Consumer guide to buying solar panels (photovoltaic panels)

Household use of solar panels has grown significantly in Australia this decade behind increased awareness of the risk of dangerous climate change, the reduced cost of systems and a range of government incentives to encourage deployment of the technology.

Solar panels are now an affordable option for Australian households looking to reduce their power bills and generate their own clean electricity. With the increased range of solar panel systems and suppliers on the market, being an informed consumer has never been more important.

This guide is designed to provide an introduction to solar panels so that you can make informed choices about a system that is right for you. Towards the back of the guide there are a series of questions you can ask your installer, electricity retailer and distributor to ensure you have all the information you need to make smart decisions.

How does solar PV work?

Solar Photovoltaic (PV) panels are generally fitted on the roof in a northerly direction and at an angle to maximise the amount of sunlight that hits the panels. Solar panels are different to solar hot water systems, which are also mounted on household roof-tops but use the heat from the sun to provide hot water for household uses.

Solar Photovoltaic (PV) panels on the roofs of homes and businesses generate clean electricity by converting the energy in sunlight. This conversion takes place within modules of specially fabricated materials that make up the solar panels. It is a relatively simple process that requires no moving parts. In most cases solar panels are connected to the mains power supply through a device called an inverter.

The technology to convert sunlight into electricity was developed in the 19th century, but it was only in the second half of the 20th century that development accelerated behind the need to provide reliable supplies of electricity in remote locations – from satellites in space to outback Australia.

Solar panels have been installed on the rooftops of houses and other buildings in Australia since the 1970s. Currently there are more than 100,000 solar panel systems safely and reliably delivering clean electricity across Australia.

Increased scale and development of the technology in the early 21st century has seen the cost of solar panels continue to fall, making them more affordable. Over the past decade there have also been changes to government programs to help households reduce their greenhouse emissions and cut power bills. Expanded use of affordable and reliable solar panels will help reduce Australia's greenhouse emissions and provide a clean and distributed source of energy across our towns and cities.

Grid-connected solar PV systems

Most suburban homes in Australia are connected to the electricity grid, which uses alternating current electricity (AC). But the electricity generated by solar panels is direct current. That means grid-connected (GC) solar PV systems need an inverter to transform the DC electricity into alternating current (AC) electricity suitable for ordinary

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household needs. The existing electrical panel distributes solar electricity firstly, and utility power secondly, to household appliances.

When the panels are not producing electricity at night, electricity is supplied from the existing electricity grid. For systems with a battery backup (optional), the inverter regulates the charge of batteries. The electricity stored in the batteries can be used at night or during blackouts.

The existing electrical meter measures your total electricity consumption and production (see figure 2 below). If your solar panels produce more electricity than you consume, you can sell the excess electricity back to your electricity retailer. This is known as a feed-in tariff agreement and is discussed in further detail below.

How much power do they generate?

The output of a solar PV system depends on its size. The most common household systems are either 1 kilowatt or 1.5 kilowatts, although some property owners have installed systems of up to 10 kilowatts. The table below shows the average daily production of some common grid-connected systems throughout Australia.

Average Daily Production			
City	**1 kW system**	**1.5 kW system**	**2.0 kW system**
Adelaide	4.30 kWh	6.45 kWh	8.60 kWh
Alice Springs	4.56 kWh	6.84 kWh	9.12 kWh
Brisbane	3.86 kWh	5.79 kWh	7.72 kWh
Cairns	3.70 kWh	5.55 kWh	7.40 kWh
Canberra	3.97 kWh	5.95 kWh	7.94 kWh
Darwin	4.30 kWh	6.45 kWh	8.60 kWh
Hobart	3.24 kWh	4.86 kWh	6.48 kWh
Melbourne	3.38 kWh	5.07 kWh	6.76 kWh
Perth	3.71 kWh	5.56 kWh	7.42 kWh
Sydney	4.00 kWh	6.00 kWh	8.00 kWh

PV-GC spreadsheet based on the CEC GC Design Guidelines

PV Array 1kWp facing true north and a tilt angle of 20° with an average inverter / wiring efficiency – 0.92, using long term average solar irradiation and temperature data from the Australian Solar Radiation Data Handbook

A typical Australian house consumes around 18 kilowatt hours per day so a 1-2 kW system displaces an average of 25-50% of your average electricity bill. Solar panels produce more energy in summer than they do in winter.

How much do solar panels cost?

The cost of solar panels has continued to change over the past decade behind different government incentive schemes and increased diversity in the panels, inverters and suppliers in the market.

Being an informed consumer is increasingly important. Similar to buying a car or a computer, you'll want to be sure that your system is a sound investment that best meets your needs at a reasonable price.

It is important to be clear on what you want from your solar PV system. Are you after a system that will partially offset your energy consumption for 5-10 years before requiring a system upgrade? Or do you want a system that will completely offset your household's electricity use for the next 25 years? Like buying a second-hand car as opposed to a brand-new sports car, these two solar PV systems are both sound investments depending on your needs, but will vary significantly in price.

The price of your solar PV system can also be affected by variables including:

- Government rebates and support schemes (these vary in each state)
- Location
- Number of panels
- Orientation of panels
- Type of panels
- Type of inverter
- System design and configuration
- Shipping costs for equipment and parts
- Contractor installation costs
- Removal of trees or other shading
- Site preparation needs (for example, condition of roof or ground)
- Structural engineering, architectural, and other professional services (for commercial systems)

Keeping in mind the variables mentioned above, the table below shows the estimated price range for grid-connected solar PV systems in the major capital cities. Government rebates such as Renewable Energy Certificates, Solar Credits and Feed-in Tariffs can be deducted from these figures.

