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FREQUENTLY ASKED QUESTIONS

DISCLAIMER

SOLAR ECONO



INTRODUCTION

You might have come across advertisements, or speeches by politicians and environmental activists, imploring you to switch to renewable energy. The supposed benefits of this change, they say, will be two-fold: to save money and secure a future which the coming generations can comfortably cherish.

And many of you may have paid heed to their bits of advice, considering to go solar but at the same time, you do have your concerns as well. For instance, is a solar system reliable? Is it costeffective? Does it really save any money for me or is this 'Go Solar and Save More' just a catchphrase employed by the corporations to make more money?

How does a solar power system actually work? How does it affect my home and neighborhood? What do I have to do to switch to solar energy? How many solar panels would I need? What would I do if there is a power outage? How can solar power cater to my energy needs at night? What if I cannot manage the upfront cost at once?

These are the questions our consultants frequently come across. While our doors are open for you to know more, we wished to prepare a handbook that will answer not only your frequently asked questions but discuss all the things you need to know before going solar. Let's go!





SOLAR ENERGY SYSTEM: AN OVERVIEW

A Brief History of Harnessing Solar Power

Humankind has been harnessing the sun's rays since time immemorial. Other than what is natural i.e. obtaining heat and light from the sun, humans used solar power as early as the 7th century B.C. In its most basic form, they'd use a magnifying glass to concentrate the rays onto a single point and cause it light a fire. Some centuries later, the concept of 'burning mirrors' was developed where large mirrors were used to light fires for religious ceremonies.

These were the early uses of solar energy. But as humanity progressed, the scientific knowledge kept accumulating, and so came the sophisticated technologies that enabled us to harness this power more efficiently and for a plethora of needs. Today, its applications range from powering our gadgets to households and from satellites to huge power plants. How did we get here?

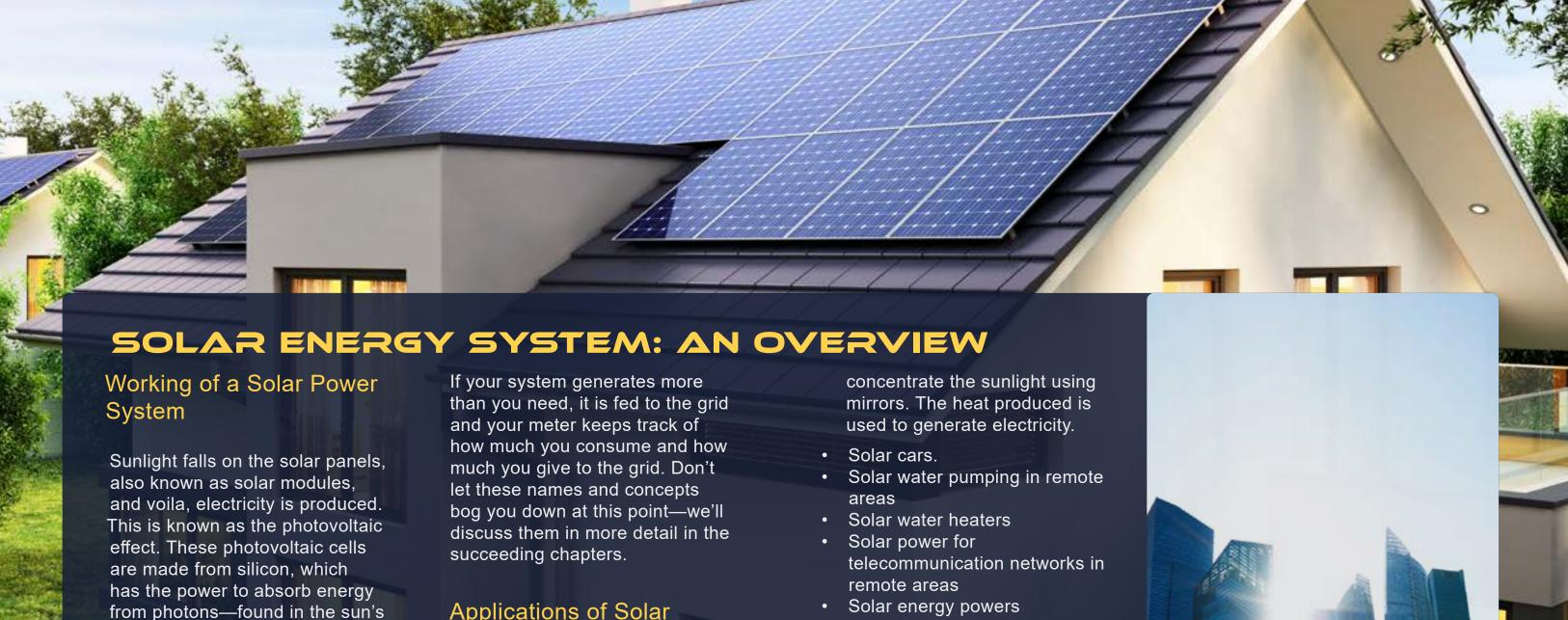
Many scientists credit Edmond Becquerel, a French physicist who, in 1839, discovered that light could augment electricity generation when two metal electrodes were placed into a conducting solution. This phenomenon, known as the "photovoltaic effect," proved effective in later Photovoltaic (PV) developments with different elements, notably selenium.

