SegenSolar (Pty) Storage Guide

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Introduction to battery storage

A battery storage system may be used to enhance the self-consumption of a PV system, provide backup in the case of a grid failure, or both. SegenSolar has systems for either application, with various sizes, using either lead-acid or lithium-ion batteries.

This guide describes how to choose the most appropriate type of battery storage system and details the solutions which SegenSolar offers.

You can also find a helpful glossary at the back of this document, should you need it.

Helpful Documents

Currently there are limited regulations and documentation around battery storage installation in South Africa so it would be advised to check with your local municipality before looking to fit a system.

Before considering adding battery storage, SegenSolar would strongly recommend that you review the following documents that are produced for the UK but will include relevant information should you choose this option:

Anyone considering designing a battery storage system should read the **BRE/NSC Technical Guide** which is an excellent introduction to the issues involved:

http://www.brebookshop.com/details.jsp?id=327624

When quoting a potential customer a battery solution you should follow the guidelines published by **RECC**:

https://www.recc.org.uk/pdf/guidance-on-battery-storage.pdf

Always refer the potential consumer to the **BRE/NSC/RECC Consumer Guide**:

http://catalogue.segen.co.uk/reseller/docs/BRE_Consumer_Guide.pdf

Why Sell Storage Solutions?

The main selling points when promoting solar storage to end users will include:

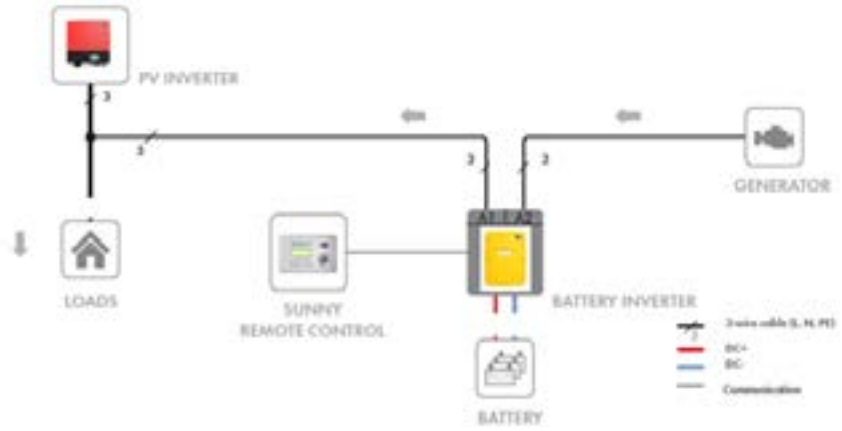
- **"Increase your self-consumption"** Promoting the benefits such as lowering their electricity bills and being more self-sufficient.
- **"Save money"** Promoting the benefits of self-consumption to protect against rising energy prices.
- **"Protect against power cuts"** Promoting that some products can function and provide energy during load shedding or grid failure.
- **"Have total visibility of your electricity use"** Promoting the use of monitoring and overseeing consumption to see how much they save/could save.

Types Of Storage System

When looking at utilising batteries, you will need to establish which system type suits your customer best.

Off-Grid

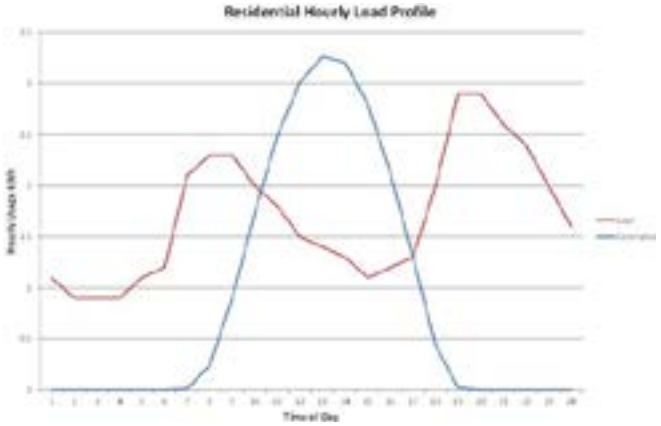
Operating totally "off the grid" requires a large capacity battery array capable of powering the property during periods of low irradiance in winter and an inverter capable of supplying the maximum load ever required at one time. This requires a significant investment in PV modules, inverters and especially batteries which cannot normally be justified if there is a good quality grid connection available at the property.



An off-grid system is well suited to rural areas with little or no grid connection but is unlikely to be a viable solution in a well-connected urban area.

Enhanced Self-Consumption

Typically a residential system will generate the most power during the day when household consumption is low. Without the ability to export surplus power the only options are to a) reduce the size of the PV system so that excess energy is minimised (this also reduces the usable energy) or b) store the energy until needed. A typical daily load profile for a residential property is shown below.



