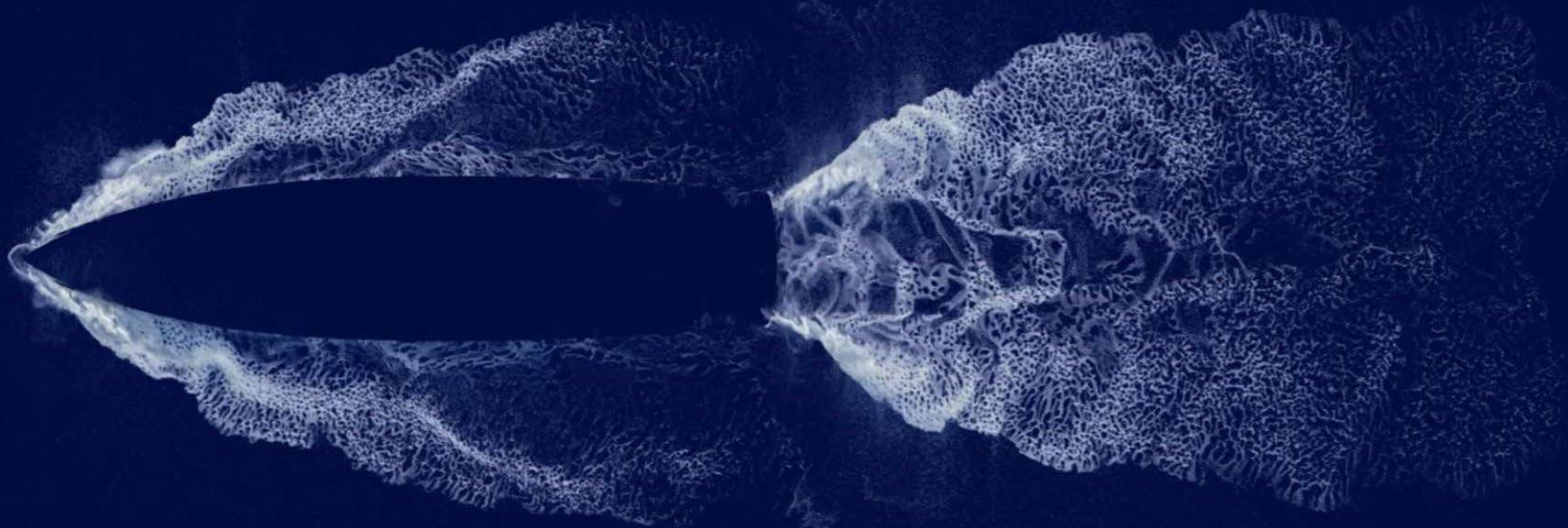


FERRY SHIPPING SUMMIT 2023



Echandia

The most durable and safe marine battery

GHG reduction and Green transition - It will be expensive whichever way chosen.

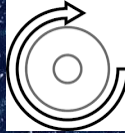


CO₂ and GHG reduction - Objectives and Timelines

	Status	2023	2024	2025	2026	2027	2028	2029	2030	2035	2040	2045	2050
IMO EEDI/EEEXI	Adopted/Exp.	EEEXI		EEDI Phase 3		(EEDI P4?)							
IMO CII / SEEMP	Adopted/Exp.	SEEMP III			11%	?	?	?	?	?	?	?	?
IMO (MEPC 80) (81 and 82)	Expected	July	81	82					CO ₂ – 40% GHG 20/30%		GHG 70/80%		GHG around 0%
IMO GHG intensity	Expected								Low Car or Zero 5/10%	?	?	?	?
IMO Med. ECA	Adopted			May									
EU ETS (New MRV Form)	Adopted		40%	70%	100% Incl. CH ₄ & N ₂ O	100% ($< 5,000$ GT?)	100%	100%	100%	100%	100%	100%	100%
Fuel EU Maritime GHG	Adopted			2%					6%	14,50%	31%	62%	80%
Fuel EU Maritime Shore-power	Adopted								Ten-T Core	All			
EU ETD	On hold												
UK (EU ETS)	Expected				Domestic?								
National US	TBI												
National Asia	TBI												
National other areas	TBI												
Regional Norway (WH-Fjords)	Expected			Tier III	ZEM								
Regional other areas	TBI												
Local ports etc.	TBI												

How Echandia can assist with battery solutions to decarbonize and meet the requirements from IMO and EU

- New Build
- Retrofit
- Fully Electrical
 - Zero Emission
- Hybrid



- Peak Shaving
 - Buffer energy
- Spinning Reserve
 - Back-up for running gensets
 - Less gensets running
- Optimize Load
 - Optimize operating genset point
- Immediate Power
 - Instant power support
- Energy Harvest
 - Recover energy from equipment
- Back-up Power
 - Black out prevention

What possible in question of range and size of a Ro/pax – Ro/Ro?

