

Electric Energy Storage



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Features

The Mega-Guard Electric Energy Storage (EES) is an advanced system for electric energy storage for marine environment. Sailing and silent running on stored electric energy becomes a reality with Mega-Guard EES.

The Mega-Guard EES consists of the following main components:

- ▶ GreenBattery
- ▶ Master BMS
- ▶ Battery Rack

Energy storage systems in between 40kWh and 12MWh can be built with Mega-Guard EES.

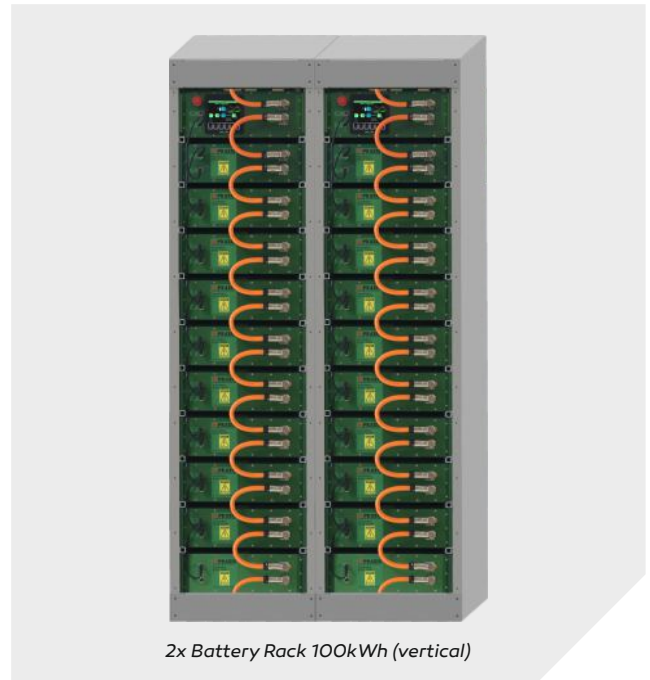
GreenBattery

GreenBattery makes use of the extremely safe LiFePO4 (or LFP) chemistry. Safety can be compared with traditional lead acid batteries and are much safer than Li-ion technology which is used by other marine battery manufacturers. In addition, life time and temperature range of LiFePO4 are much better when compared with Li-ion batteries. GreenBattery has relatively low weight and small volume per stored kWh. In fact, GreenBattery is one of the lightest batteries available for marine energy storage.

Each GreenBattery has a capacity of 10kWh and a nominal DC bus voltage of 96VDC. GreenBattery can be cooled either by forced air or by liquid. GreenBattery is totally enclosed and includes a built-in slave battery monitoring system which communicates with the Master BMS. GreenBattery fulfils the latest class requirements and includes a pressure based safety release which should be vented to the outside environment. Up to 10 GreenBatteries can be wired in a string and a Master BMS monitors and controls the string. Up to 120 strings can be wired in parallel.



Master BMS



2x Battery Rack 100kWh (vertical)

GreenBattery general specification

Stored energy	10kWh
Recommended SOC window	10% - 90%
Maximum SOC window	5% - 95%
Usable energy at recommended SOC	8kW
Technology	LFP / LiFePO4
Nominal voltage	96VDC
BMS with cell balancing	✓
Electric connections	+ and - connector with HVIL BMS connector in / out
Max charge rate	1C (=105A)
Max discharge rate	1C (=105A)
Max discharge rate 5 minutes	2C @ 10-35°C ambient
Number of charge/discharge cycles at 0,5C	
Depth of discharge 100%	>2500
Depth of discharge 90%	>3750
Depth of discharge 80%	>5000
Depth of discharge 50%	>10000
Ambient temperature charging	0 ~ 55°C
Ambient temperature discharging	-20 ~ 55°C
Storage temperature 1 year	0 ~ 35 °C
Heat generation	< 0.22kW
Cooling by liquid	Water/glycol mixture Liquid flow: 2l/min (5°C rise) @1C Inlet temp: 35°C max
Cooling by air	Forced air with fans
Exhaust	✓
Weight with forced air cooling	77kg
Weight with liquid cooling	83kg
Protection	IP67
Aluminium housing	Green anodised

Master BMS

The Master BMS monitors and controls a string of GreenBatteries. All external connections (DC bus, Ethernet, cooling and venting) of a string are made on the Master BMS. A 5,7" touchscreen Operator Panel with built-in controller is mounted in the front of Master BMS. The state of charge (SOC), voltages and temperatures of a string can be read on the touchscreen Operator Panel. The controller takes care of cell balancing, cooling control and safety functions. In addition, the controller is equipped with quad Ethernet ports for communication to external Mega-Guard High Power Inverters for battery charging and to a Mega-Guard Energy Management System. The Master BMS contains as well a DC bus contactor with pre-charge and includes air or liquid based cooling devices for the GreenBatteries. Two versions of Master BMS are available:

- ▶ Water/glycol cooled ; the Master BMS is equipped with a temperature controlled 3-way cooling valve. The cooling flow is bypassed when GreenBattery temperature drops below 22°C by energizing the valve. The EES does not heat up the battery room.
- ▶ Air cooled ; the Master BMS is equipped with fans for proper air circulation inside the Battery Rack. The battery room should be equipped with an air conditioner to take away the heat (0.22kW for each GreenBattery).

