



# Full power for healthy growth

Powered by EST-Floattech



**Green Orca®**

The world's leading lithium-polymer energy system  
from EST-Floattech

# Our vision



"A cleaner shipping industry brings together our love of water, our passion for technology, and our worldview. We developed the lithium polymer battery using the knowledge and expertise we had gained in the luxury-yacht building industry and electrical engineering. In it we saw the potential to satisfy the demands of both economics and sustainability.

Thanks to our innovative energy storage systems, vessels become more environmentally friendly and consume less energy without compromising on power, comfort or safety. We specifically opted for battery cells using EST battery technology, which generate stable and safe energy. Not only for the shipping industry, our cells are also used in mission-critical environments such as those found in the aviation and aerospace industries. They are also used on land too, often under extreme conditions, such as on a United Nations peacekeeping mission, where our batteries power an energy storage system in the desert heat.

We believe that if a job's worth doing, it's worth doing well. As engineers, we know all too well that a good battery system can only generate optimum yield if the communication between all systems on board is coordinated integrally. As far as charging is concerned, this happens automatically, quickly and safely using engines, generators or the grid, but ideally with sources of renewable energy. After all, not only does our planet provide us with clean power, it needs us to use it too."

The EST Floattech team

# Our sustainable future



Many goods and raw materials are transported on seagoing and inland vessels. Inland, a lot of work is going into the construction of bridges and dikes, while pilots, customs and the Seaport Police take care of safety and security. As a result, workboats, such as tugboats and pushers, and patrol vessels come and go, often through urban areas, or close to nature reserves and recreational areas. With environmental requirements becoming ever stricter, the challenge is to reduce these vessels' negative impact on air quality, the climate and water quality, and to reduce their energy consumption.

## **Economy and the environment can go hand in hand**

Worldwide, EST Floattech serves the maritime sector with clean, silent, powerful energy systems based on lithium polymer batteries. The environmental gains are great: NO<sub>x</sub> and CO<sub>2</sub> emissions reduced to little to nothing,

and offensive odours and noise pollution are also diminished for the crew, the environment, residents and the natural world.

Our lithium polymer batteries are implemented in fully electric vessels, as well as robust hybrid combinations with a traditional diesel or LNG generator. The battery system offers a clean, safe and powerful source of energy at the moments that would otherwise generate the most pollution, such as when entering and leaving ports, when berthing and unberthing, while waiting, or when extra power is needed during towing. Furthermore, it provides an economically sound alternative for the fuel strategy of vessels, resulting in healthy growth in the true meaning of the words.



ZERO EMISSIONS



COST SAVING



SAFETY



COMFORT



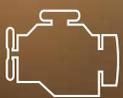
ENGINE POWER

# Intelligent ECO power for commercial vessels

Cost Saving



fuel saving  
up to 100%



smaller engine or full electric

CO2 Reduction

Connect to renewable energy



Comfort



No smell



No noise

Safety

Singe Cell Control



Performance

output from 40 kW to 8 MW

7,15 kg/kWh<sub>power/weight ratio</sub>

# Reducing NO<sub>x</sub> and CO<sub>2</sub>



CO<sub>2</sub> + NO<sub>x</sub> REDUCTION



100% RECYCLABLE

## Advantages

- Reduced NO<sub>x</sub> and CO<sub>2</sub> emissions.
- Charging using all natural energy sources.
- Ready for stricter regulations now and in the future.
- Higher residual value.
- Possibly eligible for subsidy programmes, depending on country and region.

All over the world, ports are committing to improving air quality and reducing water pollution and the negative impact on the climate. The international MARPOL Convention of the IMO is already prescribing tighter standards for the next few years, the number of Emission Control Areas is increasing, and on a local level there is increasing regulation governing the carbon footprint.

## Clean and economic

The energy generated by our intelligent and powerful lithium polymer battery systems is a clean and economic alternative. The batteries are charged simply and quickly using sustainable and clean solar, wind, tide and geothermal energy. Once the engines are running at their most economic, the batteries can also be charged conventionally by the engines.

