

SOLAR 101: A BEGINNER'S GUIDE

By *Finn Peacock*

Chartered Electrical Engineer, ex-CSIRO & Founder of SolarQuotes.com.au

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

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

The rest of my website, www.solarquotes.com.au, contains lots more information on everything you could possibly need to know about solar. 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.

Here's what you need to know before you even get quotes for solar:

- 1) The two main components of a solar PV system.
- 2) The most important thing to measure before you get solar: how much electricity you use in your home, and when you use it.
- 3) The solar rebate: still very much alive and kicking – and generous.
- 4) Don't Get The 'Rebate' and the 'Feed In Tariff' Confused
- 5) Roof direction/angle for optimal solar.
- 6) Typical payback for solar.
- 7) Costs for quality solar, and why quotes can vary wildly in price.
- 8) Batteries – do you need them?

Beginners Note: kWh stands for 'kilo-watt-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 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.

Email: finnpeacock@solarquotes.com.au

Tel: 08 7200 0177

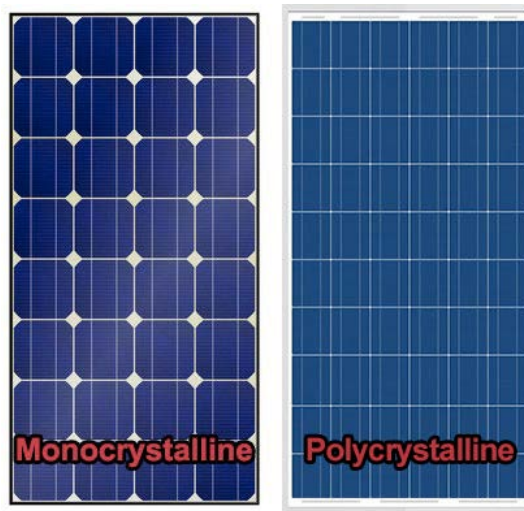
Fax: 08 8121 8547

PO Box 470
Brighton
SA 5048
Australia

#1 The two main components of a solar system

A solar system is made up of:

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



I'm here to tell you that it doesn't matter if you get a mono or a poly panel. What is important is that you buy a good brand that will last 25+ years on your roof.

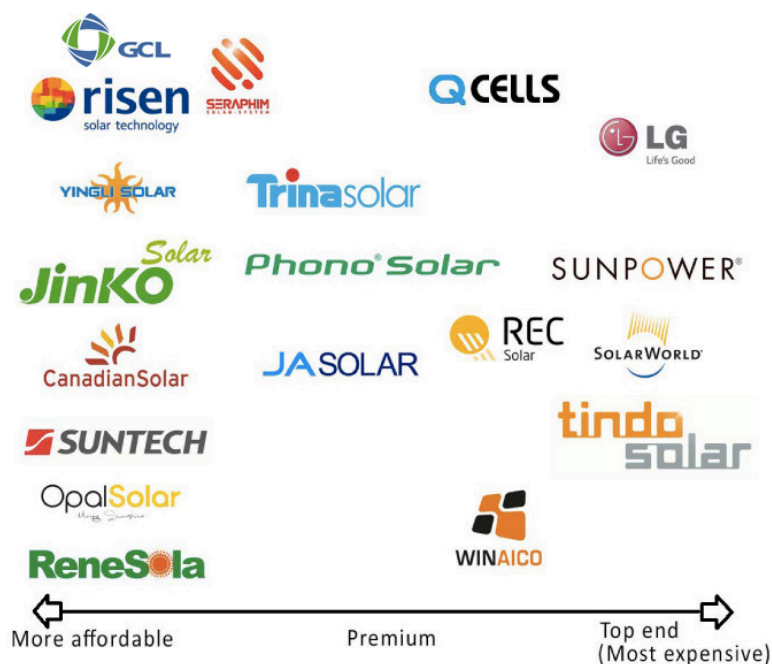
There are good budget brands and good premium brands. But there are also 'no-name' panels which are re-badged junk, that are unlikely to last more than 3-5 years on your roof. Avoid those at all costs.

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

You can choose a budget (think Hyundai), regular (think Toyota) or premium (think BMW) solar panel brand. You generally pay what you get for. Expect a premium panel to produce 5-10% more power, last longer on your roof, and degrade slower than the cheaper ones.

You probably don't know a good panel brand from a lemon, and why should you? Below is 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 us – but the following chart represents over 90% of what's being quoted in 2016 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. The brands to the left are more affordable. The brands to the right are more expensive.

2. **The second main component of a solar system is the inverter**, which can be either a *central* inverter (which is the size of a briefcase), or a *micro* inverter - which is about the size of a paperback book.



A central inverter goes on the wall. All the solar panels connect into it. A micro-inverter goes on the back of each individual solar panel

Pro-tip: Never mount a central 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. Sun kills inverters, because it cooks them.

Micro inverters are great because they optimise each panel individually, which results in more energy.

They are also safer because they use lower voltages. But microinverters usually add about 20% to the system price.

The inverter's job 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 most likely component to fail in the first 10-15 years. This is because they work hard all day, and they do wear out. So if you are on a limited budget, I recommend getting a premium inverter over premium panels. The premium inverters will last longer and are better supported if they do fail.

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 90% 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. The brands to the left are more affordable. The brands to the right are more expensive.

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 grid.

