

GREENROCK

THE SALTWATER ENERGY STORAGE SYSTEM



Partner Brochure
Integrated Storage System

GREENROCK

the Energy Storage with Energy Management System (EMS)

GREENROCK – The **Saltwater Energy Storage** System, is an integrated power storage solution. The saltwater battery based on environmentally friendly materials is **completely safe and maintenance-free**.

Electricity produced by **photovoltaic or wind energy plants** is stored and used during times when the sun is not shining or in windless times. Even without your own small power station, GREENROCK (fed from the local power grid) can secure your supply.

In case of **power outages** the battery offers back-up. Important consumers, such as refrigerator, freezer, alarm system, hot water boiler or others, stay supplied.



For our **safety & environment**



GREENROCK is the safest and most environmentally friendly stationary power storage solution. Unlike conventional lithium-ion solutions, our company relies on salt water technology. **Non-flammable, non-explosive, safe to touch and absolutely maintenance-free** are some of the key characteristics.

GREENROCK storage solutions are perfect for homes and commercial establishments that want to optimize their generated electric power for their own energy consumption. Even large scale applications up to MWh's are available. The technology has **successfully** proven itself in **thousands of installations**.

Product features

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- Safest and most environmentally friendly power storage
- Non-flammable & non explosive
- Non-toxic materials
- Absolutely maintenance-free
- Proven world-wide in thousands of installations
- Perfect for homes of any size
- Optimizing your internal power consumption
- Tax incentives or other subsidies possible

GREENROCK is a **ready-to-install storage solution** that can be integrated into the most common Smart Home systems (emergency power system is included, optional island mode function available). By **means of an App** energy flow can be represented and evaluated statistically.

Electricians appreciate the **easy installation** (it's plug & play!). The environmentally compatible salt water technology is often eligible for tax credits and other financial incentives.

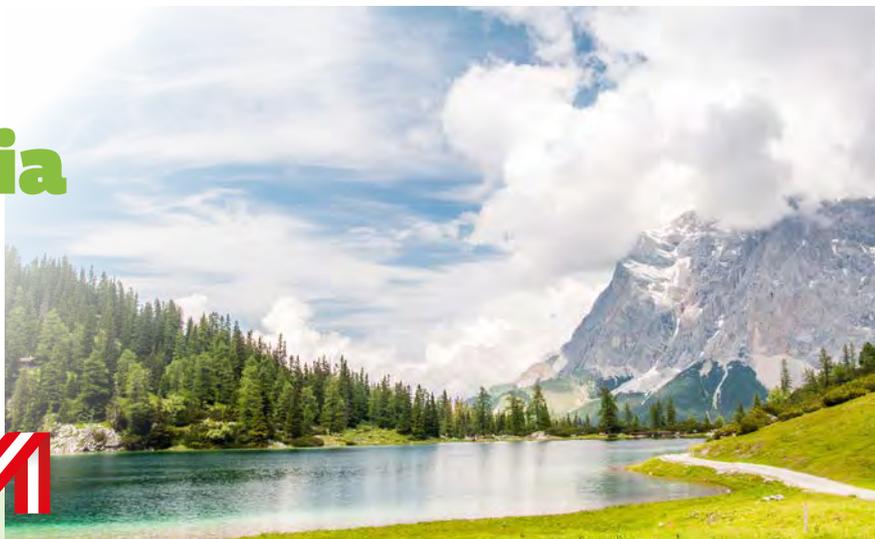
Technical Facts

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- Over 15 year's life
- Capacity from 5 to 30 kWh
- Expandable and scalable up to several MWh
- AC/DC coupling of PV system
- Single phase & three phase
- Emergency power and Island mode function
- Temperature Range -5° to 50°C
- Easy to install (Plug & Play)
- Salt water technology
- Developed & manufactured in Austria
- Modularly expandable

I am from Austria

GREENROCK is developed by BlueSky Energy, the Austrian specialist for stationary storage solutions. Our storage systems are assembled in **Austria**.



The complete system



Interior view: 1-phase complete system with 20 kWh

The Plug and Play system comes with **pre-installed** DC power electronics. The entire system is fully assembled and simple to connect. Please see pictures on page 10.

Container Solution

Container Solutions are perfectly suited for medium-sized to large-sized power storage. The storage units are **scalable and expandable** up to several MWh.

BlueSky Energy offers ready-to-connect complete solutions. Power electronic components are included.