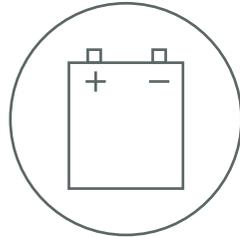
## Future proof

Running vessels on hybrid energy systems results in a large to very large reduction in NO<sub>x</sub> and CO<sub>2</sub> emissions, depending on the chosen solution. Furthermore, you will be prepared for the stricter regulations that are becoming commonplace in increasingly more regions both now and in the future, and you may also become eligible for certain subsidy programmes.

# Energy-efficient, cost-efficient



COST SAVING



LITHIUM POLYMER

## Advantages

- Peak shaving: high engine power achieved with smaller engines.
- Less consumption, lower fuel costs.
- Savings on maintenance costs.
- Fast and efficient charging.
- Charging at sea at the most efficient rotational speed.
- Long battery life.

Every journey has peaks and troughs when it comes to energy consumption. For example, extra power is needed when entering and leaving ports and when berthing and unberthing. The correct configuration of our lithium polymer batteries makes peak shaving possible, whereby peak demand is provided by the batteries rather than the existing engines or generators. The result is a significant saving in fuel and maintenance, as well as reduced investments in (often excessively) heavy-duty engines, as they no longer need to cope with peaks in energy demand. Furthermore, a more efficient and consistent use of engines means they last longer.

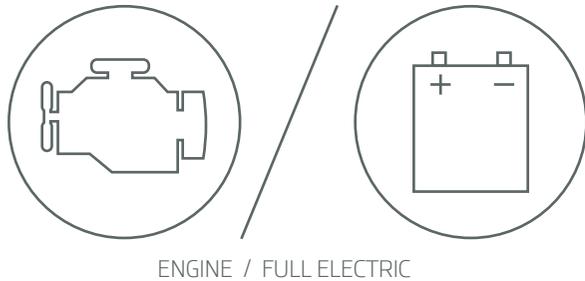
## Charged quickly, everywhere

Charging is possible at any time, in any place; at sea, when the engines are running at their most efficient, or while the ferry is on the quay, via a cable or even induction, with no connection necessary. Charging is quick: up to 1 megawatt (MW) in six minutes.

## Long life

The intelligent batteries function in all conditions and have an extremely long life of up to 20 years, depending on the number of cycles and the C-rate. The built-in active battery management system constantly measures the values and performance of each cell and ensures that all individual cells are actively kept at the same voltage level. The result is an increase in the life of the cells, and in turn the batteries. As part of this, active balancing gives real-time insight into the performance of individual cells and battery systems.

# Full engine power



## Advantages

- Batteries provide for peak demand instead of engines (peak shaving).
- Optimum energy distribution at all times thanks to active balancing.
- Regular discharge and charging cycle made redundant (active balancing).
- High power, small volume, low weight.

## Low weight, small volume

Our battery systems achieve the optimum balance between weight and volume. The special cells can store up to 240Ah per cell. The result is savings on weight and space and great improvements in the performance and speed of the vessels. With regard to the traditional lead-acid battery systems, the gains in weight and space can reach up to 75%. It's not for nothing that our cells are used in fighter jets and even in the Solar Impulse, the first aeroplane in the world to be fully powered by solar energy.

## Active balancing

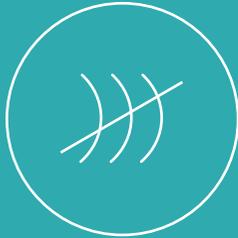
Thanks to the intelligent active balancing system, it is not necessary to fully charge the batteries, because the battery cells automatically compensate each other. This system makes redundant the familiar discharging and charging cycle characteristic of many battery systems.

## Intelligent peak shaving

The size of traditional vessel engines is largely determined by incidental power peaks, but the clean energy of our batteries is an excellent way to approach these peaks. As a result, the same power can be achieved with smaller engines. Furthermore, the batteries generate power without noise, soot (NO<sub>x</sub>) emissions or smoke.



# Comfort & safety



NO NOISE



NO SMELL

## Advantages

- Lloyd's certified.
- DNV GL 2015 tested (IEC 62619).
- Pro-active control of status, energy level and temperature at individual cell level.
- Remote active monitoring service®.
- Waterproof housing (IP65).
- Practically unaffected by vibrations, for example.
- No engine noise, offensive odours, or particulate matter.

Electric vessels increase the crew's comfort, as the batteries put an end to noise, offensive odours and soot emissions. As a result, the work is more pleasant and the working conditions improve. Not only the crew, but those living and working in ports and along canals will also be less disturbed by the vessels.

