

# Watt4Ever Circular Battery Energy Storage System Grid-scale systems



## General description

Battery Energy Storage System, containerized in maritime containers, using second-life batteries.

System used for behind-the-meter (peak-shaving, increase of own consumption, energy arbitrage), and front-of-the-meter (grid-services) applications.

## Business case for our clients

Watt4Ever's grid-scale BESS can:

- ✓ **Reduce consumption peaks**, generating savings on the energy bill and deferring investments in new transformers, grid expansions etc.
- ✓ **Allow to integrate more PV and EV chargers**. By reducing peak consumptions, buildings can accept more production and loads without replacing equipment.
- ✓ **Generate savings on energy bill** by storing excess PV consumption.
- ✓ **Ensure uninterrupted power supply**, thus avoiding diesel generators and classic lead-acid battery UPS's.
- ✓ **Generate revenue through provision of services** to the electricity system operators.

## The battery system

The BESS uses CATL Nickel-Manganese-Cobalt (NMC) modules, retrieved from EV applications, designed and built for **top performance and endurance**.

Watt4Ever recovers modules that were not or very little used ("zero-life"). As a result, Watt4Ever batteries display **superior performance and lifetime**, equal to new batteries.

- ✓ The batteries are connected in several HV strings, **tailor-fit for requested capacity and power**.
- ✓ The modules are contained in **custom-made sealed racks**, inside which modules are isolated from each other by steel sheets to avoid fire propagation.
- ✓ Secondary supply systems can also be integrated on demand for **added BESS resilience**.
- ✓ **Cooling is foreseen through air (0,5C systems) or water (1C systems)**.



*Image 1: Sealed battery racks*

## The power conversion system

For its BESS's Watt4Ever builds its own custom-made power conversion cabinets, using top-tier quality equipment from Belgian and EU champion manufacturers such as **Danfoss, ABB and Automation, tested for high performance and lifetime.**

The power conversion cabinets are built to fit client needs in power and voltage. Standard voltage output is **400V three-phase**, but different voltage levels can be integrated on demand for industrial applications.

The BESS's are capable of operating in **islanding and parallel mode**, and are equipped with **emergency stop and a by-pass switch.**



*Image 2: Power conversion cabinets under construction*

## The control system

Benefitting of **years of experience in second-life batteries**, Watt4Ever created its own control systems specifically adapted for second-life batteries used in industrial applications.

The batteries are managed by **Watt4Ever's custom-made Battery Management System (BMS)**, integrating the following functions:

- ✓ Passive cell balancing
- ✓ Over-voltage control
- ✓ Over-current control
- ✓ Over-temperature control

The system is globally managed by **Watt4Ever's Energy Management System (EMS)**, integrating all necessary functions for power control, monitoring, and system safety.

## Monitoring and management services

Included in Watt4Ever's standard offer, is Watt4Ever's monitoring service for the batteries. The client has access to a web interface displaying main functional parameters, such as :

Watt4Ever Circular Battery Energy Storage System

- ✓ Power
- ✓ Voltages
- ✓ State-of-Charge
- ✓ Temperatures
- ✓ Alarms
- ✓ State buttons (bypass, emergency stop, safety stop)
- ✓ Etc.

The monitoring system will also allow to extract historical data.

Watt4Ever will set up **an alarm system** with the client to anticipate any needs for predictive maintenance or replacement of modules in case of premature degradation, reducing thus down-times.

Watt4Ever batteries integrate ReVolta's smart battery management software, StoreNet, capable of managing the battery in demanding applications such as peak-shaving, energy arbitrage and grid services such as Frequency Containment Reserve (FCR or R1).

ReVolta's system integrates a custom-made gateway (EdgeNet), based on a standard industrial PLC running on Linux, capable of interfacing with other local equipment, meters and sensors through standard MODBUS communication, and integrating additional applications on-demand.

As an option, Watt4Ever also proposes **a service in which Watt4Ever actively manages the BESS on behalf of the client**, putting its expertise to work to perform applications such as peak-shaving and grid-services. monitoring of the system.

In addition to this option, the client has access to **OptiSchedule**, ReVolta's forecasting and optimization software module that allows to forecast and implement an optimal schedule for battery management in day-ahead and in real-time.