GREENROCK – container solution for various MWh

Advantages & Highlights of Saltwater Technology

- + The safest and most environmentally friendly power storage
- + Non-flammable cell – not explosive
- + Absolutely maintenance-free
- + Ready to connect Plug & Play complete storage system
- + Non-toxic materials
- + Environmentally friendly salt water-based electrolyte
- + Made out of common, non-toxic raw materials
- + Absolutely safe to touch
- + 100% deep discharge
- + Overloading not possible
- + Long system life, also in the state of deep discharge and partial charge
- + Security against vandalism
- + Wide operating temperature range -5°C to 50°C
- + No separate building regulations (like air conditioning)
- + Requirements for battery compartment,)
- + Transport as harmless goods – no ADR (no hazardous goods)



Salt Water Technology

To face the challenges of increasing energy consumption and increasing use of **renewable energy**, power storage systems are needed. High performance, safety, **cost efficiency** and sustainability are most important.

We offer the **world's safest & most environmentally friendly** salt water based battery. The patented Aqueous Ion Exchange Battery (AIB™) is proven in thousands of systems. The batteries are closed energy storage systems based on **saltwater electrolyte**. Power storage is made out of common, non-toxic raw materials and cost-saving production techniques.

Saltwater batteries are completely **maintenance-free** and optimized for daily deep discharge. Frequent partial charge and discharge cycles do not have any influence on the life of the battery.

Performance and operating Data

at 25°C

Nominal Energy	2.5 kWh
Nominal Voltage	48 V
Voltage Range	35 V – 60 V
Charging Profile	CC (constant current)
Usable depth of discharge (DOD)	100 %
Efficiency	88 %
Max. charge current	20 A
Max. discharge current	20 A
Operating temperature range	-5°C – 50°C
Storage temperature range	-5°C – 50°C
Life cycle	5000 cycles @ 80%



Physic characteristics

Height	960 mm
Width	313 mm
Depth	329 mm
Weight	140 kg

Warranty

10 years	acc. to warranty conditions
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Construction of the Saltwater Battery



