

Restore 500 Containerized Energy Storage System

Büdingen 2016



Powering a world in motion

Restore 500

Advantages

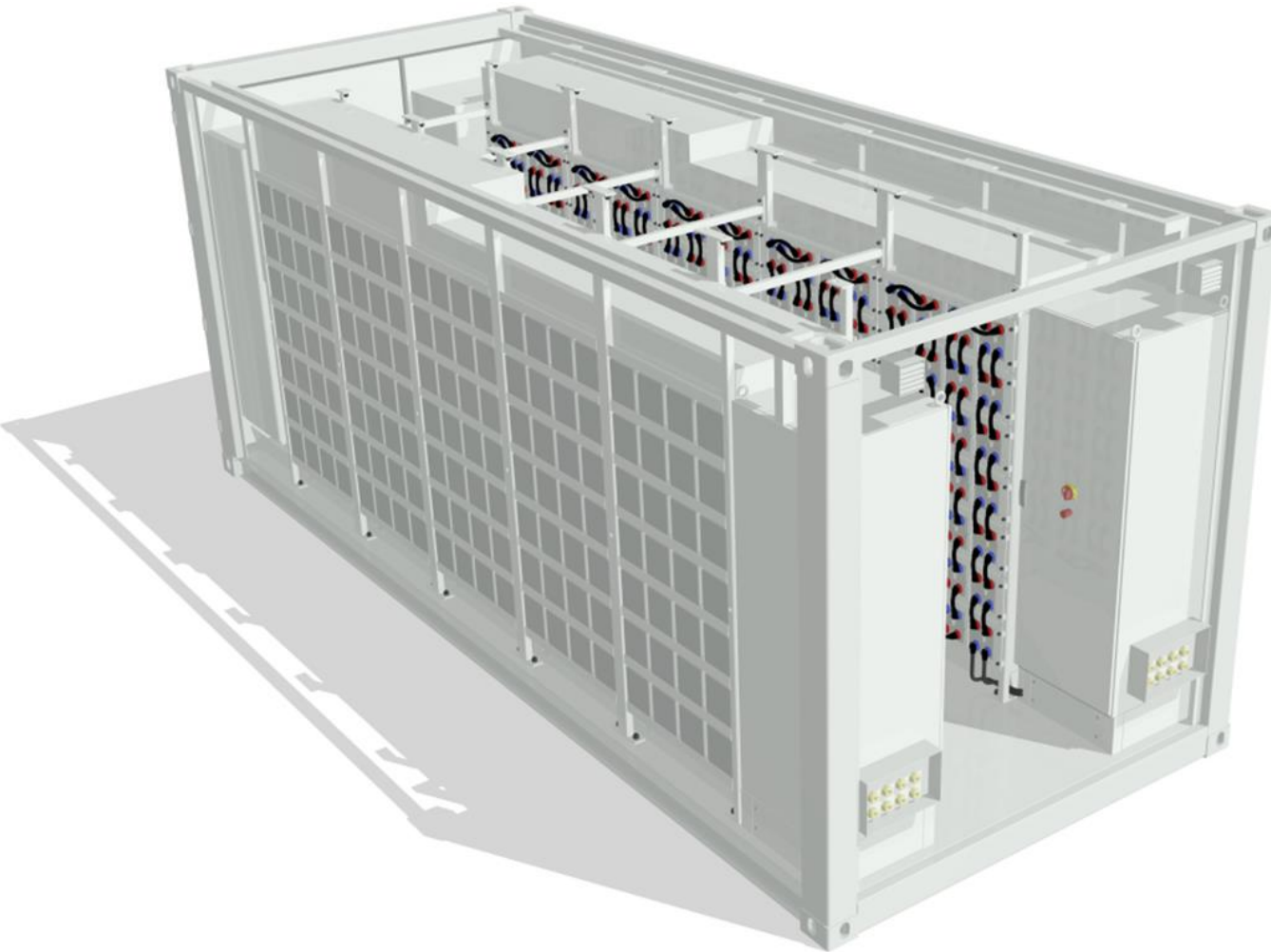
Modular 20 ft energy storage systems

- › **„Plug & Store“**
Turn-key solution, easy to install on customer site
- › **Standardized and certified design**
Standardized building blocks fulfilling all norms for battery rooms, certification according to CE; UL, TÜV and others possible
- › **Ready for worldwide use**
Fulfills all requirements for transport, auxiliary voltage and climatization
- › **Extended cycle life**
GNB[®] battery management algorithms to maximize battery life
- › **Reduction of investment cost**
Advanced lead-acid batteries enable maximum performance at minimum invest costs
- › **Optimization of operational cost**
Significant reduction of total cost of ownership through integration of the cost optimized and durable Restore 500
- › **Environmentally friendly and sustainable**
Recyclable and energy efficient production



