THE LUVSOLAR SOLAR POWER GUIDE

HOW DOES IT ALL WORK?

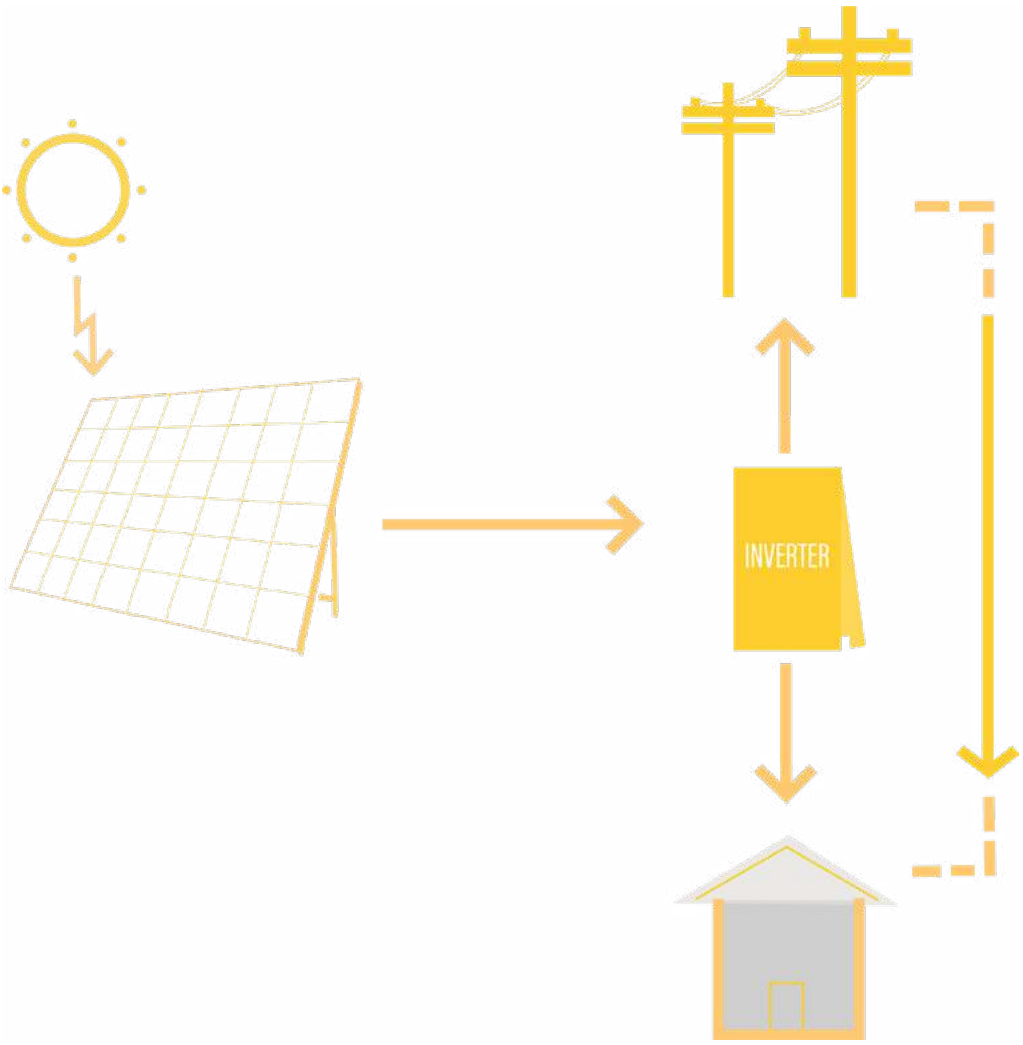
You can install many different configurations for your solar system but the basic principle is the same for all of them. It's important to remember we are talking about solar power and not solar hot water here.

FIRST OF ALL:

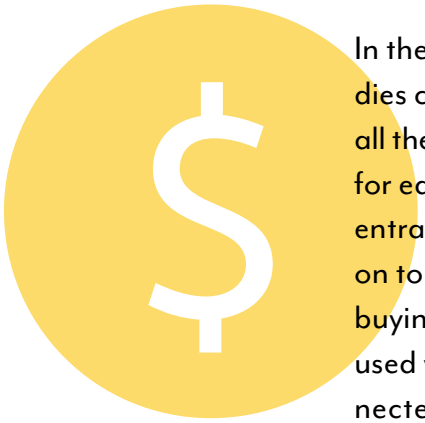
A solar power system will always consist of; a number of photo-voltaic modules (solar panels), a system to fix them to your roof, and a power conditioning box called an inverter.