Stainless steel

Stainless steel current collector



Based oxide

Manganese oxide cathode



Cotton

Synthetic cotton separator



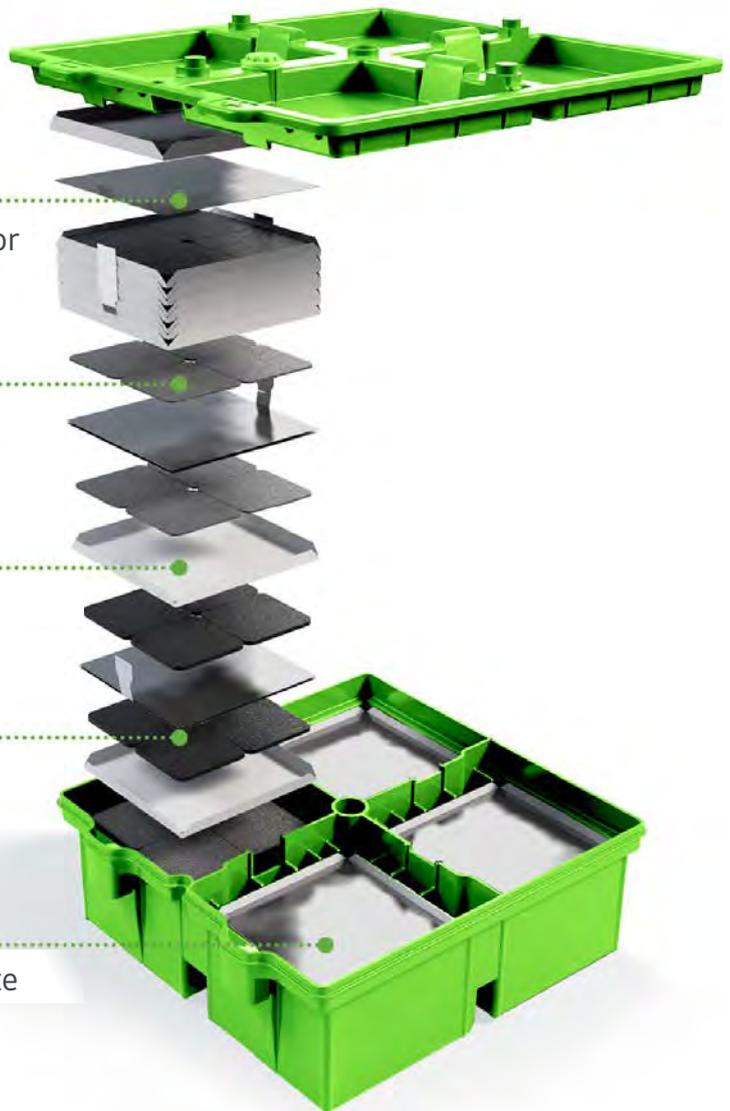
Carbon

Carbon-titanium phosphate anode



Salt water

Alkali ions saltwater electrolyte

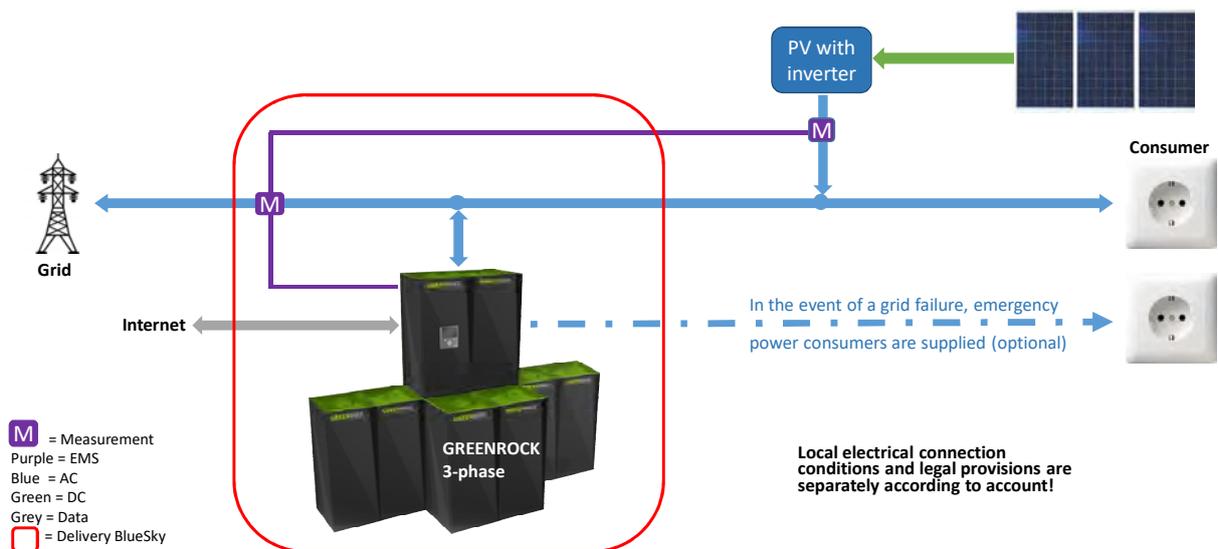


This unique technology provides sustainability for the environment & maximum safety in your home.



