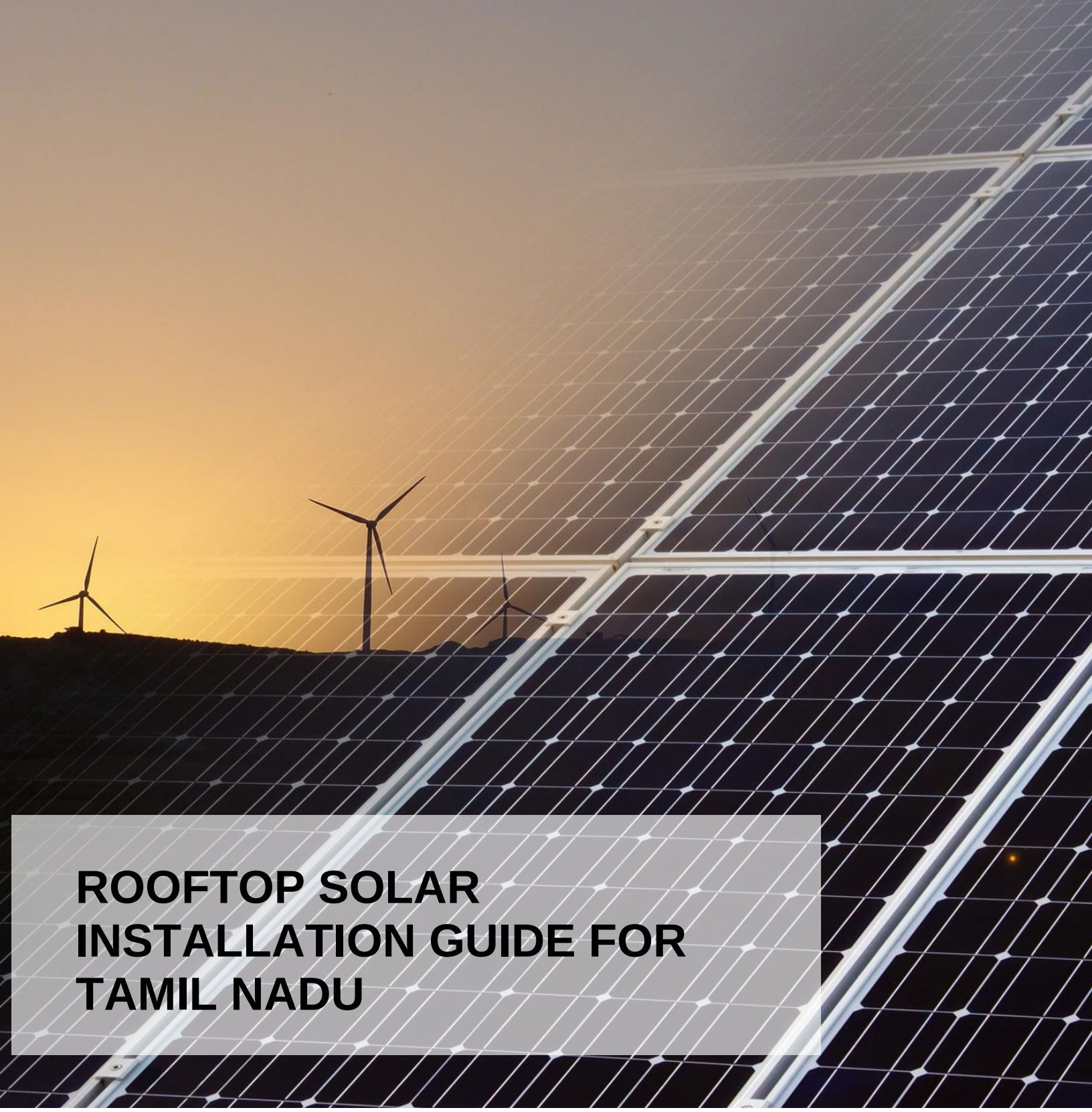

ROOFTOP SOLAR INSTALLATION GUIDE FOR TAMIL NADU

A simple practical guide for installing a grid-connected rooftop solar PV system at your premises.

ROOFTOP SOLAR INSTALLATION GUIDE FOR TAMIL NADU

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About CAG

Citizen consumer and civic Action Group (CAG) is a 35-year-old Chennai-based non-profit, non-political and professional organisation that works towards protecting citizens' rights in consumer and environmental issues and promoting good governance processes including transparency, accountability and participatory decision-making.

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Government of India plans to install 175 GW[1] of renewable energy by the end of 2022. This includes 100 GW from solar power, 60 GW from wind power, 10 GW from biomass power and 5 GW from small hydropower. Out of 100 GW solar, 40% has to come from consumer categories such as rooftop solar and small scale solar energy systems. Government of Tamil Nadu, on its part, introduced the second Solar Policy[2] in February 2019. The Policy promotes solar net feed-in tariff mechanism where the utility pays consumers for the electricity exported to the grid after self-consumption. TNERC has fixed the tariff Rs. 2.08 per unit for the exported power. However, the process of installation of grid-connected rooftop solar plants in consumers' residences/premises solar requires understanding the various policies, regulations and administrative procedures which may not be easily understandable.

This guideline walks the consumer through a step by step process of a successful rooftop solar installation.

Contents

[1] http://pib.nic.in/newsite/PrintRelease.aspx?relid=180728
[2] http://teda.in/wp-content/uploads/2019/02/SOLARPOLICY2019.pdf

1. Enquire with rooftop solar installers

Approach installers to enquire about the details of setting up a rooftop solar - such as capacity, generation etc.
Before purchasing solar system/components, consumers should ensure the quality and standards are compliant with standards as prescribed by the Ministry of New and Renewable Energy (MNRE).

Note: Tamil Nadu Energy Development Agency (TEDA[3]) has provided a list of solar installers[4] enlisted with them. But TEDA does not give assurance for the quality and price of enlisted suppliers/manufacturers/system integrators.

2. Site visit by solar installers

A site visit by the solar installers will entail understanding and calculating the required capacity and available shade free rooftop area for installing the rooftop solar plant. These calculations can also be done by a consumer. Additional requirements to be met for the rooftop solar can also be evaluated during the site visits. A site visit will help the installers understand:

- Geographical location of the premises will help the installers to understand the positioning of the solar panel and requirement of mounting structures;
- Mounting structures: It is important for the installers to inspect the condition of the roof to ensure that it is structurally sound and to design the supporting structures for the solar panels.
- Placement of the inverter: It is important to allocate a place for installing DC and AC distribution box as well as the inverter. It is always advisable to place the DC distribution box on the mounting structures to minimise the resistive loss through wires. The inverter should be placed in such a way that it should connect the DC wires and also the main supply from the utility.

[3] http://teda.in/
[4] http://teda.in/pdf/manufacturer_list_new_2013.pdf

- Wiring configuration: If a consumer is having a three-phase connection, he should ensure that the load must be distributed equally. This can be done with the help of an installer.
- Additional requirements: It may include electrical wiring, civil works for slanting roof or structurally weak roof and storage space for materials.

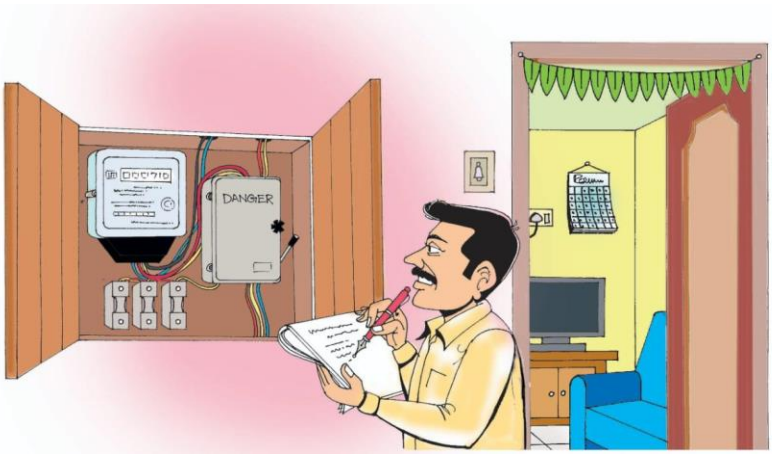


Image on placement of meter for easy assessment

3. Required capacity to be installed

a) Available shade-free rooftop area:

As per guidelines[5] issued by TEDA, the area required for installing 1 kW solar is about 12 square meters or 130 square feet approximately. The rooftop area should be free from obstacles such as tall buildings, trees, etc to allow maximum sunlight to fall on the solar panel. It should be installed minimum 2 feet away from the parapet wall to ensure there is sufficient space for persons to clean and service panels.