## Lloyd's and DNV IEC 62619

Our batteries are Lloyd's certified, and were tested by DNV/GL in 2015. We expect to be the first in the maritime sector to receive DNV certification according to the new IEC 62619 standard, which will not only apply to our batteries, but to the system as a whole, including the battery control unit (BCU). That means the entire safety system will have been certified, and therefore guaranteed. The spring loaded system of internal connections, rather than screws and bolts, is maintenance-free and vibration-proof, and the batteries' robust housing is waterproof, in accordance with IP65.

## Pro-active safety system

If, under very exceptional circumstances, an individual cell were to unexpectedly exceed the

permissible values, the battery management system will interfere to pro-actively shut down the relevant string, shutting down the battery before it starts functioning beyond its critical values. During the shutdown, the other battery strings of course remain available to generate engine power.

## Remote monitoring

It is also possible to connect the battery system to our remote active monitoring service®. We will then monitor the performance of your system, and will contact you in the unlikely event of a critical error. In addition, we can advise you on your energy consumption and will take preventative action in that respect if the data we receive gives us reason to do so. That saves you time and money.

## Comfortable

While the batteries are in use, the crew and passengers are spared from offensive odours and noise, making work and travel more pleasant and healthy. In addition, those living and working near to the vessel will be less disturbed by emissions.

# Technical information

## System integration

In our eyes, an optimally performing system is about more than battery technology alone. Our background in electrical engineering and roots in the maritime sector mean we truly understand the importance of the proper and robust integration of all technical systems on board. A seamless fit between our systems and the rest of the systems on board is crucial if you are to safely and efficiently gain maximum return from your investment. Our hybrid solutions are custom-made.

Together with our customers and their partners, such as system integrators, we seek the most economic and sustainable energy systems for clean shipping. If required, we can even engineer and realise the entire powertrain. We ensure all the necessary power, including intelligent 24/7 performance monitoring.

## Lithium polymer batteries

Our lithium polymer battery systems score excellently when it comes to the balance



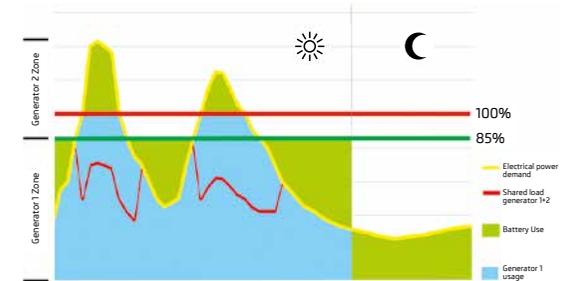
between weight and volume. The special cells can store up to 200A (ampere) per cell. With regard to the traditional lead-acid battery systems, the gains in weight and space can reach up to 75%.

## Peak shaving

Every journey has peaks and valleys when it comes to energy consumption. For example, extra power is needed when entering and leaving marinas and when berthing and unberthing. The correct configuration of our lithium polymer batteries makes peak shaving possible, whereby peak demand is provided by the batteries rather than the existing engines or generators.

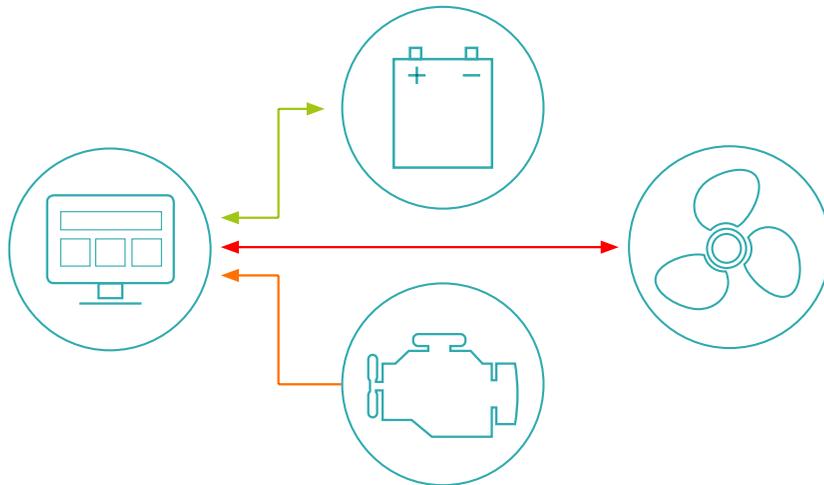
- Only one generator is active
- No cold start for second generator
- Battery support for total silence at night
- Peak shaving to reduce fuel consumption and generator maintenance
- Rapid & high current response of the energy storage system is required for peak shaving.

