Leclanché

Corporate Presentation

Leclanché
Energy Storage Solutions

Leclanché Globally

Key Figures

1909
Founded

350+
Employees

50+
Electrochemists & Engineers

170+
Customers

Sustainability

- **100%** renewable electricity used for **all production**
- Unique **water-based** electrode manufacturing process (no solvents)
- **90%** of our cell materials are **recyclable** and **recoverable**
- Systematic **reduction of CO_2 emissions** of supply chain and operations

Key Markets Addressed

Advanced batteries for heavy-duty commercial applications

Marine

Rail

Road

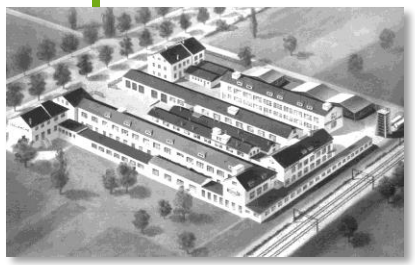
Stationary

Process & Quality Certifications

ISO 9001 : 2015 · ISO 14001 : 2015 · ISO 45001 : 2018 · ecovadis SILVER 2023 Sustainability Rating · IRIS Certification ISO/TS 22163

Our Milestones

1909 — Leclanché SA is founded in Yverdon-les-Bains, Switzerland.



2006 — Acquisition of Bulith AG & opening of Willstätt Li-ion cell production facility in Germany.

2019 — Selected as preferred global provider of battery systems to Bombardier.

2021 — Canadian Pacific Selects Leclanché For zero emissions freight Locomotives.

2022 — Leclanché moves to new headquarters in Yverdon-Les-Bains, Switzerland.

2023 — G/NMCA cells with less cobalt and 20% increase energy density.

Leclanché implements fully automated M3 Module assembly line.

G/NMC cell with non-flammable electrolyte : 80% less of risk of fire.

Grimaldi Ro-Ro Vessels.
11 x 5.1 MWh battery systems supplied from 2018 to 2023.

E-Ferry Ellen. First fully electric ferry in the world.

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Leclanché Global Presence

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*Energy Management Software

Senior Leadership Team and Board Members

Executive Officers

Phil Broad
CEO E-Mobility SA &
Group CCO

Pierre Blanc
Group CEO & CTIO

Pasquale Foglia
Group CFO

Board Members

Lex Bentner
Chairman

Christophe Manset

Abdallah Chatila

Marc Lepièce

Shanu Sherwani

Leclanché Technology

We control the value chain of our battery systems from powder to pack

Active Material Preparation → **Lithium-ion cell Manufacturing** → **Module Assembly** → **Electronics Programming** (Battery Management System) → **Battery System Assembly** → **On-site Delivery, Final Testing & Commissioning** → **After sales Support & Monitoring**

Marine

Ground

Stationary

Our value chain provides the following advantages:

- Clear technology roadmap
- Control of the full process
- Solutions that match customer specifications
- Intimate knowledge of core technology

Leclanché Energy Storage Solutions

Product Lines

- Catalogue and customer specific products engineered and certified to industry standards.
- E-Mobility products are based on our in-house manufactured cells, modules and battery systems.
- Dedicated Multi-String Managers designed to combine multiple battery systems.

Marine

MRS-3™

Ferries, Ro-Ro/Ro-Pax
Offshore, Deep Sea
Cruise Ships, Yachts

Rail

Energy Series

Trains
Locomotives
Maintenance Vehicles

Road

Fortius & Energy Series

Truck
Agricultural Vehicles
Construction Vehicles

Stationary

LeBlock™

Utilities
Commercial & Industrial
Microgrid

Product Specifications

Advanced generic battery systems for rail and marine applications featuring Leclanché European made G/NMC cells.

Rail

INT-53 Energy

- Leclanché high energy density G/NMC cells
- Class leading cycle life
- Liquid cooled
- Modular and scalable
- IEC 62928 certification

Technical Data	
Energy	52.6 kWh
Cycle life (60Ah cell, at 80% DoD) [1]	8,000 [1]
Weight	505 kg
Voltage (nominal)	876 V
Dimensions (L x W x H)	1631 x 612 x 409 mm

Marine

Navius MRS-3

- Leclanché high energy density G/NMC cells
- Class leading cycle life
- Functionally Safe BMS
- Liquid cooled
- Multiple configurations & 7 height options
- Superior safety with Battery Active Safety System

Technical Data	
Energy	80 kWh to 50 MWh+
Cycle life (65 Ah cell at 80% DoD) [1]	7,000
Energy density (65 Ah cell)	101 Wh/kg / 108 Wh/litre
Voltage (maximum, DC)	1200 V
Dimensions (D x W x H)	700 x 435 x 926 to 2,431 mm

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[1] 1C charge/discharge at RT.