A few decades later, in 1883, Charles Fritts actually produced the first solar cells made from selenium wafers. For the same reason, some historians credit Fritts with the actual invention of solar cells.

Fast forward to 1954, three American scientists, Daryl Chapin, Calvin Fuller, and Gerald Pearson developed the first-ever silicon PV cell at Bell Labs. Since today's solar power is silicon-based and since it was the first instance where a cell could actually power an electrical device for many hours a day, many scientific historians credit these scientists with the invention of solar technology.

Regardless of who is the actual inventor, they all had a definite role in bringing us to where we are today. It is to the credit of these great names that contributed to

the development of making a solar system work. But how does it work?



Applications of Solar Energy

rays—and convert it to direct

But most of our electrical and

electronic devices use alternating

current (AC). To convert it to AC,

an inverter system is attached to

these panels. From the inverter,

this electricity is fed to your utility

meter and from there, to the main

switch. If this power is as per

your home.

your demand, it is consumed at

current (DC) electricity.

Solar power today is used in a diverse range of setups. The following outlines give us an idea of the applications of this precious—but abundant—commodity.

 Large-scale electricity generation. Here, Concentrating Solar Power (CSP) is used to efficiently used to generate electricity.

- Solar energy powers spacecraft, operating in the inner solar system
- Residential applications
- Portable solar power chargers

These are but only a few of the applications of solar energy. Some of them, such as solar cars, are still going through infancy. But as the pace of developments shows, the day isn't far where solar technology will become as ubiquitous as the sun itself.



BENEFITS: WHY SHOULD YOU GO SOLAR?

Solar energy brings with itself a host of benefits for the consumers. Below, we give an overview of some of those benefits. Keep in mind that this is not an exhaustive list.

Savings

Who doesn't wish to free him- or herself from the monthly hassles of electricity bills? With solar power installed on your rooftop, you can turn this dream into a reality. You not only reduce your electricity bill, but you can also altogether eliminate it.

Given that the electricity costs are getting higher, switching to solar power can save you big time. An example would help us to understand this. The average electricity bill throughout the US is \$111. In one year, it becomes \$1332.

In 20 years, this figure will amount to \$26,640. This is without factoring in the rise and unpredictability of electricity costs. By opting for solar, this figure becomes your savings!

Now, you might wonder, what about the upfront cost? First of all, there are programs such as Solar Econo's \$0 Down Payment Financing Program. Install solar power system today without a big upfront cost in easy monthly installments and you take all.

