



SOLAR ZERO

USER MANUAL

(to July 2017)

TABLE OF CONTENTS

1.0 CONTACT INFORMATION	3
2.0 IMPORTANT SAFETY INFORMATION.....	3
2.1 WARNINGS.....	3
3.0 ACTIONS IN CASE OF SYSTEM FAILURE	3
4.0 START-UP AND SHUT-DOWN PROCEDURES	4
4.1 SYSTEM SHUT-DOWN PROCEDURE.....	4
4.2 SYSTEM START-UP PROCEDURE	4
5.0 INTRODUCTION TO THE SOLAR SYSTEM	4
5.1 THE ENVIRONMENTAL BENEFITS	4
5.2 WHY SOLARCITY?	4
5.3 HOW IT WORKS	5
5.3.1 Solar panels	5
5.3.2 Micro-inverters.....	6
5.3.3 Monitoring.....	6
5.3.4 Framing.....	6
5.4 SYSTEM MONITORING USING MYENLIGHTEN	7
5.4.1 Introduction.....	7
5.4.2 Registration	7
5.4.3 Getting started	7
5.4.4 Sharing on social networking sites	9
5.4.5 Evaluating system performance.....	9
5.4.6 Energy reports	9
5.4.7 Help	9
6.0 GETTING THE MOST OUT OF THE SOLAR SYSTEM	10
7.0 MAINTENANCE OF THE SYSTEM	10
7.1 USER MAINTENANCE	11
8.0 SYSTEM ISSUES	11
8.1 HOW WILL I KNOW IF THERE IS A PROBLEM WITH THE SYSTEM?.....	11
8.2 NETWORK ISSUES	12
8.2.1 Envoy	12
8.2.2 Envoy S Metered	13
8.3 COMMUNICATION ISSUES.....	14
8.3.1 Envoy	14
8.3.2 Envoy S Metered	14
9.0 WARRANTY	15

1.0 CONTACT INFORMATION

solarcity New Zealand Limited
 PO Box 1509 / 190 Trafalgar Street
 Nelson 7010

Customer care phone: 0800 11 66 55
 Customer care email: info@solarcity.co.nz
 Website: <http://www.solarcity.co.nz>

2.0 IMPORTANT SAFETY INFORMATION



Solar power systems are safe when operating correctly, however, there are potentially dangerous hazards associated with some system components.

Please read the following warnings before operating the system.

2.1 Warnings

DC electrical	The solar array can contain potentially lethal voltages and should not be altered by anyone other than a registered electrician. At all times during daylight hours, the solar panels and all wiring between the panels and the DC disconnect, cannot be de-energised. It is important to note that the solar panel plug and socket connectors should not be disconnected under load (when light is shining on the panels).
Electrical wiring	This installation has been installed in accordance with AS/NZS wiring standards by a registered electrician. Any unauthorised altering of the wiring presents the risk of high voltages being exposed, and the risk of death or serious injury being presented to users of the property where the system is installed.
Heights	The solar panels on the roof of your property are situated at a height where serious injury could occur if a fall happens. If you wish to access the system for maintenance purposes, please use appropriate access arrangements, e.g ladders with the necessary reach and fall arrest systems. Roofing material may also be slippery after rain, so please take care.
Glass	The solar panels are fragile to handling and high impact. Please do not stand on the panels, for any reason. If any damage occurs, please contact solarcity at the earliest opportunity.

3.0 ACTIONS IN CASE OF SYSTEM FAILURE

In an emergency, shut down the system as outlined in Section 4.0 if it is safe to do so. For other issues, please refer to Section 8.0 on 'System Issues'.

4.0 START-UP AND SHUT-DOWN PROCEDURES

Under normal circumstances, the system should not need any intervention. In an emergency, or should your electrician need to work on wiring in the house, the system may need to be shut-down. The following procedures should be followed.

4.1 System shut-down procedure

1. Turn OFF the AC SOLAR SUPPLY MAIN SWITCH which is labelled and located in the switchboard.



Do not open plug and socket connectors or PV string isolators under load.