Restore 500

System description

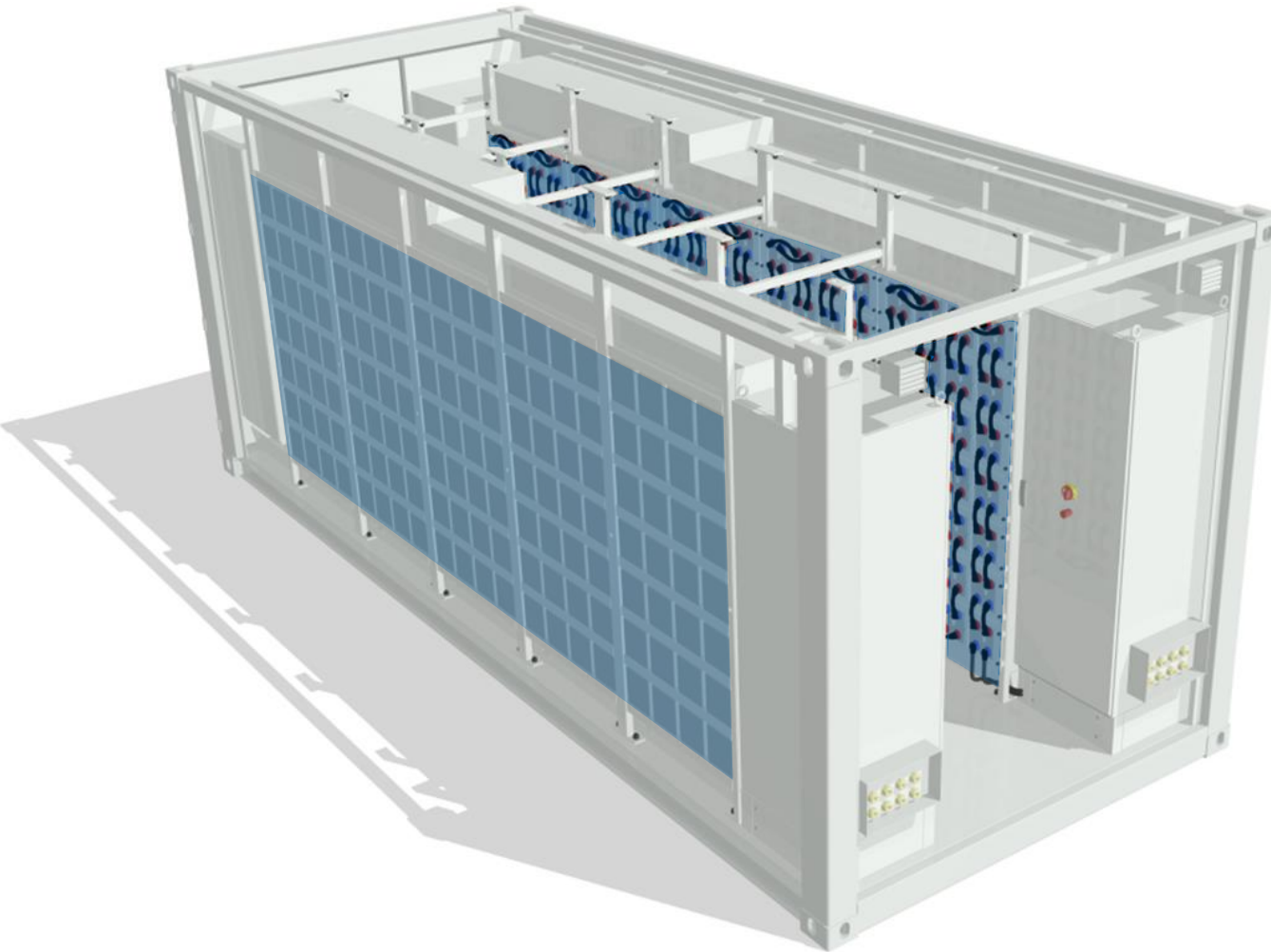


Battery Energy Storage System

- › **Dimensions**
20 ft Standard Sea Container
(6.06 m x 2.44 m x 2.60 m)
- › **Weight**
Whole system app. 27 t
- › **Foundation**
Strip foundation (lengthwise) for 14 t
each (for one container)
- › **Transportation**
CSC certified system
Fully assembled system is
transportable via road and ship
- › **Protection class**
IP 44
Protected against objects with more
than 1.0 mm diameter
Protected against splashing water
from any direction

Restore 500

System description



Cells & Battery

- › **Technology**
VRLA Gel
- › **Nominal battery voltage**
560 V DC
(Voltage adjustment possible)
- › **Battery voltage range**
476 V to 756 V DC
(Voltage adjustment possible)



3000+ cycles*
at 60% DoD
C₁₀



Recyclable



Valve regulated
lead-acid
batteries



Proof against
deep
discharge



Maintenance-
free (no
topping up)

