



SOLAR ZERO

User Manual



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1. CONTACT INFORMATION

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 PO Box 1509 / 190 Trafalgar Street
 Nelson 7010

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

2. 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 and storage battery system can contain potentially lethal voltages and should not be altered, or opened, by anyone other than a registered electrician. The solar panels, and all wiring between the panels and the DC disconnect, cannot be de-energised at any time during daylight hours. It is important to note that the solar panel plug and socket connectors should not be disconnected under load (when sunlight 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 risks high voltages being exposed, which could cause death, or serious injury.
Heights	The solar panels on the roof of your property are situated at a height where serious injury could occur if a fall happens. Please use appropriate access arrangements for inspection or cleaning purposes, 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. Do not stand on the panels, for any reason. If any damage occurs, please contact solarcity immediately.

3. ACTIONS IN CASE OF SYSTEM FAILURE

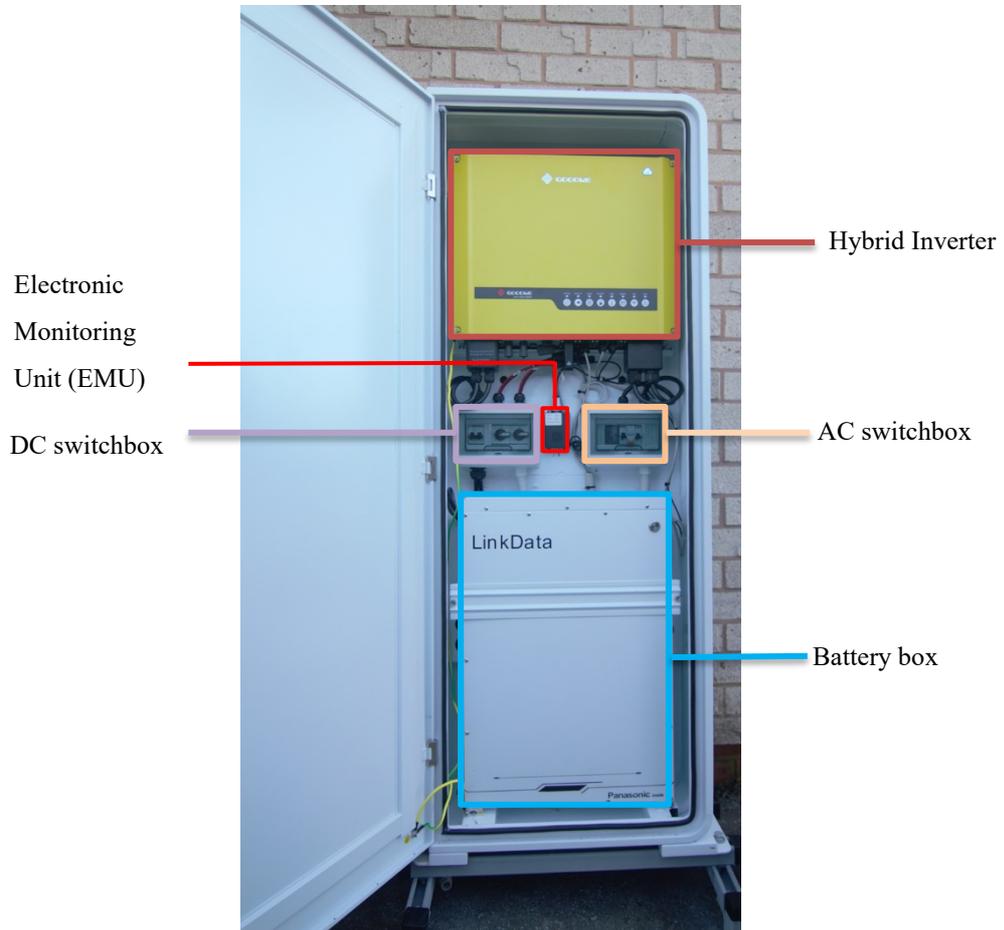
In an emergency, shut down the system, as outlined in Section 4, if it is safe to do so. For other issues, please refer to Section 8 on 'System Performance'.

3.1 Actions in case of an earth fault

The Fault indicator LED will light up if an earth fault is present. This indicates potential danger. Do not touch any conductive materials. Turn off all the DC isolators (these are insulated) and notify solarcity immediately. If there is an indication of fire, you should immediately call the fire service.

4. START-UP AND SHUTDOWN PROCEDURES

Under normal circumstances, the system should not need any intervention. The system may need to be shut down in an emergency, or if your electrician needs to work on the wiring in your home. Follow these procedures if the system needs to be shut down or started.

