

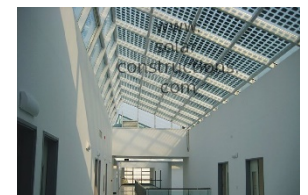


“e-Learning Workshop: Solar Policy Interpretation & Implementation Processes” 2020

Solar PV Rooftop Technology Overview

Presented by: Shatrughan Yadav
(AHASolar Pvt Ltd)

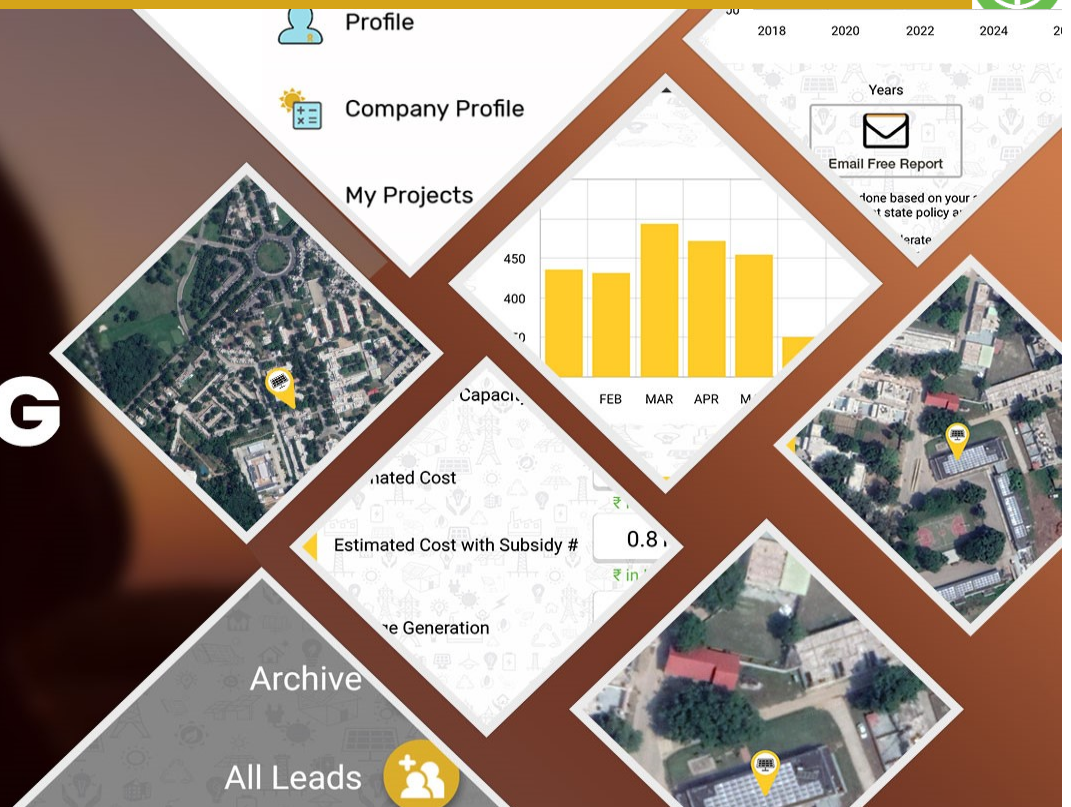
22nd April 2020, Ahmedabad (India)





AHA!
Solar Helper

DIGITALIZING Solar



- ▶ Tools for site assessment
- ▶ Undertaking a site assessment
- ▶ Typical site survey format for rooftop PV project

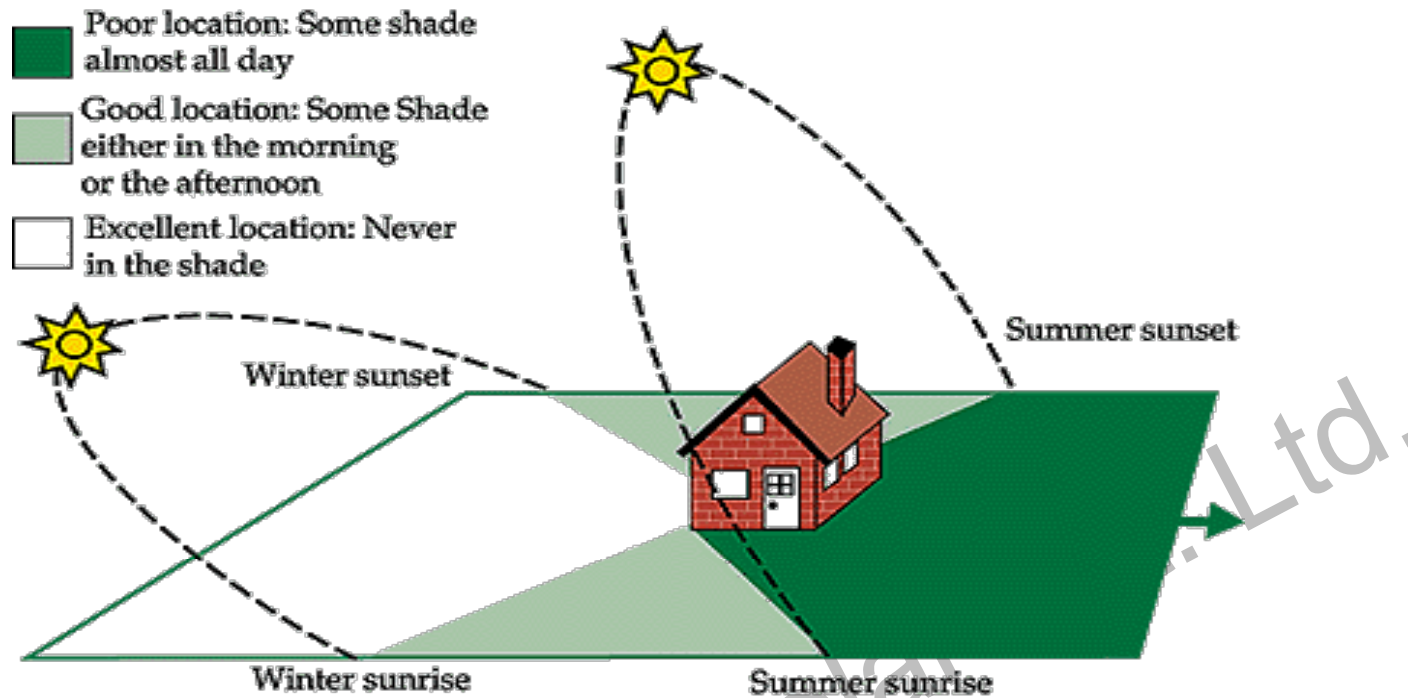
- ▶ Tools for site assessment
- ▶ Undertaking a site assessment
- ▶ Typical site survey format for rooftop PV project

Tools For Site Assessment



- ▶ Assessment of OHS
- ▶ Assessment of location for installation of PV plant
- ▶ Shadow analysis of site
- ▶ Determine PV array orientation and tilt
- ▶ Assess how the PV modules will be mounted
- ▶ Identify suitable location for inverters and other electrical equipment
- ▶ Determine cabling routes and cable run distances
- ▶ Study of site parameters that likely to affect the design considerations

- ▶ Safe access to the roof
- ▶ Exposure to the sun
- ▶ Falling from the roof
- ▶ Injuries from lifting and installing heavy inverters
- ▶ Injuries from falling objects from roof
- ▶ Cut, bump and burns from sharp and hot metallic items/ tools
- ▶ Insects biting – some insect may be poisonous