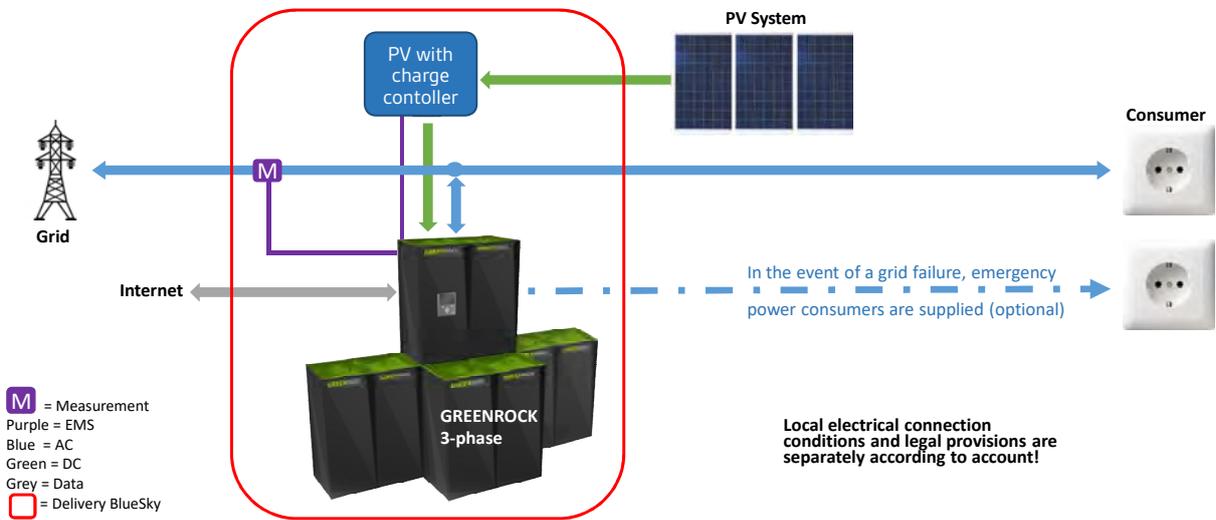
System Diagrams

AC coupling



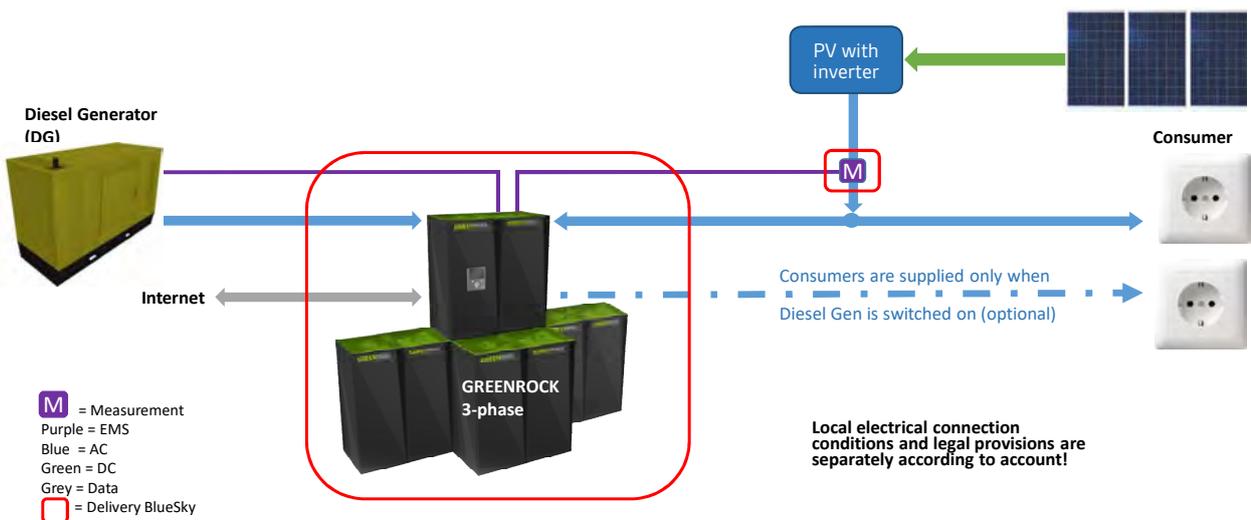
Schematic representation of a 3-phase (1 phase similar) battery system with AC-coupled PV plant. The system is perfectly suited for self-consumption of a new or existing PV system. In accordance with the AC installation certain consumers can be supplied even when a power failure from the memory.

DC coupling of PV systems with charge controller



Schematic representation of a 3-phase (1 phase similar) battery system with DC-connected PV system. The System is perfectly suited for self-consumption of a new or existing PV system. Some AC installation can be supplied from the battery even when there's a power failure.

Island solution with AC coupling



Schematic representation of a 3-phase (1 phase similar) battery system as a stand-alone solution with AC-coupled PV. Switching to stand-alone solution for power failure occurs automatically within <20ms.

Assembly

Simple and Easy



Applications

- Private**
- + Family homes
 - + Apartment buildings

- Industrial**
- + Wineries
 - + Agriculture
 - + Data centers
 - + Restaurants and hotels

