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ZEN ENERGY SYSTEMS

AC Energy System User Manual

ZEN Energy Systems
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Version 2.0

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1. Introduction

Congratulations on the purchase and installation of your ZEN Energy System featuring the latest "Micro Control Centre" technology and the ZEN Energy Manager web based monitoring platform optimised for mobile devices. Your system has been designed to the highest standards available in order to ensure you receive the best possible performance from your installation. The following manual highlights various features of your system. You can use the ZEN Communications Unit or login to the ZEN Energy Manager to keep track of your system's performance.

If you require information not contained within this manual, please consult **www.zenenergy.com.au** for further details or contact ZEN Energy Systems on **1300 936 466.**

2. System Description

Your ZEN Energy System is designed to automatically convert energy from sunlight into electricity and to export any excess energy (Net metering), or all energy (Gross metering), back into the electricity grid. It is a fully automated system that includes safety devices to protect wiring and intelligent electronics to ensure that the quality and power production is maximised.

3. System Components and Standard Operation

The solar modules convert sunlight into direct current (DC) electricity. The DC wiring connects that electricity to the ZEN Micro Control Centre (MCC). The ZEN Micro Control Centre converts the DC electricity into 230V AC electricity which is then sent to the residential switch board. The system can be monitored via the ZEN Communications Unit (ZCU) or by logging on to the ZEN Energy Manager (ZEM).

The ZEN Energy System generates electricity in proportion to the amount of sunlight on the solar modules and temperature, generating no electricity at night. The peak generation of power is on a clear cool day when the sun is at a perpendicular angle to the solar modules. Clouds, seasonal variation of solar angle, array soiling, orientation, heat and any incidental shading can decrease that performance.

The Main System components include:

- Solar Photovoltaic Panels
- ZEN Micro Control Centres
- Aluminium Array frame to AS1170.2. Certification available upon request.
- ZEN Communications Unit (ZCU).

4. Safety Instructions

ZEN Energy Systems practices and recommends a culture of high standards regarding Health, Safety and Environment. The ZEN Energy Systems are designed to meet applicable standards and codes in the regions they are marketed.

WARNING: Do not attempt to service the power system unless you are a fully qualified licensed electrical person, authorised to do so by ZEN Energy Systems and have prepared the site properly.

Safety notes are used throughout this manual and the other related component manuals.

WARNING: A dangerous voltage or condition may exist in this system.

CAUTION: This procedure is critical to the safe installation or operation of the application.

Disclaimer of Liability:

The use of this manual and the conditions or methods of installation, operation, use and maintenance of the power system are beyond the control of ZEN Technologies (Power and Energy) Pty Ltd.

ZEN Technologies (Power and Energy) Pty Ltd does not assume responsibility and expressly disclaims liability for loss, damage, or expense arising out of or in any way connected with the installation, use, or maintenance of the power system.

5. Operating Instructions

The ZEN Energy System is designed for automatic, unattended operation. The ZEN Micro Control Centres maximize energy production from photovoltaic (PV) arrays. Each PV module has individual Maximum Peak Power Tracking (MPPT) controls, which ensures that the maximum power is produced and is available for use or export regardless of the performance of the other PV modules in the array. When PV modules in the array are affected by shading, soiling, orientation, the ZEN Micro Control Centres ensure top performance from the array by maximizing the performance of each module within the array. Your ZEN Micro Control Centre (MCC) has four basic modes that it will automatically go through during each day.

Start-up Mode:

Start-up mode occurs first thing in the morning when enough sunlight is shining on your system to cause the system to begin operating.

Shutdown Mode:

Shutdown Mode will normally only occur at the end of each day when the sun goes down. However it can occur on days that are excessively overcast whereby the system does not receive enough sunlight over several minutes.

Shutdown Mode may also be initiated by the electricity grid being disconnected due to power failure. This is normal and expected.

The normal times that Shutdown Mode may be initiated include:

- End of day with too little sunlight
- The electricity supply is disconnected in your switchboard or meter board
- The electricity supply has been disconnected due to a power failure of the electricity grid
- The day is excessively overcast preventing the system from receiving enough sunlight
- The system has been isolated for maintenance.

Normal Operation Mode:

The output of your system can be viewed on your ZEN Communications Unit or by logging on to the ZEN Energy Manager.