Estimated Price		
System Size	**Estimated Lowest Price (No GST)**	**Estimated Highest Price (No GST)**
1 kW	$8,750	$10,000
1.5 kW	$11,000	$12,250
2 kW	$14,250	$15,800

Figures are estimates based on market conditions as at March 2010 and may change due to changed market settings.

Australian Standards

Recently, there has been an increase in cheap solar panels manufactured in Asia which vary in quality. Generally, price is indicative of the quality. It is difficult to tell the quality of a panel by simply looking at it so it is important to ensure that it complies with Australian Standards *IEC61730 Class A* and either *IEC61215* or *IEC61646*. This is required for a solar PV system to qualify for government rebates. Even where a rebate is not sought, installation must be compliant with *AS/NZS5033* and *AS3000*. It is important you ask your accredited installer to provide proof that your panels meet these standards.

The Clean Energy Council has a frequently updated list of all solar panel models that meet Australian standards. To see the list, please click here.

Solar PV systems must also comply with *The CEC Design and Installation Guidelines.*

Warranties

Manufacturer warranties or guarantees range from five to 25 years. Solar PV systems should last at least 25 years so a warranty or guarantee for that duration is best. Some warranties or guarantees only cover power output while others are more comprehensive and cover things like construction quality.

A system manual that provides operation, maintenance and safety information should be provided by your installer. This must also include a system energy output (kWh) estimate.

It is important to ensure you obtain written confirmation of statements made by your installer, including performance claims, guarantees and warranties. Documentation will be essential if you need to make warranty or insurance claims.

What government schemes are in place to lower the cost of purchasing a solar PV system?

There are currently four types of financial assistance offered for solar PV systems in Australia:

- Renewable Energy Certificates
- Solar Credits
- Rebates (applications for rebates must have been received by June 2009)
- Feed in tariffs

Renewable Energy Certificates

Renewable Energy Certificates (RECs) are an electronic form of currency created by the Renewable Energy (Electricity) Act 2000 (also known as the RET scheme). One REC is equivalent to one megawatt hour of electricity generated by your solar PV power system. The price of RECs changes according to market conditions. As an owner of a solar PV power system, you can register, sell, trade or surrender RECs for systems up to 100kW.

There are two ways you can be paid for your RECs:

1. Assign your RECs when you purchase your solar PV system to a registered agent in exchange for a financial benefit which may be in the form of a delayed cash payment or upfront discount on your solar PV panel system (most consumers take this option); or

2. Create the RECs yourself by finding a buyer and then selling and transferring them in the REC Registry.

For a list of registered agents, contact the Office of the Renewable Energy Regulator.

RECs may be created for solar PV systems in batches of either, 1, 5 or 15 year deeming periods. At the beginning of each successive deeming period, the Regulator (from the Office of the Renewable Energy Regulator) must be satisfied that your solar PV system is still installed and is likely to remain functional for the next deeming period. In order to claim RECs for the full 15 year deeming period, your designer/installer must be accredited by the Clean Energy Council.

The level of subsidy will depend on a number of factors, including the location (also known as the zone) of the solar PV system, the size of the system and the price of RECs at the time the system was installed.

Australia is divided up into various zones based on how much renewable energy can be generated by a solar panel in a given area. So the same sized system installed in Melbourne or Hobart (Zone 4) receives fewer RECs than those installed in Sydney (Zone 3) or Darwin (Zone 2) because Melbourne and Hobart have less sunshine so less solar energy is produced. The table below shows the level of financial support available from RECs on solar PV systems in the major capital cities of Australia.

Average Daily Production						
City	Zone	Rating	System Size	Deeming Period	Total REC Entitlement	Total Subsidy
Adelaide	3	1.382	x 1.5 kW	x 15 (years) =	31	$1240 (31 RECs x $40)
Brisbane	3	1.382	x 1.5 kW	x 15 (years) =	31	$1240 (31 RECs x $40)
Canberra	3	1.382	x 1.5 kW	x 15 (years) =	31	$1240 (31 RECs x $40)
Darwin	2	1.536	x 1.5 kW	x 15 (years) =	34	$1360 (34 RECs x $40)
Hobart	4	1.185	x 1.5 kW	x 15 (years) =	26	$1040 (31 RECs x $40)
Melbourne	4	1.185	x 1.5 kW	x 15 (years) =	26	$1040 (31 RECs x $40)
Perth	3	1.382	x 1.5 kW	x 15 (years) =	31	$1240 (31 RECs x $40)
Sydney	3	1.382	x 1.5 kW	x 15 (years) =	31	$1240 (31 RECs x $40)

Zone Rating x Rated Power Output (1.5kW) x Deeming Period (15 years) = Total REC Entitlement
Figures based on a $40 market rate for RECs
For more information, contact the Office of the Renewable Energy Regulator.

Solar Credits

The Solar Credits scheme for solar PV systems is based on the REC scheme, but multiplies by five the number of RECs able to be created for your solar PV system. These extra credits only apply to the first 1.5kW of system capacity. So if your system is larger than 1.5kW, you will receive Solar Credits plus an additional REC for every one megawatt hour of electricity able to be generated by your solar PV system.

