

Solar Power Explained

By

PowerUpsolar

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What Is Solar Energy

- **Utilise the Sun's Energy (light);** transforming it through a chemical reaction of negatively charged particles called electrons.
- **Silicon allows for the release of electrons when exposed to light.**
- **Silicon** is the main material in Photovoltaic (PV) cells (Up to 98%)
- All PV have at least two semiconductors which are positively and negatively charged.

Type of Solar Panel

By far the most common material for solar cells is crystalline silicon and these cells can be divided into four main categories:

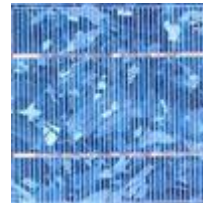
Monocrystalline

- Wafers are very thin cells cut from cylindrical ingots. Because the ingots are round the square cells are normally cut with the corners missing, meaning the cells cannot completely cover a module without wasting a bit of space.



Poly or multi crystalline

- Cells are made from cast ingots - large crucibles of molten silicon carefully cooled and solidified. These cells are comparable in performance. They can easily be formed into square shapes that cover a greater percentage of a panel than monocrystalline cells.



Mono versus Poly Panels

Mono vs Poly

To illustrate, comparing an Auxin 200 watt mono panel with their 200 watt poly panel (both with 54 cells, maximum power of 204.9W and panels tested at 25° C):

200 Watt Panel	Solar Cell Efficiency %	Open Circuit Voltage (V/°C)
Mono	15.63%	-0.35%/C
Poly	15.37%	-0.34%/C

As you can see there is not much difference between the solar cell efficiency of the mono vs the poly with the mono having the edge. However poly performs better in hotter temperatures. The Clean Energy Council states that the temperature around a panel is around 25° C greater than the ambient temperature. Perth's average temperature is 23°C so the expected average cell efficiency of mono will be 0.0805% and poly 0.0782% less than under test conditions. Not a great deal of difference but in practice it is enough for poly to get the edge.

Types of Solar Panels

Thin film

- These approaches, in contrast, are module-based. The entire module substrate is coated with the desired layers and a laser scribe is then used to delineate individual cells. Thin film PV is efficient in low light conditions and very sturdy.



Solar Dish

- Advnco/Vanguard 25 kW dish/Stirling system installed at Rancho Mirage, California. An expensive solution for the Home.



Types of PV Systems

- **Grid Connected**

The most popular type of solar PV system for homes and businesses. The solar system is connected to the local electricity network allowing any excess solar electricity produced to be sold to the network. Electricity is taken back from the network outside daylight hours. An inverter is used to convert the DC power produced by the solar system to AC power needed to run normal electrical equipment.

- **Off-Grid**

Completely independent of the grid, the solar system is directly connected to a DC battery which stores the electricity generated and acts as the main power supply. An inverter can be used to provide AC power, enabling the use of normal appliances without mains power.

Benefits

Benefits of a solar PV system to the householder

- ✓ Solar PV systems **generate electricity**
- ✓ Once the system has been purchased, electricity is generated from a **'free' resource**—the sun
- ✓ Solar electricity is generated **without emitting greenhouse gases**
- ✓ Solar panels or modules are **silent**, without any moving parts
- ✓ Solar modules are generally **unobtrusively mounted** on an existing roof
- ✓ Solar modules can be **integrated** into the building in the form of windows, walls, roof tiles or pergolas
- ✓ Solar electricity can supplement or provide **all your electrical consumption**
- ✓ Solar electricity can be **fed into the grid**
- ✓ Additional solar modules can be **added later** as demand or budget grows
- ✓ A solar module should last for at least **20–30 years**.

The Down Side

Solar modules convert energy from sunlight into direct current (DC) electricity.