## Typical generator loadcycle



## Active balancing

Thanks to the smart active balancing system, it is not necessary to fully charge the batteries, because the battery cells automatically compensate each other. This system makes redundant the familiar discharging and charging cycle characteristic of many battery systems.



- Optimum energy distribution at all times thanks to active balancing.
- Real time active balancing per cell
- Each EST module contains 7 or 14 large cells, depending on the module type
- Each cell has a solo chemical process, therefore an advanced balancing system is required
- Each cell automatically receives a unique address via a NMEA 2000 based EST-CanBus system
- The system monitors cell voltage, SOC, SOH, cell temperatures and all safety features per cell
- When unbalanced, the system transfers energy from the highest cell to the lowest cell with an accuracy of 0.005 Volts in milliseconds.

Per module, EST uses a state-of-the-art, real-time active balancing and monitoring board developed in-house.

## Active module series balancing

- Active balancing per serial system during charging, discharging or standby
- Up to 18 battery modules connected in a serial configuration
- Balancing between modules is required for serial higher voltage systems.

## Battery control unit

Our battery control unit interferes to pro-actively shut down the relevant string of batteries, if one of the individual cells exceeds its permissible values, shutting down the battery before it starts functioning beyond its critical values. During the shutdown, the other battery strings of course remain available to generate engine power. Our BCU was the first in the maritime sector to be tested by DNV certification according to the new IEC 62619 standard.

## Certification

- Lloyd's-certified batteries
- In 2015, the battery control unit was tested by DVN/GL in accordance with IEC 62619 – a first in the maritime sector
- Waterproof housing, in accordance with IP65.



## Green Orca® battery module specifications

### Green Orca 525 Marine Lithium Polymer batteries

- 505 x 540 x 240 mm (H x D x W)
- Lloyd's certified
- 52 Volt, 100Ah
- 5.25kWh at 47.5 kg.
- 300A/3C nominal charge, @23 ±3°C
- 300A/3C nominal discharge, @23 ±3°C
- 600A/6C maximum discharge, <10 sec., > SOC 50%
- Stack up to Megawatts and 1,000 Vdc
- Unique BMS with advanced active cell balancing
- NMEA 2000 based CanBus communication
- Designed for marine application, IP65
- Warranty 5,000 cycles at 80% DOD or 10 years
- No electrical or mechanical maintenance

### Green Orca 620 Marine Lithium Polymer batteries

- 505 x 540 x 240 mm (H x D x W)
- Lloyd's certified
- 26 Volt, 240Ah
- 6.2kWh at 47.5 kg.
- 240A/1C nominal charge, @23 ±3°C
- 300A/1¼C nominal discharge, @23 ±3°C
- 720A/3C maximum discharge, <10 sec., > SOC 50%
- Stack up to Megawatts and 1,000 Vdc
- Unique BMS with advanced active cell balancing
- NMEA 2000 based CanBus communication
- Designed for marine application, IP65
- Warranty 5,000 cycles at 80% DOD or 10 years
- No electrical or mechanical maintenance

### Green Orca 1050 Marine Lithium Polymer batteries

- 505 x 540 x 325 mm (H x D x W)
- Lloyd's certified
- 52 Volt, 200Ah
- 10.5kWh at 75 kg.
- 200A/1C nominal charge, @23 ±3°C
- 300A/1½C nominal discharge, @23 ±3°C
- 600A/3C maximum discharge, <10 sec., > SOC 50%
- Stack up to Megawatts and 1,000 Vdc
- Unique BMS with advanced active cell balancing
- NMEA 2000 based CanBus communication
- Designed for marine application, IP65
- Warranty 5,000 cycles at 80% DOD or 10 years
- No electrical or mechanical maintenance



Green Orca®



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EST Floatch was established in 2009. Since 2014 it has been part of an investment fund affiliated with one of the largest family companies in the Netherlands, safeguarding the continuity of our company and our sustainable and economic battery systems.

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