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

When the solar electricity comes out of your panels, it will first get used by appliances in your home, with any surplus solar exported to the grid. Your electricity retailer will pay you a small amount (around 6-10c) for each kWh that you export to the grid.

It is better to use the solar than export it. Self-consumed electricity saves about 30c per kWh, because you don't have to buy it from the grid. Exported electricity earns a 'Feed In Tariff' of about 6-10c per kWh. So self-consumed electricity is about 3x more valuable than exported electricity.

Pro Tip: Shop around for Feed-In Tariffs. They can vary from 0c to 12c depending on the retailer.

This means 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 and can see very short paybacks of 4-5 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 solar 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 30% of a well sized solar system, pushing the simple payback out to 8-10 years. But bear in mind that this is still a 10-12% return on your investment.

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

Pro Tip: Your 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 (~\$100) 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 The solar rebate: still very much alive and kicking – and generous.

The famous 'solar rebate' acts as a point-of-sale discount off the final cost of a solar system. It is worth about \$700 per kW of solar installed.

As an example, a 3kW system attracts around \$2,100 in rebates (3 x \$700 = \$2,100).

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

The only restrictions on claiming the rebate are:

- Your system is 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.

The rebate will be slowly phased out by one 15th per year for fifteen years starting on the 1st January 2017.

But don't feel pressured by shonky salesmen who are implying that if you don't sign on the dotted line *right now* you'll lose the rebate. At worst you'll lose one fifteenth of the rebate - if you delay your decision until the New Year. A small price to pay for making an informed decision, in my opinion.

Pro Tip: The rebate is based on the number of panels, not the size of the inverter. 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.

#4 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 that 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. These generous tariffs were designed to kick-start the solar industry when solar was much more expensive.

Solar has reduced in price by 80% since 2008, and the Feed In Tariffs have reduced to 6-12c, depending on your retailer. This reduction is why you see so many people screaming *"Solar isn't worth it anymore! The rebate has been massively reduced!"*

They're actually confusing the rebate with the feed-in tariff. The 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 so much, people believe that solar isn't worth it anymore. This couldn't be further from the truth.

A lower a feed-in tariff simply incentivises you to use your solar generation and not export it.

So – because feed-in tariffs have been lowered, you just need to consume as much of your own solar as possible. That's what I do, and my last summer electricity bill was \$33 for a 6-person home with a 6kW solar system on it.

Pro Tip: When you get solar, 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 to the daytime, increasing the returns on a solar system.

#5 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 production around midday (and provide the most energy overall), and west-facing panels won't produce much in the morning and early afternoon but will produce 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 solar wasn't worth it.

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

The advantage of east and west panels is that they produce more energy if you use electricity in the morning and late afternoon, so you self-consume more.

So if you have east and west facing roof areas, ask your installer about using them.

1. 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 place your panels at the ideal angle, don't worry too much. My panels 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 which have no frame around the edge, so the water will generally blow 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.**

#6 Typical payback period for a solar system.

A well-designed solar system has a typical payback period of around 5-6 years. This can vary wildly depending on your electricity usage and your system size, but when you get quotes for solar the installer should do a payback analysis for you to estimate your payback period.

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

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

As of November 2016, approximate prices for good quality solar panel systems (Tier 1 panels + quality central inverter), fully installed, are:

3kW: \$4,000 - \$6,000

5kW: \$6,000 - \$9,000

10kW: \$12,000 - \$16,000

Note that these prices also include the discount from the 'solar rebate'.

Costs can increase if you need a switchboard upgrade or other electrical work to make your home suitable for solar, or if the design of your home makes the install more difficult.

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

Adding 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 salesman, chances are they're cutting corners somewhere or using inferior quality products to deliver a lower overall cost. So, be wary!

Pro Tip: Really cheap solar costs 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.

#8 Batteries - do you need them?

Battery storage is prohibitively expensive in 2016.

As an example – it will cost about \$10,000 to add a Tesla Powerwall onto a solar system. A typical payback period of a Tesla Powerwall is about 15 years, but it only has a 10 year warranty. You'll most likely have to replace the battery long before it has paid for itself.

Compare this with solar-without-batteries. A regular non-battery solar PV system has a typical payback of around 5 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 just isn't worth it yet. Our advice is to wait 3-5 years for battery costs to come down before investing in them.

And certainly don't wait for batteries to come down in price before buying solar, because that is locking in another 3-5 years of high bills every quarter.

If you buy a system now, your bills will immediately be reduced. In 3-5 years you can simply add batteries to your existing system for even greater savings. And 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 a 'battery inverter'. You can buy one of these when you buy your batteries, and battery installation will be very straightforward.

Pro Tip: Counter-intuitively, most 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 an expensive extra feature that requires very careful design.

The next step.

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

If you have any burning questions, my contact details are:

Email: finnpeacock@solarquotes.com.au

Tel: 08 7200 0177

Fax: 08 8121 8547

PO Box 470

Brighton

SA 5048

Australia

If you'd like to take the next step and get up to 3 free quotes for solar from pre-vetted companies that I trust, please visit <https://www.solarquotes.com.au/quote/>.

Happy Solar Power Hunting!

A handwritten signature in black ink that reads "Finn Peacock". The script is cursive and fluid, with the first name "Finn" and last name "Peacock" clearly distinguishable.

Finn Peacock, founder of [SolarQuotes.com.au](https://www.solarquotes.com.au)