- Large-scale plants**
- + Container solutions

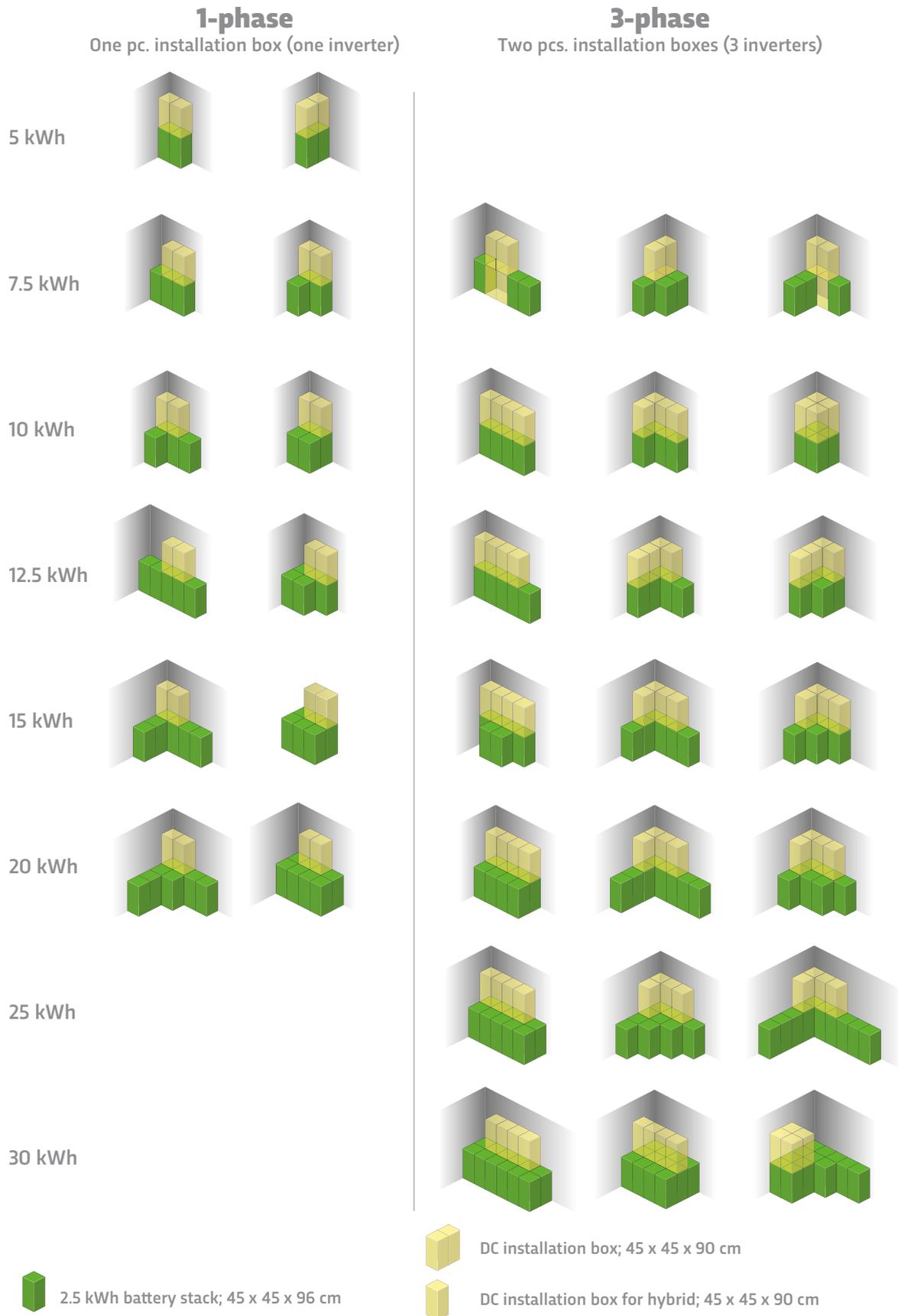
- Back-up solutions**
- + Telecommunications (local back-up storage on site)



18 kWh, Emsland, Germany

Examples for set-up of GREENROCK

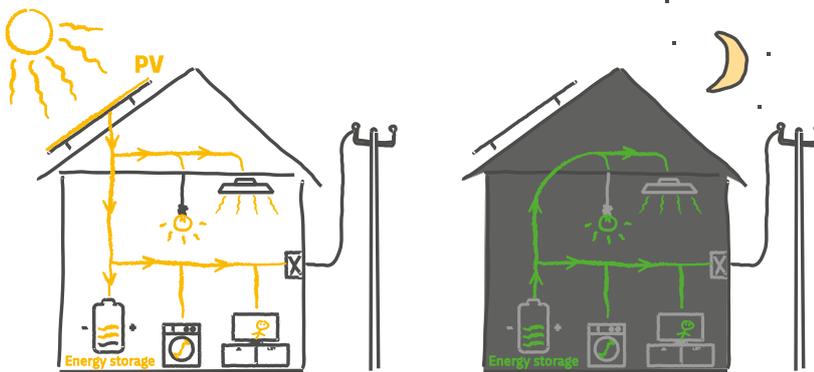
1-phase and 3-phase



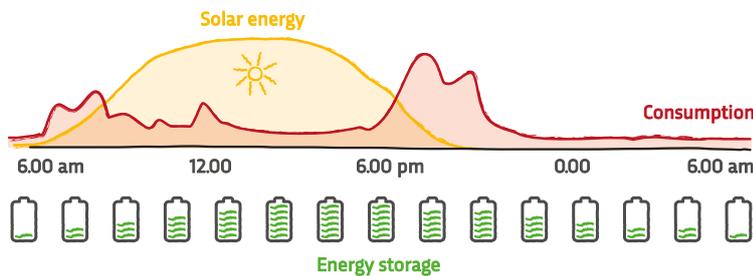
Storing photovoltaic power

Why save electricity at all?