Night Mode:

Night Mode is when the system is shut down during night time, and will read 0 output on the ZCU & ZEM.

During Night Mode, it is constantly checking for any solar power. Once enough solar power is detected it will then initiate Start-up Mode as described previously.

Also as mentioned on excessively overcast days the system may shutdown and enter Night Mode until there is enough sunlight to start up again, however this is extremely rare.

5.1 LED Lights on the Micro Control Centre

If you are able to view your installation you may see some of the following light sequences on the Micro Control Centres, each Micro Control Centre has a LED light installed.

	Three short green blinks:	System has started up successfully.
 10 second gap	Green light is flashing slowly:	System is producing power and communicating with the ZCU.
 2 second gap	Green light is flashing quickly:	System is producing power but not communicating with the ZCU.
	Red light is flashing:	System is not producing power. Grid Failure or AC Switch turned off. Please check your switch board and your ZCU or the ZEM for any events on the Panel Tab.

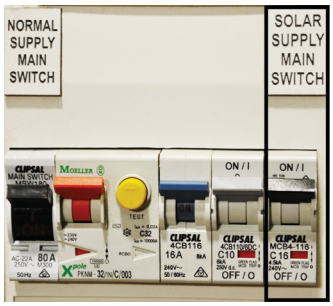
Please note: No lights will be showing when system is in shutdown mode.

- If your system is showing error codes the best thing to do is to wait 15 minutes and then check the ZCU or ZEM again. It is possible that it is either in Start-up or Shutdown Mode. Waiting gives the system a chance to finish what it is doing and to stabilise.
- If after waiting a reasonable period of time your system is still showing errors and none of the normal situations are present for initiating Shutdown Mode (see above) then please contact the ZEN Technical Support Team on **08 8211 0603.**

What happens during a power blackout?

Please note that the Micro Control Centres include safety protection devices, which will isolate and protect your solar system should the grid voltage or frequency fail (such as a blackout), or fall outside a specified range.

During an electricity blackout, the MCC will automatically sense this and shutdown. This feature is mandatory as it protects grid line workers who may periodically need to carry out maintenance work on nearby power lines.



Example Solar Supply Main Switch

5.2 Solar System Shutdown/Start-up Procedure

In order to completely shutdown the solar system, while maintaining normal grid power to the house, follow the instructions below.

Shutdown Procedure

The Solar System is shutdown by switching the Solar Supply Main Switch to the OFF Position. This switch is located at the electrical switchboard from which the Solar System is controlled.

For Maintenance Circumstances

The Solar System is shutdown by switching the Solar Supply Main Switch and the Normal Supply Main Switch into the OFF position. The Main Switches are located in the electrical switchboard from which the Solar System is controlled.

Start-up

Is the Reverse of the Shutdown Procedure above. Please note: System will take at least 60 seconds to start up and up to 15 minutes for power production to appear on ZCU/ZEM. (AS4777)

5.3 Import/Export Meter

Your energy utility, provider or Energy Retailer (not ZEN Energy Systems) is responsible for installing and invoicing you for an Import/Export Electricity Meter into your home switchboard. The installation of the Import/Export meter by your energy utility may take some period of time after installation of the solar system has been completed.

ZEN Energy Systems have submitted the necessary paperwork to action this and your Energy Retailer will contact you to confirm a connection date.