The table below shows the level of financial support available from Solar Credits on Solar PV systems in the major capital cities of Australia:

1.5 kW system under the Solar Credit Scheme		
City	1.5 kW system	Number of Solar Credits Due
Adelaide	6.04 kWh	$6,200 (31 RECs x 5 = 155 RECs)
Brisbane	5.77 kWh	$6,200 (31 RECs x 5 = 155 RECs)
Canberra	5.95 kWh	$6,200 (31 RECs x 5 = 155 RECs)
Darwin	6.45 kWh	$6,800 (34 RECs x 5 = 155 RECs)
Hobart	4.86 kWh	$5,200 (26 RECs x 5 = 130 RECs)
Melbourne	5.07 kWh	$5,200 (26 RECs x 5 = 130 RECs)
Perth	5.56 kWh	$6,200 (31 RECs x 5 = 155 RECs)
Sydney	6.00 kWh	$6,200 (31 RECs x 5 = 155 RECs)

Figures based on a $40 market rate for RECs

The same sized system installed in Melbourne or Hobart receives fewer Solar Credits because these areas have less sunshine so less solar energy is produced.

In February 2010, the Federal Government announced proposed amendments to the RET scheme. As part of these changes, the scheme will be spit into two parts:

1. the Small-scale Renewable Energy Scheme (SRES) which covers small-scale technologies such as solar panels and solar hot water systems; and
2. the Large-scale Renewable Energy Target (LRET) which covers large-scale renewable energy projects like wind farms, commercial solar and geothermal.

The SRES will provide a fixed price of $40 per REC effective from 1 January 2011.

For more information, contact the Office of the Renewable Energy Regulator.

Feed in tariffs

Several states have introduced, or are in the process of introducing, feed-in tariffs. A feed-in tariff is a premium rate at which individual state governments pay you for electricity generated by your solar PV system.

Under a net feed-in tariff, a premium is paid for any solar energy that goes back into the grid from your house. So if you have surplus energy generated by your solar panels, you get paid for it; and if you use all the energy you generate, you get paid nothing.

Under a gross feed-in tariff you get paid for every unit of electricity generated by your solar panels, regardless of whether it goes into the grid or is used by your household.

You need to apply to your electricity retailer to receive the feed-in tariff. When signing an agreement with your electricity retailer, you need to be informed. Important questions to ask about your feed-in tariff agreement include:

- What price will they pay you for your electricity (in cents per kWh)?
- What is the cost of the electricity you purchase from them (in cents per kWh)?
- Have you been signed onto a premium feed-in tariff or a standard feed-in tariff? If your electricity retailer signs you up to a standard feed-in tariff agreement you will receive less money for the electricity you feed back into the grid.
- What will be the form of payment for electricity you produce? It is likely you will receive the feed-in tariff's you earn by default as a credit on your electricity bill rather than cash.
- What will be the form of payment for surplus electricity you produce? Will it be cash, cheque or EFT on request?

Other important questions to ask when signing an agreement with your electricity retailer are discussed in further detail later in this document.

The table below shows the feed-in tariffs introduced, or in the process of being introduced, in the various states, and the savings that could be made on a 1.5 kWh system. These savings are an estimate only and may vary depending on the size of your solar PV system, the products used, location of the system and how much electricity your household consumes. For a more accurate estimate, your accredited designer/installer will be able to calculate your potential savings as part of their load analysis.

1.5 kW system under the Feed-in Tariff schemes						
City	1.5 kW system Daily Production	Feed-in Tariff		Daily Savings (based on 50% of electricity being fed into the grid)	Annual Savings (based on 50% of electricity being fed into the grid)	Annual Savings (based on 30% of electricity being fed into the grid)
Adelaide	6.04 kWh	Net	44c per kWh	$1.32	$481.80	$289.08
Brisbane	5.77 kWh	Net	44c per kWh	$1.26	$459.90	$275.94
Canberra	5.95 kWh	Gross	50.05c per <10 kWh 40.04c per 10-30 kWh	$1.19-$1.48	$434.35-$540.20	$260.61-$324.12
Darwin	6.45 kWh	TBC	TBC	TBC	TBC	TBC
Hobart	4.86 kWh	Net	20c per kWh	97c	$354.05	$212.43
Melbourne	5.07 kWh	Net	60c per kWh	$1.52	$554.80	$332.88
Perth	5.56 kWh	Net	TBC	TBC	TBC	TBC
Sydney	6.00 kWh	Gross	60c per kWh	$1.80	$657	$394.20

For more information, contact your relevant State Government Department:

Estimated Price		
State	Department	Contact
ACT	Department of Environment, Climate Change, Energy & Water	13 22 81
NSW	Department of Industry & Investment	1300 136 888
NT	Department of the Chief Minister	08 8999 5511
QLD	Office of Clean Energy	13 25 23
SA	Sustainability & Climate Change	08 8204 2999
TAS	Department of Infrastructure, Energy & Resources	1300 135 513
VIC	Department of Primary Industries	03 9742 8755
WA	Office of Energy	08 9420 5600

What does the Design and Specification of my Solar PV System involve?

Accredited Designers / Installers

To be eligible for government rebates, the designer/installer of your solar PV system must be accredited by the Clean Energy Council.

The Clean Energy Council's Accreditation scheme ensures that accredited designers/installers of solar PV power systems:

- have undergone the necessary professional training
- follow industry best practice
- adhere to Australian standards
- routinely update their skills and product knowledge.

For a list of accredited designers/installers, please see www.cleanenergycouncil.org.au.