4.2 System start-up procedure

1. Turn ON the AC SOLAR SUPPLY MAIN SWITCH which is labelled and located in the switchboard.



The inverters will take at least 60 seconds to reconnect to the grid following a shut-down or grid outage.

5.0 INTRODUCTION TO THE SOLAR SYSTEM

5.1 The environmental benefits

Electricity from the grid (unless sourced from a certified renewable source) will release carbon dioxide and other pollutants into the atmosphere.

By installing a solar system, you can reduce the amount of grid-sourced energy used in your home and therefore your CO₂ emissions, by collecting the sun's energy, which is a 100% renewable energy resource.

By producing electricity where the electricity demand is, you are also reducing the load on the national grid contributing to lower operating costs of the electricity infrastructure for everybody. Six per cent of all electricity in New Zealand is lost in the distribution lines as it is being transmitted from generator to consumer, whereas the electricity produced on your roof has negligible losses.

5.2 Why solarcity?

solarcity is in business for a purpose: to help create a cleaner world and a sustainable energy future for New Zealand. Our aim is to revolutionise the energy market and make a big difference in the fight against climate change.

solarcity is the only solar company in New Zealand to have achieved carboNZero accreditation. Being carboNZero certified means we measure all greenhouse gases we generate, and have written programmes in place to measure and minimise all greenhouse gas emissions. Any remaining emissions that can't be avoided are offset by purchasing verified carbon credits making solarcity and our installations carbon neutral. solarcity's carboNZero accreditation is independently audited annually by Landcare Research.

Thirty years ago, working with few resources in an apple shed in the heartland of New Zealand, our team designed and built the world's first solar heat pipe panel. Today, our world-class Design and Innovation Team give our customers a wide choice of the most cost-effective, innovative and well-engineered solar solutions.

5.3 How it works

The grid-connected solar power system generates electricity directly from the sun’s energy for use in your home. The electricity which is generated is used to power appliances, lights, the hot water cylinder and anything else that is drawing power at the time. When the solar system is not generating enough to supply all of the requirements of your home, at any particular moment in time, additional electricity is drawn from the grid, supplementing the solar electricity. When the solar system is generating surplus electricity, the excess electricity is exported to the grid. This energy is metered and is purchased by your electricity retailer at an agreed tariff.

The grid-connected solar power system includes:

1. Solar panels and mounting hardware
2. Micro-inverters
3. Distribution board
4. Utility meter
5. Utility grid

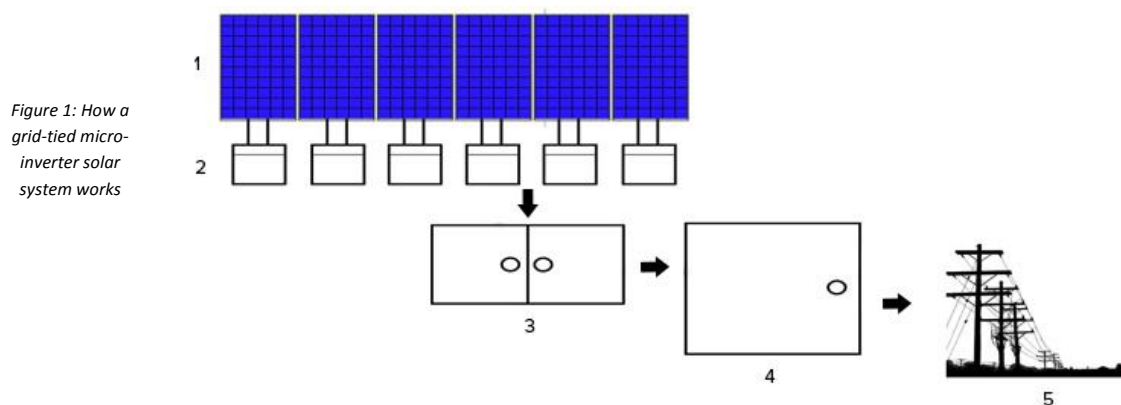


Figure 1: How a grid-tied micro-inverter solar system works

5.3.1 Solar panels

Solar panels are made up of interconnected photovoltaic cells, which convert sunlight to direct current electricity. The solar panels are linked together to make up an array. Optimal performance is obtained with direct sunlight; however, the panels still generate electricity on cloudy days. Full, or partial shading, of the solar panels by trees, other structures, or a build-up directly on the panels will lead to a reduction in performance and should be avoided. If no light is shining on the panel (for example at night, or under shaded conditions), then no power will be produced.

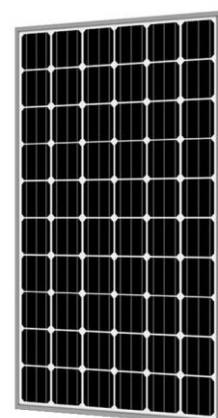


Figure 2: Solar panel

5.3.2 Micro-inverters

The micro-inverter converts the direct current (DC) electricity generated by the solar panels to 230V alternating current (AC) electricity for use in your building.

Australian and New Zealand standards require the inverter to automatically shut-down in the event of a grid power outage, or when the grid operates outside of normal parameters, in order to protect utility workers from harm when they believe the grid to be de-energised. Once the grid returns to normal operating conditions, the inverters will automatically start-up and reconnect to the grid.

Special components are required to enable the solar system to provide backup power in the event of a grid failure. solarcity’s standard grid-tied systems do not include backup.



Figure 3: Enphase micro-inverter

5.3.3 Monitoring

The Envoy, shown in Figure 4, or the Envoy S Metered, shown in Figure 5, communicate with the micro-inverters and transmit the performance data to the Enphase server. The monitoring portal, MyEnlighten, connects system users to their solar experience through an engaging interface that displays energy production, system health and environmental benefits. The Envoy S Metered has the additional benefit of displaying household consumption alongside energy production. Refer to Section 5.4 for more information on system monitoring.



Figure 4: Enphase Envoy



Figure 5: Enphase Envoy S Metered

5.3.4 Framing

The solar panels are fixed to your roof using top of the range framing components manufactured by Clenergy. Clenergy is the market leader in innovative, high quality renewable energy mounting systems. The Clenergy mounting system uses clear anodized aluminium that is designed to withstand harsh wind and marine conditions. The mounting system is compliant with AS/NZ 1170.2:2012 and the New Zealand Building Code.

5.4 System monitoring using MyEnlighten

5.4.1 Introduction

MyEnlighten provides a simple representation of a system’s energy production including overall system health, historical performance and energy equivalence. It is accessible on any web-enabled device. If you wish to access it on an iPhone, iPad or Android device, there is a MyEnlighten app available via the App Store or Play Store.

If there is an issue with the performance of the solar system, solarcity will be alerted and will resolve the issue as quickly as possible. In the unlikely event that you have noticed a problem, and have not been contacted by solarcity, please contact us on 0800 11 66 55 or by email on <mailto:systemissue@solarcity.co.nz>.

5.4.2 Registration

Once the solar system has been installed, solarcity will set the system up on the Enlighten portal. When the setup is complete, you will automatically receive an email from Enphase Energy inviting you to register and view your system. NOTE: If you have not received an email from Enphase Energy, please check your spam folder. The email is sent from dontreply@enphaseenergy.com.

5.4.3 Getting started

Before you get started, it may be helpful to watch the ‘MyEnlighten Introduction’ video available via YouTube. The link to this video is: https://www.youtube.com/watch?v=X_x-xO6mgYU (please note that the user interface has been updated since the video was made).

The link to the video for the Envoy S Metered unit is: <https://www.youtube.com/watch?v=BILCTnf1WNo>.

More information can also be found on the Enphase website using the following link: <http://www.enphase.com/enlighten>.

Once you have logged into MyEnlighten, you can get a quick overview of the system’s performance for today at the top of the screen. The green tick tells you that everything is operating as expected.