SECONDLY:

The panels produce electricity when they are exposed to light through something called the photoelectric effect (this is what Albert Einstein won the Nobel prize for in 1921!). The DC electricity produced by the panels then flows to the inverter where it is inverted to AC power at the right voltage for use in your home, or export to the grid if your panels are producing more than you are using at that time. Most modern inverters also come with wifi compatibility to allow you to monitor your system production on line from anywhere you have an internet connection.



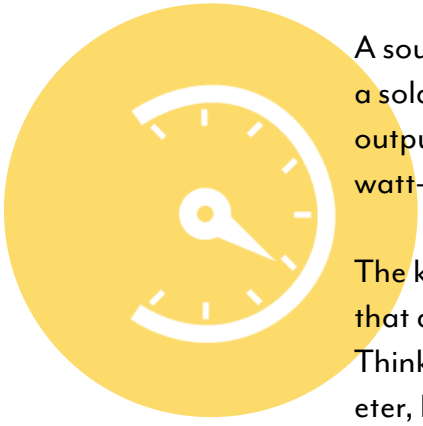
HOW DO I SAVE MONEY?



In the past, governments had implemented generous subsidies called feed in tariffs, where solar households exported all their solar power to the grid and were paid up to 66c/kWh for each unit! Most of these subsidies are now closed to new entrants, so instead of solar you produce being sold straight on to the grid, it is used in your home first, saving you from buying electricity during the day. What is generated but not used will be sold to the grid, or in the case of a battery connected system, used to charge up the battery for use later on when the panels have stopped producing for the day.

Power prices have risen significantly over the past few years, while the costs of installing solar power has come down dramatically. Installing solar is now one of the most cost-effective way to reduce your day time power usage.

WHAT IS A kWh? AND WHAT IS kWp?



A source of much confusion for homeowners considering a solar power system are the units used to measure system output. These are kWp (kilowatt-Peak) and the kWh (kilowatt-hour). So what is a kWh? and what is kWp?

The kilowatt peak (kWp) is the maximum amount of power that a solar system is rated to deliver at any point in time. Think of this like the maximum speed on your car's speedometer, but on your solar system!

Kilowatt-hours (kWh) are used to measure the total amount of energy that the system has delivered over time. This could be over a day, a week, a month, or even a year.

1 kWh = 

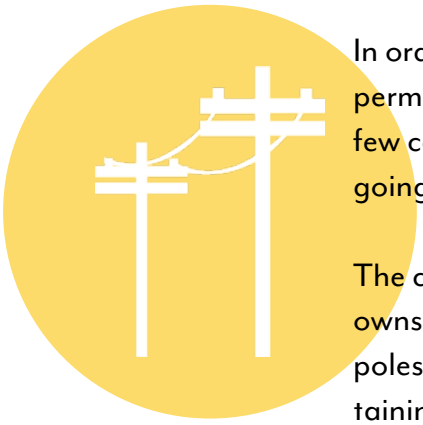
total amount of energy that you would have after a continuous power output of exactly one kilowatt consistently for a full hour

Think of kilowatts (kW) like the rate at which water flows in to a glass. Think of kilowatt-hours (kWh) like the total amount of water in that glass.

An important note on solar system ratings is that systems are rated under a specific set of reference conditions that manufacturers use called standard test conditions (STC). These indicate; the temperature, light spectra, and light intensity that a panel is exposed to in order to achieve its rated power. These conditions are almost never seen in real life. The result is that systems produce around 10-15% less than their rated output operating on your roof.

But don't worry, at LuvSolar this is always taken in to account when we assess and discuss with you your predicted solar output. The amount of sunlight and temperature range throughout the year in different parts of Australia are also well known so your system should produce very close to what is predicted.

WHAT IS AN ELECTRICITY DISTRIBUTOR, DNSP, OR NETWORK SERVICE PROVIDER?



In order to install a grid connected solar system in Australia, permission to connect to the grid is required. Except for in a few cases, the company that approves your solar system is not going to be the same company that you pay for your electricity.

The company granting you permission to connect to the grid owns the local hardware for electricity distribution, i.e. the poles and wires. They are responsible for operating and maintaining the local grid in your area. They are referred to as;

1. THE DISTRIBUTED NETWORK SERVICE PROVUDER *(DNSP)*; OR,

2. YOUR ELECTRICITY DISTRIBUTER; OR,

3. YOUR NETWORK SERVICE PROVIDER.

For the rest of this guide we will refer to them as your DNSP.

