

# **SOLAR 101: A BEGINNER'S GUIDE**

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## This cheat-sheet is for you if you are thinking of investing in solar power.

If you read this guide, you'll know more about solar energy than 99.9% of Australians, be able to go toe-to-toe with a solar salesman, and be confident you're paying the right amount of money for a properly-sized solar system installation for your home.

The rest of this website contains lots more information on everything you could possibly need to know about solar energy. But there is so much information on my website that it can feel a little like tumbling down a rabbit hole.

That's why I created this Solar 101 guide, which should take you about 10 minutes to read (for commercial property owners, read our [Commercial Solar 101 Guide](#) - it's written specifically for businesses).

If you're feeling pretty confident about solar power systems already and you're just looking to get quotes from quality pre-vetted Australian installers that I trust, then simply [click here](#).

Otherwise, here's what you should know before you get quotes for solar power:

- 1) The three main components of a solar power system.
- 2) The most important thing to measure before you get solar power: how much electricity you use in your home, and when you use it.
- 3) How many panels should you buy?
- 4) The solar rebate: still very much alive and kicking and generous.
- 5) Don't get the 'rebate' and the 'feed in tariff' confused
- 6) Roof direction/angle for optimal solar electricity generation.
- 7) Typical payback for solar power.
- 8) Costs for quality solar energy systems, and why quotes can vary wildly in price.
- 9) Batteries – do you need them?
- 10) How are you planning on paying for your system? Understanding finance.

**Beginners Note:** kWh stands for 'kilowatt-hour.' It is a unit of electricity. It is how we measure how much electricity is used. A typical Aussie home uses 16-20 kWh of electricity per day.

**Note about pro-tips:** These are intended for people who like to get a bit more technical. Feel free to ignore them if they don't make sense to you.

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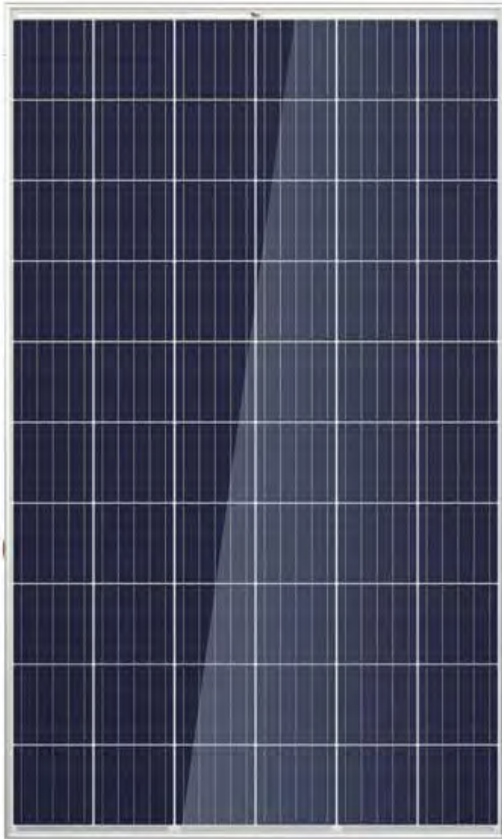
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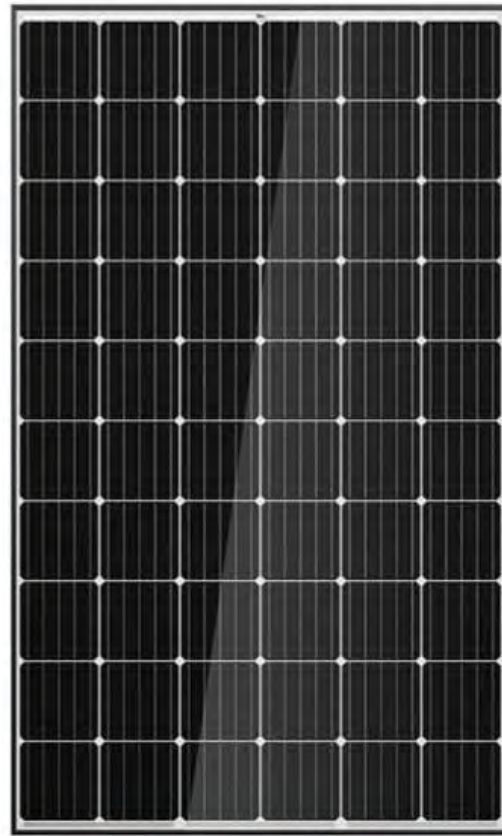
## #1 The three main components of a solar power system installation