Figure 6: Green tick showing normal operation

Figure 6: Green tick showing normal operation

You will be able to see the total energy generated for today day in kilowatt-hours, the peak power in kilowatts and the latest power in kilowatts.

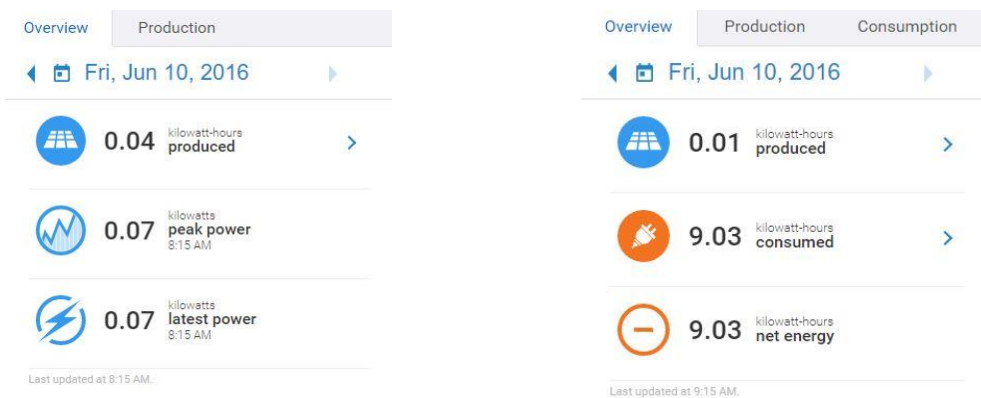


Figure 7: Today's performance on MyEnlighten for the Envoy (on left) and the Envoy S Metered (right)

In the pane to the right of the overview you will see a bird's-eye view of the array and, on the top right, you will see the current weather conditions.



Figure 8: Bird's eye view of the array(s) and current weather conditions
 Figure 8: Bird's-eye view of the arrays and display of current weather conditions

Below this you will see a graph showing production for 15-minute intervals for the selected day. You can change the selected day by clicking the arrow to the right, or left, of the date, or by clicking the date and selecting your desired date from the calendar. Historical dates will show the weather for that day but there will be no current power figure.



Figure 9: Graph of production throughout the day

With an Envoy S Metered you can see the household consumption as well as the production.

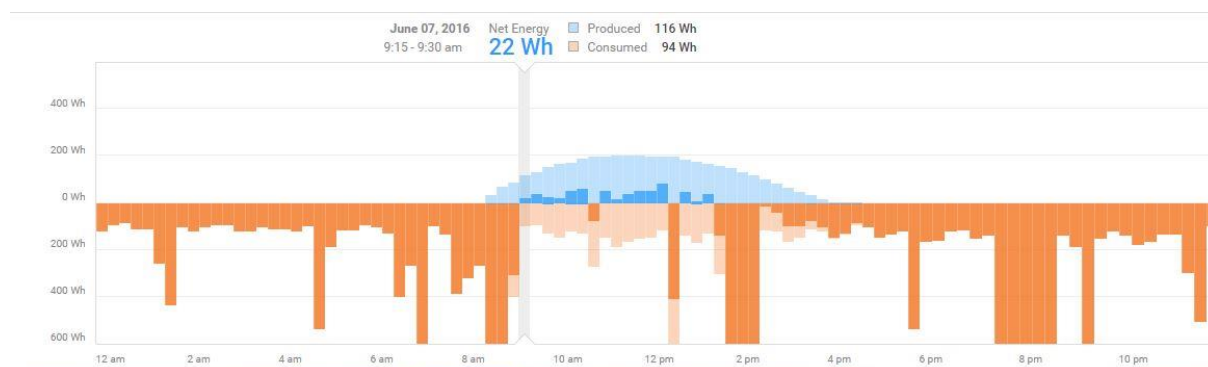


Figure 10: Graph of production and consumption throughout the day

The light blue on the graph represents energy produced by the panels which was consumed by the household. The dark blue shows solar energy that wasn't consumed by the household and was exported to the grid. The dark orange shows energy consumed by the household that was imported from the grid. The light orange shows solar energy consumed by the household.

