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SOLA ⚡ **SOLA EV**
ENERGY

SOLA

EV CHARGING STATIONS /
INDUSTRIAL ENERGY STORAGE SYSTEMS /



Manufacturing facility
with an area of **3000 m²**

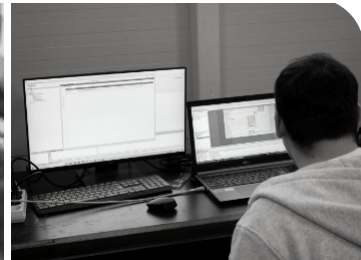
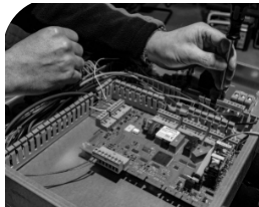


SOLA

In-house R&D Department

An internal research and development (R&D) department composed of design engineers, software engineers and electrical specialists.

This team ensures continuous technological improvement and the creation of innovative solutions in the fields of heat pumps, charging stations and energy storage systems, meeting the highest standards of quality and performance.



Application areas of **SOLA TITAN**



AIRPORTS / RAILWAY STATIONS / PORTS / BUSINESS CENTERS /
PRODUCTION FACILITIES / FACTORIES / UNIVERSITIES / SCHOOLS /
HOSPITALS AND MORE

- ✓ **PRODUCTION FACILITIES**
- ✓ **COMMERCIAL BUILDINGS**
- ✓ **ENERGY COMPANIES**
- ✓ **PUBLIC INSTITUTIONS**



SOLA Titan

Industrial Energy
Storage Systems



Capacity up to **4 179 kWh** in a 20-foot container
and customized larger projects

POLISH
MANUFACTURING



Solution
Partner
Building
Technologies

SIEMENS

Control your expenses **AND ENERGY SAFETY**

✓ **PROTECTION DURING POWER OUTAGES**

The system ensures the ability to maintain the operation of critical equipment even in the event of unplanned outages. It allows you to preserve business continuity and avoid unnecessary downtime.

✓ **MAXIMIZE SAVINGS**

Optimizing energy consumption allows for better management of operating costs (OPEX). The system supports more efficient use of available energy resources



Control your expenses **AND ENERGY SAFETY**

✓ **PROTECTION AGAINST CYBERATTACKS**

EMS has European certificates for protection against attacks from third parties and a built-in specialized crypto protection chip, communicating exclusively with EU servers.

SOLA
ENERGY ⚡

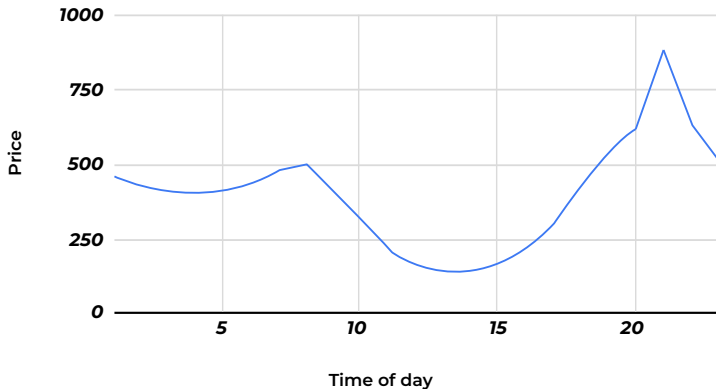


SYNCHRONIZED AND AUTOMATED TRADING OF ELECTRICITY ON THE RDN MARKET

The system buys electricity at a low price and sells it at a high price during peak hours.

Average RDN energy prices

**Example*



BALANCING MARKET

The balancing capacity market is open to entities that wish to participate in the process of maintaining the stability of the power system.

This system is composed of, among others:

- Balancing Responsible Parties (BRP) – trading companies that buy and sell electricity.
- Balancing Service Providers (BSP) – companies operating energy storage systems and RES (Renewable Energy Sources).

Is it worth investing in a commercial energy storage system to participate in the balancing market and the capacity market? Definitely yes, because:

- The daily cost of balancing market capacity reaches up to several tens of millions.
- The average price for 1 MWh of balancing capacity exceeds 300.
- The highest volume of energy and its value are recorded in the case of the automatic Frequency Restoration Reserve (aFFR) mechanism.