Solar power systems are firstly made up of:

1. **The panels**, which can either be polycrystalline or monocrystalline



**Polycrystalline**



**Monocrystalline**

It doesn't matter if you get a mono or a poly panel. What is important is that you buy a good module brand that will last 25+ years installed on your roof.

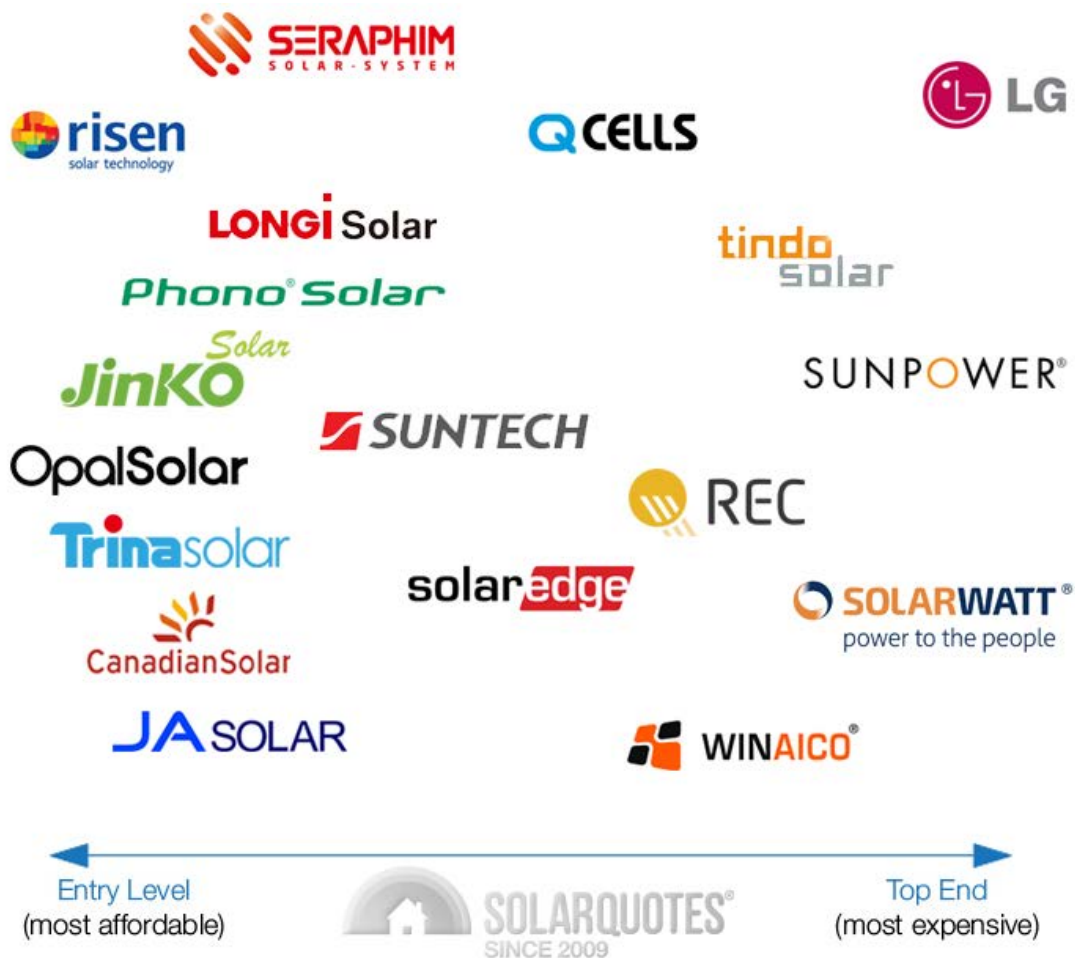
There are good budget brands and good premium brands. But there are also 'no-name' panels that are re-badged junk, that are unlikely to last more than 3-5 years on an Australian roof. Avoid installing those modules at all costs.

