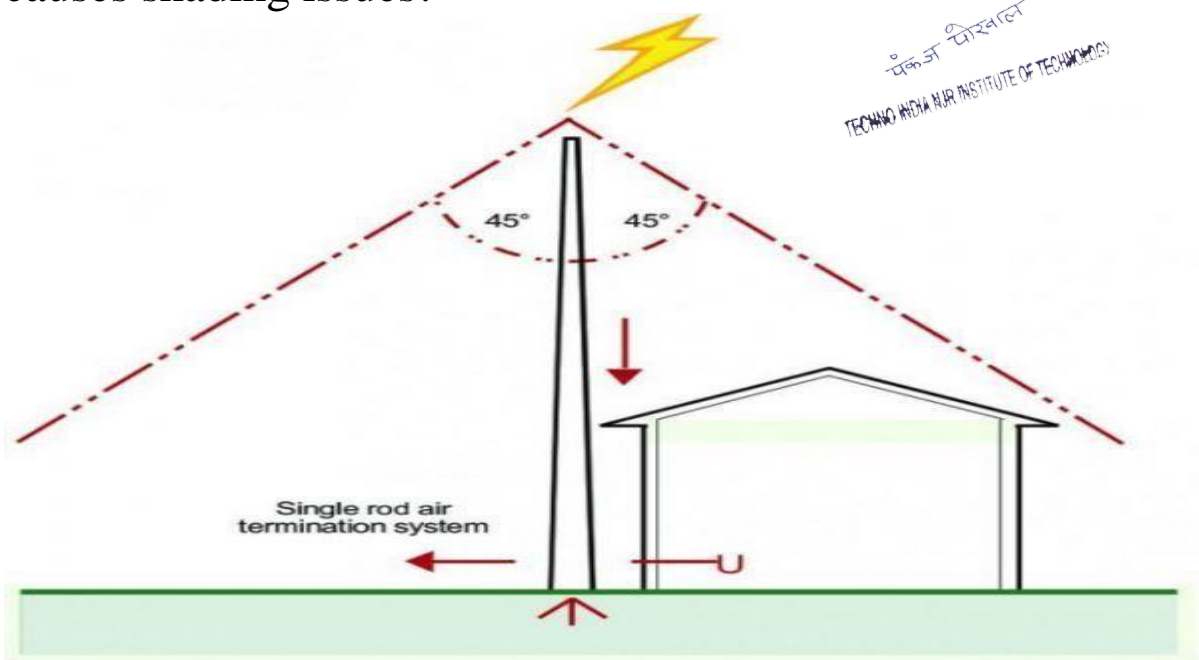
Even DC SPD's (Surge Protection Devices) can have a special separate earth for them

Lightning Arrestor:

Lightning Arrestor is a bit complicated.

