BURHANI FOUNDATION
ESTD. 1992

Standard Operating Procedure —

SOLAR PV SYSTEM

Khamgaon - 7.5 kW (Husami Masjid)

VERSION - 1.1

JANUARY, 2022

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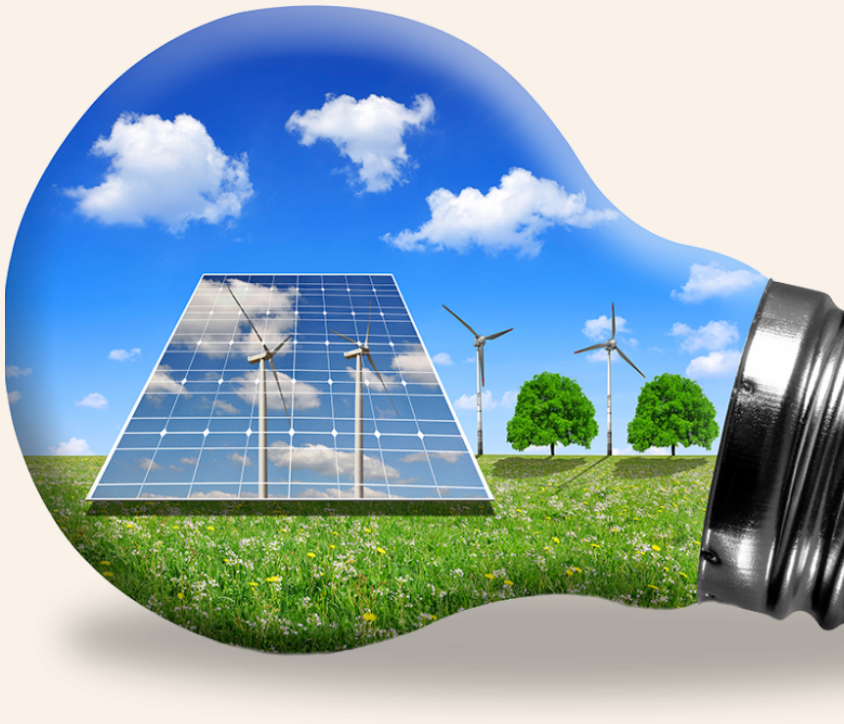
Introduction



Burhani Foundation India (BFI) was established in 1992 by al-Dai al-Ajal al-Fatimi Syedna Mohammed Burhanuddin RA for research and awareness of the environment. Today, as per the wishes and instructions of al-Dai al-Ajal al-Fatimi Syedna Mufaddal Saifuddin TUS, BFI continues to strive for greater environmental sensitivity within our community.

- One of BFI's primary focus areas is renewable energy. The environmental impact of non-renewable energy sources and the rising costs of electricity are indicative of the unsustainability of traditional energy practices.
- Recognizing both environmental and socio-economic benefits, more and more individuals and organizations are making the transition to cleaner sources of energy, one of the most promising of which is solar.
- In fact, the Indian Government has invested heavily in solar energy and many state governments now provide subsidies on the installation of solar panels.

BFI therefore recommends that you consider the installation of solar panels for community properties in your jurisdiction. Panels are most often installed on roofs, terraces and facades in urban areas, but they can also be installed on the ground level in open spaces. Along with providing a power supply, solar also substantially reduces electricity bills: the average payback period for most solar installations is approximately four years, after which energy is available at essentially no cost and requires minimal maintenance.

We all are aware of how the conventional sources of energy are exhaustible and have an adverse effect on nature. Therefore, it is high time that we switch on to a form of energy that detoxifies nature and serves humanity till eternity – solar energy is the best form of renewable energy and can be considered as the fuel of the future, hence this issue is the need of the hour and we strongly encourage you to take the initiative and lead by example. BFI is happy to assist jamaats in identifying appropriate consultants and vendors for Solar systems.

Burhani Foundation being an organization attempting for environmental awareness and research, is deeply engaged in making a Green and Smart city that can be done through the process of evolving a Standard Operating Procedure. BFI, with its expertise, can provide guidance / hand-holding for all willing Dawat Properties to implement the Standard Operating Procedure across the city.

Solar PV System

A solar photovoltaic (PV) system is a renewable energy power generation technology that uses photovoltaic modules to generate electricity directly from solar radiation, using a phenomenon called the photovoltaic effect.