More energy is generated

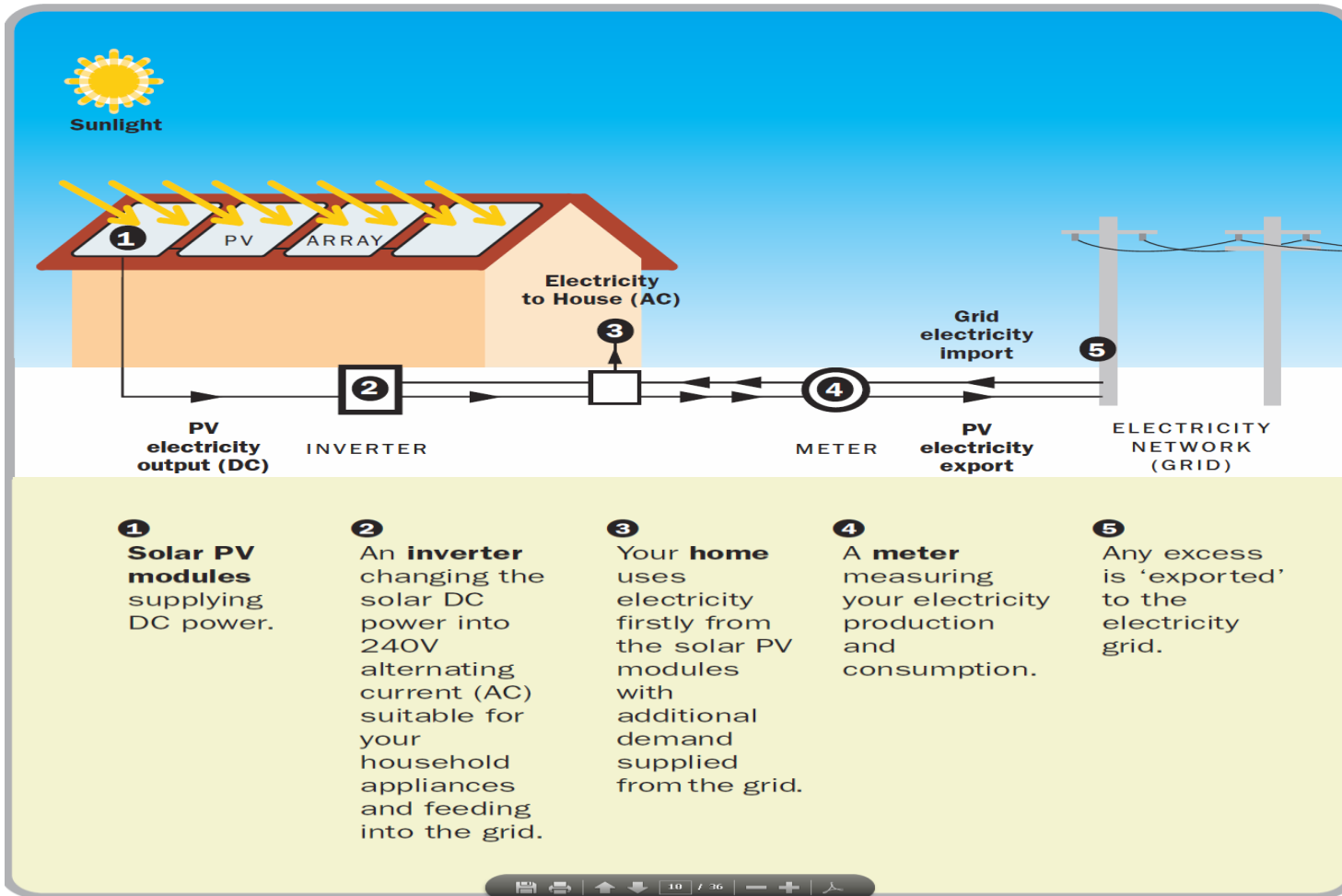
- in areas of strong solar radiation
- on long, sunny days.



Less energy is generated

- in cloudy or rainy weather
- when the panels are shaded by trees or other obstructions
- when the panels become hot.

How Does It Work



How to Choose A System

- **Quality** – How Do you know which panels
 - Manufactured by **Over 90% of PV Panels** are Made in China. BP etc. In one recent example, a U.S. solar company, Evergreen Solar, [announced](#) that it would have to give up on assembling solar panels at a U.S. factory in favor of manufacturing in China.
 - **Flat File Report** – A report states the performance of the panels coming off the production line. Jetion / Exiom Panels produce up to 7% more output. These are A grade panels made specifically for the European market. To gain a rebate in Europe panels must meet specific performance levels.

How to Choose A System

- **Panel Efficiency** – Most overrated term. All it means is how many panels is need in an area to produce X kw. Thin Film PV efficiency traditionally at 5-8%. Has improved significantly to 13% but super expensive and not that strong. (kids playing football could be a hazard).
- Whether a panel is 15% or 16% is not that important unless space is a premium.

