

COUNTRY LIVING
OFF GRID
SOLAR ENERGY

Can I connect an inverter to my solar panels without involving batteries? If yes then how?

Yes. There are two ways to use solar without batteries:

1. Grid-Tied. This is connecting your solar panels directly to the electricity grid using a DC-to-AC "grid-tied" inverter. The inverter converts the DC output of the solar panels to AC electricity that is synchronized to the grid. In this case, the solar is not directly powering your loads, but as long as your loads are connected to the grid, the solar can offset your energy consumption
2. Direct. You can connect your solar panels directly to a DC load (perhaps requiring a voltage regulator, depending on your load). Or, you can connect panels to a non-grid-tied DC-to-AC inverter, and drive an AC load directly. In these cases, you need a load that is "ok" with an intermittent power source. I have seen these approaches used with irrigation pumps, where you only get pumping when the sun is shining.

The vast majority of solar installed globally is grid-tied, and without batteries.

What is an intermittent power source?

An intermittent energy source is any source of energy that is not continuously available for conversion into electricity and outside direct control because the used primary energy cannot be stored. Intermittent energy sources may be predictable but cannot be dispatched to meet the demand of an electric power system.

https://www.youtube.com/watch?v=_MmbmK2P6H4

<https://www.youtube.com/watch?v=YqrfZvmfHQQ>

<https://www.youtube.com/watch?v=omhPFacZGqY>

<https://www.youtube.com/watch?v=Z3SRTWw1uI0>

How to Install Solar Panels & Inverter for Home-Step by Step Guide

Solar Inverter Setup

- 1) Two 150 watts solar panels (Poly Crystalline PV Modules)



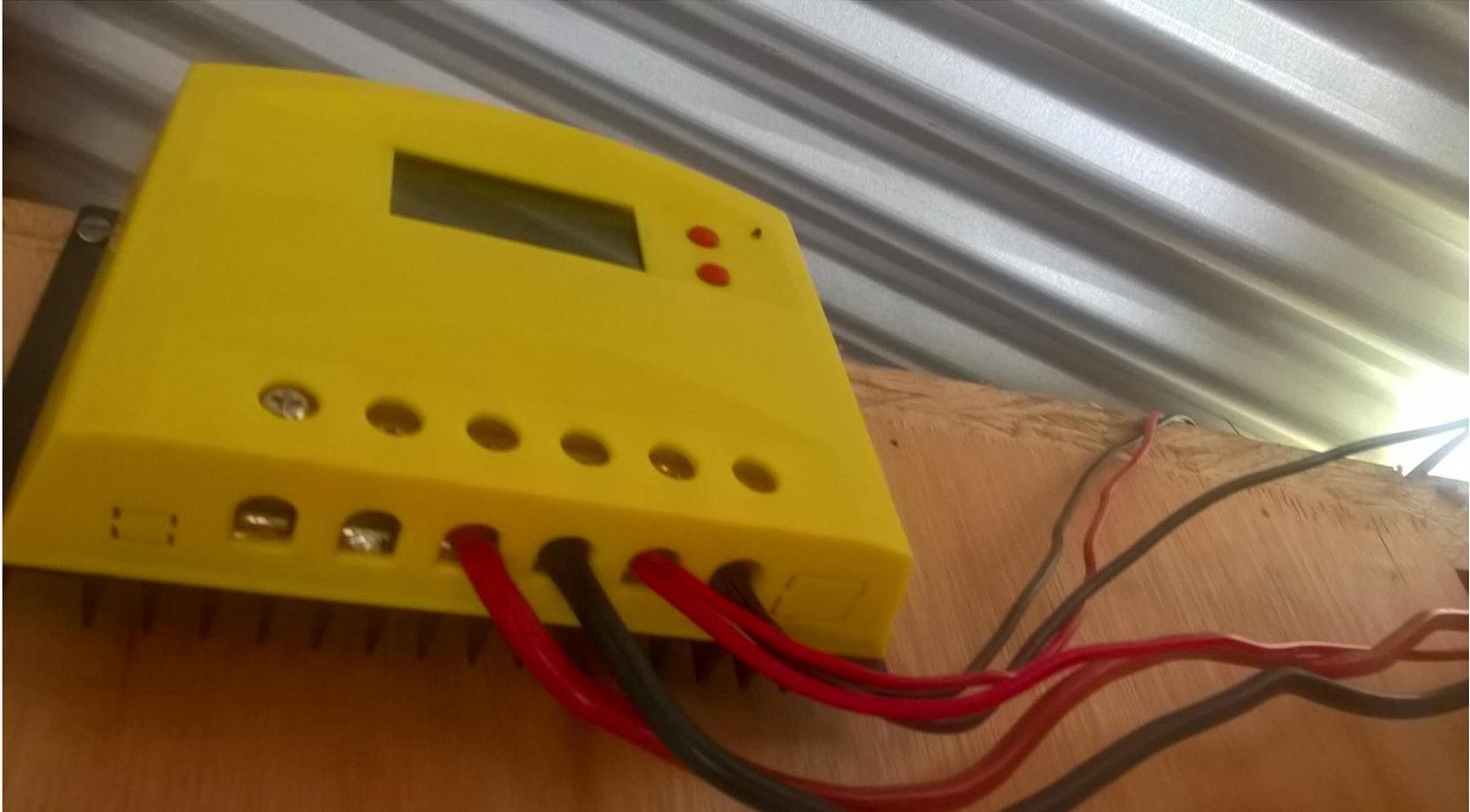
2) Luminous 300-600 [Kilo-Volt-Ampere] sine wave (battery) inverter