**Pro-tip:** Don't stress over solar panel technology. Mono- and polycrystalline are both as good in Australian climates.

You can choose to install a budget (think Kia), regular (think Toyota) or premium (think BMW) solar panel brand. You generally get what you pay for.

You probably don't know a good panel brand from a lemon, and why should you? Here's a handy cheat sheet of most of the popular solar panel brands in Australia, so you can see where they sit in the market.

The list is not exhaustive – if you're not sure about a brand, ask me – but the following chart represents over 90% of what's being quoted in 2018 in Australia (and is more or less a safe bet):



**How to read this chart:** We consider all of these brands to be reputable and well supported in Australia.

**Pro Tip:** There are detailed reviews of each brand here : [Q-Cells](#) | [Risen](#) | [LG](#) | [Trina](#) | [Jinko](#) | [Phono](#) | [Sunpower](#) | [Seraphim](#) | [Canadian Solar](#) | [Suntech](#) | [REC](#) | [JA Solar](#) | [Tindo](#) | [Opal Solar](#) | [Longi](#) | [Winaico](#) | [SolarWatt](#)

2. The second main component of a solar power system installation is **the inverter**, which can be either a string inverter (around the size of a briefcase) or microinverters, which are approximately the size of a paperback book.



A string inverter is installed on a wall and all the solar panels connect to it. A microinverter goes on the back of each individual solar panel.

**Note:** There is also a third option: 'Power optimisers', which is kind of a hybrid between the two. The most common form of power optimiser technology is SolarEdge, which has a string inverter on the wall, and also individual power optimisers on each individual panel.

Micro inverters and power optimisers are great because they optimise each panel individually, which results in more energy production. Microinverters have a further advantage in that they use safer voltages (230V AC instead of up to 600 Volts DC). But microinverters and power optimisers usually add about 20% to the total system price.

**Pro-tip:** Never mount a string inverter where it will get full sun. Choose a shaded spot, a cool garage, or ask the installer to build a simple shade over the inverter. Direct intense sunlight kills inverters, because it cooks them – and Australia's sun is particularly harsh.

The job of the inverter is to convert the DC electricity that the solar panels produce into 240V AC electricity, which is what everything in your home uses.

The inverter is the component most likely to fail in a solar power system in the first 10-15 years. This is because they work hard all day, and they do wear out.

So even if you are on a limited budget, I recommend considering installing a premium inverter.

Here's a run-down of the popular inverter brands in Australia right now, and where they sit on in terms of price and quality (again – this list is not exhaustive, but any reputable installer has a 95% chance of quoting you one of the following brands):



**How to read this chart:** We consider all of these brands to be reputable and well supported in Australia.

**Pro Tip:** There are reviews of each brand here : [Solax](#) | [ABB](#) | [SMA](#) | [Fronius](#) | [Goodwe](#) | [SolarEdge](#) | [Delta](#) | [Sungrow](#) | [Enphase](#)

**Pro Tip:** You can, and should, add up to 33% more panels than the inverter is rated at. For example, I would recommend using 4kW of panels with a 3kW inverter. You'll get 33% more [solar rebate](#) and lots more power in winter, mornings and evenings. It's a very efficient use of the inverter. Also, in many areas, the smaller the inverter, the easier it is to get permission to connect to the mains electricity grid.



The third main component of a solar power system installation is **the racking/mounting**. This is what is securely attached to your roof supports, and what your solar panels are mounted on.

There are a wide variety of racking brands out there. The difference between the solid budget end and premium end can be around \$100 per kilowatt of solar installed.

The chart below shows brands we're familiar with, and where they sit in a spectrum of price:



## #2 The most important thing to measure before you get solar power: how much electricity you use in your home, and when you use it.

When solar electricity is generated by your panels, it will first be used by appliances in your home, with any surplus solar energy exported to the grid. Your electricity retailer will pay you a small amount (around 7-20c) for each kWh that your installation exports to the grid.