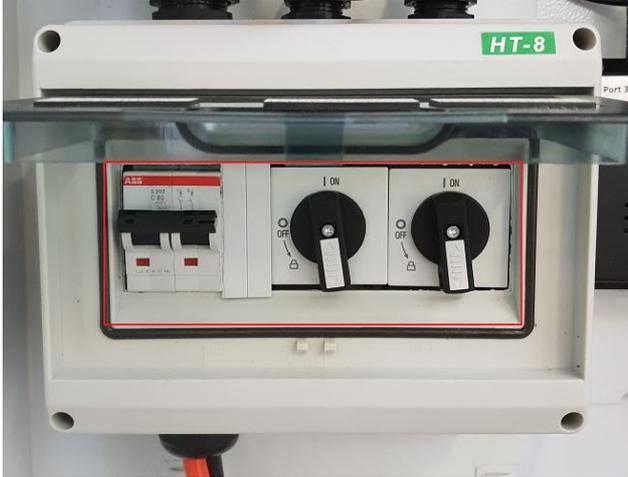


4.1 System shutdown procedure

1. In the AC switchbox:
 - a. Turn off the EMU supply switch, the grid supply switch and the backup supply switch

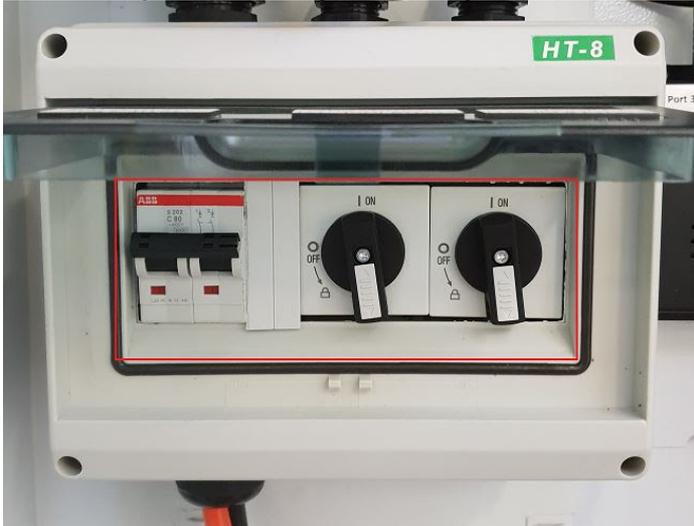


2. In the DC switchbox:
 - a. Turn off the inverter-integrated DC switch
 - b. Turn off the PV DC isolator(s)
 - c. Turn off battery DC switch



4.2 System start-up procedure

1. Turn on battery DC isolator and press the battery on switch

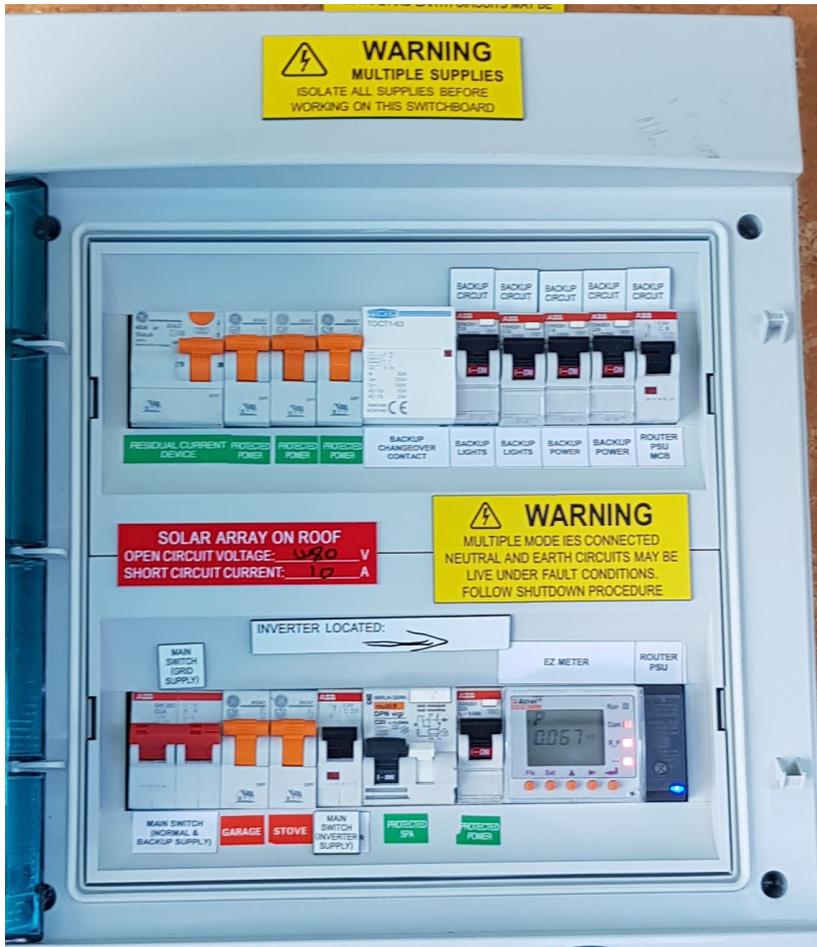


2. Turn on the PV DC isolator(s)
3. Turn on the inverter-integrated DC switch

- In the AC switchbox: Turn on the EMU supply switch, the grid supply switch and the backup supply switch



- In the solarZero switchboard: Switch all switches into the ON position



- Router: Make sure the small microTIK router is connected to your internet router via Ethernet cable and powered on:



5. INTRODUCTION TO THE SOLAR SYSTEM

5.1 The environmental benefits

solarZero provides your home with 100% renewable electricity so you can reduce your carbon footprint.

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 energy services company in New Zealand to be carboNZero certified. We have policies and programmes in place to measure and minimise the greenhouse gases we generate. Any remaining emissions that can't be avoided are offset by purchasing verified carbon credits, making our business carbon neutral. Our carboNZero certification is independently audited by Landcare Research every year.

The grid energy you purchase from Ecotricity is 100% carboNZero certified renewable electricity. Ecotricity only sources electricity from wind, hydro and solar.