The Inverter

Made in China

- History of performance is Very limited
- Kinglong Sunteams (unreliable)
- Growatt
- Samil Power
- Aerosharp (unreliable)
- Eversolar

European

- History of performance is not as limited as Chinese Manufacturers
- SMA (will not replace old for new will provide a restored as a replacement. Overpriced and limited power range)
- Aurora (excellent inverter)

Inverter Power & Start Up Range

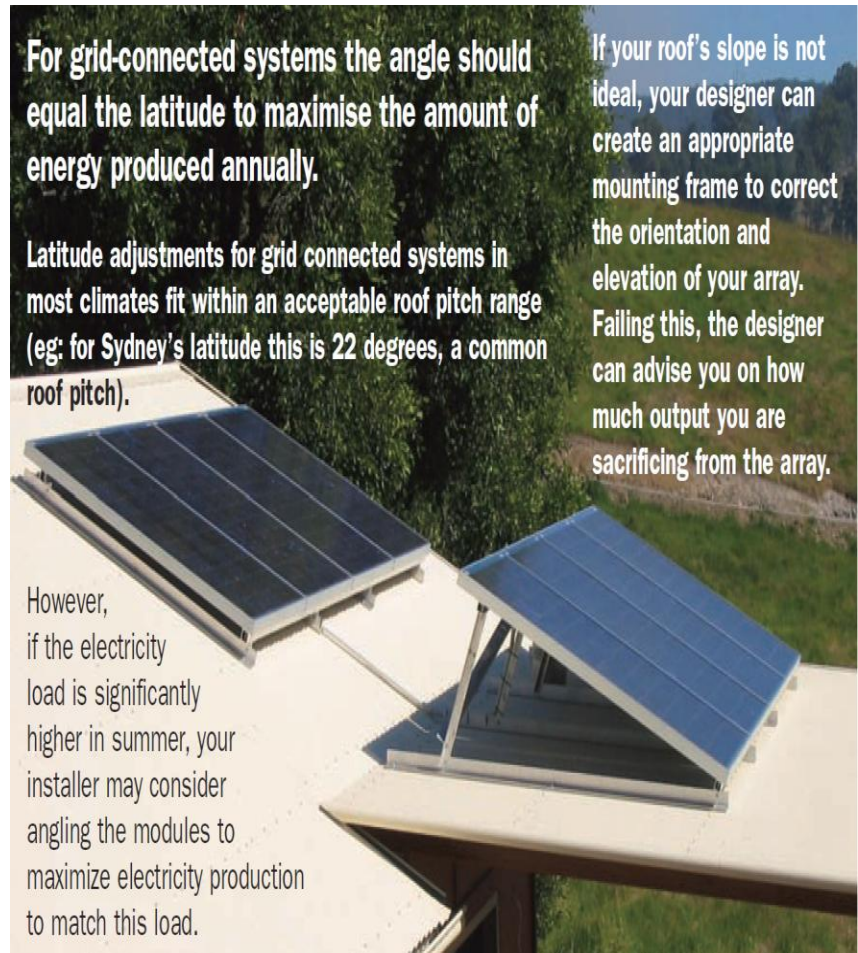
- Growatt
 - MPPT 1 for all
 - Start Up 120V
 - 1500w to 1800w 1 string Parallel 450v
 - 2000w to 2300w 2 string Parallel 500v
 - 3000w to 3150w 3 string Parallel 500v
 - 4400w to 4600w 3 string Parallel 580v
 - 5000w same 3 string Parallel 580v
- Samil Power
 - MPPT 1 for all
 - 450v to 500v Limited in panel configuration for Parallel configuration
 - Start Up 100V
 - Nominal DC Voltage is Actual as 1600w is 1600 max DC Voltage
- Eversolar
 - All Start Up 125V
 - 1500w to 1800w
 - 2000w to 2300w
 - Rest as per nominal amount of watts
 - MPPT 1 for 1500w – 3000w 1 string Max 580v DC
 - MPPT2 for 5400w 2 string Max 680v DC
- SMA (German)
 - MPPT 1 for all with 2 or 3 strings
 - Start Up 139V = 1700w, 3000w = 268V
 - 1700w to 1850w 1 string Parallel 400v
 - 2500w to 2700w 3 string Parallel 600v
 - 3000w to 3200w 3 string Parallel 600v
 - 4000w to 4200w 3 string Parallel 550v 125v Start
 - 2 MMPT & 2 STRING
 - 5000w to 5300 3 string Parallel 550v 125V start
 - 2 MMPT & 2 STRING
- Aurora (Italian & American)
 - 2.0kw Max voltage 600. 1 MMPT
 - Start Up 120V = 3.6kw, 4.0kw & 5.0kw V = 140V
 - 3.6kw Inv & 4.2kw Inverter 2 MPPT and 3 inputs. Max voltage 600
 - 5.0kw Inverter 2 MPPT and 4 Inputs. Max voltage 600

Items in red highlight functionality which is not as good as other manufacturers.