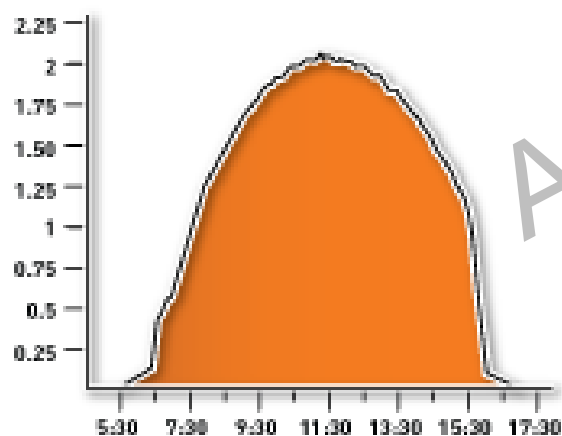
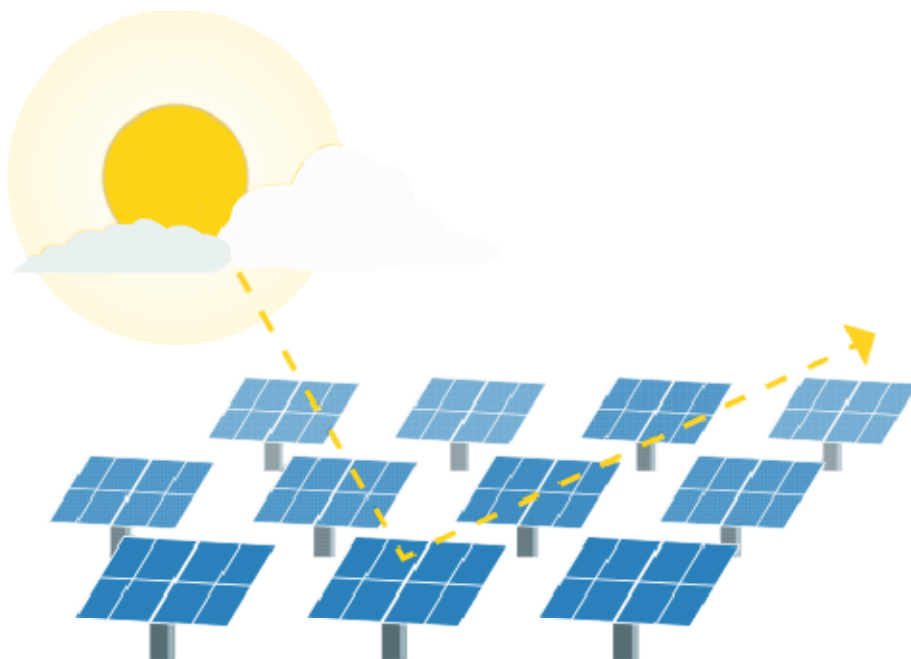


- ▶ Free from shadow in all days of the year – Use solar path finder
- ▶ Access for array maintenance
- ▶ Provide ample space for air cooling
- ▶ Prevails aesthetic of the building or premises
- ▶ Not far from the charge controller/ inverter/ battery bank
- ▶ Protect array from theft and vandalism

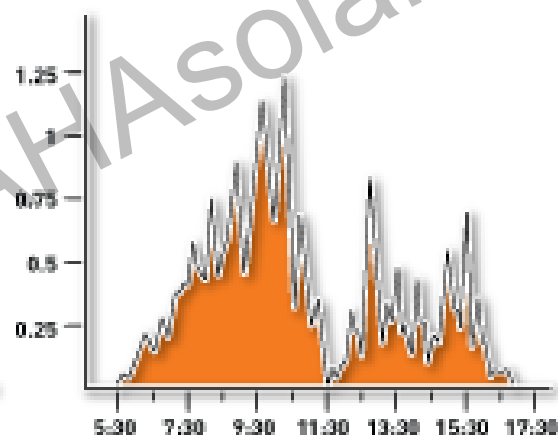
- ▶ Objects which come in the path of the incident solar rays, any time during the day, will cast shadows and would reduce the solar generation
- ▶ Even on south facing roof, a taller object in the eastern side would cast shadows during morning and a taller object on the western side would similarly cast shadows during the afternoon.
- ▶ Shading can not only lead to lower generation but can also over a period of time damage the panels.
- ▶ Roofs inclined towards south, would receive the sun rays all through the day. However roofs inclined towards east and west will have a lesser window while roofs facing north will receive the least sunlight.

Partial Shading Due to Improper Cleaning

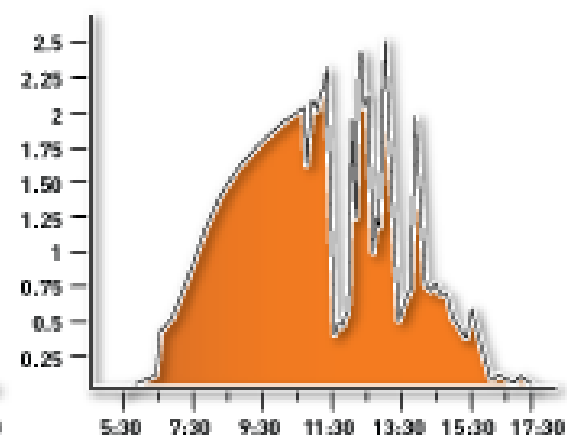




CLEAR SUNNY DAY



CLOUDY OVERCAST DAY

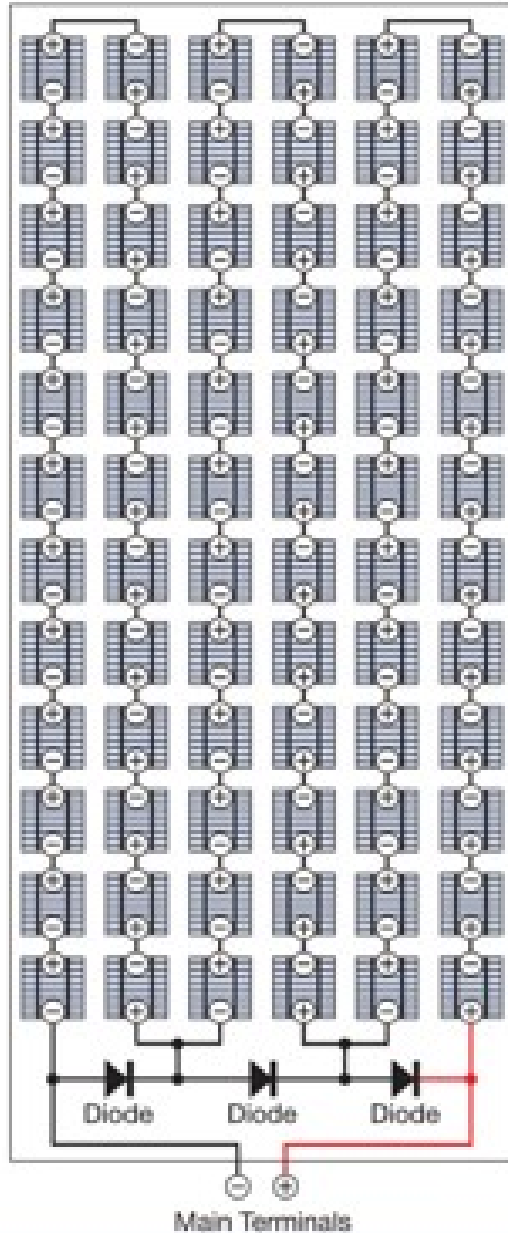


**CLOUD COVER CAME IN
AROUND MID MORNING**

- ▶ Effect of shading depends upon following factors
 - ▶ Number of shaded modules
 - ▶ Cell and bypass diode interconnection
 - ▶ Degree of shading
 - ▶ Spatial distribution and the course of shading over time
 - ▶ Interconnection of module
 - ▶ Type of inverter
 - ▶ Type of module technology