An accredited designer/installer will provide you with a solar PV system design and specification. This will include things such as:

- Establishing your electrical loads over an average day using a load analysis
- Determining the type of panels
- Determining the size of your solar PV system
- Deciding the type of inverter
- Establishing the location of solar panels in relation to angles, available sunlight, shading and temperature.

What size solar PV system should I install?

The size of your solar PV system will depend on:

- the physical unshaded area available for the installation of your panels
- how much you are prepared to spend
- what portion of your electrical consumption you wish to generate.

To work out what size solar PV system you require, you need to analyse your household's daily electricity consumption. Your monthly or quarterly electricity bill measures your household's electricity consumption in KWh. From this figure, you can calculate your average daily electricity consumption, and the average amount of electricity your solar PV system needs to produce to cover your electricity needs.

This process will be completed by your accredited designer during the design and specification stage, as part of their load analysis.

What size panels should I buy?

Solar PV panels come in different Watt sizes. The main issue to consider is whether your solar PV system has enough Watts to power your appliances, and that the solar panels will physically fit in the space you want to install them.

Each solar panel is approximately 1.5 metres long and 0.75 metres wide. As the panels are generally grouped in a set of four, a 1kW solar panel system will require around 8m2 of roof space, and a 1.5kW solar panel system requires around 12m2. This will vary depending on the type of panel installed on your roof.

What sort of panels should I buy?

There are four main types of solar panel available, each with their own benefits. During the design and specification stage, your accredited designer will help you choose which type is the best to suit your needs:

1. Mono Crystalline (monocrystalline c-Si)

These are widely considered 'top of the range' solar panels. They are a proven technology that has been in use for over 30 years.

They have the highest efficiency of 12-15% in the real world, meaning that fewer panels are required to produce a given amount of energy. They are commonly used where space is limited, or where there are high costs associated with installing large panels.

They have a very slow degradation, generally loosing 0.25 - 0.5% per year. However, they are also the most expensive to make and purchase.

2. Poly Crystalline (polycrystalline c-Si)

These panels are similar to Mono Crystalline panels, but the silicon used is Multi-Crystalline which is easier to make.

They are comparable to Mono Crystalline in performance and durability, except their efficiency is slightly lower, generally 11-13%. Slightly more panels are required to produce a given amount of electricity, however installation costs are often lower.

They are more resistant to the effects of heat than Mono Crystalline panels.

3. String Ribbon

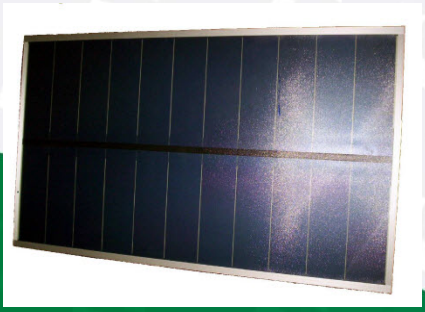
This is a relatively new technique that combines conventional crystalline silicon and newer thin films.

They have an efficiency of 11-13%, meaning that the panel size is approximately 30% bigger than Mono Crystalline and Poly Crystalline panels.

Degradation is very slow, typically losing 0.25 - 0.5% per year.

As less energy is used to manufacture these panels than the Mono Crystalline and Poly Crystalline panels, they are usually cheaper to purchase.

4. Thin Film or Amorphous



This is a very new technique, so its long-term durability can only be estimated.

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The production process is more energy efficient than the other panel varieties so the panels are generally cheaper to make and to purchase.

They have a lower efficiency of 5-6% so the panel is typically nearly double the size than the other panel varieties. However, their light weight makes them suitable for curved structures.

As a new technology, research is continuing to improve the performance of Thin Film or Amorphous panels and to refine the manufacturing process.

The most common varieties of Thin Film or Amorphous panels are:

- Cadmium Telluride Thin-Film panels (CdTe)
- Copper Indium Gallium Selenide Thin-Film panels *(CIGS)*
- Amorphous silicon Thin-Film panels (a-Si)

For more detailed information, please visit the Desert Knowledge Australia Solar Centre at - http://www.dkasolarcentre.com.au/ - The Desert Knowledge Australia Solar Centre is a live research facility run by Desert Knowledge Australia that tests the performance of different types of solar panels according to type and installation, including those mentioned above.

What angle should the solar panels be on?

Solar PV panels produce most power when they are pointed directly at the sun. In Australia, solar modules should face north for optimum electricity production. Panel orientation will often have a greater effect on annual energy production than tilt angle. A minimum tilt of 10° is recommended to ensure self cleaning by rainfall.

For grid-connected solar PV power systems, the solar panels should be positioned at the angle of latitude to maximise the amount of energy produced annually. Most Australian homes have a roof pitch of 20° to 30°.

If your roof's slope is not ideal, your accredited designer can create an appropriate mounting frame to correct the orientation and elevation of your panel. Failing this, the designer can advise you on the difference in energy output for different tilt and orientation.

However, if the electricity load is significantly higher in summer, your installer may consider angling the panels to maximize electricity production to match this load.

How much sunlight should the panels receive?

The amount of energy in sunlight that a solar PV panel receives over a day is expressed in peak sun hours. As the amount of energy generated by a panel is directly proportional to the amount of energy it receives from sunlight, it is important to install panels so they receive maximum sunlight.

Your accredited designer will calculate the amount of energy generated by the solar PV panel from the peak sun hours available. Peak sun hours vary throughout the year. The following table shows the average monthly peak sun hours for north facing PV panels at various locations in Australia.