Commercial storage systems, thanks to their advanced functionalities and support for power reserve mechanisms used by Transmission System Operators (TSO), become an ideal tool for achieving business goals in the form of profit from energy trading and balancing.



OPERATION OF BALANCING MECHANISMS

The Transmission System Operator (TSO) utilizes the following balancing mechanisms:

FCR(Frequency Containment Reserve) – primary control that operates automatically, with activation occurring no more than 30 seconds. The storage system allows for a reaction to frequency changes in a very short time (measured in milliseconds).

aFRR (automatic Frequency Restoration Reserve) – automatic secondary control, with activation occurring within 5 minutes. It balances power and frequency, allowing the grid parameters to return to normal values after FCR activation.

mFRR (manual Frequency Restoration Reserve) – manual secondary control, activated within 15 minutes. Similar to aFRR, the storage system adjusts its charging and discharging in response to signals received from the TSO.

SOLA TITAN industrial energy storage systems support the aforementioned energy market balancing services (including FCR-N, FCR-D, and FFR variants), making them an excellent solution for Distribution System Operators (DSO), solar farm operators, hydroelectric plants, and conventional power plants.



COMPREHENSIVE SOLUTION

The microgrid created by our energy storage system allows for the connection of multiple additional power generation sources at a single point of management.



GENERATORS
16 UNITS



PV SYSTEMS
3 SYSTEMS OF 16 INVERTERS EACH



WIND FARMS
3 GROUPS OF 10 UNITS



ENERGY STORAGE SYSTEMS
4 GROUPS OF 10 UNITS



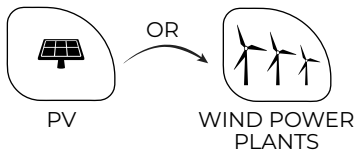
CONSUMER GROUPS
30 CIRCUITS



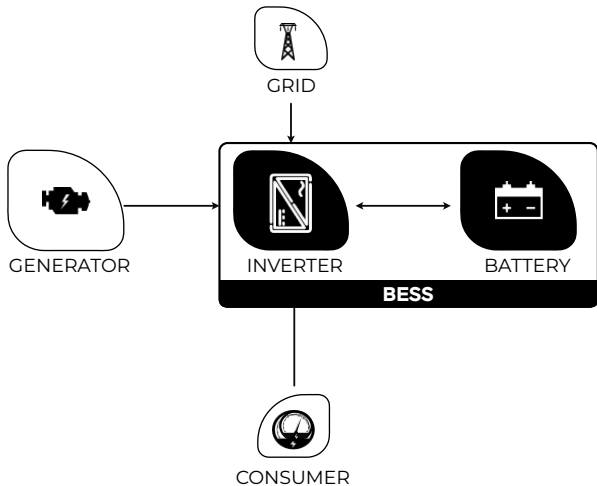
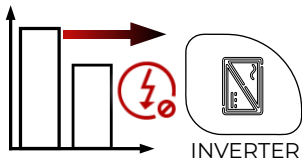
EV STATIONS
30 UNITS

LIMITATIONS OF MOST MANUFACTURERS' SOLUTIONS

RESTRICTION ON CONNECTING POWER GENERATION SOURCES!



THE SYSTEM'S POWER OUTPUT IS LIMITED BY THE INVERTER CAPACITY!