As your DNSP is not the same company that bills you for your electricity usage, you cannot change DNSPs without physically moving to a different service area.

At the top of your electricity bill there will be a phone number of a company to call in case of a fault or service interruption. This company is your DNSP.

Remember that to install a grid connected solar system you need permission to connect to the grid from your DNSP. LuvSolar will always complete the application process to get permission to connect your system for you. Although it can be helpful to know who to contact for more information about what you are allowed to install.

It's also handy to know that different DNSPs will allow different sized solar systems to connect to their network depending on the type of connection that a customer has.

Most companies will allow a 5kWp system on a single-phase connection, which is about 20 panels. Although some DNSPs will let you have more than this, most of the time if you want a larger system you will need a three-phase connection, or a system set up with export limiting. Talk to LuvSolar to find out more about export limited systems.

You can also find out who the DNSP is in your area by clicking on the link below:
https://www.aer.gov.au/consumers/making-a-complaint/who-is-my-distributor

THREE PHASE POWER; WHAT IS IT?

Traditionally in utility power networks electricity is generated in large rotating generators and comes out as three separate supplies (phases). This is known as “Three-phase power”.

There are basically three separate conductors that carry power right from the generator in the power station all the way to the small transformers that you can see on telegraph poles in residential streets.

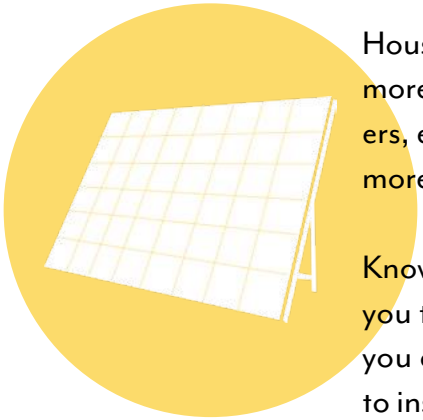
You can often see the three phases in the three distinct connections to transformers, or in the three wires in the above ground power supply in many suburban streets.

If you are a large commercial customer then you are probably drawing power through a higher capacity connection so will also be able to connect a bigger solar system, although the connection application process can be more involved.

When it comes to the electricity connection in your home, you will either be connected to 1, 2, or 3 of these phases, (but it's mainly 1 or all 3). So, what is a three-phase connection? When you are connected to all three supply phases.

Three-phase overhead lines

HOW DOES MY CONNECTION AFFECT MY SOLAR SYSTEM?

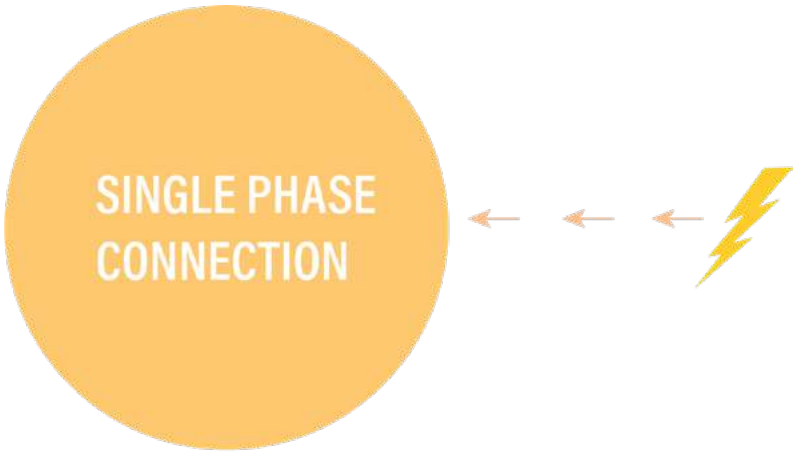


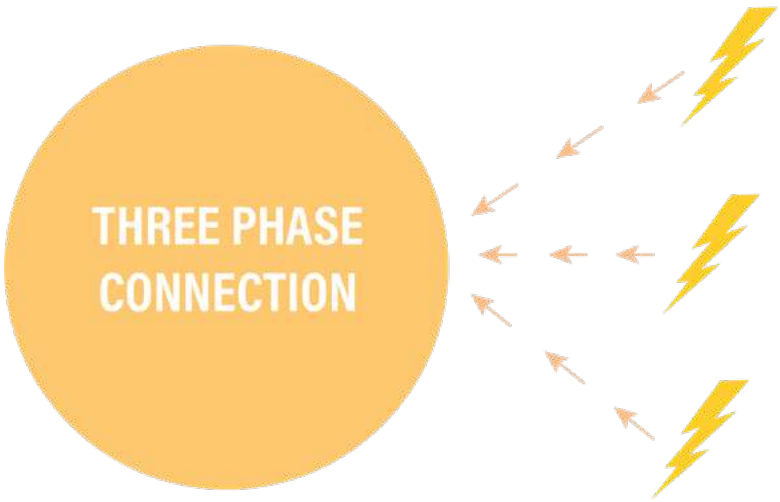
Houses with a three-phase connection will be able to draw more power from the grid. Importantly for solar home owners, electricity supply networks (DNSPs) will usually allow more solar to be connected if you have a three-phase supply.