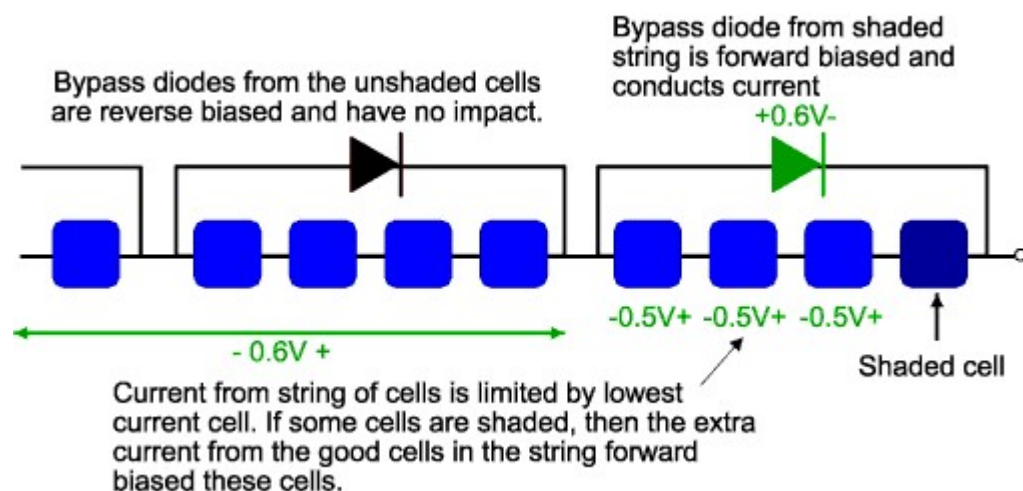
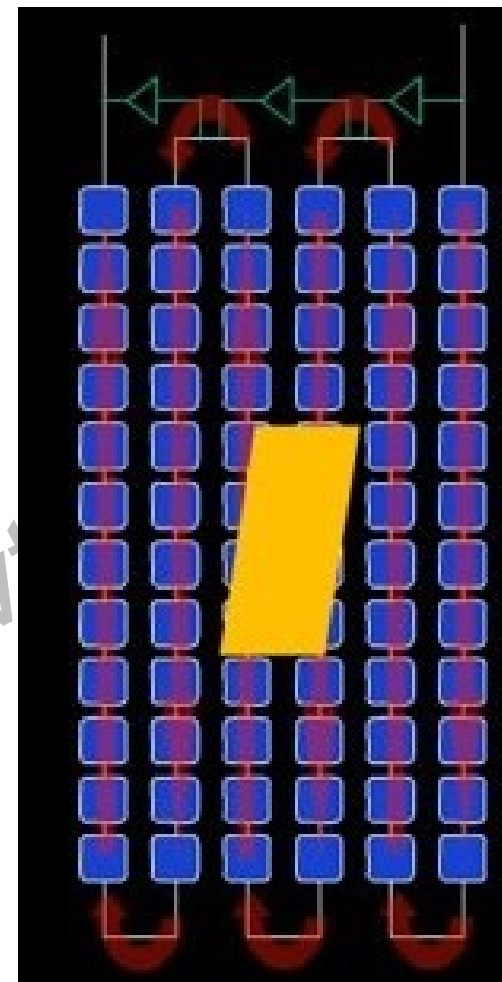
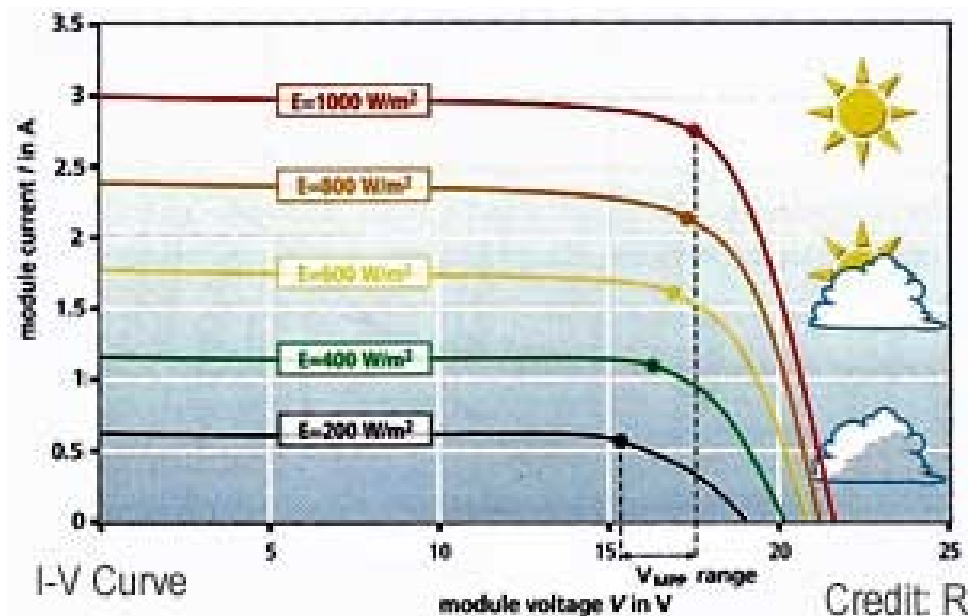
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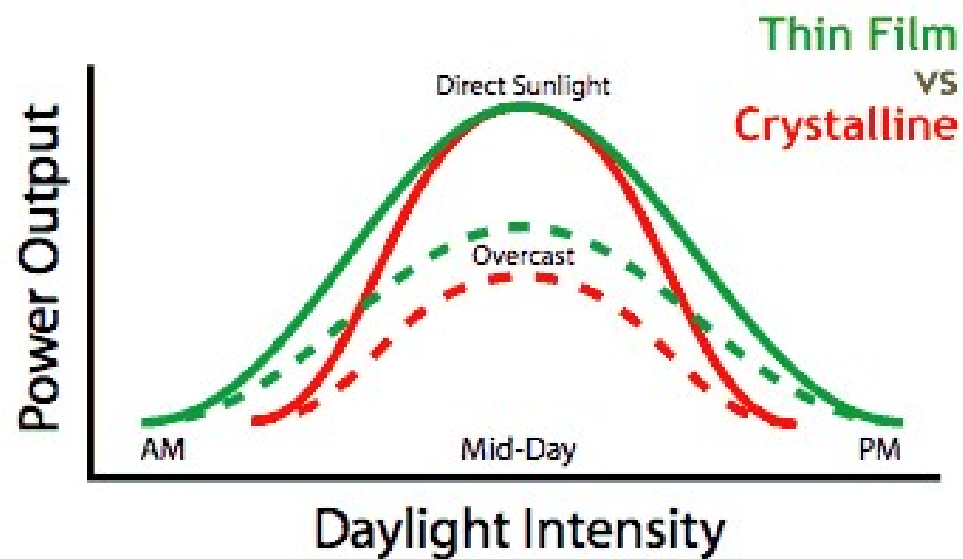
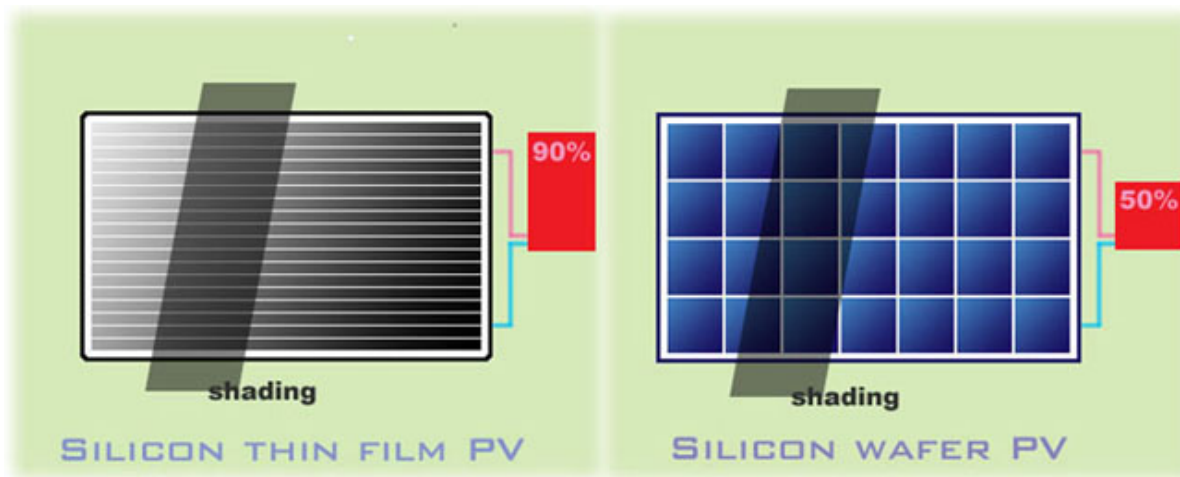
Factor Affecting Loss of Power due to Shading