	Adelaide		Alice Springs		Brisbane		Cairns		Melbourne	
Month	20 Deg Tilt	50 Deg Tilt	10 Deg Tilt	50 Deg Tilt	20 Deg Tilt	50 Deg Tilt	10 Deg Tilt	40 Deg Tilt	20 Deg Tilt	60 Deg Tilt
January	8.14	6.72	7.58	5.36	6.53	5.17	5.66	4.47	6.86	5.22
February	7.58	6.86	7.11	5.78	6.17	5.31	5.38	4.66	6.42	5.50
March	6.31	6.39	7.14	6.86	5.72	5.47	5.47	5.27	5.22	5.19
April	4.81	5.39	6.50	7.39	4.78	4.89	4.77	5.11	3.78	4.28
May	3.50	4.14	5.19	6.64	4.19	4.81	4.03	4.64	2.75	3.39
June	3.19	3.97	5.00	6.78	4.06	4.78	4.38	5.33	2.39	3.08
July	2.97	3.56	5.17	6.89	4.17	4.94	4.38	5.22	2.69	3.47
August	3.86	4.39	5.86	7.06	5.19	5.75	5.03	5.58	3.28	3.83
September	5.28	5.53	6.64	6.89	6.00	5.97	5.97	6.00	4.25	4.44
October	6.53	6.19	7.28	6.33	5.86	5.28	6.22	5.56	5.31	4.83
November	7.25	6.22	7.44	5.53	5.97	4.86	6.11	4.92	6.06	4.83
December	7.33	5.97	7.47	5.11	6.31	4.83	6.13	4.67	6.61	4.92
Avg	5.56	5.44	6.53	6.39	5.41	5.17	5.29	5.12	4.63	4.42

	Canberra		Sydney		Perth		Hobart		Darwin	
Month	20 Deg Tilt	50 Deg Tilt	20 Deg Tilt	50 Deg Tilt	10 Deg Tilt	40 Deg Tilt	10 Deg Tilt	40 Deg Tilt	10 Deg Tilt	40 Deg Tilt
January	7.61	6.39	6.67	5.56	7.79	6.33	6.53	5.28	5.39	5.03
February	7.08	6.44	5.81	5.25	7.47	6.56	5.89	5.31	5.58	5.39
March	6.11	6.17	5.67	5.69	6.86	6.81	4.72	4.89	5.69	5.69
April	4.61	4.92	4.39	4.69	5.08	5.67	3.50	3.97	6.61	6.81
May	3.56	4.28	3.64	4.36	4.14	4.97	2.53	3.31	6.31	6.81
June	3.28	4.03	3.44	4.25	3.47	4.33	2.14	2.92	6.06	6.56
July	3.17	3.83	3.31	4.06	3.61	4.39	2.53	3.44	6.58	7.06
August	4.25	4.86	4.39	5.08	4.50	5.14	3.28	4.01	6.81	7.22
September	5.03	5.17	5.19	5.36	5.67	5.92	4.17	4.39	6.89	7.00
October	6.17	5.83	5.83	5.50	6.64	6.17	5.31	5.03	6.81	6.61
November	6.78	5.86	6.28	5.39	7.42	6.14	5.75	4.83	6.53	6.14
December	7.42	6.03	6.86	5.50	7.94	6.14	6.08	4.69	5.94	5.47
Avg	5.42	5.32	5.12	5.06	5.90	5.71	4.37	4.34	6.27	6.31

Shading / Dirt

Solar PV panels should ideally be in full sun from at least 9am to 3pm. They should not be placed in shaded areas and be kept free from dust and dirt. Even a small amount of shade will have a large impact on the output of a panel, as it changes the flow of electricity through the panel. Shading or dirt on just one of the cells in a solar panel results in a loss of power from many cells, not just the one that is shaded.

Temperature

The amount of electricity a solar PV panel can generate is reduced as temperatures increase. Solar panels operate best at ambient temperatures up to 35°C. However, if the ambient temperature is higher, the panel's output declines.

What is an inverter? What sort should I buy?

Solar PV panels produce low voltage DC electricity. The inverter converts this into higher voltage AC electricity needed to supply power for standard appliances.

A sine wave inverter powers higher-end electronic equipment, and matches the quality of electricity supplied by electricity companies.

The efficiency of an inverter is measured by how well it converts the DC electricity into AC electricity. This usually ranges from 85% to 95% for most models, with 90% being about average. Check the inverter's specifications before you purchase.

Inverters are sized according to the power (watts) they can supply.

Australian Standards

It is important to ensure that your grid connect inverter complies with Australian Standards AS 4777.1 -2002, AS 4777.2 -2002 and AS 4777.3 -2002. This is required to be eligible for the REC's and Solar Credits.

Poor performance and high failure rates are common with cheap imported inverters without Australian Standards certification.

Ask your accredited installer to provide proof that your inverter meets these standards. Approved inverters should have a Certificate of Suitability number and a date of testing. The testing date should be less than 5 years old.

Manufacturer warranties or guarantees range from 5 to 15 years.

The Clean Energy Council has published a list of all grid connect inverters that meet Australian standards. To see the list, click here.

What will happen to my meter at home?

When your solar PV system is installed you may need to have a new meter installed.

If you have a traditional accumulation meter (with a spinning disk) this will need to be replaced with an interval meter or smart meter. This is because an accumulation meter does not record the energy you export to the grid or the electricity you import from the grid. An interval meter or a smart meter provide half hourly readings of the electricity you consume and the surplus electricity you generate.