[5] http://www.teda.in/pdf/Specification_Grid_Tie_SPV_plant.pdf

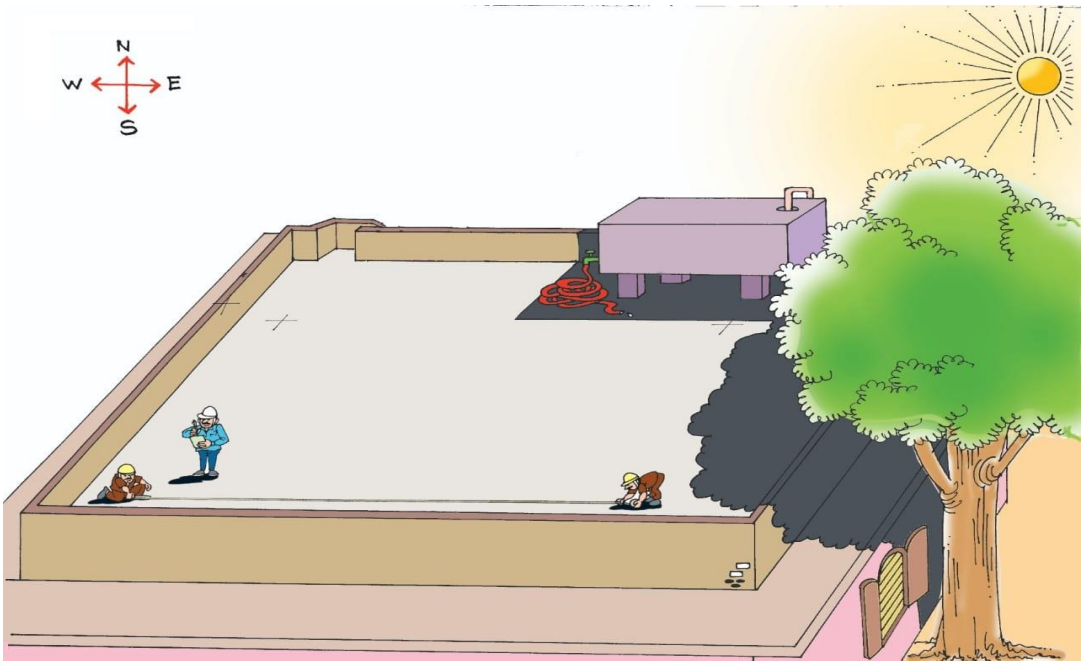


Image on area measurement

b) Electricity consumption:

The capacity of the solar plant can be determined by the electricity consumed on the premises for one year with the help of information available through the physical copies of electricity bills or white meter card or through the online consumer portal of TANGEDCO.

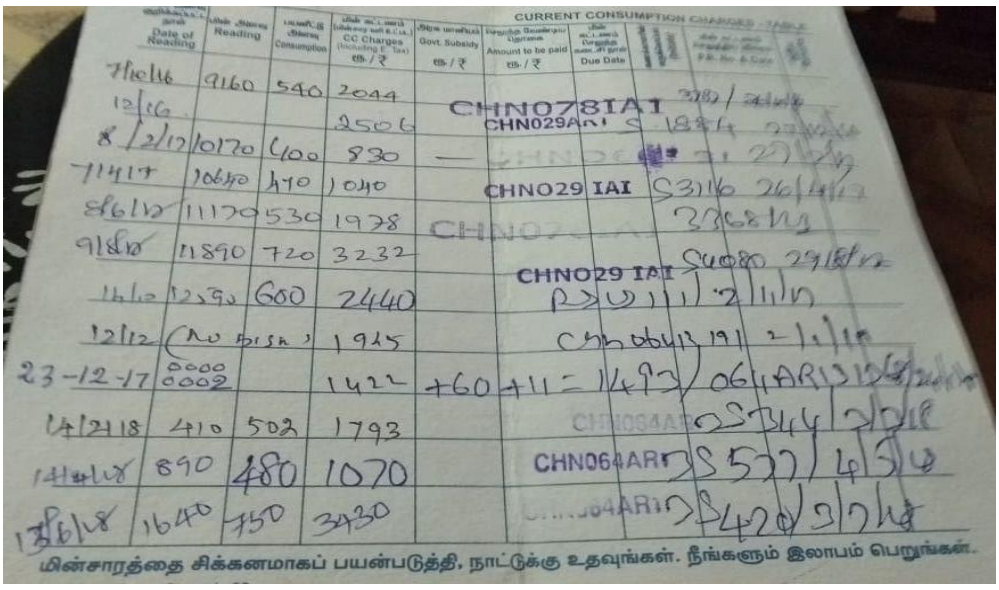


Image of a consumer white meter card

It is also necessary to verify the sanctioned load of the premises. According to the order released by TNERC on rooftop solar generation plant[6], a consumer is eligible to install upto 100 % of his or her sanctioned load given by the utility. If the required rooftop solar capacity exceeds the sanctioned load, the consumer must inform the service provider to increase the sanctioned load of the premise. A consumer can view their electricity bill in online[7] also.

Assessment Date	Assessment Entry Date	KWH Reading	KVAH reading	Maximum Demand	Power Factor	Consumed Unit
17/04/2019	17/04/2019	17440		7.21		650
16/02/2019	16/02/2019	16790		7.21		550
18/12/2018	18/12/2018	16240		7.21		590
17/10/2018	17/10/2018	15650		7.21		610
17/08/2018	18/08/2018	15040		7.21		580
18/06/2018	18/06/2018	14460		7.21		610

Image of consumer consumption details on online

How to calculate required capacity: The required capacity of the solar plant is finalised based on the annual electricity consumption in the premises and the available shade-free rooftop area. In Tamil Nadu, a solar panel of 1 kW capacity will generate an average of 1,500 units in a year. As mentioned earlier, the shade free rooftop space required for installing 1 kW solar panel is 130 sq feet.

Example 1 - Let us consider the image mentioned above as an example and assume that they had a shade free rooftop area of 200 sq ft. It shows that the consumer has consumed from 18/06/2018 to 17/04/2019 a total of 3,590 units.

The capacity of the plant based on annual energy consumption:

a) Annual energy consumption at the premises is 3,590 units.
b) Capacity of the solar plant (3,590 units / 1,500 units) = **2.39 kW**
c) Available Shade free rooftop area = 200 sq ft
d) Capacity of solar plant can be installed on the rooftop = 200/130 = **1.53 kW**

Even the consumer premise is in need of 2.39 kW, their rooftop space can support only 1.53 kW. So the required capacity of the premises is 1.53 kW.

[6] http://www.tnerc.gov.in/orders/Tariff%20Order%202009/2019/Solar-25-03-2019.pdf
[7] http://tneb.tnebnet.org/newlt/menu3solar1.html

Example 2 - Let us consider the same image mentioned above as an example and assume that they had a shade free rooftop area of 450 sq ft. It shows that the consumer has consumed from 18/06/2018 to 17/04/2019 a total of 3,590 units.

The capacity of the plant based on annual energy consumption:

a) Annual energy consumption at the premises is 3,590 units.
b) Capacity of the solar plant (3,590 units / 1,500 units) = **2.39 kW**
c) Available Shade free rooftop area = 450 sq ft
d) Capacity of solar plant can be installed on the rooftop = 450 / 130 = **3.46 kW**

In this, the rooftop area of a consumer's premise will support 3.46 kW but their required capacity is 2.39 kW only. So the required capacity of the premise is 2.39 kW.

Note - Shade-free rooftop area requirement mentioned by TEDA might be changed in the future considering the changes due to technological improvement. A consumer can discuss the same with the installer(s) during site visits to know more about the possibility of installing greater capacity using lesser space.