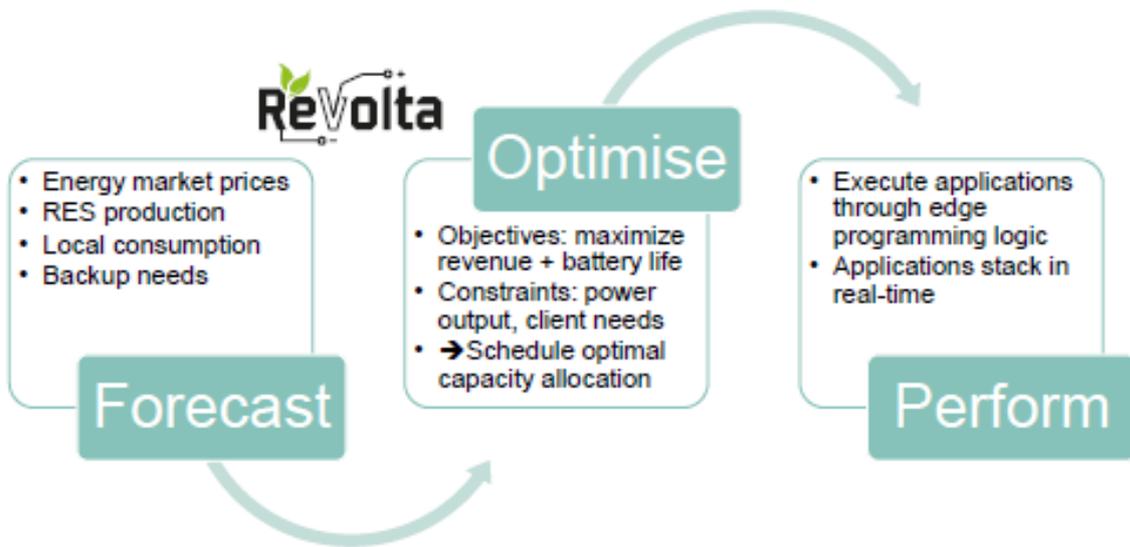


Image 3: Principle of ReVolta's optimal management system

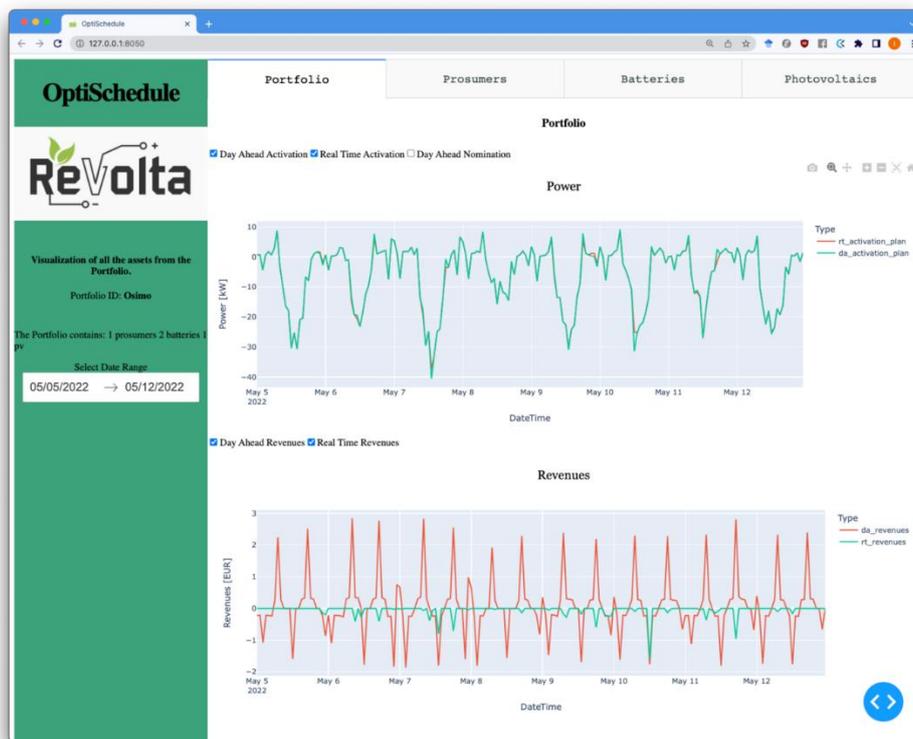


Image 4: OptiSchedule operator dashboard

## Warranties & maintenance

Watt4Ever provides:

- ✓ **Minimum 70% of SoH guaranteed for 10 years or 5.000 cycles, and**
- ✓ **5-year warranty against defects for the entire system.**

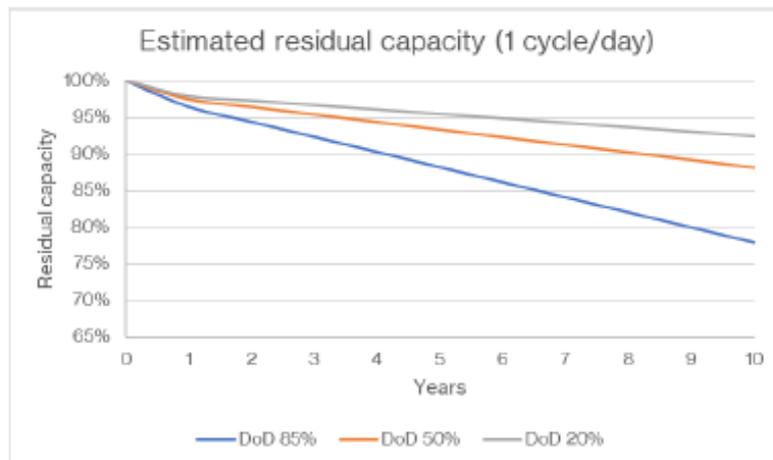
For more information on warranties, see attached General Terms & Conditions.

