REGEN
Sustainable Power Solutions power

Solar Photovoltaic Power System Handbook

Grid Connected System

1 Introduction

Thank you for selecting Regen Power as your partner for your Solar Photovoltaic Power System. By doing so you are now actively helping to mitigate the rise in greenhouse gas emissions for many years to come. You can now produce your own electricity, resulting in significantly lower energy bills and ensuring that you will be less affected by electricity tariff rises. Last but not least, the Solar Photovoltaic (PV) Power System can be regarded as a valuable asset for your house making it more efficient and environment friendly. We are sure you will feel good about what you have done.

At Regen Power, we place our customers' need for exceptional service and reliability at the top of our priorities. Accordingly, we are your first point of contact for any concerns or queries you may have about the PV system over its service lifetime.

Regen Power has taken great care in the selection of the components that make up your PV system, including:

- Ensuring that all components meet or exceed relevant International & Australian Standards.
- Tailoring the design of the system to Australian conditions.
- Providing a wide range of systems to suit individual needs and budgets.
- Ensuring that all systems require very little maintenance.
- Providing long terms warranties for peace of mind.
- Ensuring ease of installation on various roofing materials such as tile and metal.
- Making your purchase a real asset to your home.

The objective of this handbook is to provide you, the owner and operator of the PV system, with the information needed to ensure a long system life with satisfaction and safety.

2 Important Contact Numbers

Should any problems occur with your PV system please contact one of the following telephone numbers. You will be asked to describe the problem in as detailed as possible, so please familiarise yourself with the Error Report Form found in the Appendix. You may ask the installer to help you fill out the details if required.

Please record the important contact details below for future reference.
Phone Numbers: Perth (08) 9456 3491, Sydney (02) 9078 8000, Brisbane (07) 3713 3444

Installer Name: _____

Installer Phone: _____

Invoice Number: _____

Please retain your original invoice for warranty purpose.

3 How to use this Handbook

This handbook serves to give you some background information on the operation and installation of the PV system. Although your system has already been installed, please follow all instructions carefully and familiarise yourself with the system operation and maintenance requirements.

4 Safety Instructions

Regen Power places the highest priority on the health and safety of not only its employees but also its customers. Whilst your system has been installed by an accredited installer, it is very important that you understand and comply with the following safety instructions:

- Only experienced and certified electrical personnel are to be employed to do any service work on your PV system according to State and Australian electrical codes.
- Your PV modules produce high and potentially lethal DC voltage. Therefore do not interfere with any PV module, interconnecting cables or main wiring to the inverter.
- Read all the relevant technical literature supplied with your system and comply with safety recommendations contained therein.
- If minor, non-electrical servicing you wish to carry, remove any jewellery such as watches, necklaces, bracelets, rings you are wearing and any metallic objects from your pockets that could potentially cause a short circuit or electrical shock.
- Your PV array will generate power even in low light levels. Always make sure that the PV modules are fully covered with an opaque material and the isolator has been switched on before an authorised person attempts any service work.
- Do not work at heights without first ensuring that it is safe to do so and that all safety harnessing and scaffolding comply with local standards.
- Never do any servicing if it is raining or if the system is damp as moisture conducts electricity.
- Safety signage has been installed with your system. Familiarise yourself with their location and function, particularly the 'Shutdown Procedure' label.
- The inverter is designed to synchronise and export power to the grid. As such the inverter produces lethal 240 V AC, 50 Hz. Never open the inverter for any reason.

Throughout this handbook the following warnings symbols are used to draw your attention to an electrical safety issue and that a potential dangerous voltage or condition could exist, requiring that the service personnel must use extreme caution at all times.

5 The Solar Photovoltaic Power System Explained

Photovoltaic Systems make use of the 'photovoltaic effect' (*photo=light* and *voltaic=electricity*), the basic process discovered by Edmund Becquerel, a French physicist in 1839. He discovered the PV effect while experimenting with an electrolytic cell made up of two metal electrodes; finding that certain materials would produce small amounts of electric current when exposed to light.

Sunlight is composed of photons, or 'packets' of energy. These photons have various amounts of energy corresponding to different wavelengths of light. When photons strike a PV cell, they may be reflected or

absorbed, or they may pass right through the surface (causing heat only). When a photon is absorbed, the energy of the photon is transferred to an electron in an atom of the cell, a semiconductor based material (such as silicon). With its newfound energy, the electron is able to escape from its normal position associated with that atom, to become part of the current in an electrical circuit. By leaving this position, the electron leaves a hole behind. While the electron is negatively charged, the hole is recognized as a positive charge carrier and contributes to current. The PV cell has a built-in electric field, providing the voltage needed to drive the current through an external load, such as a light bulb.

Photovoltaic cells are connected to form a module (or panel); typically 60 to 72 cells per module. Crystalline silicon cells produce approximately 0.5 V each irrespective of the size of the cell. Therefore a 72-cell module will operate at close to 36 V. Modules are then connected in series and parallel to form an array to generate the required current, voltage and power. The array is then connected to an inverter to convert the DC output into AC to match the requirement of the utility.

The electricity produced by your PV system is completely independent of your electricity usage in the house as it is connected directly to the utility grid. It will rarely be the case that your electricity production exactly matches your demand. The grid essentially acts like a battery whenever you use less energy, feeding the excess electricity into the utility. On the other hand, if you need more electricity than your PV system produces, you are backed up by the utility.

The parts which make up a Solar Photovoltaic Power System are shown in Figure 1.

(1) **Solar Panels:** Convert sunlight into electrical power via the photovoltaic effect. The electrical power produced is direct current (DC) like a battery, which cannot be used with normal electrical equipment in a household straight away.

(2) **Mounting Frames:** Support the solar panels to the sub structure of the roof to ensure a secure fixture to the roof and space underneath the panel.

