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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Director

50 KW ON-Grid Solar Plant at Techno India NJR

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Director

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Table of Content:

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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 aluminum 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 Watts/m2, at a spectral density of AM1.5 and cell temperature of 25˚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 synchronized with utility grid and metered.
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 systemof 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. It 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 utilized 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.

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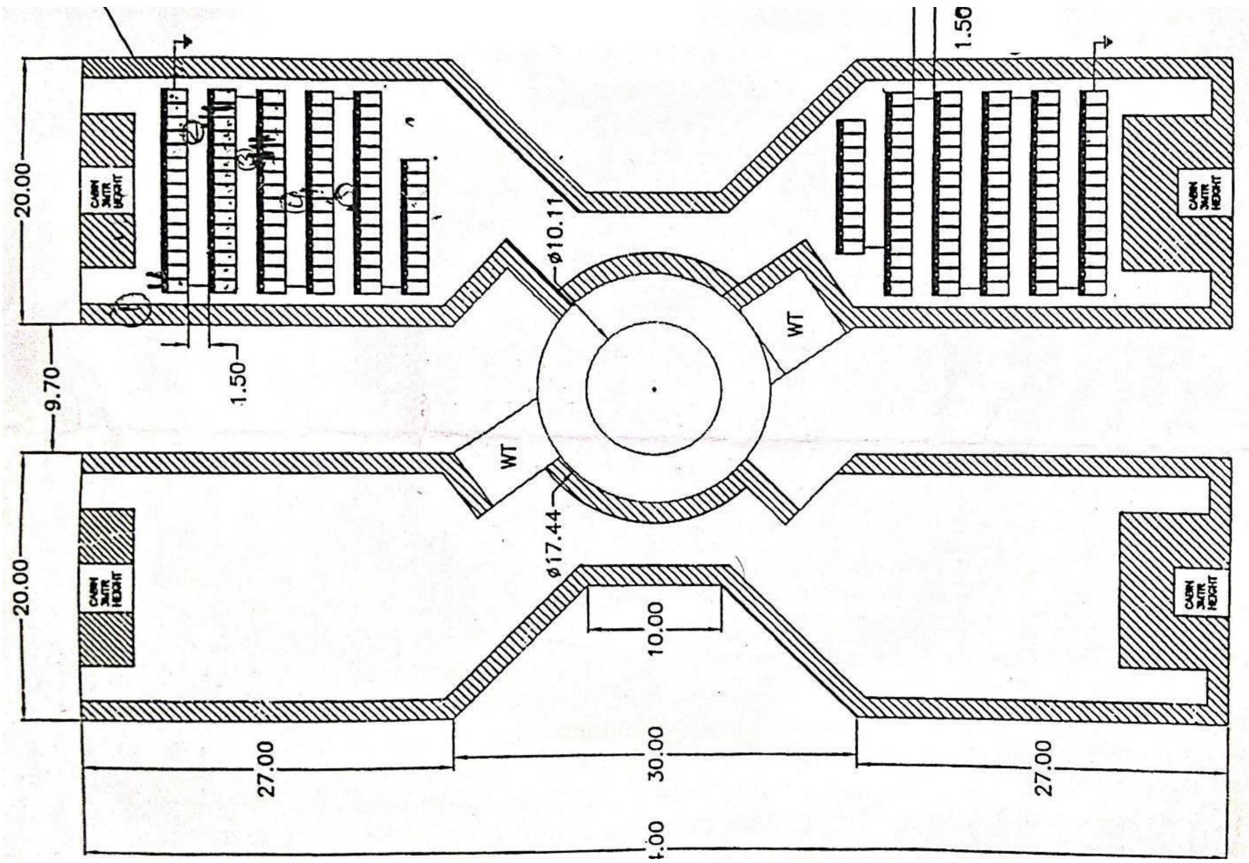
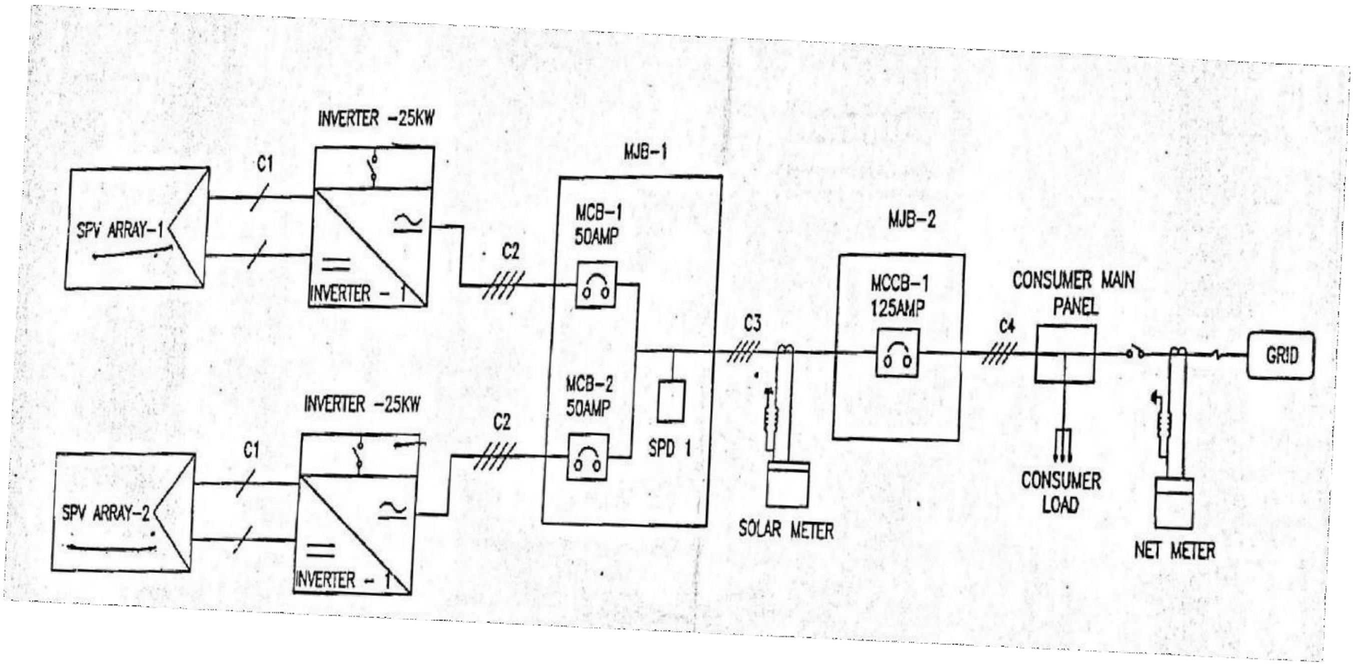


A total number of solar panels is 170 and two grid-tied type inverters each is 25 KW. Connections of all solar panel are in the manner of that 17 panels are connected in series, this is one string of 17 panels and we have 5 strings, which makes a total number of the panel is 85.

(17 panels in series) * (5 strings) = 85 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. Armored Cable
12.	C4: 3.5CX50 sq.mm, AL. Armored 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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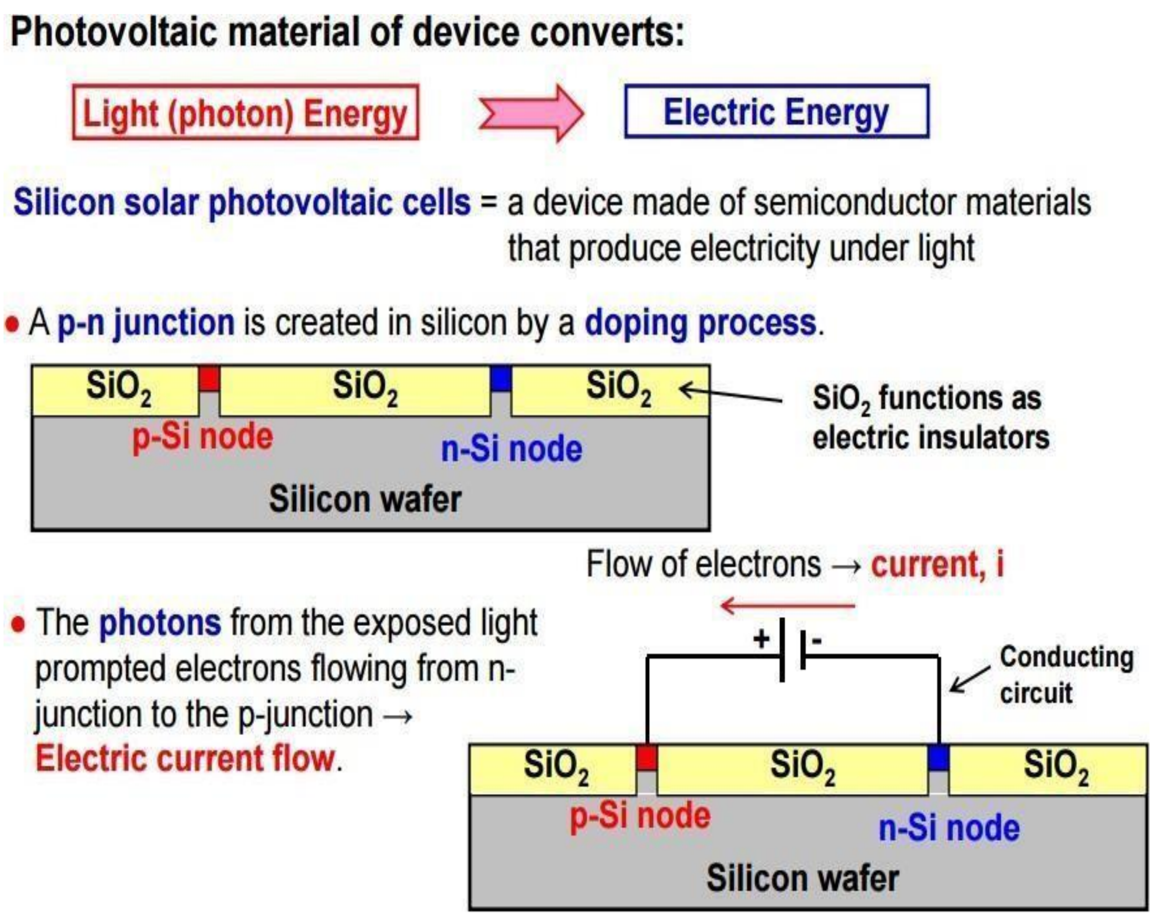
Chapter 4 Selection of PV Technology