Knowing how many phases you are connected to can help you to know how much solar you can install and whether you can install a three-phase inverter or not. It's possible to install single phase inverters on the individual phases of a three-phase supply. Although it's not possible to install a three-phase inverter on a single-phase connection.

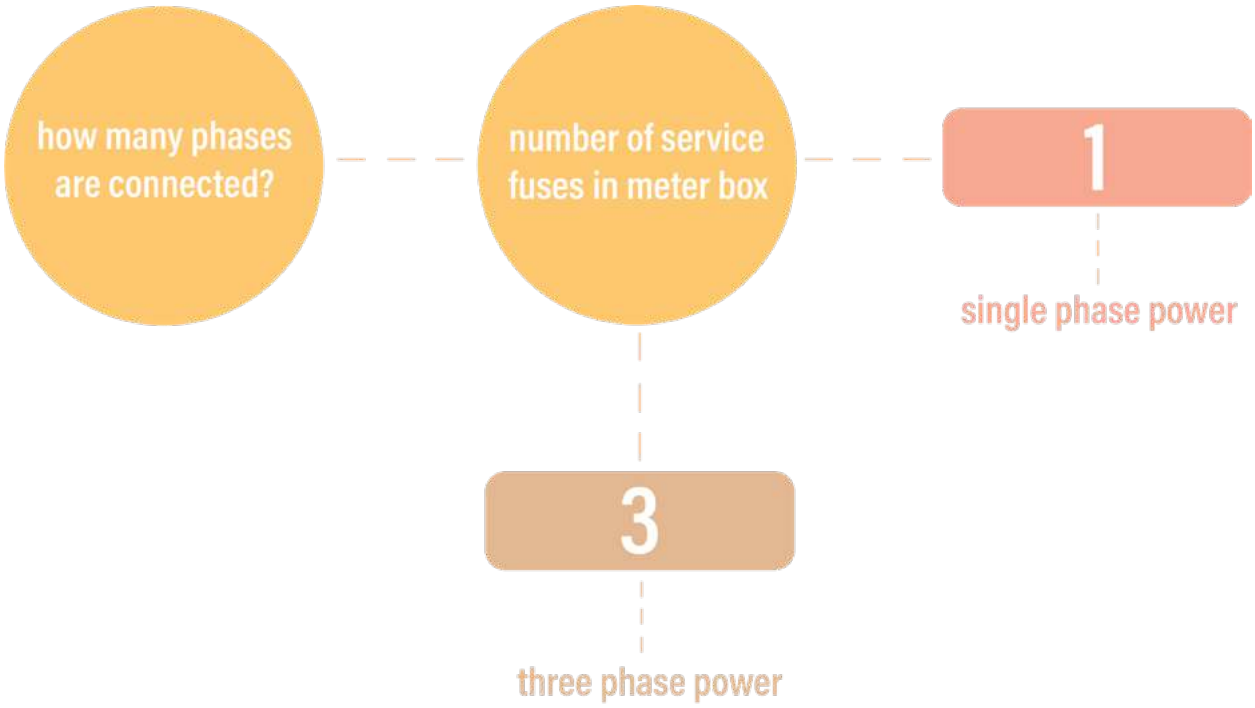
If you have a single-phase connection, you will need a single-phase inverter and will probably not be allowed to install more than 5kW of solar without export limiting.

If you are connected to more than one phase, you don't necessarily need a three-phase inverter. Although it will offer the benefit of being able to supply power evenly to all three phases. This also means that your solar system can supply your three phase appliances. A single phase inverter will only be able to supply one-third of the power for a three phase appliance and will not be able to supply power to the appliances in the house on the other phases.





HOW DO I KNOW HOW MANY PHASES I HAVE CONNECTED TO MY HOUSE?



You can tell how many phases you have by the number of service fuses in your meter box (make sure it's the main one and not a distribution board or sub board).