4. Requesting quotations from different installers

Consumers should ideally request quotations from different solar installers as this will enable them to compare the various items and services offered, in order to finalise a suitable installer.

For comparison, consumers should not only consider the cost but also some additional parameters as given below, as they are equally important for making the decision.

- **Standards:**
  - ❖ Ensure all the components listed in the quotation meet standards set by the Ministry of New and Renewable Energy[8] (MNRE)

- **Solar panels**:
  - ❖ Solar panels are available in different capacities starting from 3 Watts to 350 Watts. Consumers should ensure that the panels given in quotation are for the requested capacity. This is related to the space available in the consumer's premises e.g. a 350-watt panel will be bigger and occupy more space than a 35-watt panel.

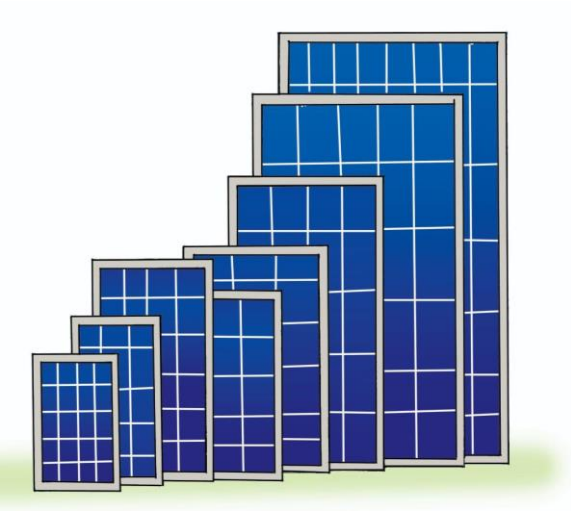


Image of Different sizes of solar panels

  - ❖ Consumers should check whether watt peak (Wp) is mentioned in the quotation. The Wp represents the maximum electric power that can be supplied by one photovoltaic panel in standard temperature and sunshine conditions. This will help one understand the efficiency of the solar panel - higher the watt peak, the higher the efficiency.
  - ❖ The consumer should check the make of panel to see if it is a standard manufacturer, this example list[9] can be used for ready reference.
  - ❖ Ensure that the installer mentions efficiency of the solar panel is greater than 13%

- **Solar Inverter:**
  - ❖ The power generated through the solar panel is Direct Current (DC)[10] while the appliances run on Alternating Current (AC)[11]. DC power should be converted to AC power. For this purpose, a solar inverter is used.

[8] https://mnre.gov.in/file-manager/UserFiles/Rooftop-Solar-PV-Quality-Standards_Revised.pdf
[9] https://www.bijlibachao.com/solar/top-ten-best-solar-panel-brands-manufacturers-india.html
[10] https://energyeducation.ca/encyclopedia/Direct_current
[11] https://energyeducation.ca/encyclopedia/Alternating_current

- ❖ Inverter capacity is usually measured in Volt Ampere (VA) or kilo Volt Ampere (kVA)[12] and is related to the capacity of the solar panel required for the premises. Ideally, the inverter capacity must be greater than or equal[13] to the solar panel's capacity.
- ❖ The make of the inverters should be checked to verify if it is from a recognised manufacturer. Sample list is given here[14] for reference.
- ❖ The inverter should have a minimum warranty of 5 years.
- ❖ The efficiency of an inverter indicates how much DC power is converted to AC power. The inverter should have an efficiency of greater than or equal to 95% with the ability to withstand a temperature range[15] of -10 °C to 60 °C. If the temperature increases, the inverter will gradually reduce its power output, by reducing the output AC in order to protect its components.

- **Output warranty:**

Output warranty for a solar panel is referred to as an assured level of power that a solar panel will produce each year. There are two types of warranties a) Linear Performance Warranty b) Standard Performance Warranty.

- ❖ Linear Performance Warranty - In this, the installer will specify that the performance of solar panels may decrease gradually year after year ie., year-1 at 2.5% decrease, and year-2 to year-25 at 0.5% decrease per annum.

- ❖ Standard Performance Warranty - In this, the installer will specify the decrease in performance of solar panels over a period of time ie., the performance of solar panels will not be less than 90% at the end of 10 years[16] and not less than 80% at the end of 25 years.`

[12] http://www.zelect.in/inverter/inverter-buying-guide
[13] http://www.altenergy.org/renewables/solar/DIY/inverter-sizing.html
[14] https://www.cleanenergyreviews.info/blog/best-grid-connect-solar-inverters-sma-fronius-solaredge-abb
[15] https://www.solarquotes.com.au/blog/how-does-temperature-affect-your-solar-inverter-power/
[16] https://solarrooftop.gov.in/pdf/faq.pdf

Thus, over 25 years, panels with linear performance warranty can be expected to generate significantly more power than the panels with standard performance warranty. So while selecting an installer, consumers should opt for installers who provide panels with linear performance warranty as they will get guaranteed performance of 85% over a period of 25 years.

- **Mounting structures:**
  - ❖ Mounting structures support the solar panels. It should be made of hot-dipped galvanised steel with a minimum galvanisation thickness of 120 microns[17]. Aluminium alloy or anodised aluminium may also be used.
  - ❖ Mounting structures should be able to withstand a wind speed of minimum 150 km per hour (kph). If the premises is near the seashore, anodised aluminium structures will be better.
  - ❖ For a cyclone prone area, mounting structures should be designed in a way to handle the cyclones where wind speeds may reach 200 kph. It has to be discussed with the installer.

Note: It is advisable to use spring washer[18] or locking washer[19] to fix solar panels to ensure that nuts do not loosen over time.

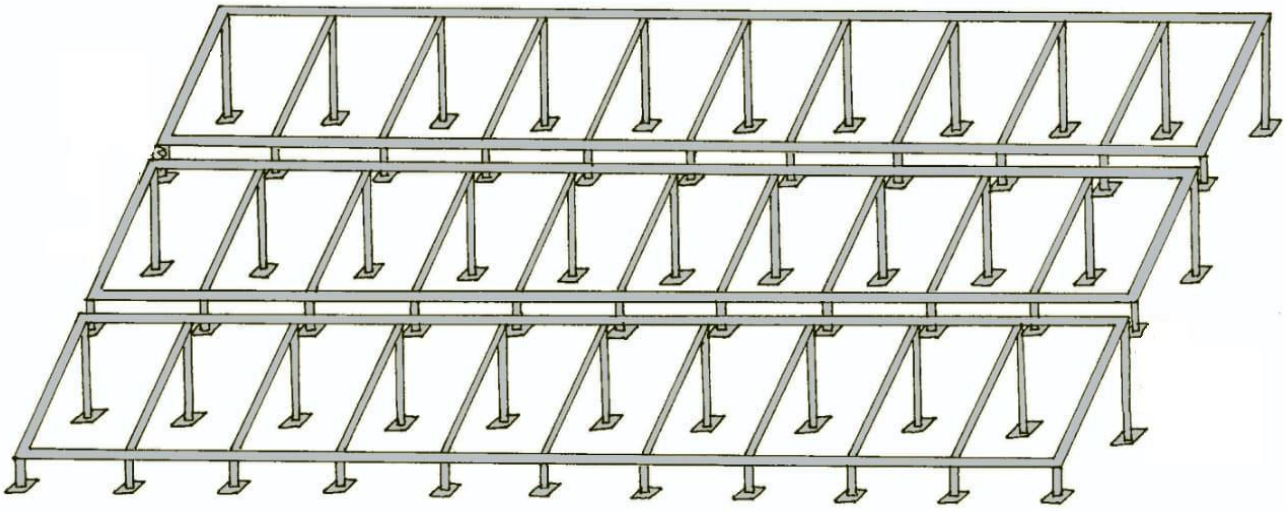


Image of a mounting structure

[17] http://www.teda.in/pdf/Specification_Grid_Tie_SPV_plant.pdf
[18] https://www.globalspec.com/learnmore/mechanical_components/springs/washer_springs
[19] https://www.hunker.com/12000174/what-is-the-purpose-of-a-lock-washer

- **AC & DC Cables:**
  - ❖ The DC power generated from the solar panel is transmitted through DC cable to the inverter. DC power gets converted to AC power by the inverter and gets transmitted to the load by AC cables. It is important to check the make of the cables and ensure they adhere to ISI standards.
  - ❖ Copper wires, being a good conductor of electricity, are preferred for wiring.
  - ❖ The minimum size of both DC and AC cables should ideally be 4.0 mm^2 copper.