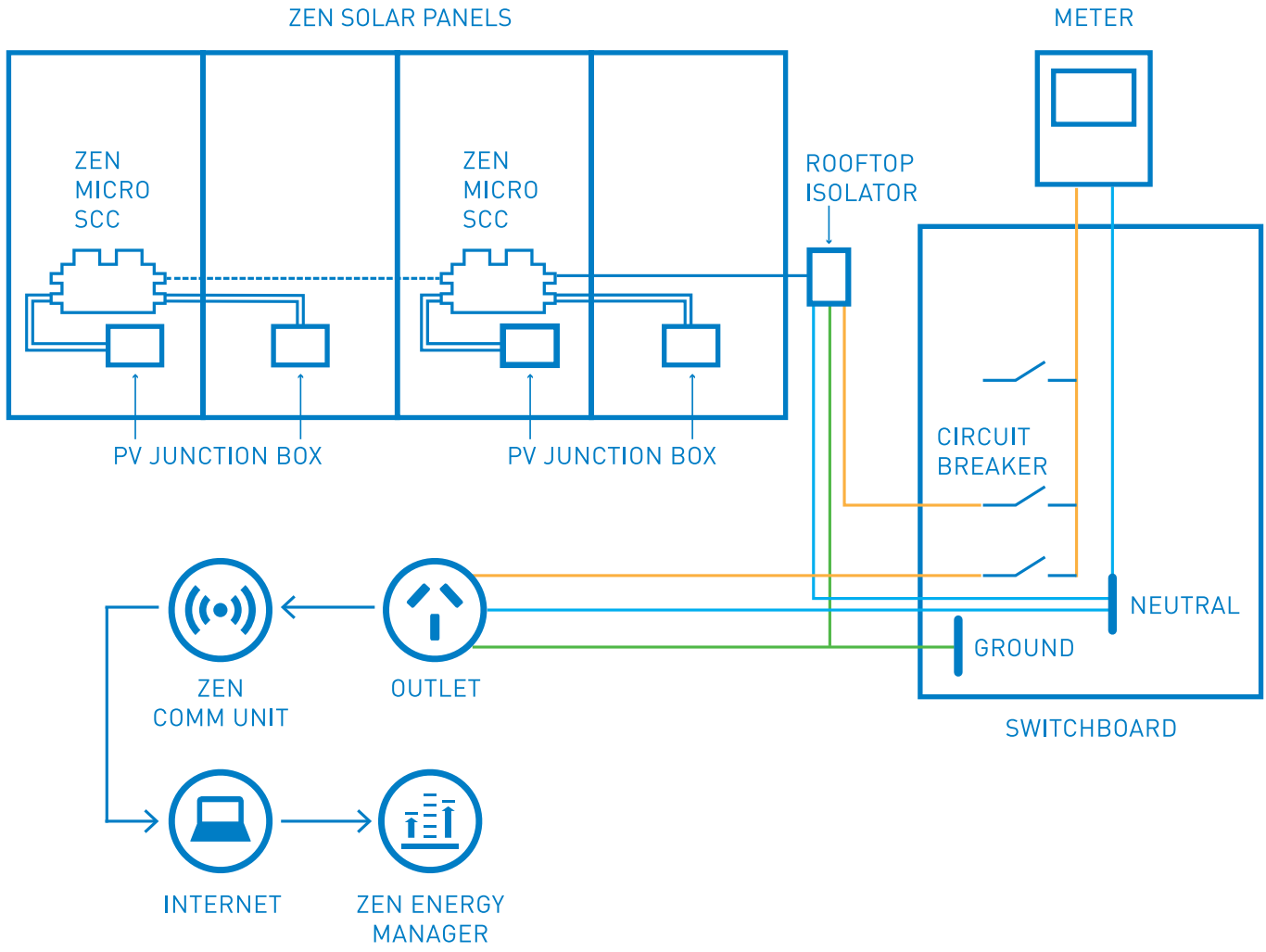
If your existing utility meter is a digital type meter the installer will leave your solar system switched off otherwise the existing meter will export your solar power generation and this will be recorded by this meter as consumption and you may be charged for this.

Once the import/export electricity meter has been installed and is working and your electricity retailer has been notified of your solar system installation, you are then ready to benefit from the Feed In Tariff.

A Net Feed In Tariff means you are paid only for the excess solar power you generate above what solar power you consume. With a Net Feed In Tariff any surplus solar power generated electricity that is unused will be fed back into the main electricity grid and you will be provided with credit on your electricity bill. What portion of your generated power you get paid for depends on the Feed In Tariff your state offers.

If you have any questions regarding your Feed In Tariff and how much you can expect to be paid for the power you generate please consult your energy retailer.

5.4 System Connection Diagram



6. ZEN Communications Unit (ZCU)

The ZEN Communications Unit or ZCU is the data logger for the Micro Control Centres and can be used by itself or connected via an ADSL Broadband router and/or Wi-Fi connection (using Wi-Fi Bridge) to the internet for access to the ZEN Energy Manager.