- + Increased self-consumption from the photovoltaic or wind turbine
- + Direct consumption of own **environmentally friendly** electricity
- + **No risk** regarding fluctuating feed-in tariffs offered by the network provider
- + Increased self-consumption **lowers electricity costs** from grid operator
- + No debate of origin (nuclear power, coal-fired power plants, ...)
- + Emergency power supply: fridge and freezer, alarm system, ventilation, utilities for animals on the farm, and much more stay supplied
- + Island-compatible storage solutions - your own **self-sufficient** network. You have light when other homes remain dark in the street.



Energy flow during the day (using a PV system with energy storage)



Perfectly customized size of a photovoltaic storage system

Depending on **local conditions** and energy a power storage in the ratio 1: 1 to 1: 1.5 to the kW_{peak} power of the PV system is recommended.

A larger storage provides **safety** with increased consumption, more reserve in case of power failure and is more durable.

Example: PV system with 8 kW_p – Photovoltaic storage with a size between 8 to 12 kWh storage capacity.



Energy Storage Contracting

What is meant by Contracting?

The power storage is rented for a certain duration. From the beginning of the contract the storage can be fully utilized. Contracting is especially interesting for commercial applications.

Advantages

- + Higher economic returns than costs from the first hour on
- + Constantly generating profits without the hassle of investing in advance or calculating investment scenarios
- + Risks regarding functionality of the energy storage device are with the contracting provider.

Terms of Power Storage Contracting?

The term may vary, terms between 5 and 12 years are common. Mostly there are options for the customer to buy or take over the electricity storage at specific dates and at defined prices from the contracting provider.

What happens in case of failure of the power storage system?

The contracting provider guarantees the operability of the electricity storage. Within agreed response times, the contracting party must restore the performance of the power storage according to agreed conditions. If this is not the case, the contracting fee may be reduced. The risk of functionality lies with the contracting provider. The customer guarantees certain conditions for operation of the electricity storage (e.g., temperature in the battery room, driven cycles ...)

Contracting facts using an example

Assumed installation in Austria. Investment in 60 kWp photovoltaic and 60 kWh electricity storage.

Overall investment – without incentives	114.000 €
Electricity costs /kWh	0,15 €
Contracting-fee/year	10.400 €
Yield/year in average*	11.377 €
Profit/year	977 €

*Yield from electricity cost savings: Assuming the electricity price remains the same. Eventual increases of the electricity price lead to increased income and tax deductibility of contracting the fee at an assumed rate of 25%.



WaterNest design by Giancarlo Zema

Self-sufficient off-grid energy supply with a **Solar island system**

Self-sufficient power supply is referred to as **off-grid**. A separate independent power grid is set up. Generators such as PV system and consumers are connected. The heart of this circle is the combination of electricity storage, inverter and **energy management system** (EMS).

Calculation and dimensioning of an island system

- + List power consumption and distribution (day / night and season)
- + Note seasonal fluctuations such as heating, air conditioning.
- + Based on the consumption data, the desired power generation is defined.
- + Energy production by photovoltaic, small wind power, diesel generator or even a combination of different producers.

The power storage system takes over as **buffer function**. Surplus or Shortage of produced power is compensated and stored. Critical consumers are powered by the battery, if the sun is not shining and the photovoltaic is not supplying power.

The GREENROCK product line offers an all in one integrated system with power storage, inverter and energy management system (EMS). Different producers and consumers can be integrated over **open interfaces**.

Advantages of GREENROCK as self-sufficient off-grid energy supply

- + Depth of Discharge (DOD) 100 %
- + 100 % maintenance-free. Rely on the systems functionality while being off-grid.
- + Made out of natural materials. No restrictions regarding transport, storage and operation.
- + Easy and fast installation (Plug & Play)
- + Low self-discharge enables effective operation of the PV island system

Energy Management System (EMS)

GREENROCK Energy Management (EMS) will help you:

- + To achieve independence from rising electricity prices.
- + Perfectly increase self-consumption, ie. less electricity purchase.
- + To achieve a high level of self-sufficiency, 98 % is seriously possible.
- + Use the electric power directly where it is produced.