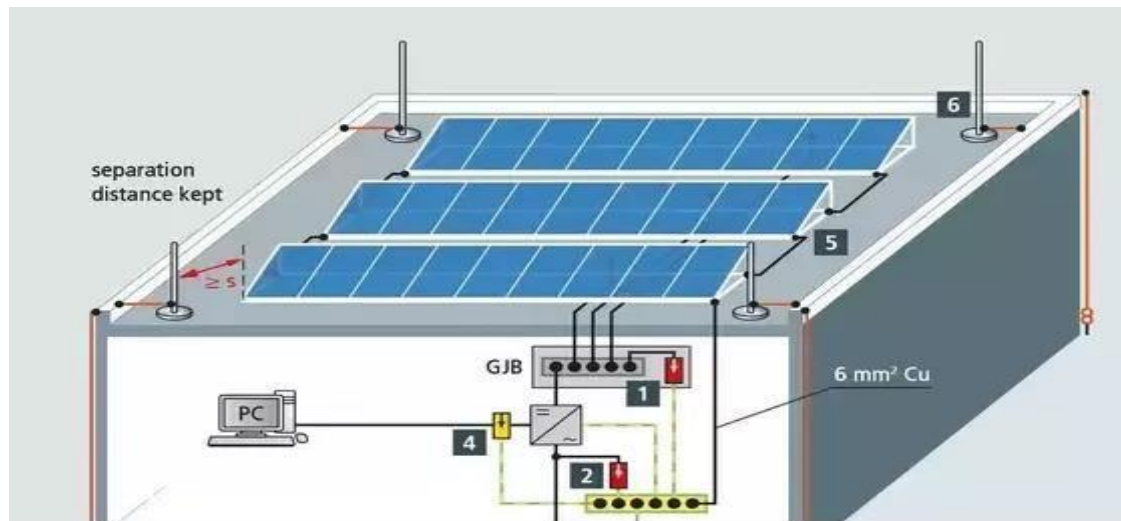
There are Multiple Methods to do this

1. **Conical Area Coverage:** In this you generally have long pole earthed solidly to ground. The Area covered by this is equal to the conical area formed (45 Degree). The Figure is Self-explanatory But generally, this method causes shading issues!



2. **Surrounding by Conductor:** In this method, you surround you entire modules by surrounding it by a G.I wire

connected to poles surrounding the entire modules.
(Assume the house to be your modules)



Selection of Earthing Techniques: As far as material selection for earthing is concerned it is based upon commercials and site requirements.

Copper is always preferred over G.I. but it is costly as compared to G.I. you can do electrode earthing over conventional plate earthing but again it is a costlier alternative and depends upon site requirements.

Most importantly you have to get your earth resistance below the specified range generally 1 Ohm.

Chemical Earthing that you mentioned includes a special chemical powder that you put in the earth pit instead of conventional salt and Coal. The powder provides a better resistance as compared to salt and coal.

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Chapter 10 Net Metering

Rajasthan would probably be the next Gujarat in India in terms of a role model for solar. The irradiation in Rajasthan is in the range of 5.5-6.0 (kWh/m²/day). That's among THE best in India (refer to this map). So, in general, the state is perfectly appropriate to go solar climatically. Further, looking at Rajasthan's solar policy which was revised in 2014 (refer), it is clear that the push for solar is not only through small rooftop plants but also through ground-mounted solar parks that should be developed soon. This article, however, will focus on rooftop solar in Rajasthan.

“Net metering” means methodology under which the electricity generated by the solar rooftop system owned by the consumer and delivered to the Distribution Licensee may be utilised to offset the electricity supplied by the Distribution Licensee to the consumer during the applicable billing period.

Following are the key highlights of the net-metering guidelines (refer) in Rajasthan:

- Released on 26.02.15
- Cumulative capacity allowed at the particular distribution transformer shall not exceed 30% of the transformer capacity
- The distribution licensee will update the capacity available at each distribution transformer, on a yearly basis on their website

- The maximum Rooftop PV solar power plant capacity that can be installed at any eligible consumer premises shall not be more than 80% of the sanctioned connected load.
- Any eligible customer needs to install a minimum of one-kilo watt peak on the rooftop and a maximum of 1 MW

The average commercial tariff for Rajasthan is ₹ 7.4. Excess injected electricity into the grid shall be paid by the distribution licensee at feed-in-tariff as follows in the next billing cycle as long as the export is above 50 units. If the export is below 50 units it shall be adjusted in the next billing cycle at the same tariff as their billing rate.

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Table- 8: Summary of Solar PV and Solar Thermal Tariffs

S. No.	Particulars	Tariff (₹/kWh) if AD benefit is not availed	Tariff (₹/kWh) if AD benefit is availed
1	2	3	4
1	Solar Photo Voltaic (PV) Power Plants commissioned by 31.03.2017	6.74	6.10
2	Solar Thermal Power Plants commissioned by 31.03.2018	11.46	10.30
3	Roof Top Solar PV installations and other small solar PV power generation plants to be commissioned by 31.03.2017	6.74	6.10
4	Small Solar Thermal Power generation plants to be commissioned by 31.03.2018	11.46	10.30

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Solar Energy:



Biliya, Rajasthan, India
Unnamed Road, Biliya, Rajasthan 313003, India
Lat N 24° 31' 3.9576"
Long E 73° 45' 5.9868"
28/02/21 11:49 AM

50 KW Solar Power Plant

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Biliya, Rajasthan, India
Unnamed Road, Biliya, Rajasthan 313003, India
Lat N 24° 31' 2.5176"
Long E 73° 45' 4.3956"
28/02/21 12:27 PM