The communication between the Micro Control Centres and ZCU is through a Power Line Communication (PLC) via an Active Line which is why it is important that the ZCU is plugged directly into an Electrical Wall socket and as close to the Electrical Switchboard from which the Solar System is controlled (look for the Solar Supply Main Switch in your electrical switchboard). Please note: The ZCU must remain plugged in at all times for accurate data to be recorded.

CAUTION: The ZCU must be plugged directly into an Electrical wall socket only.

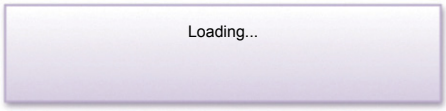
DO NOT plug the ZCU into a power board, surge protector or uninterruptable power supply (UPS).

DO NOT plug a power board into the same outlet that the ZCU is using. Plugging the ZCU into anything other than an electrical wall socket can diminish the communication performance.

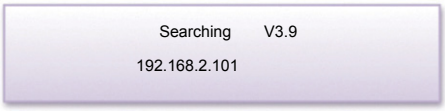
6.1 ZEN Communications Unit Set Up

Your ZEN Communications Unit will initially be set up by your installer, however should the ZCU loose connection for some reason such as being unplugged or a power failure it will go through the following sequence once reconnected. Please note: It may take up to 10 minutes for the system to completely reconnect.

The following information will be displayed in the LED screen after ten seconds.



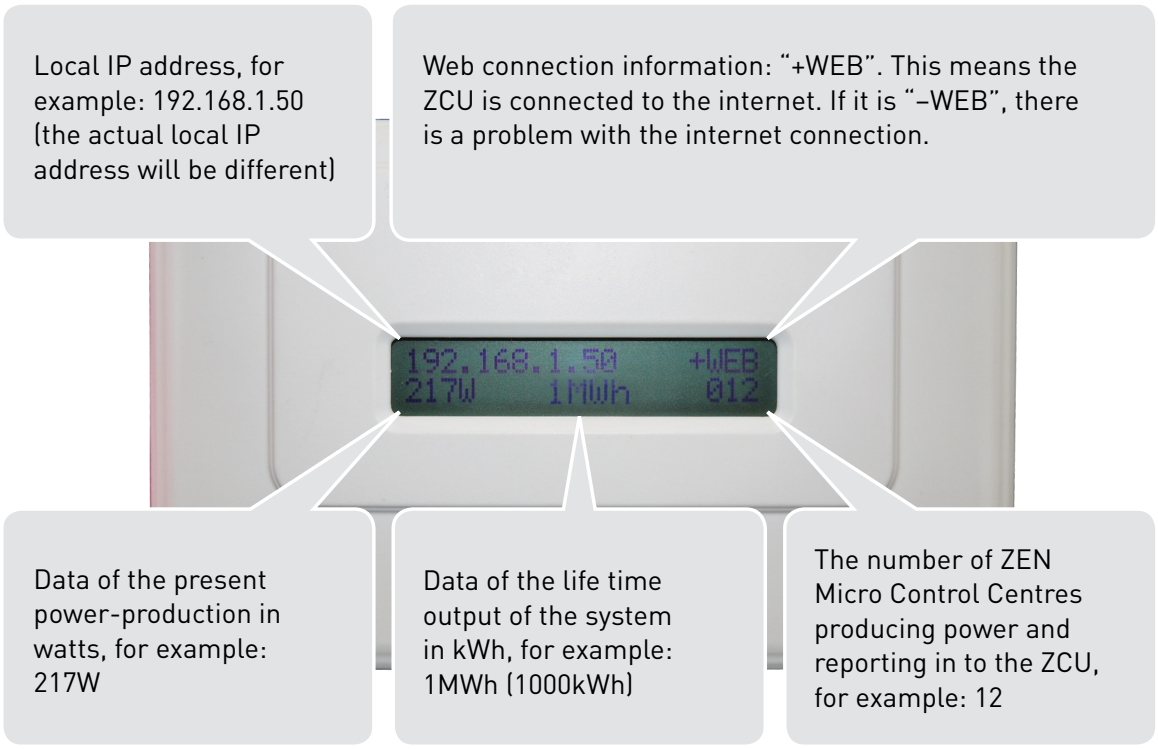
Initialisation Interface:



Starting up Interface:

Operation Interface:

6.2 Reading your ZEN Communications Unit



6.3 ZEN Communications Unit Troubleshooting

LCD Window Displays "-WEB": The ZCU could not connect to the Internet. Troubleshooting: Turn ZCU off for 15 seconds, then on again and wait for 5 - 10 minutes.