(3) **Marshaling Enclosure:** Connect all strings to the DC cable running the electrical power from the roof to the inverter. In case of a bigger PV system (> 5 kWp) the Marshaling box may contain special string fuses.

(4) **AC & DC Isolation Enclosure:** Holds a 2-pole DC Isolator Switch which protects the input side of the inverter. There is alternating current (AC) switch on the output side to allow safe disconnection of the inverter.

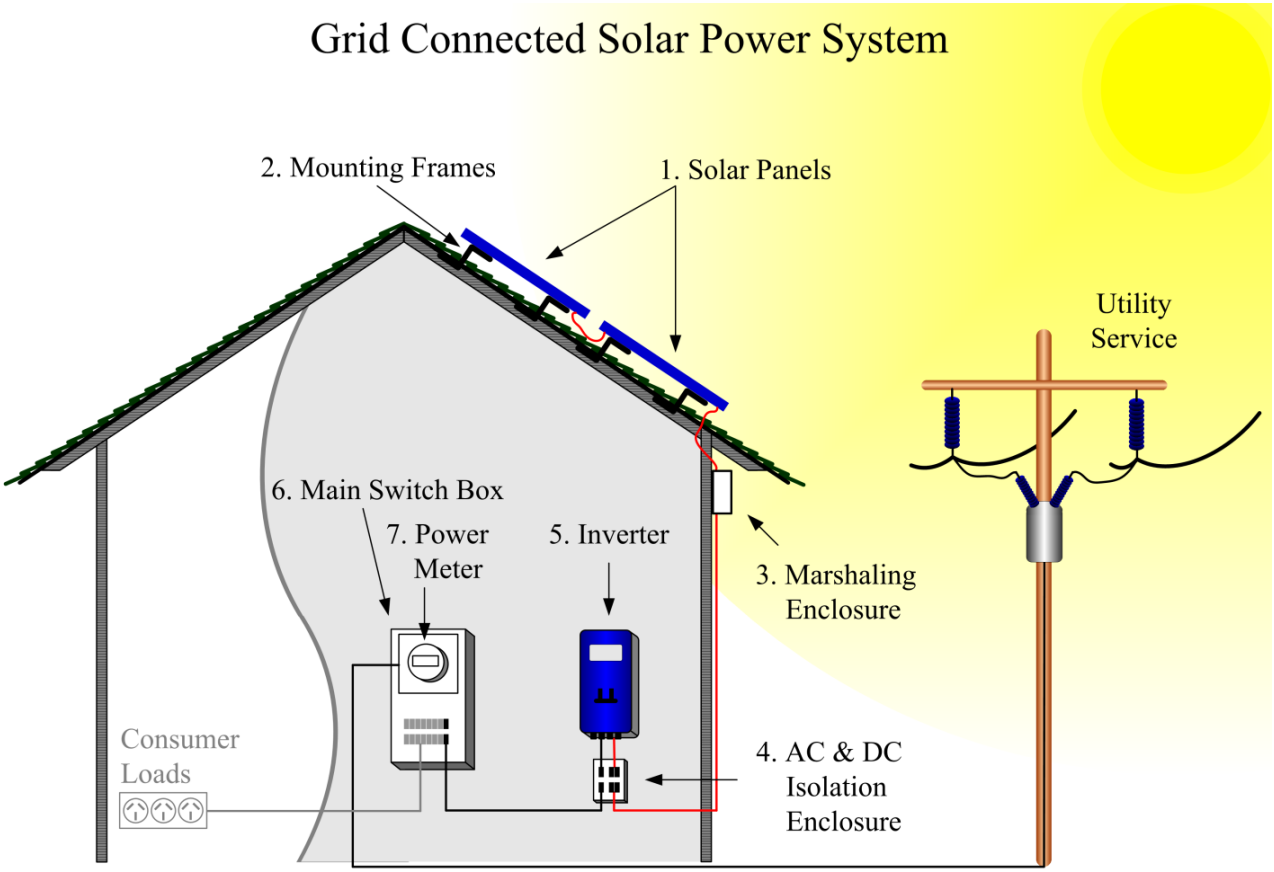

Figure 1: Schematic overview of a Grid Connected Solar Photovoltaic Power System.

(5) Inverter: Converts the DC power from the PV panels into AC in order to match the parameters of the utility grid (according to AS 4777). The inverter deactivates at night and automatically starts operating in the morning when sunlight is sufficient. The inverter is the operations centre of your system and as such, useful information can be obtained from the inverter's display.

(6) Main Switch Box: An additional AC Isolator Switch connects the PV system to the existing infrastructure. It also protects equipment from being harmed by eventual over currents from the inverter if it is in a fault condition.

(7) Energy Meter: In most cases older electricity meters will be changed to a Bi-directional Digital Meter when the Solar Photovoltaic Power System is installed at a house. This is done through your electricity retailer.

6 System Performance

The warranty (Appendix) for the PV power output is given for 25 years. It stipulates the efficiency reduction to 80% of its initial value at Standard Testing Condition (STC). We encourage owners to check the performance of the system to ensure they are getting the most benefits. This can be done by regularly recording the energy reading on the display. In this section the different factors influencing the system performance are explained.

6.1 Tilt Angle

As shown in Figure 2, the tilt of the panel is the angle it makes to the horizontal. In summer the sun is higher in the sky than in winter, and therefore the tilt angle for the panels could be made less in summer. On the other hand, in winter the sun is low and the panels may be tilted more vertical. However, for most domestic installations the tilt angle is determined by the roof inclination and cannot be changed. The optimal tilt angle for a solar system is close to the latitude angle at the site. In same cases support brackets can be used to adjust the tilt angle of the panels.