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. The battery system automatically detects when the solar system is generating surplus electricity and begins to charge. If the battery is fully charged, and the supply from the solar system still exceeds your energy demand, electricity will be exported to the grid. Our buyback guarantee ensures that when you sell solar power you're paid the same rate it costs you to buy energy, excluding network charges and GST.

In discharge mode, the battery supplies power to your home when the solar system is not generating enough to meet your total electricity needs. If your energy demands exceed the inverter's capacity, or the battery is fully discharged, additional electricity is drawn from the grid.

The battery is also charged by grid power when rates are low. That stored energy is then used to power your home when grid rates are high. solarcity manages this for you.

If there is a grid outage, the inverter disconnects from the grid and switches to backup mode. It uses energy from the solar panels and the battery to power pre-selected circuits in your home .

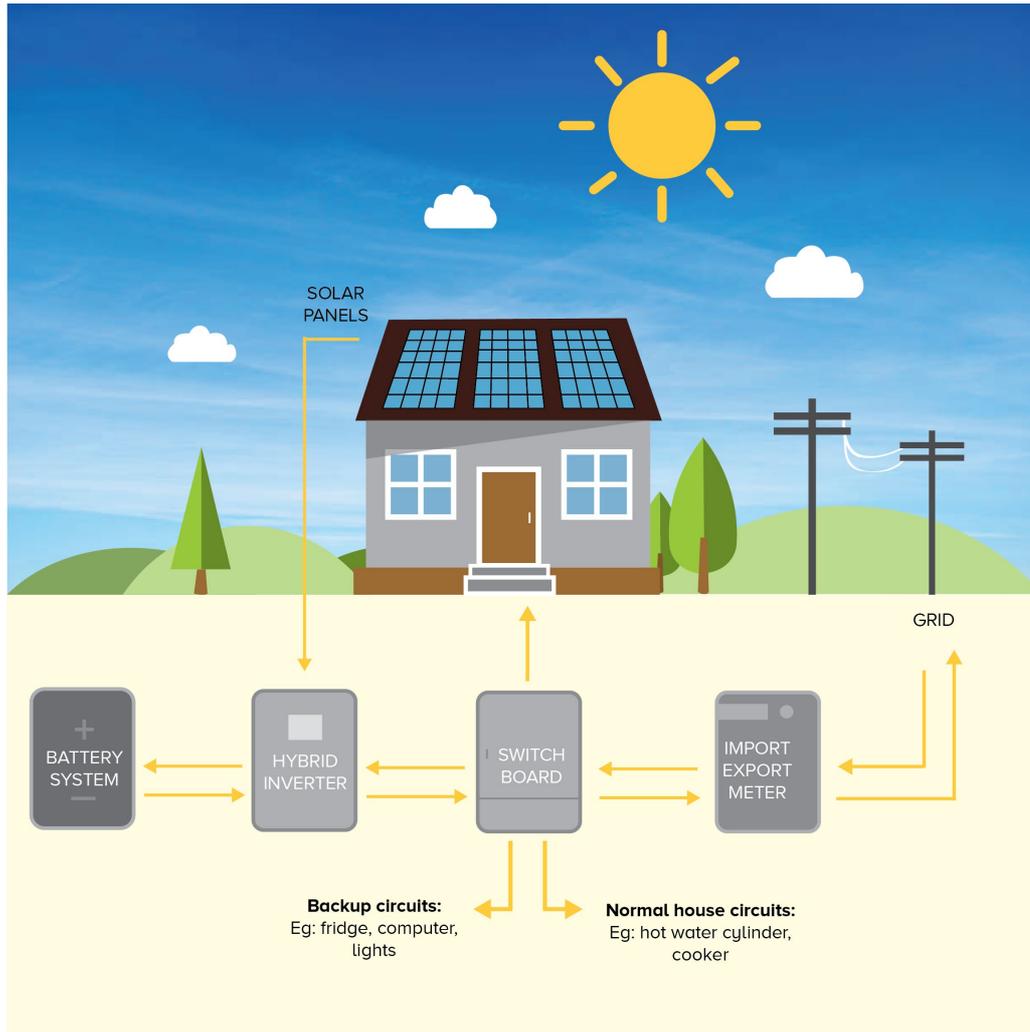


Figure 1: How solar PV, battery storage and the grid work together to power your home

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 panels (for example at night, or under shaded conditions), then no power will be produced.

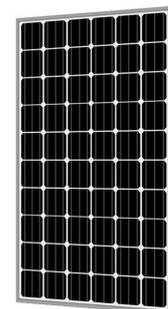


Figure 2: Solar panel

5.3.2 Battery enclosure

Your solarZero battery enclosure contains the hybrid inverter, the battery module and switchgear to interconnect the electrical components. It also hosts the communication device of the system.

5.3.2.1 Hybrid inverter

The solar panels generate direct current (DC) electricity. The hybrid inverter uses that power to charge the battery or converts it to 230V alternating current (AC) electricity for use in your home. It also converts the energy stored in the battery to AC for use in your home and allows the battery to be charged from the grid.

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. When this happens, the system automatically reconnects in backup mode. This allows some circuits in your home to operate during a power cut, and allows solar generation to continue charging the battery, or powering your home. Once the grid returns to normal operating conditions, the inverter automatically returns to grid operation mode, and all circuits in your home will be powered again.



Figure 3: Goodwe hybrid inverter

5.3.2.2 Battery

The Link Data battery unit contains the battery where energy is stored in Li-ion cells. The battery is controlled by the hybrid inverter and has a nominal capacity of 5.1 kWh.



