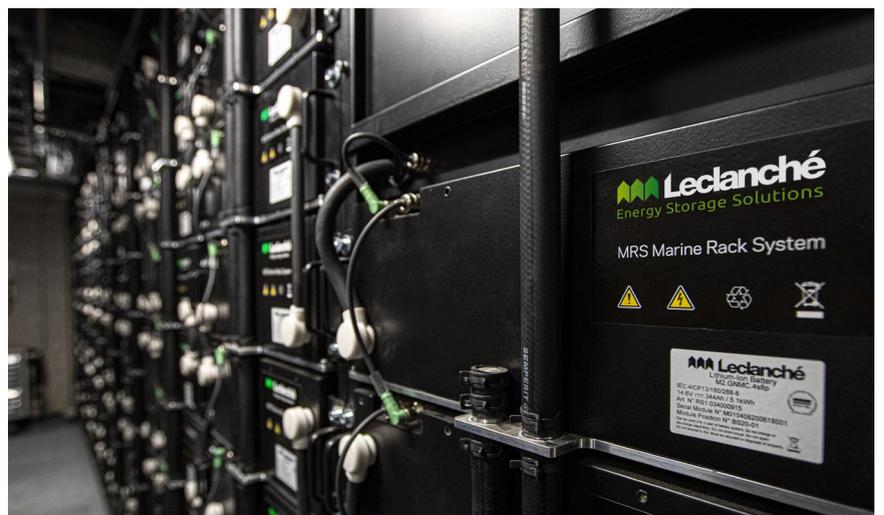


Lake Passenger Vessel

MS Jungfrau (BLS Navigation)



The first electric hybrid boat on Lake Brienz, Switzerland using a Leclanché high energy 168 kWh lithium-ion battery system.



The Challenges



Tourist vessels are a key part of the Swiss tourism industry, with a vast number of services operating on over 130 lakes across Switzerland. The vast majority of these ships are currently powered by diesel engines, contributing to significant emissions of CO² and other pollutants. Noise pollution and odours linked to tourist boats powered by diesel engines can also affect both the ship's staff and passengers, as well as residents in the ports and towns along the route.

BLS, one of Switzerland's largest transport companies, operates a fleet of vessels on lakes in the Bernese Oberland region. They are committed to reducing their environmental footprint and hence decided to find a way to reduce emissions of their fleet, initially focussing on the MS Jungfrau.

The Solution



The solution implemented for the MS Jungfrau was to convert it from a fully diesel vessel to an electric hybrid, using a 168 kWh Leclanché lithium-ion battery system. Consisting of 24 battery modules of 7 kWh each, this system will power various electrical systems of the ship (propulsion motor, lighting, galley), depending on the needs and choices of the crew.

The battery system can operate for 30 minutes in 100% electric propulsion, up to 10.5 hours in hybrid operation and is capable of recharging whilst on the water. The complete charging time of the batteries, dockside, is just under an hour and thirty minutes.

Thanks to the batteries supplied by Leclanché, BLS estimates that the MS Jungfrau's annual diesel consumption will be reduced by 12,000 liters and as a result will save 30 tonnes of CO², which is equivalent to the emission of 15 cars per year. These changes also improve passenger experience and reduced noise pollution for the towns along the route.

Vessel

Built in 1954 and with a capacity of 700 passengers, the MS Jungfrau has been completely modernised. Simulations in autumn 2019 concluded that three engines for energy generation and two electric drive motors would be the most efficient solution for the MS Jungfrau. With the help of Shiptec and Siemens, a hybrid electric and diesel propulsion system was added to the ship.

New Features :

- Three 191kW generators (Stage V emissions standard)
- Leclanché 168 kWh MRS lithium-ion battery pack
- Two Siemens drive motors
- Active diesel particulate filter system
- Fire extinguishing system & fire protection insulation for the battery and engine room
- New main control station & monitoring system.





The Technology

With over 200 patents in lithium-ion battery cell technology and production, Leclanché batteries deliver exceptional safety, longevity and cycle life. Leclanché battery systems along with the cells, are manufactured in our automated facilities, in Germany & Switzerland, in compliance with the highest environmental standards.

The Marine Rack System (MRS) provided by Leclanché for the MS Jungfrau, is a modular and scalable Li-ion battery system for marine applications. It uses high energy lithium-ion G-NMC cells with unique safety features including bi-cell laminate design and ceramic separators to ensure optimal performance.

The cells are fitted into robust modules which are packaged into IP65-rated enclosures designed for harsh maritime environments. The IP65 enclosures are assembled into the Marine Rack System (MRS) rack together with a dedicated, in-house designed, battery management system.

Safety is a Priority

Leclanché MRS was developed in conjunction with DNV, certified by all other major certification authorities (RINA, Bureau Veritas and Lloyd's register).

- Our MRS features an active foam fire extinguishing system that is also fully certified.
- Multi-layer safety measures on a cell, module and system level, tested and certified against mechanical, thermal and electrical abuse.
- Our MRS fire suppression system offers protection against all unexpected external hazards (electrical, mechanical and thermal).
- Automatic extinguishing system uses independent heat- and smoke/gas-triggering sensors to prevent false alarms and improve reactivity.
- The battery system is redundant, with four separate battery rooms: if one or more of the strings are emptied or stop working, the vessel can continue its operations.



Vessel Details

	MS Jungfrau
Vessel Type	Lake passenger vessel
Battery System	G/NMC
Battery Energy (kWh)	168
Vessel Dimensions (L x W, m)	40 x 10
Capacity	700 passengers
Operation date	2021 (after conversion)
CO ₂ saving per year (estimated vs previous vessel type)	30 tonnes

Leclanché Manufacturing Sites

Norway
Oslo
(Sales and engineering office)

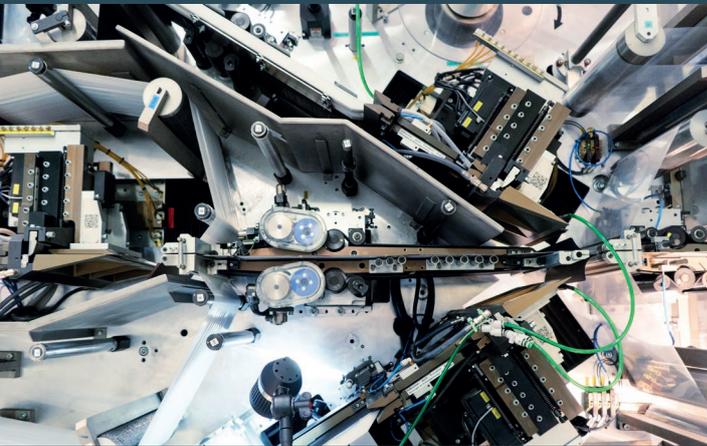
An environmentally conscious manufacturing company:

- Cell manufacturing facility fully powered by renewable energy
- The only company that utilizes a patented, fully water-based, cell manufacturing process
- Automated cell production at our state-of-the-art facility in Germany

Production and engineering facilities fully accredited by the leading international quality standards organizations including ISO 9001, 14001 and 45001

Germany
Willstätt

Switzerland
Yverdon-les-Bains



The Certificates

The **Leclanche Marine Rack System** was first certified in 2017 by DNV and was the first marine battery system to obtain this approval. Since then, it has received numerous additional class approvals from major certification authorities.

in progress:



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