3) One 200 ah Exide Invertor Plus Battery

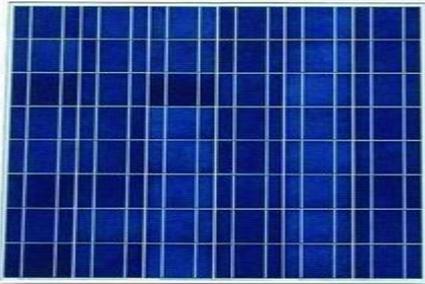


4) 24v, 40amps PWM [Pulse Width Modulation] Solar Charge controller



Solar Cost Estimation

300 WATTS Polycrystalline solar panels → 2 x 150 watts panels



How to Buy Solar Panels?

For our setup, we have 2 Nos of 150 watts (12v) panels

2 x 150 watts panel = 300 watts

Types of Solar Panels available in market

There are two types of solar cells available in market,

Mono crystalline solar panels and Poly crystalline solar panels

Mono crystalline is expensive and little more efficient than poly crystalline.

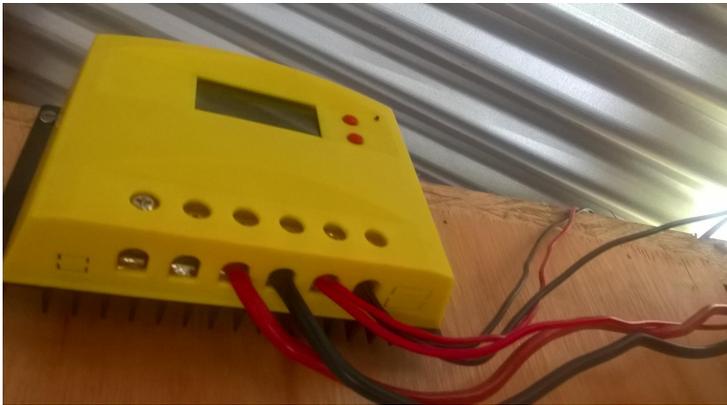
Poly crystalline solar panels are affordable, widely available and best seller in market.

How To Use Solar Inverter

Here we are going to use normal sine wave inverter for our setup,

Few Branded solar hybrid inverters are also available in market, they have inbuilt solar charge controller, but they are too expensive and most solar technicians follow this method of using normal sine wave inverter with solar charge controller.

What is Solar Charge Controller?



The current we get from solar panels will not remain constant throughout the day, so many ups and downs will be there, so that we can not connect solar photo voltaic modules directly to charge our battery, it will spoil our battery over time.

So, we need a device called solar charge controller to control the current we receive from solar panels, the charge controller has inbuilt PWM (pulse width modulation) charger to charge the lead acid battery in three stages, which ensures long life for battery.

In this 300 watts solar setup, we will get 200 watts current for sure from solar panels in day time which means 8 am to 5 pm

We can use the free current from PV modules during this day time by manually switching off the Input to Inverter (power supply from grid), so that the inverter battery will be charged with available solar power.

While the battery is getting charge from solar panels, concurrently we can use the battery power to power up our home.

So, with solar power, the battery will be get charge and on the other side the battery will deliver current to inverter for powering up our gadgets, this happens simultaneously.

Caution

As we have only 300 watts solar panel setup, we should not use more than 200 watts power from inverter during day time.

We use 220 watts power during day time, then what happens to the excess 80 watts of current generated by solar panels?

The excess 80 watts will go directly in to your battery storage, not only that 80 watts, if you switch off the LVD TV for 5 hours in day time, that 80 watts used by LCD also goes to battery storage directly.

So, you can use the excess current during night time, as you have heavy power cut even at night time, we should limit our power usage to 200 watts/hr during day time, the excess 100 watts/hr will be stored in the battery. we can use it later during nighttime.