Figure 4: Link Data battery

5.3.3 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 Backup mode

The inverter's backup mode supplies electricity to up to four circuits in your home when there is a grid power outage.

Examples of circuits that are usually connected to the backup supply include:

- Power sockets that supply fridges
- Power sockets that supply TVs and associated equipment
- Power sockets that supply internet connectivity devices
- Light circuits
- The router for monitoring and controlling your solarZero system

Examples of large loads that cannot be connected to the backup supply include:

- Electric ovens
- Electric hot water supplies
- Electric underfloor or other heating supplies

When there is a grid outage, the inverter disconnects from the grid and switches to backup mode. While in this mode only the circuits wired into the backup section of the inverter will be powered. While in backup mode these circuits are isolated from the grid. This is a regulatory requirement to protect the repair crews working on the power lines in the blackout area.

The inverter uses energy from the solar panels and / or the battery to power your backup circuits. The inverter has a maximum power rating of 3.68 kW (or 3680 Watts). That means the combined energy consumption of your appliances, devices and lights must be kept under that limit. If you go over the limit, the inverter will switch off and try reconnecting after a defined interval. If this happens, reduce your energy consumption by switching off any high wattage appliances like a heater or electric jug. The inverter will keep attempting to reconnect with reconnection intervals getting longer at each attempt (up to a maximum of one hour).

When the battery charge level reaches a pre-set minimum, it will stop supplying power. If the solar system is generating power the battery will be recharged.

5.4.1 Backup Generators



It is critical that changeover switches are installed and used correctly to prevent permanent damage to equipment.

It is possible to configure a backup generator to the system so that it can provide additional generation during a grid outage, but it is extremely important that the changeover switch is wired correctly to prevent damage to the backup generator or the solar/battery system.

The generator should always be completely isolated from the inverter. If you have a backup generator, or wish to install one, then please contact solarcity to discuss options. If you fail to do so, any damage to your equipment, or ours, is your responsibility.

If you are unsure, please contact us on 0800 11 66 55, or email technicalcare@solarcity.co.nz.

5.5 Monitoring with the solarZero app

The solarZero app consists of a set of simply to navigate screens to monitor the power flows in your household.

5.5.1 Energy flow

This animated screen shows four icons, representing the solar panels, the battery, the loads in your home and the electricity grid. Lines appear and disappear depending on an existing power flow and the moving dots along the lines indicate the flow direction of the energy.

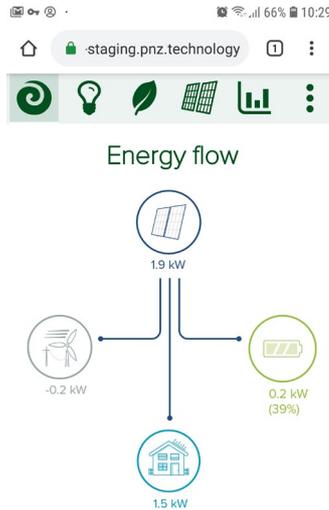


Figure 5: Energy Flow

5.5.2 Total electricity use

The next screen shows your total electricity use – both solar generated and grid imported – and lets you select by day, month or year. The options “MONTH” and “YEAR” refer to the current calendar month and year accordingly.

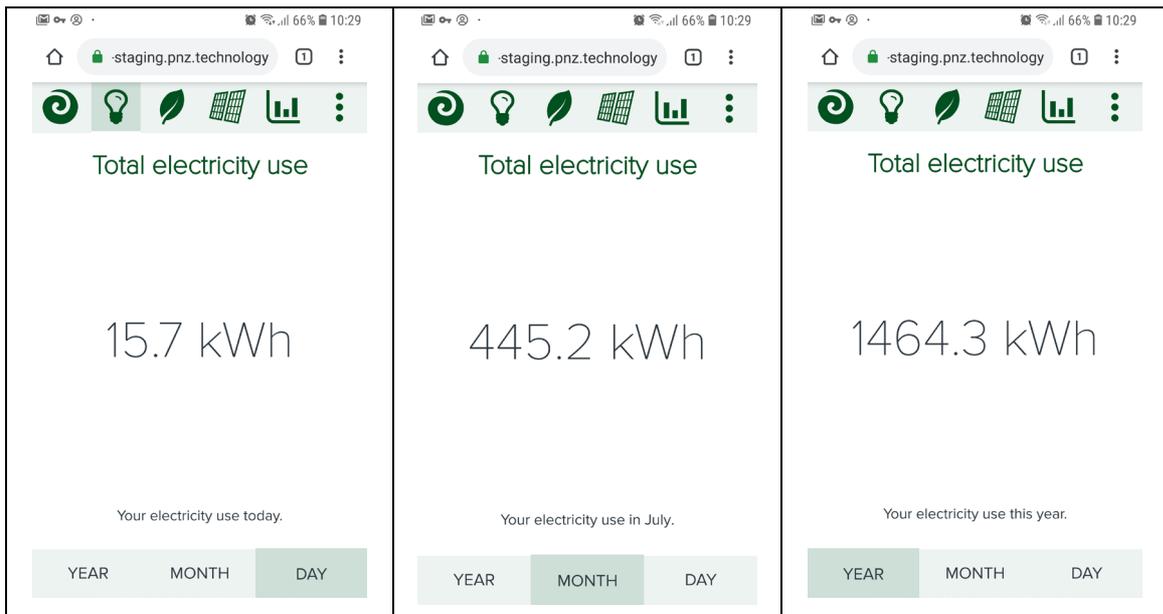


Figure 6: Total Electricity Use – Day, Month, Year

5.5.3 Solar versus Grid usage

The “Solar vs grid” screen shows the fractions of solar power and grid power that your power usage consists of and can be selected by day, month and year.