Our solar panels are long-lasting, with more than 25+ years of life span. Secondly, the payback time doesn't last long, usually five to seven years. Once you have paid, enjoy free electricity for the rest of your system's life. But when we say it's a good investment, we mean more than these savings. Keep reading and explore other benefits.

Take Control of Your Bills

Electricity costs are rising every year! As the graph by the U.S. Energy Information Administration below shows, prices have risen three percent annually and more than 70% in the last decade. Since most of our energy needs come from fossil fuels, these



BENEFITS: WHY SHOULD YOU GO SOLAR?

prices are more prone to fluctuations in the market.

With solar energy, you can shoo away your anxiety associated with climbing and unstable electricity prices. Besides, it lets you not only be energy independent but also makes your budget more manageable.

Increased Property Value

What if we told you that mounting a solar system on your rooftop adds 3-4% value to your home? That is true! According to a report by the Berkeley Lab, on average, homebuyers are willing to pay \$4 per watt for homes where the solar system is installed.

Average retail price of electricity, annual

Percent Indexed to 2002 as percent

40

20

202 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018

— United States ; residential

A 5-kilowatt solar PV system can add about \$20,000, or more, to your home's resale value.

Doesn't it sound amazing?

Durability

Solar panels are robust and come with up to 25 years of warranty. But some solar panels are designed to last for more than fifty years. Secondly, it doesn't ask for a thorough maintenance plan. All you need to is to clean it once a month so the accumulated dust doesn't affect the efficiency of your panels.

Remote Power

Solar power is of great utility for those living in remote locations. It may be too expensive or impossible to run power lines into your home. In such a scenario, a solar system becomes even handier, powering your home and fulfilling your other energy needs.

Clean and Green Energy

Solar energy is clean, green, and sustainable. Not only humans but animals and plants too pay—and have paid over the years—the price of fossil fuel consumption.

According to the US
Environmental Protection Agency, the average household emits roughly 20 metric tons of carbon every year. Turning to renewable energy sources, solar being the most notable and cost-effective of all, a typical household of two persons can reduce these emissions by 4 to 5 tons. Similarly, when many people start relying on solar energy, your utility uses fewer fossil fuels to meet the energy demand, thus fewer carbon emissions.





FINANCING OPTIONS

The solar system has a number of benefits. Fine. But how to finance it? What if you cannot manage the upfront cost but like to go solar, are there any options for you? Let's discuss the financing options.

Cash

This is simple. You do have the upfront cost, thus you can manage to install the system right away. Contact a good installer company, they'll offer the plans based on your needs.

You select the one that suits you, they install it, you pay them and it's done. In this case, you receive the most benefits such as all the tax credits and incentives offered by your state, the federal government, local bodies and other organizations.

Solar Loans

You don't have the upfront cost? It is okay. There are some financial institutions that offer soft loans to those who want to go solar.

This loan can be obtained if you have a fair to good credit score. Some solar companies have partnered with financial institutions that can enable qualified citizens to install a solar system at as low as \$0 down payment.

Both cash and solar loan enable you to claim the Federal Income Tax Credit and other rebates. In a solar loan, the interests you pay on your loan may be tax-deductible. More savings? Yes. Even if you obtain the system on loan, you can still save 40 to 70 percent on your monthly bills over the lifespan of your system.





FINANCING OPTIONS

Lease

A lease is like renting a solar system. It's another option you may consider if you want to avoid the upfront cost. If you lease a solar power system, you don't own it—it is the property of the solar company, or a third party, who pays for it. You just have to pay a monthly agreed-upon fixed amount for the time of your agreement, usually 20-25 years.

At the end of the term of your agreement, you may buy the system at its market price.

