Best Choice for Your Residential PV Storage System
- SPH Hybrid System

Growatt SPH3000 / SPH3600 / SPH4000 / SPH4600 / SPH5000 / SPH6000

- IP65 Protection Level
- Natural Cooling
- Smart Battery Management
- Online Smart Service
- Flexible Battery Solution up to 10kWh

Shenzhen Growatt New Energy Technology Co., Ltd
Tel: 1800 476 928 (1800GROWAT)  Web: www.ginverter.com.au  Email: info@ginverter.com
INTRODUCTION

Battery storage allows electricity generated by solar panels during the day to be stored for use later when the sun has stopped shining. Although batteries were first produced in the 1800s, the types of battery energy storage systems that can store solar power and provide electricity to households today are fairly new.

A battery storage system connects to a house in two main ways – DC (direct current) coupled or AC (alternating current) coupled.

A DC-coupled battery storage system is integrated into the solar system. These systems generally have a single inverter that converts the DC electricity to AC to supply the house or feed back into the grid.

An AC-coupled system is separate to the solar system. It connects directly to the house wiring via a dedicated bi-directional battery inverter, using local AC electricity to charge the battery and discharge it directly to the house. Once set up, a battery storage system should operate automatically.

THE BENEFITS OF BATTERIES

Installing a battery storage system can provide a number of benefits when used in conjunction with an existing or new solar panel system.

A battery storage system can:
• Help reduce reliance from the grid
• Maximise the energy used from solar panels by allowing it to be stored rather than sent to the grid
• Offset the increased cost of power used during peak times, such as during the evenings
• Save money by storing energy from the grid overnight when prices are low to use during peak times when prices are high - (this will depend on the power agreement)
• Provide electricity during power outages (this will depend on the system)
• The significant reduction in the cost of battery storage systems in recent years means that installing a battery is fast becoming a viable option for many Australian households.

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INTRODUCTION

WHAT IS BATTERY CAPACITY?
One important consideration is the usable amount of energy in a battery storage system. Some manufacturers promote their battery capacity based on the total capacity, for example 10kWh. But all battery storage systems have what is called depth of discharge (DoD).

Depth of discharge is how much of the total capacity can be used. The majority of battery storage systems cannot have 100% of the total energy drawn out of the battery.

Depth of discharge is expressed as a percentage of the total capacity.

If a 10kWh battery has a DoD of 80%, it will provide 8kWh of usable energy.

Lead-acid battery systems typically have a depth of discharge between 30% and 50%.

Lithium-ion battery systems typically have a depth discharge of 80% and above.

HOW LONG DO BATTERIES LAST?
Product warranties on battery storage systems vary widely and are generally anywhere from two to 10 years. A battery storage system will often last longer than its warranty but its ability to store energy will gradually reduce over time with use.

The retailer the battery was purchased through should provide a retailer warranty. Warranties vary between retailers including how they define the life of the battery. Some retailers offer a warranty as an ‘energy throughput’ figure which means they guarantee their batteries will store and deliver a given amount of energy, no matter how quickly that limit is reached.

Energy throughput for lithium-ion batteries ranges from 4000 to 6000 cycles (charges/discharges of the battery) at 80% discharge rate, meaning an expected life of 10 years for high performing systems (if cycled once per day). Some battery retailers offer a warranty guaranteeing either an energy throughput or a lifetime in years, usually based on whichever limit is reached first.

A house with solar panels and a DC-coupled battery storage system

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Solar PV
Energy Storage System

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+61 3 9795 9601
info@risenenergy.com.au
Unit 35, 15 Ricketts Road, Mount Waverley Vic 3149
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- Build
- Operate
- Storage

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THE THREE MOST COMMON WAYS TO PURCHASE A BATTERY STORAGE SYSTEM

If your purchasing a battery storage system on behalf of your customer it's important to discuss their needs with a system designer. The most common ways to purchase a system are shown as follows:

<table>
<thead>
<tr>
<th>BATTERY STORAGE SYSTEM</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OFF-THE-SHELF SYSTEM</strong></td>
<td>These systems are typically all-in-one systems that require little customisation to be installed.</td>
<td>One manufacturer One warranty</td>
</tr>
<tr>
<td><strong>SEMI-CUSTOMISED SYSTEM</strong></td>
<td>Your designer may select various components (such as the inverter) and connects this to an off-the-shelf battery system to make your battery storage system.</td>
<td>Customisable Flexible energy and power limits can be set</td>
</tr>
<tr>
<td><strong>FULLY-CUSTOMISED SYSTEM</strong></td>
<td>A system where the installer makes the battery system from individual battery cells or modules on site and connects it to an inverter to make the battery storage system.</td>
<td>Most designer flexibility of all solutions Customisable energy and power limits</td>
</tr>
</tbody>
</table>