6.2 Orientation Angle

Ideally PV panels should face true north, however the angle is ultimately determined by the orientation of the roof where they are installed. The range of proper orientation angles are shown in Figure 2. It is important to note how much of the energy yield (kWh) is lost by a non optimum orientation. Figure 3 gives the performance of the PV array with respect to orientation and tilt. For example, the panels in Figure 2 have a tilt angle of 25° and face -30° off north. This is in the red area of the plot, which means the system performs between 95% and 100% energy yield.

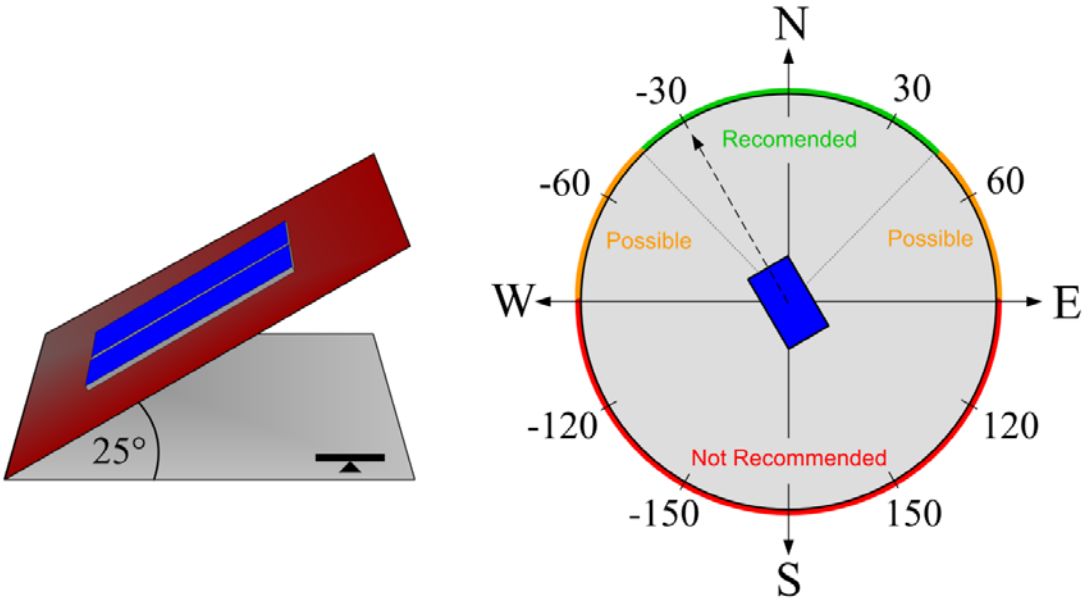

Figure 2: Tilt angle for panels installed on inclined roof (left); orientation angle for panel (right).

6.3 Shading

How much does shade from the tree on neighbour's property take away from my energy yield? Shading is a critical issue for a PV system because the effect is counter intuitive. If one out of six panels is completely shaded the energy production does not decrease by 1/6 or 17%, but usually by about 100%. In addition, partial shading

can cause damage to PV cells. This is due to the fact that the panels are connected in series and as such, the weakest link determines the energy output. PV panels have built-in diodes to reduce the effect of partial shading.

In reality, shading of the PV array may not be prevented entirely, especially at times of sunrise or sunset when shadows are long. However, as the energy production of the system is less in the morning and late evening hours, marginal shading is generally accepted at those times. Placement of panels where objects (trees or buildings) cause shading on the panels between 10 am and 2 pm must be avoided. Regen Power has the right to decline installation in cases where shading of panels cannot be avoided.

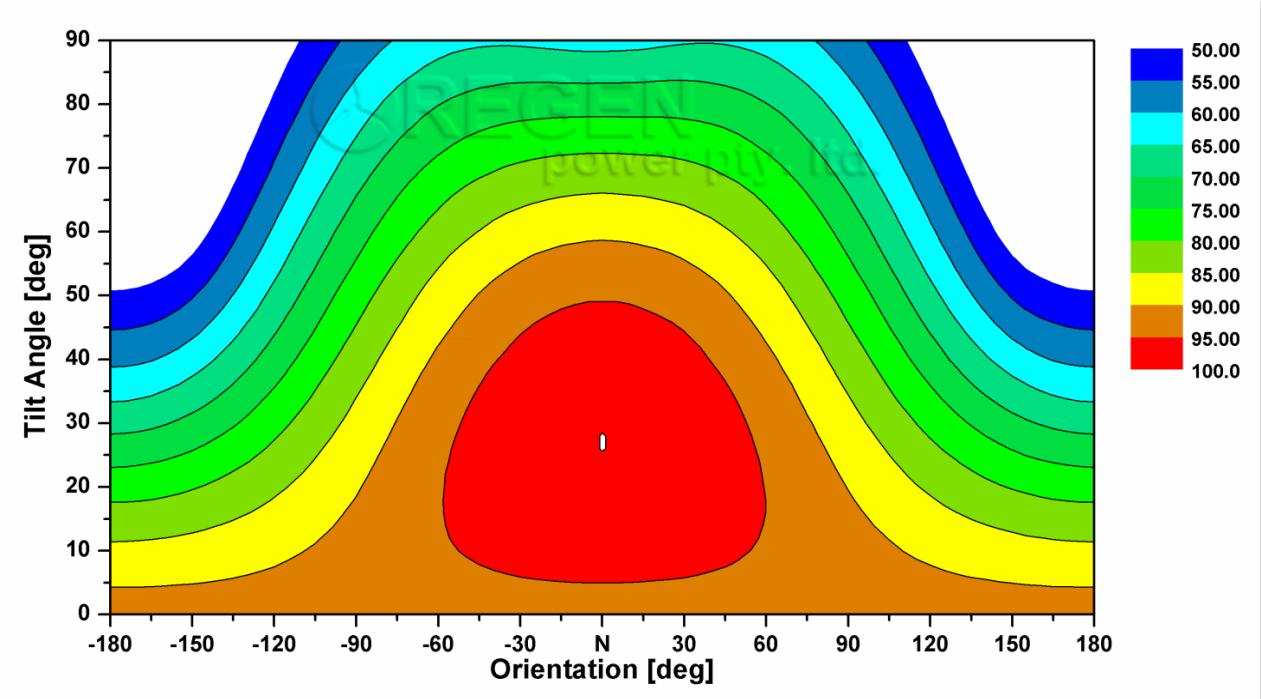

Figure 3: PV array performance with respect to tilt angle and panel orientation.