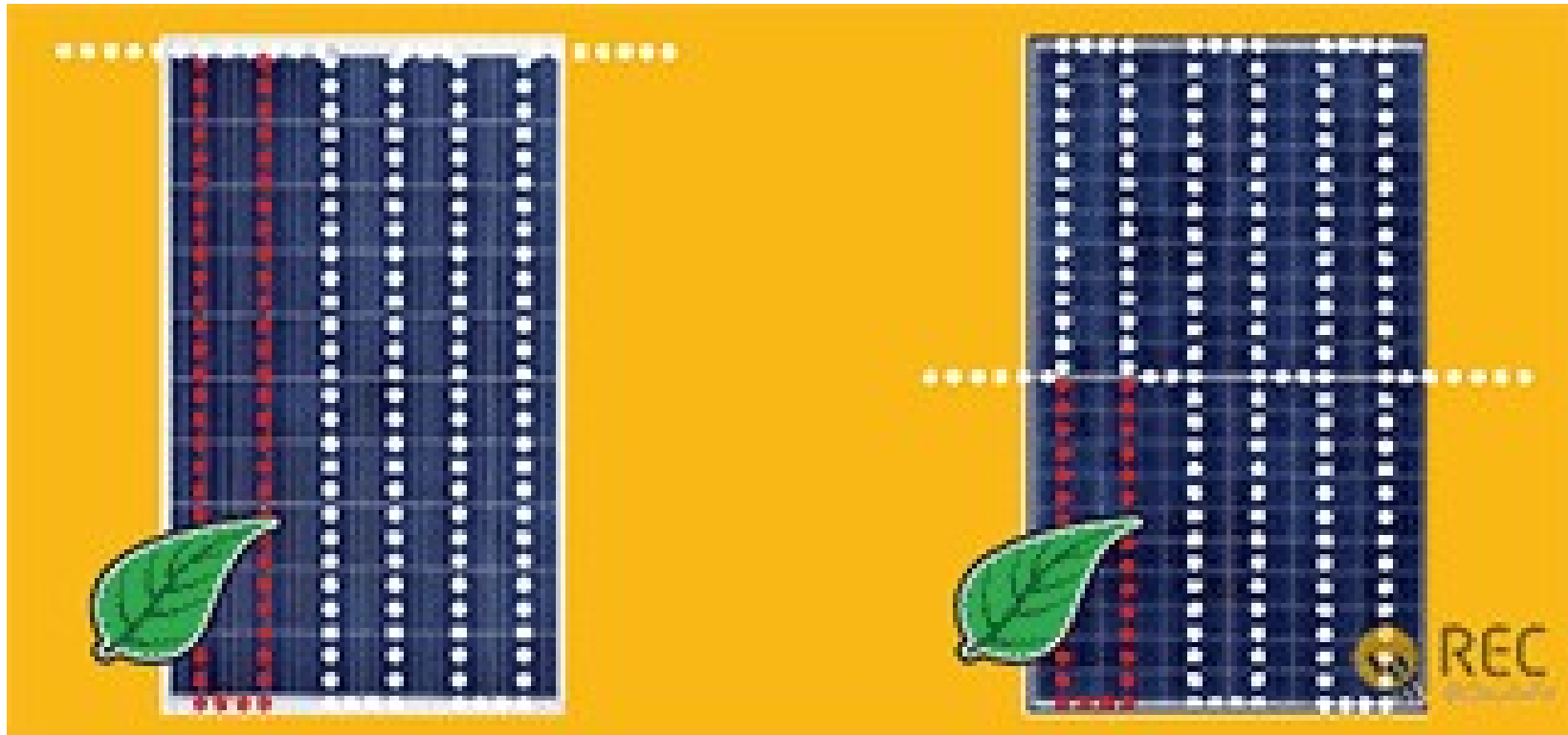
- **No cells shaded:** Current passes through all cells. No current passes through bypass diodes.
- **One cell shaded:** Current bypasses the 24-cell series string and passes through the bypass diode in parallel with that string.
- **One row of cells shaded:** Current bypasses three 24-cell series strings and passes through three bypass diodes.
- **One column of cells shaded:** Current bypasses the 24-cell series string and passes through the bypass diode in parallel with that string.
- **Entire module shaded:** Current bypasses all cells and passes through three bypass diodes.

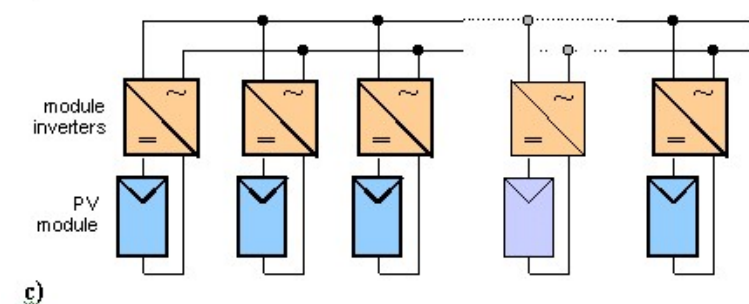
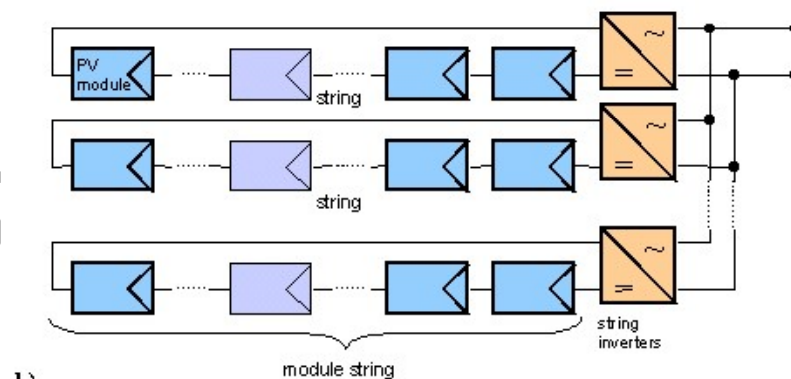
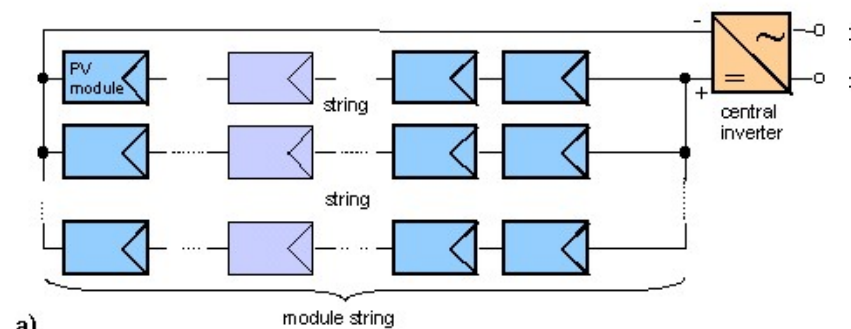
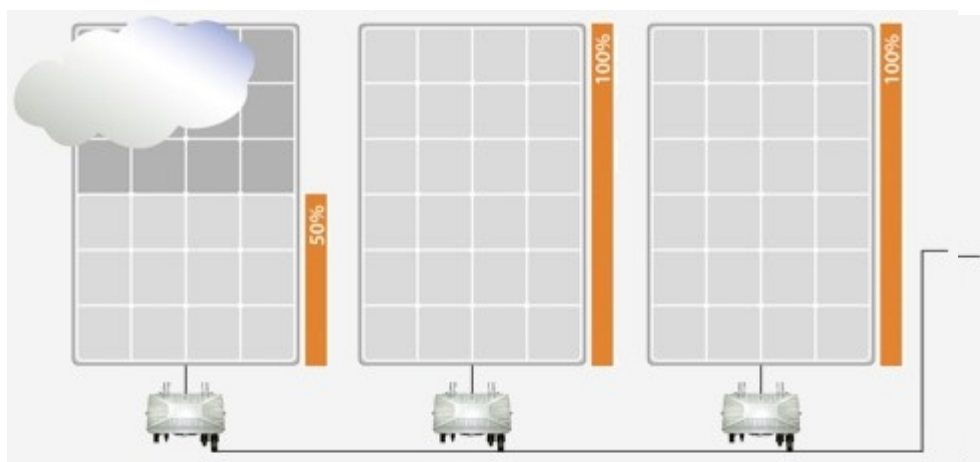
Electrical Behaviour of SPV Modules Under Shadow