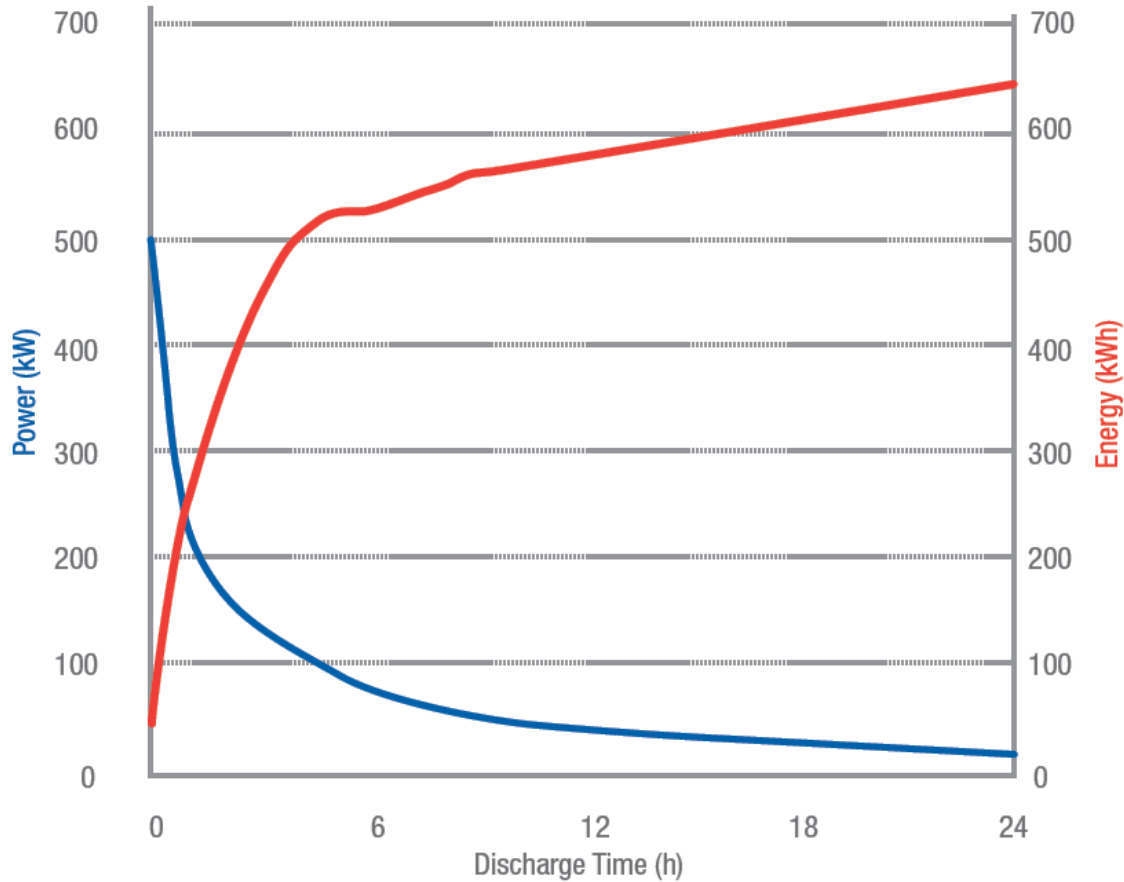


Tubular plate

* with IUI charging, at 20°C

Restore 500

Power and Capacity

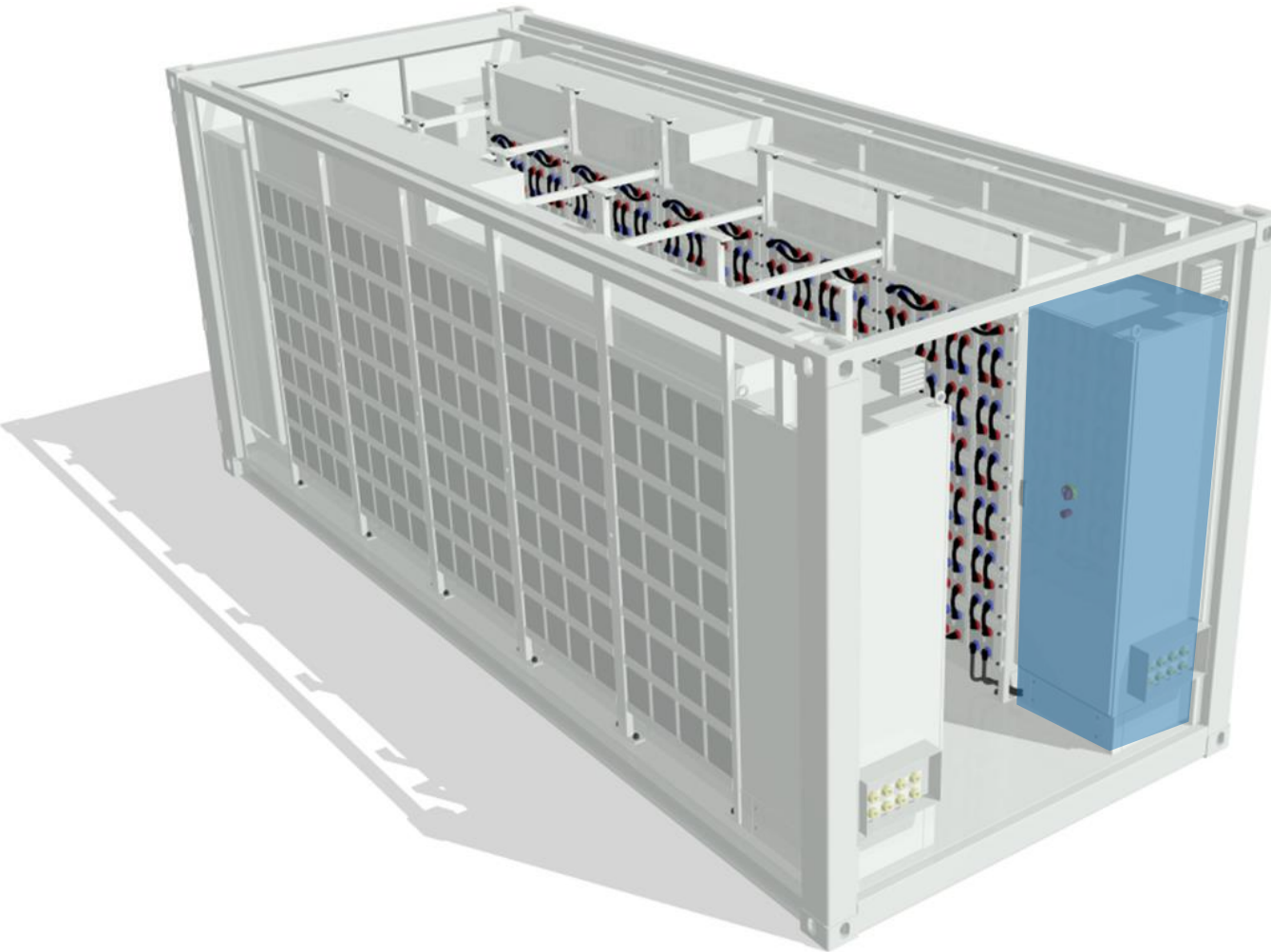


Time [min]	Current [A]	Power [kW]	Energy [kWh]	Capacity [Ah]
5	950	488	40	79
15	926	430	107	231
60	491	245	245	491
120	335	181	362	670
300	181	104	521	907
600	102	56	564	1020