Included in the offer, a yearly visit by a technician, including :

- ✓ general system inspection,
- ✓ inspection with thermal camera, and
- ✓ with replacement of minor consumables (i.e. air filters, sensors, batteries and other consumables of auxiliary systems).

**Model 3: Watt4Ever BESS modules (CATL 18kWh) lifecycle estimate (1 cycle/day starting on installation date)**

Year	Estimated residual capacity		
	DoD 85%	DoD 50%	DoD 20%
0	100,0%	100,0%	100,0%
1	96,4%	97,5%	97,9%
2	94,4%	96,4%	97,3%
3	92,3%	95,4%	96,7%
4	90,3%	94,4%	96,1%
5	88,2%	93,4%	95,5%
6	86,2%	92,3%	94,9%
7	84,1%	91,3%	94,3%
8	82,1%	90,3%	93,7%
9	80,0%	89,3%	93,1%
10	78,0%	88,2%	92,5%



## Technical Datasheet

	Watt4Ever Grid-Scale Battery Storage Systems		
	Technical Data Sheet		
	10-ft maritime container	20-ft maritime container	40-ft maritime container
	<b>Battery</b>		
Cell manufacturer	CATL		
Cell chemistry	NMC		
Enclosure	Custom-made battery racks		
Temperature range	-5°C/+40°C		
Battery losses	1-2%		
Nominal capacity	90-200kWh	200-600kWh	600-1500kWh
Depth of Discharge	80%		
DC Voltage	400-800V		
Max C-rate	1C		
Round-trip efficiency	90%		
	<b>DC/AC Inverter</b>		
Brand	Danfoss		
Backup capability	Yes		
Power	Up to 200kVA		
Output DC voltage	3x230V+N		
Inverter losses	2-3%		
	<b>Control system</b>		
Battery Management System	Watt4Ever		
BMS communication protocol	CANBus		
Energy Management System	Watt4Ever		
EMS communication protocol	Modbus TCP		
Connectivity	3G/ 4G connection		
	<b>Housing</b>		
Casing	10ft shipping high-cube container	20ft shipping high-cube container	40ft shipping high-cube container
Placement	Outdoors		
Dimensions	3050x2438x2889	6058x2438x2889	12190x2438x2889
Openings	2 side openings + 1 door on long side		
Colour	RAL-9010 (Pure White)		
IP rate	IP66		
Isolation/ Weatherproofing	Regular sandwich panels isolation 40mm (REI60 on battery side)		
Weight (approx.)	Up to 6 tons	Up to 15 tons	Up to 35 tons
	<b>Temperature control</b>		
Battery	Water-cooled for 1C capacity, Air-cooled if lower discharge rate		
Container	HVAC split system for room temperature control		
	<b>Safety features</b>		
Safety standards	IEC 62619, Low-Voltage Directive (2014/35/EU), Electric safety approved under Belgian electric safety regulations (RGIE), designed under principles of UL1973 and UL9540 standards		
Fire suppression system	HALI GAS 1230 Liquid (FK5112)		
Fire safety features (included)	Module compartmentation, fire-proof separation of battery space (REI60), fumes exhaust, flooding valve, anti-deflagration panels, fire detection system, fire suppression system	Module compartmentation, fire-proof separation of battery space (REI60), fumes exhaust, flooding valve, anti-deflagration panels, fire detection system, fire suppression system	Module compartmentation, fire-proof separation of battery space (REI60), fumes exhaust, flooding valve, anti-deflagration panels, fire detection system, fire suppression system

## Safety at the heart of our concerns

Based on its experience with second-life batteries, Watt4Ever puts **safety at the heart of its system design**.

Re-used battery modules undergo a **strict quality control procedure** and are tested to ensure their health.

Each type of module used in our systems is tested **using the same procedures as new batteries**, according to international testing protocols (IEC 62619).

The systems themselves are **designed to meet the requirements of international safety standards** (UL9540, UL1973), as well as the regulatory requirements of the RGIE.

Fire safety is ensured by the design of the system, which provides:

- 1) Active battery supervision
- 2) Compartmentation of each battery cell to prevent fire spread
- 3) Fire detection and extinguishing systems by a specialized aerosol agent for battery fires.

## Why choose Watt4Ever's circular BESS?

- Watt4Ever is a **100% Belgian startup**, developing unique know-how on batteries in Belgium.
- Watt4Ever Circular BESS's are made from **circular batteries**, with a **reduced environmental footprint**. For every 100kWh of battery capacity reused rather than manufactured, Watt4Ever batteries avoid:
  - o 11t of grey CO2 emissions
  - o 1t of hazardous waste
  - o 555kg of Cobalt
  - o Impact on water reserves from lithium extraction
- Watt4Ever's systems are manufactured using **top-tier quality power systems**, ensuring reliability and adaptability.
- Watt4Ever's systems are designed and built in Belgium, and **Watt4Ever's engineers and technicians accompany the client for all his troubleshooting and maintenance needs**.



Want to know more? Visit our website [www.watt4ever.be](http://www.watt4ever.be) or contact us at [info@watt4ever.be](mailto:info@watt4ever.be) or +32 478 963 312!

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2021-2022