If you click the 'System details' section below the graph, you will see the number of micro-inverters installed, some information about the array(s) and the site address. You can also personalise this section by adding a description and photos.

5.4.4 Sharing on social networking sites

Using MyEnlighten, you can easily share the system's performance on Facebook, Twitter and Google+. To do this, click on the relevant icon at the top left corner of the screen.

5.4.5 Evaluating system performance

The 'Production' section of MyEnlighten allows you to evaluate historical system performance and consumption (in the case of the Envoy S Metered) data. This data can be viewed in both grid and graph form and in months, days and hours. The time period can be changed by clicking on the relevant description, just below the production heading.

When in grid form, the colour coding shows you how well the system performed in the period. Light blue means higher production and dark blue indicates lower production. The time period can be changed by clicking on 'Months', 'Days' or 'Hours'. If you hover over a square, you will be able to see the actual kilowatt-hours of electricity produced in the time period at the bottom of the screen. There is also a graph showing the greater time period, with the specific square (currently being hovered over) highlighted.

In the case of the Envoy S Metered, instead of a grid there is a graph showing production and consumption, with the highlighted information that corresponds to the selected tab.

5.4.6 Energy reports

You can run a report to display solar production for a daily, monthly or specified time period. This can be done in the 'Reports' section towards the bottom of the screen. You can then download, print, or email the report.

5.4.7 Help

For more information, click on the 'Help' icon which is located at the top right corner of the screen. If you have a question, that is not answered here, please contact solarcity on 0800 11 66 55, or <mailto:systemissue@solarcity.co.nz>.

6.0 GETTING THE MOST OUT OF THE SOLAR SYSTEM

There are many ways to reduce the energy demand of your home and to maximise your use of solar power. Below are some basic suggestions, plus you should check out our website at <http://www.solarcity.co.nz> for more advice, user feedback, and frequently asked questions.

Here are a few tips to getting started:

- To reduce your energy demand, install energy efficient light bulbs and purchase energy efficient appliances. Look out for the Energy Rating label which has to be supplied for all new whiteware, heat pumps, televisions and computer monitors that are sold in New Zealand. Many of the top performing models will have four or five stars. Selecting energy efficient appliances can have a significant impact on how much electricity they consume and their lifetime running costs.
- The solar system will be generating the most electricity between 9am and 3pm so change your behaviour and turn appliances on during the day. Some appliances have timers which will allow you to set the time that they come on. Stagger the use of your high energy consuming appliances, like a washing machine or dishwasher, during these hours. This will help reduce the amount of power that you need to purchase from the grid.
- If possible, you should programme, or design, your hot water system to run during the day. Normal household cycles typically consume hot water during the morning and then heat it up during the day. If you have a timer on your hot water cylinder, it should be tuned to run from 12-3, when the most solar power will be produced.
- Shade on the solar system will reduce the amount of electricity that it produces, potentially significantly. To keep the system performing at its best, maintain any trees surrounding the house which may grow to shade the solar system. Any new additions to your roof, such as an aerial or antennae, should be installed well clear of the array.
- Ensure that the solar panels are kept clean. Build up of dirt on the panels causes shading and reduces the electricity generation. Most systems will self-clean with the rain, if they are installed at a pitch of 10 degrees, or steeper. However, it is good practice to check the panels every quarter. If you live in an area that has significant pollen, the pollen can stick to the panel surface and may not easily wash away with rain. See the maintenance section below for more information on cleaning.

7.0 MAINTENANCE OF THE SYSTEM

solarcity agrees to repair the system under the terms of the Limited Warranty.

The new solar system will, under normal circumstances, operate without any intervention. For ongoing optimal performance, a few simple actions can be taken to ensure that the system continues to perform safely, efficiently and has a long operating life.