- **Online monitoring**
  - ❖ Usually, the installer will provide some way to monitor the solar power generation such as a mobile application and/or through web-based monitoring. A consumer should ensure the availability of online monitoring of solar generation data for their benefit. A sample image is given below.
  - ❖ Check the parameters available for the online monitoring system.
  - ❖ Some basic parameters are the power generation rate, cumulative solar generation (month and year wise), facility to download the generation data, etc.

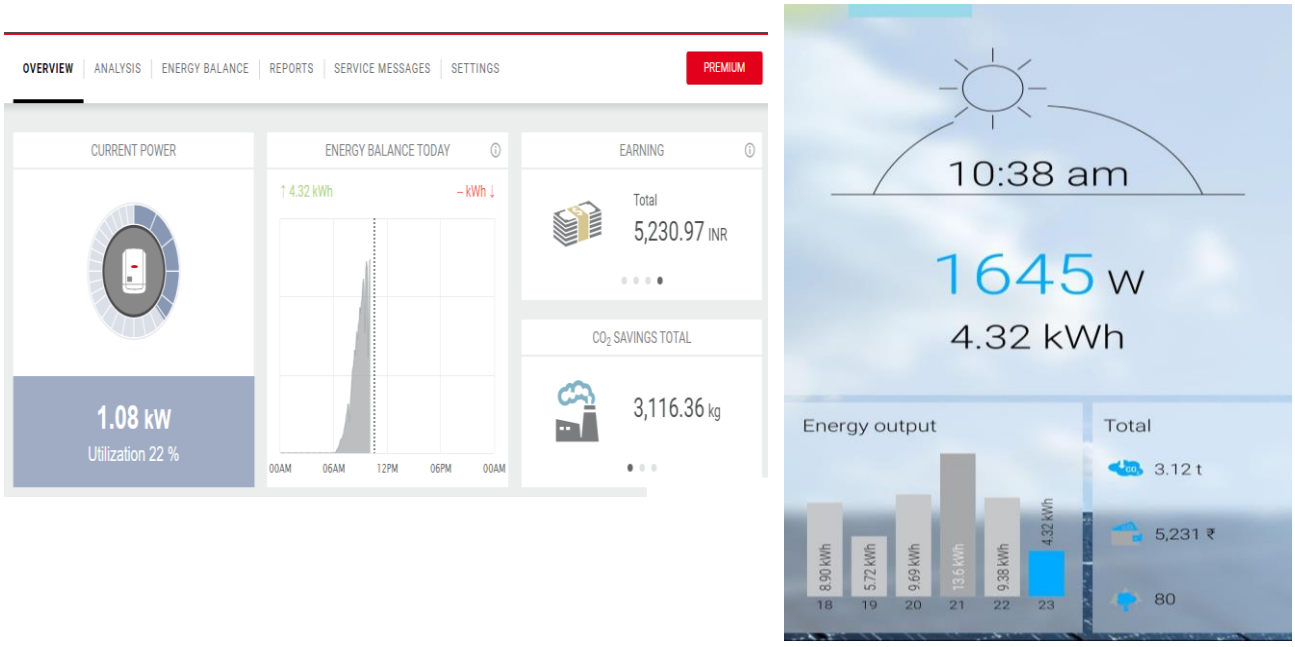


Image of a Sample online monitoring data

- **Maintenance**

  - ❖ Maintenance includes three major items i.e. servicing of inverters, electrical wiring, and solar panel efficiency for output.
  - ❖ A consumer has to ensure that annual maintenance is included in the base price. The consumer should also keep a check on what services are covered under or excluded from the Annual Maintenance Contract (AMC).

[Note: For all rooftop solar for which subsidy is availed, annual maintenance for 5 years is already included from the date of installation – consumers should confirm the same. However, for non-subsidised rooftop solar, maintenance is usually covered for the first year, free of cost. Subsequently, a consumer may enter into an AMC with the service provider.]

  - ❖ Be sure to check the processes for identifying performance issues, point of contact, and estimated time to inspect and resolve the issue; check whether there will be additional charges.

- **Subsidies (if any)**:

  - ❖ Subsidies are given by MNRE and state renewable energy departments in order to encourage consumers to install rooftop solar. Earlier 30% of the benchmark cost or 30% of the actual cost of the project, whichever is less was provided as subsidy by MNRE. In addition to this, in Tamil Nadu, under incentive for domestic solar rooftops - Individual, a subsidy amount of Rs. 20,000[20] was provided by TEDA (state renewable energy department of Tamil Nadu) for residential consumers who installed 1kWp grid connected rooftop panel.

[20] http://teda.in/apply/incentive-for-domestic-solar-rooftops-individual/

- Presently, under Phase II of the Grid-connected Rooftop Solar Programme for achieving 40 GW[21] capacity from Rooftop Solar by the year 2022, MNRE is providing a subsidy to consumers for installation of the grid-connected rooftop solar system. The details are given below.

S.no	Total capacity of rooftop solar installations	Applicable subsidy in terms of benchmark cost or costs arrived at through tender, whichever is lesser
1	Upto 3 kW	40%
2	Above 3 kW and upto 10 kW	40% for first 3 kW and 20% for balance capacity
3	Above 10 kW	40% for first 3 kW and 20% for the next 7 kW. No subsidy beyond 10 kW capacity

- As per guidelines, only MNRE[22] and/or TEDA[23] approved installers should give quotation after deduction of subsidies while other installers will only provide guidance on how to get subsidies from the government.

- **Payment terms and conditions**

- Generally, installers demand an advance payment - between 30% and 50% of the total amount. Payment mode will have to be ascertained (i.e., cash, cheque, online).
- Consumers will receive an acknowledgement for the payment done.

[21] https://mnre.gov.in/sites/default/files/schemes/Notification-20082019-184419.pdf
[22] https://solarrooftop.gov.in/pdf/faq.pdf
[23] http://teda.in/apply/incentive-for-domestic-solar-rooftops-group/

- **Material dispatch and installation**

  - ❖ Check for the time period for dispatch of materials.
  - ❖ The time period for dispatch is based on the availability of the materials. Certain installers have stock readily available and may deliver in a short span of time. While others may have to get the stock from outside resulting in longer delivery time.
  - ❖ Check the time period required for installation.

By following the above mentioned guidelines, consumers have to choose a suitable installer.

5. Assessing the technical feasibility for connecting with TANGEDCO distribution network

A consumer interested in installing a rooftop solar PV system should enquire with TANGEDCO for connecting rooftop solar PV with the utility's distribution network or grid. TANGEDCO officials in the consumer's area will ascertain the technical feasibility of connecting the rooftop solar with the utility grid.

TANGEDCO officials will ensure that:

a) the installed capacity does not exceed 100% of the sanctioned load as per TNERC Order on Rooftop Solar Generation 2019[24]
b) the total solar PV system connected to the distribution transformer does not exceed 90% of the distribution transformer capacity.

Consumers can avail further guidance from the rooftop solar installers.

[24] http://www.tnerc.gov.in/orders/Tariff%20Order%202009/2019/Solar-25-03-2019.pdf

How does the rooftop solar, connected to the distribution network or grid of the utilities, work?

Rooftop solar generates DC power and a solar grid inverter will convert the DC power to an AC power. For its functioning, the solar grid inverter synchronises its AC output frequency with the grid frequency (nominally 50Hz) and adjusts its AC voltage output to be slightly higher than the grid voltage so that surplus energy, if any, flows to the grid. The customer is a net exporter of power to the grid when there is surplus generation than consumption and is a net importer of power from the grid when solar generation is less than consumption. Both grid frequency and voltage are needed for the solar grid inverter to function correctly.

If the rooftop solar is not connected to the distribution network or grid of the utilities, will it still function?

Yes. This is an off-grid system where the inverter creates AC power (voltage, frequency, wave form). The battery is a storage device in which DC power is stored. In this case, the battery does not provide frequency and provides only DC voltage, not AC voltage. To elaborate, a stand-alone inverter creates "fresh" AC power (voltage, frequency, wave form) from DC. A solar grid inverter adds energy to an already existing AC power waveform. Some stand-alone inverters create pure sine waves, others create block waves or approximate sine waves.