**OFF-THE-SHELF SYSTEM** *(Manufacturer BESS*)

- “All-in-one” system - requires little customisation before installation.
- Predefined energy and power limits
- User has to deal with a single manufacturer and a single warranty

*BESS - battery energy storage system

**SEMI-CUSTOMISED SYSTEM** *(Manufacturer battery system)*

- More customisable. The designer selects components such as the inverter and connects them to an off-the-shelf battery
- Flexible energy and power limits
- More complex. More than one manufacturer, more than one warranty

**FULLY CUSTOMISED SYSTEM** *(Installer constructed BESS)*

- Most customisable. The designer makes the battery system and connects them to an inverter to make the storage system
- Customisable energy and power limits
- Most complex. Multiple warranty considerations
# Battery Storage Systems

## What Different Types of Batteries are Available?

<table>
<thead>
<tr>
<th>LITHIUM-ION BATTERIES</th>
<th>Advantages (compared to lead-acid batteries)</th>
<th>Disadvantages (compared to lead-acid batteries)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lithium-ion batteries are becoming a popular choice for use with household solar panels, and may become the main technology used in the future. Lithium-ion technology has been used for many years in portable devices, including in laptops and mobile phones. Due to falling costs and increased production, they can now be manufactured in larger sizes and are well suited to storing solar power.</td>
<td>Higher capacity and storage</td>
<td>Cost</td>
</tr>
<tr>
<td></td>
<td>Lighter weight and higher voltage</td>
<td>Possible limitation in operating temperature range</td>
</tr>
<tr>
<td></td>
<td>Smaller space and environmental footprint</td>
<td>Limited recycling programs in Australia</td>
</tr>
<tr>
<td></td>
<td>Reduced maintenance due to inbuilt battery management systems</td>
<td>Lesser known technology</td>
</tr>
<tr>
<td></td>
<td>Longer cycle life and greater depth of discharge</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LEAD-ACID BATTERIES</th>
<th>Advantages (compared to lithium-ion batteries)</th>
<th>Disadvantages (compared to lithium-ion batteries)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The technology behind lead-acid battery storage is similar to that of a car battery. Lead-acid batteries are commonly used with solar panels in remote rural homes, where connection to the grid is prohibitively expensive. Thanks to advances in technology, systems wellsuited to solar power storage are readily available in the form of low-maintenance sealed lead-acid batteries.</td>
<td>Well-understood technology</td>
<td>Require regular (albeit simple) checks and maintenance</td>
</tr>
<tr>
<td></td>
<td>Relatively cheap</td>
<td>Limited depth of discharge (i.e. a lower proportion of the energy stored can be used)</td>
</tr>
<tr>
<td></td>
<td>Easy to acquire</td>
<td>Requirement for external venting, which restricts installation locations</td>
</tr>
<tr>
<td></td>
<td>Readily recyclable and have commercial value</td>
<td></td>
</tr>
</tbody>
</table>

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*ILLUSTRATION: CLEAN ENERGY COUNCIL*
OTHER BATTERY TYPES

FLOW BATTERY
A flow battery is a type of rechargeable battery where re-chargeability is provided by two chemical components dissolved in liquids. These chemicals are contained within the system and are most commonly separated by a membrane. This technology is akin to both a fuel cell and a battery, where liquid energy sources are tapped to create electricity and are able to be recharged within the same system.

One of the biggest advantages of flow batteries is that they can be almost instantly recharged by replacing the electrolyte liquid, while simultaneously recovering the spent material for re-energisation.

However the main limitation with flow batteries is their low energy and power density compared to Li-ion and lead-acid.

Different classes of flow cells (batteries) have been developed, including redox, hybrid and membraneless. The fundamental difference between conventional batteries and flow cells is that energy is stored as the electrode material in conventional batteries but as the electrolyte in flow cells.

SALTWATER
Saltwater batteries are often the cheapest, safest and most environmentally-friendly batteries on the market. The components are non-toxic and non-corrosive meaning the batteries contain a safe, water-based electrolyte and are non-combustible. Maintenance of saltwater batteries is low as fluid levels do not need to be maintained and the terminals do not need to be cleaned. Saltwater batteries also have a longer system life. AHI batteries are more expensive than equivalent lead-acid batteries in terms of up-front costs. Over the lifetime of the AHI's the combination of longer product life and better overall performance can put them ahead. Saltwater still faces an uphill battle against the more established lithium-ion batteries and delivery of large price reductions.