The States and Territories have committed to the progressive rollout of smart metering across Australia from 2007. While a smart meter is similar to an interval meter in that it records electricity usage in 30-minute intervals remotely to your electricity company, smart meters have a range of additional capabilities. So if your new meter is an interval meter, it will need to be replaced again with a smart meter when this rollout occurs.

Depending on where you live, your interval meter may be a gross meter or a net meter.

If you are on a gross feed-in tariff scheme, your gross meter separately measures the total electricity consumed by your household and the total electricity generated by your solar PV system. Your electricity company reads the meter and determines the total amount of electricity generated by your solar panels, regardless of whether it goes into the grid or is used by your household.

If you are on a net feed-in tariff scheme, your net meter measures your household's electricity and the electricity generated by your solar PV system together. Your electricity company reads the meter and calculates any surplus electricity fed back into the grid.

Your new meter must be installed by a Level 2, Category 4 Accredited Service Provider (Level 2 Electrician). This may be organised by your accredited designer/installer; or your electricity retailer; or electricity distributor. Ask to find out who will organise this for you. Alternatively, you may choose to organise a Level 2 Electrician yourself.

The installation of a new meter may affect your electricity billing rates:

- The new meters are provided by your electricity distributor. The cost of this is passed from the electricity distributor to your electricity retailer. Generally, this cost is recovered by your electricity retailer through increased network charges on your monthly electricity bill.
- You may move from an off-peak tariff to a time-of-use (TOU) tariff. A TOU tariff is a pricing structure that changes depending on the time of day you consume power. In peak demand periods (day), charges will be

higher than consumption during lower demand periods (night). So while electricity is most expensive during the day, this will be offset by your solar PV system producing energy during this time also.

Quotation / Contract

Following the design and specification you may request a quotation for the design and installation of the system.

The quotation should provide specifications, quantity, size, capacity and output for the major components, including:

- solar PV modules
- mounting frames
- structure
- inverter
- any additional metering
- data-logging
- travel and transport
- requirements
- other equipment needed
- any trench digging
- a system user manual.

The quotation should also specify a total price, together with proposed start and completion dates. The quotation should form a basis for your contract with the designer/installer.

In addition, a contract for the supply and installation of the power system should be included with the quotation.

The contract should include:

- an estimate of the average daily electricity output (in kWh)
- the estimated annual production
- the estimated production in the best and worst months
- the responsibilities of each party
- warranties and guarantees, including installer workmanship schedule of deposit and progress payments.

Questions to ask your Designer / Installer

When signing a contract with your distributor/installer, you need to be informed. Important questions to ask include:

- **Accreditation**
  - Is the designer/installer Accredited?
  - What is their Accreditation Number?
  - Will your system be designed and installed by an accredited individual?
  - Check the Accreditor's List on the Clean Energy Council website to confirm - www.cleanenergycouncil.org.au
- **Experience**

- How many systems has the designer/installer completed?
- How many systems similar to your system has the the designer/installer completed?
- When was the last time the the designer/installer completed a system? New products are constantly entering the market. A designer/installer who has completed several recent installations will probably be up-to-date on the newest products and the latest regulatory issues.

- **Quality of Products – Australian Standards**
  - Do the modules you use meet the Australian Standards? Check the Module List on the Clean Energy Council website to confirm - www.cleanenergycouncil.org.au
  - Do the inverters you use meet the Australian Standards? Check the Inverter List on the Clean Energy Council website to confirm - www.cleanenergycouncil.org.au
  - Do some research on the other balance of system components that your designer/installer suggests, such as the controller. Do the products meet industry standards?
- **Warranties**
  - What kinds of warranties come with the products?
  - Which warranties are your responsibility and which are the manufacturer's?
  - How long have the equipment manufacturers been in the PV industry? Long warranties are meaningless if the manufacturers aren't around in five years.
  - If you have to deal with the panel or inverter manufacturer in the future, do they have an Australian office?
  - If you know of other people who have used these products, ask for their feedback: Are they satisfied? Have they had problems?
- **Service Agreements & Performance Guarantees**
  - What performance guarantees do you get for the system as a whole?
  - How will you know if your system is performing to it's max potential on a day to day basis?
  - Does the designer/installer provide some kind of optional service agreement?
  - If problems arise with your system, what services will the designer/installer provide and for how long?
  - Will the designer/installer be readily available to troubleshoot and fix problems?
  - If something goes wrong, who is responsible for repair or replacement costs?
  - Who is responsible for maintaining the system?
  - If you are responsible, what kind of training will the designer/installer provide?
  - Will basic system safety issues be explained?
- **Paperwork**
  - Does the designer/installer handle organising all the necessary metering changes?
  - Does the designer/installer organise all the paperwork for your local electricity supplier to move you to a premium feed-in tariff?

- Does the designer/installer handle all the REC paperwork for you so you just have to pay the difference?

- **References**
  - Contact the designer/installer's former customers to find out if the they were knowledgeable, easy to work with, and took the time to explain the systems operation. Also find out if their systems are working well, if there have been any problems, and, if so, if they returned to fix them. Ask for the designer/installer business references, and check them, especially if the company's reputation is unknown.

- **Quote**
  - Does the price quoted include or exclude money received from RECs?
  - Does the price quoted include all the necessary metering changes and paperwork for my local electricity supplier?
  - Does the quote include all labour charges?
  - Does the designer/installer give an accurate estimation of system production with their quotes?

- **Payment Terms**
  - What are the payment terms?
  - Is there a deposit? When is it required?
  - Do you need to pay the whole amount of just the difference after the RECs?