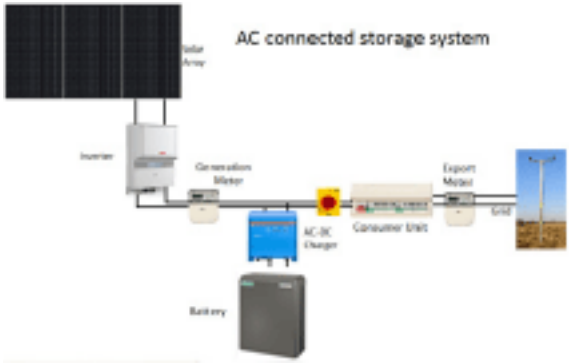
With this example, reducing the size of the PV system by 50% would all but eliminate the surplus but would reduce the useful energy generated by 30%. In the same example there is about 8kWh of surplus energy which could be used to recharge a battery for use in the evenings. The use of a time switch on a washing machine and/or dishwasher can help to maximise the use of generated energy during the sunshine hours.

Grid-Backup

In properties where the grid reliability is low, or ensuring maximum power availability is essential, then it may be appropriate to have a grid-backup system that can operate with no grid for a period of time. Adding a battery inverter, or a hybrid inverter, along with a battery makes it possible to combine the energy from the PV system with that from the stored battery to power at least the essential loads in the property. The size of the battery required depends on the rating of the essential loads to be driven from it at times when no solar power is available.

Shown to the right is a typical system layout for a grid-backup system, using a Solar PV inverter and a Battery Inverter, which gives maximum flexibility in the system design and can be retrofitted to an existing Solar PV system.

An AC coupled system provides the most flexibility in the design in terms of different battery and inverter sizes and backup capabilities and can be easily retrofitted to an existing solar PV system.



Hybrid Inverters For Grid BackUp

An alternative solution for new installations is to use a combined PV and battery inverter, commonly referred to as a hybrid inverter. This is a multi-function device that includes all the functions required to configure a grid-backup solution, as seen here on the right.

This has the advantage of fewer components, and therefore reduces installation time, but there are restrictions on the size and design of the PV array and output power. Typically this is an appropriate solution for a new solar PV installation, but could be retrofitted by replacing the existing inverter.

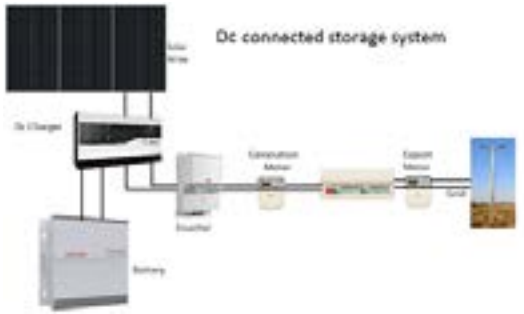
Types Of Storage System Cont.

DC String Connected

The simplest type of self-consumption system is to add a DC battery controller into one of the strings of the PV system.This manages the charging and discharging of the battery in line with the solar PV energy available and the demands of the property.

Typically these types of system, like that available from Growatt, only support one value of current (single MPPT), so for systems with strings on different roof faces, the most productive string should be utilised.'

SegenSolar offers battery solutions from Growatt and GoodWe.

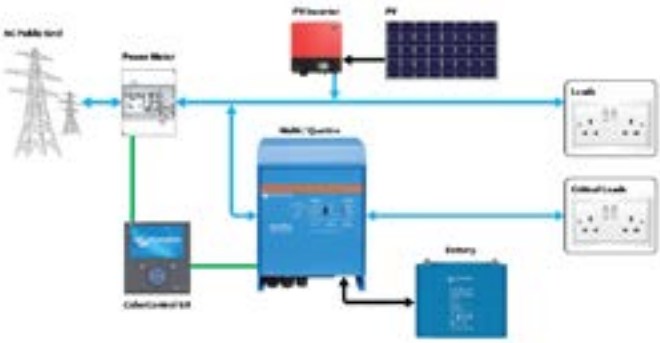


AC Coupled

SegenSolar offer two AC coupled self consumption systems, from SMA and Victron.

This system is a great retrofit option as it is independent from an existing array on the AC side, and can also be used with other sources of power such as generators.

The flexibility of this system is the key selling point here, with a large scope for installations and even retrofit possibilities.



Types of Battery

The choice of a battery is one of the most critical decisions that need to be made when designing a grid-backup or enhanced self-consumption solar PV system. The two main types of battery commonly chosen for solar PV systems are Lead Acid and Lithium Ion with various different types and products from many different manufacturers available on the market. The table below gives a summary comparison of the key attributes of these two different battery technologies.