ULTRABATTERY
UltraBattery is a hybrid, long-life lead-acid energy storage device. It combines the fast charging rates of an ultracapacitor technology with the energy storage potential of a lead-acid battery technology in a hybrid device with a single common electrolyte. UltraBattery is ideal for any variable power application where variable and/or rapid charge and discharge of energy is needed. These include:

- Hybrid electric vehicles
- Managing variability on electricity grids
- Ancillary services for electricity grids
- Smoothing the variability in solar and wind energy signals
- Storing energy from renewables for later use
- Stand-alone microgrids in combination with renewable generation to deliver local power
- Energy storage for residential solar panel installations
- Transport system support
YATES ELECTRICAL SERVICES are working with land-owners in South Australia to reactivate redundant land parcels rendered unusable for traditional farming practices by drought - to create a distributed network of large scale solar farms. We are assisting farmers to reduce their financial reliance on the volatile primary production markets, while simultaneously creating supplementary income streams for their business. To find out more, visit www.yateselectrical.com.
QUESTIONS AND ANSWERS

What does battery capacity mean?
Typically battery capacity is expressed in kilowatt hours (kWh), similar to the way electricity is charged. Some battery manufacturers express their capacity in ampere hours (Ah).

The battery capacity quoted by the manufacturer is an ideal number that is used for comparing batteries. One important consideration is the useable amount of energy in a battery storage system. Some manufacturers promote their battery capacity based on the total capacity, for example 10 kWh.

How big are battery storage systems?
A number of battery storage solutions are available. They come in a range of sizes (typically between the size of a split system air conditioner and a fridge) based on the technology that they use and the amount of energy they store. Lead-acid batteries tend to be physically larger than lithium batteries.

Where can a battery system be installed?
Some battery storage systems can be wall mounted while others are floor standing. Some can be installed inside while others are best suited for outside. Multiple batteries can be installed to increase storage capacity in which case extra storage will be required.

Lead-acid batteries tend to be physically larger than lithium batteries and are best suited to being installed outside or in a garage or basement as they vent hydrogen when charged. Lithium batteries are designed to be wall mounted inside a utility room, which helps control the batteries' temperature. It is also important to consider ventilation with inside batteries.

Outside batteries will come with a weatherproof enclosure and will need a suitable place to be installed. They will need to be out of direct sunlight and not adjacent to heat or ignition sources.

Is battery storage applicable if there is a feed-in tariff?
An important consideration when installing a battery storage system to a solar panel system is the impact it will have on the existing solar feed-in tariff.

A CEC Accredited Designer will be able to calculate the potential savings as part of the load analysis and choose a system that is right for the client's needs. Factors such as the size of the system, how much electricity is exported and the feed-in tariff amount will determine the cost savings to the client.
**Will the battery work in a blackout?**

Not all battery storage systems provide backup power. Some will work during a blackout, and some may operate following a brief power outage. If the battery storage system needs to work during a blackout, discuss it with the system designer and choose an appropriate product. If an uninterrupted supply of electricity is required then an uninterruptible power supply (UPS) battery storage system will need to be installed. UPS battery systems are typically larger and more complex to install and will cost more than other systems.

If the battery is charged it will be able to provide power to the home during a blackout. However, there may be a limit to the number of appliances that can be operated during the blackout. This will depend on the rating of the battery storage system. Alternatively the installer can wire specific appliances so they can be used in a blackout. Some storage systems can power a whole house during a blackout.

Some systems will have a disruption to power (usually a couple of seconds) between the blackout occurring and the system kicking in to supply power. If a customer is looking to go completely ‘off the grid’ consult with a CEC Accredited Designer.

**Going completely ‘off-grid’?**

If a client would like to completely disconnect from the grid and supply their entire household with clean power there are a number of things for them to consider.

- The solar system will need to be large enough to meet the power needs and the battery will need to be able to cover the requirements at all times including peak times. In most cases that means a very large solar system and battery storage system will need to be installed
- Large systems can present challenges including their physical size, town planning regulations and grid connection requirements. Off-grid systems are more complex to design and install
- Back up will be required by the client if something goes wrong

**Installing a battery storage system**

The cabinet or housing of the battery should be built to comply with the standards and building codes applicable in the relevant jurisdiction.

