

FAQ: Grid Connected Solar Rooftop System

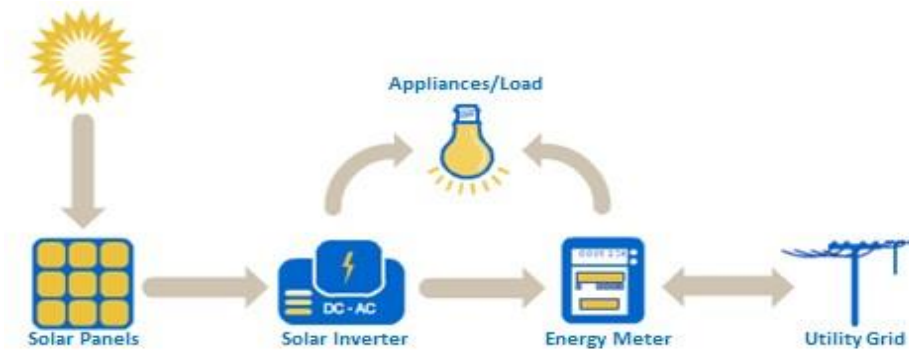
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1 About solar rooftop system

1.1 What is a Grid Connected Rooftop Solar PV System?

In grid connected rooftop or small solar photovoltaic (SPV) system, the DC power generated from solar panel is converted to AC power using power conditioning unit/Inverter and is fed to the grid. Operating modes of grid connected rooftop solar PV system can be explained



1.2 What are the main components of a Grid Connected Rooftop Solar PV system?

- **Solar PV Modules/Solar Panels** – The Solar PV modules/Solar Panels convert solar energy to DC (direct current) electrical energy. They are available in different technologies such as crystalline silicon, thin film silicon, CIGS, CdTe, HIT, etc. Crystalline Silicon Solar PV panels are most commonly used in solar rooftop system. Multiple panels are connected together to form arrays as per the desired capacity of the system.
- **Inverter** – Inverter converts variable DC output of Solar PV panels into AC power. Inverter also synchronizes with the grid so that generated power from the module can be injected into the grid.
- **Module mounting structure** – The module mounting structure, is the support structure that holds the Solar PV panels in place for full system life and is exposed to all weather conditions. These are normally fixed at particular angle and orientation in case of solar rooftop system. But these can also be of type that tracks the Sun, called as trackers.
- **Bi-direction Meters** – Meters are used to record the generation or consumption of electricity. Bi-direction (or Net-Meters) are used to keep track of the electricity that solar PV system injects to utility grid and the electricity that is drawn from the utility grid.
- **Balance of System** – These consist of cables, switchboards, junction boxes, earthing system, circuit breaker, fuses, lightning protection system, etc.

1.3 How much area is required for a 1 kWp rooftop Solar PV system?

A 1 kW rooftop system generally requires 10 sq. metres of shadow-free area. However, actual area requirement may vary depending on the efficiency of solar module, and their placement etc.

1.4 Why do I need shadow-free area for modules?

Solar modules (and cells within) need uninterrupted sunlight to produce maximum electrical energy. With the shadow even on a part of the module, the generation reduces to a great extent thereby wasting installed system capacity. Also, prolonged (regular, though intermittent) shadow on some cells or modules reduces their life substantially and these become useless much before their standard life of over 25 years.

1.5 What types of roofs are suitable for Rooftop solar (RTS) system?

Rooftop solar PV systems can be installed on any type of roof having sufficient load bearing capacity. .

1.6 What is the daily energy generated from a 1 kWp Solar Power Plant?

On a clear sunny day, 1 kWp solar power plant can generate 4 to 5.5 units in a day.

1.7 Will I get constant / same energy from the RTS all year round?

No, the daily energy generation from the RTS shall be dependent on the temperature and solar irradiance among other parameters and these may not be same every day.

1.8 What are the factors affecting generation?

- Plant Location
- Quality of equipment used
- No. of sunshine hours
- Workmanship
- PV module tilt angle and orientation
- Module Cleaning
- O&M activities etc.

1.9 Will I get same annual energy from the RTS for all 25 years?

No. On exposure to sunlight and outside environment, the solar module lose their generation capacity and this is called degradation.