If you wish to use more electricity or want to install more solar than your local network will allow on a single phase, then it may be possible to contact your DNSP and upgrade your supply and add additional phases.

Distribution board

Single phase connection

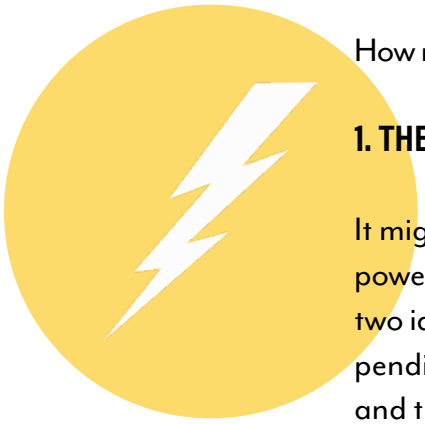
Three phase connection

Above are three pictures that show what you will see in your meter box. The first picture shows a distribution box, not a main supply connection. Notice there is no meter or service fuse.

The second picture shows a single phase connection. This is indicated by the black service fuse at the bottom left, under the meter itself - if there is only one big main service fuse, you're on a single phase connection.

The third picture is a main supply box with a three-pase connection. Notice the three service fuses in the top left?

HOW MUCH POWER WILL MY SOLAR SYSTEM GENERATE?



How much power your system will generate depends on a few things.

1. THE RATED POWER OUTPUT OF THE SYSTEM (KWP)

It might be pretty obvious that a larger system will generate more power, and more energy over time than a smaller system. However, two identical systems will produce a different amount of power depending on where in the world they are installed, the time of year, and the way that the panels are positioned.

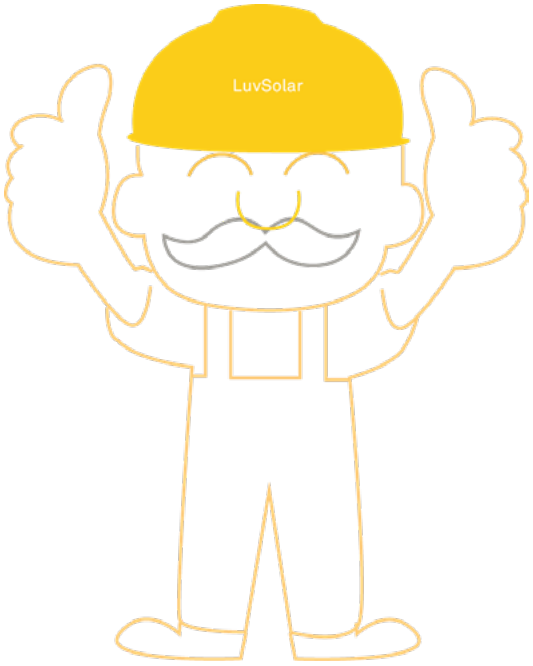
2. HOW MUCH SUNSHINE THE SYSTEM RECEIVES ON AVERAGE

The average level of solar energy at a given location can be represented by something known as Peak Sun Hours (PSH). Peak sun hours are really just a way to measure how much sunlight a location receives throughout the day on average. As an example, Brisbane receives more sunlight than Hobart, so Brisbane will have more peak sun hours. Although sunlight is one of the main things affecting solar power output, system efficiency and temperature also have some effect on production.

A peak sun hour is basically an amount of solar energy equivalent to a single kWh of sunlight per square meter.

3. THE QUALITY OF SYSTEM DESIGN AND EQUIPMENT

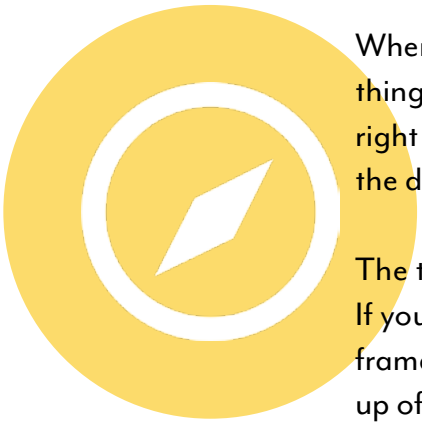
Solar systems installed correctly with good quality equipment should keep producing as expected, saving you money for many years. Although it's important that the panel configuration is carefully matched to the inverter, and that the system design is appropriate for the roof orientation (and any shading expected to occur). Getting these things right will ensure reliable system performance and good return on your investment. That's why it's so important that your solar company takes the time to design the system correctly, and makes sure that it will perform on your roof.