Please note that it is the homeowner's responsibility to keep the solar panels clean. You can easily perform the visual inspections outlined below, or we can recommend a suitably qualified and approved contractor to perform these services, at your cost, if required.

Regular rain is usually sufficient to keep the panels clean, although if more than a fine layer of dust is present, cleaning is advised to maintain optimum performance. Only clean panels when cool; in the morning, or in the evening. Use a soft brush and water to avoid scratching the panels.



The system **MUST** be shut down to perform the cleaning steps below.



Do not clean solar panels with cool water during hot, sunny days.

7.1 User maintenance

Maintenance should be carried out by trained and competent persons only. You may feel competent to carry out some work yourself. If doing so, you must follow standard industry practice and appropriate safety guidelines. The solar system must be switched off before any cleaning is carried out.

Sub system or component	Maintenance	Period	Remarks
Site	Verify: <ul style="list-style-type: none"> a) Cleanliness (accumulation of debris around and/or under array) b) No shading of array 	Quarterly	Clean site as required Trim trees, if required
Solar panels	Verify cleanliness (accumulation of dust or fungust, etc on array) <ul style="list-style-type: none"> a) If the array is less than 10° Check for visual defects, including: <ul style="list-style-type: none"> a) Fractures b) Browning/Discolouration c) Frame corrosion 	Quarterly Quarterly (minimum) 1 year	Clean, if necessary Clean if necessary, subject to climatic conditions Panels with visual defects should be further inspected by a solarcity service agent for performance and safety (this is done at no charge)

8.0 SYSTEM ISSUES

solarcity will monitor the performance of the solar system and benchmark it against expected generation. If there are any performance issues, solarcity will contact you to run through some troubleshooting checks.

In the unlikely event that you notice an issue with the system and have not yet been contacted by solarcity, please contact us on 0800 11 66 55 or <mailto:systemissue@solarcity.co.nz>.

8.1 How will I know if there is a problem with the system?

If you want to check how the system is performing, please log in to MyEnlighten. See Section 5.4 for more information on MyEnlighten.

The numbers and graphics at the top of the MyEnlighten page give you a snapshot of how the system is performing. If you see a display like the one shown below in Figure 11, with a green tick, your system is operating with normal system production.



Figure 11: Overview of system's current performance

To receive an email notification if the system experiences a production issue, follow the steps below:

- Click the drop-down arrow next to 'Signed in as...' at the top right corner of the screen and choose 'Settings'.
- Next to 'Emails', check 'Notify me about system production issues'.
- Click 'Save Changes'.

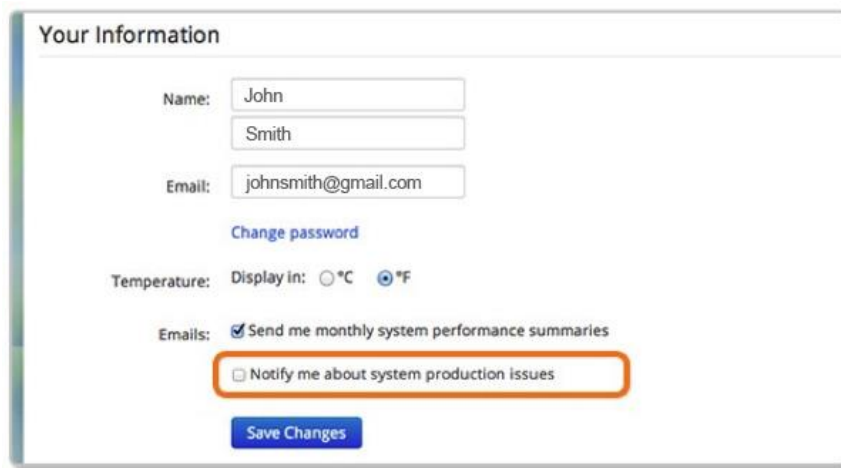


Figure 12: Amending setting to receive email notifications

8.2 Network Issues

If, rather than the green tick, you notice an orange wifi symbol, then your Envoy is having trouble connecting to the internet.