*final discharge voltage 1.6 Volt per cell

Restore 500

System description

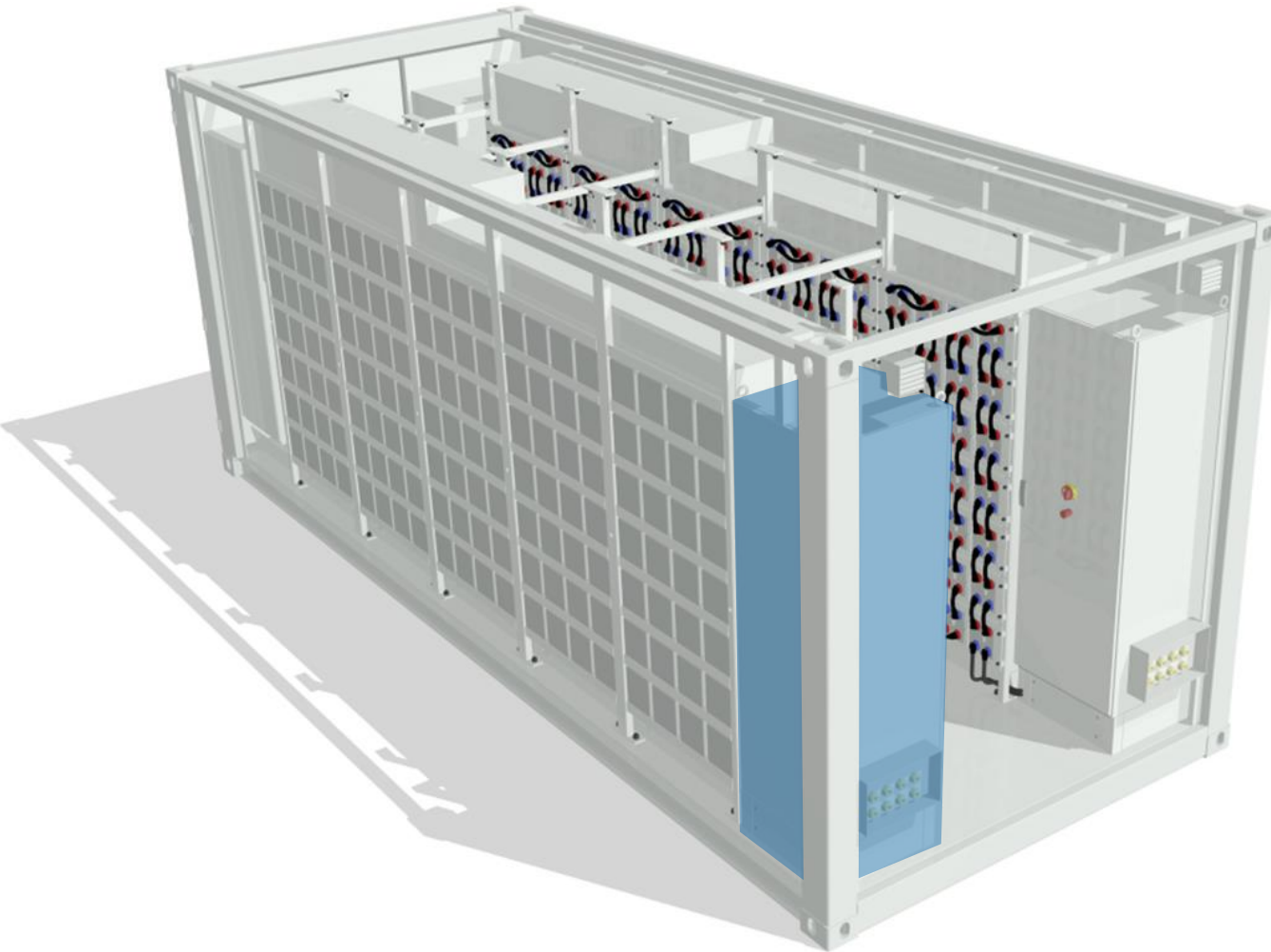


Battery Monitoring & Management System

- › **Measurement**
Voltage, current, temperature, time
- › **Logged Battery data**
Voltage, current, temperature, time, capacity, power, state of charge, state of health (prediction), critical values, maximal values, warnings, errors
- › **Warnings and alarms**
Airflow, insulation and critical values monitoring
Fire and smoke detection system
Safety shut down
- › **Data memory and data logger**
Up to 8 GB locally
Centralized storage of data via safe communication optional
- › **Supported communication**
VPN communication, Ipsec, Modbus
TCP IP/UDP, Modbus RTU / ASCII,
CAN, Profibus, RS232 und RS485