**What happens if your client moves house?**

It is possible for a storage system to be moved if your client moves residence, in the same way solar panels can be moved. If the product standards change, the battery storage system may no longer meet the new standards and it won’t be able to be re-installed. If the system is moved it has to be carefully reinstalled by an accredited installer.
SAFETY AND STANDARDS

Battery storage systems do have some safety risks, just like solar panels or any other major piece of electrical equipment. Provided your system is installed to all relevant Australian Standards and used and maintained properly, battery storage is safe, but it's important to be aware of the risks so you can manage them safely.

The main safety hazards are:
- The general hazards of electrical wiring
- Chemical, fire or explosive hazards. For a battery system these are similar to the risks associated with bottled gas or a natural gas service. For this reason smoking around a battery system is dangerous and it is advisable to check whether the system being installed vents gas
- Non-flammable gases escaping when charging or discharging from lithium batteries may pose a risk to inhaling noxious gases similar to natural gas leaks
- Chemical leakages similar to corrosive fluid in car batteries or household chemical cleaning products
- Small children and pets should be kept away from the battery storage system
- Items should not be stored on top of the battery storage system

- The battery storage system will heat up similar to a laptop but shouldn’t be hot to touch. Like all electrical equipment, battery storage systems emit some level of electromagnetic radiation, within safe limits.
- If an incident occurs call 000 immediately
- Servicing of the battery storage system should be done by an accredited installer

SAFETY STANDARDS FOR LITHIUM BATTERIES


The standard requires testing under a range of extreme conditions such as dropping the battery from a height, smashing it, firing a nail into it, overheating it, overcharging it and short-circuiting the terminals. Batteries need to determine they can withstand extreme conditions such as fire, explosions, leakage, venting of flammable gases or rupture of the casing.

The standard also requires the manufacturer to provide important safety information for end users.

If you are considering the purchase of a lithium battery, ask the retailer to provide proof that it has been tested to the new standard, particularly through inclusion on the CEC Approved Energy Storage Devices list. Only products that are listed under their actual brand name and model number are valid.
MAINTENANCE

The lifetime of a battery is strongly dependent on how the system is used. Poor or heavy usage may mean the product doesn’t last as long as the manufacturer’s specifications. The lifetime also depends on ambient temperatures. All battery types should be checked during extreme hot and cold weather to see whether they are still performing as required.

Batteries can be discharged over a large temperature range (-20°C to 60°C) but the charge temperature should be limited for best results.

A system owner’s electricity consumption may also change over time, which can alter the long-term performance and life of the battery storage system.

SYSTEM MONITORING

It is important to keep an eye on how a battery storage system is operating. Different manufacturers have different ways to do this:

• Some systems have a display on the battery storage system itself, with indicators such as operating mode and battery state of charge.
• Some systems support a remote display option that can be installed inside the house.
• Some systems can connect to the internet and allow the user to view information on a computer, smartphone or tablet, even when they are not at home.

In addition to monitoring systems provided by your battery storage system manufacturer, third-party home energy monitoring solutions are also available.

INSPECTIONS

Depending on which state a system is installed in, a safety inspections may be carried out by a relevant electrical authority. These inspections may be mandatory or may occur on a random audit basis. In some states, the installer is responsible for organising the inspection of a system. The inspection may need to be carried out before the system can be connected to the grid.
WARRANTIES

If there is an issue with the battery storage system while it's still under warranty the owner should contact the retailer to have the product repaired or replaced. Contact details should be provided on the warranty documentation. In addition to any contractual warranty, the owner has additional rights under Australian Consumer Law, and the relevant state sale of goods legislation.

The ACCC website also has further information on warranties, consumer guarantees and rights to remedies: accc.gov.au/consumers.

WORKMANSHIP COMPLAINTS

The benefit of the owner using a CEC Accredited Designer/Installer is that the CEC can resolve complaints involving workmanship issues that breach the Accreditation Guidelines or relevant Australian Standards by a CEC Accredited Designer/Installer. This only applies to individual tradespeople who hold CEC accreditation and does not extend to retailers.

RETAILER COMPLAINTS

If the owner has a complaint against a company identifying itself as a CEC Approved Solar Retailer, the owner should first contact the company.

If they are not satisfied with the response from the company, they should contact the relevant consumer protection organisation. They can also register their complaint with the CEC who can investigate breaches of this code. This may result in the retailer having its approval revoked.
WHAT SHOULD OWNERS DO IF THE COMPANY HAS GONE OUT OF BUSINESS?

