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Fact Sheet #9

Solar Power

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This fact sheet covers:

- The solar opportunity
- Key terminology
- How solar works
- How much power does it generate
- Steps to save on electricity cost with solar
- The economics of installing solar PV
- Financial incentives
- Optimum system size
- Financing options

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Australian Government
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The solar opportunity

A small business consuming 50,000 kilowatt hours per annum that installs a 15 kW system can displace an average of 33 per cent of its electricity usage.[1]

Energy is one of the big issues of our time and solar energy is a promising solution. The sun's energy is a renewable energy source, free of charge and causes no pollution.

Solar power is divided in two different technologies:

a) solar PV (photovoltaic) to generate electricity
b) solar hot water (thermal)

In this fact sheet we will focus on solar PV that generates electricity by using the sun rays (photons) to convert it into power.

Electricity costs are a substantial expense for many businesses and prices have steadily increased over the last few years. By installing a solar PV system, businesses and individuals alike are able to generate electricity on their own premises. It is a great solution to save electricity costs, mitigate the risk of increasing electricity prices and reduce the carbon footprint of your operation.

Terminology

Kilowatt (kW) = power
Kilowatt-hour (kWh) = energy, i.e. what you are billed for on your electricity bill

Performance warranty = relates to the warranty that is given on solar panels. It is usually 25 years to 80% of the rated power.

Feed-in tariff / Renewable Energy Buyback Scheme = money you get paid for feeding excess energy back into the grid.

Self-consumption = share of solar PV output that is consumed directly onsite

Inverter: converters DC electricity generated by the panels to AC electricity to make it usable for appliances.

Network operator: owns the power lines and the grid infrastructure.
Retailer: sells electricity.

Approval process: solar PV systems need approval before installation. The process is managed by the installer and involves the customer, the retailer and network operator.

[1] Note: this calculation assumes 85% self-consumption of solar PV output. Source: Clean Energy Council, Guide to installing solar PV for business and industry 2013

How does a solar system work

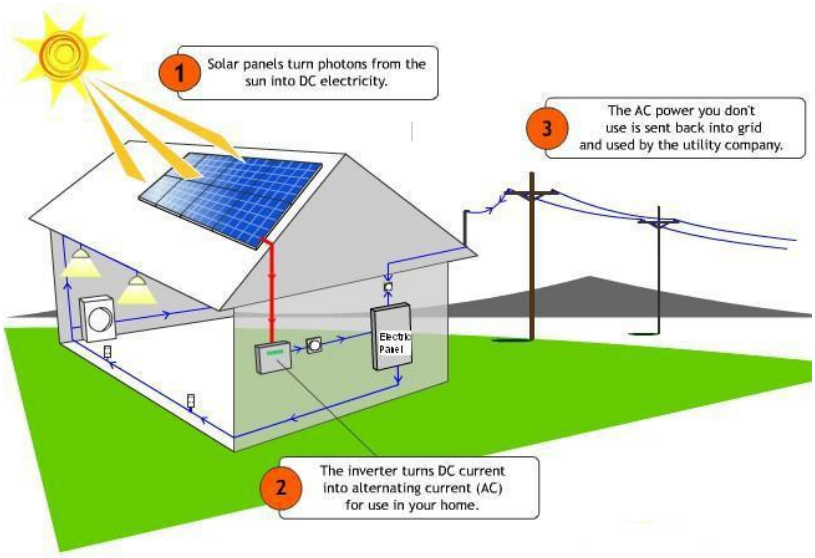
To generate solar electricity, two things are required:

- solar cells, and
- sunlight.

Sunlight is made of photons which are small particles of energy. Solar cells are made from silicon (Si). When sunlight hits solar cells these photons are absorbed by the material of this solar cell. The photons cause a movement of electrons within the silicon, which essentially is the generation of current (electricity).

In general, a solar system (depicted below) comprises very few components and no moving parts:

- Solar panels
- Inverter
- Safety devices (circuit breakers).