If you want to know what the peak sun hours are in a location closest to you, **click here**

You can also see the best tilt angle for your system. Notice that the optimum tilt angle gets higher as you move from Darwin (20 degrees) to Hobart (40 degrees)?

SOLAR PANEL ORIENTATION

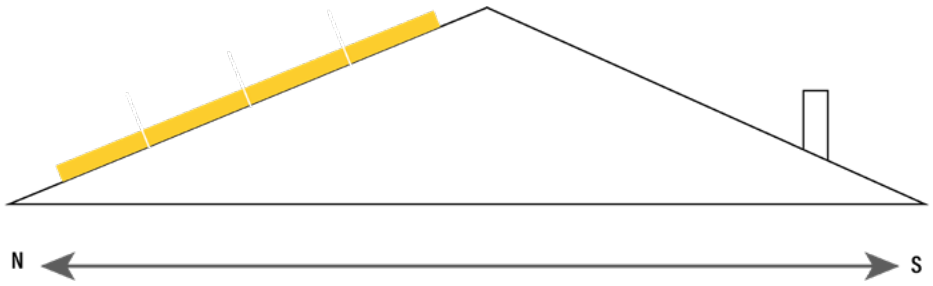


When talking about solar panel orientation, there are two things to think about. The first is the tilt angle, i.e. how upright from horizontal is the panel. The second is the azimuth, the direction that the panel is tilted toward (N,E,S,W).

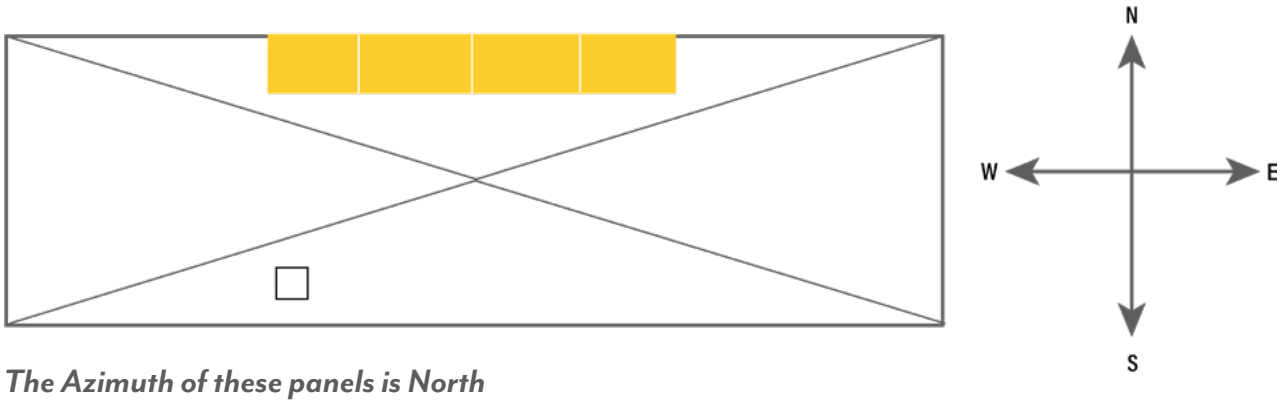
The tilt angle will usually be fixed by the slope of your roof. If you have a very flat roof, you might want to invest in tilt frames to optimise the capture of sunlight and stop the build up of dust, leaves and other debris.

The roof surface that you choose to install on, will ideally be the North facing roof pitch, this will maximize energy capture throughout the year. But installing on the North pitch might not be possible because of shade on this area of your roof, or limits on how much space you have.

THE AZIMUTH — the direction in which the solar panels are tilted



The tilt matches the slope of the roof



The Azimuth of these panels is North

If you don't have a good North facing roof pitch to install panels. You can install on the East and West pitches with losses of around ~10% of the total possible energy capture. This may sound like a lot, but in reality, East and West facing arrays will produce more power in the morning and afternoon when most households energy usage is high. This results in a higher percentage of the solar power being used, rather than exported to the grid. As more of the power that you are using is coming from your solar, depending on your usage patterns East and West facing arrays can have similar payback periods to North facing arrays.

If you are billed on time of use pricing (peak and off peak), using West facing solar panel orientation can actually provide very good financial returns. This is because most customers pay more for power during the afternoon and early evening. Sometimes around twice as much! So systems facing West provide more solar power in the afternoon when power prices are highest on the grid.