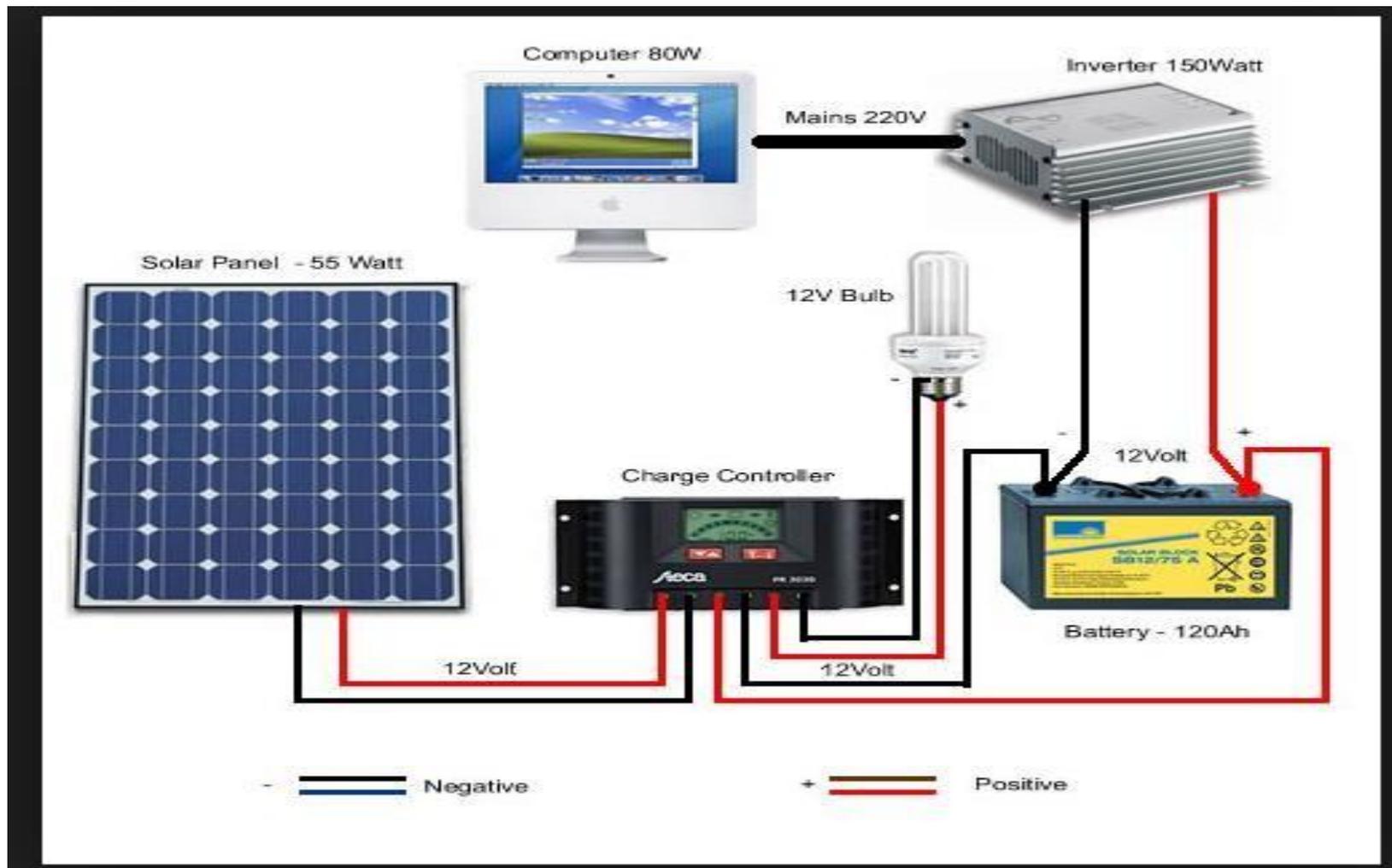
MOST IMPORTANT THING TO REMEMBER !