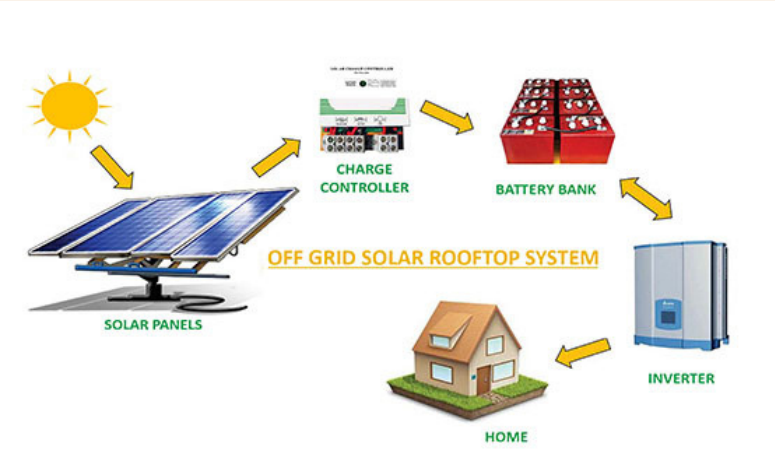
The electricity generated can be stored, used directly, or fed back into the grid. Solar PV is a reliable and clean source of electricity that can suit a wide range of power generation applications for residential, industrial, agricultural, etc.

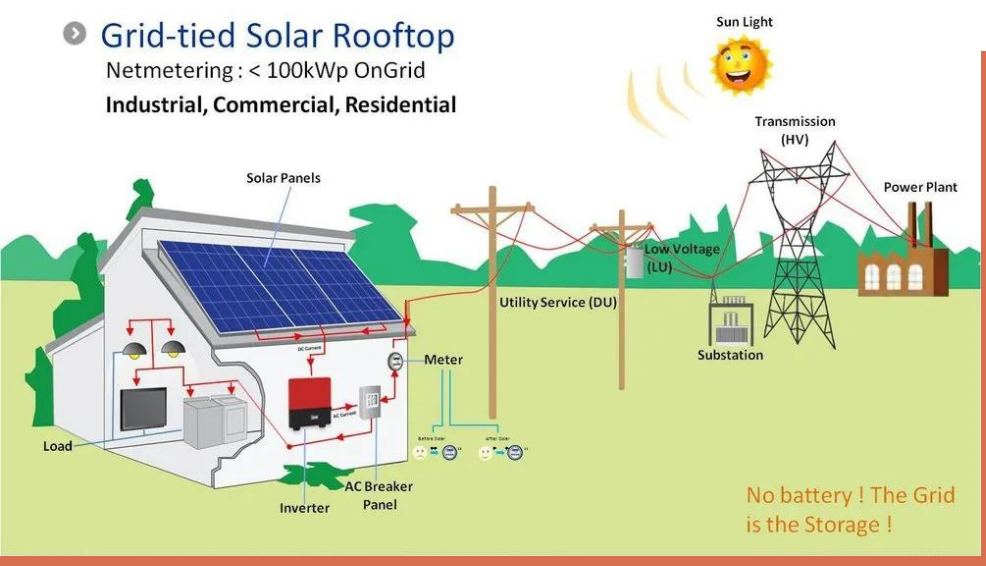
- Solar rooftop PV Classification:

1) Grid-tied solar rooftop PV system:
A grid-tied solar rooftop PV system is, as the name suggests, a plant connected to the grid through net or gross metering without any battery backup. Most of the state governments and the Central government are promoting this type of rooftop system.

2. Hybrid plant:
A hybrid rooftop system is similar to grid-connected solar rooftop PV, but it is installed with a battery backup. At times of power failure, the backup supplies power to the consumer, which a simple grid-connected solar rooftop system cannot do.

3. Off-grid solar system:
Off-grid solar systems are not connected to the grid. They are installed with a battery backup. They are considered to be expensive due to the additional cost of the battery bank. They are often installed in remote areas where the grid is yet to reach or will never reach.





Benefits of solar energy for the environment

Solar energy reduces harmful emissions caused by the burning of fossil fuels and improves the health of those around you for years to come. Some of the key environmental benefits of solar are as follows:

1) Decreases Water Usage:

Solar panels do not require water to function, while conventional electricity sources use tens of thousands of liters of water every year. The power sector in India mainly utilizes plants for cooling generations, processing/refining fuel and transporting fuel through pipes.

2) Mitigates air pollution:

Fossil fuels generate harmful gases like methane and carbon dioxide which reduce the air quality. Air pollution can hinder our health and wellbeing by causing anxiety, headaches, pneumonia, heart attacks, asthma, bronchitis, and allergies. Solar energy dramatically reduces carbon emissions in the air you breathe, which improves your overall health.