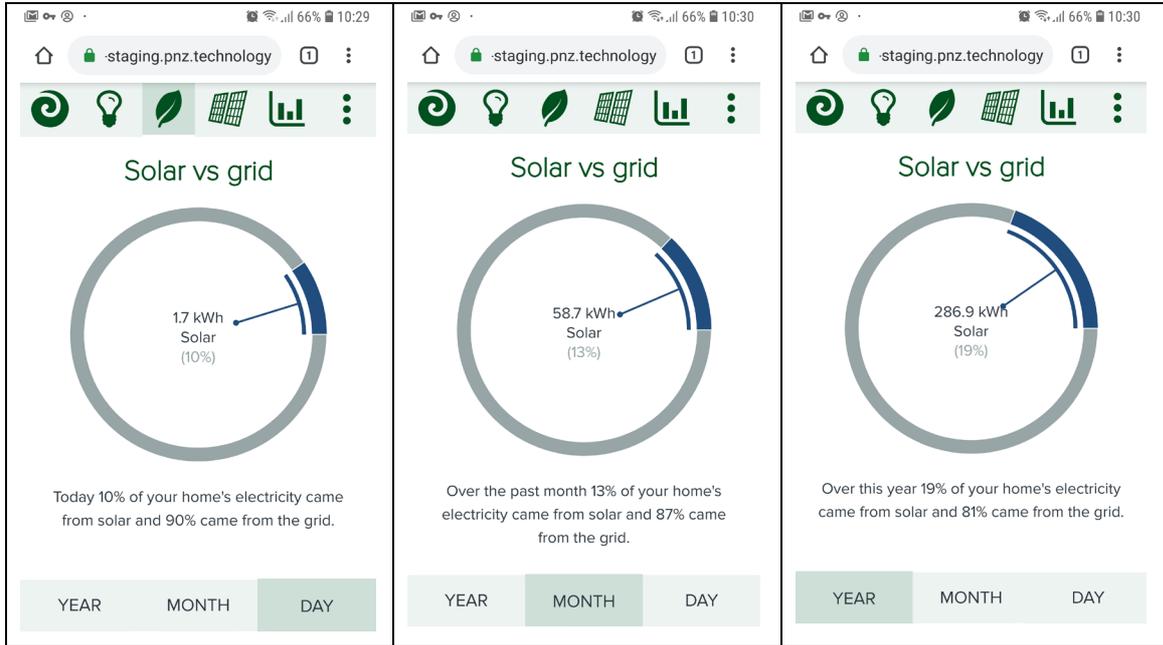


Figure 7: Solar vs grid – Day, Month, Year

5.5.4 Self-consumption of the solar power produced

This next screen shows the amount of solar energy that has been used directly by your home. The balance is what has been exported to the grid. You can select day, month or year.