6. Meeting additional requirements

The installer may recommend additional requirements during the site visits. For example,

- If the requirement of wires between the inverter and building's electrical distribution box is more than 25 metre[25] length then the cost of extra wires may have to be borne by the consumer.
- If the roof is weak or in a slanting position, a concrete block may be required to withstand the mounting structures of the rooftop solar.

Apart from the above, a consumer may have to provide space for storage of the panels and other components during the period between delivery and installation date.

7. Material purchase

According to the terms and conditions mentioned by the installer in the quotation, a consumer may need to pay a certain percentage of the cost as advance to commence installation of rooftop solar. Once advance amount is disbursed, installer should send the materials within the time limit mentioned in the quotation. The consumer should follow up with them for the dispatch of material.

It is important to check the quality of the material after delivery. The quality of solar panels and other components will directly impact the lifetime of the plant and the rate of solar power generation.

a) **Label:** All PV modules should have a label affixed at the rear side of the module displaying the manufacturing details. The label should include information such as maximum power, current and voltage at maximum power, short-circuit current, open-circuit voltage, manufacturer's name, model number, and serial number. The label should be water resistant and heat resistant. If the label is missing or any technical information is omitted, then the module may be counterfeit.

[25] http://teda.in/apply/incentive-for-domestic-solar-rooftops-individual/

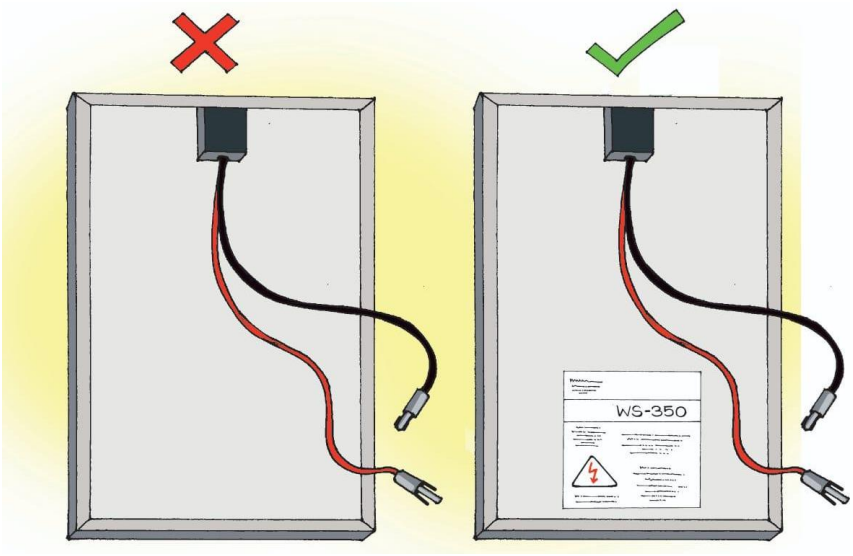


Image of a panel with and without the label

b) **Cracks and scratches in front glass:** Scratches on the glass cover of the solar panels is a major issue. Water can ingress through the cracks and affect the transmission of light to the underlying cells, leading to output power degradation. Scratches or cracks are also an indicator of poor handling of the module during the manufacturing or transportation process.

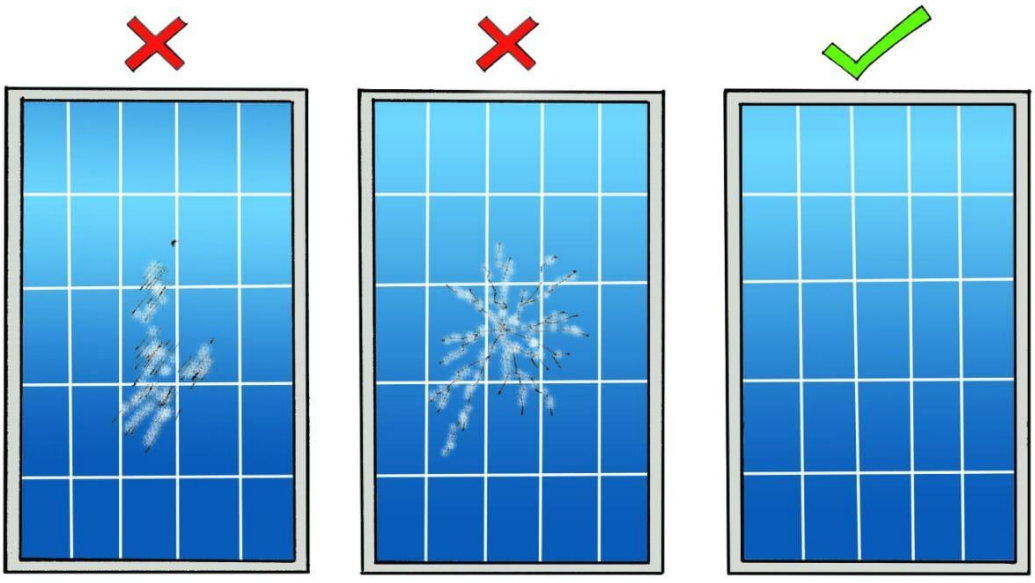


Image of panel with and without cracks and scratches

8. Installation of the plant:

Following delivery of the material, installation will have to be undertaken by the installers within the time period specified in the quotation. Solar panels are not kept flat but are placed at an angle to capture maximum solar radiation. The angle varies based on the location; in Tamil Nadu, the angle is generally between 11 to 13 degrees. The panels are installed with north-south orientation (ref below image), to avoid shadows falling on the solar panels, and to enhance power generation.

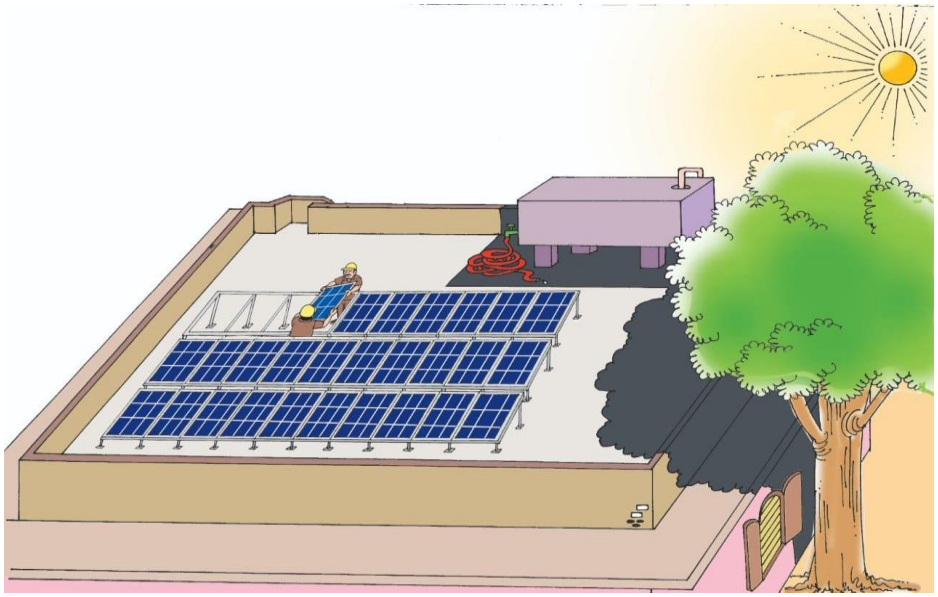
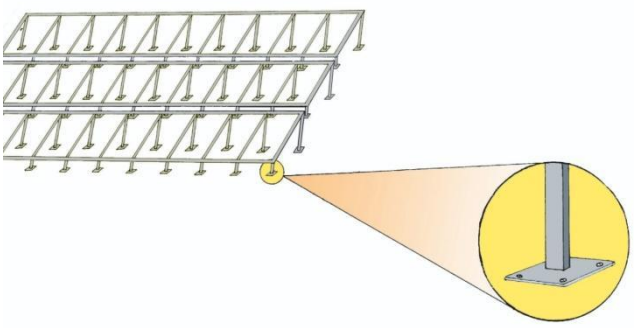
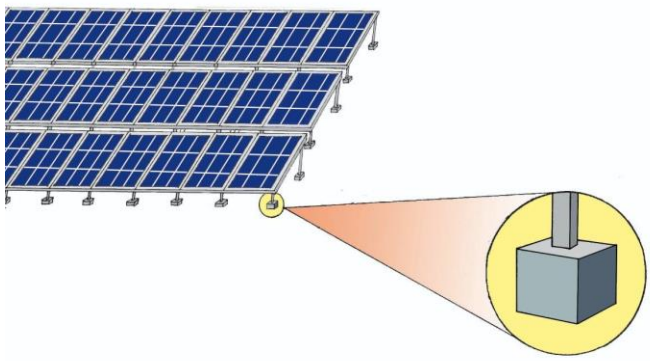


Image of installing solar panels

It is advisable to mount the panels on a concrete surface so as to increase its resilience against weather conditions such as strong winds. The below images represents a mounting structure without concrete surface during installation of the panels and other represents the mounting structure with concrete surface after installation of the panels.