Tilt frames allow you to set the tilt angle on a flat roof (credit: Antai Solar)

Panel tilt angles will match the roof pitch in most cases. This is usually between 0-35 degrees. Over this range, tilt angles make less difference to system production than the direction the panels are facing. It is important to remember in Australia panels should never be tilted toward the South. This is because the sun path changes position from almost directly overhead in the Summer to lower in the Northern sky in winter.

As part of our free quote and energy consultation LuvSolar can advise you on the optimal system orientation for your needs. Interested? Click the link below and we'll take a look at your roof and recommend the best system design for your needs.

https://luvsolar.com.au/luvsolar-solar-power-price/

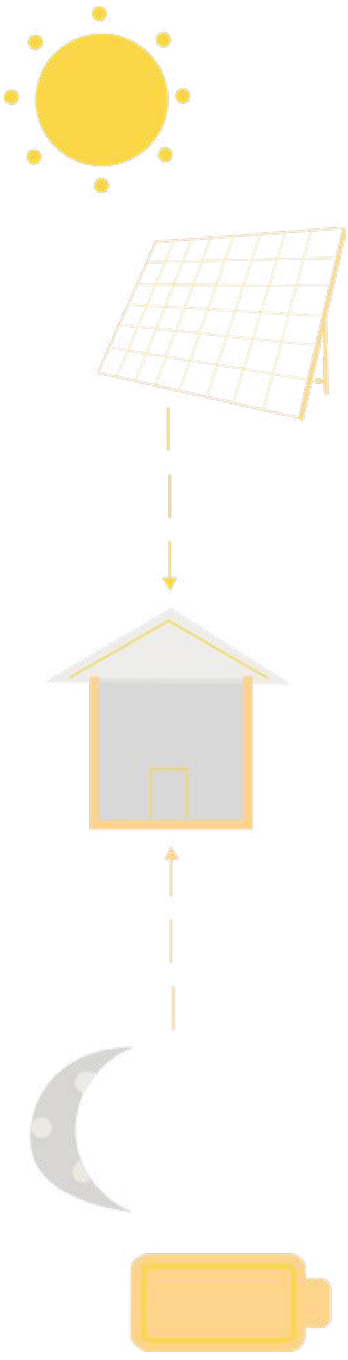
ARE SOLAR BATTERIES A GOOD INVESTMENT?

With the release of compact, low maintenance lithium ion batteries solar households can now become almost 100% self-sufficient when it comes to power. The idea is that you have a solar system with a small battery but remain connected to the grid, maximising your return on investment.

Your solar battery only needs to be big enough to supply your home energy needs in the evenings. This is a much better value investment than a system that is completely off the grid, as your battery costs are about 25% of those in an off-grid system.

Given the costs of solar batteries in an off-grid system this is a very big saving. The other problem with fully off-grid systems is that they really need a back-up petrol/diesel generator, this adds further cost and complexity to the system. Even with oversized battery banks and backup generators, people running off grid systems still need to choose their appliances carefully. This is because off-grid systems can only supply a limited amount of power at any given time.

The hybrid system is a solar system with a battery that remains connected to the grid. This offers the best of both worlds. Homeowners cover their evening usage with a battery but remain connected to the grid. This means that they have the security of being able to use power freely as any other house would.



So the question remains: are solar batteries a good investment? Well for some households they are, but when does a solar battery make sense financially?

WHEN YOU PAY ENOUGH PER QUARTER IN POWER BILLS TO JUSTIFY THE COST; AND,

WHEN YOU PAY A HIGHER AMOUNT FOR POWER YOU USE AT NIGHT.

If you pay a flat rate for your power, a hybrid system will probably take over 10 years to pay itself off at current prices. In the end you will get better value from a good quality solar system without a battery.If you do pay more for power at night, the following example illustrates the value in a hybrid system. If you are on a flat rate, it is not really applicable.

Many home owners pay more or less the same for their power no matter when they use it. However some DNSPs moved their customers on to time of use pricing. This means that when demand for power is highest, like in the evening, prices are higher. If you live in Sydney's eastern suburbs, the Central Coast, or in Newcastle, you will likely be billed in this manner.