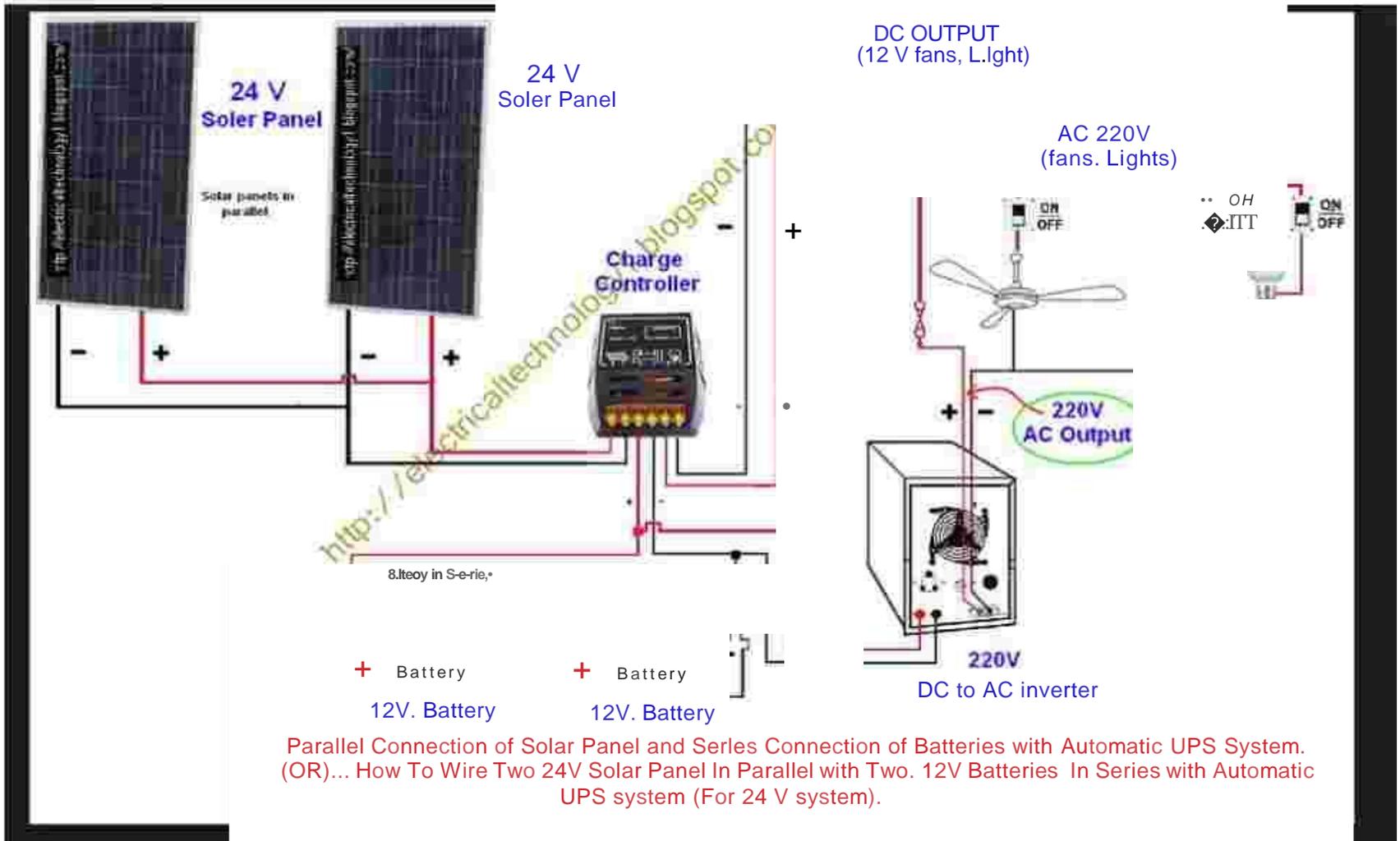


In this whole setup, one thing you should remember is

Point No.1 → Manually switch off the Grid power supply to inverter every morning 7 or 8 AM (according to the availability of sun light)

Point No.2 → Manually switch on the Grid power supply to inverter on evening time, when sunlight goes off.





What is Solar Net Metering and How Does it Work



Many consumers who are thinking about going solar have heard the term “net metering” but aren’t sure what it means.

What is Net Metering?

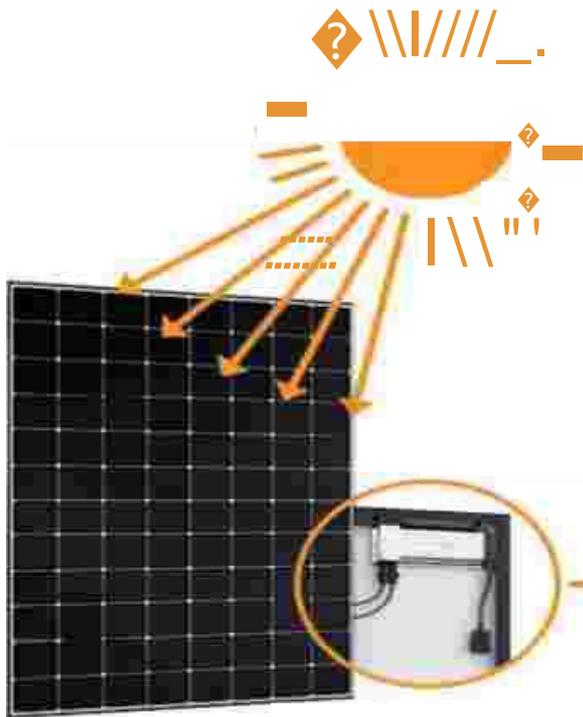
Put simply, net metering is a utility billing mechanism available in most states that offers a credit to residential and business customers who are making excess electricity with their solar panel systems and sending it back to the grid.

How Does Net Metering Work?

When you have a rooftop solar system, it can often generate more electricity than you consume during daylight hours.

With net metering, the homeowner is only billed for the “net” energy used each month, that is, the difference between the energy produced by the solar power system and the energy consumed by the house over the monthly billing period.

When your house or business is net-metered, you’ll see the meter run backwards, and that means, depending upon local policies, you may get a credit to hedge against the electricity you use from the grid when it’s not sunny or at nighttime. You are then billed only for your “net” energy use. The excess energy generated gets put back to the grid for your neighbors to use. (Read about [net metering for businesses](#) on the SunPower Business Feed.)