LCD Window Displays "000!": The number of installed units doesn't match the ZEN Micro Control Centres. This may indicate that the ZCU is having difficulty communicating with the system. It could also be caused by low light levels, resulting in module voltage that is too low for the Micro Control Centre to power up.

192.168.2.118 +Web
2776W 1kWh 12!

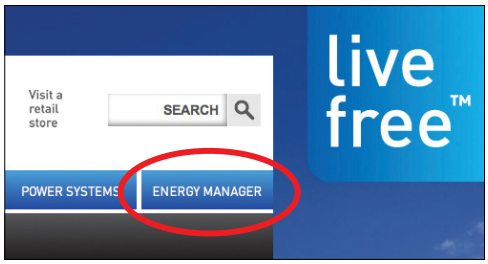
Try plugging the ZCU into an electrical socket in a different location. Keep it away from your router, but as close as possible to the Solar Supply Main Switch on a dedicated power outlet (GPO).

Please contact ZEN Technical Support to troubleshoot any issues you have with your ZEN Communications Unit.

7. ZEN Energy Manager (ZEM)

The ZEN Energy Manager or ZEM is a web based monitoring solution which allows you to see your energy system output including individual panel performance on all your connected PC's and mobile devices. If you have an internet connection and will be connecting to the ZEN Energy Manager this will be connected one of two ways, either directly through your Broadband router with an Ethernet cable or via a Wi-Fi Bridge. Please note that MAC OS is not supported by the Wi-Fi Bridge. The ZEN Energy Manager is connected via the ZEN Communications Unit. This service is provided to you free of charge for the first 12 months of installation.

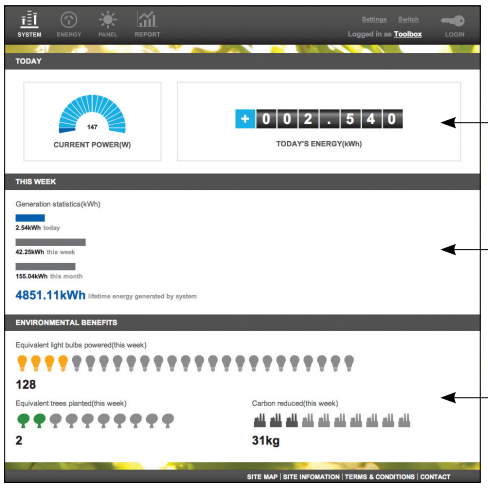
7.1 Log In



Your Log In details for the ZEM will be provided to you after installation has occurred. To access the ZEN Energy Manager Log In screen please go to the ZEN Energy Systems website **www.zenenergy.com.au** and click on the ZEN Energy Manager Tab.

7.2 ZEN Energy Manager Information Displayed

Once you have logged in you will be taken to the System screen which displays an overview of your system production including the environmental benefits.



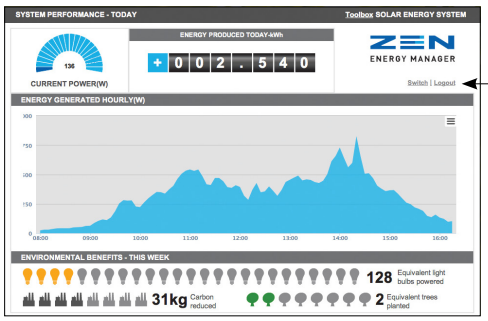
Current Energy Production

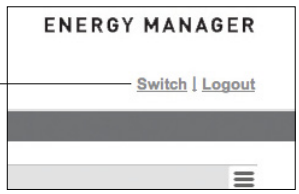
Energy Generation Snapshot

Environmental Benefits

For Home or Business Owners wishing to display the output of their system, the 'Switch' option takes you to an overview page of your systems daily performance.

To return to the full version simply click the Switch link a second time.