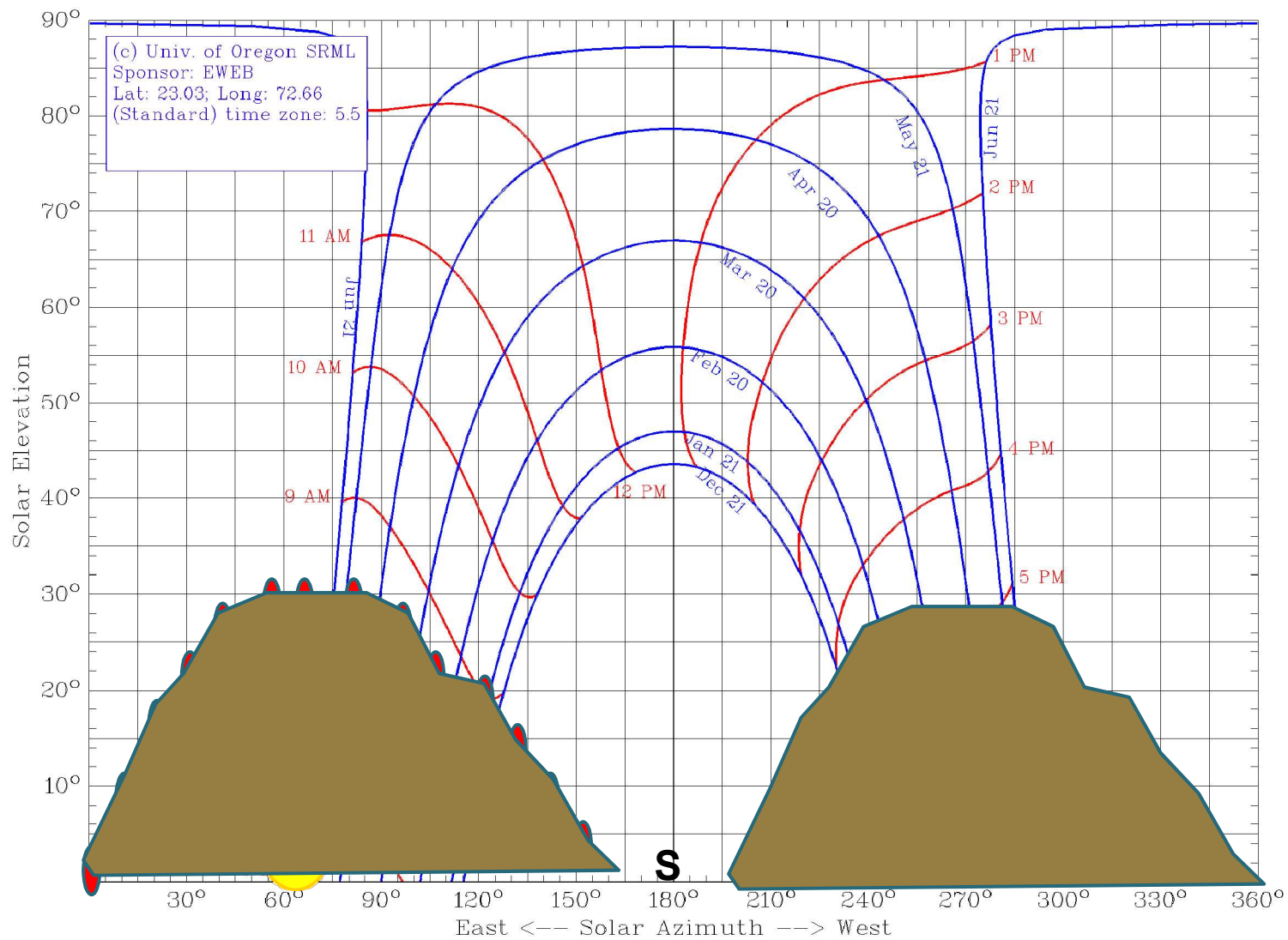


Solar PV Module Technology- Half cut cells

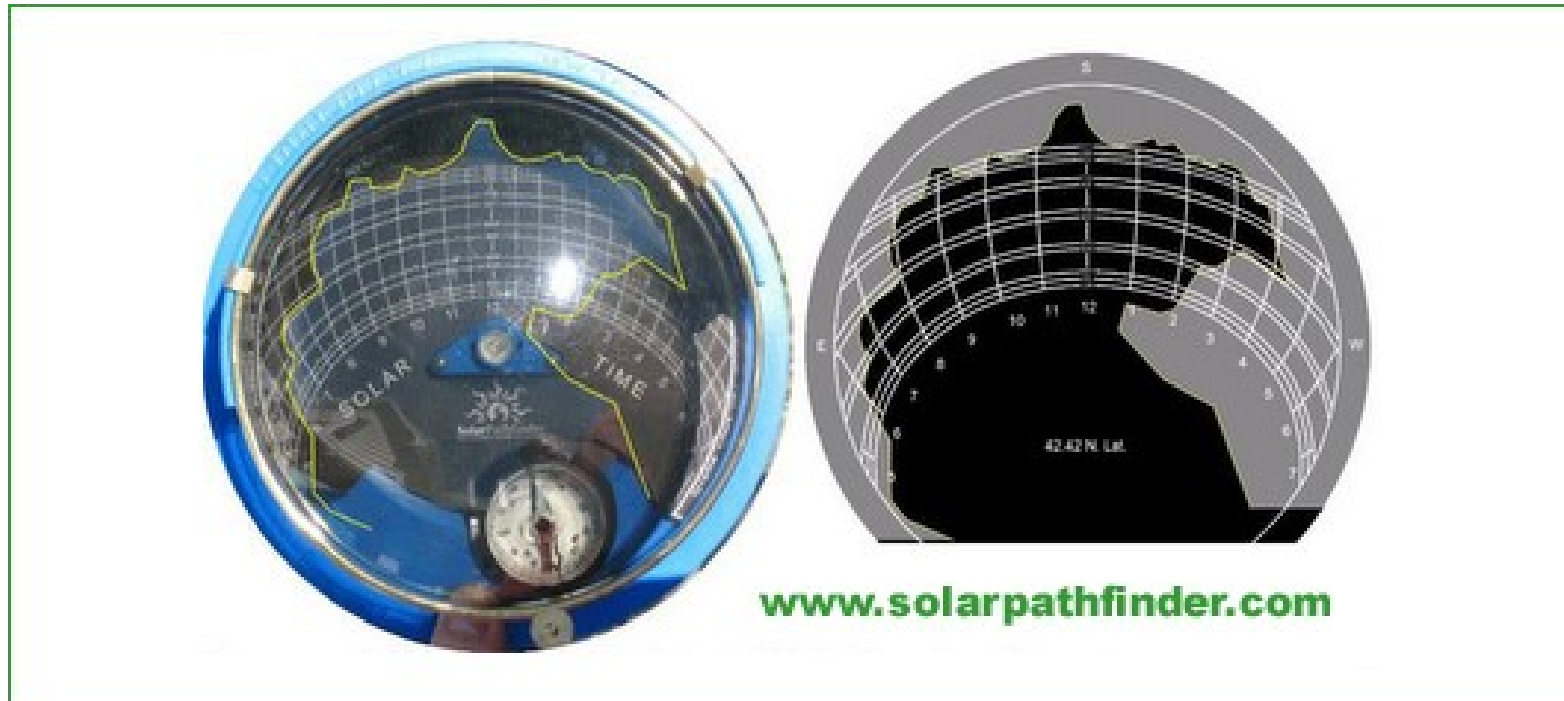




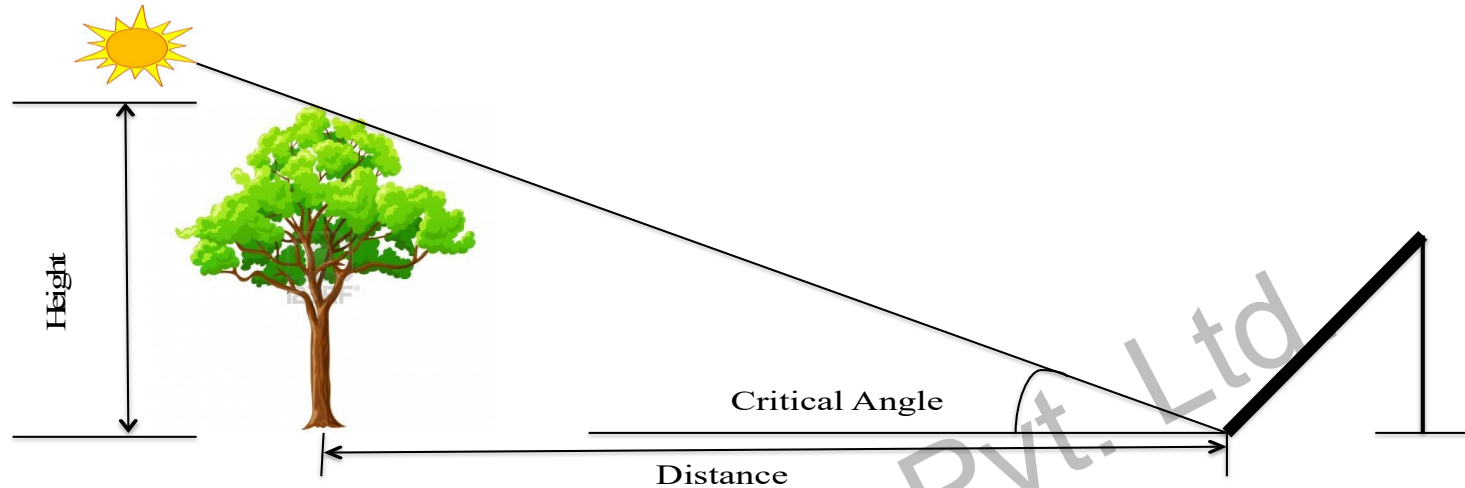
Calculate Loss of Solar Energy for Shaded Period