The electricity that is generated by the solar panels is first used within the respective building.

- If the demand is higher than the output of the panels, additional electricity will come from the grid to match the demand.
- If the output of the panels exceeds the energy demand in the building, electricity will be fed back into the grid.

Electricity moves with the speed of light and this process happens completely unnoticed.

How much power does it generate

The sun's intensity fluctuates based on seasons, cloud cover, temperature etc. However, on a yearly basis the amount of irradiation that we receive in Australia is very stable and predictable. Therefore, the output of a solar PV system can be predicted very accurately, depending on orientation, tilt of the panels and overall system efficiency.

The output of a solar PV system can be broken down to an average daily output as depicted in the table below:

The output of a solar PV system depends on its efficiency, size and location. Commercial systems can range anywhere from 5 to10 kilowatts (kW) up to a few megawatts (MW). This table shows the average daily production of some common grid-connected system sizes throughout Australia.

The rated output is that achieved in perfect laboratory conditions. The CEC design summary software takes these de-ratings into account when predicting averages for any given system.

Panels generate more electricity in summer than in winter and the table reflects the average daily electricity generated over a year.

AVERAGE DAILY PRODUCTION

CITY	10 KW	50 KW	100 KW	150 KW
ADELAIDE	42 kWh	210 kWh	420 kWh	630 kWh
ALICE SPRINGS	50 kWh	250 kWh	500 kWh	750 kWh
BRISBANE	42 kWh	210 kWh	420 kWh	630 kWh
CAIRNS	42 kWh	210 kWh	420 kWh	630 kWh
CANBERRA	43 kWh	215 kWh	430 kWh	645 kWh
DARWIN	44 kWh	220 kWh	440 kWh	660 kWh
HOBART	35 kWh	175 kWh	350 kWh	525 kWh
MELBOURNE	36 kWh	180 kWh	360 kWh	540 kWh
PERTH	44 kWh	220 kWh	440 kWh	660 kWh
SYDNEY	39 kWh	195 kWh	390 kWh	585 kWh

Source: Clean Energy Council database

Steps to save on electricity cost with solar

There are a number of factors that need to be considered when considering solar for your business.

1. Load analysis based on historical data and system design based on roof characteristics (space, orientation, tilt)
2. Choice of quality equipment
3. Retailer and network operator approval
4. Installation
5. Performance monitoring (optional)

After the installation, the system will operate on its own without any manual input required by the customer.

1. Load analysis (consumption profile)

A load analysis is an important part of the process to choose the appropriate sized system for your needs. Most businesses consume electricity during the day (offices, retailers, manufacturing, schools, medical centres etc.). When the consumption profile matches the output profile of the solar PV system, high cost savings can be achieved. Both the system design and size is influenced by the consumption profile. For example, a business with a high consumption in the afternoon will be better off with panels facing west (to catch the afternoon sun) to offset its electricity use. For a business that mainly consumes power during the night (e.g. night clubs) only a small solar PV system might be required to offset the daytime consumption for office equipment and refrigeration.

Excess electricity that is not consumed on site will be exported into the grid. Some retailers offer a 'feed-in tariff' to buy back excess power from you. Feed-in tariffs are substantially lower than the electricity tariff you pay to your electricity retailer. That's why it is always best to consume electricity onsite which is called 'self-consumption'. Where feeding power into the grid is not allowed, systems must be fitted with grid protection equipment that prevents power from flowing back.

2. Choice of quality equipment

There is a diverse range of products in the market, from poor quality to very high quality. A solar PV system has an expected life of over 30 years so it pays to invest into a genuine high quality system. Generally, performance warranties are given over a 25 year term on the panels by the manufacturer. It is important to choose a supplier you can trust to be around for an extended period of time to back these warranties. Make sure you chose a supplier that offers genuine quality products and a high degree of transparency as to where they come from.