3) Slows down climate change:

The burning of fossil fuels increases the presence of greenhouse gasses like carbon dioxide and methane into the atmosphere that contributes to an enhanced greenhouse effect which is warming our planet faster than before. The consequent increase in global temperature results in the melting of glaciers, rising sea levels, which in turn causes a number of calamities like cyclones, frequent floods, extreme heat and drought. On the other hand, generating electricity from solar panels does not produce any greenhouse gases and therefore helps to slow down climate change.

4) Lowers consumption of fossil fuels:

We have always largely depended on coal, oil and natural gas for our energy needs. Fossil fuels are finite in nature and cannot keep up with the increasing demand of energy and are major contributors for pollution. Solar energy, on the other hand, is abundant and can be endlessly harnessed to meet global energy consumption, reduce energy costs and ensure a stable energy future.

Process of Implementation of Solar Panel:

One of the more appealing aspects of going solar is the notion that a solar system will help offset part of or the entire electric bill.

Understanding the difference between your electricity needs and the capabilities of your system can prepare you for the reality of post-solar electric bills. Having a personal energy source (the solar system) does not mean that it is an unlimited supply of energy, but having the right system size and understanding your energy consumption can help you take steps to optimize your system's efficiency.

A solar system is sized according to your past 12-month energy consumption plus the solar capacity of your home.

It's important to be accurate in your energy consumption calculations. Without getting too in-depth, the easiest way is to contact your utility company and request your usage data for the past 2-3 years. One year is often enough, but if your energy needs have changed, it's not a bad idea to go back in time a little bit more to understand where your energy expenditures go. Getting an average is the only way to accurately determine actual consumption, since a solar system's energy output and your own consumption will vary month to month. Peak times could be summer when the A/C is running nonstop; or winter, when days are shorter, the lights are on more, and you heat your home with electricity. In ideal weather conditions (sunny yet pleasantly warm days in early fall, for example), you may end up overproducing. But in blazing hot July or dark and cold January, your solar system may only be able to cover a portion of your electricity consumption.

The offset (how much electricity your system can produce versus how much you actually use) is calculated on an annual basis (as an average of all months and all consumption rates). If you divide your total yearly solar production by your total yearly consumption, you may not come close to 100% offset depending on the size and efficiency of your system, and the location in relation to the sun.

The good news is that photovoltaic systems are becoming more and more efficient, and with a few considerations you may be able to achieve optimal offset.

Surendranagar - 15 kW (Najmi Masjid)

Step – 1

Calculating your electricity consumption

Get your usage history for the past 12 months, and calculate your average monthly consumption. You can also access this information if you keep your bills or pay your bills online. Again, keep in mind that energy use fluctuates wildly throughout the year, which is why an average is essential.

- What you want to look for is kilowatt hours (kWh). Add up the kWh for all 12 months.
- Divide that number by 12 to get an average. Then, divide the monthly consumption by 30 to arrive at your daily kWh usage.

Keep in mind that solar panels don't produce energy at night, and this is an important consideration when calculating the optimal system size for your property. This is where net metering comes in to balance out the difference between your system's production capacity and your consumption.

During the day, your system may overproduce electricity, sending it back to the grid and causing your meter to essentially run backward; at night, or on cloudy/rainy days, the panels are not producing energy, so energy is pulled from the grid. Your electric bill will reflect the difference between the energy you put into the grid and the energy you pull from the grid.

Step – 2

Determining Insolation

Before you look into the capacity of solar systems, you need to understand the insolation of your home. Insolation is not the same as insulation.

Insolation is the amount of solar energy available to you at your location by the amount of sunlight (most intense and direct) that falls on solar panels per day which is expressed in kWh/sq mtrs/day. Insolation varies according to season, latitude, atmospheric transparency, the slope of the ground and obstructions such as trees as well as high rise buildings surrounding your building. These factors affect how much solar energy actually reaches your solar array installed on your roof top.

India, for example, has 4 - 5 kWhours/day hours from 1kWp solar system installed. Not surprisingly, insolation affects temperature (the higher the insolation, the higher the average temperatures).

Step – 3

Calculating the size of your Solar system

Now that you know what your average daily kWh (units) consumption is, you can calculate the size of your solar system.

1) In India an average insolation is 4 – 5 kWh/m2/day. That means at crystalline panel efficiency (which are the kind used in rooftop systems due to their higher efficiency) we can generate 4.5kWh (average) of power per day from a 1kWp panel.