Solar Water Heater

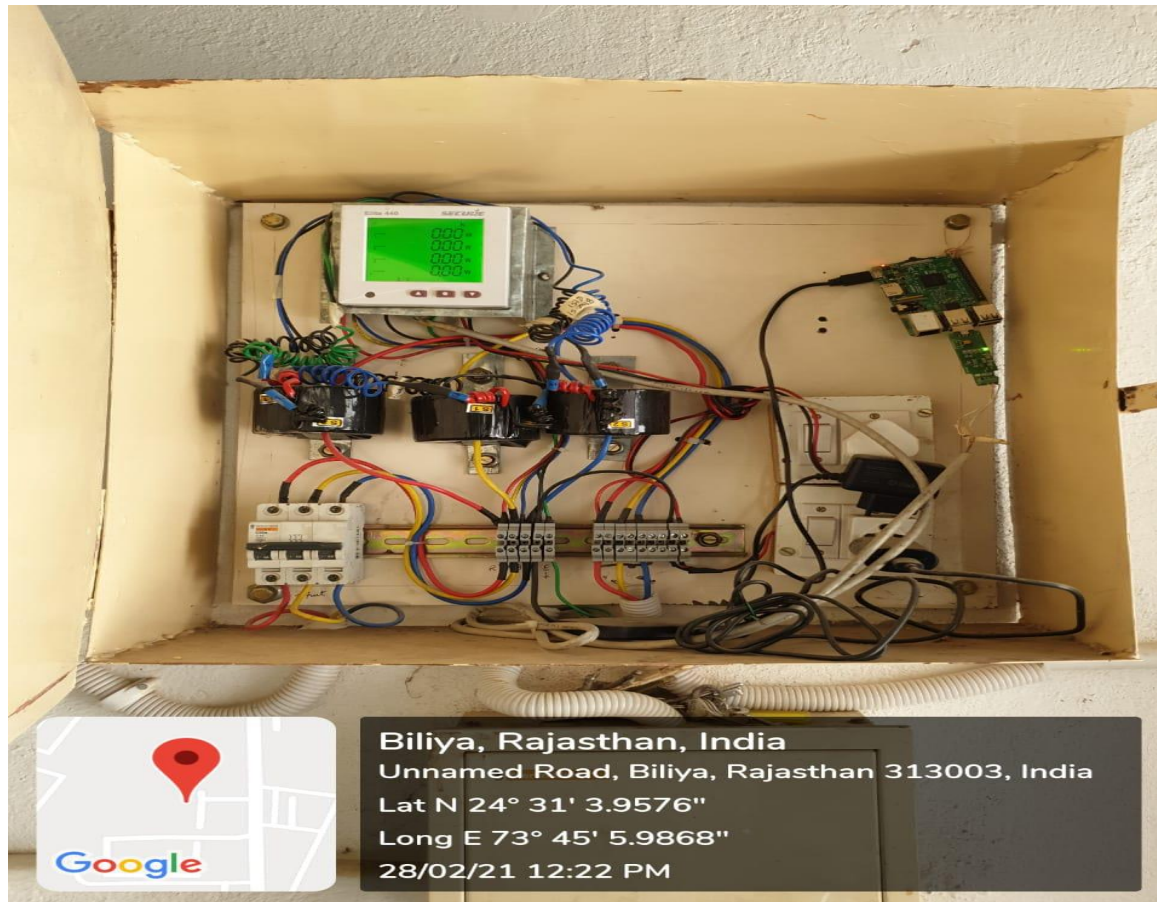


Biliya, Rajasthan, India
Unnamed Road, Biliya, Rajasthan 313003, India
Lat N 24° 31' 4.4292"
Long E 73° 45' 6.4188"
28/02/21 10:12 AM

Solar Street Light

4. Smart Meter Sensor-based energy conservation

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Smart Meter Sensor-based energy conservation

Key points:

- Problem Statement
- Solution

- Technology Details
 - IOT
 - CLOUD

Problem Statement:

There is a need for a viable method for metering and calculating the energy consumption. Innovative software-based solutions that could provide live information related to consumption of electricity by various appliances. Methods for making it more cost-effective.