Attribute	Lead Acid	Lithium Ion
Total Storage Capacity	An individual lead-acid battery will typically have a gross storage capacity of 100Ah - 200Ah @ 12V or 1.2kWh - 2.4kWh. They may be connected in series for a higher voltage and/or in parallel for greater capacity at the same voltage. A typical lead-acid pack suitable for a residential grid-backup solution will be in the range of 8kWh - 25kWh depending on the length of time required to operate off-grid and the total power of the loads to be supported.	Lithium Ion battery packs typically are supplied as self-contained units with a built-in battery management system (BMS). Gross capacities vary from about 2kWh up to 8 - 10kWh depending on the model and manufacturer. Some models may be connected in parallel, others may be extended with expansion packs and all need to be fully supported by the software in the battery charger/inverter chosen.
Daily Usable Capacity	There is a close relationship between the amount of the total battery capacity that is used each day and the life of the battery as expressed by the number of cycles and typically it is recommended to only discharge a lead-acid battery down to about 50% of the total capacity, this if referred to as a 50% Depth of Discharge (DOD). This makes the storage capacity available for daily use only 50% of the gross storage capacity.	Most lithium-ion batteries can be used daily down to about 90% of their gross storage capacity with little or no impact on their lifetime in terms of number of cycles. This makes the storage capacity available, for daily use, 90% of the gross storage capacity.
Full Cycle Efficiency	Lead-acid batteries tend to get less efficient the nearer to full capacity they reach. This either results in a low full cycle efficiency of less than 80% (if they are re-charged near to their full capacity) or the need to design the system to only use about 80% - 90% of their full capacity (in order to maximise their efficiency).	Most lithium-ion batteries have a full cycle efficiency of around 90% - 95% even for a cycle from their full depth of discharge up to full capacity making them ideally suited for daily use applications like solar PV systems which need to use most or all of their retained energy in the evening/night and charge up again fully during the day.
Lifetime (Cycles)	The number of cycles that a lead-acid battery can be used for is directly related to the amount of energy charged and discharged in each cycle. With a system configured to utilise 50% of the gross storage capacity on a daily basis a typical lead-acid battery will have a lifetime of 2,000 - 2,500 cycles. Allowing for some degradation over the life of the battery a useful lifespan of about 5 years in a well-designed system may be expected.	A good quality lithium-ion battery may have a lifetime of 5,000 - 7,000 cycles which is considerably more than 10 years of normal usage. The built-in BMS will ensure that the battery condition is always maintained in optimum condition and a full 10 year life may be expected.
Cost	The initial investment cost of a lead-acid battery will be relatively cheap when expressed as £ per kWh of gross capacity but all comparisons should always be done on a £ per kWh of usable capacity which makes a lead-acid battery twice as expensive as it may initially appear.	The initial investment cost of a lithium-ion battery may be 2.5 - 3 times more expensive per kWh of gross capacity compared to a similar sized lead-acid battery but when comparing the £ per kWh of usable capacity the difference will be typically about 1.5 times as expensive. The lithium-ion battery will however last twice as long as the lead-acid so over a 10 year period the lithium-ion will almost always be a cheaper option with no need to renew the battery after 5 years.
Weight	A lead-acid battery may weigh between 70kg and 80kg per kWh of usable capacity so a typical 5kWh - 6kWh domestic battery pack may weigh in excess of 350kg which may cause difficulty in locating a large battery pack in a residential property as a strong floor will be required.	A good quality lithium-ion battery pack will typically weigh between 10kg and 15kg per kWh of usable capacity so considerably less than an equivalent lead-acid pack but a typical residential battery pack will still weigh 75kg - 100kg requiring some consideration as to where to place it.
Charge / Discharge Power	Most lead-acid batteries can be charged and discharged relatively rapidly and when connected in parallel the total charge/discharge rate is in effect increased. In a typical solar PV system a lead-acid battery pack may be charged and discharged in 2 - 3 hours with a peak discharge rate much higher for short period of times.	Most lithium-ion batteries have a relatively restricted charge/discharge rate often needing 3 - 4 hours to charge and a maximum discharge rate of between 1kW and 2kW for a typical residential system. A system utilising lithium-ion batteries therefore needs to be designed to take care to only connect essential loads to the circuit that will be powered from the battery pack.
Operating Temperature	Lead-acid batteries are significantly impacted by the ambient temperature and an increase from 20c to 30c can result in a 25% reduction in the lifetime as defined by the number of cycles and a 50% reduction in the lifetime as defined in years.	Lithium Ion is less impacted by moderate temperature changes and ambient temperatures in the range of 15 - 30 degrees centigrade will not significantly impact the lifetime nor performance of the battery.

Types Of Battery Cont.

The choice of battery type is not a simple decision with many different factors to take into account but we would always recommend that a comparison is made using the above considerations and looking at the total cost over the life of the system and not simply choosing the lowest initial cost option which in many cases may be more expensive over the life of the system.