6.4 Soiling of the Panels

Another form of shading occurs when a dirt film is deposited on the panels. Such a dirt film has an evenly distributed impact on all panels and none of the panels stop working completely, meaning that the system can still work, however with a slightly reduced output. Normally natural rainfall washes the panels often enough to prevent a large accumulation of dirt, however in very dusty and dry regions it may be necessary to clean the panels using a water hose when a build-up occurs.

6.5 Temperature

The performance of PV cells are affected by temperature such that the higher the cell temperature, the lower the energy production. Cells can reach high temperatures, for example, when the solar radiation is at its strongest in summer around noon, the cells can heat up to around 70°C. The heat is dissipated via the back of the panels by natural convection, as shown in Figure 4. For this reason, it is important to avoid heating the cells by restricting airflow underneath the panels. Do not use any sort of visual cover and make sure that obstacles, such as leaves from nearby trees, cannot accumulate and hamper the airflow.

As a simple rule, a rise in temperature by 10°C lowers the effective power output of the PV system by about 4% - 5 %.

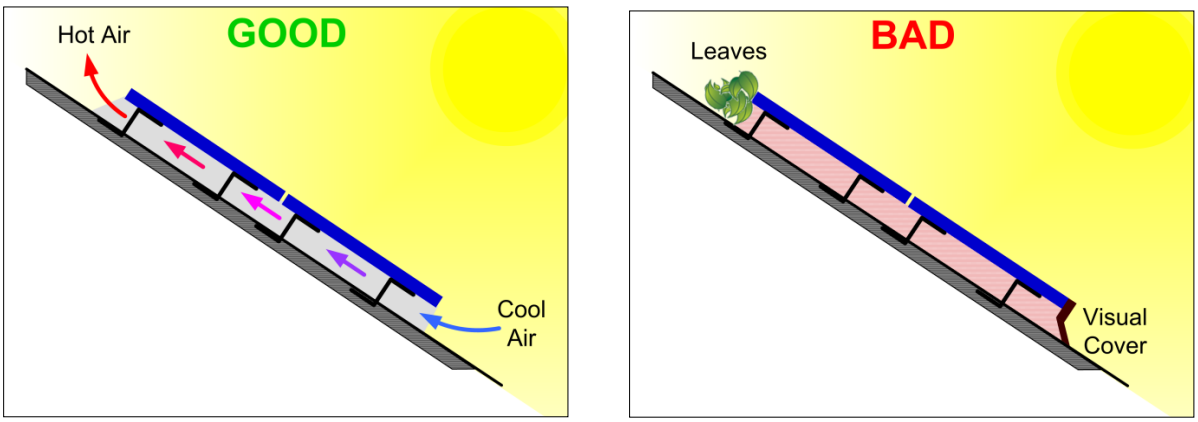

Figure 4: Effective dissipation of heat from the panels.

6.6 System Degradation

The power output of the PV panels will reduce slowly over time, typically by 0.5% per annum. This means that the system will lose 12% efficiency after 25 years of operation. The warranty on the power output of the panels guarantees a degradation of less than 0.9% per annum, resulting in a minimum efficiency of 80% after 25 years. Table 1 summarises the drop in efficiencies over time.

Table 1: PV array degradation over time.

	Year of Operation					
Degradation	**0**	**5**	**10**	**15**	**20**	**25**
0.5% pa	100%	98%	95%	93%	90%	88%
0.9% pa	100%	96%	91%	87%	83%	80%

7 Output of a Typical Solar PV Power System

Figure 5 shows the performance of a typical 1 kW(p) PV system in Perth. As seen, there is greater energy in summer than in winter. Between November and February the output reaches 6 units (kWh) per day, whereas in winter months the output averages 3.5 kWh a day.

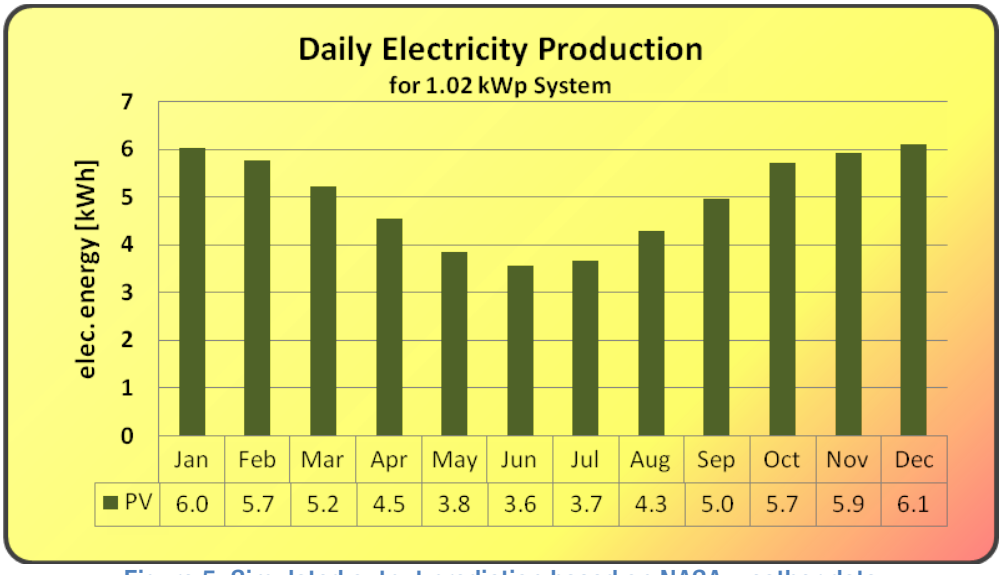

Figure 5: Simulated output prediction based on NASA weather data.