9. Application for net feed-in

According to the latest TNERC order[26] issued in March 2019, consumers wishing to install grid connected rooftop solar have to install two meters namely, solar generation meter and bi-directional meter. TANGEDCO, through a memo[27], has made the installation of the solar generation meter as optional for the time being.

- **Bi-directional meter:** The bi-directional meter is used to measure the amount of power imported from the grid as well as the power exported from the solar panel.
- **Solar generation meter:** The generation meter is used to measure the amount of solar energy generated by the plant.

Normally, the meter installed by TANGEDCO is an unidirectional meter which records the power consumed by the consumer from the grid. It is not programmed to record separately any power produced from solar panels and exported to the grid. This is because the unidirectional meter can account for a unidirectional flow of power rather than a bidirectional flow. Thus, in case of solar generation, an unidirectional meter will record both import and export of power, as consumed. This leads to a higher electricity bill.

To overcome this difficulty, a bidirectional meter is required to be installed as it has the capability to record both import and export of power separately. The bidirectional meters are installed by TANGEDCO as per TNERC order. The TANGEDCO will buy the meter and also test it before installation. The cost of the bidirectional meter including its testing and installation charges will have to be borne by the consumer.

After installation, the installer should give the following documents to facilitate the application process for a net feed-in connection application:

[26] http://www.tnerc.gov.in/orders/Tariff%20Order%202009/2019/Solar-25-03-2019.pdf
[27] http://www.tnebea.in/201921/2019/may19/SOLAR%20Instns%20%2010.05.2019%20%20%20mail.pdf

a) *System description:* It includes the specifications of solar panel and inverter used in the plant;

b) *System single line diagram:* It determines the design of the rooftop solar plant. It shows the solar PV array, inverter, combiner boxes, meters and the connections between them in a simple line;

c) *Solar PV array layout:* Solar array is a group of solar panels arranged in a way to capture more sunlight to generate maximum output. The schematic representation of the array is known as the solar PV array layout;

d) *Routing diagram of cables and wires:* The schematic representation of connections between the solar panels, inverter combiner boxes and meters;

e) *User manuals of solar PV panels and solar grid inverter, and datasheets:* Detailed information and instructions about the solar panels and solar grid inverter, and datasheets to monitor daily generation will be provided by the installer;

f) *Contact details of the service centre:* Name, address, mobile number and email address of the installer / service center (in case the installer is in a different location) to be contacted in case of failure or complaint;

g) *Warranty cards:* Warranty cards will ensure the performance of rooftop solar panels over the years; and

h) *System operation and maintenance register:* Based on the quotation, the installer will visit and check the working of rooftop solar periodically. To record this, a maintenance register will be provided to the consumer. To ensure periodical maintenance, consumers should follow up with the installer and get the possible date for the next maintenance.

Application process

The application process as listed in the TNERC order[28] issued in March 2019 is as follows. This is paraphrased below:

- Application for Solar Power connectivity (Annexure 1) to be submitted to the respective Section Officer/Designated Officer of TANGEDCO along with a registration fee of Rs. 100. The TANGEDCO has to acknowledge receipt of the application (Annexure 2);
- Both the applicant and TANGEDCO should sign a net feed-in connection agreement (Annexure 3)
- TANGEDCO is mandated to install the required energy meters and commission the solar metering facility within three weeks from the date of application by the consumer; and

TANGEDCO should enhance and update their billing system such that relevant details of the net feed-in scheme are included in the bills of consumers. The billing data of each consumer shall be made available online along with a sample bill explaining various billing components.