Solar Energy System

Energy from the sun is converted into electricity for your home.

Net Metering

Electricity you don't use gets sold back to the utility company.

Inverter
(DC in / AC
out)

Home
Electrical
Panel

Utility Meter

Utility
Grid

SUNPOWER™

The Benefits of Net Metering

Net metering can save homeowners hundreds of dollars on their utility bills every year, so it's a good reason to make the money-saving choice and go solar sooner rather than later.

There's another benefit from net metering. Since your solar system is generating electricity near the point where it will be used, this reduces strain on the grid's distribution and transmission infrastructure and minimizes energy loss from sending voltage many miles from the nearest power plant. While some claim that net metering represents an unfair burden on non-solar electricity customers, [many net metering cost-benefit studies](#) have found the opposite to be true.

Pros and Cons of Monocrystalline vs Polycrystalline solar panels

Published on 08/23/2017 by [Andrew Sendy](#), updated on 03/06/2019

Read time: 6 minutes

What are the pros and cons of Monocrystalline, Polycrystalline and Thin Film solar panels?

There are 3 types of technology utilized in the solar panels available on the market today, these are monocrystalline, polycrystalline, and thin film amorphous.

As the names suggest Monocrystalline and Polycrystalline are both types of solar cells that are made from crystalline silicon. Almost all quotes you will get when considering buying solar panels for your home will use [crystalline solar panels](#).

2-3 years ago the most common type of [solar panel](#) used in residential solar installations in America were monocrystalline solar panels but in the last three years polycrystalline solar panels have become the most commonly used [solar panels in residential solar installations in America](#).

These types of crystalline silicon solar panels are known in the industry as simply 'Mono' or 'Poly' panels.

It is more important that you choose a good brand of solar panels. A [good brand of solar panels](#) is from a company that invests heavily in the quality of their manufacturing process and invests heavily in their reputation.

The five best solar panels based on consumer reviews in 2019

SolarReviews has a list of the [top 20 solar panels in 2019](#) based on reviews by actual residential solar panel owners. The top five based on customer ratings are:

1. [SunPower](#)
2. [LG Solar](#)
3. [SolarWorld Americas Inc.](#)
4. [Canadian Solar](#)
5. [Silfab](#)

Both monocrystalline and polycrystalline solar cells are very similar in performance. What really determines your outcome in terms of system performance over the lifetime of the [solar panel](#) is a lack of defects in the manufacturing process and having a company that will replace the panels if their performance falls below the warranted levels.

Thin film is a totally different technology. It is much less efficient and therefore uses much more roof space. Its one advantage is that it performs better in low light conditions, when there is partial shading of the system or in extreme heat.

The key facts about each type of solar cell:

Monocrystalline



Overview and Appearance

This is the oldest and most developed of the three technologies. Monocrystalline panels as the name suggests are created from a single continuous crystal structure. A Monocrystalline panel can be identified from the solar cells which all appear as a single flat color.

Construction

They are made through the Czochralski method where a silicon crystal 'seed' is placed in a vat of molten silicon. The seed is then slowly drawn up with the molten silicon forming a solid crystal structure around the seed known as an ingot. The ingot of solid crystal silicon that is formed is then finely sliced ingot what is known as a silicon wafer. This is then made into a cell.

The Czochralski process results in large cylindrical ingots. Four sides are cut out of the ingots to make silicon wafers. A significant amount of the original silicon ends up as waste.

Polycrystalline



Overview and Appearance

Polycrystalline or Multicrystalline are a newer technology and vary in the manufacturing process.

Construction

Polycrystalline also start as a silicon crystal 'seed' placed in a vat of molten silicon. However, rather than draw the silicon crystal seed up as with Monocrystalline the vat of silicon is simply allowed to cool. This is what forms the distinctive edges and grains in the solar cell.

Polycrystalline cells were previously thought to be inferior to Monocrystalline because they were slightly less efficient, however, because of the cheaper method by which they can be produced coupled with only slightly lower efficiencies they have become the dominant technology on the residential solar panels market.

In November 2015 Trina Solar announced that it had produced a multi-crystalline cell with efficiency of 21.25%. This should allow them to produce polycrystalline modules with efficiencies between 18-20% a concept that was thought impossible as recently as 2013.

Underpinning the new record for p-type multicrystalline solar cells has been the continued quality improvements of multicrystalline wafers that have helped pushed standard 60-cell multicrystalline panels from 240W to 260W in recent years.

Polycrystalline are now very close to Monocrystalline cells in terms of efficiency.

Source: www.pv-tech.org/news/trina-solar-sets-new-21.25-multicrystalline-cell-efficiency-record

Thin Film



Overview and Appearance

Thin film panels are a totally different technology to Mono and Polycrystalline panels. They are a new technology compared to Mono and Polycrystalline cells and would not be considered a mature technology as vast improvements in this technology are expected in the next 10 years.