The output shown in Figure 5 is based on a system with low shading, a 25° tilted roof and north orientation. Simulated values can vary from your system according to installation as well as weather conditions. The performance chart is therefore intended as a guide.

8 What Savings can I expect from my PV System

Once installed, savings essentially depend on the size of the PV system (kW rating), the way you make use of its output energy, and the tariff structure in your State.

8.1 System Rated Power

As a rule a 1 kW (peak) PV system will generate between 4 kWh to 5 kWh of electrical energy per day depending on location and the factors discussed in Section 6. This is based on annual average (365 days) as seen in Section 7. Using a conservative number of 4 kWh per kW installed, a 1.5 kW system will generate 6 kWh per day or 2,190 kWh per year. Experience showed for example that a 1 kW PV generates at least 1,500 kWh or 1.5 MWh per year. This energy is generated at the exact point of use rather than at a central coal-fired power station, avoiding transmission and distribution losses. Generating your own solar electricity thus means a reduction in CO_2 and other gaseous emissions by approximately 2 metric tons per kW installed.

8.2 Feed-in-Tariff

The feed-in tariff is an incentive to support the generation of clean electricity by way of legislation that enforces utilities to buy excess energy generated from small-scale photovoltaic (and other renewable energy sources) such as the PV system you just installed. This system is well known around the world and can generally be one of two schemes: a gross feed-in tariff or a net feed-in tariff.

The net feed-in tariff scheme pays for excess energy generated that is exported to the grid and measured at the point of utility. In this case, the PV generated energy feeds the house first and any excess energy beyond that is metered and purchased by the utility. For example, the tariff in Qld and is currently legislated at 44 cents/kWh although several electricity suppliers pay few cents more. Since we purchase electricity far cheaper than 44 cents/kWh it makes sense to conserve the use of this energy (kWh) during the day and sell it at a premium rate.

The gross feed-in tariff scheme will pay up for all energy produced by the PV system irrespective of the load in the house and thus energy is measured at the output terminals of the inverter. This scheme which was introduced in NSW in 2009 offered initially 60 cents/kWh but has dropped to 20 cents/kWh. A feed-in tariff helps you to recover the investment on your PV system much faster.

8.3 Load Management

As explained above in the case of net feed-in tariff it is important to shift the use of electricity during the time the PV system is generating electricity in order to take advantage of the high tariff the utility is prepared to pay. Except for a refrigerator that must run continuously the use of heavy appliances such as ironing, cooking or washing can be done in the evening or the early hours of the morning. An energy audit can be done to examine ways by which energy can be saved.

Let's now examine a situation where a 1.5 kW system is installed in a house in one of the major cities such as

Brisbane or Perth. We will assume that this system generates on an annual average basis 6 kWh and that the owner is offered 50 cents/kWh for excess energy purchased by the grid and that the owner is paying a tariff of 25 cents/kWh including GST for electricity he/she buys. Assuming that the owner is conscious of his/her consumption and that he is able to export 4 kWh of his PV generated energy to the grid and that 2 kWh is used during the day (running the fridge and making tea or coffee). Based on these realistic assumptions the owner is saving $2.5 every day on his/her electricity bill or nearly $1,000 per year. Table 2 is a guide to savings resulting with the use of a PV system. Actual savings can vary depending on your electricity usage during the day.

Table 2: Estimated savings in electricity bills.

PV size (kW)	Daily saving	Annual saving
1.5	$2.75	$1,000
2.0	$3.78	$1,380
3.0	$5.83	$2,130

9 Electricity Audit

Energy audit can be done to examine ways to manage your electricity usage and help reduce your electricity bills. A sketch showing a typical household electricity profile (blue plot of power versus time) is shown in Figure 6, starting at midnight and ending midnight. As seen, there is a small rise in power use around 7 am and a peak around 7 pm. The area under the curve represents the daily energy consumption or kWh which we pay. Figure 6 also shows the simulated systems outputs for PV rated 1 kW and 1.5 kW during an average day between 6 am and 6 pm.