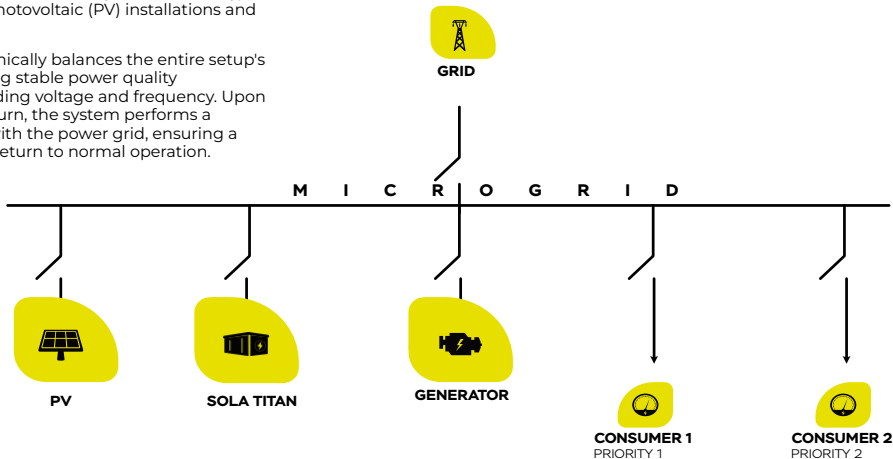


OUR SOLUTION

Upon loss of grid power, the energy storage system's control unit assumes control over the energy flow. The PCS module automatically transitions into microgrid creation mode, managing loads and controlling available energy sources such as photovoltaic (PV) installations and generators.

The system dynamically balances the entire setup's operation, ensuring stable power quality parameters, including voltage and frequency. Upon detecting grid return, the system performs a synchronization with the power grid, ensuring a smooth and safe return to normal operation.

SOLA
ENERGY ⚡



SEAMLESS UPS SWITCHING — WITHOUT AN STS MODULE

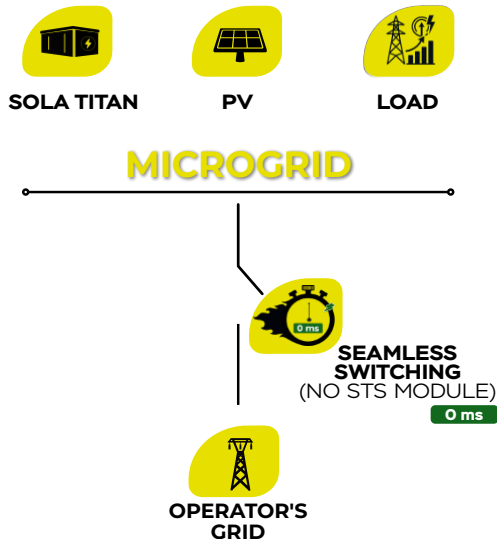
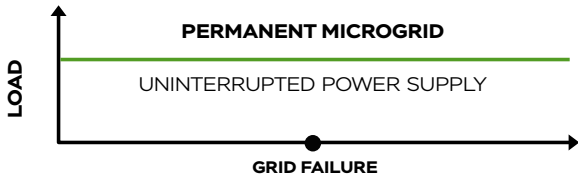
How does SOLA Titan work?

Integrated Microgrid: the PV system, storage system and generator are connected into a single grid. The power sources do not switch over – they operate in parallel.

In the event of a failure in the external grid, the main circuit breaker installed at the point of connection to the grid (PCC) immediately isolates the microgrid.

0 ms Result: The load is continuously supplied from the internal power source, without any distortion of the sine wave or voltage spikes.

The Advantage: All-in-One system - no external STS modules in the system and uninterrupted power supply.



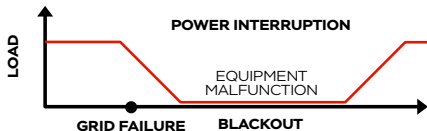
SOLUTION OF MOST MANUFACTURERS

How competitors' BESS systems work

The inverter, synchronized with the grid, supplies power to the loads. In the event of a utility failure, it must transition to autonomous mode. When power is lost, the STS module disconnects the grid; however, the inverter momentarily ceases operation and enters autonomous mode only after a significant delay. The fault detection process requires the external STS to first register the grid outage, which typically takes approximately 20 ms. Only after this detection is confirmed does the STS physically switch the contacts.

The main problem:

The **STS** acts as a Single Point of Failure. During this transfer process, a power "flicker" (voltage drop) is inevitable, posing a serious risk of damage or resets to sensitive electronic equipment.