Solution:

- Eliminates manual meter readings
- Quick and Accurate Detailed Reading
- Real Time Monitoring for Distributors as well as Consumers
- Optimizes income with existing resources

Technology Details:

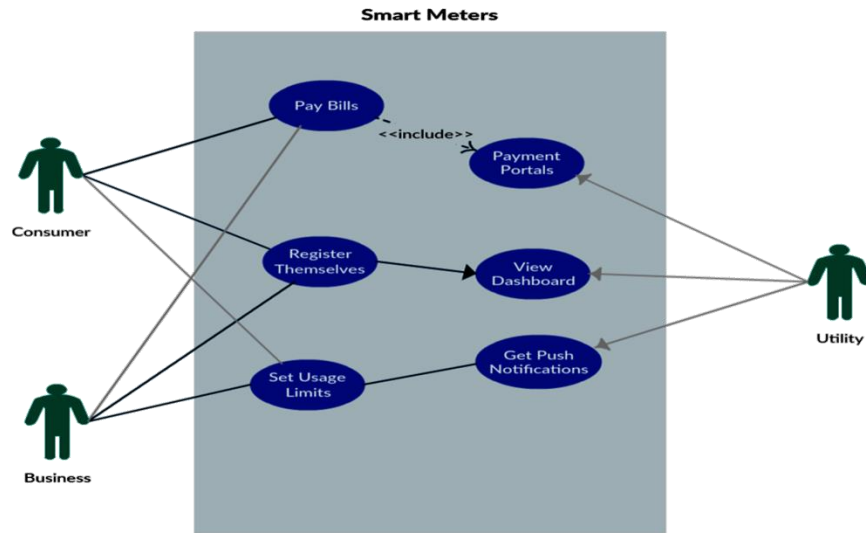
Cloud Computing: Cloud computing is A model for enabling convenient, on-demand network access to A shared pool of configurable computing resources (E.G., Networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.

Internet of Things: The internet of things refers to the ever-growing network of physical objects that feature an IP address for internet connectivity, and the communication that occurs between these objects and other internet-enabled devices and systems.

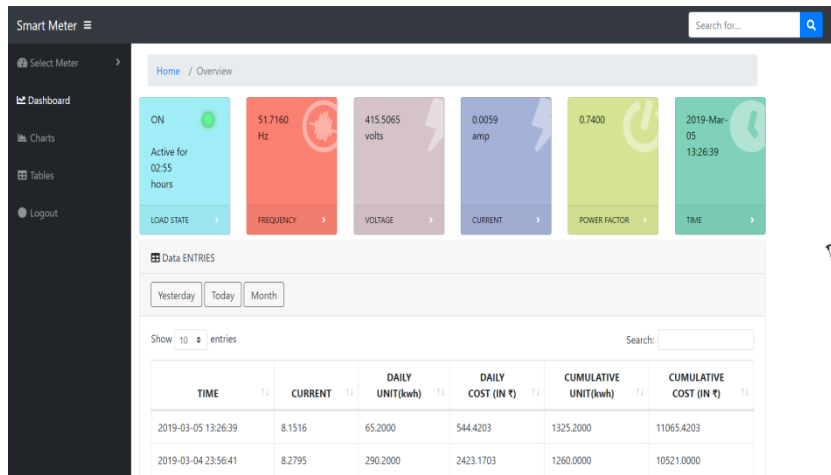
Data Analytics: Data analysis is a process of inspecting, cleansing, transforming, and modeling data with the goal of discovering useful information, informing conclusions, and supporting decision-making.

Use case Diagram:

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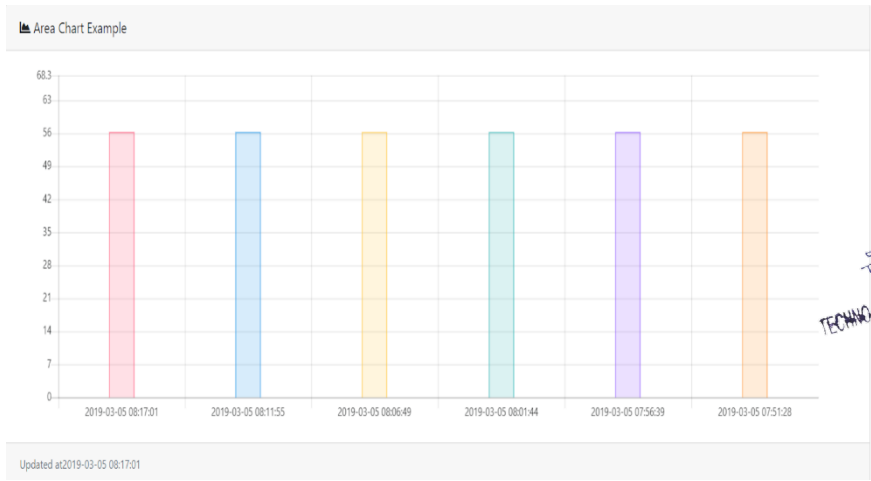