If the retailer has become insolvent and are unable to be contacted, a complaint can be lodged with the retailer's administrators. You can find out if a company has become insolvent via the Australian Securities and Investment Commission (ASIC) website or by phoning 1300 300 630. The owner can also contact the local fair-trading or consumer affairs office.

If the manufacturer has gone into administration, a complaint can be lodged with the company’s administrators. The owner may become an unsecured creditor.

COMMERCIAL COMPLAINTS

If the owner has a commercial complaint including warranties, payments and contractual issues they should contact the relevant Fair Trading or Consumer Affairs office in their state or territory.

ACT: Fair Trading (02) 6207 3000
NSW: Fair Trading 13 32 30
NT: Consumer Affairs 1800 019 319
QLD: Office of Fair Trading 13 74 68
SA: Consumer and Business Services 13 18 82
TAS: Consumer Affairs and Fair Trading 1300 654 499
VIC: Consumer Affairs 1300 558 181
WA: Consumer Protection 1300 304 054

ELECTRICAL SAFETY

If there are concerns about the safety and technical compliance of the battery storage system contact the electrical authority in your state or territory.

ACT: Planning (02) 6207 1923
NSW: Fair Trading 13 32 30
NT: NT WorkSafe 1800 019 115
QLD: Electrical Safety Office 1300 362 128
SA: Office of the Technical Regulator (08) 8226 5518
TAS: Department of Justice 1300 135 513
VIC: Energy Safe Victoria (03) 9203 9700
WA: Energy Safety (08) 6251 1900
BATTERY RECYCLING AND END OF LIFE

When purchasing a battery storage system for install, ask the retailer whether they have a battery recycling program in place.

Batteries contain harmful and dangerous materials such as acid, lithium and heavy metals (cadmium, cobalt, lead). Batteries need to be managed throughout their life cycle and their end-of-life. This includes handling, collection, storage, transport and processing.

When a battery needs replacing, the old battery should be disposed of at a battery recycling station or other suitable site. Batteries that require recycling should be stored safely in a cool, dry place out of the reach of children and pets and all exposed terminals should be taped up.

More information on battery recycling can be found at batteryrecycling.org.au and envirostream.com.au – Australia’s first lithium-ion battery recycler.

Simple steps to safe and responsible battery disposal

Steps to safe & responsible disposal of batteries

1. When buying your batteries find out if your batteries contain recycled content & are recyclable
2. Learn about the risks of deinstallation & understand your system. Know what to do and what not to do
3. Plan for safe and responsible management of batteries at the design and Installation stage
4. Find an accredited installer to advise you on deinstallation
5. Ensure an accredited recycler is used
BATTERY RECYCLING

WHY IS IT IMPORTANT TO RECYCLE YOUR BATTERY STORAGE SYSTEM?
Depending on chemistry type, batteries may contain harmful and dangerous materials such as acid, lithium and heavy metals (e.g. cadmium, cobalt and lead).

<table>
<thead>
<tr>
<th>Importance of safe &amp; responsible disposal of your Battery Energy Storage System</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ENVIRONMENT:</strong> Recycling or reuse ensures resources are not wasted</td>
</tr>
<tr>
<td><strong>ENVIRONMENT:</strong> Disposal to landfill may cause fire, releasing highly toxic smoke to the community</td>
</tr>
<tr>
<td><strong>ENVIRONMENT:</strong> Disposal to landfill may contaminate soil or water</td>
</tr>
<tr>
<td><strong>ENVIRONMENT:</strong> Recycling using accredited recyclers ensures safe recovery of material</td>
</tr>
</tbody>
</table>

YOU CAN BE PART OF THE SOLUTION
Ensure your batteries are managed responsibly and are recycled or reused, to:

- Enable the recovery and reuse of lead, iron, plastics, aluminium, copper, lithium, cobalt and electrolyte
- Divert toxic and hazardous materials from landfill
- Ensure that batteries are managed safely
- Prevent injury due to contractor training and experience in safe lifting and handling
- Minimise the risk of damage and potential for fire during removal and transport
- Protect system components during de-installation, improving potential for reuse in a second life
There are two key concepts to understand:

- **Power** – how fast energy can be supplied (kilowatts or kW)
- **Energy** – how much energy is stored by the system (kilowatt hours or kWh)

Check the energy bill for information. A ‘typical’ house may use around 18 kWh of energy per day with a maximum power consumption of 4.5-15 kW, although this can vary significantly.