Restore 500

System description

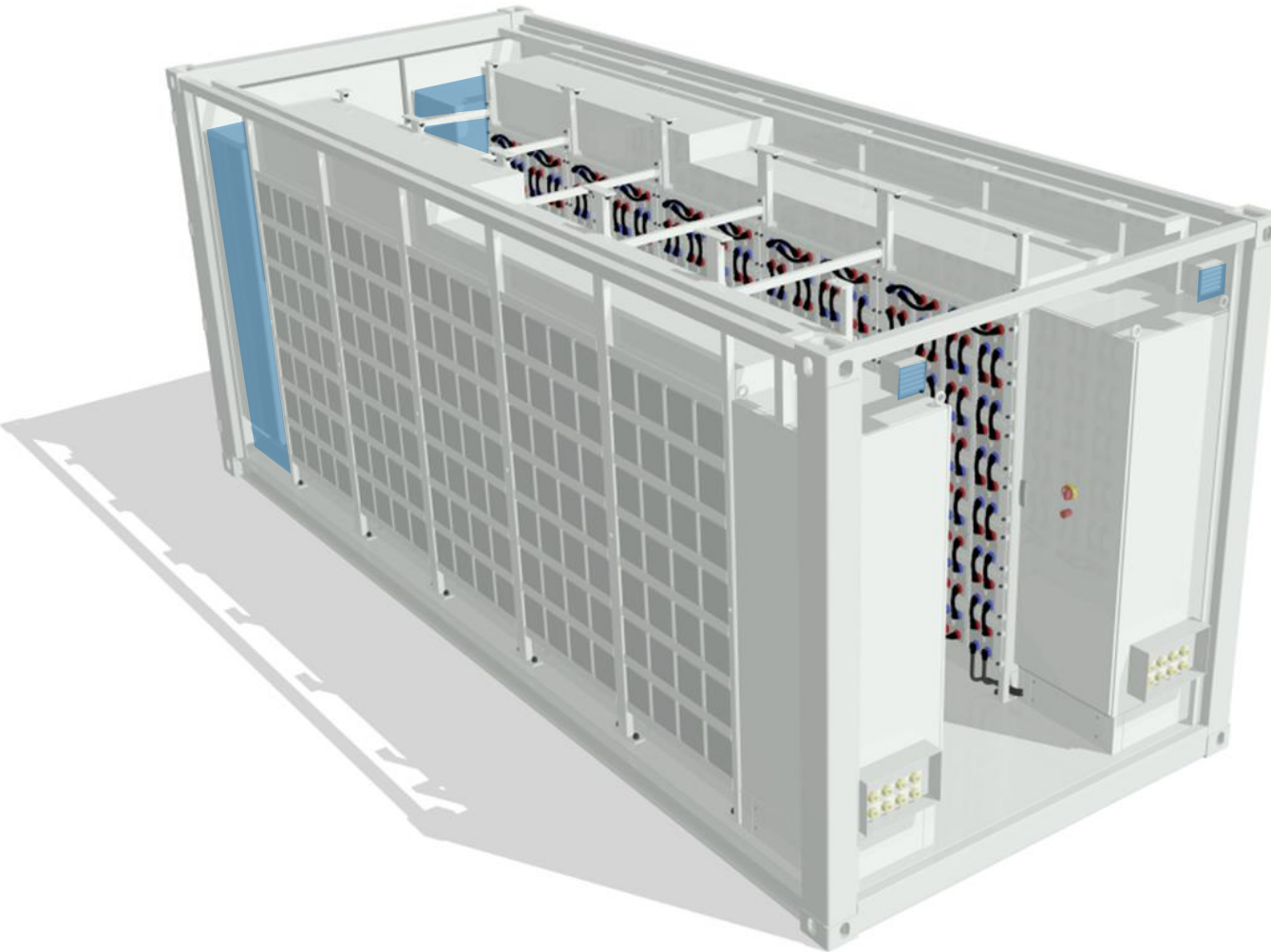


Control & Processing unit

- › **Fuse and circuit breaker**
Shuts down the system even under full load
Controlled by BMS
- › **Auxiliary voltage**
88 V to 260 V
50 Hz and 60 Hz
1 phase
- › **UPS system**
Integrated uninterruptable power supply
Whole systems powers it self for a certain time in case of black out
- › **Insulation monitoring**
Measuring of insulation resistance
Communication to the BMS

Restore 500

System description



Climatization & Ventilation

› Climatization

Integrated climatization for optimal performance and maximal power

› Ventilation

Integrated, redundant and monitored ventilation fulfills all specifications of DIN EN 50272-2 and DIN EN 50272-3