Hence divide Average daily consumption computed by an average insolation level (4.5kWh per day) to get the solar system size in kW.

e.g.
1. Av. Daily consumption = 20.47 kWh/day (assumption)
2.Av. Insolation level = 4.5kWh/day for 1kWp solar system
3. Size of solar system = 20.47/4.5
= 4.54kW
= 4540 watts

2) Now to decide nos. of solar panels required is as under.
If we want to install 330Wp capacity panel for our system then divide solar system size find out in 1 above by the capacity of one panel to be installed i.e. 4540 watts / 330 Wp = 13.76
Hence nos. of panels required will be 14 Nos.

Step – 4

Site Considerations

Once you know the capacity of the system, the next question is, where will you put the panels, and can your roof / terrace accommodate them all? A roof / terrace mounted system is the simplest and most cost-effective solution. However, not all roofs/terraces face south, and not all are big enough to accommodate the required number of panels.

A small, shaded, or unusually shaped roof / terrace will affect solar panel size, quantities, and efficiency. If you have a large usable roof/terrace area, you could sacrifice some efficiency and choose more, larger panels to achieve your target energy output. But if your roof/terrace isn't ideal; if the usable area is limited, the roof pitch doesn't face south, or the home is in partial shade, going with fewer small, high-efficiency panels will give you the greatest possible output.

Step – 5

Speak to vendors and obtain quotations for your requirement

Once the initial assessment of requirements, viz. a budgeted estimate of capital expenditure, available space and generation potential are carried out, the next step is to speak to solar vendors and obtain quotations. This serves the purpose of ascertaining the options available within your budget and adjusting your assessment for site-specific conditions.

Step – 6

Evaluate vendor quotations based on price, warranties and vendor credentials

Choosing a good vendor is critical to getting the most out of your rooftop PV system as carelessness in design or construction/installation can either significantly reduce the power output from your plant or deliver a plant that isn't suited to your needs.
A few things to keep in mind when finalizing a vendor are:

- Supplier Background & Credibility
- Ask for details of projects that they have already implemented
- Check if they are MNRE authorized, or registered under your state's energy development agency (or equivalent body)
- Check if the supplied products have been manufactured in a ISO-9001 certified plant
- Verify supplier's claims about the product/component with datasheets available on the manufacturer's website (e.g., if the supplier claims that the panels are suitable for coastal areas, check the product datasheet to see if it has cleared the salt mist corrosion test)

Step – 7

Operation Manual and Maintaining Daily Data Log

An Operation, Instruction and Maintenance Manual, should be provided with the system after completion and energization of the project by vendor.
The following minimum details must be provided in the manual:

• About the solar power plant – its components and expected performance.
• DO's and DON'Ts

- Cleaning of Solar PV Modules in regular intervals
- Clear instructions on regular maintenance and troubleshooting of solar power plant
- AS built Drawings for the Installation
- OEM Warrantee Certificates of Inverters, PV Modules, Batteries etc.
- Specification of PV Plant
- Data Sheets of major equipment like PV Module, Inverter etc.
- Name and address of the E.P.C Contractor and the contract person in case of non-functionality of the solar power plant.

MAINTENANCE OF SOLAR SYSTEM

It is better to be safe than sorry

Preventive Maintenance:

Preventive maintenance refers to the routine and regular maintenance of assets in order to keep them running and prevent any costly unplanned downtime from unexpected equipment failure. It is suggested that solar plants undergo preventive maintenance operations at least once a year.

This operation involves a comprehensive test of all physical and electrical components of an array, which includes the physical panel, racking setup, electrical connections and strings, utility meter and the inverter. If any of these components yield issues or suggest faults, corrective maintenance measures will be applied.

Corrective Maintenance:

Corrective maintenance is similar to the services done by a fire extinguisher. These activities restore the harm or exchange of failed components. Some corrective upkeeps, like inverter resets or communication resets can be activated remotely.

Corrective maintenance strategies help solve a live problem on site so operations can continue smoothly.

It includes

- Fault Diagnosis: Also known as troubleshooting, it involves identification of location and type of error. With continuous monitoring systems, this step can be fast tracked.
- Temporary repair: Restore the function of a component for a limited period of time.
- Repair: Restore the damaged function permanently.

Condition-Based Maintenance:

This maintenance strategy monitors actual asset working conditions to decide the type of maintenance it requires. In solar, this is accomplished through –

1. Remote Monitoring Systems: This provides information like battery voltage, battery charging state, performance metrics and module temperature. This is combined with live data logging.
2. Maintaining Daily Data Logs: It gives insights about energy usage and consumption. A multi-control status screen can allow users to access data logs of multiple sites at once. Therefore, control of every single module and string lies in the hands of the remote user. This reduces downtime by 80% as well as labor cost.

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