It is better to use the solar power generated by your system than export it. Self-consumed electricity saves about 30c per kWh as you don't have to buy that energy from the grid. Exported electricity earns a 'feed in tariff' of about 7-20c per kWh.

So self-consumed solar energy is about 2-3x more valuable than exported solar electricity.

**Pro Tip:** [Shop around](#) for feed-in tariffs. They can vary from 0c to 20c depending on the retailer.

This means Australian households that use a lot of electricity during the day, or can set their appliances to run on timers, are a natural fit for solar panels and can see very short paybacks of 3-5 years (20-25% returns).

If you are at home during the day or have pool pumps which run all day, your self-consumption can be up to 65% (with exports only 35%) and a solar power system installation is likely to be a very good investment.

If you are not at home during the day (hello to all you 9-5ers!), you will typically self-consume about 20% of a well sized solar power system installation, pushing the simple payback out to 6-8 years.

Bear in mind that this is still a 12-15% return on your investment.

Avoid any solar energy company that calculates your payback based on 100% self-consumption. Practically no-one has 100% self-consumption. The company is being dishonest in order to get your sale.

**Pro Tip:** Your electricity bill only tells you how much energy you use every month, or 3 months. If you live in Victoria, you can ask your retailer to give you a spreadsheet of your electricity use every half hour. If you live elsewhere, you can buy a cheap energy monitor to collect this data for a few weeks before you get a quote. A good installer can use this data to more accurately size your solar system for optimum savings.

### #3 How many panels should you buy?

My answer to this question has changed considerably compared to just a few years ago.

This is because prices for solar have fallen considerably, electricity prices have risen, and feed-in tariffs (what you're paid for exporting excess electricity generation) have also risen.

The only limitations now are your budget, what your roof can properly fit, and the amount your DNSP (Distributed Network Service Provider) allows you to install.

For most homes, this means the sweet spot is **6.6kW of panels** (approx. 22-24 in total) **with a 5kW inverter**.

I've written about this topic in more detail [here](#).



## #4 The solar rebate: still very much alive and kicking and generous.

The famous Australian federal 'solar rebate' (technically known as the 'STC scheme') acts as a point-of-sale discount off the final cost of a solar power system installation. It is worth about \$650 per kW of solar panels installed (as at May 2019), but this will vary depending on where you live.

As an example, a 3kW system attracts around \$1,950 in rebates.

Anyone can claim the rebate, even if you've already bought solar power systems in the past and want to buy a new system.

The only restrictions on claiming the rebate are:

- Your system must be less than 100kW in size.
- You get it installed and designed by a Clean Energy Council (CEC) accredited professional (you can ask the installer on the day to provide proof of accreditation!)
- You use panels and inverters that are approved for use in Australia by the Clean Energy Council (such as the ones I mentioned in #1).

The federal solar rebate is slowly being phased out. It reduced by one thirteenth (7%) on the 1<sup>st</sup> January 2019, and will reduce by the same amount every year after that – so it will be zero in 13 years time.

For those of you in Victoria, the Labor government recently introduced a [state-level rebate](#) that gives eligible recipients (up to) an extra \$2,250 off the cost of a solar system.

**Pro Tip:** The federal rebate is based on the number of solar panels, not the size of the inverter in the installation. This often makes adding panels over and above the inverter rating very worthwhile. Don't worry – it is safe and approved by the regulators (up to 133% of inverter capacity). Ask your installer about 'oversizing' your panel array. Any good installer will know exactly what you mean. Untrained commission-only sales people won't.

## #5 Don't get the 'rebate' and the 'feed in tariff' confused

We've already learned that the 'Feed In Tariff' is the rate you are paid for solar electricity you export into the grid.

Between 2009 and 2012, people signed up to generous feed-in tariffs that paid them anywhere between 20c per kWh and 66c per kWh of electricity exported. These generous tariffs were designed to kick-start the solar energy industry when solar power systems were much more expensive.

Solar energy systems have reduced in price by 80% in Australia since 2008, and Feed In Tariffs have reduced to 7c – 20c, depending on your retailer.