› Environmental conditions

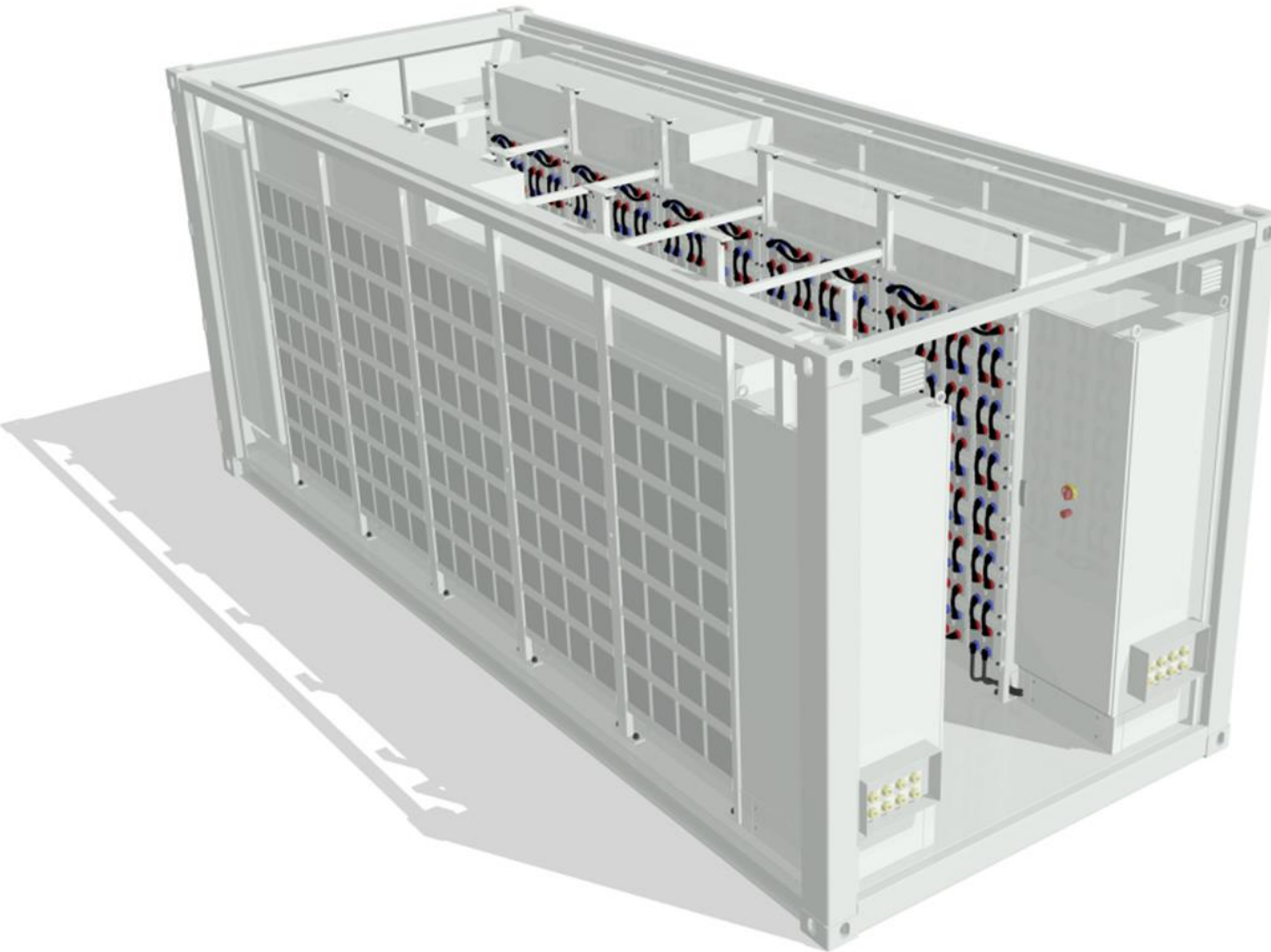
Outside temperature: -20°C to +44°C
Height above sea level: up to 3500 m

Optional:

Outside temperature: -40°C to +56°C
Height above sea level: up to 4500 m
Protection against harsh environmental conditions such as e.g. dust, sand and spin drift etc.

Restore 500

System description

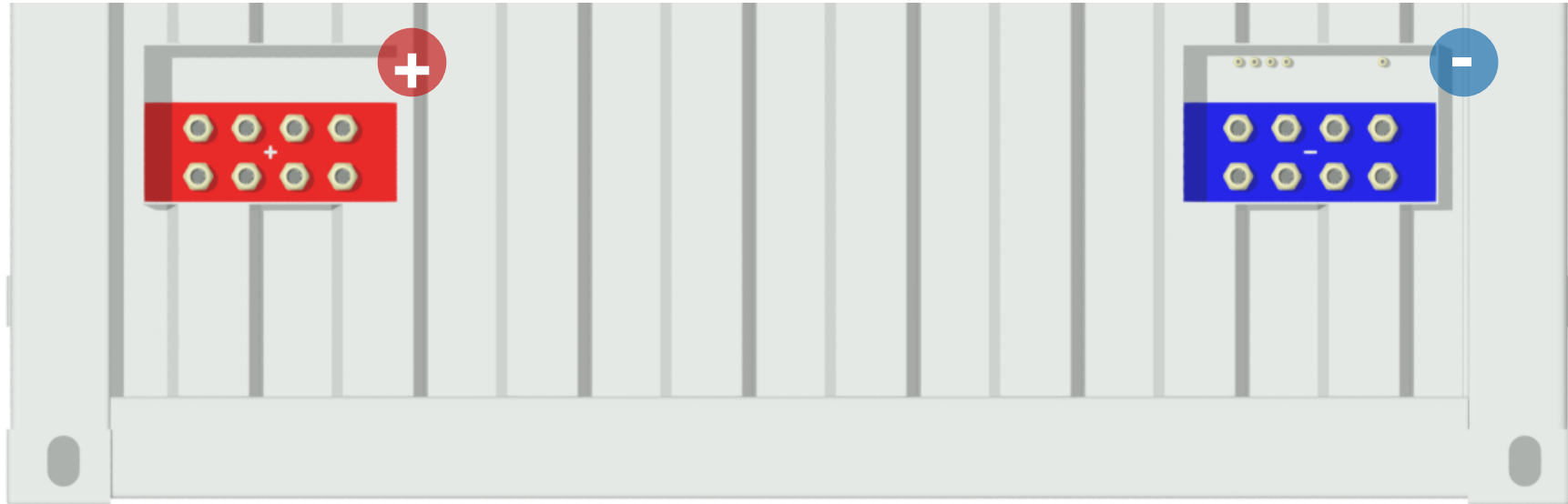


Safety

- › **Emergency stop device**
Triggering the emergency stop puts the system to a safe non-operating mode
- › **Anti panic door / Locking system**
Usage of an anti panic door according to DIN EN 50272-2
- › **Door contact switch**
Opening the door is monitored and puts the system to a safe non-operating mode
- › **Fire detection system**
Fire detecting device with redundant temperature and smoke detection
- › **Lightning protection**
Diagonal grounding points at the corners of the container divert the flash to the ground
Additional lightning protection possible

Restore 500

Commissioning / Installation on customer site (Plug and store)



The Restore 500 system is designed to ensure a fast and easy installation on customer site. The system could be connected with up to eight (8) 300 mm² cables which are connected to two protected copper bus bars in the electrical cabinets.