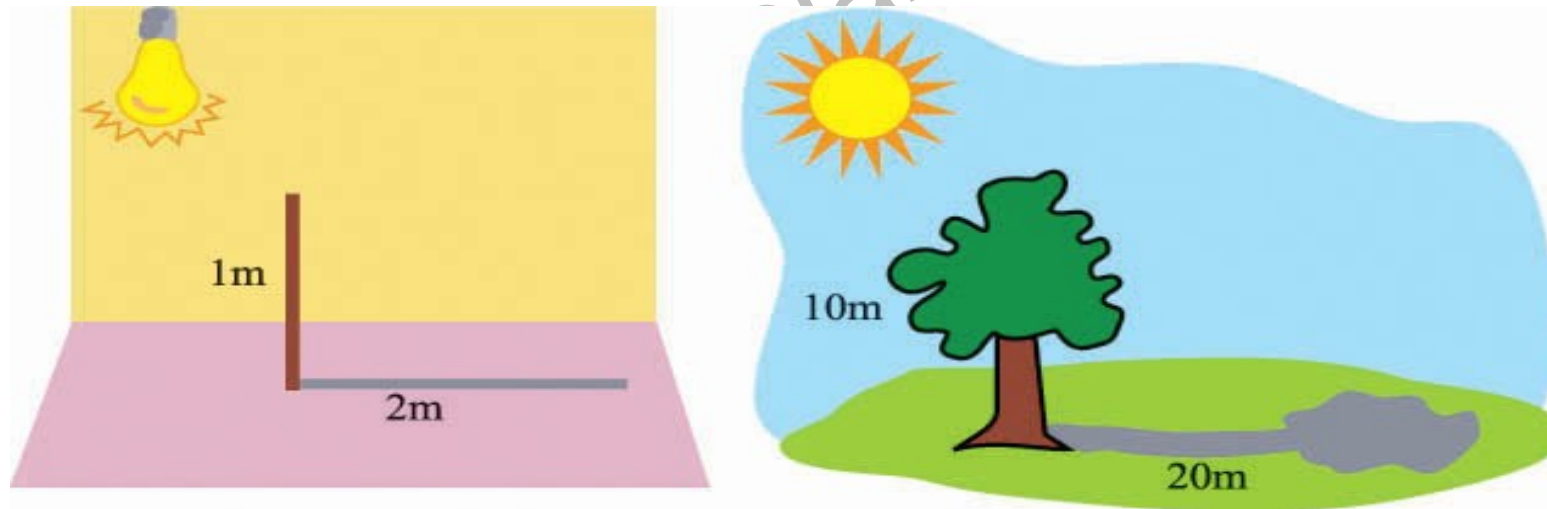
► Shadow analysis - using of sun pathfinder



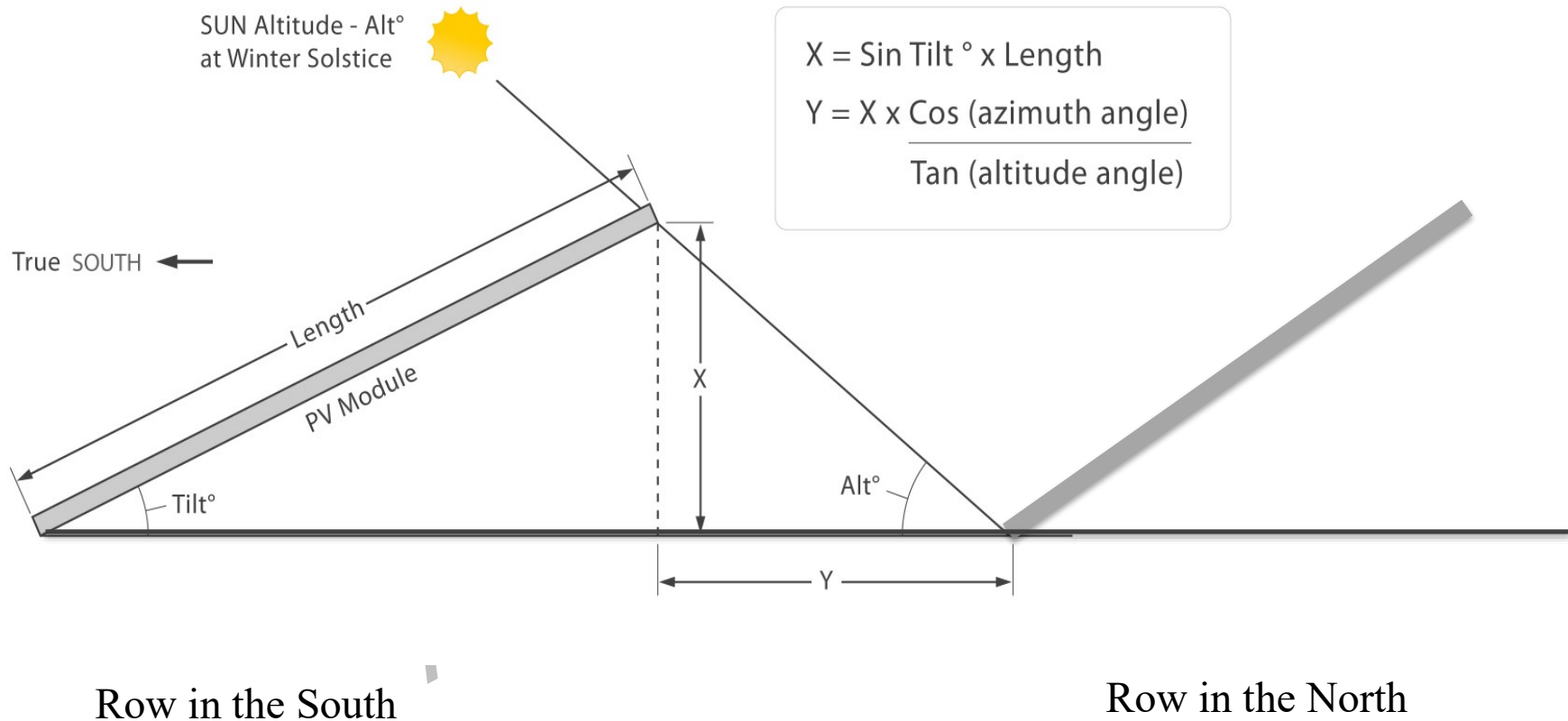
► Shadow analysis - using sun position (azimuth and altitude angle)