This reduction is why you see so many people screaming 'solar power isn't worth it anymore! The rebate has been massively reduced!'

They're actually confusing the rebate with the feed-in tariff. The federal rebate is still alive and kicking and isn't being reduced significantly anytime soon.

One important point to clarify – because feed-in tariffs have dropped, some people believe that installing solar power systems isn't worth it anymore. This couldn't be further from the truth.

A lower feed-in tariff simply incentivises you to use your solar energy generation and not export that electricity.

So – because feed-in tariffs have been lowered, you just need to consume as much electricity that your solar power system generates as possible.

That's what I do, and one of my last summer electricity bills was \$71 for a 5-person home with a 6kW solar system installation on it – and that was when feed in tariffs were even lower.

**Pro Tip:** When you get a solar power system, use the timers on your washing machine and dishwasher so they run during the day. Also put timers on your hot water and any pool pumps, and you can shift significant amounts of energy use to the daytime, increasing the returns on a solar system installation.

## #6 The basics of roof direction/angle for optimal solar system placement.

### 1. Panel Direction

The sun rises in the east and sets in the west. This means that east-facing solar panels will produce most of their energy in the morning and drop off in the afternoon.

North-facing solar panels will peak in electricity production around midday (and provide the most energy overall).

West-facing panels will produce very little in the morning and generate most of their energy in the late afternoon.

It used to be true that if you couldn't put panels on a north-facing roof, then a solar power system wasn't worth it.

Now that prices of solar power systems have dropped so much (around 80% over the last 7 years in Australia), it is economical to have east facing panels, west facing panels, or a combination of north, east and west.

In some cases it can even make sense to have south facing panels – although this would be a last resort.

The advantage of east and west facing panels is that they produce more energy in the

morning and late afternoon.

This often coincides with both breakfast and the family returning from school/work. So a working household can self-consume more solar energy with east and west facing panels, accelerating their solar payback.

If you have a working household and east and west facing roof areas, ask your installer about using them.

## 2. Panel Angle

The ideal panel angle to maximize the energy produced over the whole year is simply the latitude of your location:

Canberra	Hobart	Darwin	Adelaide	Perth	Brisbane	Melbourne	Sydney
35°	42°	12°	35°	31°	27°	37°	34°

So, for my house in Adelaide, the ideal solar panel angle is 35° from horizontal.

If you're not able to install your panels at the ideal angle, don't worry too much. The panels in my own installation are at 15 degrees, and I only lose 4% in annual energy yield compared to the perfect angle.

Generally, unless your roof is flat, the ideal angle is whatever your roof is built at.

**Pro-Tip:** Flat roofs cause problems with water pooling and dirt build up on the panels. A way around this is to use 'frameless' panels that have no frame around the edge, so the water will generally flow over the edge instead of pooling and eating the frame seal. **It is often cheaper to use frameless panels than to install tilt frames on a flat roof.**

## #7 Typical payback period for a solar power system.

A well-designed solar system installation has a typical payback period of around 4-7 years in Australia.

This can vary wildly depending on your electricity usage and your system size, but when you get quotes for solar power systems, the installer should do a payback analysis for you to estimate your payback period.

**Pro Tip:** If the installer is estimating your electricity self-consumption without half hour usage data, then get payback calculations for worst case self-consumption and best case energy self-consumption, and make sure you are happy with the payback range.

## #8 What price-range can you expect to pay for quality solar power, and why can quotes vary wildly in price?

As of May 2019, approximate prices for good quality solar panel systems in Australia (Tier 1 panels + quality string inverter), including full installation, are:

3kW: \$3,500 – \$5,000

5kW: \$4,500 – \$8,000

6kW: \$5,000 – \$9,000

10kW: \$8,000 – \$12,000

To be clear – the upper end prices are for top-end systems (e.g. LG/Sunpower panels with full panel level optimisation), installed by a solar [‘craftsman’](#).

Note that the above prices also include the discount from the solar ‘rebate’.

However, for those of you in Victoria, the above prices do not include the [state-level rebate offered by the Victorian government](#) (which gives a further rebate of up to \$2,250).