COMPETITORS' ENERGY STORAGE SYSTEMS

ON-GRID / OFF-GRID



STS

Delay in switching

> 20 ms



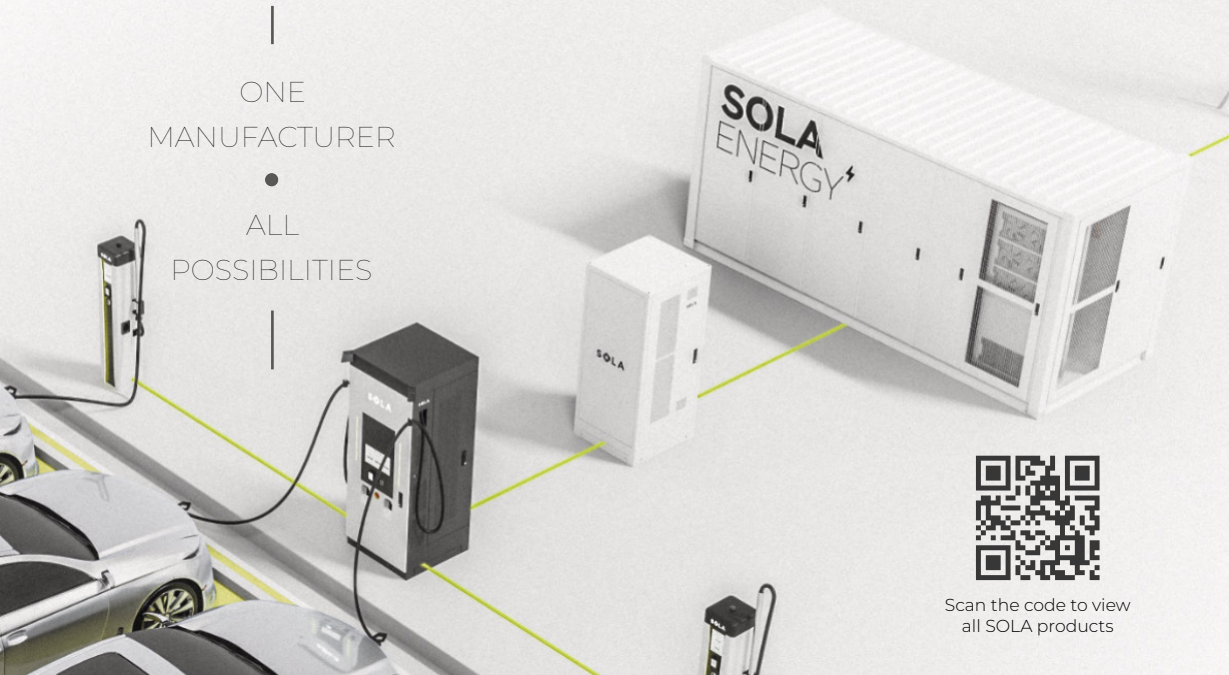
CONSUMER



OPERATOR'S GRID

|
ONE
MANUFACTURER

•
ALL
POSSIBILITIES



Scan the code to view
all SOLA products

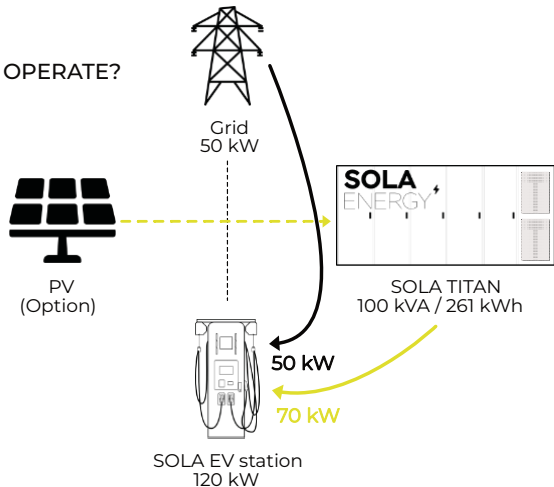
INTELLIGENT SYNCHRONIZATION OF MULTIPLE ENERGY SOURCES

HOW DOES THE EV + ENERGY STORAGE SYSTEM OPERATE?

SCENARIO 1

In a situation where the utility grid has a power limitation of 50 kW, the SOLA TITAN 100 kVA / 261 kWh provides additional energy for the charging station. As a result, the 120 kW charging station receives 50 kW directly from the grid and an additional 70 kW from the SOLA TITAN energy storage system.

Optionally, SOLA TITAN can store energy generated by solar panels and utilize it to power the charging infrastructure or the facility. This ensures stable operation even in the event of grid overload or limitations, and allows for the optimization of electricity costs.