Power Purchase Agreement

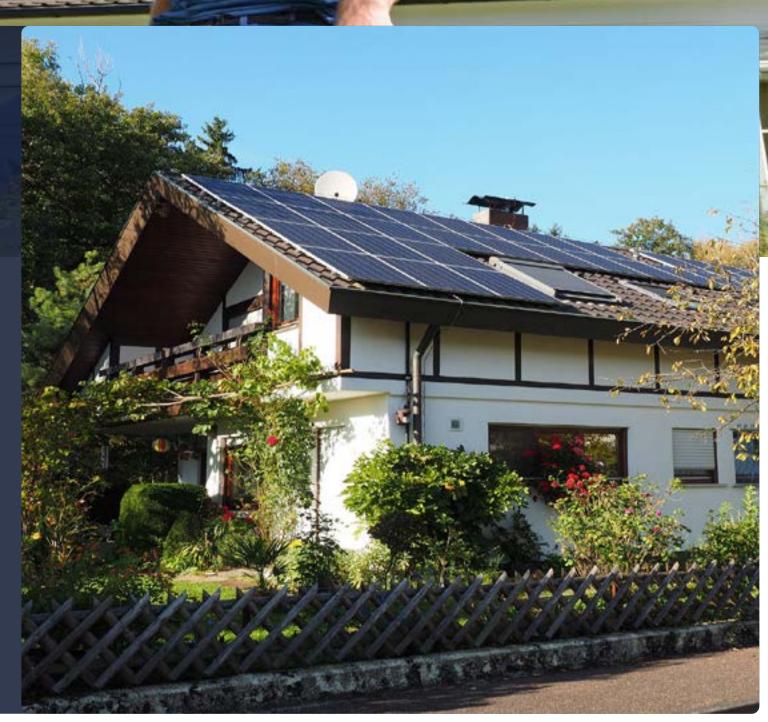
Power Purchase Agreement (PPA) is almost like a solar lease. The key difference here is, in the

former, the homeowner rents the solar system and its components and pays for it. In PPA, the third party installs the solar system and sells you the electricity you use.

It may be fixed, or variable, as the agreement may be.

The latter two options allow you to save 10 to 30 percent per month over your electricity bills. And all this, without incurring the upfront cost.

However, since it is the solar company or a third party that owns the system, it is they who are eligible for the tax credits and other incentives and not you.





INCENTIVES AND REBATES

Here is a brief breakdown of the incentives and rebates programs the federal or state governments provide to the Americans. The goal here is that more people should turn to renewable energy sources.

Net Metering Policy

What is net metering? When you, being someone who has installed a solar panel system, produce electricity from the system, it goes to the grid. Your utility gives you 1kWh power for 1kWh your system produce. But what if your system generates excess power? Fret not! Most states have offered this incentive where if your system generates excess power, that will be fed to the grid. At the end of the month, if your consumption and generation matched, you won't have to pay

any bill. If however, your system generated more, you'll be given a credit for that power.

Federal Income Tax Credit

Currently, this Tax Credit stands at 26% of the total cost of the system. That is, if your solar power system is worth \$10,000, you will be given \$2,600 back in the form of a tax break.

This incentive, however, has an expiry date. As the table below shows, you can only claim 22% of the cost of the system in 2021, 10% in 2022, and 0% (for residential installations) in 2023. Now is the best time to turn your rooftop into your own little powerhouse and earn 26% of your cost back.

SR. NO	YEAR	SOLAR INVEST CREDIT
1	2018	30%
2	2019	30%
3	2020	26%
4	2021	22%
5	2022	10%
6	2023	No Longer Available For Residential Solar Installa- tions



State and Local Incentives

Other than the above, there is another group of incentives offered by the state and local governments. While the space doesn't allow us to go state-specific here, generally, the following are the incentives offered by different state and local stakeholders.

i. Rebates

This is a cash rebate that you receive after installing your solar system. It can come from your state or local government, utility, municipality, or other organizations that want to encourage more people to adapt to renewable energy. This further reduces your upfront cost.

ii. Tax Credits

This is an additional tax break you may avail by going solar.