All delivered Restore 500 systems support of the shelf parallel and serial interconnection.

*in between a defined voltage range

Restore 500

Commissioning / Installation on customer site (Plug and store)

Configuration:

If the technical information about converter manufacturer and application are available the Restore 500 system will be shipped preconfigured to customer site.

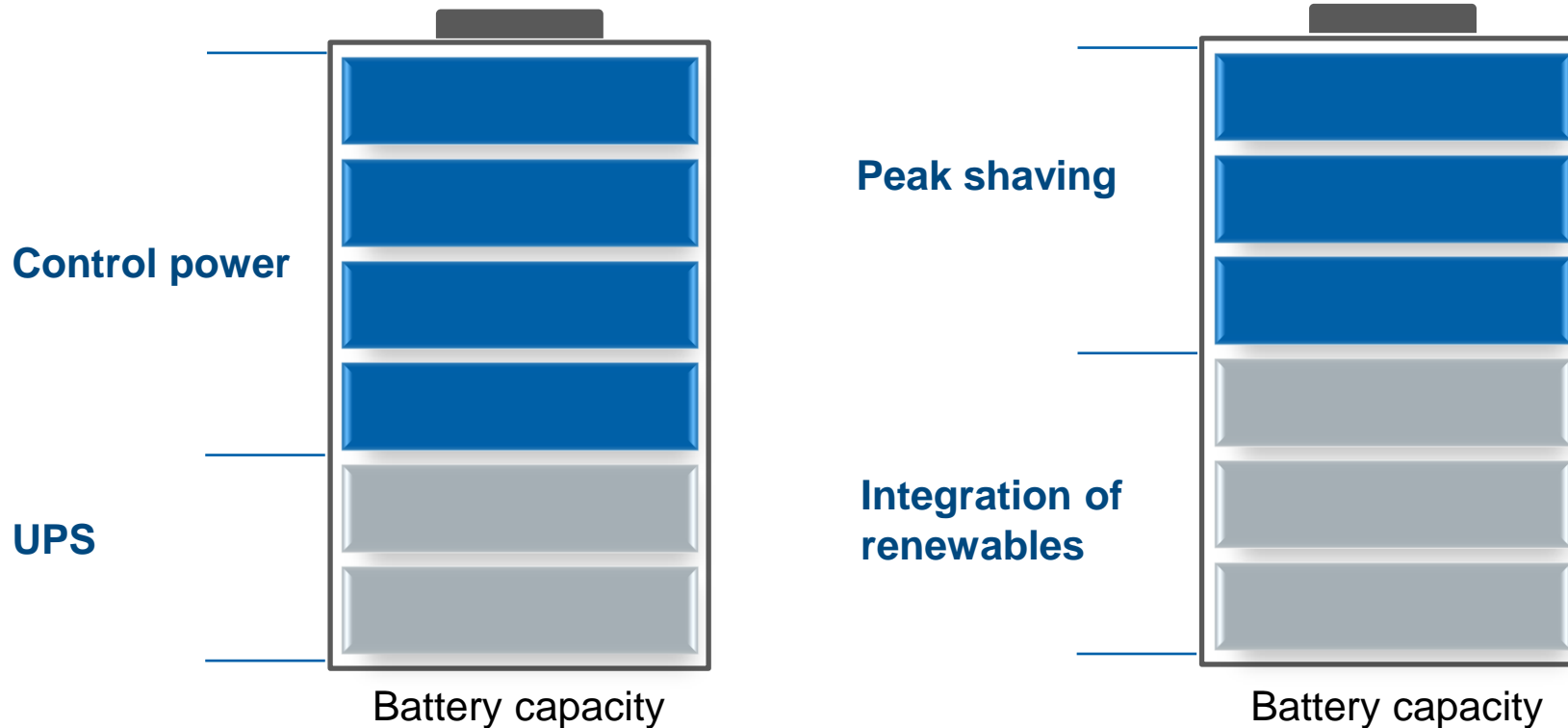
Commissioning:

1. A flat, compressed place has to be provided (e.g. stripe foundation)
2. After the delivery to customer site the system will be checked by an EXIDE technician.
3. Container will be connected to protective earth. (If required installation of earth rod)
4. Auxiliary AC power supply will be connected, checked and documented.
5. Preconfiguration of software and components will be checked, tested and documented.
6. Uninterrupted power supply (UPS) will be activated, checked and documented.
7. Communication system and protocols will be checked, tested and documented.
8. Software tools for communication (VPN communication), passwords, access to firewall and the information for the other security related systems will be given to the customer.
9. DC cables will be connected to the container.