A thin film panel can be identified as having a solid black appearance. They may or may not have a frame, if the panel has no frame it is a thin film panel.

Construction

Thin film panels are made by depositing a photovoltaic substance onto a solid surface like glass. The photovoltaic substance that is used varies and multiple combinations of substances have successfully and commercially been used. Examples of the most common photovoltaic substances used are:

- Amorphous Silicon
- Cadmium Telluride (CdTe)
- Copper indium gallium selenide (CGIS)
- Dye-sensitized solar cell (DSC)

Each of the above are known as different panel 'types' but all fall under the umbrella of being a Thin Film panel.

Performance

Thin film cells have got a reputation as being the 'worst' of the [solar panel](#) technologies because they have the lowest efficiency. However, this is only because they have a lower power efficiency which only means they require the most space for the same amount of power. Since they are becoming the cheapest panels to produce because of the low material costs for thin film they are quickly becoming the more economically efficient panel types.

Depending on the technology, thin-film module prototypes have reached efficiencies between 7–13% and production modules operate at about 9%. Future module efficiencies are expected to climb close to the about 10–16%.

The market for thin-film PV grew at a 60% annual rate from 2002 to 2007. In 2011, close to 5% of U.S. photovoltaic module shipments to the residential sector were based on thin-film.

Advantages of Monocrystalline

1. Monocrystalline solar panels have the highest efficiency rates since they are made out of the highest-grade silicon. On October 2 2105, SolarCity announced that it has developed the world's most efficient solar panels. The new panels convert more than 22% of sunlight into electricity.
2. Just days later Panasonic announced it had trumped that achievement. A Panasonic [solar panel](#) has established a new world record module conversion efficiency of 22.5% on a commercial sized prototype using solar cells based on mass production technology. The test results were confirmed by the renowned [Japanese National Institute of Advanced Industrial Science and Technology](#). The 72-cell, 270-watt prototype incorporates newly developed enhanced technology that will eventually be scaled into volume production.

3. Panasonic also says it is introducing the HIT® N330, the latest addition to the company's high-efficiency hetero-junction photovoltaic module product line and its most powerful photovoltaic module to date. It will be available in the UK and other European markets starting in March, 2016. Manufactured at Panasonic's state-of-the-art, vertically integrated solar fabrication facilities in Malaysia, HIT® N330 features 19.7% module-level efficiency and a nominal power output of 330 watts.
4. Monocrystalline silicon solar panels are space-efficient. Since these solar panels yield the highest power outputs, they also require the least amount of space compared to any other types. However, monocrystalline solar panels produce marginally more power per square foot of space used in an array and so.
5. Monocrystalline Panels have a long lifespan. Most [solar panel m](#)anufacturers put a 25-year warranty on their monocrystalline solar panels. Because both types of crystalline solar panels are made from crystalline silicon, a very inert and stable material it is very likely that these solar panels will last much longer than their 25 year warranty life.

6. Monocrystalline solar panels tend to be more efficient in warm weather. With all solar cells electricity production falls as temperature goes up. However, this degradation of output is less severe in monocrystalline panels than polycrystalline solar panels. However, in practice the difference is very small. The level to which each solar panels production falls as temperature increase is called the temperature co-efficient and is published with the specifications for each panel.

This article is solely about different types of solar panels. If you want to learn about what other equipment a photovoltaic system consists off, go to [Solar Power System](#).

Disadvantages of Monocrystalline solar panels

1. Monocrystalline solar panels are the most expensive. In recent years a rash in installation of polycrystalline ingot, cell and module production efficiencies have mean that polycrystalline [solar panel](#) have become more common and have benefited from costs advantages over mono panels. Most manufacturers that still make mono panels have targeted the premium end of the market.
-

Advantages of Polycrystalline solar panels

1. The process used to make polycrystalline silicon is simpler and cost less. The amount of waste silicon is less compared to monocrystalline.
2. Polycrystalline solar panels tend to have slightly lower heat tolerance than monocrystalline solar panels. Polycrystalline solar panels will tend to have a higher temperature co-efficient than solar modules made with mono cells. This means that as heat increased output for this type of cell will fall less. However, in practice these differences are very minor.

Disadvantages of Polycrystalline solar panels

1. The efficiency of polycrystalline-based solar panels is typically 14-16%. Because of lower silicon purity, polycrystalline solar panels are not quite as efficient as monocrystalline solar panels.
2. Lower space-efficiency. You generally need to cover a larger surface to output the same electrical power as you would with a [solar panel](#) made of monocrystalline silicon. However, this does not mean every monocrystalline [solar panel](#) perform better than those based on polycrystalline silicon.