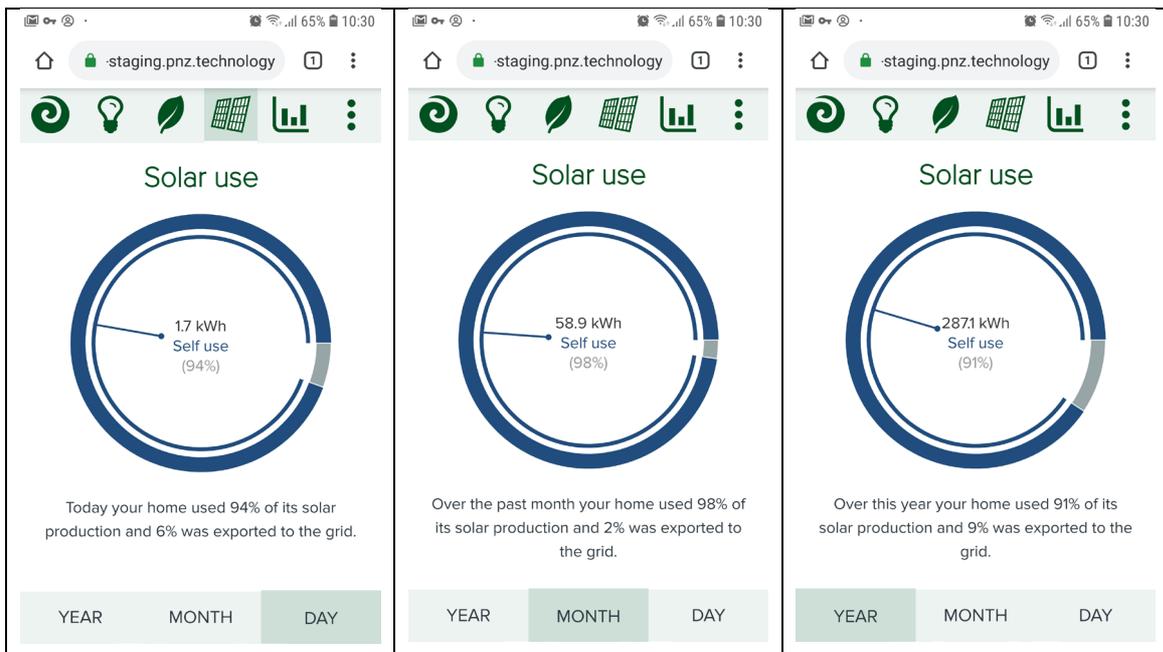
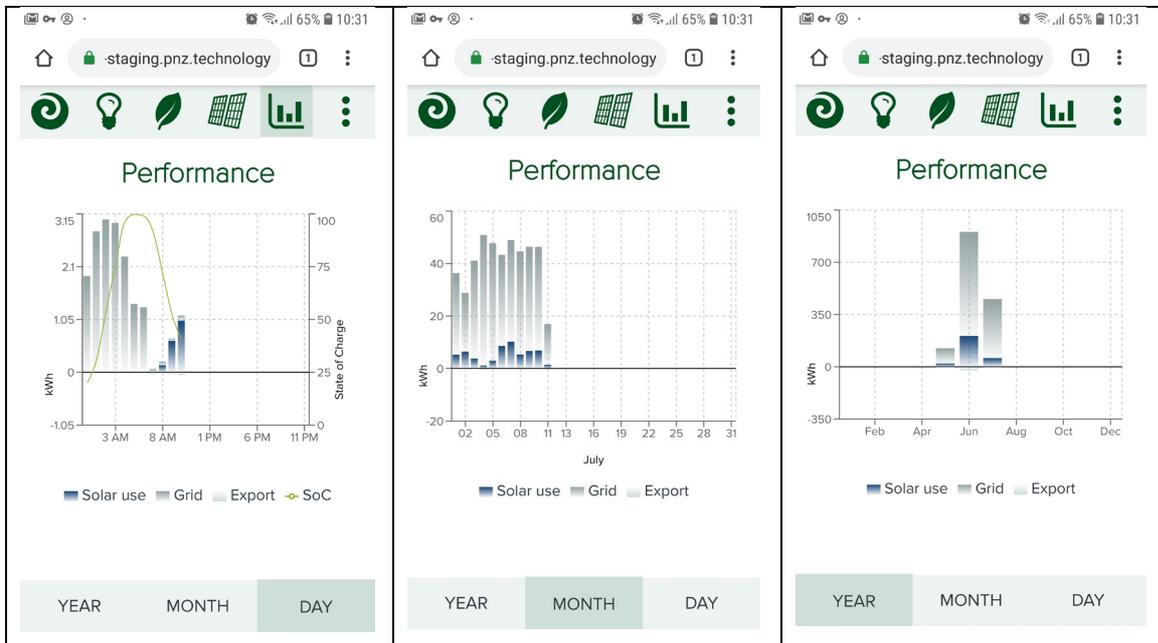


Figure 8: Solar use – Day, Month, Year

5.5.5 System Performance

This screen shows a bar chart with a representation of solar use, grid use and grid export. As in screens before, you can select between the day, month and year options. All three have a left vertical axis in common with a kWh-scale. Imported grid power and solar power used by appliances in your home are displayed as positive values. Any solar energy exported into the grid is shown as negative values.

The “DAY” view has an additional value displayed called State of Charge (SoC – vertical axis to the right). It ranges from 0% to 100% and represents the amount of usable energy currently stored in the battery, relative to its maximum.



The horizontal axis is divided into hours, days and months for the “DAY”, “MONTH” and “YEAR” view accordingly

Figure 9: Performance – Day, Month, Year

5.5.6 Detail views

Besides the bar charts described before, there are detailed line graph views available for the current day and month. You can navigate there by selecting the rightmost icon on the top navigation bar (three vertical dots) and then select “DETAIL”.

The vertical axis to the left again displays the kWh. The horizontal axis displays the hours in the day-view and the days in the month-view.

Both views display the following recorded values:

- **Solar** – Solar generation of the panels on your roof
- **Grid** – Imported grid power
- **Export** – Excess of generated solar power that has been exported into the grid

The day-view also displays

- **Charge** – Power used to charge the battery
- **Discharge** – Energy discharged from the battery
- **SoC** – State of Charge. This value represents the amount of electric energy stored in your battery in relation to the maximum energy that can be stored in the battery. The value ranges from 0% to 100%