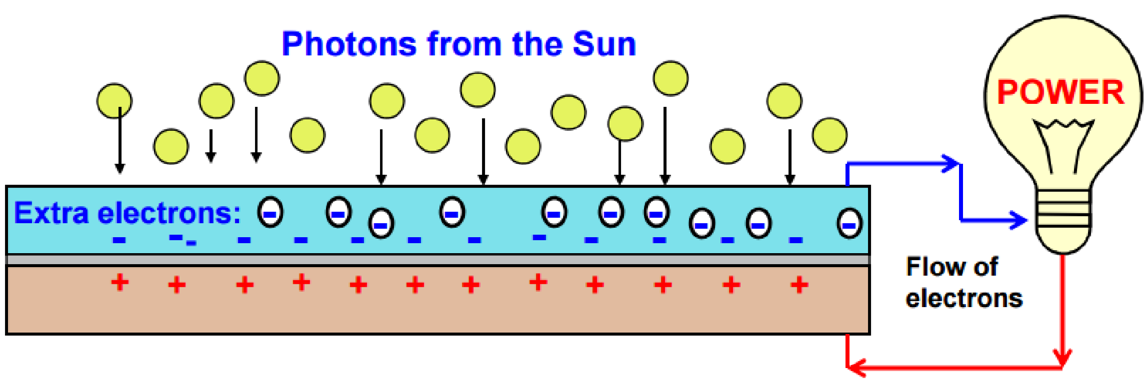
Science of Silicon PV Cells

- 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





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Common Solar Cell Materials

Single Crystalline	Polycrystalline (Thin films)
Silicon (Si): Single crystalline Polycrystalline silicon Amorphous silicon (non-crystalline Si for higher light absorption) **Gallium arsenide** (GaAs)	**Cadmium telluride** (CdTe) **Copper indium diselenide** (CIS)

Approximate Achievable Conversion Efficiencies

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

GaAs	25 – 30%
CdTe	7%
CIS	10

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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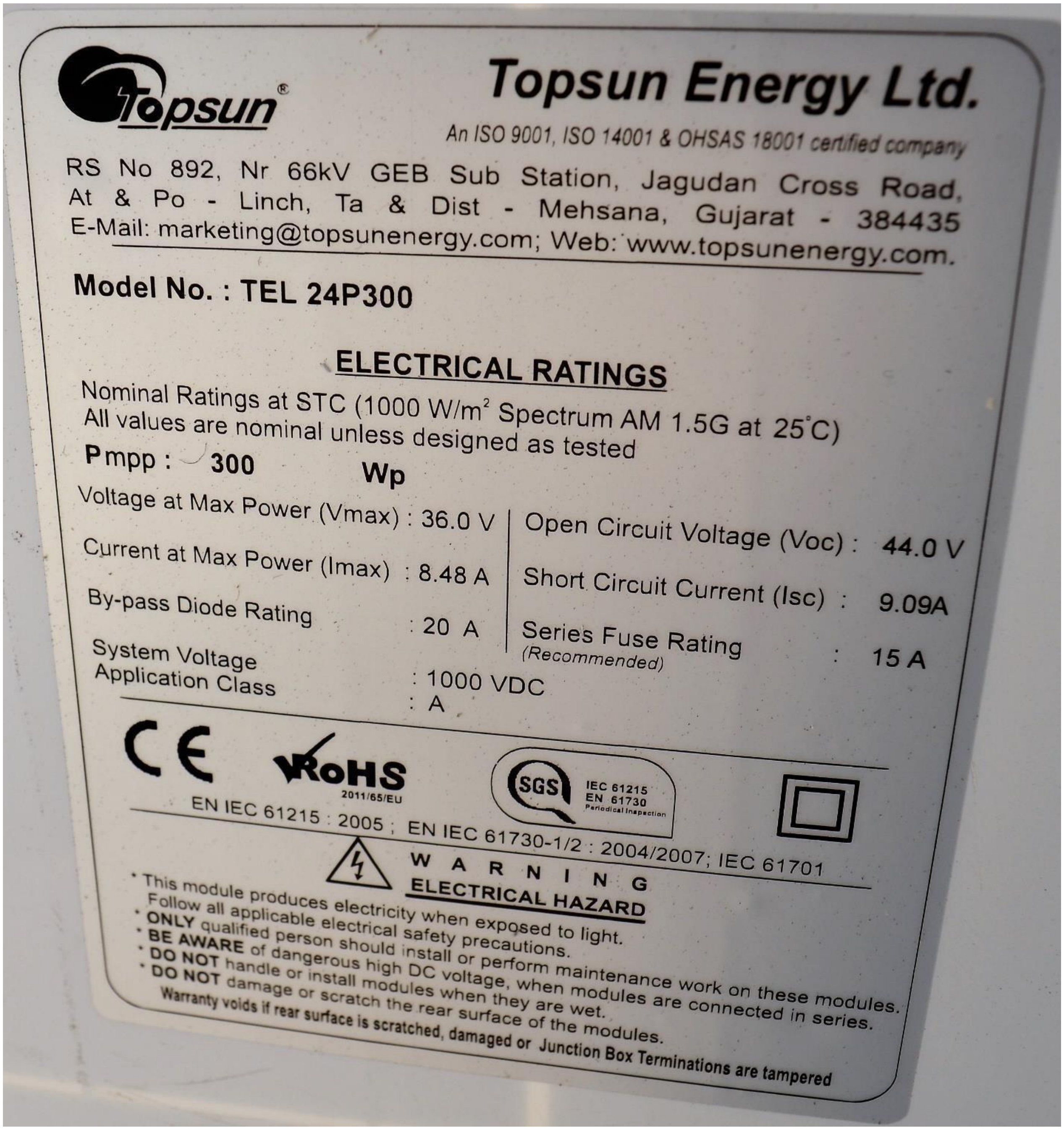
Specification of the single solar panel:



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According to solar panel electrical ratings:

The Voltage at Max Power (Vmax) is 36V, Current at Max Power (Imax) 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 X 36 = 612 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 galvanized iron as well as aluminum structures. Some of the projects have adopted a combination of steel structure and aluminum structure wherein vertical legs are made off hot dipped galvanized steel and rest of the members are made off extruded aluminum structure. Typically, module mount structure comprises of following components:

1. Vertical rail (Rafter)
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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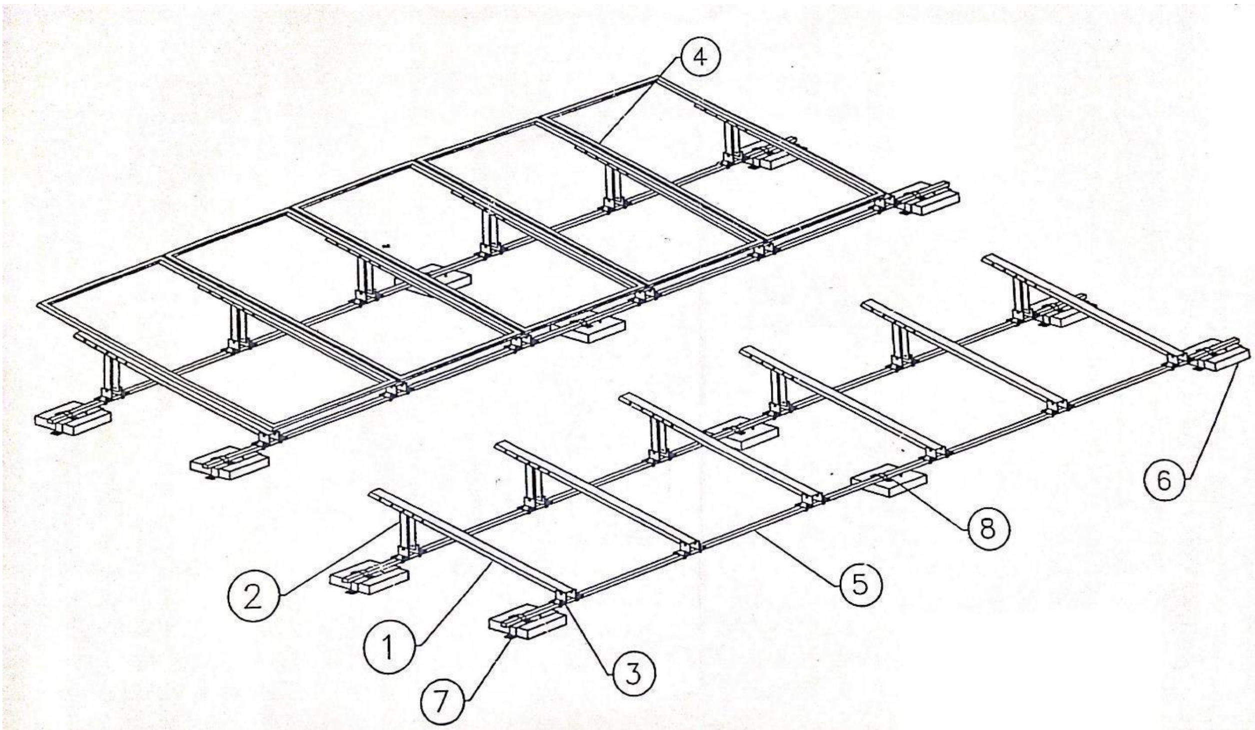

1. Module Mounting 'C' Channel—50x72x50x2mm—1600mm Long
2. Vertical Support 'C' Channel—50x65x50x2mm—500mm Long
3. Support 'L' Clamp
4. Aluminum 'T' Clamp
5. Base Pipe
6. Rcc Base
7. Rcc Base Fitting Clamp
8. Base Pipe Fitting Clamp

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 allows 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

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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 optimize 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. e more efficient the inverter, the better the LCOE (leveled 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 centers of solar power plants, so that real-time monitoring of solar panels and inverters can be implemented.