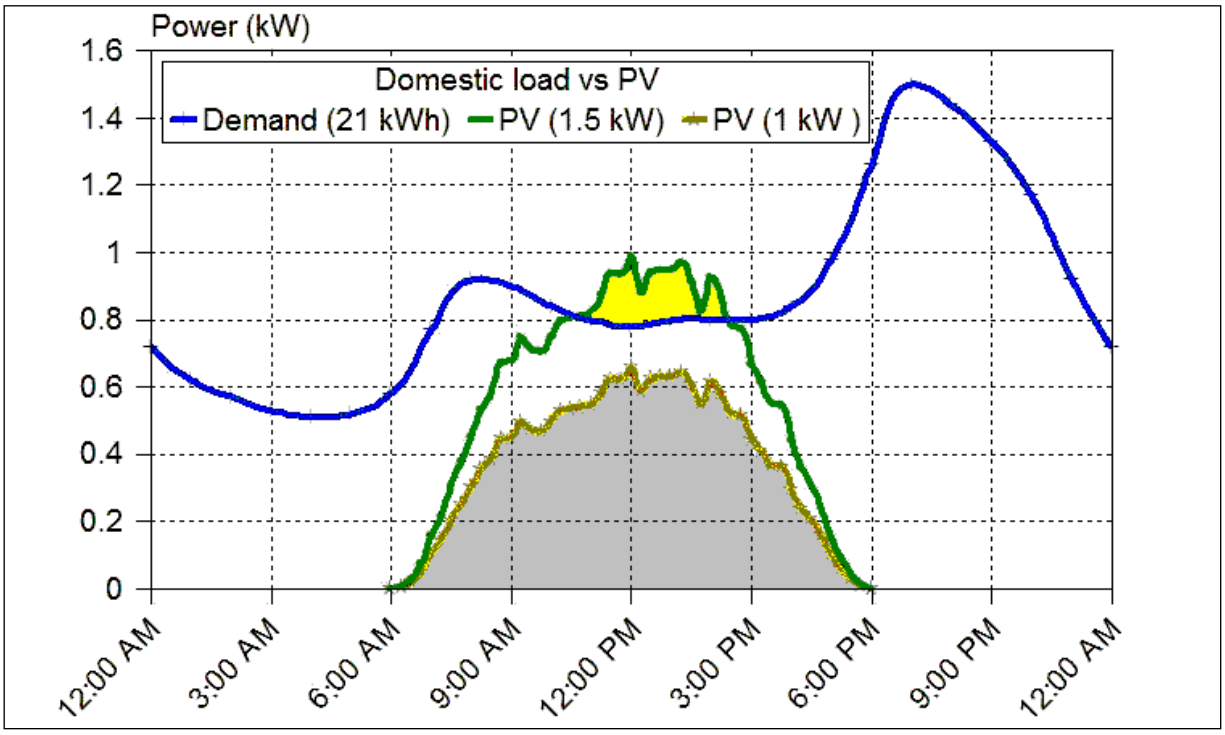

Figure 6: A daily load curve and the output of a 1 kW and 1.5 kW PV systems versus time.

As seen, the output of a 1 kW PV system as depicted by the grey area offsets the electricity usage of the house but there is no excess energy to export to the grid. On the other hand, the output of a 1.5 kW PV system is large enough to supply the house load and allows a surplus of energy, as marked by the yellow region, to be fed to the grid. It is this surplus energy that earns the owner the biggest incentive. Shifting the load therefore outside the period of solar power generation will mean that the yellow region will expand. A larger size photovoltaic system will sure improve the energy balance and allows more energy to be exported to the grid. Consider using a solar hot water system for heating water instead of electricity. Gas cooking particularly during the day (while your solar PV system is generating electricity) will save expensive electricity that can be exported to the grid. This will continue to be important as electricity prices increase if carbon taxes are introduced.

Table 3 gives a listing of the main appliances used around the house and their typical consumption. The average consumption per household in Australia is about 10 MWh per year.

Table 3: Appliances list for home energy audit.

Appliance	Quantity	Power (W)	Time of use (hours/day)	Energy (Wh/day)
Refrigerator				1800 - 2400
Freezer				1000 - 1200
Electric heater		1000 - 2400		
Air conditioner		600 - 2400		
Fan		60 - 120		
Iron		1000 - 1200		
Fluorescent light		10 - 40		
Incandescent light/globe		25 - 100		
Television		100 - 400		
Video		80 -120		
Radio/Cassette		40 - 80		
Hair dryer		600 - 1000		
Electric blanket		20 - 50		
Electric stove		1000 - 2400		
Electric oven		1500 - 3000		
Kettle		900 - 2000		
Food processor		250 - 450		
Toaster		800 - 1200		
Other kitchen appliance				
Washing machine		600 - 900		
Clothes dryer		200 - 500		
Computer		180 - 250		
Screen/monitor		180 - 250		
Printer		100 - 200		
Facsimile machine		100 - 200		
Swimming pool pump		700 - 1000		
Electric hot water heater		1800 – 2400		
Other appliances				
Total Energy Consumption				**12,000 – 24,000**

10 Operating Instructions

10.1 Inverter Status

Your PV system is designed to work fully automatic and unattended. The technology is simple, has no moving parts and does not require user interference. Important and useful information is displayed on the inverter LCD. In some cases the operating conditions are given by coloured LEDs next to the inverter display. Regen Power uses inverters from manufacturers of Eversolar, Samil, SMA, CMS or Power One; all of high quality and comply with Australian and NZ standards. The LED indications are slightly different among these inverters and it is important to refer you to the Instructions Manual of the exact inverter that has been installed for you.

If your inverter is installed outside the house next to the switch board you may want to erect a canopy above the inverter to reduce heat stress and accumulation of rain water. The canopy must be at least 0.25 m above the inverter. For your specific inverter please refer to the inverter Manual.

During normal operation the inverter will display parameters such as voltage, power, energy and total energy. For most fault conditions the nature of the failure is indicated on the inverter display. Some fault conditions are non-critical and will automatically resolve themselves, such as if unexpected fluctuations are detected in the utility grid. However, some fault conditions may be critical and need attention, for example if the inverter cannot synchronise to the grid. Therefore it is important to:

(1) Always have your inverter manual handy

(2) Look up the error message in the manual and follow the advice given

(3) If advised, contact Regen Power and specify the error

10.2 Maintenance

The PV power system is characterized as “low maintenance” mainly due to the absence of moving parts. Regular maintenance involves inspection for damage and simple cleaning if necessary. If after following the suggestions below, your system still does not appear to be working or if you have any questions please call Regen Power on their number(s) listed in Section 2.

10.2.1 Solar Photovoltaic Array

Periodically inspect for broken module glass, shading, and excessive soiling.

WARNING: Do not attempt to clean or otherwise come in contact with the surface of a PV module with a broken glass face; this could result in a dangerous shock.

The system can lose 4 - 8% of its production capacity from dirty modules if cleaning is not accomplished, depending on local conditions. Flushing down with a water hose should remove accumulated dust and dirt. Cleaning with a sponge and soapy water may be necessary if bird guano build up occurs. Incidental shading of the PV array by vegetation or other objects is to be avoided.