One system multiple applications

Hybrid applications due to flexibility of battery energy storage

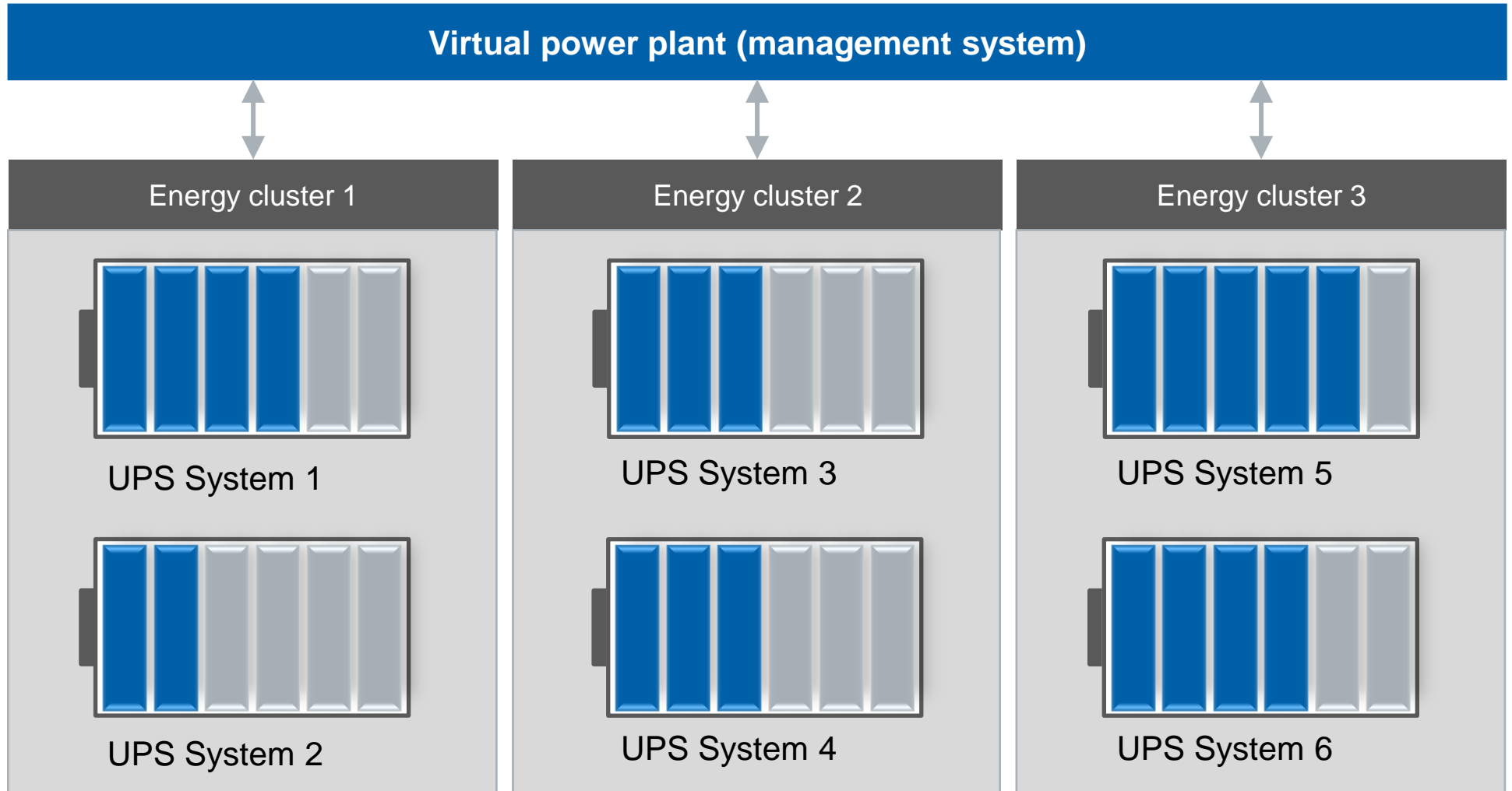
It is possible to provide multiple functions with only one battery energy storage system e.g.



This will enhance the flexibility of the storage system and improves the return of invest (ROI).

Virtual power plants

Coupling of several decentralized systems



Advantages of lead acid technology

Advanced lead acid technology „Made in Europe“



Source: Exide Technologies

- › Demonstrated return of invest in large scale battery energy storage e.g.
 - › BEWAG Battery, Berlin 1986-1995
 - › Metlakatla, USA 1998 until today
- › Storage efficiency up to 95%*
- › Safe Technology with clear norms and regulations
- › Lower costs as compared to other electrochemical storage technologies
- › Fully recyclable storage technology („Closed loop“) Recycling rate of more than 95% (glass: 70%, paper 70,4% in Europe 2011)

*depending on charging strategy and lead acid technology

Applications of Battery Energy Storage

Applications, Subgroups and potential Costumers



› Hybrid and green deployment



- › Optimizing or replacing diesel generators
- › Grid stabilization
- › Grid building

TELECOM
OIL & GAS
MINING
REMOTE COMMUNITIES

› Back-Up Power (UPS)



TELECOM
OIL & GAS
ENERGY
SECURITY

› Renewable Energy Management



- › Own consumption
- › Generation smoothing
- › Ramp rate control

RESIDENTIAL, COMMERCIAL, INDUSTRIAL
POWER PLANT

› Grid & Power Quality



- › Grid stabilization
- › Peak shaving
- › Control power
- › Intraday energy trading

TRANSMISSION SYSTEM OPERATOR
DISTRIBUTION SYSTEM OPERATOR
POWER PLANT

Restore 500

Technical data



	Restore 500	
Norms followed	DIN EN 0100, DIN EN 50272-2, DIN EN 50272-3, IEC 62485-2, 2006/42/EG, Cells are UL certified and fulfill the requirements according to IATA DIN EN 13501 (option)	
Certified according to: (certification ongoing)	TÜV approval	UL approval (US / Canada)
	CE approval	GL / DNVGL approval
	CSC approval	CB approval
Build according to:	ISO 9001	ISO 14001