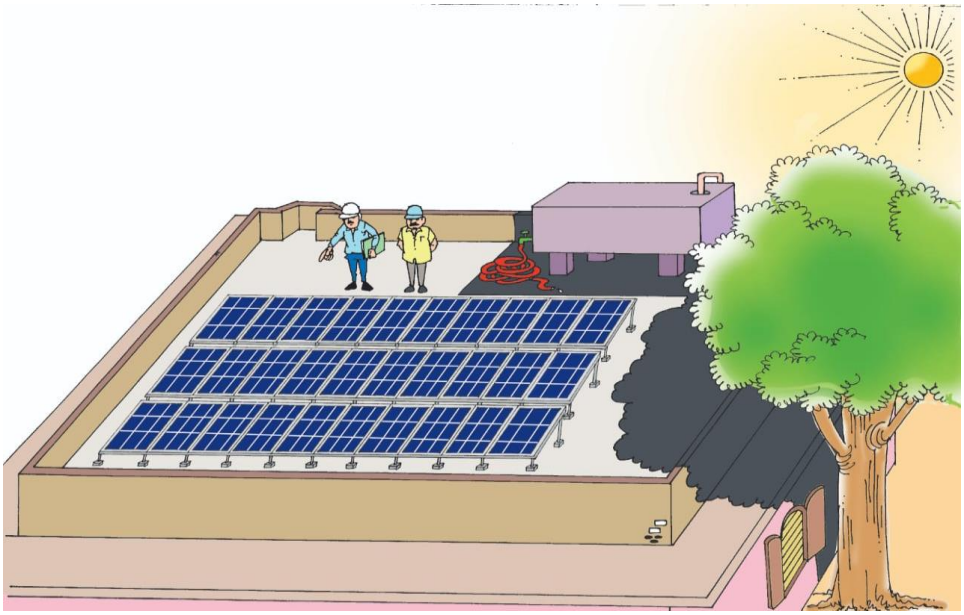


Image of a solar panels installed on the premises

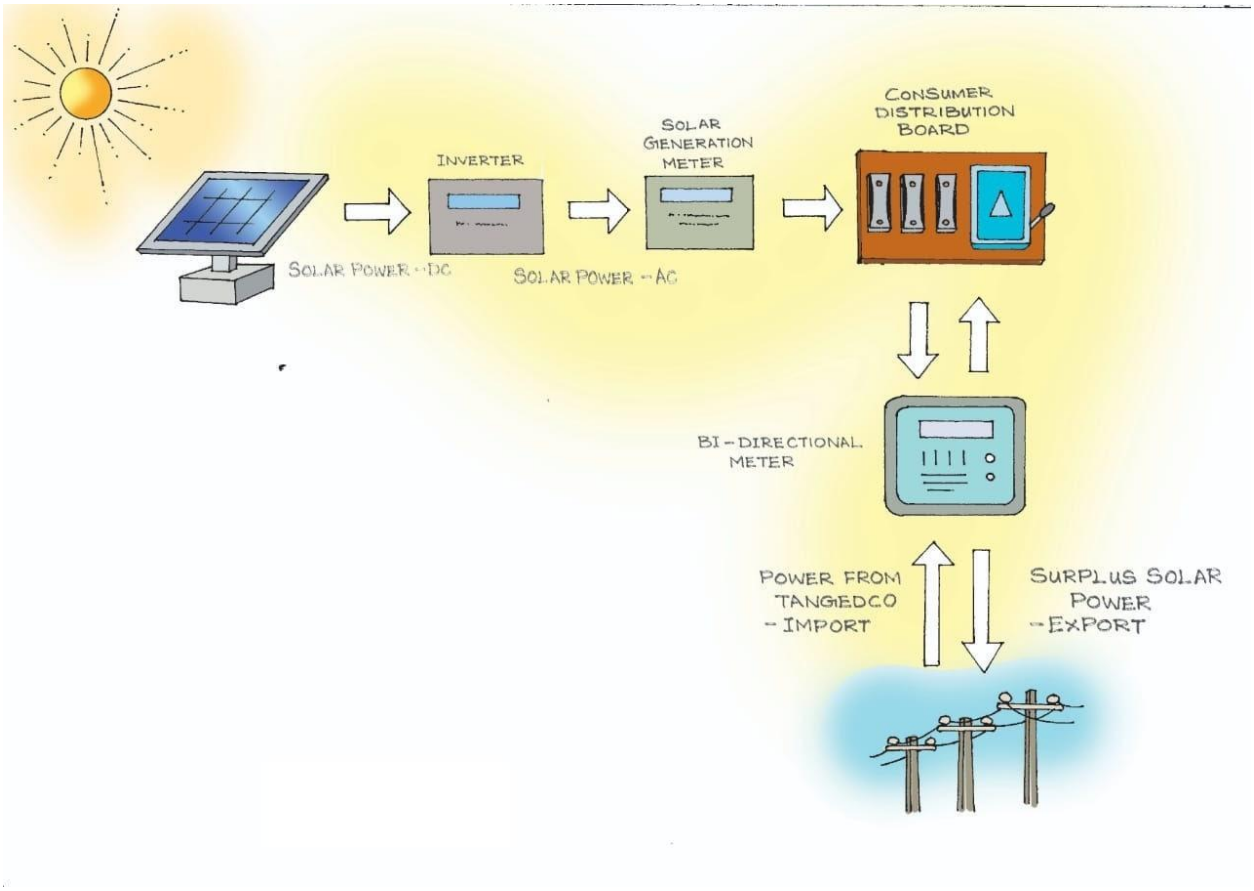
[28] http://www.tnerc.gov.in/orders/Tariff%20Order%202009/2019/Solar-25-03-2019.pdf

10. Net feed-in and Billing Arrangement:

According to the Tamil Nadu Solar Policy 2019, a net feed-in arrangement[29] has been introduced in Tamil Nadu. Under this arrangement,

a. a consumer has to pay for the units of electricity imported from the TANGEDCO grid as per the prevailing tariff[30] while
b. TANGEDCO will pay for the units of electricity exported by the consumer, through generation from rooftop solar panels, to the grid.

The result is that, if the net monetary charges of the exported units are higher than imported units, then the difference in charges will be added as a credit and shall be carried over to the next billing period for adjustments against subsequent billing. If it is less, a consumer has to pay the difference in charges within the specified period.



[29] https://energypedia.info/wiki/Feed-in_Tariffs_(FIT)#Advantages_of_feed-in_tariffs
[30] http://www.tangedco.gov.in/linkpdf/ONE_PAGE_STATEMENT.pdf

Per unit price of surplus solar energy exported to the grid by consumers under solar net feed-in is fixed by TNERC[31]. This price is fixed for each financial year by TNERC and takes the lowest price from among the following:

- 75% of the pooled cost of power notified by the Commission for the respective financial year, or
- 75% of last feed in tariff determined by the Commission, or
- 75% of solar tariff discovered in latest bidding.

Based on the above, the rooftop solar tariff for exported power has been fixed at Rs. 2.08 (based on the order - Memo.No.CE/Coml/SE/EE-2/AEE-2/F-Solar NFI/D 145/20, Dt. 29.06.2020) for the plants commissioned in the financial year 2020-21. This solar net-feed in is applicable for the life of the grid-connected solar system.

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Per unit price of power imported from grid:

The price of power imported from grid supply will be the as per respective tariff[32] based on their consumer category ie., consumer with 112 kW connected load is eligible for installing grid connected rooftop solar.

Billing Procedure:

The total price of exported power will be calculated by multiplying the number of units exported and per unit net-feedin price fixed for the consumer category upto 112 kW capacity. This will be considered as credit.

The total cost for import will be calculated based on present tariff, as mentioned in the previous section. This will be considered as debit. During every billing cycle (i.e., bi-monthly), the billing will be done as follows:

- If the cost of debit is greater than credit, then the consumer needs to pay the excess debit amount. (i.e., bill amount in INR = debit – credit)

[31] http://www.tnerc.gov.in/orders/Tariff%20Order%202009/2019/Solar-25-03-2019.pdf
[32] http://www.tangedco.gov.in/linkpdf/ONE_PAGE_STATEMENT.pdf

Example – 1

Solar net meter readings	Import (Units)	400
	Export (Units)	350

Debit (for 400 units) = Rs. 830; Credit (for 350 units) = Rs. 728
Bill amount = Rs. 102

Therefore, the consumer would have to pay Rs. 102 for this billing cycle

- If credit is greater than the debit, then exceeded credit will be added in the consumer's account. It will be adjusted in the next billing cycle, if required. Otherwise, it will be carried forward in the consumers' account.

Example – 2

Solar net meter readings	Import (Units)	400
	Export (Units)	600

Debit (for 400 units) = Rs. 830; credit (for 600 units) = Rs. 1,248

The consumer has a credit value of Rs. 418 and this will be adjusted during the subsequent billing cycle or will be carried forward in the consumer's account. This process will continue until the end of the settlement period, which is 12 months (i.e., 1 April to 31 March).

According to Tamil Nadu Solar Policy 2019[33], TANGEDCO will pay the cumulative credit to the consumer for the year. This has to be paid to the consumer within 15 days from the date of billing, by cheque. The payment shall not carry any interest if settled within 15 days from the date of bills being raised. Beyond this period, payments will attract interest equivalent to the interest rate on security deposit and it is 5.70%[34] per annum for the financial year 2019-20

[33] http://teda.in/wp-content/uploads/2019/02/SOLARPOLICY2019.pdf
[34] http://www.tnerc.gov.in/orders/Tariff%20Order%202009/2020/Interest2019-20.pdf

Annexures

Annexure 1
Rooftop Solar net feed-in Connection Application

To:
The Section Officer/Designated Officer
Distribution Licensee [name of office]

Photo of applicant

I / we herewith apply for a solar energy net feed-in connection at the service connection and for the solar PV plant of which details are given below.

1	Name of applicant	
2	Address of applicant	
3	Service connection number	
4	Service connection tariff	
5	Telephone number(s)	
6	Email ID	
7	Solar PV plant capacity (Watts)	
8	Solar grid inverter make and type	
9	Solar grid inverter has automatic isolation protection (Y/N)?	
10	Has a Solar Generation Meter been installed (Y/N)?	
11	Expected date of commissioning of solar PV system.	

Name:
Date: Signature

Annexure 2

Net feed- in Application Acknowledgement

Received an application for a solar energy net-feed in connection from,

Name.

Date:

Service Connection number:

Application registration no.:

Solar Plant Capacity:

Name of Officer:

Signature Designation/TANGEDCO

Annexure 3

Solar Net feed-in connection agreement

This Agreement is made and entered into at (location) …… on this (date)……..day of (month)……. between the Eligible Consumer, residing at (address) as first party

AND

---------- ---------- distribution Licensee (herein after called as TANGEDCO) and having its registered office at (address)…….... as second party of the agreement

And whereas, the TANGEDCO agrees to purchase the electricity generated from the eligible consumer's SPG plant of capacity …… watts and as per conditions of this agreement and regulations/orders issued by the Tamil Nadu Electricity Regulatory Commission.

Both the party hereby agrees to as follows:

1. Eligibility

1.1 Eligibility for net-feed in shall be as specified in the relevant order of the Tamil Nadu Electricity Regulatory Commission. Eligible consumer is required to be aware, in advance, of the standards and conditions his system has to meet for being integrated into grid/distribution system.

2. Technical and Interconnection Requirements

2.1 The eligible consumer agrees that his solar generation plant and net feed-in system will conform to the standards and requirements specified in the following Regulations and codes as amended from time to time.
(i) CEA's (Technical Standards for connectivity of the Distributed Generating Resources) Regulations, 2013
(ii) Central Electricity Authority (Installation and Operation of Meters) Regulation 2006

(iii) Tamil Nadu Electricity Distribution Code
(iv) Tamil Nadu Electricity Supply Code

2.2 Eligible consumer agrees that he has installed or will install, prior to connection of Photovoltaic system to TANGEDCO's distribution system, an isolation device (both automatic and inbuilt within inverter and external manual relays) and agrees for the TANGEDCO to have access to and operation of this, if required and for repair & maintenance of the distribution system.