If you want to downgrade to a reputable budget inverter (e.g the ones on the left hand side of the inverter chart higher up this page), **you may be able to save about \$700** on these prices.

Costs can increase if you need an electricity switchboard upgrade or other electrical work to make your home suitable for solar power, or if the design of your home makes the system installation more difficult.

If you decide to go with micro inverters over a string inverter, costs will also increase by approx. 20%.

Installing battery storage (for an off-grid or hybrid system) will at least double the price of the system.

If you’re quoted much less than these price ranges by a solar energy salesman, their margins are likely very slim (and potentially unsustainable), or they may have to cut corners to get there whether that is with their customer service or elsewhere. So, be wary.

**Pro Tip:** Really cheap solar energy systems cost more in the long run, from repairs and lost output. Avoid it. It breaks my heart to see cheap solar panels go to landfill after a few years.

## #9 Batteries - do you need them?

Battery storage is prohibitively expensive in 2019 for most households.

As an example – it will cost about \$12,000+ to add a decent amount (around 10 kWh) of energy storage to a solar power system in Australia.

A typical payback period of a battery that size is about 15 years – but most batteries only have a 10 year warranty; meaning you’ll most likely have to replace the battery before it

has paid for itself.

Compare this with a solar energy installation without batteries. A regular non-battery solar power system has a typical payback of around 4-6 years, and will last about 25 years.

This means that once you hit the point where the savings of the system have paid it off, you should have another ~20 years of free electricity to collect from the system.

So – if you are buying batteries in the hope of saving money, battery storage isn't worth it yet. Our advice is to wait 2-5 years for battery costs to come down before investing in energy storage. Certainly don't wait for batteries to come down in price before buying a solar power system, because that is locking in more years of high energy bills every quarter.

If you buy a system now, your electricity bills will immediately be reduced. In 2-5 years you can simply add batteries to your existing system for even greater electricity cost savings.

You don't even need to buy any special type of system to be ready for batteries. Every grid connect system ever installed in Australia is compatible with batteries using a special box called an 'AC coupled battery inverter'.

You can buy one of these when you buy your batteries, and solar battery installation will be very straightforward.

**A note about state battery rebates:** In South Australia you can now get a battery subsidy of \$500 per kWh up to a maximum of \$6,000. If you find a good deal this could halve the cost of an installed battery, [potentially giving a sub 10-year payback](#). So in South Australia batteries have gone from being 'too expensive' to 'worth considering'.

**Pro Tip:** Counter-intuitively, many battery systems will not provide backup when the grid goes down. If you really need backup then you must specify this up front, as it is often an expensive extra feature that requires careful design and some rewiring of your switchboard.

## # 10 How are you planning on paying for your system? Understanding finance.

Most Australians buy solar power systems with cash. If you are debt-free and have cash looking for a place to go, then investing in a solar power system is worth serious consideration.

A solar system installation currently generates a tax-free, reliable return that, at the time of writing, is far higher than bank interest rates or government bonds.

However, some of us don't have the luxury of easy access to thousands of dollars. A lot of solar installers out there offer "no interest" finance – and if that sounds too good to be true, it's because it probably is.

If you see a deal that claims 'no interest' your BS detector should be going off. All finance has a cost – the “no interest” deals often charge the installer a fee of around 15-25% on top of the cash price.

That cost is passed on to you.

In my experience, you can get a much better deal overall by organising your finance independently and avoiding the easy-sign-up, 'no interest!' deals.

And it just so happens that, [through a partnership with Parker Lane](#), we offer solar power specific finance options through our quote service that don't cost an arm and a leg, making it easy for you to arrange a repayment option that's suitable for your needs.

## The next step

So there you have it, my 101 guide to solar power for your home.

If you have any burning questions about the information in this guide, my contact details are:

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Happy Solar Power Hunting!



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### About Finn Peacock

I'm a Chartered Electrical Engineer, solar and energy efficiency nut, dad, and founder of [SolarQuotes.com.au](http://SolarQuotes.com.au). My last "real job" was working for the CSIRO in their renewable energy division. Since 2009 over 350,000 Australians have used my site to get quotes for high quality PV systems from pre-vetted solar installers.