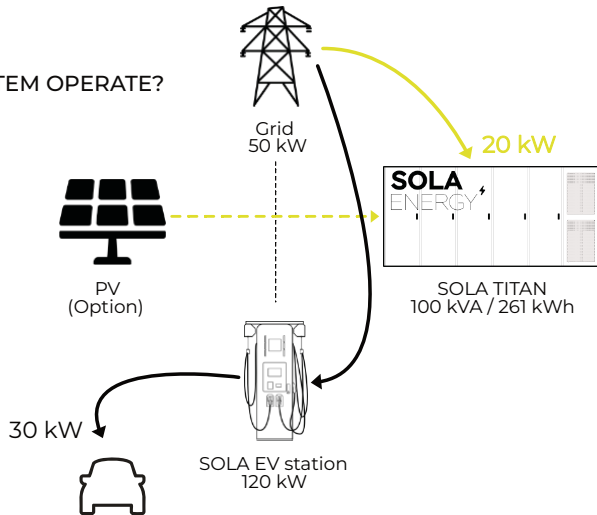


INTELLIGENT SYNCHRONIZATION OF MULTIPLE ENERGY SOURCES

HOW DOES THE EV + ENERGY STORAGE SYSTEM OPERATE?

SCENARIO 2

In a situation where the grid is limited to 50 kW, but the charging station is only delivering 30 kW to the vehicle, the system distributes the energy in the most effective manner. 30 kW is delivered directly to the vehicle charging, and the remaining available grid power – 20 kW – is automatically stored in the SOLA TITAN energy storage system. This approach allows for the utilization of all available grid power and the storage of surplus energy, which can then be used to charge vehicles during the night hours when there is no solar generation. As a result, the system ensures stable operation of the charging infrastructure, energy flexibility, and maximum efficiency in utilizing available grid capacity.



INTELIGENTNA SYNCHRONIZACJA WIELU ŹRÓDEŁ ENERGII

The integration of different energy sources allows for cost optimization, increased reliability, and flexible power management.



Photovoltaics (PV)

A key source of renewable energy,
integrated with energy storage system



Wind turbines

Excellent synergy with
energy storage systems



Diesel generators

Stable emergency source
in hybrid systems



Gas turbines

Flexible source
supporting power regulation



Automatic synchronization
of energy sources in real time



Dynamic switching and power
optimization depending on load



Integration with energy storages
and grid systems

KEY COMPONENTS OF THE SOLA TITAN ENERGY STORAGE SYSTEM



DANFOSS BI-DIRECTIONAL POWER CONVERSION SYSTEM (PCS)

The VACON PCS, manufactured by the Danfoss Group (Denmark/Finland), is responsible for energy conversion, ensuring the energy transfer between the Alternating Current (AC) grid and the Direct Current (DC) circuit.

Its main function is the conversion of voltage and current. The device enables dynamic control of energy flow. It is characterized by low Total Harmonic Distortion (THDi), and an additional LC filter reduces the amount of electromagnetic interference.

HiTHIUM LFP BATTERIES

We utilize batteries based on LFP (Lithium Iron Phosphate) technology, whose key features include safety, long lifespan, and high energy and power density, meeting the requirements of industrial energy storage systems. Each battery module is equipped with a Battery Management System (BMS) from a leading Polish manufacturer.

Key Fact: HiTHIUM ESS Cell 314 Ah battery cells are certified in accordance with international standards and stand out due to the absence of ignition or explosion risk during puncture and crush tests, as well as a wide operating temperature range. Thanks to its high reliability and efficiency, HiTHIUM is listed as Tier 1 by BloombergNEF (2Q \ 2024), confirming high confidence from financial institutions and stable product quality.



KEY COMPONENTS OF THE SOLA TITAN ENERGY STORAGE SYSTEM



INSULATED CONTAINER ENCLOSURE

Effectively protects the energy storage system from adverse external conditions, ensuring stable operating conditions for battery modules and PCS (power conversion system).