10.2.2 General System Inspection

An annual inspection of fasteners, mounting hardware and incidental corrosion is suggested. This should not require any exposure to live electrical equipment. In general, the wiring, the inverter, and the metering device should not need any maintenance or further inspection unless system output or power drops below expected values and cannot be brought back up by module cleaning. Also important in the inspection is to mitigate anticipated shading due to vegetation growth.

10.2.3 System Circuit Breakers

The homeowner should regard the PV system AC circuit breaker in the same fashion as any other residential circuit breaker. They are highly developed safety devices and are safe to operate if in doubt. The AC breakers are located in the isolation enclosure close to the inverter or in the residential switch / meter box. PV system AC breakers can open automatically due to transients experienced in the utility grid interconnection. When a PV system circuit breaker is found to be "off" (or open), simply move the breaker to the "on" (or closed) position. If a problem does exist, the breaker will quickly open again. In this case the owner should contact Regen Power.

10.2.4 System Performance

The PV system operations are displayed at the inverter via an LCD screen and at the meter display (depending on meter). These will indicate how much power is being generated. With time and experience, you will become familiar with the normal operating performance, as described earlier (function of season, cloud cover, array soiling and shading). If under performance is suspected, and is not improved by washing the PV array (or removing debris), the owner should contact Regen Power.

WARNING: Regen Power expressly recommends that homeowners NOT explore the wiring systems or components beyond the level they are accustomed to as they encounter in the usual residential power systems and appliances.

11 Service Information for Qualified Technicians

WARNING: This section is intended to provide a troubleshooting guide for qualified personnel experienced in energy conversion systems and electronics. Use appropriate electrical safety procedures when performing test which expose live electrical parts. Remember, whenever a PV panel is exposed to light it is generating electricity. Always record all steps and results in the trouble shooting process.

When the PV system seems to be not operating properly, follow these steps:

- Refer to the Inverter Installation and Operation Manual:
  - Check the inverter display for trouble codes.
  - Perform actions indicated by the troubleshooting guidelines.
- If the inverter troubleshooting process indicates a problem at the PV array:
  - Verify that there is sufficient sunlight with no shading for operation. Very overcast sky may prevent PV electricity generation.
  - Verify that no extraneous material has come to reside on the array. Debris must be removed.
  - Visually check the PV array for broken modules.

WARNING: Do not attempt to clean or otherwise come in contact with the surface of a solar module with a broken glass face; this could result in a dangerous shock.

- If the solar array must be further investigated:
  - Open all PV system related AC breakers.
  - Open all PV system related DC breakers and fuses.

WARNING: The PV source circuits will be live (during daylight hours) from the PV array even when the DC isolator is open. A shock hazard exists in this area.

- Verify integrity of the isolator. If found open, reset or replace with same type as installed.
  - Perform the Start Up procedure Inverter Installation and Operation Manual.
- Check open circuit voltage at each of the PV source circuits.
  - Open all PV source circuit isolators.
  - Each source circuit should be showing the same voltage characteristics (+/- 5 V DC). Under variable solar radiation conditions, perform the measurements repeatedly and rather quickly to determine consistency.

WARNING: The PV source circuits will be live (during daylight hours) from the PV array even when the DC isolator is open. A shock hazard exists in this area.

- If the voltage test indicates a problem in the PV array:

WARNING: Working at elevations above grade requires safe working procedures. Consult your local Safety Regulations authority, and use recommended safety equipment.

- On the roof, determine the location of the Array Junction Box.
- Check the connectors for all the PV source circuits.
  - If found to have loose connections, tighten them and re-check the voltage tests at the Array DC isolator junction box.
- Locate and replace the low voltage module(s).
- Test open circuit voltage on the leads into the Inverter DC isolator – (Inverter end).

1. DEFINITIONS

The following have these meaning in these terms unless the contrary intention appears.

(a) **Regen Power or Regen:** Regen Power Pty Ltd, a company duly incorporated pursuant to the Corporations Act (ACN 103 145 731) and having its principal office at 4/90 Catalano Circuit, Canning Vale, WA 6155.
(b) **Installation Site:** the site at which the solar photovoltaic power system is installed.
(c) **Purchaser:** the person named as Purchaser in the original contract signed with Regen Power
(d) **System:** There are essentially two main parts in the solar PV system namely the PV panels and the inverter.
(e) **PV:** abbreviation for phovoltoltaic. The solar PV panels (or modules) are installed on the roof at the Installation Site. This part of the System produces DC electricity when exposed to the sun. Your PV panels may be mono-crystalline or poly-crystalline.
(f) **Inverter:** This part of the System converts the DC electricity to AC electricity in order to match the requirement of the electricity network according to AS 4777. Regen Power uses inverters from reputable companies. The customer is required to keep the Instructions Manual of the installed inverter in a safe place. The Instructions Manual is the first point of reference to use in case of suspected reduction in performance.
(g) **Auxiliary parts:** In addition to the PV panels and the inverter, the system must be electrically wired using standard DC and AC cables and DC and AC circuit breakers.
(h) **Force majeure:** circumstances beyond Regen's control which Regen Power is unable to overcome by exercising reasonable diligence and reasonable cost
(i) **Nominated Output:** the expected output for solar PV panels as advised. This is also termed Output Power at Standard Testing Conditions (STC) at 1000 W/m^2, AM1.5 and 25^oC.