As long as they are connected to the grid, the battery storage system does not need to provide for all the power needs.

Most battery storage systems currently on the market have a power rating of 2-5 kW and an energy rating of 2-10 kWh. Multiple systems can be used to scale this up if necessary.

The peak demand will depend on how many and which appliances are used at the same time. Typical maximum power requirements of some high-powered appliances are:

- Air-conditioner 2-5+ kW
- Water heater 3 kW
- Clothes dryer 2.4 kW
- Electric kettle 2.4 kW
- Hair dryer 1.2 kW
- Dishwasher 1.5 kW
- Washing machine 1.5 kW
- Microwave oven 1.5 kW
- Plasma TV 0.8 kW
- LED/LCD TV 0.2 kW

As a general rule, any appliances that cool or heat will need more power than other appliances.

### Battery Storage System Checklist

Every good install ends with the system owner being given a simple, clear briefing on technology that’s new to them. The checklist below will help new battery owners feel comfortable about their investment and their system.

- Understand what the battery will be used for and the amount of energy available for that use (this is usually less than the manufacturer's rated total amount of energy labelled on the batteries).
- The owner needs to monitor the system regularly (at least once a month) and know how to read any battery monitoring system that is in place.
- Make sure the owner knows what to check for when doing a visual check or taking meter readings.
- As batteries do not perform well with sudden changes in ambient temperature, on extremely hot or cold days the owner many need to do additional monitoring.
- Ensure batteries are not accessible to children and are vermin-proofed. Do not store items on top of or lean items against batteries or enclosures because they could be a potential electrical fire risk. Suggest installing signs as a reminder.
- Ensure batteries have the correct safety and warning signs for the battery type, and that the owner knows the correct procedures in case of an emergency.
- Keep manufacturer, installer and warranty information to refer to as needed.

<table>
<thead>
<tr>
<th>Models</th>
<th>48V 400V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type-R</td>
<td>Type-C</td>
</tr>
<tr>
<td><strong>Total Energy [kWh]</strong></td>
<td>6.5</td>
</tr>
<tr>
<td><strong>Usable Energy [kWh]</strong></td>
<td>5.9</td>
</tr>
<tr>
<td><strong>Voltage Range [V]</strong></td>
<td>42.0 ~ 58.8</td>
</tr>
<tr>
<td><strong>Max Power [kW]</strong></td>
<td>4.2</td>
</tr>
<tr>
<td><strong>Peak Power [kW]</strong></td>
<td>(48V: for 3 sec.)</td>
</tr>
<tr>
<td><strong>Dimensions [W x H x D, mm]</strong></td>
<td>452 x 656 x 120</td>
</tr>
<tr>
<td><strong>Weight [kg]</strong></td>
<td>52</td>
</tr>
</tbody>
</table>
Change Your Energy
Charge Your Life

COMPACT & POWERFUL
ENERGY STORAGE FOR YOUR HOME

<table>
<thead>
<tr>
<th>Models</th>
<th>48V</th>
<th>400V</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RESU6.5</td>
<td>RESU10</td>
</tr>
<tr>
<td>Total Energy [kWh]</td>
<td>6.5</td>
<td>9.8</td>
</tr>
<tr>
<td>Usable Energy [kWh]</td>
<td>5.9</td>
<td>8.8</td>
</tr>
<tr>
<td>Voltage Range [V]</td>
<td>42.0 ~ 58.8</td>
<td></td>
</tr>
<tr>
<td>Max Power [kW]</td>
<td>4.2</td>
<td>5.0</td>
</tr>
<tr>
<td>Peak Power [kW]</td>
<td>4.6</td>
<td>7.0</td>
</tr>
<tr>
<td>(48V: for 3 sec.)</td>
<td>110 (Backup Mode)</td>
<td></td>
</tr>
<tr>
<td>(400V: for 10 sec.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dimensions [W x H x D, mm]</td>
<td>452 x 656 x 120</td>
<td>452 x 484 x 227</td>
</tr>
<tr>
<td>Weight [kg]</td>
<td>52</td>
<td>75</td>
</tr>
</tbody>
</table>

1) Battery Total Energy is measured at the initial stage of battery life under the condition as follows: Temperature 25°C
2) Battery Usable Energy is based on battery cell only and lower values are expected with conversion losses to AC property use
3) The RESU models can be combined up to 2 units to increase energy capacity. For details, please refer to the manual.
The only storage system that adapts to your needs

eBick, the solution for self-consumption and remote applications between 9 and 206 kWh per String.