Equally critical is the size of the battery; one too small providing insufficient benefit, and one too large being a significant additional unrequired expense. Detailed below are some of the factors that need to be considered when determining the size of battery required:

<table>
<tr><th>Attribute</th><th>Comments</th></tr>
<tr><td>Essential Load Energy Usage</td><td>For a grid-backup solution the most important thing to consider is the loads that need to be supported when the grid has failed. It is not generally practical to consider powering all the loads in the property, e.g. an electric oven will consume considerable amounts of electricity and would require a very large battery to run even for a short time. A good way to consider this is to generate a list of essential energy loads to be backed up and the amount of time they're needed in a typical day. An essential load is basically something energy must always be available for. This could be something normal like a freezer or burglar alarm, or something site specific like a fish tank. If no power was available, would it lead to loss of fish or just defrosted ice cream? In the UK, power cuts are relatively rare but for more remote locations or other countries it is definitely worth considering. A lot of loads won't require their maximum power all the time, so you can add a factor to take that into account. Once that's done, you'll have an accurate baseline of energy consumption and be able to consider the appropriate battery capacity.
<table>
<tr><th>Load</th><th>Power (W)</th><th>Time</th><th>Factor</th><th>Daily (Wh)</th></tr>
<tr><td>Lights</td><td>200</td><td>5</td><td>1</td><td>1000</td></tr>
<tr><td>Fridge</td><td>150</td><td>24</td><td>0.3</td><td>1080</td></tr>
<tr><td>Freezer</td><td>150</td><td>24</td><td>0.2</td><td>720</td></tr>
<tr><td>Wi-Fi Router</td><td>10</td><td>24</td><td>1</td><td>240</td></tr>
<tr><td>Phones</td><td>50</td><td>1</td><td>1</td><td>100</td></tr>
<tr><td>Fish Tank</td><td>30</td><td>24</td><td>1</td><td>720</td></tr>
<tr><td>TV</td><td>170</td><td>4</td><td>1</td><td>680</td></tr>
<tr><td>Other</td><td>100</td><td>24</td><td>1</td><td>2400</td></tr>
<tr><td>Total</td><td></td><td></td><td></td><td>7690</td></tr>
</table>
</td></tr>
<tr><td>Battery Operating Time</td><td>The next critical decision is to decide the number of hours that the system needs to power the essential loads for. Typically a failure due to a grid fault will typically last for between 1 and 24 hours. The decision on how many hours to allow for is largely driven by the budget available as the cost of the battery pack will be directly related to its size; and its size will be directly related to the number of hours chosen. Usually a system will be sized to support the essential loads for between 12 - 24 hours.</td></tr>
<tr><td>Space Available</td><td>Especially when choosing a lead-acid battery the space available to hold the installed battery and the strength of the floor may be a consideration that imposes a limit on the maximum size of the battery that can be installed. With a Li-Ion battery this is unlikely to be a major concern as a Li-Ion battery will be much smaller and lighter than a similar usable capacity of lead-acid battery.</td></tr>
<tr><td>Charging Time and Rate</td><td>The battery will be charged from the surplus energy available from the PV system, this is the difference between the energy generated by the solar PV system and that used by the loads during the daylight hours. It is therefore important to ensure that the battery can be fully recharged during a typical day of sunlight, especially in the winter months. A battery pack which is too large relative to the PV system will not get fully recharged and therefore not be fully available to provide power in the event of a grid failure.</td></tr>
<tr><td>Maximum Depth of Discharge</td><td>Each battery pack will have a recommended maximum depth of discharge, e.g. lead-acid might be 50% and Lithium Ion might be 90%. Having determined the total energy required to be generated from the battery pack with the equation: 'essential loads energy in 24 hours divided by 24 multiplied by the required battery operating time' then the gross battery capacity needs to be determined by dividing by the recommended DOD. e.g. 7,690W / 24 * 12 hours / 90% DOD = 4,27kWh.</td></tr>
</table>

SegenSolar offers a range of 48V lead-acid (gel) battery packs from Hoppecke and lithium-ion batteries from LG Chem and Growatt for enhanced self-consumption and grid-backup application.

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Battery System Sizing

What you need to know to size a system:

- Does the customer require an **On-grid**, **Off-grid** or **Grid- backup** system?
- What would the customer like to use in the backup circuit, i.e. essential loads only?
- What size PV system has the customer had installed and what type of inverter?
- Is there any electricity usage data available i.e. is an export meter or logger fitted?
- Where will the batteries have to be installed?
- How much is the customer willing to spend?

SegenSolar's Battery Sizing Tool

Calculating the amount of excess energy available for a battery storage system requires an analysis of the hourly energy generation throughout the year and the expected hourly energy usage of the property.

SegenSolar provide a unique tool that assists in this process by allowing;

• Input of the system size.

• Input of a location near to the target property to enable detailed irradiance calculations.