Dashboard:



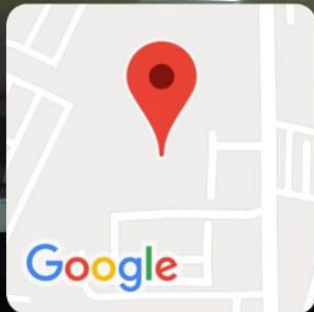
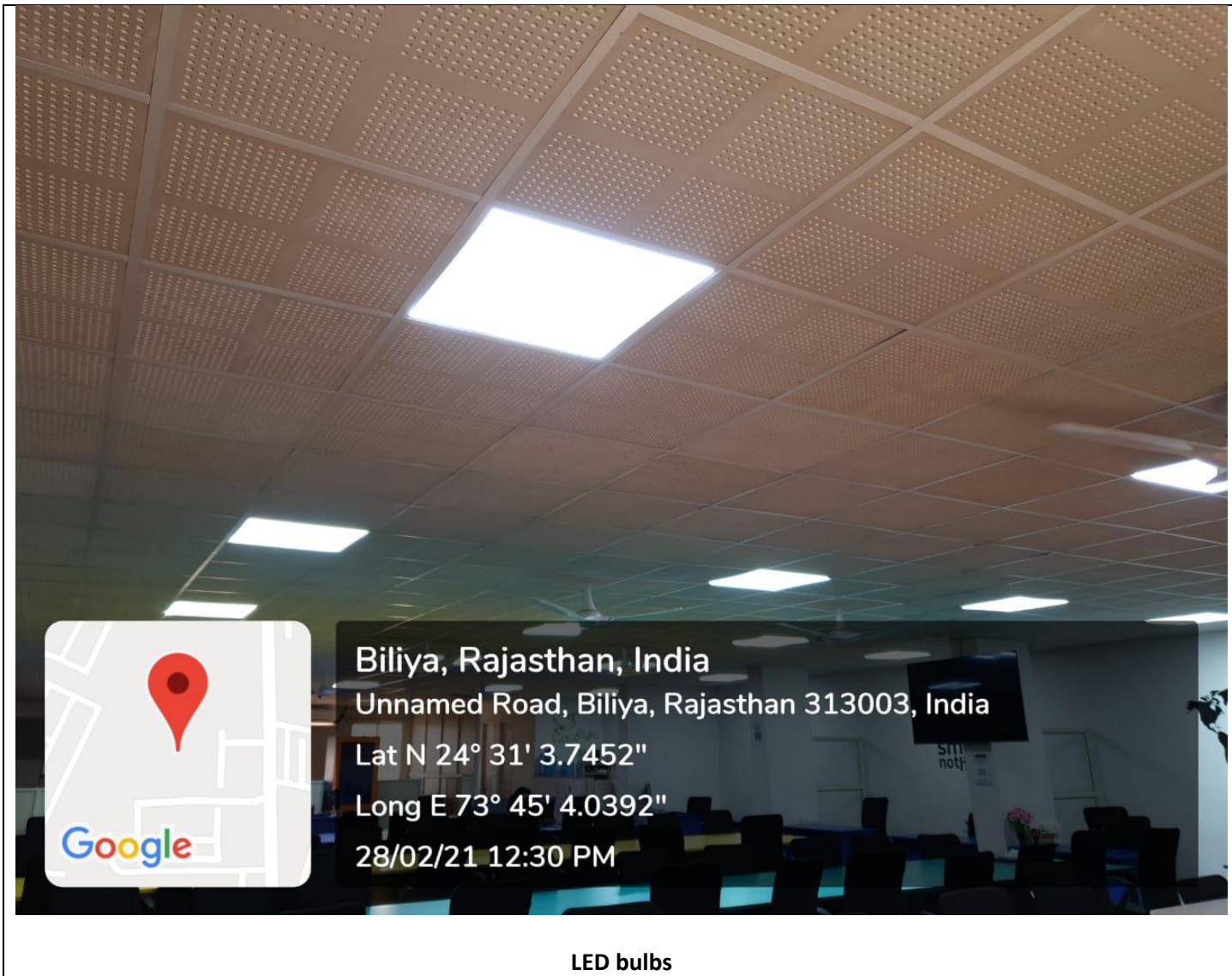
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Analytics Based on different Parameters:



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5. Use of LED bulbs/power efficient equipment:



Biliya, Rajasthan, India

Unnamed Road, Biliya, Rajasthan 313003, India

Lat N 24° 31' 3.7452"

Long E 73° 45' 4.0392"

28/02/21 12:30 PM

LED bulbs

पंकज पीरवाल
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अजमेर विद्युत वितरण निगम लिमिटेड
विद्युत उपभोग विवरण (कार्यालय प्रति.)
पत्र सं. 13012301290189
क. सं. 130123008307

उपभोगकर्ता का नाम: **नावादिप जितेन्द्र राणावत**
पता: **एनके.एन. चौरटेखल फ्री एरिया, एन (O&N), Madri, AVVNL.**

क्र.सं.	विवरण	दिवस	विवरण (रु.)
1.	विद्युत चार्ज		84420.00
2.	स्टाफ शुल्क		20250.00
3.	विद्युत सारफार्स		
4.	घर की वोल्टता (1) डीएस (2) डीएस (3) डीएस (4) डीएस (5) डीएस		-506.52
5.	अनुसंधान उपभोग प्रति		
6.	सी.टी., पी.टी., गैसीयर विद्युत		900.00
7.	दुर्घटनकारी विद्युत		
8.	अन्य		4143.00
9.	पिबिटर (-) (1) कोटेशन		
10.	(1) कोटेशन, पिबिटर, टायमिंग रिपेयर		
11.	विद्युत प्रति (ड्रम सं. 1 से 8 तक का योग)		109226.63
12.	विद्युत शुल्क अधिभोग पर		3815.60
13.	अन्य संशोधन शुल्क		953.90
14.	अन्य देय/प्राप्त कोटेशन प्रति		
15.	अन्य देय/प्राप्त कोटेशन शुल्क		-13141.39
16.	अन्य देय/प्राप्त कोटेशन अनुसंधान शुल्क		
17.	अन्य देय/प्राप्त कोटेशन अनुसंधान शुल्क		
18.	अन्य देय/प्राप्त कोटेशन, एन.डी.डी., पोस्टल चार्ज/भुगतान		
19.	समाप्ति/विद्युत प्रति (कोटेशन)		
20.	विद्युत उपभोग प्रति (ड्रम सं. 10 से 19 तक का योग)		100854.74
21.	विद्युत प्रति तक अनुसंधान प्रति		
22.	अधिनियम अनुसार प्रति (घर/शुल्क)		
23.	राज्य सरकार द्वारा लागू प्रति - (1) डीएस (2) डीएस		
24.	(1) कोटेशन प्रति, अन्य सारफार्स		100855.00
25.	विद्युत प्रति तक देय प्रति (ड्रम सं. 20-21-22-23)		1921.70
26.	विद्युत प्रति तक देय प्रति (ड्रम सं. 24 एवं 25 का योग)		102776.00

कुल देय/प्राप्त: 13012301290189
कुल देय/प्राप्त: 130123008307

अन्य देय/प्राप्त: 13012301290189
अन्य देय/प्राप्त: 130123008307

अन्य देय/प्राप्त: 13012301290189
अन्य देय/प्राप्त: 130123008307

अजमेर विद्युत वितरण निगम लिमिटेड
विद्युत उपभोग विवरण (कार्यालय प्रति.)
पत्र सं. 13012301290189
क. सं. 130123008307

विवरण	दिनांक	दिनांक	दिनांक	दिनांक	दिनांक
विद्युत उपभोग प्रति	6359	9539	Nov20	Oct120	Sep20
अनुसंधान प्रति	6609	9914	15342	24450	22848
अनुसंधान प्रति	20.600	20.900	22848	26344	22869
अनुसंधान प्रति	08-12-2020	23-12-2020			

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अजमेर विद्युत वितरण निगम लिमिटेड
विद्युत उपभोग विवरण (कार्यालय प्रति.)
पत्र सं. 13012301292345
क. सं. 130123008307