Items in purple highlights better than normal performance.

Installation

- Only to be completed by Accredited Installers.
- Electrician to complete part or all of the installation.
- Inspector required to approve Installation EWR electrical Works Request.
- What is wrong with the install in the picture!! Insufficient space between panels as shading likely to occur.
- North Facing – North East to North West:OK



Recs (STCs)

- These are the number of certificates you receive from the government for installing a solar system.
- Each system is assigned a different number of Recs.
- They have a value. Today it is \$30 per Rec. 31/1/12
- In nearly all cases they are assigned to the installer and deducted off the overall price.
- Consider them as Shares with a fluctuating market value. Prices quoted weekly.
- **Number of RECS assigned will be reduced by 30% in August 2012.**

Sample Quote

Name:	Stassi	Date:	1/02/2012	
Address:	0			
City/Town:	Coburg	State:	0	
Post Code:	0			
Phone:		Mobile:		
Site Visit on:	0	By:	Claude	
Quote	1.52 KW solar panel system with Axiom or Jetion 190 watt solar panels.			
Description	Qty	Rate	GST	Total (incl GST)
'Axiom' or 'Jetion' Solar 190 watt panels	8	\$280.00	\$224.00	\$2,464.00
Inverter - EversolarTL1500	1	\$500.00	\$50.00	\$550.00
Panel Mounting System	1	\$251.70	\$25.17	\$276.87
Tile Roof Brackets	0	\$317.70	\$0.00	\$0.00
Wire, conduit, connectors	1	\$100.00	\$10.00	\$110.00
DC Circuit breakers/Fuses between panels and inverter	1	\$230.00	\$23.00	\$253.00
IP66 outdoor enclosure	2	\$25.00	\$5.00	\$55.00
AC Circuit breakers in fuse box	1	\$15.00	\$1.50	\$16.50
Safety signage	1	\$50.00	\$5.00	\$55.00
Delivery and installation	1	\$1,100.00	\$110.00	\$1,210.00
			Total	\$4,990.37
Cost per Watt: \$1.10			REC Discount	-\$3,317.00
Panel power output: 6.08 kWh			With REC cash-in	\$1,673.37
Note:			Rounded down to nearest \$10	\$1,670.00