Product Specifications

Design optimised products for Marine and Stationary applications.

Road

Fortius-145

- Leclanché high energy density G/NMCA cells
- Class leading cycle life
- Liquid cooled
- Modular and scalable
- IoT remote monitoring*
- Available from 2025

Technical Data	
Energy	147 kWh
Cycle life (80% DoD)	6,000
Weight	975 kg
Voltage (nominal)	670 V
Dimensions (L x W x H)	1,781 x 564 x 738 mm

Road

INT-39 Energy

- Leclanché high energy density G/NMC cells
- Class leading cycle life
- Liquid cooled
- Modular and scalable
- IoT remote monitoring*
- ECE R100.2 certification

Technical Data	
Energy	39.4 kWh
Cycle life (80% DoD)	8,000
Weight	372 kg
Voltage (nominal)	657 V
Dimensions (L x W x H)	1266 x 612 x 409 mm

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*Option available when a Multi-String Manager (MSM) is also specified.

Product Specifications

Design optimised products for Stationary applications.

Stationary

LeBlock

- Modular and scalable concept
- Integrated auxiliaries
- Plug & Play: easy to interconnect
- Simplified logistics
- Fast installation on site
- Liquid cooled
- Certification: ANSI/CAN/UL 9450A

Technical Data	
Energy	744 kWh to 50 MWh+
Current (maximum, DC)	3,600 A
Weight (Combi Block / Battery Block)	1,100 kg / 7,500 kg
Voltage (maximum, DC)	1,500 V
Dimensions (D x W x H) in mm Dimensions (D x W x H) in inches	2,664 x 1,457 x 2,896 8.74 x 4.78 x 9.50

Product Specifications

Multi-String Manager (MSM) for road battery systems where more than one battery pack/string is used in parallel.

Multi String Managers

MSM-M3-GRT

- Designed to interface seamlessly with existing Leclanché road and rail battery packs.
- Reliable controller for the connection multiple packs or strings in parallel.
- IoT edge device for remote monitoring*

Technical Data	
Application	Road (Packs with M3 Modules)
Quantity of packs	4
Weight	4.5 kg
Hardware	Bosch
Remote data-logging (option)	Wi-Fi / GSM
Dimensions (L x W x H) in mm	380 x 255 x 111

MSM-M2-GRT

- Designed to interface seamlessly with existing Leclanché road and rail battery packs.
- Reliable controller for the connection of multiple packs or strings in parallel.
- IoT edge device for remote monitoring*

Technical Data	
Application	Road (Packs with M2 Modules)
Quantity of packs	4
Weight	3.7 kg
Hardware	Bosch
Remote data-logging (option)	Wi-Fi / GSM
Dimensions (L x W x H) in mm	166 x 254 x 373

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*Optional. The IoT edge device is integrated within the MSM enclosure.

Product Specifications

Multi-String Manager (MSM) for rail battery systems where more than one battery pack/string is used in parallel.

Multi String Manager

MSM-M3-RA

- Designed to interface seamlessly with existing Leclanché rail battery packs.
- Certifications (controller): Rail
  - EN/IEC 61373, EN 50657, DIN EN 50125-1,
  - EN 50155 / IEC 60571

Technical Data	
Application	Rail (INT-53 Energy pack)
Quantity of packs	8
Weight	0.259 kg (controller only)
Hardware	Wago
Software	Leclanché SA
Dimensions (L x W x H) in mm	100 x 112 x 72 (controller only)

Reference Customers

Commercial Vehicle & Rail

Alstom AGC
Train
INT-53 Energy

Canadian Pacific
Locomotive
INT-53 Energy

Končar
Train
INT-53 Energy

Socofer
Maintenance
INT-53 Energy

FCC
Refuse Truck
INT-39 Energy

Urovesa
Truck
INT-39 Energy

Major Truck OEM
Refuse Truck
Fortius-145

Defence OEM
Defence vehicle
INT-22 Energy

Note: Non-exhaustive list

Reference Customers

Marine

Ellen e-Ferry
Ro-Pax vessel
System energy: 4.3 MWh

Wasaline
Ro-Pax
System energy: 2.4 MWh

Damen #1 (L. Ontario)
Ro-Pax vessel
System energy: 1.9 MWh

Damen #2 (L. Ontario)
Ro-Pax vessel
System energy: 4.6 MWh

Grimaldi Ro-Ro Series (11x)
Ro-Ro vessel
System energy: 5.0 MWh p.u.