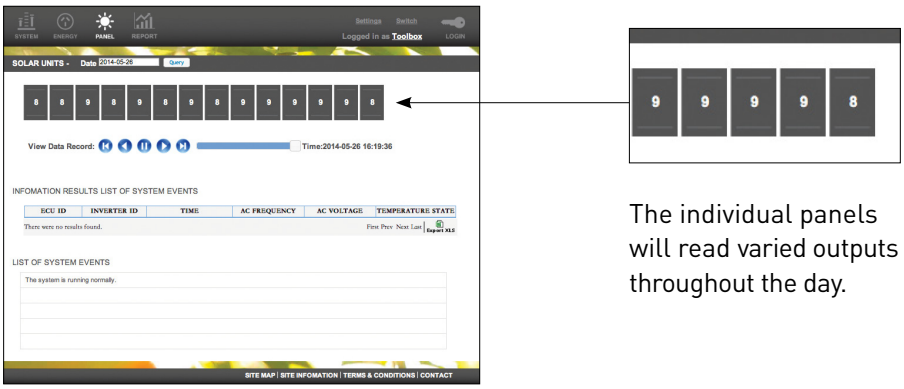


ENERGY

Select the Energy icon to be taken to a graphical display of your system production, if you hover your mouse over points of the graph it will give you the system information for that particular time. You can also enter a specific date to find out that day's generation.

PANEL

Select the panel icon to display the output of each panel. Any system events such as power outage or disconnection are also displayed on this page these can be downloaded as an excel spreadsheet by clicking on the Export XLS logo.

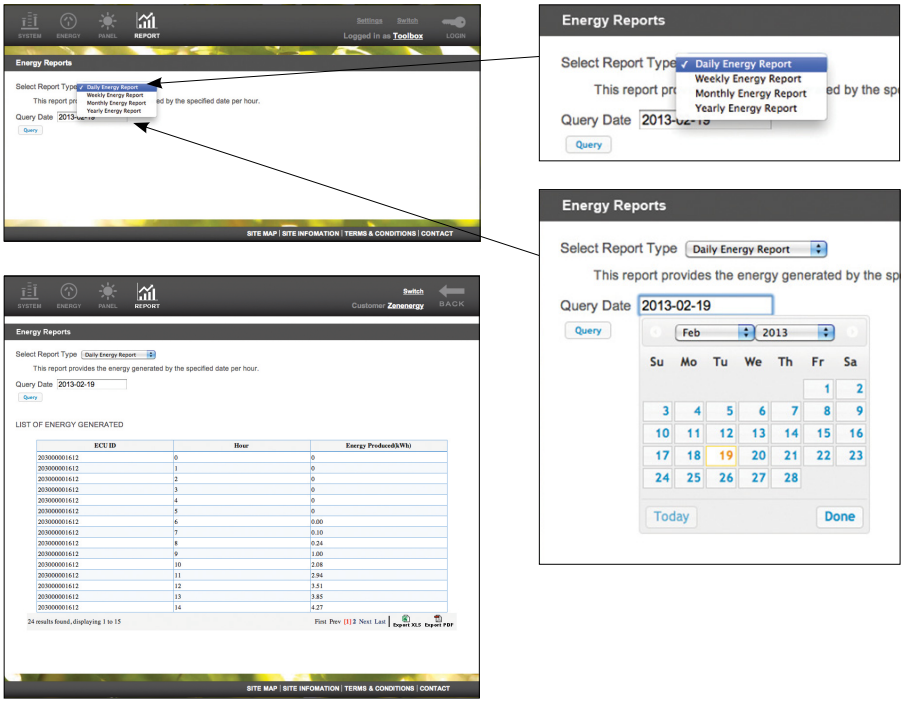


The individual panels will read varied outputs throughout the day.

REPORT

Select the Report icon to view your system performance in a numerical format. You can select Daily, Weekly, Monthly or Yearly reports. This information can also be downloaded in an Excel or PDF format.

Select the Report type you wish to view, select the date and then click query. The information will be displayed on the screen.
To download select the Export XLS or Export PDF tab on the bottom right.



8. FAQ's

Q. How much power am I putting back (exporting) into the grid?

A. With a Net Feed In Tariff (FIT) this is determined by how much energy your ZEN Energy System is generating and how much you are using. Any excess or unused energy is exported to the grid.

Example 1 - Export mode (putting energy back into the grid for any given period). If your ZEN Energy System has generated 5kWh and you have used 2.5kWh, then 2.5kWh will be put back (exported) to the grid during that time.