Residents of the said states can claim this credit after installing a solar power system in their homes.

iii. Solar Renewable Energy Certificates (SRECs)

Laws in some states require utility companies to generate a definite percentage of power from solar energy. Now, if you live in any of those states and have a solar power system installed, you can obtain these certificates after selling the surplus energy to your utility company.

iv. Tax Exemptions

In addition to the above, some states and local governments provide property tax exemptions for the added value of your home after installing solar.



But this increase will not be counted while assessing your tax liabilities.

Besides, there is a sales tax exemption program in many states—which means you don't have to pay tax on installing a solar system.

These incentives greatly reduce the cost of your system and can save hundreds (or even thousands) of dollars.

Keep in mind that they vary from state to state. Check with your state or your installer company, they will give a thorough appraisal of the incentives you may be eligible for.



COMPONENTS OF A SOLAR

SYSTEM

Usually, when we think of a solar panel system, a set of rectangular PV cells come to mind. But behind the scenes, different equipment is at play to turn your power system on. They are the modules, batteries, inverter, mini inverters, frames, breakers, relays, grid, and wires.

Let's discuss each of them separately.

Solar Panels

These are also known as solar modules. A combination of many solar panels, such as 10 panels, forms an array. We can rightly call these panels the heart of the solar system. It is made of silicon, metal, and glass—silicon being its essence.

You would have noticed squares on a solar panel. They are the cells, each panel arranged in a configuration that contains 32, 36, 48, 60, or 72 cells. For commercial setups, panels consisting of 72 cells are usually preferred since they are cheaper to install on a larger scale and generate more electricity than those with fewer cells.

Similarly, panels consisting of 60 cells are more preferred for

residential units since they are lighter and easier to install. But other than the divisions based on the number of cells, panels vary based on how they are made. Usually, any solar panel that you may have seen will be any of the below three.

i. Monocrystalline Solar Panels

As the name suggests, each cell of the monocrystalline panel is made from a silicon wafer that is made of a single crystal of silicon. Since it is made from a single crystal, the electrons have enough room to move easily. That means higher efficiency. Of all the available PVs, mono has the highest efficiency, ranging from 17 to 22 percent. This is also the most expensive of all.

ii. Polycrystalline Solar Panels

Also known as multi-crystalline, they are not made from a single silicon crystal. Instead, many fragments of silicon crystals are melted to form wafers for the panels. They have lower efficiency, ranging from 15 to 17 percent. Since they are cheaper to manufacture, they have a lower price than monocrystalline panels.

COMPONENTS OF A SOLAR SYSTEM

iii. Thin-Film Solar Panels

Unlike the above two, thin-film solar panels are made from a variety of materials.

Their process of construction is also different, where a photovoltaic substance is deposited on a solid surface, typically glass.

These photovoltaic substances may be cadmium telluride (CdTe), amorphous silicon (a-Si), copper indium gallium selenide (CIGS), and dye-sensitized solar cells (DSC).

They are lightweight and can even be made flexible. But their efficiency is the lowest of all, between 10 and 13 percent, and for the same reason, are cheaper than the above two.

Inverters

Inverters are vital components of a solar system. Its role is to convert the DC electricity to AC electricity, making the power suitable for our needs.

Had inverters not been there, we would have to switch our whole household electricity system to DC-based.

Given that there are many types of inverters available in the market, a brief overview of each would help us understand the differences among them.

i. String Inverters

Its name says it all. This inverter is attached to the solar arrays—the combination of several panels—directly. Each cell is directly connected to the inverter,

from where it converts the DC coming from each string to AC and sends it down to the main switch.

A string inverter is a cost-effective and short-term solution and can work best for a row of 5-10 solar panels. Therefore, you can save more by installing one string inverter instead of going for 5-10 micro-inverters.

One of the disadvantages of a string inverter, however, is that the strings attached to it don't work as individuals but more like a team. If one of the cells breaks down, or comes under a shade, the performance of all is affected.