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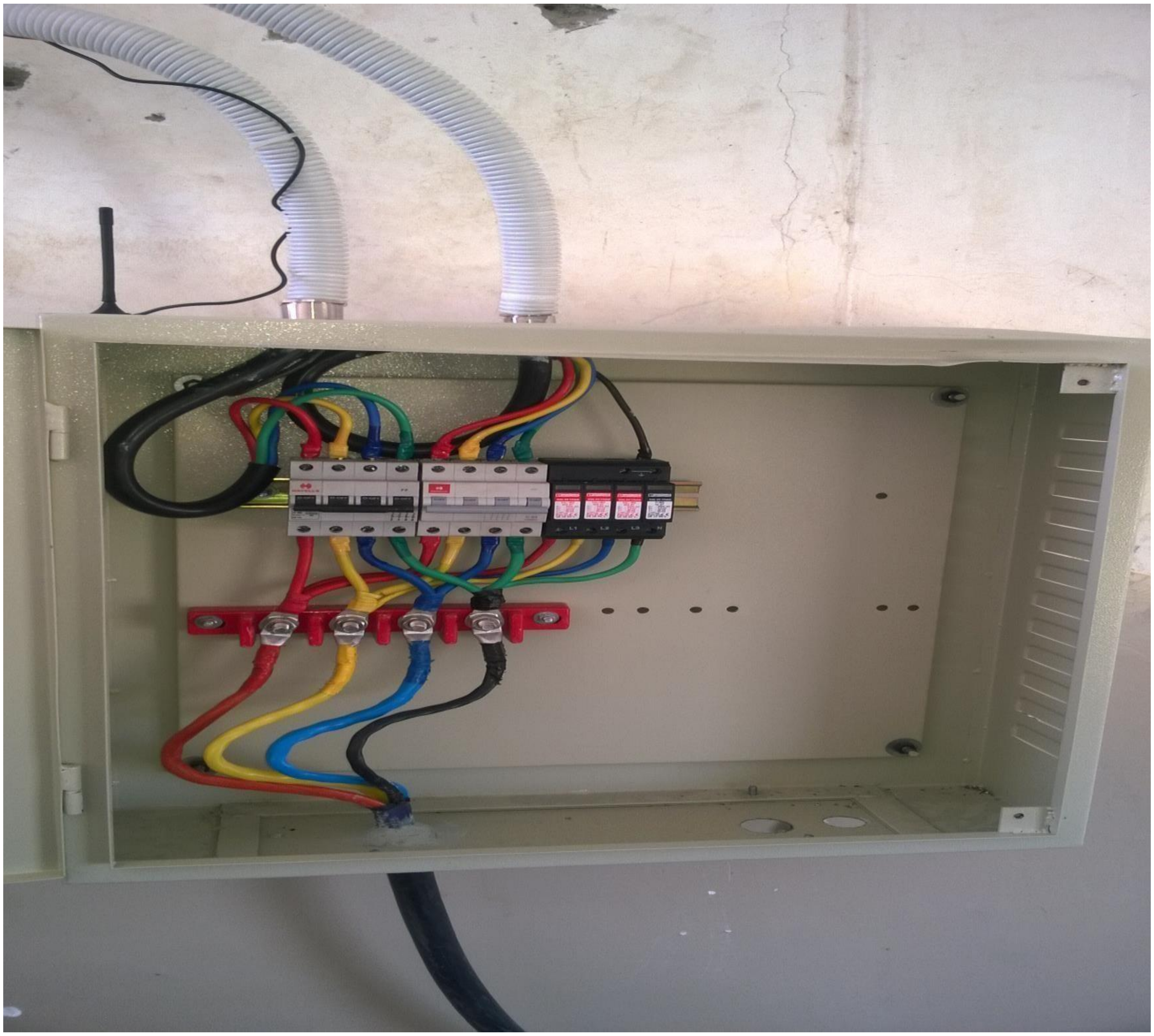
Each inverter is of 25KW rating and converting DC to AC and output of each adding in junction box shown in fig:



How does it work?

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

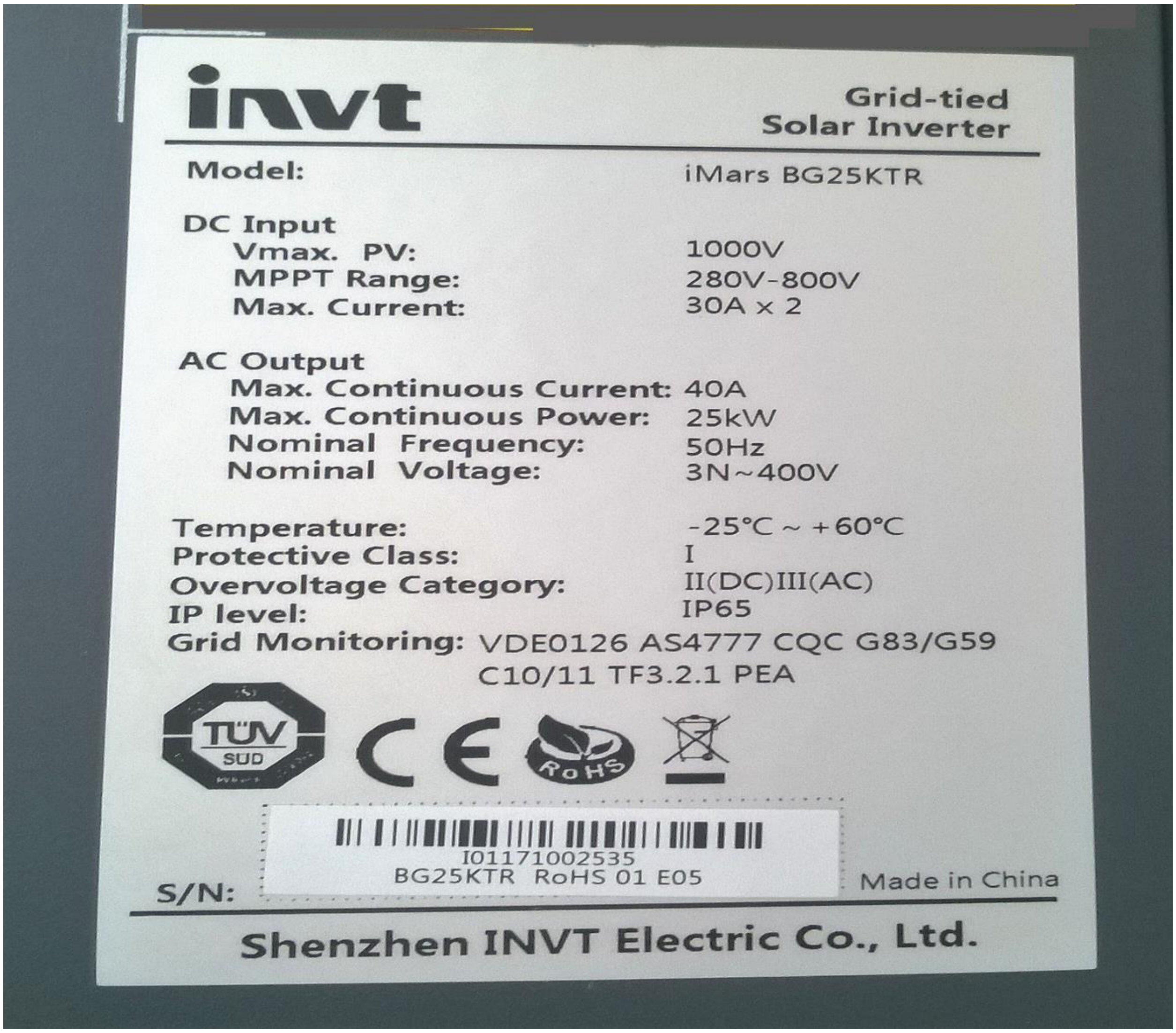
String Inverter - Single Phase

1800Wp, 2400Wp, 3300Wp
4600Wp, 5500Wp
12000Wp

Central Inverter - Three Phase

50KWp, 100KWp, 250KWp, 500KWp, 1000KWp

Specification of Inverter:



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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.

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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.

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

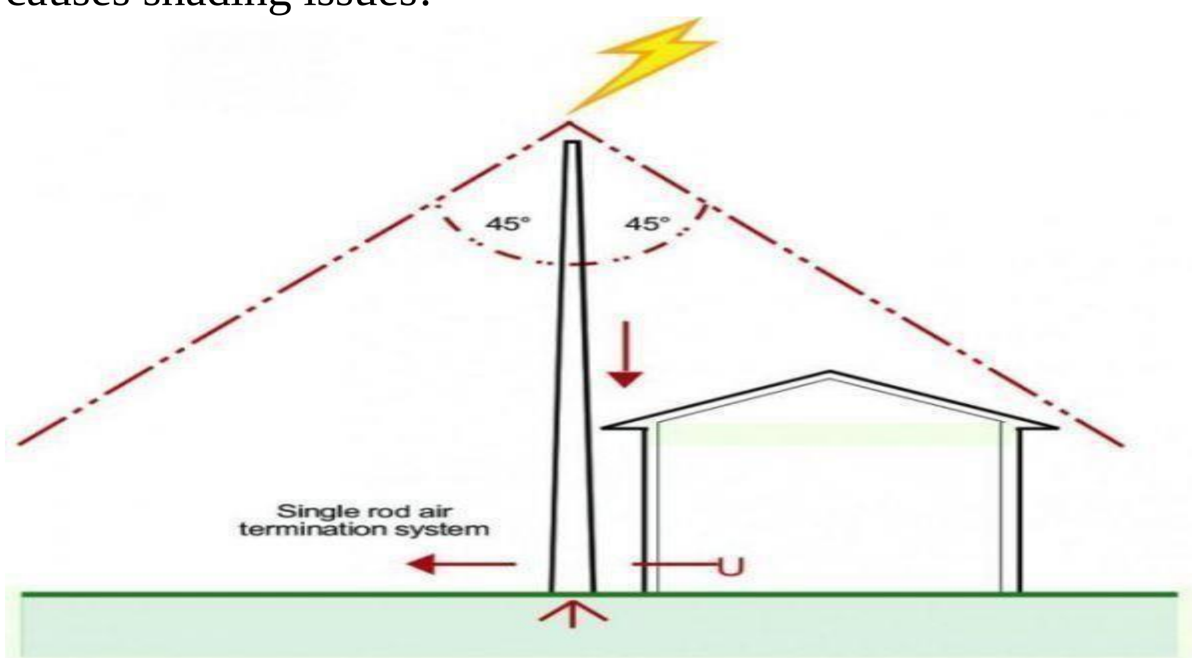
Even DC SPD's (Surge Protection Devices) can have a special separate earth for them

Lightning Arrestor:

Lightning Arrestor is a bit complicated.