उपभोगकर्ता का नाम: **नावादिप जितेन्द्र राणावत**
पता: **एनके.एन. चौरटेखल फ्री एरिया, एन (O&N), Madri, AVVNL.**

क्र.सं.	विवरण	दिवस	विवरण (रु.)
1.	विद्युत चार्ज		102102.48
2.	स्टाफ शुल्क		20250.00
3.	विद्युत सारफार्स		
4.	घर की वोल्टता (1) डीएस (2) डीएस (3) डीएस (4) डीएस (5) डीएस		-714.72
5.	अनुसंधान उपभोग प्रति		
6.	सी.टी., पी.टी., गैसीयर विद्युत		900.00
7.	दुर्घटनकारी विद्युत		
8.	अन्य		7500.04
9.	पिबिटर (-) (1) कोटेशन		
10.	(1) कोटेशन, पिबिटर, टायमिंग रिपेयर		
11.	विद्युत प्रति (ड्रम सं. 1 से 8 तक का योग)		130037.77
12.	विद्युत शुल्क अधिभोग पर		4614.80
13.	अन्य संशोधन शुल्क		1153.70
14.	अन्य देय/प्राप्त कोटेशन प्रति		
15.	अन्य देय/प्राप्त कोटेशन शुल्क		-1179.83
16.	अन्य देय/प्राप्त कोटेशन अनुसंधान शुल्क		
17.	अन्य देय/प्राप्त कोटेशन अनुसंधान शुल्क		
18.	अन्य देय/प्राप्त कोटेशन, एन.डी.डी., पोस्टल चार्ज/भुगतान		
19.	समाप्ति/विद्युत प्रति (कोटेशन)		
20.	विद्युत उपभोग प्रति (ड्रम सं. 10 से 19 तक का योग)		134626.44
21.	विद्युत प्रति तक अनुसंधान प्रति		
22.	अधिनियम अनुसार प्रति (घर/शुल्क)		
23.	राज्य सरकार द्वारा लागू प्रति - (1) डीएस (2) डीएस		
24.	(1) कोटेशन प्रति, अन्य सारफार्स		134626.00
25.	विद्युत प्रति तक देय प्रति (ड्रम सं. 20-21-22-23)		2577.16
26.	विद्युत प्रति तक देय प्रति (ड्रम सं. 24 एवं 25 का योग)		137204.00

कुल देय/प्राप्त: 13012301292345
कुल देय/प्राप्त: 130123008307

अन्य देय/प्राप्त: 13012301292345
अन्य देय/प्राप्त: 130123008307

अन्य देय/प्राप्त: 13012301292345
अन्य देय/प्राप्त: 130123008307

अजमेर विद्युत वितरण निगम लिमिटेड
विद्युत उपभोग विवरण (कार्यालय प्रति.)
पत्र सं. 13012301292345
क. सं. 130123008307

विवरण	दिनांक	दिनांक	दिनांक	दिनांक	दिनांक
विद्युत उपभोग प्रति	7691	11537	Nov20	Oct20	Sep20
अनुसंधान प्रति	7973	11960	15342	24450	22848
अनुसंधान प्रति	21.300	31.950	22848	26344	22869
अनुसंधान प्रति	08-01-2021	22-01-2021			

August Month Net meter calculation



Bill 01 details:

Bill Import: 469948 kWh

01 Bill Export: 9656 kWh

01 Bill Net: 460291 kWh

01



02

Bill 01 details:
Bill Import: 454716 kWh
02 Bill Export: 9577 kWh
02 Bill Net: 445139 kWh

पंजाब विश्वविद्यालय
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अजमेर बिजुल वितरण निगम लिमिटेड
विद्युत उपभोग विवरण (उपभोग प्रति)
दिनांक : 30/07/2020
उपभोग विवरण नं. : 2324.77