Figure 13: System reporting issue

solarcity may contact you regarding a system reporting issue. You can try the following steps before replying if you wish, Otherwise, contact us and we will help you to resolve the issue.

8.2.1 Envoy

The LCD screen on the Envoy displays whether the Envoy is connected to the internet, or not. If the display shows “- Web”, there is an internet connectivity issue.

Please perform the following tasks to restore the internet connection between the Envoy and Enlighten:

- Check the power connections for the Envoy and the internet router. Verify that both have power. If they do, please switch the devices off and turn them back on in the following order: DSL/cable modem, router, then Envoy.
- If the Envoy is plugged into the router using an ethernet cable, please check that the cable is correctly plugged into both devices. To be sure, you may need to remove and reconnect the cable, making sure the plug locks into place (you should hear a click).



Figure 14: Enphase Envoy

- Use the menu button (on the right hand side of the Envoy) to select “Get new IP address”, then allow about 60 seconds for the new IP address to display.

Once these checks have been carried out, please check the display on the Envoy. If “+Web” displays, then the Envoy has reconnected to the internet. If “-Web” still displays, please contact solarcity on 0800 11 66 55, or <mailto:systemissue@solarcity.co.nz>.

8.2.2 Envoy S Metered



The Network Communications LED (the uppermost LED with a  symbol beside it) shows whether or not the Envoy is connected to the internet. If the light is solid green then there is an internet connection, if the light is anything other than solid green then please see below.



Figure 15: Enphase Envoy S Metered

LED is OFF:

- If the LED is off there is no network connection. Please check the power connections and verify that your router and the Envoy have power. Apply power again in the following order: Modem, Router, Envoy.
- If the Envoy uses a wifi connection, then check for any metal objects between the Envoy and the router. Also check that the router and internet connection are operational by testing other devices are working correctly. If neither of these seem to be the issue then try to initiate the connection between the devices again as follows:
 1. Find the WPS button on your router (usually shown as a wifi symbol with a lock ) and press and hold for 2 seconds or more. It usually begins to flash.
 2. Next move to your Envoy and press and hold the ‘AP Mode’ button on the Envoy (situated immediately below the second LED – the one with a picture of an arrow pointing into a rectangle) for at least 5 seconds. The Network Communications LED (the uppermost LED) should begin flashing green.
 3. Wait for three minutes and ensure that the LED becomes solid green.
 - If the Envoy is plugged into the router using an ethernet cable, please check that the cable is correctly plugged into both the router and the Envoy. To be sure, you may need to remove and reconnect the cable, making sure the plug locks into place (you should hear a click).
 - If the Envoy is plugged into the router using an ethernet bridge, then unplug at both power points and then plug them in again. Please ensure that both bridges are plugged directly in to the wall plug rather than in to any multi-boards. All of the LEDs on the bridges should be either on, or blinking.

LED is solid amber:

- If the LED is solid amber then the Envoy has a connection to the local network but not to the internet. Please complete all the steps above for the ‘LED is OFF’, especially checking that other devices connected to the same network have access to the internet.
- Also, if you have changed the password recently to your Router and your Envoy is connected by wifi you may need to repeat the wifi connection initiation steps above.

LED is flashing green:

- If the LED is flashing green then the Envoy is attempting a connection. Check back in a few minutes and the LED should now be solid green again.

If, after trying all of the above, you cannot get the Envoy to reconnect to the internet please let us know, either by email to <mailto:systemissue@solarcity.co.nz> or by calling 0800 11 66 55.

If you are going away for an extended period of time and wish to switch your router off, or are aware of internet connectivity issues at your property, you can let us know your return date, or the resolution date, to avoid unnecessary contact during that period.

8.3 Communication Issues

If, rather than the green tick, you notice an orange plug symbol, then your Envoy is having trouble communicating with some, or all, of the inverters.



Figure 16: Micro-inverters not reporting

solarcity may contact you regarding this issue. You can try the following steps before replying, if you wish. Otherwise, contact us and we will help you to resolve the issue.