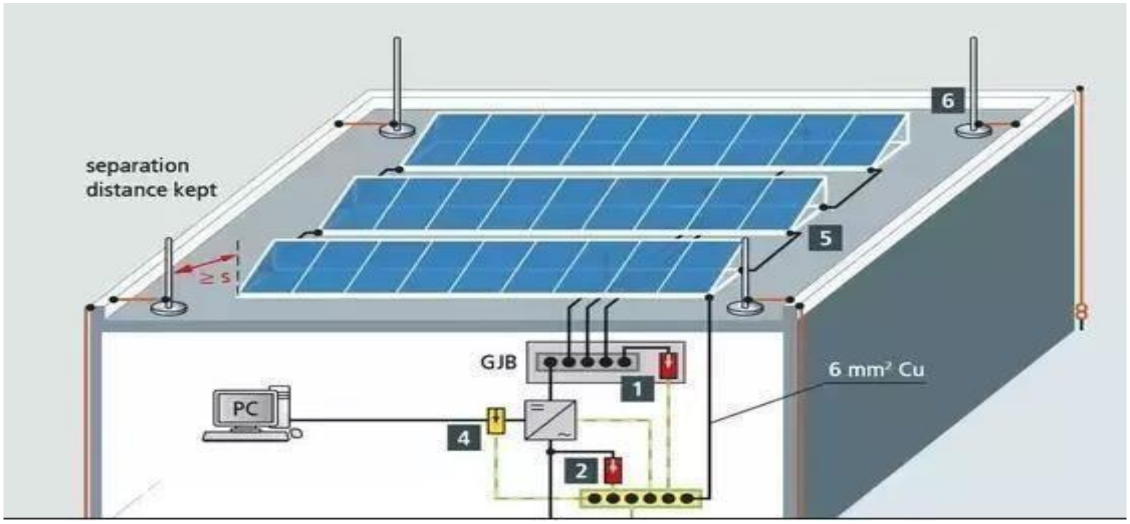
There are Multiple Methods to do this

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 your 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 utilized 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:

50 KW Solar Power Plant

	
Solar Water Heater	**Solar Street Light**

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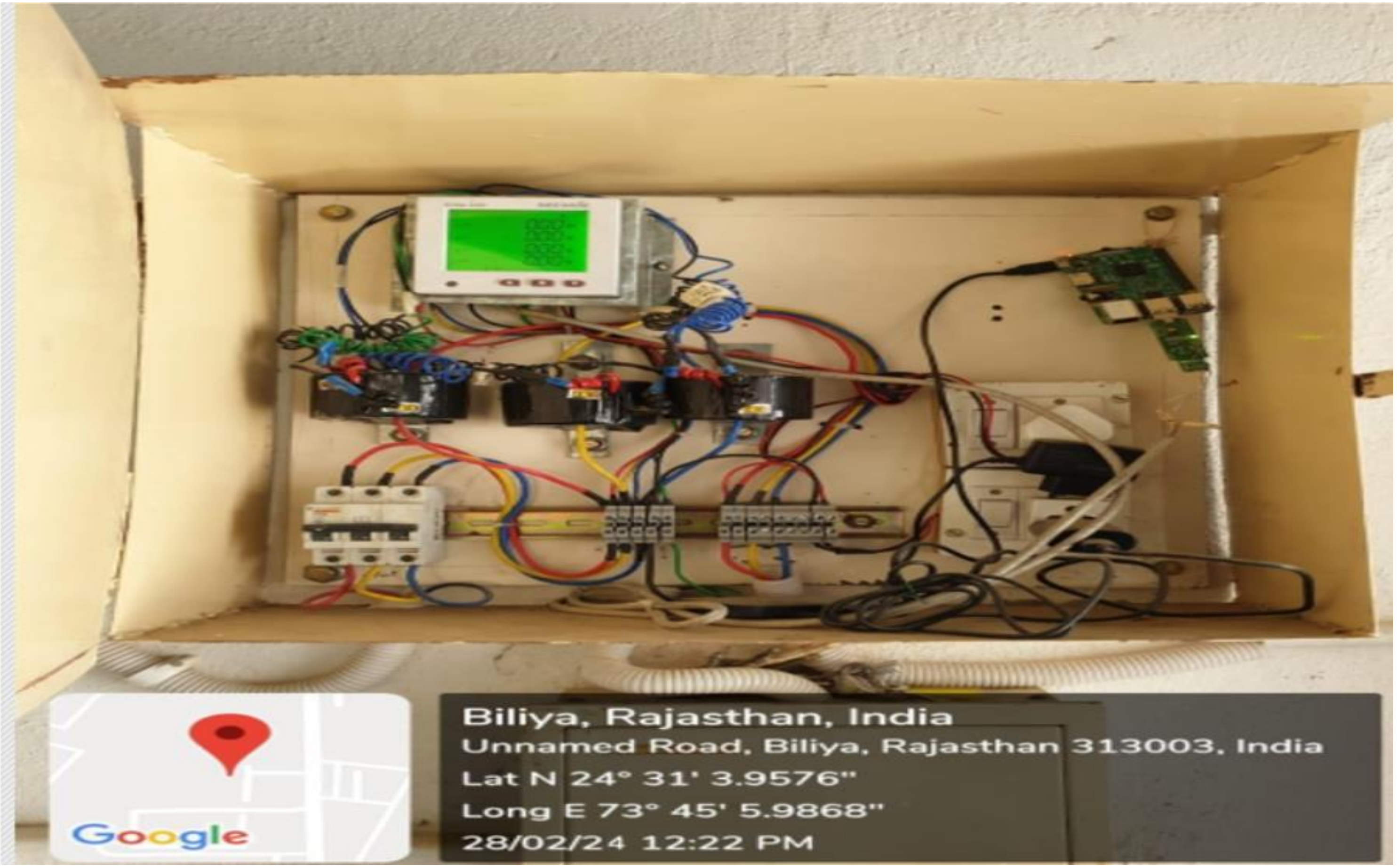
4. Smart Meter Sensorbased energy conservation



Smart Meter Sensor-based energy conservation

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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.

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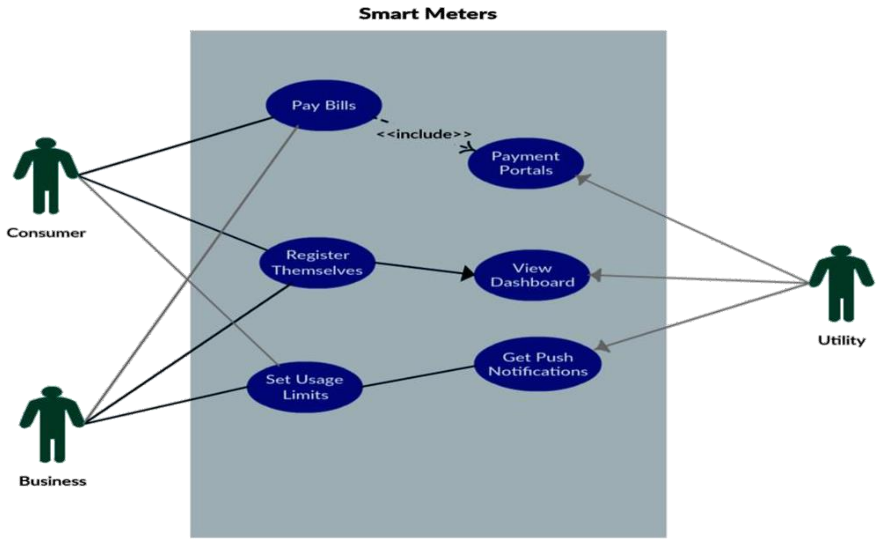
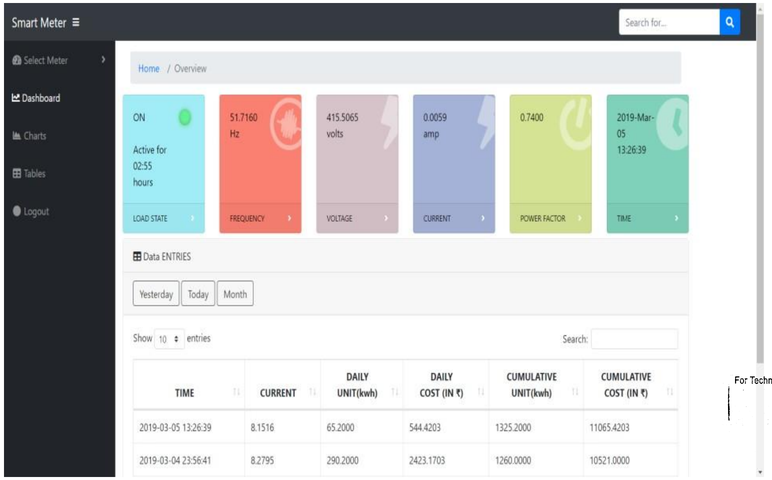
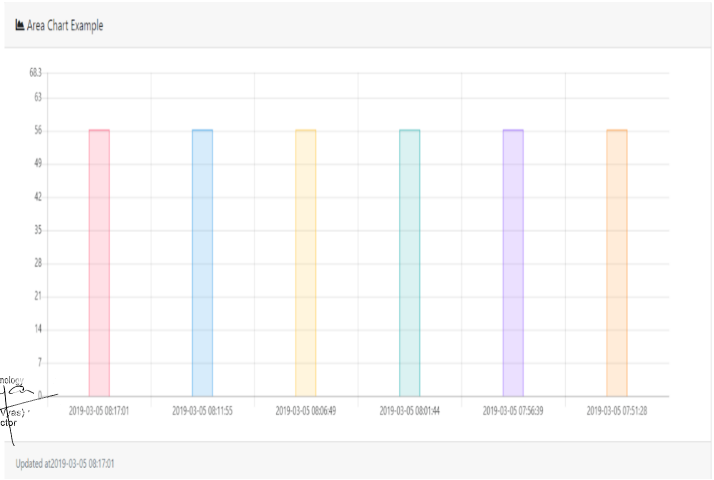
Use case Diagram:



Dashboard:





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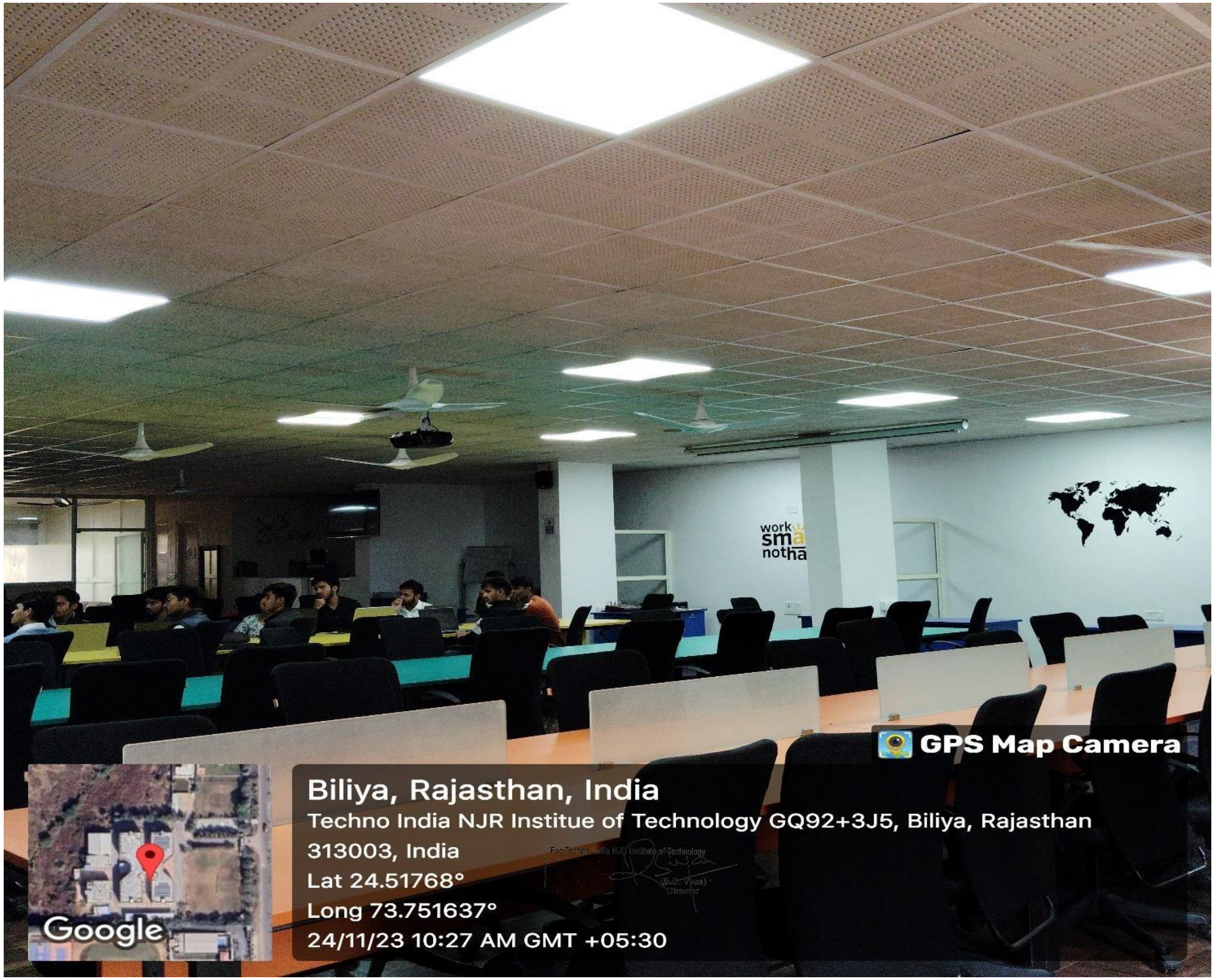
Analytics Based on different Parameters:

5. Use of LED bulbs/power efficient equipment:



LED bulbs

उपखण्ड कोड, नाम व पता: 1301230 AEN(O&M, Madri) AVVNL

ईमेल:

अजमेर विद्युत वितरण निगम लिमिटेड

विद्युत उपभोग विपत्र (उपभोक्ता प्रति.)

पेन नं. AACCA8562E

कार्यालय फोन नं. 0294-2491526

पता शिकायत केन्द्र :

बिल नं. 13012301280189

टोल फ्री शिकायत नं. 18001806565

नाम	नावादिप जितेन्द्र राणावत		
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RSN:	233		
सेवा क्रमांक	8211939	अमानत राशि	226456.00
वर्तमान खाता संख्या	0692/0309		
बिल माह	Dec/2020	कुल माह बिल	1.0000
फीडर कोड	11F1023107	टैरिफ कोड	2011
स्वी. श्रेणी	NDS		
स्वी. लोड (कि.वा./हा.पा.)	120.00 KW	कनेक्टेड लोड (कि.वा./हा.पा.)	120.00 KW
कांट्रेक्ट डिमांड (के.वि.ए.)	100	शहरी/ग्रामीण	RURAL
सप्लाई वोल्टेज	11000 V	मीटरिंग वोल्टेज	11000 V
मीटर स्वामित्व		मीटरिंग टाइप	TVM
पॉवर फैक्टर	0.962	बिलिंग डिमांड	75.0000
औसत मासिक उपभोग (यू.कि.व.)	16789	मीटर सुरक्षा राशि	
मीटर की स्थिति	OK	उपभोक्ता की स्थिति	R
वर्तमान पठन तिथि	01-12-2020	गत पठन तिथि	01-11-2020
वर्तमान स्थापित मीटर नं.	496145	गुणांक	15/10
वर्तमान पठन (KWH)	502835	गत पठन (KWH)	496476
वर्तमान पठन (KVAH)	546020	गत पठन (KVAH)	539411
वर्तमान पठन (KVA)	20.600	गत पठन (KVA)	
बदले गये/अतिरिक्त मीटर नं.		गुणांक	
वर्तमान पठन (KWH)		गत पठन (KWH)	
वर्तमान पठन (KVAH)		गत पठन (KVAH)	
वर्तमान पठन (KVA)		गत पठन (KVA)	
मीटर की स्थिति		ट्रा. क्षति	कुल उपभोग
उपभोग (KWH)	6359		9539
(KVAH)	6609		9914
(KVA)	20.600		30.900
बिल जारी करने की तिथि	08-12-2020	नियत भुगतान तिथि	23-12-2020

क्रम सं.	विवरण	बिलराशि (रु.)
1.	विद्युत खर्च	84420.1
2.	स्थाई शुल्क	20250.00
3.	डिमांड सरचार्ज	
4.	पावर फैक्टर सरचार्ज (+) प्रोत्साहन (-)/ शंट कैपेसिटर सरचार्ज (3%)	-506.52
5.	अनाधिकृत उपभोग राशि	
6.	सी.टी./पी.टी./मीटर किराया	900.00
7.	ट्रांसफार्मर किराया	
8.	अन्य	4163.00
9.	रिबेट्स (-) (i) वोल्टेज	
	(ii) सोलर/स्प्रिंकलर/ग्रामीण रियायत	
10.	निगम राशि (क्रम सं. 1 से 9 तक का योग)	109226.63
11.	विद्युत शुल्क वर्तमान उपभोग पर	3815.60
12.	जल संरक्षण उपकर	953.90
13.	नगरीय उपकर	
14.	अन्य देय/ जमा कोड निगम राशि	-13141.39
15.	अन्य देय/जमा कोड विद्युत शुल्क	
16.	अन्य देय/जमा कोड जल संरक्षण उपकर	
17.	अन्य देय/जमा कोड नगरीय उपकर	
18.	अन्य देय/जमा कोड/एल.ई.डी./डेफर्ड योजना भुगतान	
19.	समायोजित राशि (कोड)	
20.	कुल उपभोग राशि (क्रम. सं. 10 से 19 तक का योग)	100854.74
21.	पिछले बिल तक बकाया राशि	
22.	स्थगित बकाया राशि (चालू माह)	
23.	राज्य सरकार द्वारा वहन राशि – (i) टैरिफ सब्सिडी	
	(ii) ओला वृष्टि/ अन्य सब्सिडी	
24.	नियत तिथि तक देय कुल राशि (क्रम. सं. 20+21-22-23)	100855.00
25.	विलम्ब भुगतान सरचार्ज	1721.70
26.	नियत तिथि पश्चात् देय कुल राशि (क्रम. सं. 24 एवं 25 का योग)	102776.00

पिछले छः बिलिंग माह में अंकित उपभोग माह उपभोग (यूनिट)

माह	Nov20	Oct20	Sep20	Aug20	Jul20	Jun20
उपभोग	15342	24450	22848	26344	22869	25620

उपभोक्ता पेन नं. 0

बार कोड:

*** सीएससी एवं ई-मित्र कियोस्क द्वारा जारी मात्र कम्प्यूटर अंकित रसीद ही मान्य है।

Deposit on 18/12/20

मोहर सहायक अभियन्ता

अजमेर विद्युत वितरण निगम लिमिटेड

विद्युत उपभोग विपत्र (कार्यालय प्रति.)

उपभोक्ता का नाम नावादिप जितेन्द्र राणावत

बिल नं. 13012301280189

के. नम्बर 130123008307

बिल माह	Dec/2020	भुगतान का माध्यम : नगद/चैक नं.		भुगतान प्राप्ति की मोहर हेतु स्थान
वर्तमान खाता संख्या	0692/0309	नियत भुगतान तिथि	23-12-2020	
उपखण्ड का कोड	1301230	नियत भुगतान तिथि तक देय राशि	100855.00	
वृत व उपखण्ड		नियत भुगतान तिथि पश्चात देय राशि	102776.00	

उपखण्ड कोड, नाम व पता: 1301230 AEN(O&M, Madri) AVVNL

ईमेल:

अजमेर विद्युत वितरण निगम लिमिटेड

विद्युत उपभोग विपत्र (उपभोक्ता प्रति.)

पेन नं. AACCA8562E

कार्यालय फोन नं. 0294-2491526

पता शिकायत केन्द्र :

बिल नं. 13012301292365

टोल फ्री शिकायत नं. 18001806565

नाम	नावादिप जितेन्द्र राणावत		
पता	एजुकेशान चैरिटेबल फौ एसापि◌ेल .बेल्टनन रिको इंडस्ट्रीयल एरिया		
मोबाइल नं.	8696932800	बिलिंग स्थिति	REGULAR
ईमेल :			
के. नंबर:	130123008307		
RSN:	233		
सेवा क्रमांक	8211939	अमानत राशि	226456.00
वर्तमान खाता संख्या	0692/0309		
बिल माह	Jan/2021	कुल माह बिल	1.0000
फीडर कोड	11F1023107	टैरिफ कोड	2011
स्वी. श्रेणी	NDS		
स्वी. लोड (कि.वा./हा.पा.)	120.00 KW	कनेक्टेड लोड (कि.वा./हा.पा.)	120.00 KW
कांट्रेक्ट डिमांड (के.वि.ए.)	100	शहरी/ग्रामीण	RURAL
सप्लाई वोल्टेज	11000 V	मीटरिंग वोल्टेज	11000 V
मीटर स्वामित्व		मीटरिंग टाइप	TVM
पॉवर फैक्टर	0.964	बिलिंग डिमांड	75.0000
औसत मासिक उपभोग (यू.कि.व.)	16789	मीटर सुरक्षा राशि	
मीटर की स्थिति	OK	उपभोक्ता की स्थिति	R
वर्तमान पठन तिथि	01-01-2021	गत पठन तिथि	01-12-2020
वर्तमान स्थापित मीटर नं.	496145	गुणांक	15/10
वर्तमान पठन (KWH)	510526	गत पठन (KWH)	502835
वर्तमान पठन (KVAH)	553993	गत पठन (KVAH)	546020
वर्तमान पठन (KVA)	21.300	गत पठन (KVA)	
बदले गये/अतिरिक्त मीटर नं.		गुणांक	
वर्तमान पठन (KWH)		गत पठन (KWH)	
वर्तमान पठन (KVAH)		गत पठन (KVAH)	
वर्तमान पठन (KVA)		गत पठन (KVA)	
मीटर की स्थिति		ट्रा. क्षति	कुल उपभोग
उपभोग (KWH)	7691		11537
(KVAH)	7973		11960
(KVA)	21.300		31.950
बिल जारी करने की तिथि	08-01-2021	नियत भुगतान तिथि	22-01-2021