**TWO-STAGE PROTECTION
OPERATING IN PARALLEL**

SOLA **SAFE** Anti Fire **EFFECT**

CONTINUOUS LITHIUM
DETECTION IN THE AIR

Aerosol is dispersed within the hermetically sealed,
liquid-cooled battery pack

STAGE 1

STAGE 2

/ Siemens

The entire container is filled with inert gas to prevent the spread of fire due to the SAFE (Sola Anti Fire Effect) system. After replacing the damaged component with a new one, the SOLA TITAN Energy Storage System is ready for reuse.

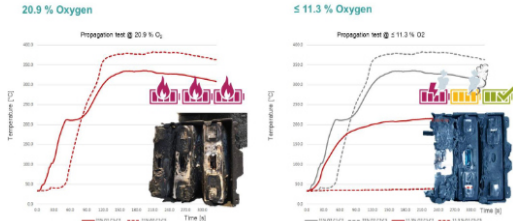


Photo from real-world tests at the Siemens laboratory

*Source: White Paper / May 2021

Fire protection for Li-ion battery energy storage systems.

SIEMENS

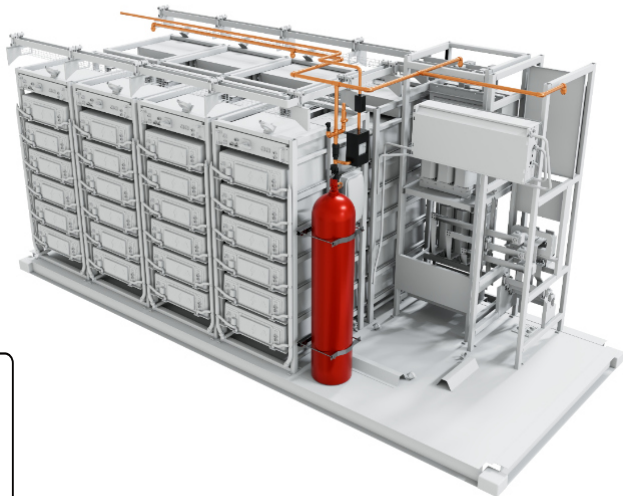
SIEMENS CERBERUS PRO

Fire protection system certified in Europe

An automated fire extinguishing system located in both the battery section and the power converter section.

A two-stage fire protection system ensures early detection of possible sources of fire or overheating of battery cells, resulting in the release of gases, while the activation of the fire extinguishing system itself does not cause damage to battery sections not affected by the source of fire.

Advanced technology for detecting and extinguishing a possible fire minimises the danger and reduces potential material losses to a minimum.



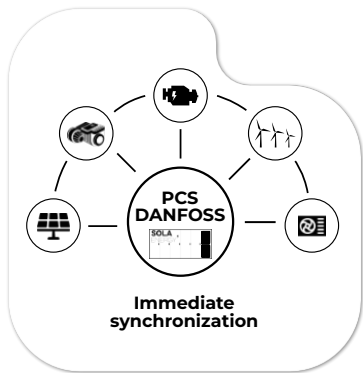
SYSTEM CERTIFIED
IN EUROPE BY VdS

VdS is an independent German research institute that certifies products in the field of fire protection and technical safety.



SOLA **GRID** SYNC

/ PCS DANFOSS



Enables immediate synchronization with the grid
– no interruption occurs in energy storage operation during a grid outage or when the grid returns.



IMMEDIATE UPS
SWITCHING



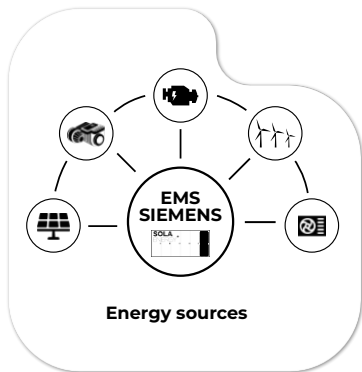
LIQUID-COOLED
PCS



VIRTUAL SYNCHRONOUS
MACHINE MODE

SOLA **GEN** SYNC

/EMS Siemens



Allows operation with multiple energy sources – diesel generator, gas turbine, PV, wind turbine, and others. EMS synchronizes all these devices.