1.10 What are the advantages of Grid-Connected Rooftop Solar System?

- Saving on electricity bill by the consumer.
- Utilization of available vacant roof space, no additional land required.
- Low gestation period.
- No additional requirement of transmission and distribution (T&D) lines.
- Reduces T&D losses as power consumption and generation are collocated.
- Improvement in the tail-end grid voltages and reduction of system congestion.
- Long term energy and ecological security by reduction in carbon emission.
- Better management of daytime peak loads by DISCOM/ utility.
- Meeting of the Renewable Purchase Obligations (RPOs) of obligated entities.

2 Cost of system and subsidies

2.1 What is the average cost of grid connected rooftop solar systems?

The current **benchmark cost** of grid connected rooftop solar systems can be seen in notification section at <https://solarrooftop.gov.in/notifications/view>

2.2 What are the subsidies/ capital support available from the Government?

Central financial assistance (or subsidy) is available **only** for residential sector grid connected solar rooftop projects only. For other sectors e.g. Govt., institutional, social, commercial, industrial etc. CFA is not available.

Central Financial Assistance (CFA)* to Residential sector

- CFA @ 40% of benchmark cost or @40 % of tendered rates (whichever is lower) for capacity up to 3 kWp
- CFA @ 20% of benchmark cost or 20 % of tendered rates (whichever is lower) for capacity beyond 3 kWp and up to 10 kWp
- CFA @ 20% of benchmark cost or @ 20 of tendered rates (whichever is lower) for GHS/RWA capacity up to 500 kWp (limited to 10 kWp per house and total upto 500 kWp)

For calculation of CFA, the PV plant capacity will be inverter capacity or the PV module capacity, whichever is lower. For availing CFA, the PV module and cell shall be manufactured in India only.

2.3 Whether residential consumer has to pay the full cost of the system for residential sector subsidised projects?

No. Consumer has to pay the balance amount after deducting the subsidy (eligible CFA) from the L1 project cost discovered by the DISCOMs. Advisory on scheme is also available at https://mnre.gov.in/img/documents/uploads/file_f-1610949591054.pdf

2.4 At what rate the full cost of the solar rooftop plant be decided?

Consumers are advised to pay only according to the rates (L1 rates) decided by DISCOMs. If any vendors are charging more price than the rates decided by DISCOMs from domestic consumers, in that case consumers are advised to inform DISCOM so that the DISCOM identify and punish such vendors.

2.5 Is there any Subsidy/Support from State Government?

Information on state subsidies can be seen on the website of the concerned electricity distribution company. The rooftop solar portals of electricity distribution companies can be assessed at: https://solarrooftop.gov.in/grid_others/discomPortalLink

2.6 Whether MNRE has empanelled any agency for implementation?

No. MNRE is implementing the programme through power distribution companies/DISCOMs of various States. These DISCOMS are responsible for discovery of rates and empanelment of vendors for implementation of the projects..

Consumers can apply online through the portals of these DISCOMS which can be assessed at: https://solarrooftop.gov.in/grid_others/discomPortalLink

2.7 How should I evaluate vendors offering me RTS? What are the main points of consideration?

The system price, though important, should never be the only factor for deciding vendor. Customer should consider at least the following factors:

- Price of the offered system.
- Warranties of system and components.
- Energy generation estimates and guaranties.
- Service backup and arrangements the vendor has in the area.
- Reference installations in the track record of the vendor – along with those customers’ feedback about system performance and service provided by the vendor

2.8 How can I make payment to the Electricity Distribution Company (DISCOM)?

Since the system is grid connected through net metering, DISCOM will generate bill based upon the reading provided by the net meter installed at the consumer premises. The consumer will have to pay for the net units (total imported units minus exported solar units) only.

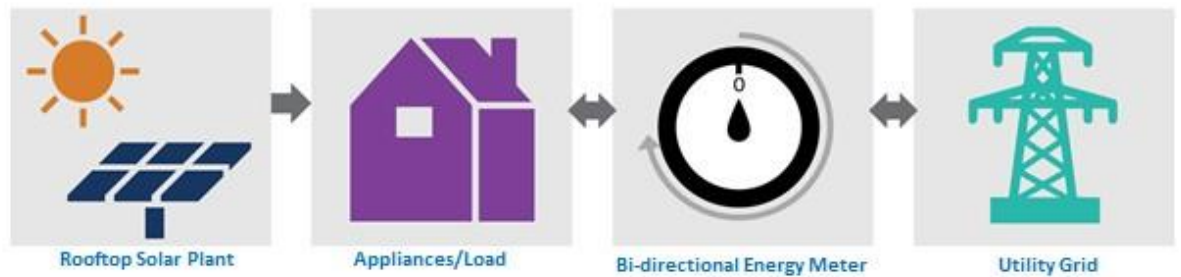
2.9 Can I make my monthly electricity bill ‘zero’ by installing RTS?