Secondly, if in the future, you wished to increase the number of

your modules—panels—you will have to install a new inverter. This will increase your upfront cost.

ii. Microinverters

Microinverters are attached to each solar panel. The conversion from DC to AC happens separately in all inverters and from there, this current is fed into the main switch.

Since they work individually, the performance of all is not affected in case one cell—or inverter—experiences a problem. They are used both in commercial and residential units.

Another benefit is that if you wanted to expand your system in the future, you won't need reinstallation of the existing panels and inverters.



COMPONENTS OF A SOLAR SYSTEM

Just add cells and the same number of inverters, and congratulations, your system is updated.

iii. Hybrid Inverters

These inverters are combining technology that mixes inverters and batteries. In this arrangement, the inverter is connected to the batteries, solar panel system, and grid. It's an all-in-one inverter responsible for many functions.

Primarily, it converts DC to AC but it also monitors the charge in batteries and controls this charge. Other than this, when the batteries are charged, and there is excess power, it sends that back to the grid using the charge controller.

iv. Central Inverter

This works a lot like a string inverter. The notable difference between the two is that the string inverter converts DC to AC coming directly from each string.

In the central inverter, however, the strings are not directly attached to the inverter but are fed into a common combiner. The collected DC from that combiner then goes to the central inverter, where it's converted to AC.

Batteries

Another key component of the solar system is batteries provided that you are using an off-grid or a hybrid system. The market is flooded with different types of batteries, each calling itself the best. Let's see which one could work best for your system.

i. Lead-Acid Batteries

Lead-acid batteries are a triedand-tested technology, serving the car industry and off-grid solar system for decades.

As compared to its competitors, they are less expensive and work well for a home that wants to go off-grid cost-effectively.

Their downside is, they have a shorter life-span and lower depth of discharge—the amount of battery's capacity that can be used.

ii. Lithium-ion Batteries

Unlike their lead-acid counterparts, lithium-ion batteries are more compact and lighter. They have a higher depth of discharge and longer lifespan.

More importantly, they don't require refills and maintenance.

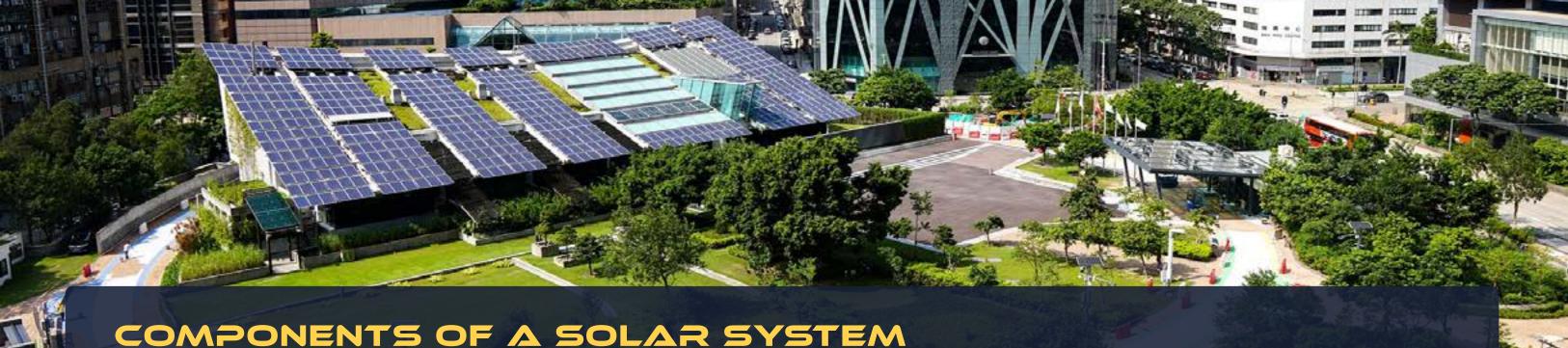
If you want your batteries to work for a longer period, lithium-ion is the best choice for you. However, they are expensive as compared to lead-acid batteries.

iii. Flow Batteries

While not popular like lead-acid and lithium-ion, flow batteries are making their presence felt everywhere.