3. Monocrystalline and thin-film solar panels tend to be more aesthetically pleasing since they have a more uniform look compared to the speckled blue color of polycrystalline silicon.
-

Advantages of Thin Film solar panels

1. Mass-production is simple. This makes them and potentially cheaper to manufacture than crystalline-based solar cells.
2. Their homogeneous appearance makes them look more appealing.
3. Can be made flexible, which opens up many new potential applications.
4. High temperatures and shading have less impact on [solar panel](#) performance.
5. In situations where space is not an issue, thin-film solar panels can make sense.

Disadvantages of Thin Film solar panels

1. Thin-film solar panels are in general not very useful for in most residential situations. They are cheap, but they also require a lot of space. SunPower's monocrystalline solar panels produce up to four times the amount of electricity as thin-film solar panels for the same amount of space.

2. Low space-efficiency also means that the costs of PV-equipment (e.g. support structures and cables) will increase.
3. Thin-film solar panels tend to degrade faster than mono-crystalline and polycrystalline solar panels, which is why they typically come with a shorter warranty.



Battery Reconditioning.comTM



The 3 Best Batteries For An Off-Grid Energy System

What are the best batteries for an off-grid energy system?

Because of the falling prices of renewable energy systems, more and more people are looking to use alternative energy sources as a way to:

Save money

Become more energy independent

And break their dependence on the big energy companies

However, installing a renewable energy system, in most cases, requires you to make a considerable initial investment that you won't get back for several years. One of the biggest expenses associated with alternative energy systems is the batteries in the battery bank.

So choosing the correct batteries for your off-grid system is crucial (*and [keeping the batteries as long as possible is also critically important!](#)*)

What are the best batteries to use in your solar power, wind power, or other alternative energy system?

- 1. Lead Acid-Batteries VS. Other Battery Technologies** in a battery bank
- 2. Deep Cycle vs. Shallow Cycle Batteries** in a battery bank
- 3. Flooded Lead-Acid Batteries (FLA) VS Sealed Lead-Acid Batteries (SLA)** in a battery bank
- 4. And finally, which 3 Batteries we recommend for your residential off-grid energy system**
(based on the criteria we go over in this article)

Lead Acid-Batteries vs. Other Battery

Technologies

Many of the batteries that are used in renewable energy systems were originally designed for other purposes. The most prominent example of this is the lead acid battery which has dominated the industry for a long time.



Deep cycle lead-acid batteries have proven to be one of the best (and most affordable) battery types for alternative energy system battery banks for these reasons:

-
-
-
-

They're able to withstand frequent discharging

They're cheaper than other kinds of batteries

They have more rugged durability in a battery bank

They deliver more consistent performance than other batteries

The fact that they are widely produced also means that they are relatively easy to replace if a battery in your battery bank needs replacing.

Deep Cycle vs. Shallow Cycle (Car) Batteries

Back when the renewable energy industry was still picking up steam, people that wanted to go completely off the grid would often have to improvise and make do with car batteries. However, car batteries were never built for this purpose and shouldn't be continuously drained and recharged (which is what they need to do in a solar panel or wind turbine system).

Car batteries are supposed to be used only for starting and ignition. If you take a look inside one, you will see that they have a large number of thin plates.

These plates have a big total surface area that can facilitate a large number of chemical reactions. When you start your car, these reactions produce the sudden burst of power that is needed for ignition.

Deep cycle batteries on the other hand, have thick lead plates that don't give much room for chemical reactions. Though they produce less current, they are designed to do so for a much longer period of time.

In essence, car batteries are "shallow cycle" batteries that will quickly burn out when used as storage for renewable power.

Flooded Lead-Acid Batteries (FLA) VS Sealed Lead-Acid Batteries (SLA)

Before telling you what three batteries are best for alternative energy system's battery banks, it should be made clear why flooded lead-acid batteries (FLA's) are better for renewable energy than sealed lead-acid batteries (SLA's).

One of the reasons that some people favour SLA's is because they require little maintenance. Unlike FLA's that need to be checked regularly for water level, SLA's that are used properly can be left alone.

However, sealed lead-acid batteries have two big flaws: they are sensitive and wear out quickly. So if you're planning on using your solar panel or wind power system every day, this will eventually pose a problem.

So, here are the categories of flooded lead-acid batteries that are best for an off- the-grid power system:

The 3 Best Batteries

So now that we know we want a lead acid battery, that's flooded (FLA), and also has deep cycle properties ...here are our 3 favorite batteries for an off-grid system's battery bank:

So, here are the categories of flooded lead-acid batteries that are best for an off- the-grid power system:

1) Golf Cart Batteries five to six year life span



Golf cart batteries are the most widely manufactured batteries on this list.

They also work great in an alternative energy system application. So it's no surprise that they're one of the most commonly used batteries in battery banks for renewable energy systems.

2) Industrial or Forklift Batteries



A battery bank that uses one or more industrial batteries follows the opposite philosophy of a golf cart battery bank. Instead of relying on multiple strings of smaller batteries, you use a few or even one battery to store all of your energy.

Because these batteries aren't usually manufactured to standard dimensions, you will have to have one made that is just right for your needs.