SOURCES OF
RENEWABLE ENERGY



CONNECTION
TO THE GRID



INDUSTRIAL
PROSUMER

ADVANCED LIQUID COOLING

SOLA C-MASTER

Our energy storage systems are equipped with a cooling system that utilizes liquid as the working medium. The unit maintains the optimal temperature for the battery cells and the PCS (Power Conversion System) at approximately 25 °C, which allows for maximizing their lifecycle.

Liquid cooling PCS



Maintenance-free



Keeping electronics in a clean environment.

Baterie oraz PCS pracują w środowisku hermetycznym (nie są narażone na czynniki zewnętrzne - kurz).

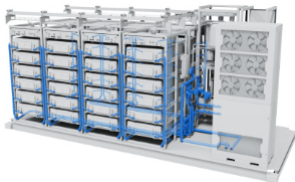
Battery liquid cooling



Temperature stabilized in the 24-26°C range



The optimal operating temperature for the battery is 25°C, which prevents premature degradation.



BENEFITS OF COOLING SYSTEMS

- Reduced Service Costs
- Increased Component Lifecycle
- Resistance to Harsh Industrial Conditions

FUNCTIONALITY



ECONOMY
MONITORING



GRID FAULT DETECTION
AND ISOLATED
OPERATION DETECTION



FREQUENCY REGULATION



CONTROL
OF STORED ENERGY



GENERATOR
CONTROL



CO2
MONITORING



BLACKSTART



COGENERATION SYSTEM
CONTROL



AUTOMATIC
LOAD DISTRIBUTION



ARCHIVATION



SELECTION OF OPERATING
MODES



SERVICE MANAGEMENT
AND CONTROL



EZA / RFG CONTROL



MONITORING
AND REPORTING



BALANCE CONTROL OF
OPERATING TIME



VOLTAGE REGULATION



DSO GATEWAY



BASIC FUNCTION
OF SCADA SYSTEMS



SHORT-CIRCUIT POWER



ENERGY SCHEDULE



LOAD MANAGEMENT



ENERGY RECOVERY
FOR HEATING



CONNECTION POINT
CONTROL



INTEGRATION WITH
PHOTOVOLTAIC SYSTEMS



SCHEDULE OF THE
CHARGE LEVEL



NOTIFICATIONS
AND WARNINGS



POWER SCHEDULE



INTEGRATION WITH
WIND FARMS



LOAD AND PRODUCTION
FORECASTING

INTEGRATION WITH EUROPEAN ENERGY GRIDS

- ✓ Full compatibility with European energy grids thanks to support for IEC 104 and IEC 61850 protocols.
- ✓ Remote control and integration with energy operators across Europe, as well as with SCADA systems via IEC 104.
- ✓ Intelligent automation at the Smart Grid level thanks to the IEC 61850 protocol.

MODBUS
TCP

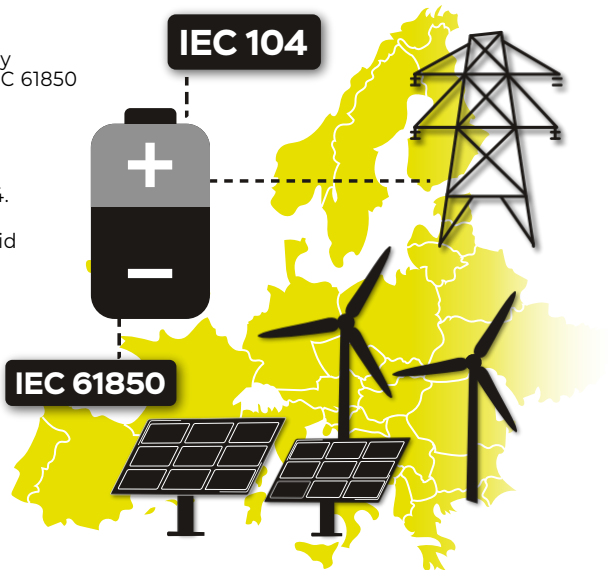
PROFIBUS

PROFINET

DNP3

OCPP

AND THAT'S
NOT ALL!



WE OFFER MORE THAN JUST THE EQUIPMENT!

WE OFFER:

- Solutions to problems during grid failures or disconnections
- Seamless and uninterrupted switchover to backup power
- Microgrid with the capability to connect multiple generation sources
- Cybersecurity
- Automated Business



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