क्र.सं.	विवरण	दर (₹)	कुल राशि (₹)
1.	विद्युत खर्च	202204.00	
2.	व्याज शुल्क	0000.00	
3.	इंधन संचयन		
4.	सुरक्षा फंड (सुरक्षा) (सुरक्षा फंड पर 2%)	-404.61	
5.	अवशिष्ट उपभोग खर्च		
6.	वी.पी.सी. संचयन	700.00	
7.	प्रशासकीय खर्च		
8.	अन्य		
9.	किंवा (1) शून्य		
10.	(K) संचयन/सिद्धांत/अवशिष्ट संचयन		
11.	विद्युत शुल्क संचयन उपभोग पर	22240.77	
12.	अन्य वी.पी.सी.	2224.77	
13.	अन्य वी.पी.सी.		
14.	अन्य वी.पी.सी.		
15.	अन्य वी.पी.सी.		
16.	अन्य वी.पी.सी.		
17.	अन्य वी.पी.सी.		
18.	अन्य वी.पी.सी.		
19.	अन्य वी.पी.सी.		
20.	अन्य वी.पी.सी.		
21.	अन्य वी.पी.सी.		
22.	अन्य वी.पी.सी.		
23.	अन्य वी.पी.सी.		
24.	अन्य वी.पी.सी.		
25.	अन्य वी.पी.सी.		
26.	अन्य वी.पी.सी.		
27.	अन्य वी.पी.सी.		
28.	अन्य वी.पी.सी.		
29.	अन्य वी.पी.सी.		
30.	अन्य वी.पी.सी.		
31.	अन्य वी.पी.सी.		
32.	अन्य वी.पी.सी.		
33.	अन्य वी.पी.सी.		
34.	अन्य वी.पी.सी.		
35.	अन्य वी.पी.सी.		
36.	अन्य वी.पी.सी.		

अन्य देय/ जमा कोड निगम राशि 2324.77

Solar generation is adjusted to this section of bill (Fuel Surcharge)

अजमेर बिजुल वितरण निगम लिमिटेड
विद्युत उपभोग विवरण (उपभोग प्रति)
दिनांक : 30/07/2020
उपभोग विवरण नं. : 2324.77

क्र.सं.	विवरण	दर (₹)	कुल राशि (₹)
1.	विद्युत खर्च	202204.00	
2.	व्याज शुल्क	0000.00	
3.	इंधन संचयन		
4.	सुरक्षा फंड (सुरक्षा) (सुरक्षा फंड पर 2%)	-404.61	
5.	अवशिष्ट उपभोग खर्च		
6.	वी.पी.सी. संचयन	700.00	
7.	प्रशासकीय खर्च		
8.	अन्य		
9.	किंवा (1) शून्य		
10.	(K) संचयन/सिद्धांत/अवशिष्ट संचयन		
11.	विद्युत शुल्क संचयन उपभोग पर	22240.77	
12.	अन्य वी.पी.सी.	2224.77	
13.	अन्य वी.पी.सी.		
14.	अन्य वी.पी.सी.		
15.	अन्य वी.पी.सी.		
16.	अन्य वी.पी.सी.		
17.	अन्य वी.पी.सी.		
18.	अन्य वी.पी.सी.		
19.	अन्य वी.पी.सी.		
20.	अन्य वी.पी.सी.		
21.	अन्य वी.पी.सी.		
22.	अन्य वी.पी.सी.		
23.	अन्य वी.पी.सी.		
24.	अन्य वी.पी.सी.		
25.	अन्य वी.पी.सी.		
26.	अन्य वी.पी.सी.		
27.	अन्य वी.पी.सी.		
28.	अन्य वी.पी.सी.		
29.	अन्य वी.पी.सी.		
30.	अन्य वी.पी.सी.		
31.	अन्य वी.पी.सी.		
32.	अन्य वी.पी.सी.		
33.	अन्य वी.पी.सी.		
34.	अन्य वी.पी.सी.		
35.	अन्य वी.पी.सी.		
36.	अन्य वी.पी.सी.		

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Net metering calculation:

**01 Bill Export: 9656 kWh
kWh**

02 Bill Export: 9577

Unit calculation formula:

- 1. Difference: $9656 - 9577 = 79$ kWh**
- 2. Total Unit Exported to grid: $79 * 1.5 = 118$ kWh (units)**
- 3. Cost of Exported Units: $118 * 8.85$ (8.85 Rs./Unit)=
1048.73 Rs.**
- 4. 1048.73 Rs. Adjusted in highlighted section of Bill.**
- 5. Total Fuel Surcharge (Debit Rate) of August month
Bill: 3373.5 Rs.**
- 6. Fuel Surcharge (Debit Rate) - Cost of Exported
Units (Credit Rate) = $3373.5 - 1048.73 = 2324.77$
Rs.**

पंजाब टोस्वेल
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