You might see something like this on your bill:

> **"Peak 38c/kWh (this is usually power used from 2pm-8pm weekdays)**
>
> **Off Peak 9c/kWh (this usually power used from 10pm-7am)**
>
> **Shoulder 17c/kWh (this is power used pretty much all other times)**
>
> **A connection charge of 80c/day"**

An average 3-4 bedroom house might use around 24 kWh per day. If we assume, that out of this 24 kWh it breaks down across the day like this:

> **• 11.25 kWh is being used between 2 pm-8 pm (at 38c/ kWh);**
> **• 3.75 kWh is being used between 8 pm-10 pm (at 17c/ kWh); and,**
> **• The remaining 9 kWh is used through the day from 7 am-2 pm (at 17c/kWh).**

Then:

11.25kWh x $0.38 = $4.28

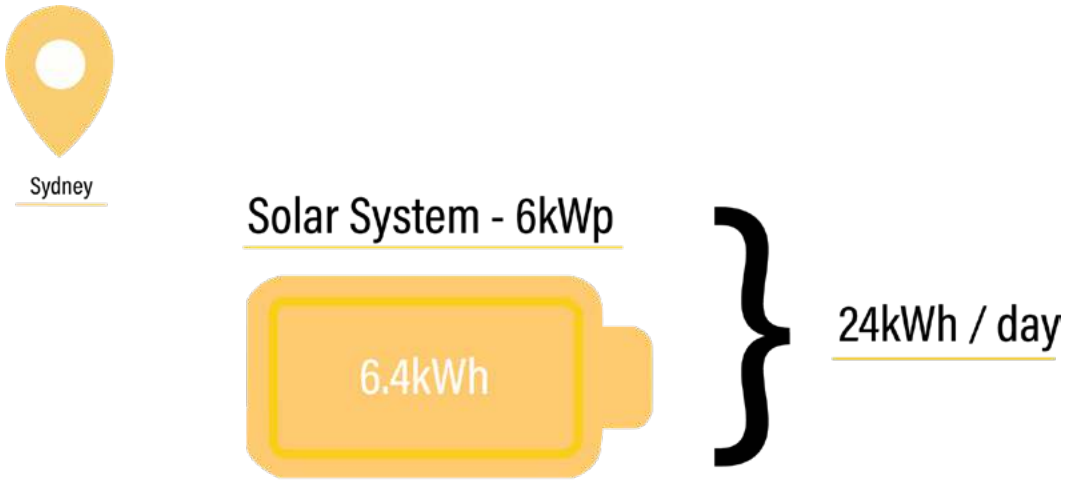
3.75kWh x $0.17= $0.64

9kWh x $0.17 = $1.53

$4.28 + $0.64 + $1.53 +$0.8 *(remember the connection charge)*

= **$7.25/day**
(of which 59% is a result of power used between 2pm-10pm)

Now say we have a 6kWp Solar system with a 6.4kWh battery connected. This will produce around 24kWh on an average day in Sydney.



Around 16.5 kWh might be produced between 7am-2pm. This is enough to completely charge the battery and provide the 9kWh that the house uses in this time. There will also still be 0.6kWh in surplus being exported to the grid. (a 6.4kWh battery will generally take around 7.1kWh to charge because of charging/discharging efficiency).

Now between 2pm-8pm let's say the solar system produces 7.5kWh. But during this time 11.25kWh is used by the home. The battery can provide the excess 3.75kWh that is not being supplied by the solar system. This still leaves the battery with 2.65kWh to supply the house between 8pm-10pm when we have estimate that 3.75 kWh is required. Meaning that the household only had to buy 1.1kWh @ 17c /kWh from the grid.

So the total spend on power for the house with the hybrid system installed is:

1.1kWh x 17c/kWh =18.7c

+ 80c *(there's that connection charge again)*

-5c *(remember that 1kWh that wasn't used during the day? Your retailer will give you a small amount for it)*

=94c/day;

meaning that the household makes a saving of $6.31/day or $2,303.15 in the first year.

Systems like this are available from LuvSolar—so get in contact and see if a battery connected system might be right for you!

click here to request a free quote

In summary, the answer to the question of "Are solar batteries a good investment?" will be yes under the following circumstances;

IF YOU ARE ABLE TO GENERATE ENOUGH POWER TO CHARGE THEM WITH YOUR OWN SOLAR; AND

YOU PAY MORE FOR YOUR POWER AT NIGHT THAN DURING THE DAY; AND

YOUR AVOIDED COST OF POWER JUSTIFIES THE SYSTEM COST.

Note that the scenario above assumes that power prices do not increase (if they did the payback period would look a bit better). It also assumes no degradation in system performance or battery capacity. In reality most batteries have warranties on their capacities that cover the first 4-10 years of operation and solar system degradation is generally in the order of 0.75% per year. Other assumptions are that energy usage and production on each day of the year is the same and that power is used at a constant rate from 7am-10pm, this is obviously not the case in reality, but it serves as a good example to illustrate what the savings from a hybrid system might look like.

For more information, contact:

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