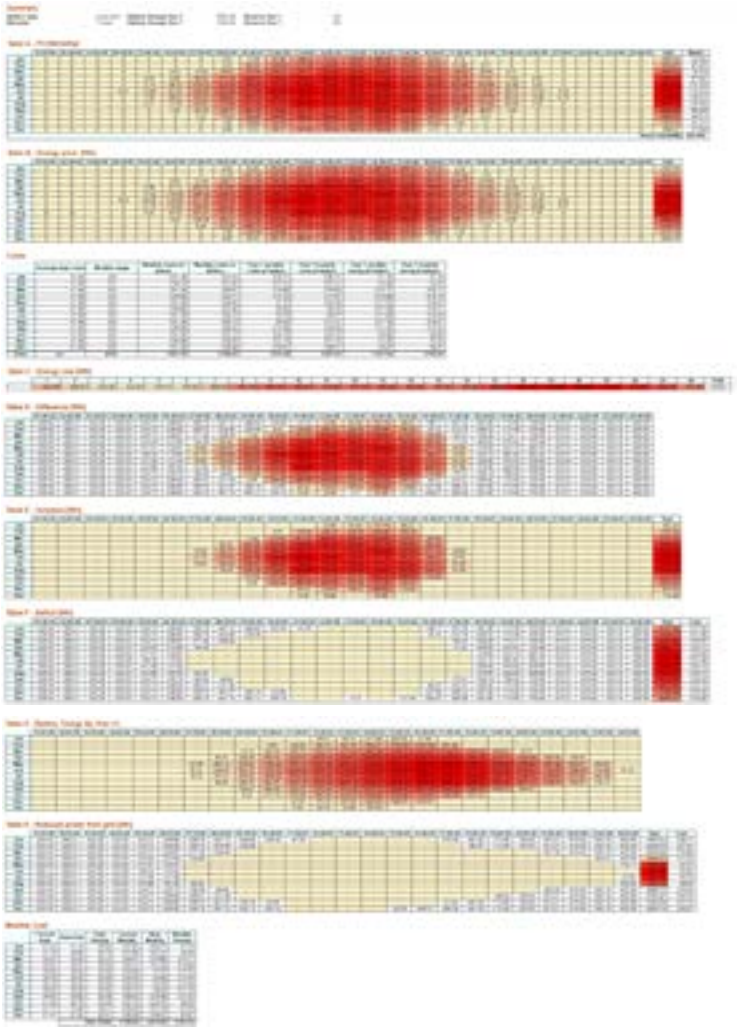
• Selection of the property load profile from a set of pre-defined examples.

The tool will display the expected PV generation values for the chosen location.

Specifically we see a value for each hour in each of the twelve months of the year. The conditional formatting intuitively displays how "sunny" each period is, and confirms our expectations: the summer months obviously give more energy than the winter months due to both longer days and more intense sunlight.

Simply fill in the requested fields and it will generate a detailed summary for the property (either on the page or in a convenient pdf format).

For assistance using the tool, you can download the battery calculator tool guide here.



Battery Storage and Transport

Temperature

Batteries must be stored and transported within the temperature range stated on the data sheet. Batteries discharge at different rates depending on their temperature. At high temperatures, particularly for lead, charge is lost more rapidly.

Batteries should not be allowed to discharge beyond manufacturer specified limits while in storage. It is advised that batteries are not stored for a lengthy period. If they are to be stored for a lengthy period, they should be charged to maintain healthy operation for when they are installed and also comply with all warranty terms.

The acceptable duration of uncharged storage will vary by battery type and manufacturer. Consult the datasheet or seek advice if you plan to keep batteries in stock.

Do not let the packaging get wet as this is a barrier for safe transport.

Insurance

The property owner will need to inform their Insurance provider of the products being installed.

The installer/distributor will need to inform their insurance company of the product, storage and distribution details as they are classed as dangerous goods.

There are many regulations which cover lithium metal batteries and lithium-ion batteries as they are covered under the heading Dangerous goods.

- The regulations are controlled by IATA for air, ADR for road and IMDG for sea.
- They are Class 9 dangerous goods and come under three headings:
    - Batteries transported on their own UN3090 UN3480
    - Batteries transported with equipment UN3091 UN UN3481 (Hoppecke, LG Chem)
    - Batteries contained in Equipment UN3091 UN3481 (Tesla)

All goods must be considered dangerous even in small quantities and must be handled and labelled accordingly.

As the goods are hazardous goods you need to understand the regulations around how they are handled and what to do in an Emergency.

Fire fighting

There are many different ways to deal with lithium ion battery fires. Covering goods with Carbon dust in a circular motion and waiting for up to 2 days for them to go out is usual.

Pouring water over them can be dangerous as water and lithium can ignite.

DO NOT USE Halon as this causes lithium to ignite.

The major issue is the required ventilation and space when charging Lead Acid due to the gassing of the batteries.

Battery Inverter/Controllers Supplied by SegenSolar

SegenSolar stock a broad portfolio of battery inverter/controller products offering system and design flexibility.

SolarEdge

5 & 6/kW Hybrid Inverter

The SolarEdge 5&6/kW Inverter provides everything provides everything that is needed in a single device to interface to a PV panel array, battery pack and grid-connection and offers grid-backup capabilities for designated essential loads.

The SolarEdge is currently only compatible with the Tesla batteries.

Key Selling Points:

- Easy Maintenance - remote access to inverter software.
- Enhanced Safety - designed to eliminate high voltage and current during installation, maintenance or fire fighting.
- Full Visibility - built-in monitoring of battery status, PV production, remaining backup power, and self-consumption data
- On-grid Applications - maximizes self-consumption, export limit, time of use shifts for reduced electric bills.