GREENROCK Energy Management System provides control and access to:

- + Energy flow of photovoltaic
- + Energy flow of battery incl. visualization
- + Temperature monitoring and warning function
- + Energy flow of inverter including visualization
- + Overview of the energy balance (how many kWh were produced by the PV, how many kWh were purchased, consumption balance)

Additional up-grades possible at any time:

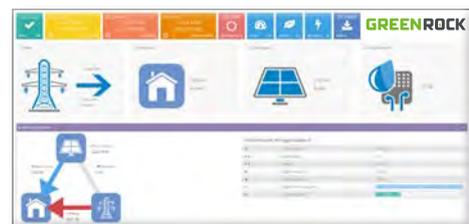
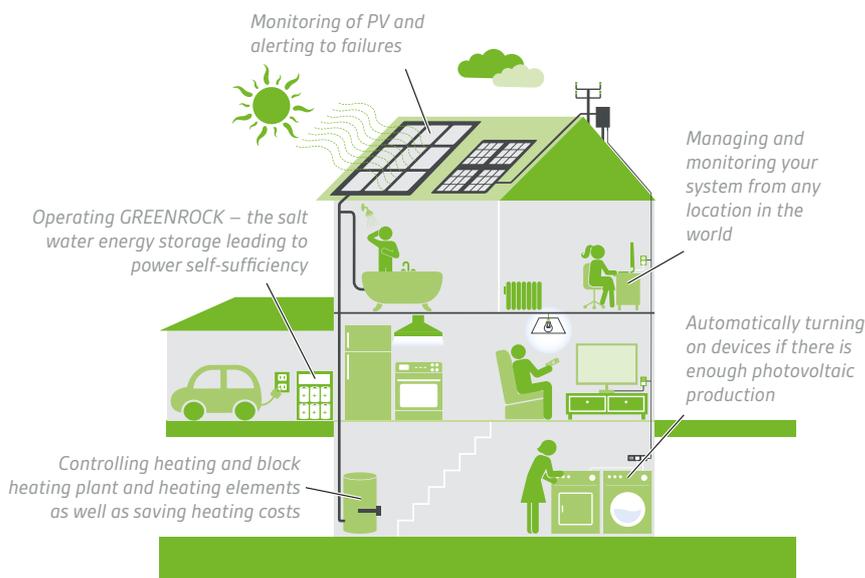
- Integration with heating element
- Integration with heat accumulator (water boiler)
- Integration with heat pump
- Integration with electric filling station
- Integration of peak shaving / load shedding (load management)

Wide scope of applications:

- + Integration of various producers (PV, wind power, thermal, CHP or diesel generator)
- + Networking / Clustering of multiple memories and control as off-Grid or microGrid solution

Agricultural and commercial solutions:

Perfect coordination between energy production and consumers. Especially in agricultural applications milking and feeding stations can be perfectly coordinated.



Example: visualization of energy flow

References



Farm in Austria

72 kWh grid-connected system for increased solar self-consumption and **self-sufficiency**.

Farmer Jürgen Hutsteiner can self-sufficiently provide his farm with 10,000 chickens and cultivated areas in



the summer months. With his **electric car** he delivers eggs to local restaurants and markets. The electric vehicle is charged with the produced solar energy.

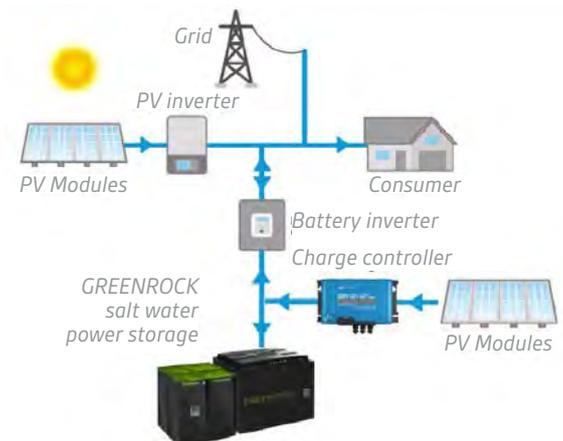
- + Safety for residents and animals at the farm
- + Emergency power supply: constant power supply from the saltwater battery in case of power outage
- + Significant savings in electricity bills
- + Perfect improvement of self-consumption from the PV system

CO2 neutral eggs from the area



"Our GREENROCK power storage system in combination with the PV plant is nearly 100% self-sufficient in summer time. Thanks to island mode function ventilation, lighting and operating features are working properly in case of an outage by the power supplier. Our animals are never in danger."