Yara Birkeland
Autonomous Container Ship
System energy: 6.7 MWh

MS Jungfrau
Passenger Lake Vessel
System energy: 0.2 MWh

Siemens/Shiptec CGN*
Passenger Lake Vessel
System energy: 0.6 MWh p.u.

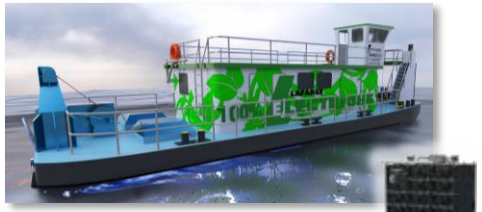
Note: Non-exhaustive list

*Project won, system to be delivered

Reference Customers

Marine

CMAL Islay (4x)*
Ro-Pax
1.1 MWh x 4
Delivery: 2024 / 2025



Lafarge Marsouin*
Ro-Pax vessel
System energy: 0.8 MWh
Delivery: 2024

Brunvoll*
Ferry
0.94 MWh
Delivery: 2024

Cadeler*
Windfarm Vessel
5.2 MWh
Delivery: 2025

Confidential Yacht (4x)*
Super Yacht
5.5 MWh (total)
Delivery: 2024 / 2025

Confidential Yacht *
Super Yacht
0.5 MWh
Delivery: 2025

Note: Non-exhaustive list

*Project won, systems to be delivered

Reference Customers

Stationary

Enel Green Power
Cremzow, Germany
Frequency regulation
System energy: 34 MWh

S4 Energy
Noord Holland, Netherlands
Frequency regulation
System energy: 9 MWh

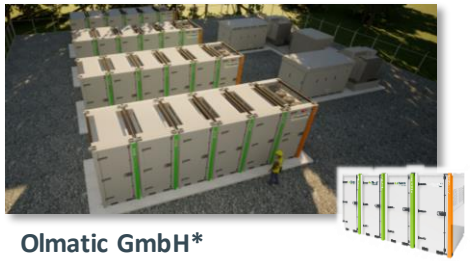
Romande Energie
Aigle, Switzerland
Frequency regulation & EV charging
System energy: 2.5 MWh

SGEM
Marengo, USA
Frequency regulation
System energy: 20 MWh

Veolia Gas Power Plant
Levice, Slovakia
Secondary Frequence Control
System energy: 5.2 MW / 2.9 MWh

Damen Shipyards*
Millhaven/Kingston, Canada
Load displacement & vessel charging
System energy: 6 + 10 MWh

Terna Energy
Crete, Greece
Solar + storage
System energy: 5 MWh



Olmatic GmbH*
Sembach, Germany
Frequency regulation
System energy: 12 MWh

Green Power

Energy Storage Solutions

*Project won, systems to be delivered

Cell Technology and Roadmap

Leclanché is continuously enhancing the energy output / capacity of its cells

Cell energy is continually increasing while maintaining exceptional cycle life

Over 160 patents covering cell technology included in 10 patent families

Reduced cobalt in the cathode and higher energy materials to further reduce the costs per kWh

Continuous work on next generation cell technologies with partners from academia and industry

Materials with lower carbon footprint and energy-saving processing steps to make our batteries more sustainable

Control of the full value chain and supply of technologies designed for the specific application

	2018	2020	2022	2024	2026
Strategic evolution of Leclanché cell performance	 **43 Ah 158 Wh/kg**	Graphite anodes NMC-532/622 cathodes	 **65 Ah 220 Wh/kg**	NMCA cathodes High voltage electrolytes	 **72 Ah 240 Wh/kg**	Silicon anodes	 **75 Ah 250 Wh/kg**

Leclanché Energy Storage Solutions

Taking the Lead on Sustainable Batteries

Reducing the environmental impact of our batteries at every stage of the life cycle

Leclanché 6R Circular Economy Concept

Recycling & Reuse

- Up to 95% recyclable
- Collaboration with leading recycling partners

Manufacturing

- 100% renewable electricity used at all production facilities
- Solvent free thanks to water-based cell production process