Example 2 - Import mode (importing energy from the grid for any given period). If your ZEN Energy System has generated 5kWh and you have used 7.5kWh then you have used (imported) 2.5kWh from the grid.

Q. Why is the reading on my ZEN Energy System not the same as the import/export meter?

A. The reading on your display on your ZEN Energy System shows the Gross or total amount of energy being generated by your ZEN Energy System at that time. The import/export meter only shows the excess amount of solar energy your ZEN Energy System has put back into the grid. Varying home electricity usage with a Net Feed In Tariff system, will also cause major differences of these two values.

Q. Will my ZEN Energy System be able to generate power for use during a power failure?

A. No, for safety reasons, your ZEN Energy System will automatically turn off during a network power failure. It will also automatically turn back on again, once the power has been restored. This feature is mandatory as it protects grid line workers who may periodically need to carry out maintenance work on nearby power lines.

Q. How much money will I get back from the power I 'export' back into the grid?

A. Your energy retailer will be able to provide you with this information.

Q. My ZEN Communications Unit or ZEN Energy Manager has stopped working?

A. 1. System is shut down either from a power failure or system is in Night Mode.
2. The ZCU has been unplugged from the mains power. Please check all cables.
3. Internet connection has been lost. Please check your internet connection.

If after checking all the above the ZCU or ZEM is still not working please contact ZEN Technical Support.

9. Maintenance

The ZEN Energy System is characterised as "low maintenance" partly due to the lack of moving parts.
The only regular maintenance required is periodic inspection for damage and some simple cleaning of the modules.

If after following the suggestions noted in this manual your system still does not appear to be working, or if you have any questions please call the ZEN Technical Support Team **08 8211 0603**.

General Inspection

An annual inspection of fasteners and mounting hardware is suggested. This should not require any exposure to live electrical equipment. In general, the wiring system, the Solar Control Centre, and the metering device should not need any maintenance or further inspection unless system power drops from expected values.

Your roof's structural integrity will have been inspected pre installation however it is recommended that a qualified person inspect the structural integrity of your roof after 5 years of installation.

CAUTION: Take appropriate precautions when working at elevated heights. Do not attempt to access the roof and wash the solar array unless safety precautions to prevent falling from heights are in place. The risk of falling from height is increased with a sloped surface that has been made slippery by water.

WARNING: If the surface of a solar PV module is cracked, smashed or damaged, then **DO NOT** attempt to touch or clean that panel in any way. There may be exposed high voltages present which could result in a dangerous electrical shock!!

WARNING: ZEN expressly states that owners **DO NOT** investigate the wiring systems themselves. There is high voltage and currents present in all parts of the system. All wiring must only be done by a licensed electrical person.

Cleaning

The system's energy output may be reduced if the modules become dirty and cleaning is not carried out. Natural rainfall will wash the modules and should remove accumulated dust and dirt. However, cleaning with a sponge and soapy water may become necessary if bird droppings etc build up on the module. Please note: It is recommended that the array be inspected for soiling every 6 months (e.g at the start of summer and winter).

Shading

Incidental shading of the solar array by trees and vegetation, or other objects may cause significant loss of power. If in doubt, go outside and take a look at any shading that may be forming onto the solar panels, and during different times of the day (morning, midday, afternoon). This may also be season-specific shading (e.g. during winter only, where the sun is lower in the sky).

Safety Testing

The Small Embedded Generator Act requires the system to be safety tested every five years. If you do not ensure this maintenance is performed and an electrocution occurs, system owners risk maximum penalties including imprisonment.

Monitoring

The ZCU/ZEM is provided to enable customers to monitor their systems. It is advised that monitoring devices are checked at least once a week, during daylight hours, to ensure the system is operating to its full potential.

10. System Performance

The ZEN Energy System operation is displayed on the ZEN Communications Unit and the ZEN Energy Manager (if applicable). These will indicate how much power is being generated by the ZEN Energy System. With time and experience, you will become familiar with the normal operating performance, as described earlier (a function of season, cloud cover, array soiling and shading).

If under performance is suspected, you should always contact the ZEN Technical Support Team.