3. Retailer and network operator approval

It is mandatory to get network operator approval before the commencement of the installation. In many cases, it is also required to get approval from the electricity retailer. Some retailers will change the tariff structure when you install solar PV so it is important to engage with them early in the process to rule out any surprises.

Network operators might impose technical restrictions on your system such as grid protection devices to block the flow of power back into the grid. The rules vary depending on size and location of the system. A local installer will be able to guide you into the right direction.

4. Installation

Installation involves mounting the panels onto an aluminium substructure on your roof or onto a ground mounted frame. A licenced electrician will run the cabling from the panels to the inverters and connect the inverters to your existing switchboard. It is recommended to use CEC (Clean Energy Council) accredited installers with a proven track record and high quality workmanship. Once the system is installed, it will be commissioned by the licenced electrician and it is ready to produce clean electricity.

5. Performance monitoring (optional)

Performance monitoring allows you to check the system's output in near real time on a web based portal (Internet) or within your local network. It's a great tool to react quickly to a potential fault and also check the output vs. the promised performance.

The economics of installing solar PV

The economics of installing solar PV are great as systems costs have fallen tremendously over the past years whereas electricity costs have increased.

Generally, the return on investment is influenced by the system's energy output, the electricity tariff, by how much of the output you are consuming on site (self-consumption), the system costs, the reliability of the system and the financial incentive schemes available.

The payback time varies according to the above factors but tends to be in the range of 3 to 7 years for commercial clients with internal rate of returns in the range of 14 to 38 per cent p.a.

When assessing the investment into a solar PV system, the total lifetime cost of the system and the total energy generated should be compared to the cost of electricity from the grid during the same period.

Financial incentives

Solar PV systems attract financial incentives based on their size and location as legislated in the RET scheme (Renewable Energy Target). The scheme is available both for commercial and residential customers. Systems up to 100 kW qualify for Small-scale Technology Certificates (STCs) and whereas system above 100 kW need to be registered as "power stations" to receive Large-scale Technology Certificates (LGCs) on a quarterly or yearly basis depending on their electricity output.

SMALL-SCALE TECHNOLOGY CERTIFICATES – LEVEL OF FINANCIAL SUPPORT

CITY	ZONE	RATING	SYSTEM SIZE	DEEMING PERIOD	TOTAL STC ENTITLEMENT	TOTAL SUBSIDY
ADELAIDE	3	1.382	30 kW	15 years	622	$21,770 (622 STCs x $35)
BRISBANE	3	1.382	30 kW	15 years	622	$21,770 (622 STCs x $35)
CANBERRA	3	1.382	30 kW	15 years	622	$21,770 (662 STCs x $35)
DARWIN	2	1.536	30 kW	15 years	691	$24,185 (691 STCs x $35)
HOBART	4	1.185	30 kW	15 years	533	$18,655 (533 STCs x $35)
MELBOURNE	4	1.185	30 kW	15 years	533	$18,655 (533 STCs x $35)
PERTH	3	1.382	30 kW	15 years	622	$21,770 (622 STCs x $35)
SYDNEY	3	1.382	30 kW	15 years	622	$21,770 (622 STCs x $35)

The total STC entitlement = zone rating*rated power output (30 kW)* deeming period (15 years).

[2]

Optimum system size

The optimum system size depends on the available roof-space and the load profile i.e. consumption patterns of the customer.

If the roof size is large enough, the following rule of thumb can be applied (before a detailed assessment of the load) to determine the optimal system size:

a) stable electricity consumption - > offset 30 – 50% of your total consumption with solar
b) varying electricity consumption - > offset 10 – 20 % of your total consumption with solar.

Other factors have to be taken into account as well such as limitations in system size from network operators and eligibility for financial incentives.

Financing options

There are financing options available such as leasing, rent-to-own and chattel mortgages that enable customers to get solar powered without upfront investment costs.

If cleverly designed, the systems can pay for themselves (electricity cost savings are equal or higher than repayments).

[2] Source: Clean Energy Council, Guide to installing solar PV for business and industry 2013