They are suitable for longduration storage, with no limitation on its cycle.

In fact, some developers opine that the flow battery's technology has no cycling limitations, and can be charged and discharged



COMPONENTS OF A SOLAR SYSTEM

altogether without having a significant impact on its lifespan. They have the highest depth of discharge and can tolerate extreme temperatures.

Their downside is, they are more expansive than both lead-acid and lithium-ion batteries.

Racking – How to Mount Solar Panels

i. Rooftop Mounting

In residential units, this is the most common mode of mounting solar panels. While mounting your solar panels, you should be careful about the direction, pitch angle, shape, and size of the roof. The main aim is, to keep the panels in such a position to receive the maximum sunlight.

Ideally, your home should have a large, sunny, south-facing roof with a 30-degree pitch and no shading. Should you have an ideal roof? Not really. Even if it is not, your solar company will install the panels in such a way that will work best for you.

ii. Placing PVs on the Ground

Only rooftop is not the favorite habitat of solar panels. Since rooftop-mounted panels serve a residential unit well, and also there is little space in homes, we don't often see ground-mounted panels in residential areas.

Usually, for commercial usage, the PVs are installed on the ground as their energy needs require a bigger solar plant. These panels can be mounted in two ways. A standard ground mount is where panels are fixed on the ground in one place.

Another way is mounting them on poles. One advantage of the latter is that it can incorporate a tracking system, which allows panels to follow the path of the sun—exactly like a sunflower.





CONNECTING YOUR SOLAR SYSTEM TO GRID

One of the notable concerns of our customer has been this: How to connect a solar system to the grid and if there are different arrangements through which we can tailor our system to our own needs. This chapter explores different arrangements in which you can connect your solar system to your grid.

Direct Grid-Tie System

In this arrangement, your solar system is connected directly to the grid. You use the electricity you generate. But what about the night? Since your solar system won't work at night, you'll have to use the electricity coming from the grid.

Its benefits are manifold, notably the credit system. The excess power your system generates is fed into the grid. At the end of the month, if your system produces more power than you consume, you'll be given a credit for that. If your production and consumption matched, well, you won't have any electricity bill.

There is one downside to it and that is, what to do during a blackout? Let's explore more

arrangements to address what can we do about that.

Off-Grid or Battery-Based Grid System

In this arrangement, your solar system is not connected to your main grid but batteries. These batteries store the excess power your system generates for your night needs and other unexpected circumstances.

But setting up this system requires more upfront cost than the ongrid system as there have to be additional batteries that can store power at least for two days.

Even then, this arrangement still may not shield you from the long power outages. Also, you will have to change batteries more often as you primarily depend on them.

So what to do now?

Let's move to our next arrangement and that is the Hybrid System.

Hybrid System

As the name suggests, a hybrid system is a combination of the above two. In this arrangement, your solar system is directly connected to the grid as well as



CONNECTING YOUR SOLAR SYSTEM TO GRID

batteries.

You use the power your system generates during the daytime, and at night, your system automatically switches to the electricity provided by the grid.

But since there are batteries attached, you don't need to worry during power outages as power stored in batteries will cater to your needs.

At the end of the month, if your system generated more power than you consumed, you receive credit for that. Vice versa, you receive your bill—which surely is way less than your usual bill.



But Which System is Right for You?

With batteries or without batteries? It depends on your budget, needs, and preferences.

Your solar installer company will guide you with better insights after analyzing your preferences, usage, needs, lifestyle, and budget.

A general rule is if you live in an area with power outage issues, or hurricane-prone areas, the battery system or hybrid system is for you.

If you face two to three outage issues annually, then you can go for the direct grid-tie system.



What should I do to go solar today?