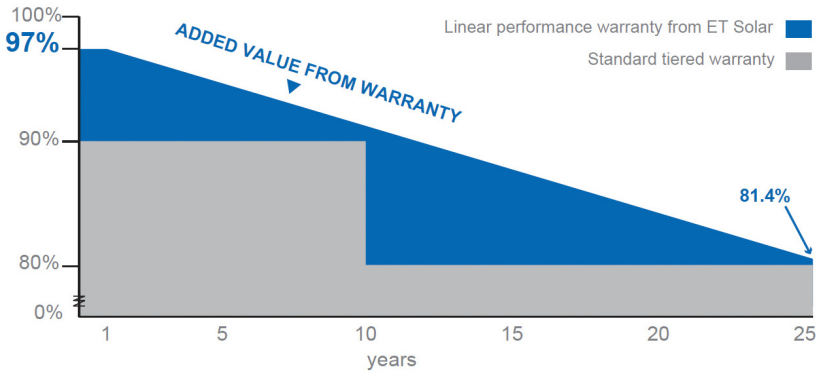
No. of Panels	System Size (kW)	Ave Daily Yield (kWh)	Annual Yield (kWh)	No. of Panels	System Size (kW)	Ave Daily Yield (kWh)	Annual Yield (kWh)
6	1.5	6.9	2519	24	6	27.6	10074
7	1.75	8.1	2938	25	6.25	28.8	10494
8	2	9.2	3358	26	6.5	29.9	10914
9	2.25	10.4	3778	27	6.75	31.1	11333
10	2.5	11.5	4198	28	7	32.2	11753
11	2.75	12.7	4617	29	7.25	33.4	12173
12	3	13.8	5037	30	7.5	34.5	12593
13	3.25	15.0	5457	31	7.75	35.7	13012
14	3.5	16.1	5877	32	8	36.8	13432
15	3.75	17.3	6296	33	8.25	38.0	13852
16	4	18.4	6716	34	8.5	39.1	14272
17	4.25	19.6	7136	35	8.75	40.3	14691
18	4.5	20.7	7556	36	9	41.4	15111
19	4.75	21.9	7975	37	9.25	42.6	15531
20	5	23.0	8395	38	9.5	43.7	15951
21	5.25	24.2	8815	39	9.75	44.9	16370
22	5.5	25.3	9235	40	10	46.0	16790
23	5.75	26.5	9654	40+ = panels x 1.08 (approx)			

Notes: The calculation of the yield is based on estimated values and mathematical models.
The only terminology used is kilo Watt hours (kWh). We consume kWh's, we produce kWh's, kWh's are shown on our power bills, kWh's are recorded on the ZEN Energy Manager. The calculation of the yield is based on estimated values and mathematical models.
System power and yield are rounded to 1 decimal place. All calculations are based on: - entire system facing North; no shading issues; at approx 30° pitch, i.e. Standard Test Conditions (25ºC, 1000 Watt/Sqm irradiance, 1.5 atmospheric mass).

11. Warranty

ZEN Energy Systems take care of the service or replacement of any faulty components within the stated factory warranty periods if a problem should ever occur with your ZEN Energy System.

ZEN Solar Panels/Modules Linear Warranty
Free from defects in materials and workmanship for 10 years.



Year	1	2	3	4	5	6	7	8	
Min power output	97.00 %	96.35 %	95.70 %	95.05 %	94.40 %	93.75 %	93.10 %	92.45 %	
Year	9	10	11	12	13	14	15	16	
Min power output	91.80 %	91.15 %	90.50 %	89.85 %	89.20 %	88.55 %	87.90 %	87.25 %	
Year	17	18	19	20	21	22	23	24	25
Min power output	86.60 %	85.95 %	85.30 %	84.65 %	84.00 %	83.35 %	82.70 %	82.05 %	81.40 %

ZEN Micro Control Centre Warranty
Free from defects in materials and workmanship for 25 years as standard.

ZEN Communications Unit (ZCU) Warranty
3 year limited warranty.

ZEN Installation Limited Warranty
Free from defects in wiring and installation for 5 years (pertaining to the ZEN Solar Installation only).

If you require further warranty information then please refer to our website **www.zenenergy.com.au** or call Customer Support on **1300 936 466.**

Contact, Support and Enquiries

For any technical support or enquiries, please contact the ZEN Technical Support Team on: **1300 936 466**, direct on **08 8211 0603** or email **techsupport@zenenergy.com.au**

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