This is possible in very rare cases because the consumer shall be required to pay some minimum charges like fixed charges, etc. even if the consumed energy is all self-generated. However, ‘electricity charges’, a major component of the monthly bill, can be reduced to zero by optimally designing and maintaining the RTS. The monthly electricity bill may come to zero in States which give revenue for surplus power generated.

3 Metering arrangement for solar rooftop

3.1 What is net-metering?

All solar PV systems generate power only during daytime when sun is available. In net metered systems, the generated power is utilized for self-consumption, and excess power is exported to the grid as long as grid is available. In case, where solar power is not sufficient due to cloud cover etc., power is drawn from the grid to power the loads. A bi-directional or net meter records the energy flow in both the directions and at the end of billing period net energy used is calculated. The beneficiary has to pay for only the net energy used.



3.2 What is Gross Metering?

In gross metering the power generated from the Rooftop Solar plant is only fed to the grid. The system owner gets paid by the DISCOM for such exported power at a pre-decided tariff.

3.3 What is Net billing?

Connections in net billing RTS are similar to net metering. However, at the end of the billing cycle (normally a month) any excess energy in the grid shall not be carried forward like in net metering, but shall be purchased by the DISCOM as per pre decided tariff. Therefore, energy banking in the grid is only within a billing cycle.

3.4 Can the RTS be installed for only captive use without being connected to Grid?

Yes, the plants which are not connected to the grid are normally called behind the meter plants and MNRE subsidy is not available for such plants even for residential sector. However, it is required to follow rules and regulations specified for this purpose by the state authorities.

4 Business model for solar rooftop system

4.1 What are the models for implementation of Rooftop PV systems?

CAPEX Model: Here, the system is owned by the consumer himself and he bears the cost of the system.

RESCO Model: Here, the entire system is owned by the 3rd party project developer. The consumer only purchases the generated energy by paying pre-decided tariff on a monthly basis as per Power Purchase Agreement (PPA). Responsibility of O&M for the system lifetime (25 years) is also with the developer.

4.2 What is the payback for solar rooftop using various business models?

A simple payback period can be calculated by using rooftop calculator available at following web link: https://solarrooftop.gov.in/rooftop_calculator

5 Installation of solar rooftop system

5.1 How can I apply for installation of solar rooftop system?

Residential consumers and Group Housing Society can apply for installation of solar rooftop system through the online portal of DISCOMs. The link for the online portal of DISCOMs is mentioned- https://solarrooftop.gov.in/grid_others/discomPortalLink

5.2 What is the general procedure for installation of Rooftop Solar system for beneficiary?

The interested beneficiary may install the solar rooftop systems through project developers/system integrators/manufactures etc. after taking necessary approval from DISCOMs within the capacity limit as laid down in the order of respective State Electricity Regulatory Commission/Joint Electricity Regulatory Commission of the respective States/UTs.

5.3 Can I install Rooftop Solar system if I live in a rented house?

The RTS under any framework like net or gross metering can be installed by the electricity consumer. So, if you have electricity connection in your name and you pay regularly the electricity bill in your own name and **also you have the permission of use the roof for solar rooftop installation from the owner**, you can install the RTS.

5.4 What kind of system can be installed in Group Housing Society (GHS)?

With several common rooftops available in a society, there is a great potential for harnessing solar energy through rooftop PV systems. The energy generated from these systems is used to offset the common loads of the society (common lighting, lift, pumps, etc.). A Net Meter shall be provided against, the Single Point Delivery (SPD) common meter of Cooperative Group Housing Society (CGHS). In this, the society ultimately gets benefitted in terms of reduced monthly electricity expenses.

5.5 If I shift my residence or office where RTS is installed, what will happen to the RTS?

The system is easy to be dismantled and reassembled elsewhere. So, it can be shifted to your new residence.