2.3 Eligible consumer agrees that in case of a power outage on TANGEDCO's system, photovoltaic system will shut down, automatically and his plant will not inject power into Licensee's distribution system.

2.4. All the equipment connected to distribution system must be compliant with relevant international (IEEE/IEC) or Indian standards (BIS) and installations of electrical equipment must comply with Central Electricity Authority (Measures of Safety and Electricity Supply) Regulations, 2010 as amended from time to time.

2.5 Eligible consumer agrees that licensee will specify the interface/ interconnection point and metering point.

2.6 Eligible consumer and licensee agrees to comply with the relevant CEA regulations in respect of operation and maintenance of the plant, drawing and diagrams, site responsibility schedule, harmonics, synchronization, voltage frequency, flicker etc.,

2.7 Due to TANGEDCO's obligation to maintain a safe and reliable distribution system, eligible consumer agrees that if it is determined by the TANGEDCO that eligible consumer's photovoltaic system either causes damage to and/or produces adverse effects affecting other consumers or TANGEDCO's assets, eligible consumer will have to disconnect photovoltaic system immediately from the distribution system upon direction from the TANGEDCO and correct the problem at his own expense prior to a reconnection.

3. Clearances and Approvals

3.1 The eligible consumer agrees to obtain all the necessary approvals and clearances (environmental and grid connected related) before connecting the rooftop solar photovoltaic system to the distribution system.

4. Access and Disconnection

4.1 TANGEDCO shall have access to metering equipment and disconnecting means of photovoltaic system, both automatic and manual, at all times.

4.2 In emergency or outage situation, where there is no access to a disconnecting means, both automatic and manual, such as a switch or breaker, TANGEDCO may disconnect service to the premise.

5. Liabilities

5.1 Eligible consumer and TANGEDCO will indemnify each other for damages or adverse effects from either party's negligence or intentional misconduct in the connection and operation of photovoltaic system or TANGEDCO's distribution system.

5.2 TANGEDCO and eligible consumer will not be liable to each other for any loss of profits or revenues, business interruption losses, loss of contract or loss of goodwill, or for indirect, consequential, incidental or special damages, including, but not limited to, punitive or exemplary damages, whether any of the said liability, loss or damages arise in contract, or otherwise.

5.3 TANGEDCO shall not be liable for delivery or realization by eligible consumer for any fiscal or other incentive provided by the Central/State government beyond the scope specified by the Commission in its relevant Order.

6. Commercial Settlement

6.1 The commercial settlement under this agreement shall be as per the order on Rooftop Solar Generation issued by the TNERC on 25.03.2019 .

7. Connection Costs

7.1 The eligible consumer shall bear all costs related to setting up of photovoltaic system including metering and interconnection costs.

7.2 The eligible consumer agrees to pay the actual cost of modifications and upgrades to the service line required to connect photovoltaic system in case it is required.

8. Termination

8.1 The eligible consumer can terminate agreement at any time by providing TANGEDCO with 90 days prior notice.

8.2 TANGEDCO has the right to terminate Agreement on 30 days prior written notice, if eligible consumer breaches a term of this Agreement and does not remedy the breach within 30 days of receiving written notice from TANGEDCO of the breach.

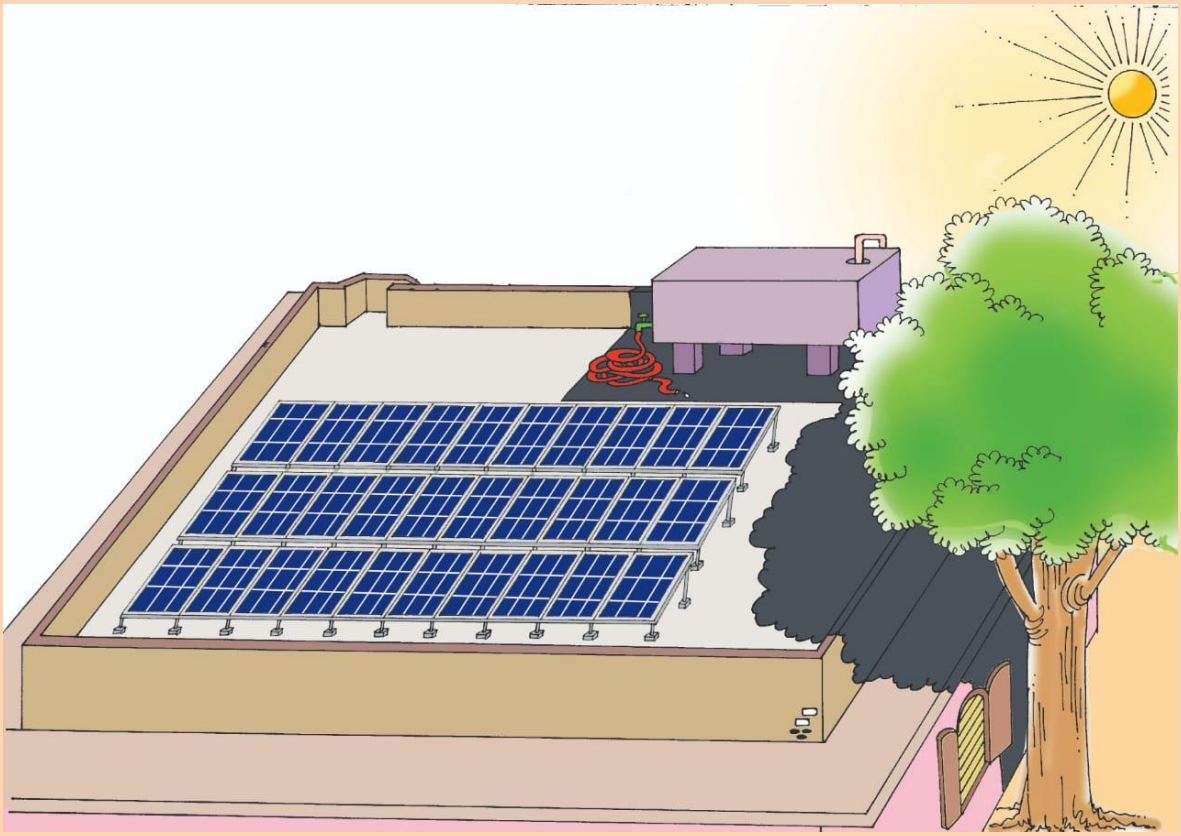
8.3 Eligible consumer agrees that upon termination of this Agreement, he must disconnect the photovoltaic system from TANGEDCO's distribution system in a timely manner and to TANGEDCO's satisfaction.

In the witness, whereof of Mr. …….. for and on behalf of … …….. (Eligible consumer) and Mr. …… for and on behalf of……. (TANGEDCO) sign this agreement in two originals.

Eligible Consumer	Distribution Licensee
Name	Name

Checklist for choosing an installer

1	Ensure that the solar panel and its components mentioned in the quotation comply with MNRE standards	
2	Ensure that the performance warranty for the panels have been mentioned.	
3	Quotation should mention that solar panels have an efficiency greater than 17%	
4	Mounting structures should: ● Withstand the wind speed of 150 km per hour; ● Be made of hot dipped galvanised steel with a minimum galvanisation thickness of 120 microns or aluminium alloy; and ● Be made of anodised aluminium, if the premises is located near the seashore.	
5	Inverter should have: ● Minimum warranty of 5 years; ● Working efficiency greater than or equal to 95%; and ● Withstand the temperature range of -10°C to +60°C	
6	Additional requirements (if any) mentioned by the installer should include: ● Civil structures ● Electrical works	
7	Advance amount to the paid should be mentioned in payment terms and conditions.	
8	Provision for online monitoring of solar generation data	
9	Annual Maintenance Contract (AMC) including the base price and services covered under or excluded	
10	Confirmation of post installation service ● Point of contact for issues ● Identification of performance issues ● Timeline for attending to the issue ● Additional charges, if any.	



Contact details

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