Call us. One of our consultants will appraise your energy's needs based on your monthly electricity bills.

They'll assess your area's climate, your roof structure, angle, pitch, and orientation and suggest a system that would work best for you home.

If you are happy with the plan, it's almost done.

How long will it take to install a solar power system in my home?

Not much. It may take a day or two, depending on your location and home parameters. Our crew is professional and well-versed in the solar technology.

Once the contract is finalized, we prioritize installing the system within a day, without any compromise on the quality of the work and equipment during installation.

What if I decide to move?

If you own the system, the new owner will pay for the system. A solar home is sold at premium. Studies shows that a solar home is preferred 20 times more than a non-solar home.

But if you want to take it with yourself, the dismantling, transportation, and reinstallation of the system may cost you a little. If it's on lease or power purchase agreement, we make it easy for you to transfer your agreement to the new homeowner.

When you decide to move, give us a call, we'll find an easy solution for you based on your preferences.

4. Does solar add value to my home?

Yes. Studies show that installing a solar system increases the value of your home by 3-4%. A 5-kilowatt solar PV system can add about \$20,000 to your home's resale value.



Since you are not owning the system, the value of your solar system is not included in the assessment of your home's value. But it still sells guickly

and is preferred over those homes which don't have the system installed.

• What difference, if any, would I feel after I go solar?

Your lights, air conditioners, refrigerators, and other electrical and electronic appliances would work as they did earlier.

The only difference you would feel is your savings on electricity. You won't pay exorbitant bills every month, and can even sell to your utility company if your system generates more power than you need.

How can I sell electricity to my utility company?

Through an arrangement known as net metering. This means that a twoway meter keeps track of the electricity you draw or send to the grid.

When you draw, the meter runs forward; when you send, the meter runs backward. At the end of the month, your bill would tell you how much your utility owe to you or vice versa.

Which financing option is good for me?

There is no a one-size-fits-all answer for this. It mainly depends on your budget and how much you like to spend on the system.

Cash would work best for everyone. But if you lack the upfront cost, the rest of the options will still save you much more than you currently spend programs.

Must I go solar?

Yes, if you want to save more money as well as the environment. Going solar, as is presumed, is not only about the environment.

It is about saving your hard-earned money as well. Similarly, going solar gives you energy independence and shields you from the rising and fluctuating electricity costs.

What would I do if there is a blackout?

If your system is grid-tied, your system won't give you any light during the nighttime. But if it is off-grid, the blackouts won't affect you.

The latter, however, is comparatively expensive as large storage system is necessary. This is why, to avoid the blackouts, install a hybrid system. In this system, your usual energy needs come from your solar system and the grid. During a blackout, batteries would cater to your needs.

How do I know if my home is good for a solar system?

It depends on the sunlight your area receive daily. But it also depends on the electricity costs in your state and your home parameters. Contact us and one of our consultants will run a cost-benefit analysis of the system and will guide you further.

Even if your home is not ideal, solar can cater to your needs well, saving your money.



You can renew your lease agreement; you can also buy the system at its fair market price, or else return the system to your solar lessor.

Does a solar system work in winter?

Yes. While a solar system generates more electricity during summers, they are designed to work in all seasons including winters.

Does a solar system work if snow is accumulated on the panels?

Since PV cells generate electricity from the sun's rays, if they are blocked by the snow, they won't generate electricity.

But the panels are installed in a slope, allowing the snow to slide down itself. If it is accumulated, you have to remove it to enable the panels to generate power.

What is kW and kWh?

Kilowatt (kW) is a unit of power. It tells us about the rate of production or consumption of an electrical/electronic device.

While kilowatt-hour (kWh) is the unit of energy. It tells us about the power used in an hour. For instance, if a 50-watt bulb is kept on for 20 hours, it'd use up one kWh. Similarly, a 1000-watt device would take one hour to consume one kilowatt of power.

In case you have further questions, don't hesitate to contact us.

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Disclaimer

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