क्रम सं.	विवरण	बिलराशि (रु.)
1.	विद्युत खर्च	102102.45
2.	स्थाई शुल्क	20250.00
3.	डिमांड सरचार्ज	
4.	पावर फैक्टर सरचार्ज (+) प्रोत्साहन (-)/ शंट कैपेसिटर सरचार्ज (3%)	-714.72
5.	अनाधिकृत उपभोग राशि	
6.	सी.टी./पी.टी./मीटर किराया	900.00
7.	ट्रांसफार्मर किराया	
8.	अन्य	7500.04
9.	रिबेट्स (-) (i) वोल्टेज	
	(ii) सोलर/स्प्रिंकलर/ग्रामीण रियायत	
10.	निगम राशि (क्रम सं. 1 से 9 तक का योग)	130037.77
11.	विद्युत शुल्क वर्तमान उपभोग पर	4614.80
12.	जल संरक्षण उपकर	1153.70
13.	नगरीय उपकर	
14.	अन्य देय/ जमा कोड निगम राशि	-1179.83
15.	अन्य देय/जमा कोड विद्युत शुल्क	
16.	अन्य देय/जमा कोड जल संरक्षण उपकर	
17.	अन्य देय/जमा कोड नगरीय उपकर	
18.	अन्य देय/जमा कोड/एल.ई.डी./डेफर्ड योजना भुगतान	
19.	समायोजित राशि (कोड)	
20.	कुल उपभोग राशि (क्रम. सं. 10 से 19 तक का योग)	134626.44
21.	पिछले बिल तक बकाया राशि	
22.	स्थगित बकाया राशि (चालू माह)	
23.	राज्य सरकार द्वारा वहन राशि – (i) टैरिफ सब्सिडी	
	(ii) ओला वृष्टि/ अन्य सब्सिडी	
24.	नियत तिथि तक देय कुल राशि (क्रम. सं. 20+21-22-23)	134626.00
25.	विलम्ब भुगतान सरचार्ज	2577.16
26.	नियत तिथि पश्चात् देय कुल राशि (क्रम. सं. 24 एवं 25 का योग)	137204.00

पिछले छः बिलिंग माह में अंकित उपभोग माह उपभोग (यूनिट)

माह	Dec20	Nov20	Oct20	Sep20	Aug20	Jul20
उपभोग	9538	15342	24450	22848	26344	22869

उपभोक्ता पेन नं.

बार कोड:

*** सीएससी एवं ई-मित्र कियोस्क द्वारा जारी मात्र कम्प्यूटर अंकित रसीद ही मान्य है।

मोहर सहायक अभियन्ता

अजमेर विद्युत वितरण निगम लिमिटेड

विद्युत उपभोग विपत्र (कार्यालय प्रति.)

उपभोक्ता का नाम नावादिप जितेन्द्र राणावत

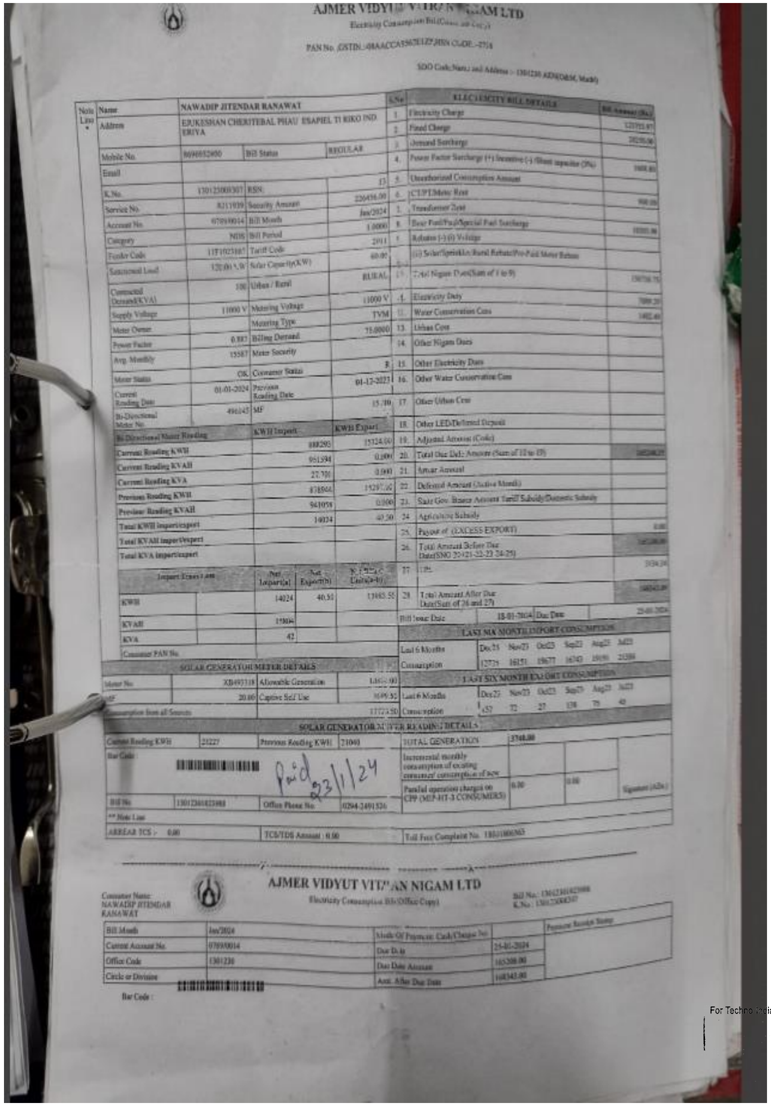
बिल नं. 13012301292365

के. 130123008307

बिल माह	Jan/2021	भुगतान का माध्यम : नगद/चैक नं.		भुगतान प्राप्ति की मोहर हेतु स्थान
वर्तमान खाता संख्या	0692/0309	नियत भुगतान तिथि	22-01-2021	
उपखण्ड का कोड	1301230	नियत भुगतान तिथि तक देय राशि	134626.00	
वृत व उपखण्ड		नियत भुगतान तिथि पश्चात देय राशि	137204.00	

For Techno India NJR Institute of Technology

(R.S. Vyas)
Director



AJMER VIDYUT VITRAN NIGAM LTD

Electricity Consumption Bill (Consumer Copy)

SDO Code, Name and Address :- 1301230 AEN(O&M, Madri)

Name	NAWADIP JITENDAR RANAWAT
Address	EJUKESHAN CHERITEBAL PHAU ESAPIEL TI RIKO IND ERIYA
Bill Status	REGULAR
K.No.	130123008307
RSN	13
Service No.	8211939
Security Amount	220456.00
Account No.	07890014
Bill Month	Jan/2024
Category	NDS
Bill Period	1.0000
Feeder Code	11F1023107
Tariff Code	2011
Sanctioned Load	120.00 KW
Solar Capacity(KW)	60.00
Contracted Demand(KVA)	100
Urban / Rural	RURAL
Supply Voltage	11000 V
Metering Voltage	11000 V
Metering Type	TVM
Power Factor	0.887
Billing Demand	75.0000
Avg. Monthly	15587
Meter Status	OK
Consumer Status	R
Current Reading Date	01-01-2024
Previous Reading Date	01-12-2023
Bi-Directional Meter No.	496145
MF	15.?/10

Bi-Directional Meter Reading	KWH Import	KWH Export
Current Reading KWH	888293	15324.00
Current Reading KVAH	951594	0.000
Current Reading KVA	27.701	0.000
Previous Reading KWH	878944	15297.00
Previous Reading KVAH	941058	0.000
Total KWH import/export	14024	40.50

Import Trans Loss	Net Import(a)	Net Export(b)	Net Billed Units(a-b)
KWH	14024	40.51	13983.55
KVAH	15004		
KVA	42		

S.No	Electricity Bill Details	Bill Amount (Rs.)
25	Payout of (EXCESS EXPORT)	0.00

Bill Issue Date: 18-01-2024; Due Date: 25-01-2024

Last Six Month Import Consumption: Dec23 12725, Nov23 16151, Oct23 19677, Sep23 16743, Aug23 19191, Jul23 21386

Last Six Month Export Consumption: Dec23 157, Nov23 72, Oct23 27, Sep23 138, Aug23 75, Jul23 45

Solar Generator Meter Details: Meter No XB493318; MF 20.00; Captive Self Use 3599.50; Consumption from all Sources 17773.50

Solar Generator Meter Reading Details: Current Reading KWH 21227; Previous Reading KWH 21040; TOTAL GENERATION 3740.00

Parallel operation charges on CPP (MIP-HT-3 CONSUMERS): 0.00 / 0.00

Office Phone No. 0294-2491526

ARREAR TCS :- 0.00; TCS/TDS Amount : 0.00

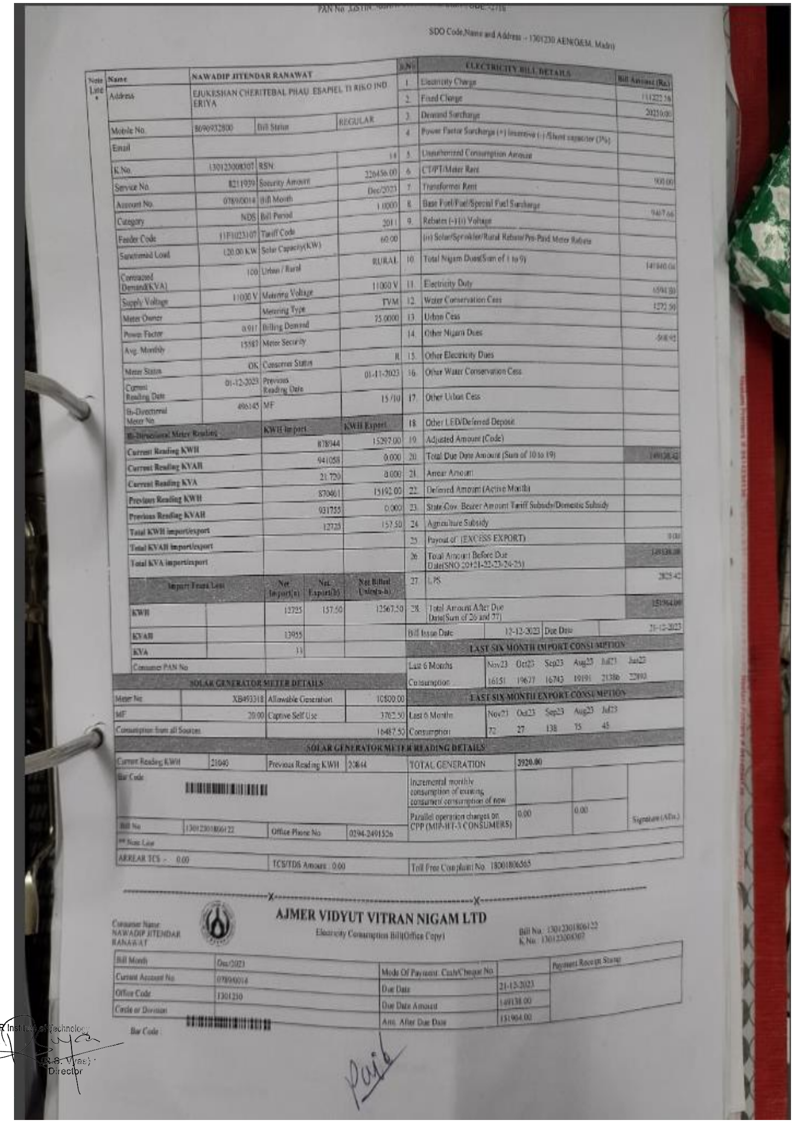
Paid 23/1/24

AJMER VIDYUT VITRAN NIGAM LTD

Electricity Consumption Bill (Office Copy)