5.6 Whether solar module should be made of indigenously for subsidised projects?

Yes. Only indigenously manufactured PV modules with indigenous solar cell can be used in Solar PV systems power plants for **subsidised** sector projects. For reference, as per the ALMM list 10th March 2021 Clause 4 IV- *Link:-* (https://mnre.gov.in/img/documents/uploads/file_f-1615380939218.pdf).

However, there is **no** such limitation in case the project installed without any subsidy.

6 Operation and maintenance of solar plant

6.1 What is the minimum warrantee period envisaged under the scheme?

Solar PV modules used in solar power plants /systems must be warranted for their output peak watt capacity, which should not be less than 90% at the end of 12 years and 80% at the end of 25 years. The mechanical structures, electrical works including power conditioners/inverters/charge controllers/maximum power point tracker units/distribution boards/digital meters/switch gear/storage batteries, etc. and overall workmanship of the SPV power plants/ systems must be warranted against any manufacturing/ design/ installation defects for a minimum period of 5 years.

6.2 What are the O&M aspects of a grid-connected rooftop solar PV system?

Compared to most other power generating technologies, solar PV systems have very low maintenance and servicing requirements. However, suitable maintenance of a PV plant is essential to optimise energy yield and maximise the life of the system. Some of the maintenance activities typically may include but not limited to the following:

- Module cleaning is required periodically (dust, bird dropping and other debris can cause decrease in power generation). Periodicity depends on local conditions like dust, birds, air pollution, etc.
- Other items should be checked periodically as stated below:
 - *Checking module connection integrity*
 - *Checking junction boxes / string combiner boxes*
 - *Inspecting mechanical integrity of mounting structures*
 - *Tightening cable connections that have loosened*
 - *Replacing blown fuses*
 - *Repairing lightning damage*
 - *Repairing equipment damaged by intruders or during module cleaning*

6.3 There is presence of monkeys in our area. Would they be damaging the RTS?

The solar modules are made up of toughened or tempered glass top and so are not easily broken due to monkeys or any falling objects. These can be broken if deliberately someone throws stones. Guarding of module surface with wire mesh is one solution for monkey menace, but not recommended because this regularly casts shadow on the modules.

7 General information about solar rooftop

7.1 What is the gross potential of solar power in the country?

India is endowed with vast solar energy potential. About 5,000 trillion kWh per year energy is incident over India's land area with most parts receiving 3-5 kWh per sq. m per day. Based upon the availability of land and solar radiation, the potential of solar power in the country has been assessed to be around 750 GW.

7.2 What is the potential for rooftop solar power in the country?

National Institute of Solar Energy (NISE), An Autonomous Institute under the Ministry of New and Renewable Energy has estimated a potential of 43 GW for Grid Connected RTS in the country.

7.3 What targets has the Government kept for installation of Rooftop Solar Plants in the country?

Government of India has set the target of installing 40,000 MW of Rooftop Solar (RTS) Power by the year 2022. State-wise tentative targets are available in the website link ([State-wise-and-year-wise-target-for-installation-of-40000MWp-GCRT-systems_0.pdf](#))

7.4 What is the State wise breakup of sanctioned capacity under the Phase-II RTS scheme?

The details on capacity sanctioned under Phase-II of RTS scheme can be seen on the following link: https://solarrooftop.gov.in/grid_others/phase2SanctionList

7.5 Which are the States that have Net-metering regulations?

Electricity regulatory commissions have notified the regulations for all States /UTs. Amendments if any may kindly be seen at the websites of the respective State Electricity Regulatory Commission/Joint Electricity Regulatory Commission.

7.6 Approved List of Models and Manufacturers of Solar Photovoltaic Module:

Approved List Models and Manufacturers of Solar Photovoltaic Module (ALMM) is available at https://mnre.gov.in/img/documents/uploads/file_f-1615380939218.pdf .

However, ALMM order in respect of List I (Modules) shall be applicable on all such bids whose last date of bid submission is on or after 10.04.2021

7.7 Want to know more details on rooftop solar for knowledge purpose?

Yes. Ministry of New and Renewable Energy has created a knowledge portal for knowledge dissemination among the Consumers/DISCOM Officials/Bankers/SERCs etc., which can be access by using the URL: https://solarrooftop.gov.in/grid_others/knowledge

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