Key Selling Points:

- Perfect for new systems
- Hybrid so can work just as an inverter offering battery flexibility
- Customer could buy smaller battery to accompany and then upgrade later down the line
- Compatible with Lead Acid and Lithium Ion Batteries

GoodWe

5.6/kW Hybrid Inverter

The GoodWe hybrid inverter provides everything that is needed in a single device to interface to a PV panel array, battery pack and grid-connection and offers grid-backup capabilities for designated essential loads.

The GoodWe fully supports the LG Chem lithium-ion battery, the Hoppecke lead-acid battery packs and the Pylon Battery Module supplied by Segen enabling many options of high quality/high performance solutions.

Victron

Quattro

The Quattro can be connected to two independent AC sources. The Quattro will automatically connect to the active source.

The main output has no-break functionality. In the event of a grid failure, or generator power being disconnected, the Quattro takes over the supply to the connected loads.

This happens so fast (less than 20 milliseconds) that computers and other electronic equipment will continue to operate without disruption. The second output is live only when AC is available on one of the inputs of the Quattro. Loads that should not discharge the battery, such as air-conditioning or a water heater can be connected to this output.

The Quattro will prevent overload of a limited AC source. First, battery charging will automatically be reduced when otherwise an overload would occur. The second level will boost the output of a generator with power taken from the battery.

Key Selling Points:

- Gives a great amount of system flexibility as it's compatible with a wide range of Lead Acid & Lithium Ion
- Offers great monitoring capabilities
- Seamless operation with a generator

Key Selling Points:

- Gives a great amount of system flexibility as it's compatible with a wide range of Lead Acid & Lithium Ion
- Offers great monitoring capabilities
- Great for tech savvy customers

Victron

Multiplus

The MultiPlus is a powerful true sine wave inverter, a sophisticated battery charger that features adaptive charge technology and a high-speed AC transfer switch in a single compact enclosure.

The MultiPlus will prevent overload of a limited AC source. First, battery charging will automatically be reduced when otherwise an overload would occur. The second level will boost the output of a generator supply with power taken from the battery.

In the event of a grid failure or generator power being disconnected, the inverter within the Multi is automatically activated and takes over the supply to the connected loads. This happens so fast (less than 20 milliseconds) that computers and other electronic equipment will continue to operate without disruption.

Growatt

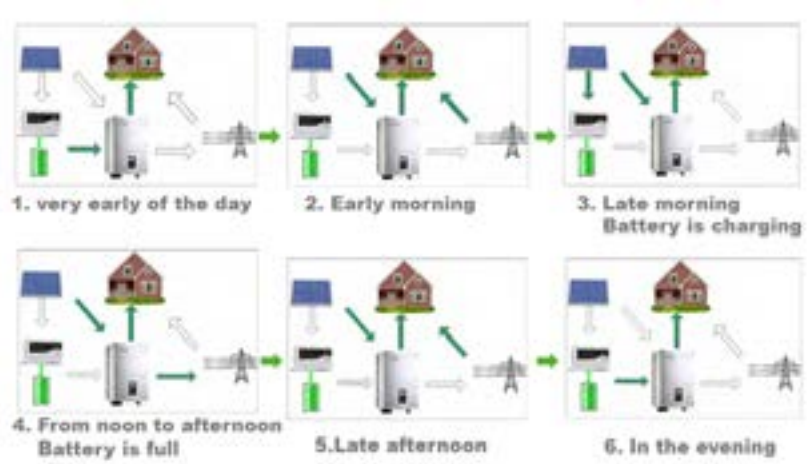
SP1000/2000

The Growatt SP2000 along with their associated lithium-ion battery packs, GBLI2701 and GBLI5001 provide a very cost effective and easily installed DC connected battery storage solution.

The packages consist of just a controller, battery pack and meter clamp making them very easy and quick to retrofit onto almost any existing PV system with a suitable voltage and current of PV array.

They are connected into the PV string between the panels and the PV inverter and automatically store surplus energy when generation is greater than consumption and release it when generation is lower than consumption.

Shown below is the energy flow during 6 typical phases of the day with a Growatt system:



Key Selling Points:

- Perfect for retrofit opportunities
- DC installation means easier and quicker
- Lowest cost per kWh
- Integrated DC Switch

SMA

Sunny Island

The Sunny Island supports a wide range of on-grid and off-grid applications, and has a number of compelling product features. Its high protection class, wide temperature range and overload capacity provide the kind of reliability needed for off-grid use. Intelligent load and energy management keeps the system running even in critical situations. And being a core element in the SMA Flexible Storage System for new and existing PV systems, the Sunny Island system stores generated solar power and works with the Sunny Home Manager to intelligently manage home energy consumption. The quick configuration guide and intuitive remote control user interface help ensure quick and convenient commissioning in any both cases.

The scalable system design also allows back-up systems of up to almost 300kW

Key Selling Points:

- Perfect solution for "Edge of Grid" customers
- Off grid capabilities
- Great for commercial sites.
- Compatible with Lithium Ion and Lead Acid batteries.