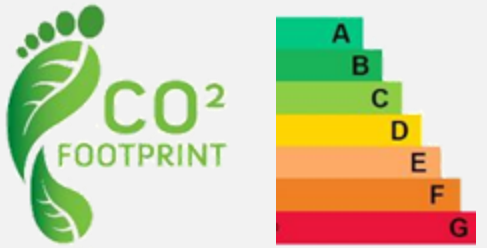
Consumption & Use

- Class leading cell cycle life to maximise battery service life.
- Global after-sales services with IoT for maintenance optimisation

Battery Carbon Footprint

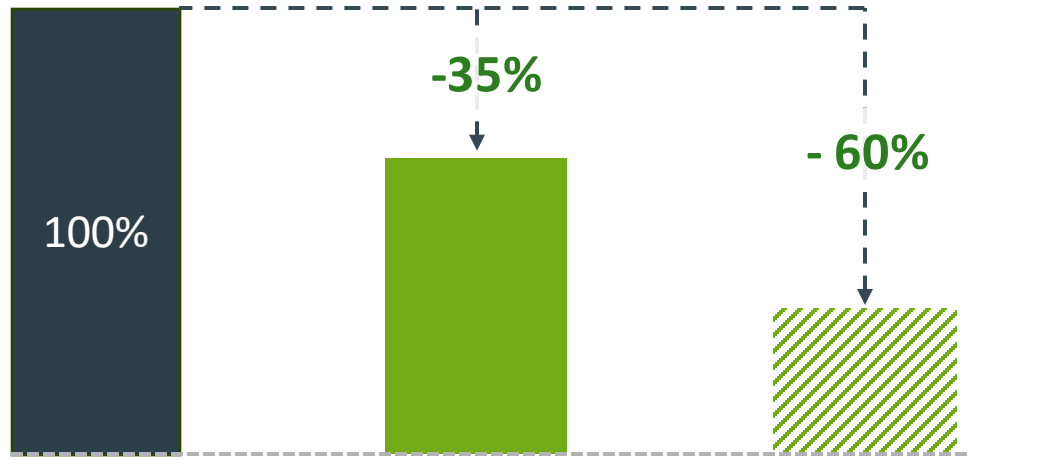
Measurement of our environmental impact & avoided emissions

- The new EU battery regulation of July 2023 set up a mandatory carbon footprint declaration for batteries
- Performance classes and maximum limit set to challenge the industry
- Low carbon footprint will become a key buying criteria



Leclanché's battery carbon footprint is already 35% lower compared to average battery producers thanks to:

- Production running on 100% renewable electricity
- Unique water-based binder process



Production Technology

- Leclanché designs and manufactures cells and modules in-house.
- Development of formulations, production processes and characteristics of the electrodes.
- Manufacture of graphite anodes, NMC622 and NMCA cathodes.

Cells

- High-energy density and high-power cells
- Class-leading cycle life
- New “Flame Retardant” (FR) cells
- Manufactured in a state-of-the-art automated production facility in Germany
- Electrodes made exclusively using a water-based binder (WBB)
- Experienced in production of LTO anodes

Technical Data	60Ah FR	60 Ah	65 Ah	72 Ah
Cell chemistry	G/NMC	G/NMC	G/NMC	G/NMCA
Cell type	Pouch	Pouch	Pouch	Pouch
Cycle life (80% DoD)[1]	8,000	8,000	7,000	6,000

Modules

- Specifically designed for transport applications
- Available in 8 configurations
- Functionally Safe slave unit
- 400A (medium) or 800A (high) power variants
- Assembled on an automated production and testing facility, designed to automotive industry standards

Technical Data (with 65Ah cell)	20 cell	24 cell	32 cell	36 cell
Energy	4.8 kWh	5.8 kWh	7.7 kWh	8.7 kWh
Configurations	2	1	2	3
Weight	32 kg	38 kg	50 kg	55 kg

Production Facilities

Leclanché is one of the few battery system suppliers that manufactures cells in-house, in Europe

Cell Production Line
Willstätt, Germany

- In-house cell production from raw materials
- Patented unique water-based manufacturing process for all electrodes, in production since 2012
- Producing pouch cells with G/NMC and G/NMCA chemistries

- **European cell and module production**
- **Scalable production technology**
- **Highly automated lines**
- **Certifications that de-risk planned expansion**
- **Production facilities with 100% renewable energy**
- **Products designed by Leclanché engineers & electrochemists**

Module Assembly Line
Yverdon, Switzerland

- State-of-the art automated production facility, designed with leading engineering company Comau (Stellantis Group)
- 400 MWh per year, and further expandable
- More than six times the production capacity of the previous module line

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