Battery Rack

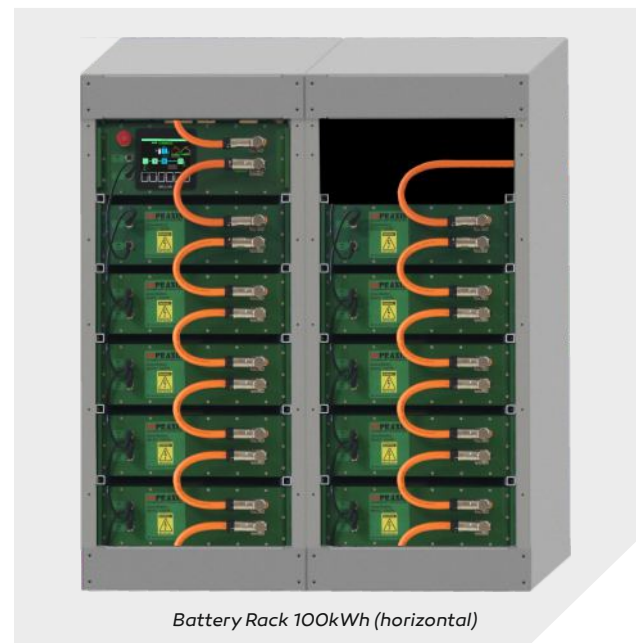
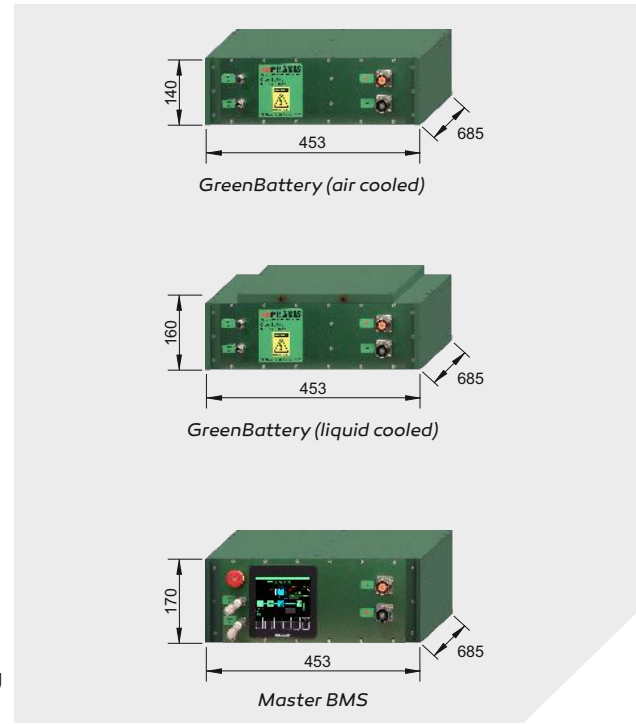
GreenBatteries and the Master BMS are placed in a specific designed Battery Rack. The Battery Rack contains cooling channels (air or liquid) and makes it possible to exchange a GreenBattery by sliding out and in. Battery Racks are supplied in two different mechanical lay-outs: a vertical one for space saving and a horizontal one which is applied when not enough room height is available.

Battery Racks need to be installed in a battery room in accordance with class regulations.

The following Battery Racks are available:

Battery Rack Capacity	Rack size vertical W x H x D	Rack size horizontal W x H x D	Weight air cooled	Weight liquid cooled and sea water flow (10°C rise)	Number of GreenBattery	Nominal DC bus voltage
40kWh	520x1020x760mm	n/a	415kg	440kg 4l/min	4	384VDC
60kWh	520x1350x760mm	n/a	580kg	615kg 6l/min	6	576VDC
80kWh	520x1670x760mm	1035x1020x760	750kg	800kg 8l/min	8	768VDC
100kWh	520x1995x760mm	1035x1350x760	920kg	980kg 10l/min	10	960VDC

Mounting & dimensions



Vessel Management System



Power Management System



Fire Alarm System



CCTV Video Distribution



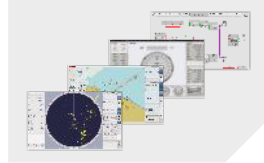
Ship Performance Monitor



Fleet Management System



Integrated Navigation System



Heading Control System



Propulsion Control System



Dynamic Positioning System



BNWAS Watch Alarm System



Navigation Light Control



Wiper Control System



Energy Management System



Electric Propulsion Motor



Electric Steerable POD



High Power Inverter



DC bus Generator



Electric Energy Storage



Electric Fin Stabilizer



*Ship automation,
navigation and
electric propulsion*