8.3.1 Envoy

The LCD screen shows the number of micro-inverters that are communicating with the Envoy. The number in the bottom right hand corner of the screen should match the number of panels you have on your roof. If this number is less than the number of panels you have on the roof then some, or all, of the micro-inverters are not communicating with the Envoy. Please see below for a few things that you can check before contacting solarcity.

Your Envoy should be plugged in as close as possible to your switchboard. If you have moved the Envoy to a different location, to where it was originally installed, then please move it back to its original location.

If you have plugged the Envoy in to a multi-plug or power-board then there may be too much interference on the line for the micro-inverters to communicate with the Envoy. Please make sure that the Envoy is plugged directly in to a wall socket.

You will need to wait at least 15 minutes for any changes to be reflected on the MyEnlighten page.

If none of these things have fixed the problem, please check that the solar supply main switch (located at the switchboard) is on.

In the event that you cannot locate the issue after trying all of the above, please contact us.

8.3.2 Envoy S Metered

The fourth LED (with a lightning bolt symbol) shows the status of communications between the micro-inverters and the Envoy. If the LED is solid green then all of the micro-inverters are communicating with the Envoy. If the LED is solid amber then at least one of the micro-inverters is not communicating with the Envoy. If the LED is off, then the micro-inverters are not communicating with the Envoy due to low light conditions (e.g. at night). If the LED is solid amber then please ensure that the solar supply main switch is switched on and contact solarcity.

9.0 WARRANTY

Subject to the terms of the Limited Warranty in paragraph 24, solarcity warrants that during the Term of this Agreement between solarcity and the customer, the system will operate within the tolerance of 20% of the specifications provided to you at the time of Switch-On, subject to the customer complying with their obligations and subject to a performance degradation of 0.8% per year (being the standard manufacturer warranted performance degradation of such systems).

If after the Switch-On it becomes apparent that the annual energy yield of the system is 20%, or more, below solarcity's estimates for the customer's specific property, for a period of at least six months, based on actual NIWA data, measured in kWh, then either party has the right to cancel its agreement with the customer on notice to the other (in which case no further fees or payments are payable from the date of cancellation) or agree a decrease in the monthly fee (which reflects the different performance level to that anticipated when calculating the monthly fee) together with a revised performance estimate.

solarcity undertakes to perform its obligations under this agreement to the usual and reasonable professional standards within the industry and prudent electric practices, complying with all statutory and regulatory requirements and professional codes relevant to the work being undertaken.

During the term of the agreement between solarcity and the customer, under normal use and conditions, the system will be free from defects or breakdown in materials or components. solarcity will repair or replace any defective part of the system within a reasonable period upon receipt of the customer's advice, or identify via remote monitoring that there is an issue to which this limited warranty applies. solarcity may use new or reconditioned parts, or upgrade parts when making repairs but, in any case, will ensure the system performs to the design specification at the time of the Sign-Off.

If solarcity damages the property or the customer's belongings, solarcity will repair or pay for the damage it caused. Installing solar panels can incur minor cosmetic blemishes while the workers affix the system. solarcity will make reasonable endeavours to minimise cosmetic damage to the customer's roof.

When solarcity penetrates the customer's roof during a system installation, solarcity will warrant roof damage it causes due to solarcity's roof penetrations. This roof warranty will run the longer of one (1) year following the completion of the system installation, or the length of any existing installation warranty or new homebuilder performance standard for the customer's roof (the "Roof Warranty Period").

The customer can advise an issue under this limited warranty by writing (including by email) to solarcity at the address shown on the front of this User Manual.

Exclusions:

This limited warranty does not cover the customer for any lost power production, or fault, as a consequence of someone other than solarcity, or its agents, servicing, repairing, removing or re-installing the system, or for any breach by the customer of their agreement with solarcity, including denial of access, failure to clear the system of shading vegetation, or wilful or negligent damage to the system, or a failure to keep the system free of debris.