Jürgen Hutsteiner, farmer, Steyr, Austria



Swedish school relies on safety



Tiundaskolan Uppsala - Safety is our top priority

On the occasion of the opening of the Energy Fair in Uppsala (Nov. 2017), Deputy Mayor Maria Gardfjell emphasized the issue of security. There where children are around absolutely **no threats of danger** are accepted. Risks of explosion or fire of lithium-ion batteries must be excluded at 100%. Decision had clearly fallen for the safe **salt water technology**. After all, it's about our children and our future.

- + Safety of children is number one priority
- + Highest energy and environmental standards
- + at first expansion rate photovoltaic system is aligned with 24 kWh GREENROCK saltwater energy storage
- + Awareness raising among students. This generation will shape our energy future.



"When we were assigned the task of building the brand new Tiunda school, the goals regarding energy and environmental standards were set pretty high. With GREENROCK we are sure to fully use the solar system and to cut power peaks."

Micael Östlund, technical manager
Skolfastigheter, Sweden

Tyrol Using own solar power around the clock



„Previously, we had to give away surplus solar power to the grid operator and buy expensive solar power again at night. Thanks to GREENROCK power storage, we can now use our own solar power around the clock and are largely independent of the price of electricity.,, Anita L. Austria

GREENROCK 12 kWh storage Chemnitz

New company location - new energy concept

The PV system and GREENROCK provide safety at the new workplace.

Energy security through electricity production from the own PV system and storing the surplus energy in the GREENROCK storage with included **emergency power functions**.

Occupational safety through safe saltwater technology. GREENROCK is neither flammable, nor explosive nor toxic.



GREENROCK can be found in the storage room, Germany

Regensburg GREENROCK 10 kWh storage



Objectives: Covering annual electricity consumption of approx. 5000 kWh with own solar energy. Installation of 10 kWp solar system and 10 kWh electricity storage.

Safety and environment are the focus. No dangerous or limited raw materials are used for energy storage.

- + PV system for self-consumption
- + Excess energy is cached with GREENROCK
- + Emergency power network is set up in the event of a power failure
- + Switch output for additional consumers such as electric car or heating element available
- + Data on PV and power storage can be called up directly via the WLAN function and app

Objectives: All energy produced by the PV system is consumed directly. No feedback to the grid of the power supplier.

24 kWh GREENROCK electricity storage and 10.8 kWp solar system. **State funded subsidy** made investment even more interesting.

Belgium Car garage relies on clean energy

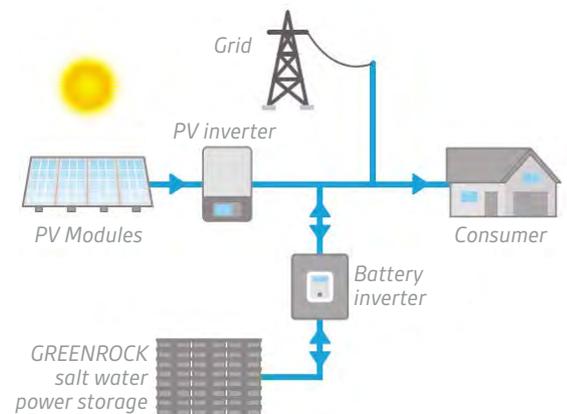




Multi-family house in Styria

24 kWh grid-connected system for increased **solar self-consumption** with emergency power function and island solution.

An apartment building in Styria relies on solar energy. The installed PV system supplies power for immediate consumption, charges the saltwater batteries and supplies a **hot water tank**. The optimal distribution and accurate billing of self-generated energy is ensured by **digital electronics**. The builders aim was to save green electricity in a green technology. The chosen batteries work with salt water instead of toxic materials and are therefore harmless.



"The project was born out of the idea to entirely supply a multi-family house with solar energy. Generous photovoltaic areas provide energy that is converted into electricity and heat. The power storage serves as a buffer when no sun is shining. The GREENROCK storage provides us with an economical solution and maximum security.,,"

Paul Langmann, Langmann Consulting, Austria

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