Or you can try to find an old industrial or forklift battery that's the correct size for your system and use that.

Other things to consider are:

These bigger batteries will be heavier and more difficult to move around. There may be advancements in battery technology that could make the battery obsolete in years to come.

3) L16 Batteries



If you want batteries that have a little more capacity than golf cart batteries but don't want to spend on industrial batteries, L16 batteries are a good middle ground..

These flooded lead-acid batteries were originally designed for supermarket floor scrubbers.

The good thing with these batteries is that they last a bit longer than golf cart batteries – about six to eight years. However, they are often twice as heavy and the 6-volt models can be twice as expensive.

Conclusion

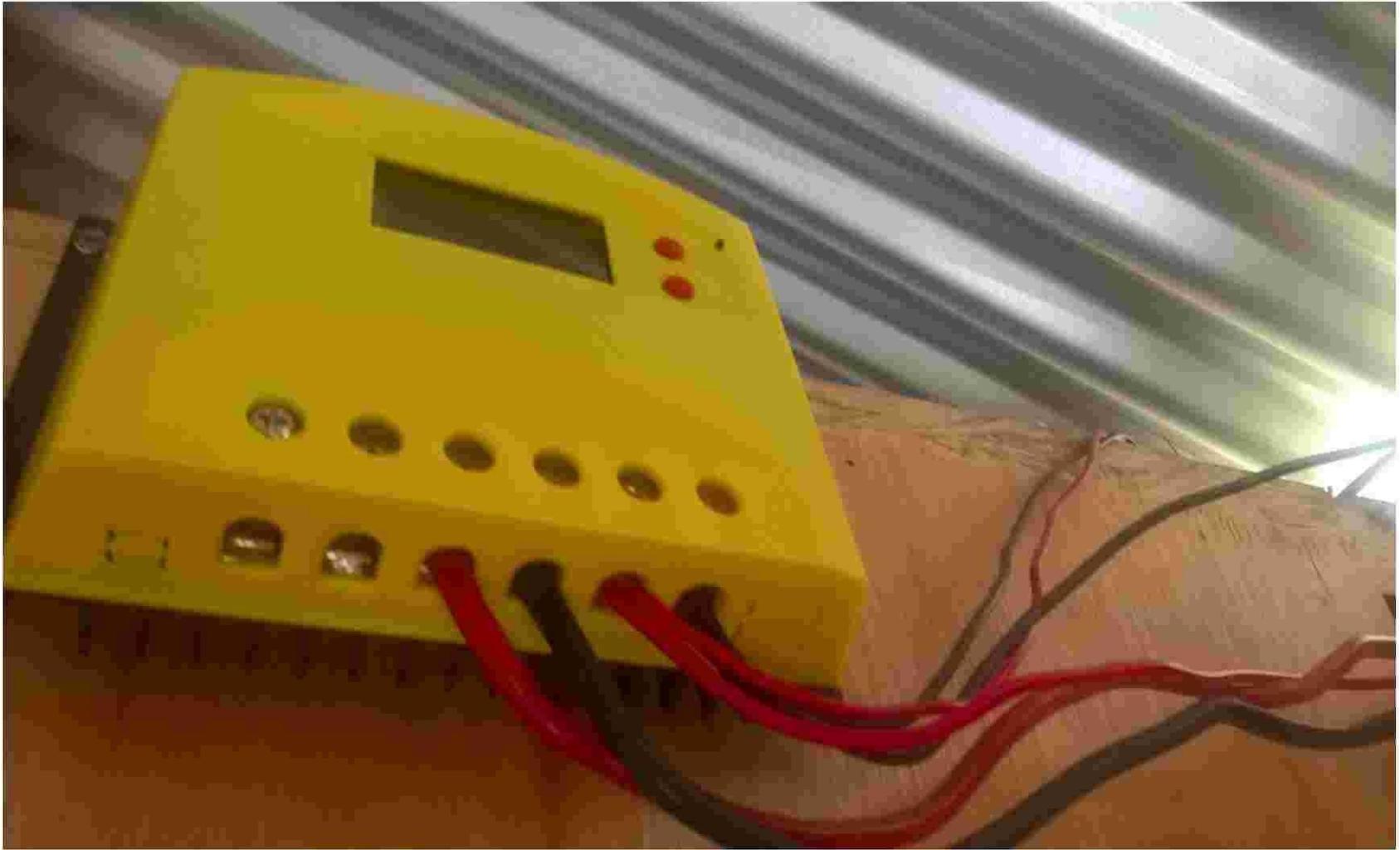
Different homes will have different power requirements and will need battery banks that are sized accordingly.

If you build a battery bank using any of the three batteries mentioned above, you should be able to create a battery bank that is just right for your needs.











MF SOLAR BATTERY

CEIL
NXT

12V 100Ah
100Ah
12V 100Ah
100Ah

LINCO
MADE IN CHINA
DC-AC POWER INVERTER