Consumer Name: NAWADIP JITENDAR RANAWAT

Bill Month	Jan/2024
Current Account No.	07890014
Office Code	1301230
Due Date	25-01-2024
Due Date Amount	165208.00
Amt. After Due Date	168343.00



AJMER VIDYUT VITRAN NIGAM LTD

SDO Code, Name and Address :- 1301230 AEN(O&M, Madri)

Name	NAWADIP JITENDAR RANAWAT
Address	EJUKESHAN CHERITEBAL PHAU ESAPIEL TI RIKO IND ERIYA
Mobile No.	8090932800
Bill Status	REGULAR
K.No.	130123008307
RSN	14
Service No.	8211939
Security Amount	220456.00
Account No.	07890014
Bill Month	Dec/2023
Category	NDS
Bill Period	1.0000
Feeder Code	11F1023107
Tariff Code	2011
Sanctioned Load	120.00 KW
Solar Capacity(KW)	60.00
Contracted Demand(KVA)	100
Urban / Rural	RURAL
Supply Voltage	11000 V
Metering Voltage	11000 V
Metering Type	TVM
Power Factor	0.911
Billing Demand	75.0000
Avg. Monthly	15587
Meter Status	OK
Consumer Status	R
Current Reading Date	01-12-2023
Previous Reading Date	01-11-2023
Bi-Directional Meter No.	496145
MF	15/10

Bi-Directional Meter Reading	KWH Import	KWH Export
Current Reading KWH	878944	15297.00
Current Reading KVAH	941058	0.000
Current Reading KVA	21.720	0.000
Previous Reading KWH	870401	15192.00
Previous Reading KVAH	931755	0.000
Total KWH import/export	12725	157.50
Total KVAH import/export		
Total KVA import/export		

Import Trans Loss	Net Import(a)	Net Export(b)	Net Billed Units(a-b)
KWH	12725	157.50	12567.50
KVAH	13955		
KVA	11		

S.No	Electricity Bill Details	Bill Amount (Rs.)
1	Electricity Charge	
2	Fixed Charge	111222.56
3	Demand Surcharge	20250.00
4	Power Factor Surcharge (+) Incentive (-) /Shunt capacitor (3%)	
5	Unauthorized Consumption Amount	
6	CT/PT/Meter Rent	
7	Transformer Rent	900.00
8	Base Fuel/Fuel/Special Fuel Surcharge	9467.66
9	Rebates (-) (i) Voltage	
	(ii) Solar/Sprinkler/Rural Rebate/Pre-Paid Meter Rebate	
10	Total Nigam Dues(Sum of 1 to 9)	141840.06
11	Electricity Duty	6594.80
12	Water Conservation Cess	1272.50
13	Urban Cess	
14	Other Nigam Dues	-568.95
15	Other Electricity Dues	
16	Other Water Conservation Cess	
17	Other Urban Cess	
18	Other LED/Deferred Deposit	
19	Adjusted Amount (Code)	
20	Total Due Date Amount (Sum of 10 to 19)	149138.42
21	Arrear Amount	
22	Deferred Amount (Active Month)	
23	State Gov. Bearer Amount Tariff Subsidy/Domestic Subsidy	
24	Agriculture Subsidy	
25	Payout of (EXCESS EXPORT)	0.00
26	Total Amount Before Due Date(SNO 20+21-22-23-24-25)	149138.00
27	LPS	2825.42
28	Total Amount After Due Date(Sum of 26 and 27)	151964.00

Bill Issue Date: 12-12-2023; Due Date: 21-12-2023

LAST SIX MONTH IMPORT CONSUMPTION	Nov23	Oct23	Sep23	Aug23	Jul23	Jun23
Consumption	16151	19677	16743	19191	21386	22893

LAST SIX MONTH EXPORT CONSUMPTION	Nov23	Oct23	Sep23	Aug23	Jul23
Consumption	72	27	138	75	45

Solar Generator Meter Details: Meter No XB493318; Allowable Generation 10800.00; MF 20.00; Captive Self Use 3762.50; Consumption from all Sources 16487.50

Solar Generator Meter Reading Details: Current Reading KWH 21040; Previous Reading KWH 20844; TOTAL GENERATION 3920.00

Incremental monthly consumption of existing consumer/ consumption of new

Parallel operation charges on CPP (MIP-HT-3 CONSUMERS): 0.00 / 0.00

Bill No 130123018061?2; Office Phone No 0294-2491526

ARREAR TCS :- 0.00; TCS/TDS Amount : 0.00; Toll Free Complaint No. 18001806565

AJMER VIDYUT VITRAN NIGAM LTD

Electricity Consumption Bill (Office Copy)

Consumer Name: NAWADIP JITENDAR RANAWAT

Bill No. 130123018061?2; K.No. 130123008307

Bill Month	Dec/2023	Mode Of Payment: Cash/Cheque No.	
Current Account No.	07890014	Due Date	21-12-2023
Office Code	1301230	Due Date Amount	149138.00
Circle or Division		Amt. After Due Date	151964.00

Paid

For Techno India NJR Institute of Technology

(R.S. Vyas)

Director

August Month Net meter calculation

Bill 01 details:

01 Bill Import: 469948 kWh

01 Bill Export: 9656 kWh

01 Bill Net: 460291 kWh

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02

Bill 01 details:

Bill Import: 454716 kWh

02 Bill Export: 9577 kWh

02 Bill Net: 445139 kWh

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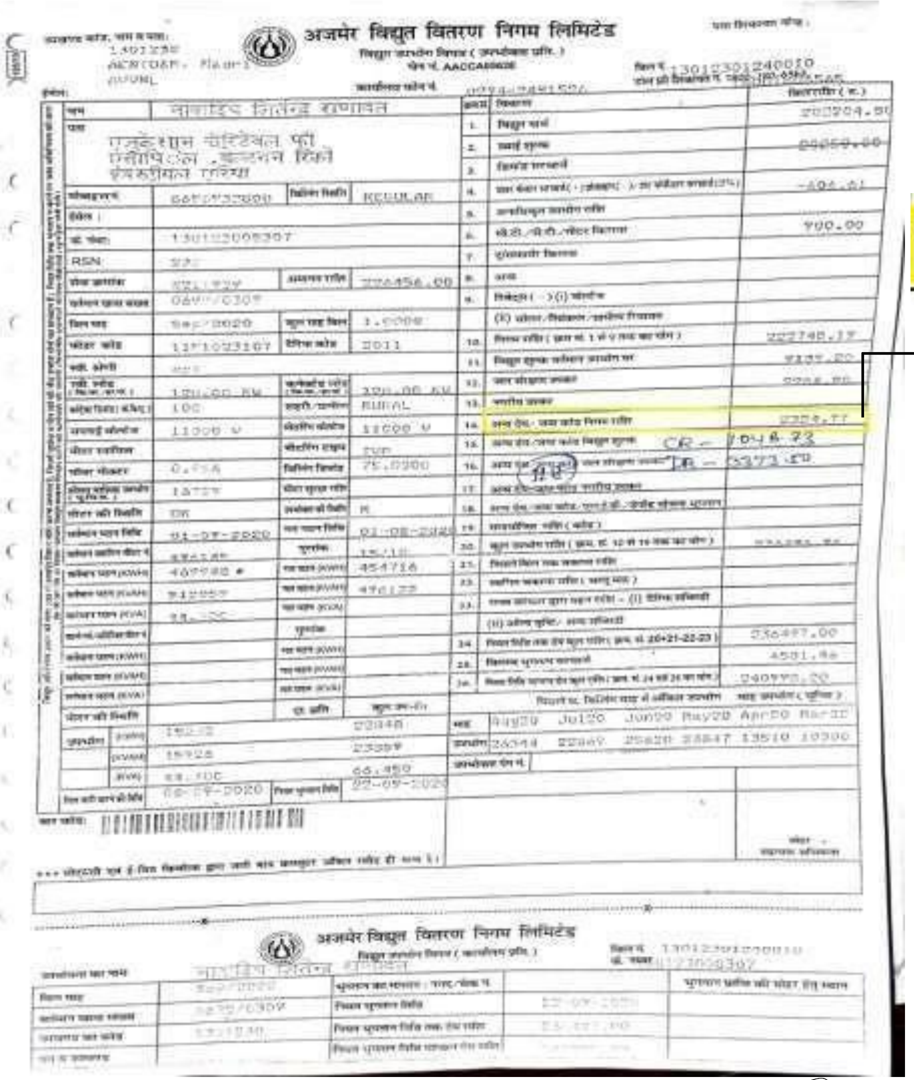
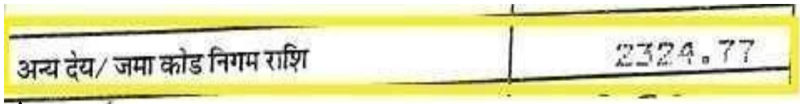


अजमेर विद्युत वितरण निगम लिमिटेड

अन्य देय/ जमा कोड निगम राशि	2324.77

अजमेर विद्युत वितरण निगम लिमिटेड



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

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(R.S. Vyas)
Director

Net metering calculation:

01 Bill Export: 9656 kWh

02 Bill Export: 9577 kWh

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 monthBill: 3373.5 Rs.**
6. **Fuel Surcharge (Debit Rate) - Cost of Exported Units (Credit Rate) =3373.5 – 1048.73 = 2324.77 Rs.**

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(R.S. Vyas)
Director

1. Energy Audit

Collection of experimental data:

All required data is collected by the Department of Electrical Engineering. In the building, in every room, how many fans, tube lights, bulbs, computers, instruments AC, etc. will be measured. According to the survey following data is collected.