- **Time Frames**
  - What is the lead time from your payment to getting electricity from your solar PV system?

- The Final Decision
  - By installing a solar PV system, you need to take responsibility for it and learn the basic safe operation and proper maintenance of your systems. You should think carefully before selecting a designer/installer. Online and mail-order solar PV system suppliers who never visit your home may have difficulty recommending the most appropriate equipment. A comprehensive, on-site solar and load analysis and two way interview can help ensure a thoughtfully designed and well-planned installation.

What happens after my Solar PV System has been installed?

Entering into agreement with your electricity retailer

After your solar PV system has been installed, you will need to enter into an agreement with an electricity retailer. Not all electricity retailers offer solar friendly policies so it is best to check and compare the following items prior to entering into an electricity trading agreement.

Questions to ask your Electricity Retailer

- What price will they pay you for your electricity (in cents per kWh)?
- What is the cost of the electricity you purchase from them (in cents per kWh)?

- Are you signed onto a premium feed-in tariff rate or a standard feed-in tariff rate? If your electricity retailer signs you up to a standard feed-in tariff agreement you will receive less money for the excess electricity you feed back into the grid.
- What will be the form of payment for electricity you produce? It is likely you will receive the feed in tariff's you earn by default as a credit on your electricity bill rather than cash.
- What will be the form of payment for surplus electricity you produce? Will it be cash, cheque or EFT on request?
- Penalty clauses (termination costs)
- Billing / payment periods
- Do you organise all the necessary metering changes? If no, refer to 'Questions to ask your Electricity Distributor' (below). If yes – the following questions apply:
    - Is your new meter an interval meter or a smart meter? If it is an interval meter it will need to be replaced with a smart meter when the rollout occurs.
    - Can you have a smart meter, rather than an interval meter, installed to avoid unnecessary meter exchange costs when the smart meter rollout occurs?
    - Will your new meter continue to measure off-peak power use?
    - Is your new meter a gross meter or a net meter?
    - What is the cost of your meter?
        - Is it supplied free of charge?
        - Is there an upfront cost?
        - Is the cost recovered through increased network charges on your monthly electricity bill?
    - What is the cost of installing your meter by a Level 2, Category 4 Accredited Service Provider (Level 2 Electrician)?

Questions to ask your Electricity Distributor

- Do you organise all the necessary metering changes?
- Is your new meter an interval meter or a smart meter? If it is an interval meter it will need to be replaced with a smart meter when the rollout occurs.
- Can you have a smart meter (rather than an interval meter) installed to avoid unnecessary meter exchange costs when the smart meter rollout occurs?
- Will your new meter continue to measure off-peak power use?
- Is your new meter a gross meter or a net meter?
- What is the cost of your meter?
    - Is it supplied free of charge?
    - Is there an upfront cost?
    - Is the cost recovered through increased network charges on your monthly electricity bill?

- Do you need to organise a Level 2, Category 4 Accredited Service Provider (Level 2 Electrician) or will they organise this for you?

Safety Inspections

Following the installation of your solar PV system, safety inspections may be carried out by your relevant electrical authority. Depending on which State you live in, these inspections may be mandatory or may occur on a random audit basis. It is the responsibility of either your installer or your relevant electrical authority to organise these inspections. For more information, please contact your relevant electrical authority from the table below.

State	Responsible Authority	Phone
ACT	ACT Planning and Land Authority	02 6207 1923
Victoria	Energy Safe Victoria	03 9203 9700
Tasmania	Office of Electricity Standards and Safety	03 6233 7851
South Australia	Office of the Technical Regulator	08 8226 5500
Queensland	Electrical Safety Office	07 3225 2000
NT	NT Worksafe	1800 019 115
NSW	Office of Fair Trading	13 32 20
Western Australia	Energy Safe WA	08 9422 5200

The Clean Energy Council, the Department of Climate Change and the Office of the Renewable Energy Regulator also conduct its own inspection program. This applies to installations completed by Accredited Designers and Installers. It occurs on a random basis and aims to ensure that solar PV systems meet the Australian Standards and Accreditation Guidelines.

Dispute Resolution

Clean Energy Council

The Clean Energy Council deals with complaints involving a breach of the Accreditation Rules, Accreditation Code of Conduct or relevant Australia Standards.

For example, this may involve:

- Faulty or poor workmanship, such as incorrect wiring, incorrect labelling or damage to your house during installation
- Use of modules and inverters that do not meet the Australian Standards
- Dishonest behaviour relating to payments, discounts, rebates and grants and the conditions applying to them

If you have a complaint of this nature, the Clean Energy Council will require you to provide the following in writing to accreditation@cleanenergycouncil.org.au :

- Full contact details of all involved parties
- A description of the problem that has led to dispute

- All relevant information on any dispute
- Any actions taken to resolve the dispute
- Full detail of all interaction with the Accredited person.

The Clean Energy Council may decide to appoint an investigator. Where the dispute cannot be immediately resolved, a tribunal will be established to determine the appropriate actions required to deal with all issues to the satisfaction of the parties involved. The Tribunal may decide to:

1. Downgrade or extend the designer/installer's Accreditation to Provisional; or
2. Suspend the designer/installer's Accreditation; or
3. Putt the designer/installer on a year's probation; or
4. Cancel the designer/installer's Accreditation either for a specified period or for life.