Key Selling Points:

- Perfect for AC Retrofit
- Optimal for Self-Consumption
- Compatible with Tesla Type C
- Universal compatibility with many inverter suppliers

SMA

Sunny Boy Storage 2.5

The Sunny Boy Storage is a battery inverter ideally suited to coping with the electricity demand of a private household. The device combines the flexibility of the AC coupling with the advantages of high-voltage technology, enabling a significant reduction in system and installation costs.

Due to it's small size, it's perfectly suited for smaller UK domestic arrays.

The Sunny Boy Storage 2.5 and the compatible Tesla Type C battery are due in stock in August 2016.

Batteries Supplied by SegenSolar

SegenSolar stock a broad portfolio of battery products, carefully selected to cover a range of applications.

Battery Size	2kWh	2.5kWh
DOD (Depth of Discharge)	80%	80%
Nominal/Usable Capacity	1.6kWh	2kWh
Number of cycles	2500	2500
Cycle efficiency	92%	92%
Weight	33kg	42kg
Life Expectancy	7 years	7 years
Warranty	2 years	2 years

Victron

Lithium-Ion Phosphate Batteries

Victron batteries supplied by SegenSolar have in built cell balancing and connections to the battery management system they are lightweight at only 16kg and easily transportable.

You can connect up to ten batteries in parallel and up to four batteries in series so that up to a 48V battery bank of 2000Ah can be assembled. The daisy-chained batteries must be connected to a Battery Management System (BMS).

LG Chem

6.4kWh Lithium-Ion Polymer

The LG Chem Battery range has very good energy density, a small foot print, and a built in switch and fuse.

It is expandable with up to two expansion packs giving it a maximum overall size of 12.4kWh, usable 11kWh. It is a lithium –ion polymer (Nickel-Manganese-Cobalt = NMC) and is supplied with two wall attachment brackets to prevent tipping.

Battery Size	6.4kWh	3.2kWh
DOD (Depth of Discharge)	90%	90%
Nominal/Usable Capacity	5.76kW	2.88kW
Number of cycles	6000	6000
Cycle efficiency	95%	95%
Weight	60kg	30kg
Life Expectancy	10 years	10 years
Warranty	10 years	10 years

Battery Size	5.5kWh	6.4kWh	8kWh	11kWh	16kWh	22kWh
DOD (Depth of Discharge)	50%	50%	50%	50%	50%	50%
Nominal/Usable Capacity	2.75kWh	3.2kWh	4kWh	5.5kWh	8kWh	11kWh
Number of cycles	2500	2500	2500	2500	2500	2500
Cycle efficiency	-	-	-	-	-	-
Weight	195kg	253kg	295kg	370kg	590kg	740kg
Life Expectancy	10 yrs	10 yrs	10 yrs	10 yrs	10 yrs	10 yrs
Warranty	1 yrs	1 yrs	1 yrs	1 yrs	1 yrs	1 yrs

Hoppecke

Classic Lead Acid Range 5.5-22 kWh

Hoppecke is a long established German battery manufacturer with a wealth of experience. They are the largest battery manufacturer in European ownership for industrial applications in Europe.

Hoppecke batteries are tested to work with products from SMA, Victron and GoodWe. Segen supplies Hoppecke lead-acid packs in sizes ranging from 5.5kWh up to 22kWh. These packs are supplied with all cables, battery fuses and mounting case making them completely self-contained.

A good overview of the battery pack and its installation is available on YouTube:

https://www.youtube.com/watch?v=MulfRfiyFk4

Growatt

GBL1 5001 Lithium-Ion (nickel-cobalt manganese) 3kWh & 5kWh

Growatt batteries are manufactured by Darfon, a BenQ company in China.

The 4.8kWh battery is for use with the Growatt SP2000 only, creating an easy to install DC domestic package.

A new 2.7kWh battery is also now available along with the SP1000 1kW battery controller making it ideal for smaller PV systems.

Battery Size	2.7 kWh	4.8 kWh
DOD (Depth of Discharge)	80%	80%
Nominal/Usable Capacity	2.2kW	4.4kW
Number of cycles	3000	3000
Cycle efficiency	94%	94%
Weight	30kg	46.5kg
Life Expectancy	10 years	10 years
Warranty	5 years	5 years

Compatibility Chart

To the left is a chart stating battery and battery controller/inverter compatibility for the SegenSolar portfolio.

- LG Chem is compatible with both the Sunny Island and the GoodWe ES. ***Compatibility with Victron is to be determined/in progress.***
- Hoppecke Lead Acid battery is compatible with the Sunny Island, the Victron Quattro and Multiplus and the GoodWe ES.
- The Growatt batteries are currently only compatible with Growatt controllers.
- Victron batteries are currently only compatible with Victron controllers.

In order to make it easier for you, we have created ready matched packages ready to buy.

SegenSolar Storage Packages

All battery storage systems require a number of different components to fully function and, to make these easier to configure and purchase, SegenSolar has defined a number of packages ranging in system type and size.