Table: Total Load During Jun 2023 to Jul 2024

Department/Office	Fan	LED Tube light	A.C.	Fridge	Computer	Printer	Scanner	Xerox Machine	Projector	LED TV
Director Office	2	6	2	0	1	1	0	0	0	0
Principle Office	4	9	2	0	0	1	0	0	0	0
Chemistry Lab	11	16	0	0	0	0	0	0	0	0
Physics Lab	3	6	0	0	1	0	0	0	0	0
Chairperson Room	1	2	1	0	0	0	0	0	0	0
Account Dept	4	2	1	0	3	1	1	3	0	0
Exam Dept	4	5	0	0	2	1	1	1	0	0
Staff Room	18	30	5	0	25	18	5	0	0	0
Library	8	16	0	0	3	1	1	1	0	0
Classrooms	102	216	0	0	7	0	0	0	8	0
Pantry	1	3	0	1	0	0	0	0	0	0
Seminar Hall	8	16	5	0	1	0	0	0	1	0
Wash room	0	18	0	0	0	0	0	0	0	0
Passage	0	60	0	0	0	0	0	0	0	0
Dept Labs	158	256	20	0	424	0	0	0	8	2
I3 Lab	11	21	4	1	11	3	1	0	1	2
Mechanical Workshop	20	30	0	0	1	0	0	0	0	0
Hostel	30	40	0	0	3	0	0	0	0	0
Canteen	15	16	0	3	0	0	0	0	0	0
Main Entrance	6	16	0	0	0	0	0	0	0	0
Gym	12	15	0	0	0	0	0	0	0	1
Visiting Room	1	2	0	0	0	0	0	0	0	1
Parking Area	6	12	0	0	1	0	0	0	0	1
Total Quantity	**425**	**813**	**40**	**5**	**483**	**26**	**9**	**5**	**18**	**7**
Avg. Wattage rating of single appliance(W)	**60 W**	**25 W**	**1.5 / 2.0 Ton**	**1100 W**	**180 W**	**100 W**	**100 W**	**300 W**	**220 W**	**90 W**
Average number on at a time	**204**	**510**	**20**	**4**	**220**	**20**	**6**	**4**	**14**	**5**
Total Wattage on at a time (W)	**12240**	**12750**	**34500**	**4400**	**39600**	**2000**	**600**	**1200**	**3080**	**450**
Total maximum Power Requirement of all appliances =							**110820**	**Watts**		

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2. **Bore-well motor details**: 3- phase Induction motor of 5 HP, consumes approx. 8 units per day so monthly around 240 units.

3. Power Consumption of Electricity Board

Table: Power Consumption During June 2023 to July 2024

Sr. No.	Month	Consumption Units (kWh)
1	Jun	22893
2	Jul	21386
3	Aug	19191
4	Sep	16743
5	Oct	19677
6	Nov	16151
7	Dec	22725
8	Jan	14024
9	Feb	11460
10	Mar	10451
11	Apr	11778
12	May	20193
13	Jun	22751
Total Power Consumption in Yearly		**229423**
Average Power Consumption in Monthly		**17648**

4. Average power consumption of one years is 17648 kWh (Units) is collected after deducting the Solar generation which approximately generation capacity in between 3000 to 4000 Units per month.

For Techno India NJR Institute of Technology

(R.S. Vyas)

Director

5. Graphically Representation of Electricity Distribution:

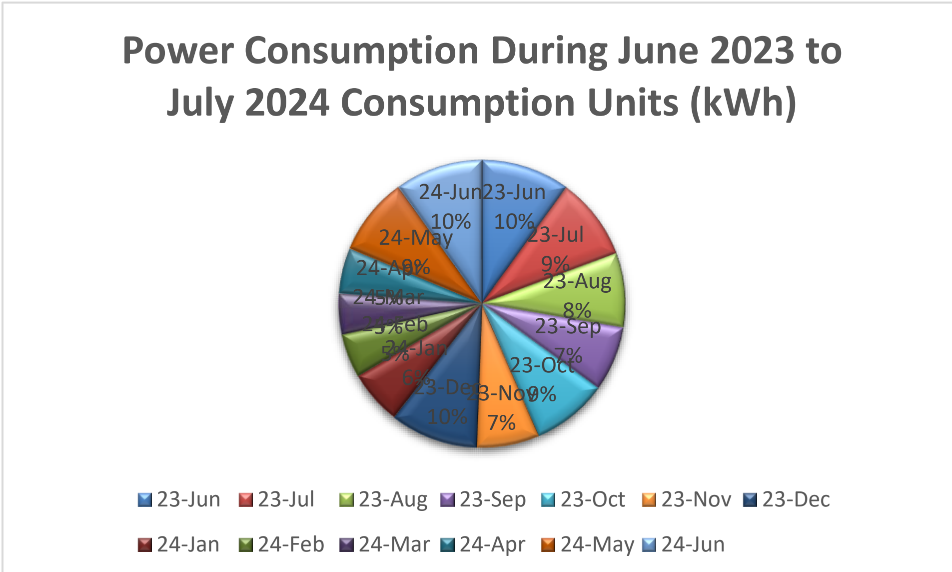

Fig: Electricity distribution from June 2023 to July 2024

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(R.S. Vyas)
Director

6. Total requirement of electricity, generation of electricity using renewable energy sources (Jun 2023-Jul 2024):

Renewable Max Unit generation	Renewable energy source	Renewable energy generated and used
200 kWh/day	50 kW Solar on the grid	3000 to 4000 kWh/Month

7. Renewable energy generation details:

50 kW capacity Solar on the grid power plant. Total per day generation is around 200 Units (kWh)

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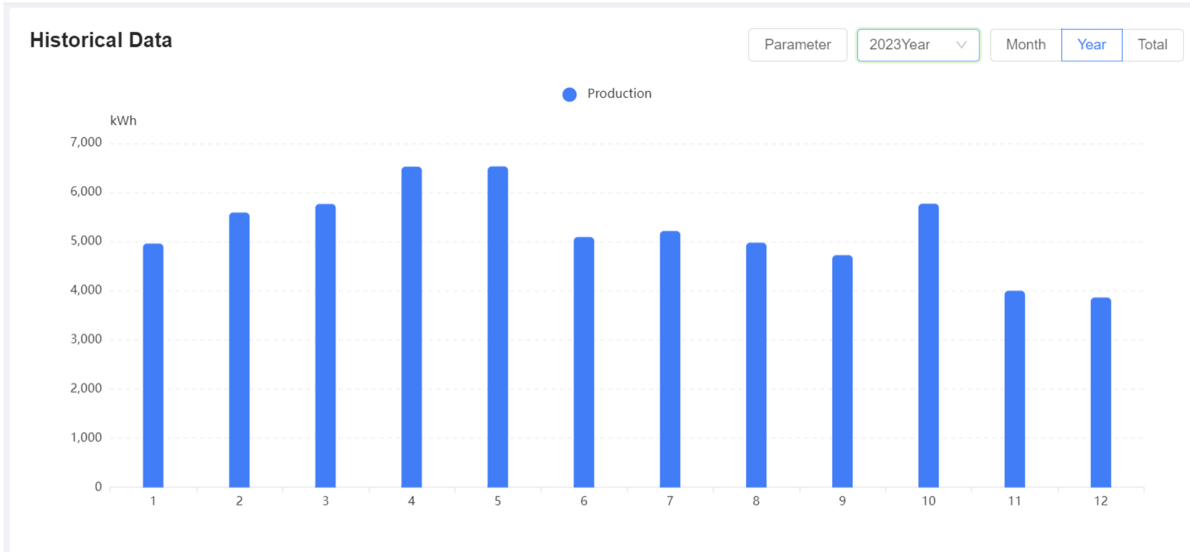

Fig: Jan 2023 to Dec 2023 month per day Solar generation graph

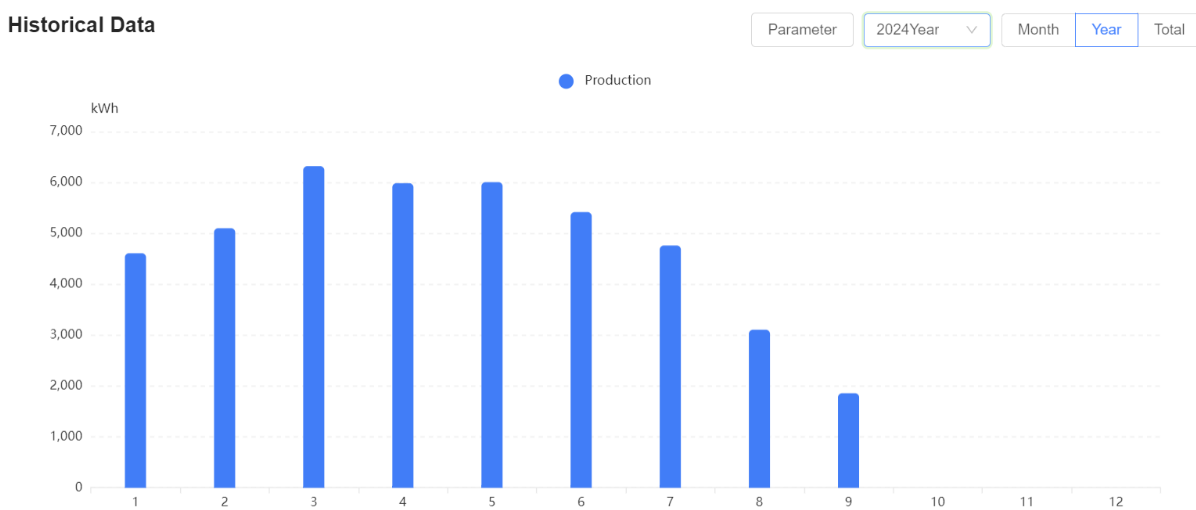

Fig: Jan 2024 to Sep 2024 month per day Solar generation graph

For Techno India NJR Institute of Technology

(R.S. Vyas)
Director

Basic Info

Plant Name: Techno NJR

create date: 2020-11-08

create user: Techno NJR

Time Zone: (UTC+05:30) Chennai,Kolkata,Mumbai,New Delhi

Administrative Area: India Rajasthan Udaipur Udaipur

Address: Plot-SPL-T, Bhamashah (RIICO) Industrial Area, Kaladwas Udaipur 313003 (Rajasthan) I...

Coordinate: Longitude 73°45'6.79" Latitude 24°31' 3.17"

System Info

Plant Type: Residential Rooftop

System Type: All on Grid

Operating Date: 2020-11-08

Azimuth: 180°

Installed Capacity: 50kWp

Angle of tilt: 26°

Yield Info

Currency: INR

Unit Price: 8.85INR/kWh

Total Cost: 375.00K INR

Fig: Solar Power Plant Profile

8. Conclusion:

In conclusion, data generated in energy audits are useful for understanding the energy distribution and utilization of college. The college needs a maximum of 15731 kWh (Units) per month. On-grid Solar plant generates a maximum of 200 units per day so monthly generation is around 4000 to 6000 kWh (Units).

9. Recommendation:

- Use separate sub energy meter/connection for different locations like hostel, canteen, Mechanical workshop and offices.
- Replace all non-LED Tube lights with LED lights and bulbs, to save more power.
- Replace CRT monitor using LED or LCD monitor.

10. Result and Discussion:

As far as the energy audit, electricity audit is the main concern regarding the educational institutions. We have collected data by considering the tube light, fan, computer, printer, A.C. and instruments. The total requires full load power is 217.855 kW. The energy consumption of two years by all devices is **32844 kWh** per month and On-grid solar renewable sources generate around 3000 to 4000 Units/Month.