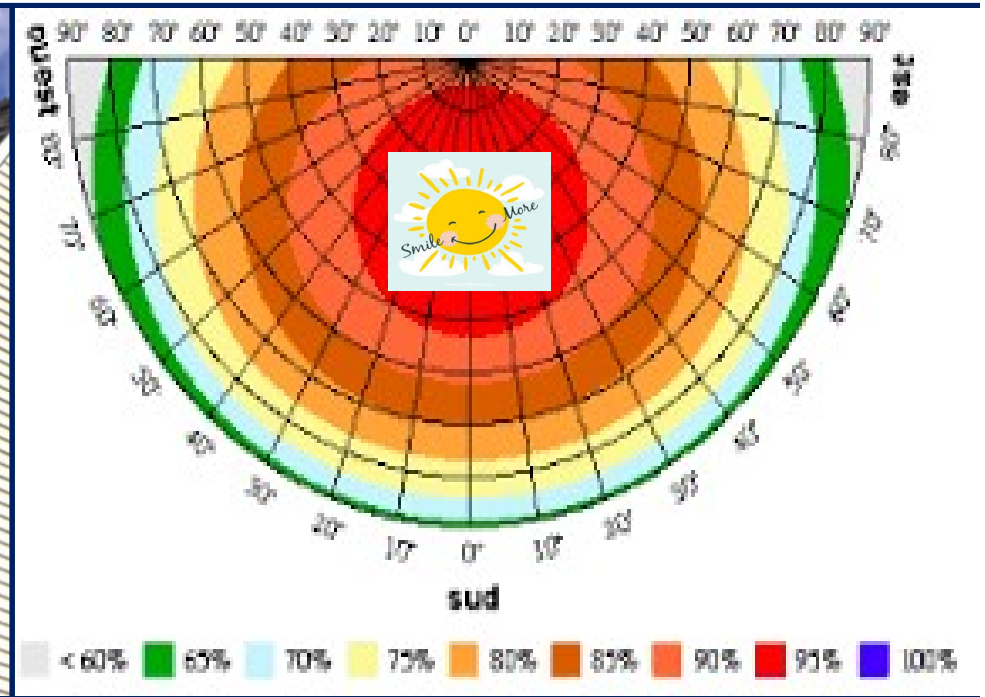
► Shadow analysis –Thumb Rule



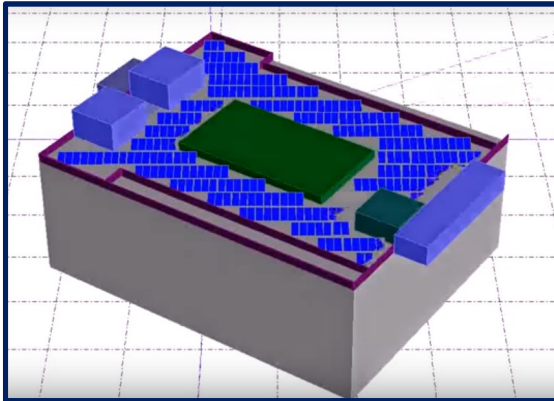
Site assessment – Space between two rows



Site assesment – Array orientation and tilt



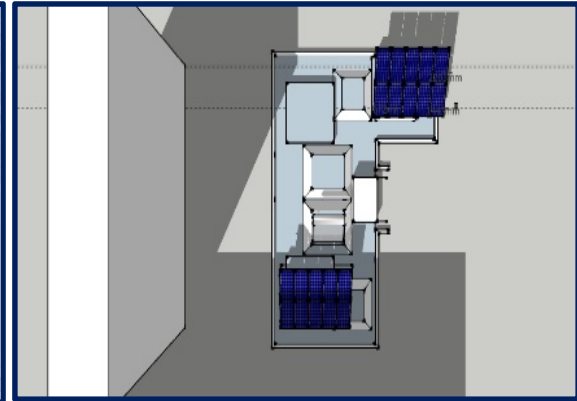
► Shadow analysis – using Software



PV Syst



Autodesk Ecotect



Sketchup



Helioscope



Sun Analyzer

- ▶ Location of inverter should be such a way that access is controlled
- ▶ Minimize distance from the Solar PV array to reduce losses
- ▶ Protection from environment as needed by the inverter class
- ▶ Sufficient ventilation for cooling
- ▶ The location of overcurrent protection devices and/or load breaking disconnecting means should be at the end of the cable that is electrically most remote from the PV modules.

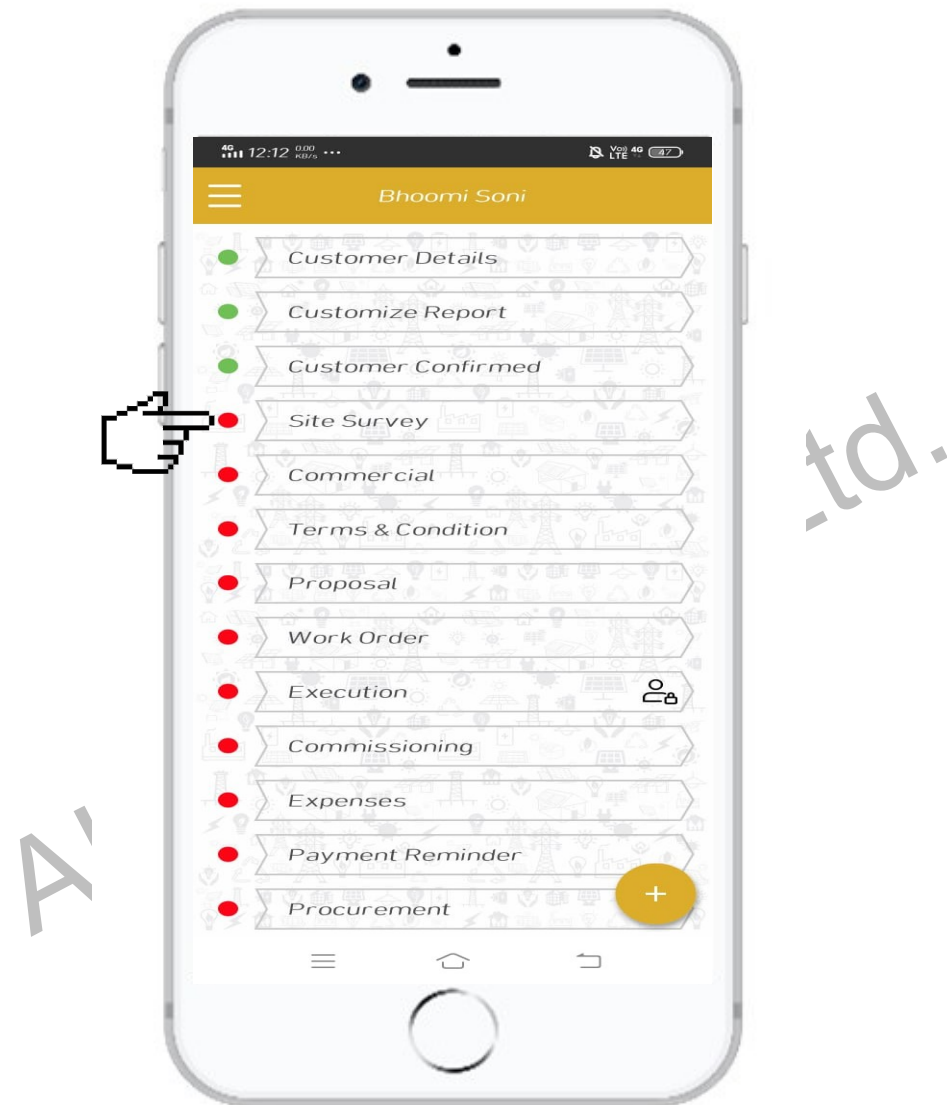
- ▶ PV array mounting arrangement would depend on the type of roof



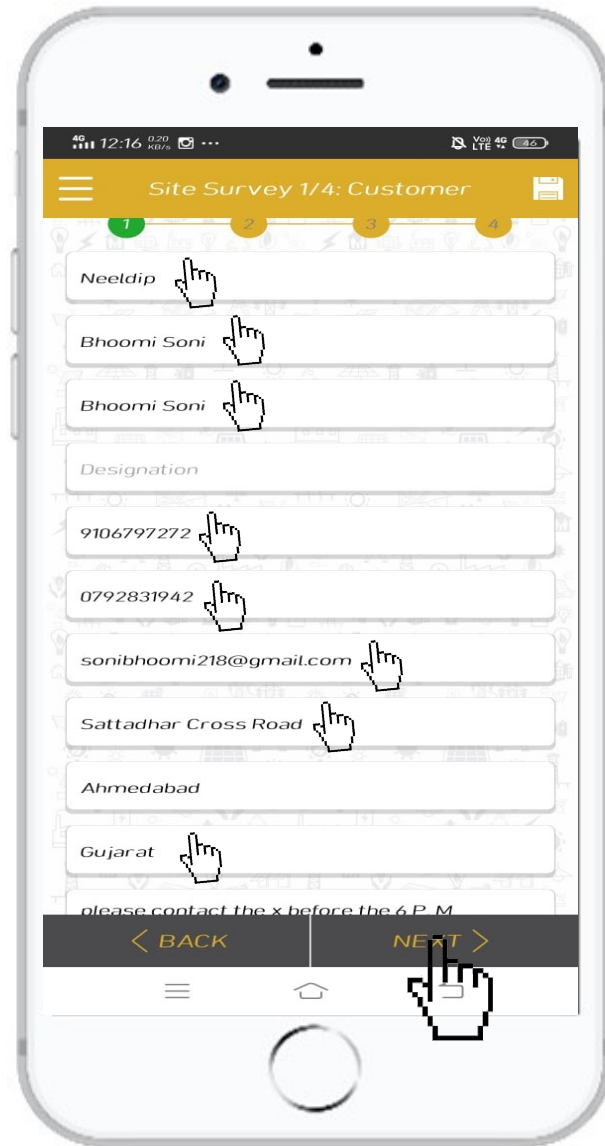
- ▶ Load bearing capacity of roof depends of the age of roof
- ▶ Typically RCC Roof has a life of 100 years, Asbestos roof have much lower life at 30 years, Depending on the grade, corrugated metal has life span between 20 and 100 years.
- ▶ Usually the load of the structure including PV and the supporting structure varies from 30 Kg/m² to 60 Kg/m²
- ▶ As per MNRE technical specification the total load of the structure should be less than 60 kg/m².
- ▶ For large system a suitable walk-way will be required for maintenance purpose