2. WARRANTY APPLICABLE TO THE SYSTEM

2.1 Subject to statutory warranties, Regen Power will, at its absolute discretion, either repair or replace the Goods or part thereof that Regen consider has failed in the following cases only:
(a) where any PV panel installed as part of the System fails to perform to at least 90% of Nominated Output, but only where the failure arises and is notified to Regen Power within 10 years of the date the Agreement comes into effect;
(b) where any solar panel installed as part of the System fails to perform to at least 80% of Nominated Output, but only where the failure arises and is notified to Regen within 25 years of the date the Agreement comes into effect,
(c) where any solar PV panels installed as part of the System fail as a result of defects in materials or workmanship, but only where the failure arises and is notified to Regen within 5 years of the date the Agreement comes into effect,
(d) where the inverter installed as part of the System fails as a result of defects in materials or workmanship, but only where the failure arises and is notified to Regen within 5 years of the date the Agreement comes into effect, and
(e) where the System fails as a result of failures in workmanship in the installation of the System, but only where the failure arises and is notified to Regen Power within 60 months of installation.
2.2 Except as provided, all express and implied warranties, guarantees and conditions under statute or general law as to merchantability, quality, description, suitability or fitness of the System for any purpose or as to design, assembly, installation, materials or workmanship or otherwise are expressly excluded to the extent permitted by law. Regen Power will have no responsibility or liability for any damage or injury to persons or

property, for economic loss, or for any other loss resulting from any cause whatsoever arising out of or related to the System, including but not limited to, any defects in the System, or from the use or installation of the System.

2.3 The warranties provided in clause 2.1 will not apply to any parts that have been subjected to:

(a) misuse, abuse, neglect or accident;

(b) alteration, improper alteration or reinstallation by Customer or any other person;

(c) non-observance with use and maintenance instructions;

(d) repair, modification or repositioning by anyone other than a service technician approved by Regen Power in writing;

(e) power failure, power surge, lightening, flood, fire, accidental breakage or other events outside of Regen's control;

(f) the type or any part of the System being altered, removed or made illegible.

2.3 If the System components are installed in conditions which are different to the conditions under which the manufacturer assessed the Nominated Output, then the Nominated Output for the purposes of clauses 2.1(a) and 2.1(b) will be adjusted downwards by a factor which reflects those differences.

3. CUSTOMER OBLIGATIONS

The customer agrees to the following:

(a) Periodically clean the PV panels and especially after dust storms.

(b) Periodically remove any branches or droppings affecting the output of the panels.

(c) Periodically observe of any shading by trees on the Installation Site or nearby trees or buildings which could affect the performance of the System.

(d) Provide adequate protection for the inverter if placed outside. A canopy may be required to prevent direct heat and rain. The canopy must not obstruct airflow. Customer must refer to Inverter Instructions Manual for details on how to protect the inverter. The customer may wish to consult with the installer on the proper way to erect the canopy.

(e) Provide adequate ventilation if the inverter is installed in a garage or a confined space. Customer must refer to Inverter Manual for details on how to protect your inverter.

(f) Periodically check the inverter display for output performance particularly the total energy (kWh) generated to date.

(g) Refrain from switching on and off the DC or AC circuit breakers and follow proper start-up and shut-down procedures as indicated.

Western Australia
4/90 Catalano Circuit
Canning Vale, WA 6155
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Fax : (07) 3712 0618
admin.qld@regenpower.com

Warranty Certificate

Congratulations on your purchase of a Regen Power Solar Photovoltaic Power System.
Your PV system should provide you years of trouble free electricity wherever there is sun.

Warranty Period
5 years electrical installation
25 years limited output (Refer to our website for your particular PV Modules) www.regenpower.com/warranty
5 years inverter (Refer to inverter warranty declaration)

Please complete the following details and retain with the original purchase document:

Owner's name: . . . . . .

Address: . . . . . .

City: . . . . . State . . . . . Postcode: . . . . . .

Invoice No: . . . . . .

Date of installation of PV panels and Inverter: . . . . . .

Date of installation of electricity meter: . . . . . .

Installer's name and telephone number: . . . . . .

Brand of PV panels: . . . . . .

Brand of inverter: . . . . . .

In the event that service is required, please call the National Service and Warranty Number.
1300 876 354

Prior to calling for Service or Warranty, please ensure you refer to your Inverter Operating Instruction Manual, and in particular the Troubleshooting section.
www.regenpower.com

Smart Power Meter Email EM1000 Display Register

If you have a Email EM 1000 single phase smart power meter, here are the break-downs of what each register or display are on your power, assuming Import / Export power, such as a grid-connected solar photovoltaic (solar PV) array.

Pressing the RED button (top-right corner of the smart power meter) changes to the next display / register:

Display / Register number:

1. Total kWh
2. Total kWh – Peak
3. Total kWh – Off Peak
4. Total kWh – Weekday shoulder
5. Total kWh – Weekend shoulder
6. Total kWh – EXPORTED
7. Total kWh – EXPORTED – Peak
8. Total kWh – EXPORTED – Off Peak
9. Total kWh – EXPORTED – Weekday shoulder
10. Total kWh – EXPORTED – Weekend shoulder
11. Voltage (e.g. 240v)
12. Current (Amps) e.g. 2.5A
13. Power Factor (e.g. -0.85)
14. Display Test
15. Time
16. Date

The display / register list then repeats again.

Note: The “Exported” values will appear with a minus or ‘negative’ (-) symbol next to them, to indicate that you have exported power back to the grid.

Logbook for Recording PV Output Energy

PV System Address			
PV Size in kW		Module Type	
PV Array Orientation		Array Tilt Angle	
Inverter Type		Power of Inverter kW	
PV Installation Date		Meter Installation	

Date	Time	Inverter Reading Total kWh today	Inverter Reading Total kWh to date	Electricity Export Reading to date (option)	Electricity Import Reading to date (option)

Logbook for Preventative Maintenance

PV System Address			
PV Size in kW		Module Type	
PV Array Orientation		Array Tilt Angle	
Inverter Type		Power of Inverter kW	
PV Installation Date		Meter Installation	

As the system owner, you are required to ensure that PV panels are not shaded either partially or fully due to growing tree branches or by neighbouring buildings. You are also required to clean the panels periodically and after dust storms. If you are not able to do that task safely please contact the office in your State for advice. Charges will be on an hourly basis and will depend on type and size of installation.

Date	Time	Observation	Preventative or Maintenance

Contact Us

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