Grid Backup Packages

All these packages are capable of providing energy to defined essential loads in the property in the event of a grid-failure. SegenSolar have created packages in a range of sizes to suit customer requirements.

These packages are made up of the following:

- Victron Multiplus Inverters
- GoodWe Hybrid Inverters
- Sunny Island Battery Controllers
- Victron batteries
- Hoppecke batteries
- LG batteries

In order to locate these packages on the SegenSolar Portal, simply select "Products" from the top bar menu and select " PV Storage Packages". You can then select "Grid Backup Packages" from the left hand menu.

Enhanced Self-Consumption Packages

These packages enable the property to utilise a greater proportion of the energy generated by the PV system but do not operate in the event of a grid-failure.

In order to locate these packages on the SegenSolar Portal, simply select "Products" from the top bar menu and select " PV Storage Packages". You can then select "Self Consumption Packages" from the left hand menu.

Pre-Sale Checklist

1. Has the property got a large enough solar system with sufficient spare energy to charge the battery most of the year and are all applicable electrical energy efficiency measures in place, e.g. L.E.D. lighting? A much too small PV system (kWp < 50% of the battery kWh capacity) or a property occupied during the day every day with a high base load is unlikely to have sufficient spare electrical energy to fully charge the battery most days of the year.

2. Is the existing PV system export monitored, or has a detailed energy usage survey been completed, to assess how much spare energy is available to charge the battery? If they have an immersion heater controller in place this may give false results.

3. Can you easily access the property, get the equipment and tooling to the installation area, is there sufficient room in the proposed installation area and can the installation wall / floor safely take the weight?

4. Does the property have an internet connection for the system to allow monitoring and enable the full manufacturer warranty cover if applicable?

5. Is their existing PV inverter fully compatible with the new storage system? Is a firmware upgrade required?

6. Has permission been given by the local municipality to connect a battery to the existing PV system and has the homeowner been advised to notify their building and contents insurance companies?

7. Is the building occupied all the time and for how long in a year, e.g. a property only let for holidays or where the occupiers are away for sustained periods on holiday or business may not fully benefit from all the increased self-consumption available?

8. If a pure self-consumption system is being proposed is the home owner aware that the storage solution does not offer a grid-backup capability? If a grid-backup solution is being proposed, is the home owner aware of what equipment, and for how long it will realistically be able to power it for? Does the quotation include any re-wiring of the consumer unit to separate out the nominate essential loads to be live during a grid failure?

9. Is there a fire alarm system in the property with a detector in range of the inverter and battery system?

10. Has the enhanced self-consumption or backup energy assessment given to the homeowner taken into account the efficiency of the inverter/battery, degradation over the expected life of the battery and the reduced charge available during the winter months due to lower PV energy generation?

Glossary

Edge of Grid = Edge of grid refers to locations where there is a grid connection but it's not dependable for whatever reason (eg deliberate load shedding vs unplanned blackouts).

Amp (A) short for Ampere = a measure of flow rate of electrical charge equal to 6.241x 1018 charge carriers (or one coulomb) per second (Important for understanding electrical capacity issues).

Volt (V) = the derived unit for electric potential, electric potential difference (voltage), and electromotive force defined as the difference in electric potential between two points of a conducting wire when an electric current of one ampere dissipates one watt of power between those points. (Again, important for understanding electrical capacity issues).

Watt (W) = is a derived unit of power used to express the rate of energy conversion or transfer with respect to time. A watt is the rate at which work is done when one ampere (A) of current flows through an electrical potential difference of one volt (V). (This becomes the ground understanding the relationship between power, current and potential).

W = V x A

Amp-hour (Ah)= A unit of electric charge, equal to the charge transferred by a steady current of one ampere flowing for one hour, or 3600 coulombs. A millimampere-hour (mA.h or mAh is one-thousandth of an ampere-hour (3.6 coulombs).

Watt-hour (Wh) = The watt-hour is a unit of energy equivalent to one watt (1 W) of power expended for one hour.

C-rate (C) = A measure of the rate at which a battery is being discharged. A 1C rate is defined as the discharge current divided by the current draw under which is the battery would last for one hour. A 1C discharge the rate means the battery will be completely discharged in 1 hour. (This unit has a great effect on how we understand battery capacity).

Cycle = A charge cycle refers to the process of charging and discharging a battery. This term is used when specifying a battery's expected life, as in the number of charge cycles a give battery is expected to provide.

Depth of Discharge or DOD = How deeply the battery can be discharged. If a battery can be discharged down to no lower than 20% of its capacity then the products DOD is 80%

Capacity = This is the size of capacity a battery has if it could discharge 100% of its energy.

Usable Capacity = This is the actual amount of energy that can be discharged when you take into consideration the batteries DOD.

Usable Capacity = Capacity x DOD

Roundtrip Efficiency = Percentage measurement of battery efficiency taking into consideration the energy loss in the charge/discharge cycle.

Charge/Discharge Power = The rate at which energy can be added to or taken from a battery. Measured in kW

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All information stated in this document is correct at time of printing, but is subject to change.

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