Current Pricing

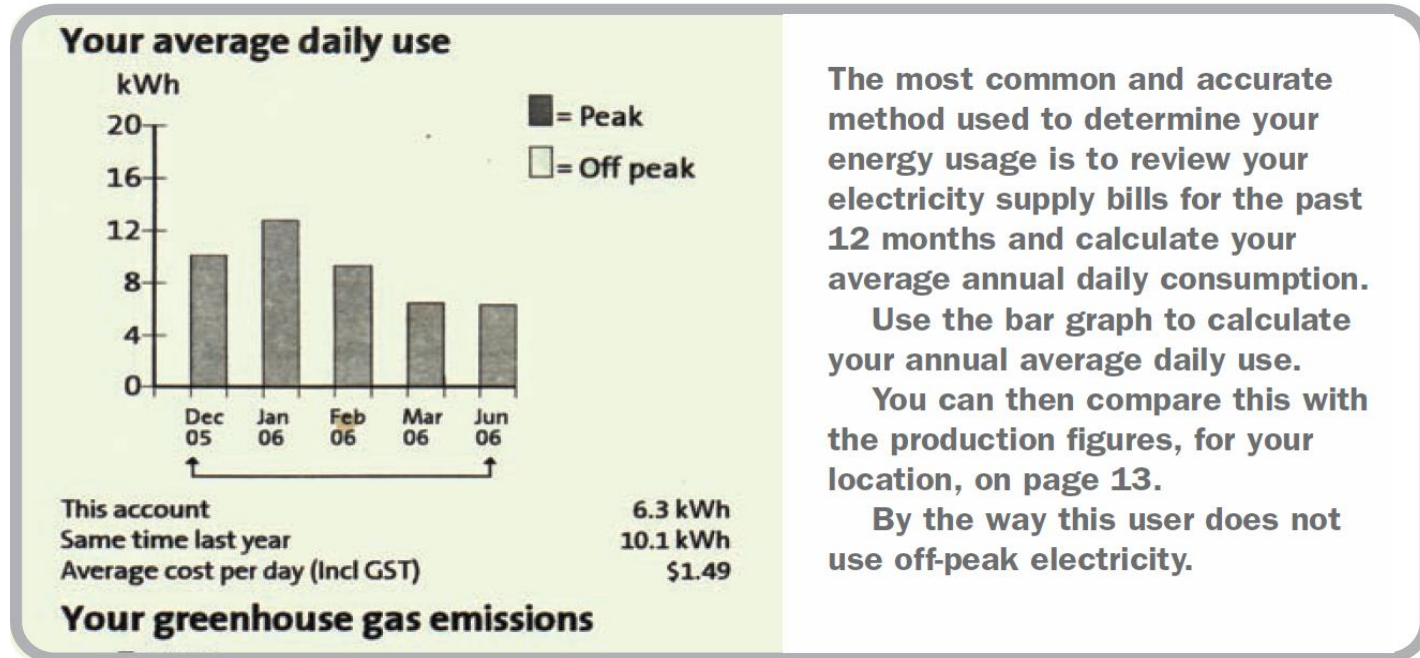


Value For Money

- **SoleSolar Estimated Electricity Savings**
- **At Sole Solar we aim to give you the best return on your investment.**
- **1.5kw Solar System.** The expected electricity savings per year is \$525.60. A Return on Investment of 30% $(1.5 * 4 \text{ Peak Sun Hours} * 365 * 24 \text{cents}) / \$1650.00 = >30\%$ For Next 12 -15 Years depending on Power
- **1.9kw Solar System.** The expected electricity saving per year is \$665. A return on Investment of 25%
- **2.66kw Solar System.** The expected electricity saving per year is \$932. A return on Investment of 25%
- **3.04Kw Solar System.** The expected electricity savings per year is \$1065. A return on Investment of 25%
- **4.18kw Solar System.** The expected electricity saving is \$1460. A return on investment of 22%
- **4.94kw Solar System.** The expected electricity saving per year is \$1750. A return on investment of 22%
- ******Calculations are based on a STC price of \$31.00 (10/12/2011). The RECSs market price is expected to fluctuate.**
- ******Cost of electricity is based on a rate of 24 cents.**
- ******Performances measured have shown that our systems produce up to 6% more than the standard nominal rated output**

Does not take into account future price rises or Excess input into the Grid. Therefore are likely to greater.

What System For Me



The most common and accurate method used to determine your energy usage is to review your electricity supply bills for the past 12 months and calculate your average annual daily consumption.

Use the bar graph to calculate your annual average daily use.

You can then compare this with the production figures, for your location, on page 13.

By the way this user does not use off-peak electricity.

- Determine your average daily use – Take average use over year and divide by 4 (Peak Sun Hours). The number will be the system size you need.
- What you can afford
- Up scalable of inverter & Panels **(Can occur but avoid extra costs later in replacing the inverter or rewiring for panel additions)**

What To Do

- Install a system and quarantine electricity price rises
- Use a quality Installer (Accredited)
- Buy the biggest system you can afford. Eliminate add on costs, more panels and changing of inverters.
- Take advantage of the HIGH \$AUD.
- Take advantage of Recs as In August 2012 the number assigned will be reduced.

Smart Meters



- A mandatory requirement as of JANUARY 2012
- New Meter Installation - Owned by Distributor paid by YOU: **Great Deal (NOT)**
- **If the Smart Meter is installed prior to or after the solar install, ensure the solar system remains OFF until the smart meter and solar system are configured by the electrical supplier - OR IT WILL DOUBLE YOUR BILL.**
- Old Meter are able to BE WOUND BACK if at the time of the inspection the solar system is left on: GOOD
- **ONLY ALLOWED TO INSTALL UP TO 5KW**

Question Time

Email me at

- pusolar@hotmail.com OR
- Call me on 0449970597
- Warranty 5 years on Inverter & Workmanship
- Panels Mechanical 12 years &
- Performance 25 years to 80% performance. Guaranteed PRC Govt

Member Offer - \$100 off for 1.5kw to 2.66kw

\$200 off for 3.04kw plus

**Refer a Non Member and receive the discount
direct.**



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Member of the Clean Energy Council