State and Territory Offices of Fair Trading/Consumer Affairs

If you have a complaint about a commercial matter, you can contact the Office of Fair Trading (sometimes called 'Consumer Affairs') in your state or territory. Examples of commercial complaints include:

- Disputes to do with price
- Disputes over warranty
- Disputes to do with the terms and conditions of the agreement with your electricity retailer
- Disputes over the level of service provided by your designer/installer
- Disputes about the quality of work provided (excluding safety issues)

The Office of Fair Trading can negotiate on your behalf and arrange mediation where necessary, but it does not have the power to force your designer/installer to fix the problem.

State	Body	Phone
ACT	Office of Fair Trading (ACT)	02 6207 0400
VIC	Consumer Affairs (VIC)	1300 55 8181
TAS	Consumer Affairs and Fair Trading (TAS)	1300 65 44 99
SA	Consumer and Business Affairs (SA)	08 8204 9777
QLD	Office of Fair Trading (QLD)	13 13 04
NT	Consumer Affairs (NT)	1800 019 319
NSW	Office of Fair Trading (NSW)	13 32 20
WA	Consumer Protection (WA)	1300 304 054

Electrical Authorities

If you have concerns about the safety and technical compliance of your solar PV system, you can contact the electrical authority in your state or territory who may arrange for your solar panel system to be inspected.

State	Responsible Authority	Phone
ACT	ACT Planning and Land Authority	02 6207 1923
VIC	Energy Safe Victoria	03 9203 9700
TAS	Office of Electricity Standards and Safety	03 6233 7851
SA	Office of the Technical Regulator	08 8226 5518
QLD	Electrical Safety Office	07 3225 2000
NT	NT Worksafe	1800 019 115
NSW	Office of Fair Trading	13 32 20
WA	Energy Safe WA	08 9422 5200

Small claims courts and tribunals

If you have been unable to resolve your dispute to your satisfaction with assistance from either the Clean Energy Council or the Office of Fair Trading, you can take your complaint to the appropriate Small Claims Tribunal or Court in your state or territory. You should seek independent legal advice about whether this option is available and suits your circumstances.

State	Responsible Authority	Phone
ACT	Small Claims Court	02 6217 4272
NSW	Consumer, Trader & Tenancy Tribunal (CTTT)	1300 135 399
NT	Local Court (Small Claims Division) Limit is $5,000 and claims must be lodged within 2 years of the event	08 8999 6298
QLD	Small Claims Tribunal The limit on small claims is $7,500	07 3247 4578
SA	Magistrates Court - Small Claims Deals with disputes of up to $5,000	08 8204 2444
TAS	Magistrates Court - Minor Civil Claims Division Any dispute claiming $5000 or less.	03 6233 3623
VIC	Victorian Civil and Administrative Tribunal No limit to the amount you may claim	03 9628 9830
WA	Magistrates Court	08 9425 2222

Industry Ombudsman

If you have a complaint about your electricity retailer or electricity distributor, you can contact the Energy Ombudsman in your state or territory. For example, the Energy Ombudsman may be able to help if your complaint is about:

- The provision and supply of electricity
- Failure to provide or supply electricity services
- Quality of electricity supply
- Billing
- Credit and payment services
- Electricity disconnections
- Connection or transfer issues
- Actions of a supplier which affect your property
- Metering not working
- Billing unfair

State	Body	Phone
ACT	Essential Services Consumer Council	02 6207 7740
NSW	Energy and Water Ombudsman NSW	1800 24 65 45
NT	Ombudsman for the Northern Territory	1800 80 63 80
QLD	Energy Ombudsman QLD	1800 662 837
SA	Energy Industry Ombudsman SA	1800 66 55 65
TAS	Energy Ombudsman Tasmania	1300 76 67 25
VIC	Energy and Water Ombudsman (Victoria)	1800 50 05 09
WA	Energy Ombudsman Western Australia	1800 75 40 04

Summary

A Step-by-Step Process to having your Solar PV System Installed

1. You conduct your own research into the benefits of having a solar PV system installed

2. You contact several CEC Accredited Designers/Installers to arrange for a quote. A list of CEC Accredited Designers/Installers in your area can be found at www.cleanenergycouncil.org.au

3. By asking informed questions, (see 'Questions to ask your Designer/Installer), you then select a CEC Accredited Designers/Installers.

4. The CEC Accredited Designer/Installer designs a PV system to meet your requirements (see 'What does the Design and Specification of my Solar PV System involve?')

5. You, or the CEC Accredited Designer/Installer, apply for any applicable rebates (see 'What government schemes are in place to lower of cost of purchasing a solar PV system?')

6. You, or the CEC Accredited Designer/Installer, complete the connection and approval process for your Electricity Retailer and Electricity Distributor. This process varies between States and Territories (see 'Flowcharts for the Connection Procedures of each State and Territory' at www.cleanenergycouncil.org.au)

7. You enter a Premium Feed-in Tariff Agreement with your Electricity Retailer (see 'Questions to ask your Electricity Retailer')

8. The CEC Accredited Designer/Installer completes the installation of your solar PV system

9. The CEC Accredited Designer/Installer contacts your Electricity Retailer or Electricity Distributor to arrange for your new meter to be installed (see 'Questions to ask your Electricity Retailer' or 'Questions to ask your Electricity Retailer')

10. A Level 2, Category 4 Accredited Service Provider (Level 2 Electrician) installs your new meter

11. Your solar PV system is now ready to produce electricity.

12. Depending on which State you live in, your local electrical authority may conduct a safety inspection of your solar PV system

NB: Please note this process may vary slightly between the States and Territories.