- ▶ Operating Temperature affects performance. Therefore arrays should be installed such way that there sufficient air flow/ventilation for cooling
- ▶ High wind pressure can damage the structure and modules. Therefore mounting structure should be opted such a way that there is minimum wind pressure
- ▶ High Humidity and salty atmosphere can corrode the structure and the extreme levels in the site should be known.
- ▶ Lightning strikes can damage the electrical equipment and some times the modules. So lightning vulnerability in the site should be known

Site assessment – Site Survey



Site assessment – Site Survey



The image shows a mobile app interface for a site survey. The screen displays a form titled "Site Survey 1/4: Customer" with a progress bar at the top showing steps 1, 2, 3, and 4. The form contains several input fields with pre-filled text and a "NEXT" button at the bottom right. Hand icons indicate the sequence of data entry.

Site Survey 1/4: Customer

1 2 3 4

Neeldip

Bhoomi Soni

Bhoomi Soni

Designation

9106797272

0792831942

sonibhoomi218@gmail.com

Sattadhar Cross Road

Ahmedabad

Gujarat

please contact the x before the 6 P. M

< BACK NEXT >

c. Ltd.

Site assessment – Site Survey



Site Survey 2/4: Roof

1 2 3 4

Flat RCC

Yes, roof is strong enough to support PV module & MMS

Approx Roof Area Overall*

Shadow-free*

Site Accessibility

1. Road to site NO YES

2. Ladder to roof NO YES

Age of Building

Is there any major shadow - casting object on the roof?

Height of Parapet

< BACK NEXT >

Site Survey 2/4: Roof

shadow - casting object on the roof? tree

Height of Parapet

How many floors below the Terrace?

Distance of DC cable

Place for Inverter

Place for Battery

Place for AC Distribution Box

Place for Metering Point

Take Photographs ?

extra 3 M

< BACK NEXT >

solar

Site assessment – Site Survey



4G 12:28 0.00 KB/s LTE 4G 45

Site Survey 3/4: Electrical Interfacing

1 2 3 4

Voltage Level Phase ☒ 3ph, 1Ph.

R-Phase A RN V

Measured Frequency Hz

Critical Load kW

Diesel Genset NO ☐ YES ☐

Inverter NO ☐ YES ☐

Is MCB Required on Load side NO ☐ YES ☒

Is MCB Required on Solar Met... NO ☐ YES ☒

Take Photographs ? ☐

Approximate percentage of power consumed between 10AM to 5PM: %

Working days per week Days

Notes

< BACK NEXT >

. Ltd.

Site assessment – Site Survey



4G 12:33 0.00 KB/s VoLTE 4G 45

Site Survey 4/4: Bill & Tariff

1 2 3 4

PGBC

1234567910

3-, 4-wire, CT-operated

Meter Accuracy Class

Residential

Electrical Load Details

Sanction/Contract Load

☒ kW ☐ kVA 8

Monthly

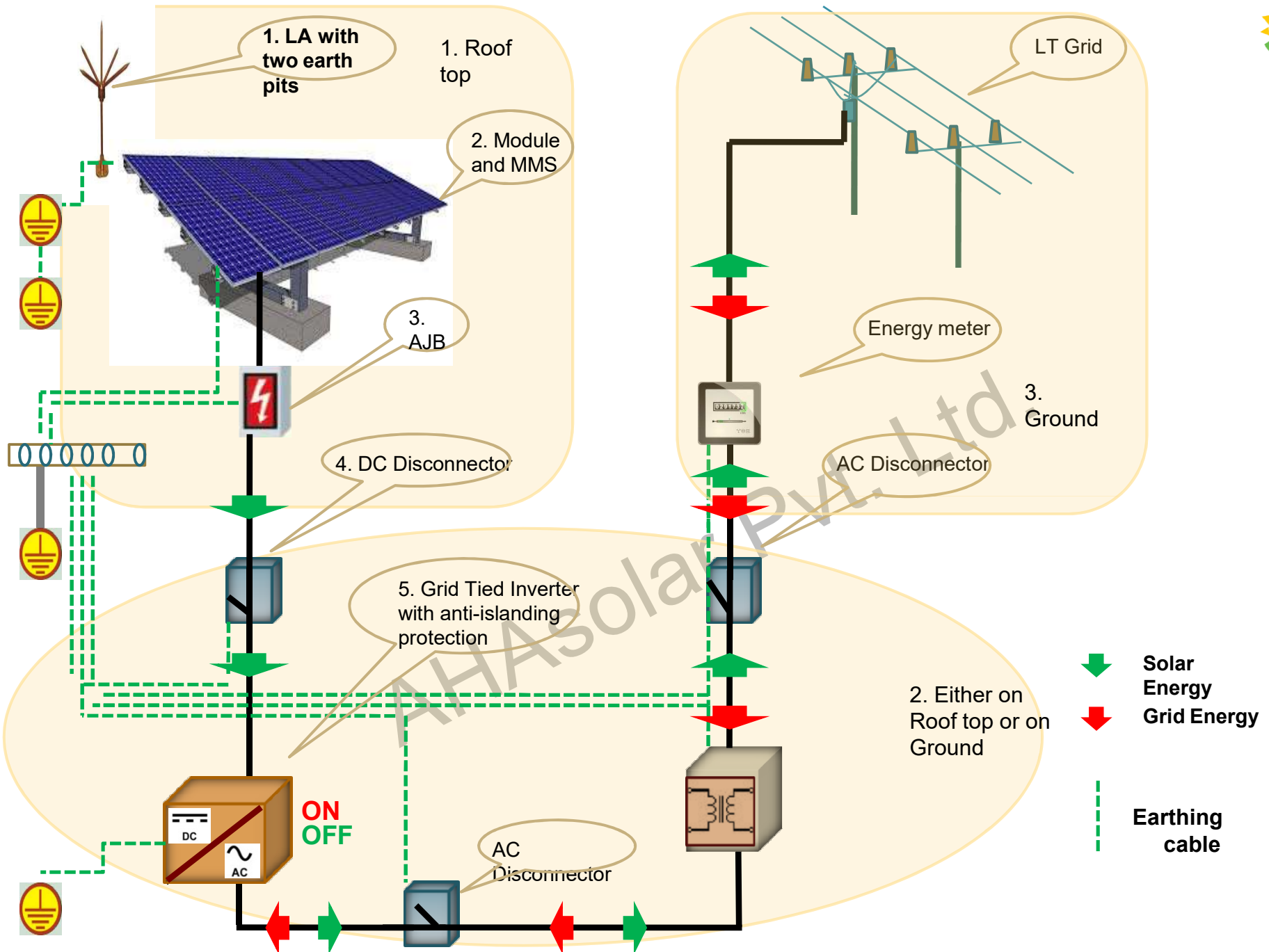
Enter Monthly Electricity Bill +

Month	Year	Con(kWh)	Bill (INR)
January	2019	1200	8300
February	2019	1000	7000
March	2019	1200	8400
April	2019	1400	9800
May	2019	1500	10500
June	2019	1000	7000
July	2019	1000	7000
August	2019	1200	8400
September	2019	1500	10500
October	2019	1400	9800
November	2019	1200	8400
December	2019	1000	7000

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Thank You

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