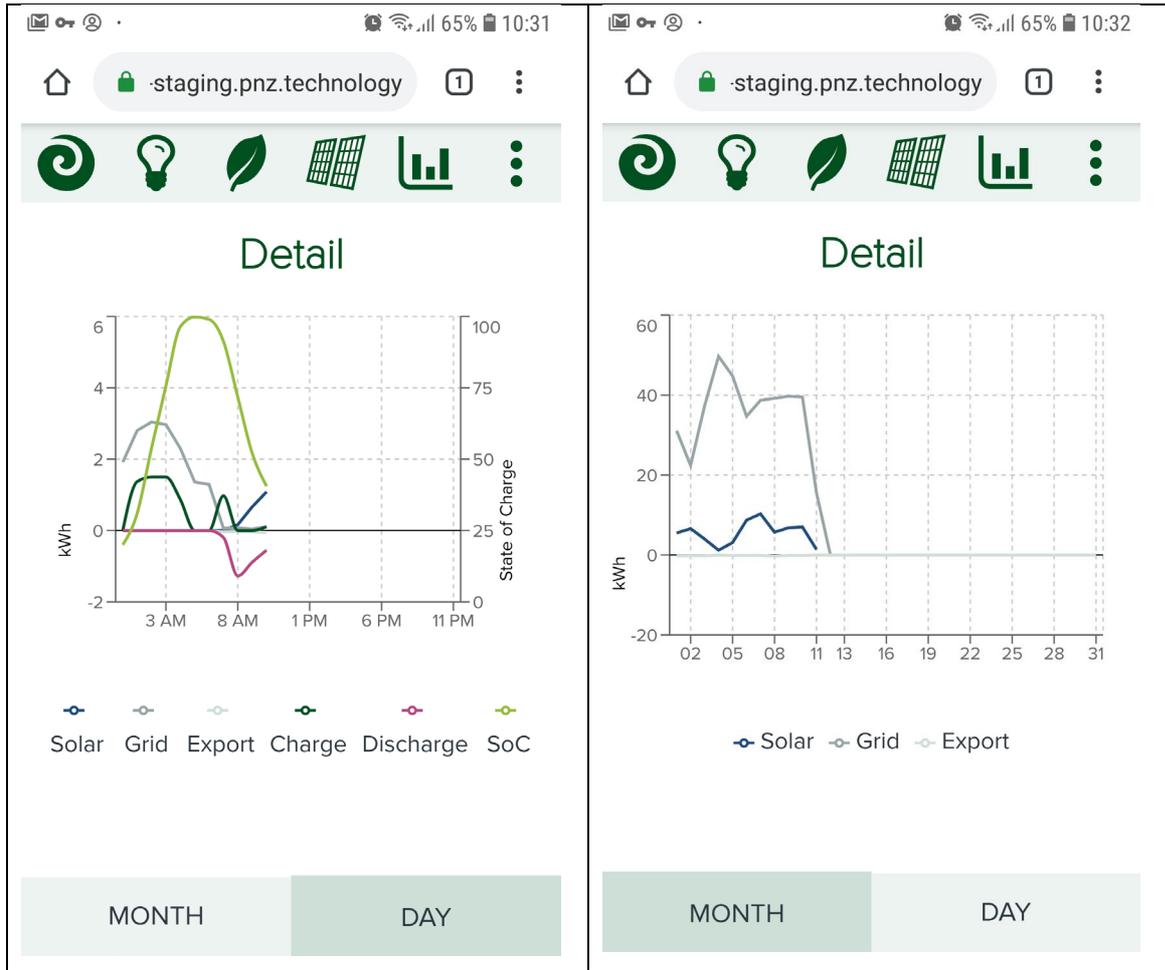


Figure 10: Detail view – Day, Month

5.5.7 System information and support

When selecting the rightmost icon in the top navigation bar with the tree vertical dots you get another two options to select besides the “DETAILS” screen, describes in the previous section.

The selectable options are “SYSTEM” and SUPPORT”.

The System screen shows all the background information, some of it being unique to the battery installed in your home. It consists of:

- Customer number – The unique number under which your property is identified in our database
- Device installed capacity – This is the nameplate capacity of the battery. Please note that this is not the “usable” amount of power available for use at your house. The usable capacity is set to 80% of that capacity (e.g. 6.4 kWh * 80% = 5.12 kWh). The reason to keep a safety buffer is to prevent the battery of reaching a state of “deep discharge” that would result in irreparable damage.
- Device name
- Device serial number – This is the serial number of the EMU (Energy Management Unit) in the battery. We use this number combined with the customer number to link the battery installed in your home with the data displayed in the app on your phone or tablet.
- Installed date – The date when your battery was activated and linked to our fleet management system
- Running status – Current status of the battery

The Support screen displays the solarcity phone number that you can call if you have any questions or if you are experiencing any issues with the product.

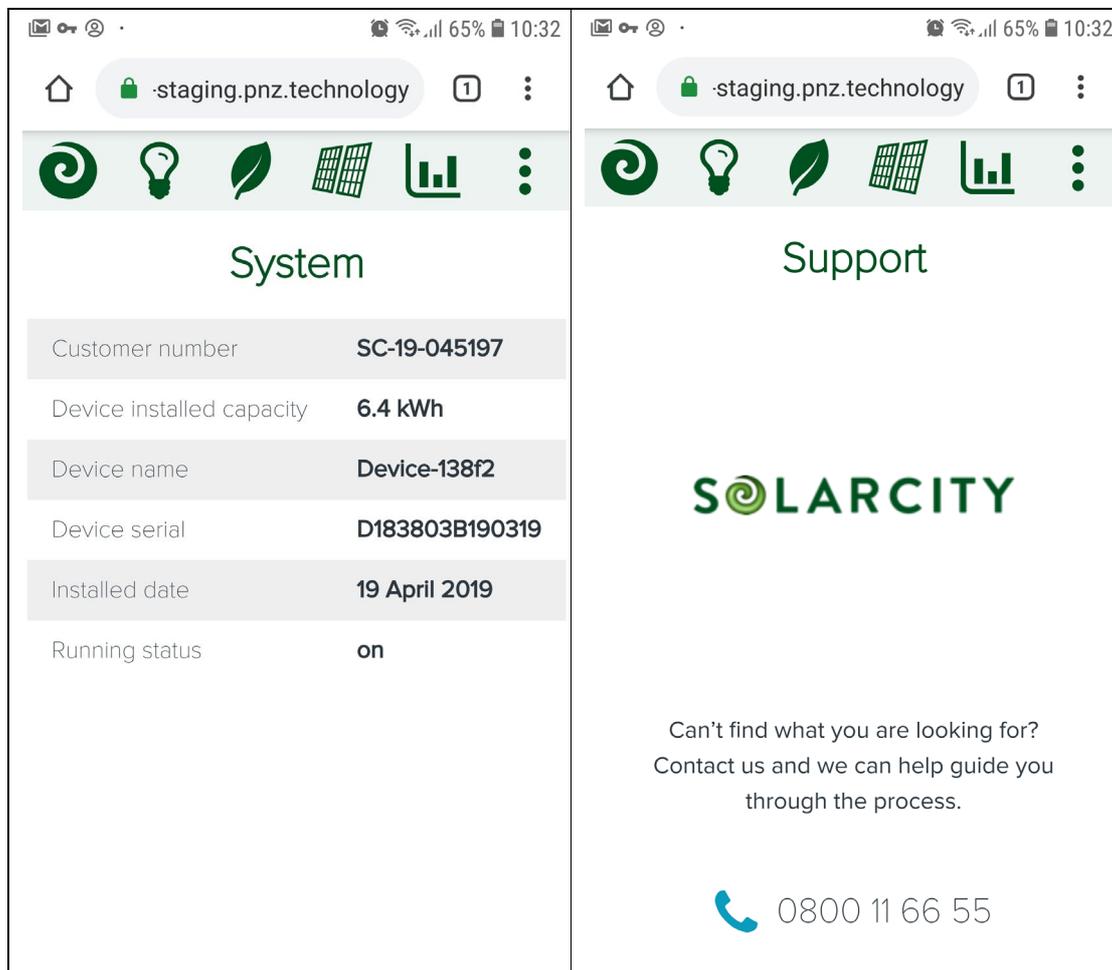


Figure 11: System information and support

6. 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 can check out our website at <http://www.solarcity.co.nz> for more advice and frequently asked questions.

Here are a few tips to get you started:

- To reduce your energy demand, install energy efficient light bulbs and upgrade to energy efficient appliances when they need replacing. 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 their lifetime running costs.
- The solar system and battery will deliver up to two-thirds of your home's electricity needs. If you need more power than the system and battery can provide it will be supplied automatically from the grid. Aligning your electricity consumption to your solar generation will maximise the savings potential of solar. The battery gives you more flexibility by storing surplus solar power from the day so you can use it at night. Stagger the use of your high energy use appliances, like a washing machine, dryer or dishwasher. This will help reduce the amount of power that you need to purchase from the grid.
- If you have an electric hot water cylinder in your house: Typically, hot water is used in the morning. Instead of your cylinder reheating immediately you can delay it to late morning / early afternoon, so that solar energy can be used to provide some of the electricity required. As part of our solar installation we wired your hot water cylinder, so you can switch it on and off with a simple swipe of the solarZero app.
- We've programmed the battery so that it provides you with power during peak times when rates for grid energy are high, typically between 7-9am, and from 5-9pm. This schedule may be varied by us during the course of the year to optimise charge and discharge times according to the times with high rates. During the day the battery stores surplus solar power. During the night it stores grid power when energy rates are low so that it fully charged before the morning peak.
- Shade on the solar panels reduces the amount of electricity that the system produces. To keep the system performing at its best, maintain any trees surrounding the house which may grow to shade the solar panels. Any new additions to your roof, such as an aerial or antennae, vent pipes, sky lights, chimneys, etc. must be installed well clear of the array so that they don't create any shading on any of the panels in the array.
- Ensure that the solar panels are kept clean. Build-up of dirt on the panels causes shading and reduces electricity generation. Most panels will self-clean when it rains, 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. 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 before the cleaning steps below are performed.



Do not clean solar panels 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 cleanliness (accumulation of debris around and/or under array)	Quarterly	Clean site as required
	Shading of array		Trim trees, if required
Solar panels	Verify cleanliness (accumulation of dust or fungus, etc. on array)	Quarterly	Clean, if necessary
	Check for visual defects, including: <ul style="list-style-type: none"> • Fractures • Moisture penetration • Browning/Discolouration • Frame corrosion 	Yearly	Panels with visual defects should be further inspected by a solarcity service agent for performance and safety (this is done at no charge)

8. SYSTEM PERFORMANCE

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 systemissue@solarcity.co.nz.

9. WARRANTY

Subject to the terms of the Limited Warranty in this clause 5, and the terms of clause 24 in your agreement, solarcity warrants that during the Term the System will operate within the tolerance of 20% of the Expected Energy Production, subject to you complying with your obligations under the Agreement 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 the Expected Energy Production for a period of at least six months, based on actual NIWA data, measured in kWh, then the parties will confer to agree on appropriate enhancements to the System so as to produce an annual energy yield within the required tolerance of 20% of the Expected Energy Production or (if enhancements are not agreed) on a reduction to the Expected Energy Production (with a proportionate reduction in the quantum of the Monthly Payment).

solarcity undertakes to replace the battery when it reaches the manufacturer's end of life criteria. (expected around Year 10), at no extra cost to you.

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, under normal use and conditions, the system will be free from defects or breakdown in materials or components. We will repair or replace any defective part of the system within a reasonable period upon receipt of your advice, or if we identify via remote monitoring that there is an issue to which this Limited Warranty applies. We 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 System Switch-On.

If we damage the Property or your belongings we will repair or pay for the damage we 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 your roof.

When we penetrate your roof during a System installation, we will warrant roof damage we cause due to 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 your roof.

You can advise an issue under this limited warranty by writing (including by email) to solarcity at the address shown at the start 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 you of this Agreement, 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.

The Limited Warranty is in addition to any warranties or guarantees that apply under applicable law, including the Consumer Guarantees Act 1993.