- Operational profile and especially required speed is essential and the first step to estimate the amount of battery energy to be installed onboard.
- In a fully electric ship, all the required energy are stored in the batteries as a large part of the propulsion system both in terms of weight and cost. (Batteries are in principle both the Main Engines and Fuel tanks in the same “Box”)
- Correspondingly when removing all fossil combustion engines, shafts and supporting auxiliary systems saves a large part of weight and cost.
- Also, a fully electric ship design could offer a wide range of possibilities when it comes to the design arrangement of the propulsion system freeing up more commercial space for pax and cargo and it may provide more capacity compared to a fossil sister ship or you could have a smaller ship with the same capacity with less energy needed!
- Other parameters such as regulations, displacement, hull shape, draft, length, width, stability, fire safety, ventilation and service area notation etc. needs attention.



Bottlenecks

The main bottleneck for fully electric ships are in general the grid power availability and shore-to-ship charging capacity.

The shore grid and the actual ship-to-shore interface need to be enabled to deliver a 1) charging capacity of min. the voyage used energy 2) at a given port turnaround time of typically 1 to 2 hours for large Ro/pax and down to a few minutes for medium/small size vessels.

Many stakeholders are involved such as the port, city, grid owner and good planning ahead is a must as it normally takes time.



What can Echandia offer



Echandia Energy

Echandia Power

Echandia offers batteries with LTO chemistry

LTO

NMC

LFP

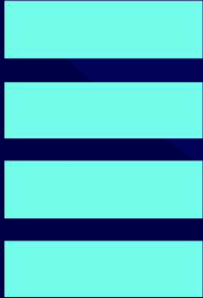
- Long Lifetime
- Safe



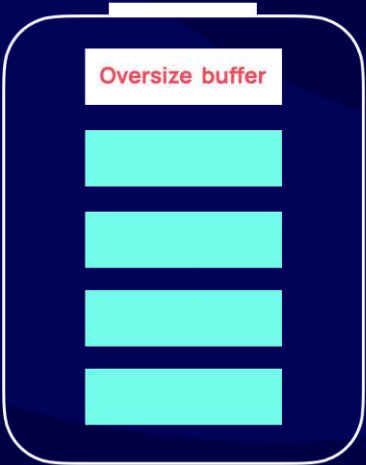
Use smaller systems and more of installed capacity

Echandia LTO is more durable and thus less installed energy is needed to deliver required energy at end of life (EOL).

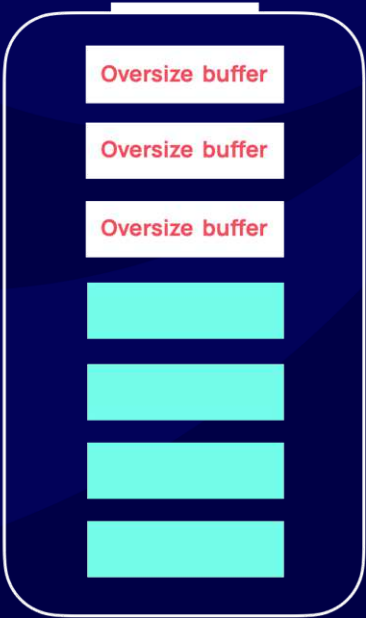
Required energy



Echandia LTO

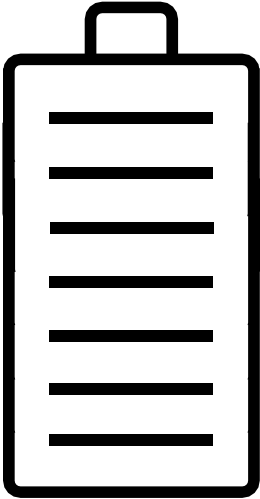


Alternative



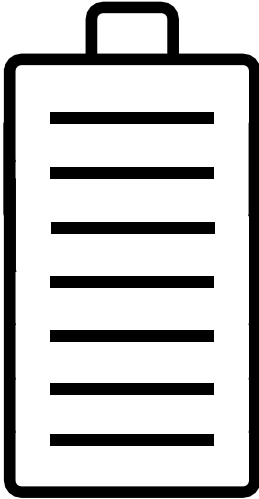
Usable Capacity vs Installed Capacity

Echandia LTO



90%
Usable Energy

Alternative



60% – 70%
Usable Energy

Carrying additional weight

LTO has Lowest Total Cost of Ownership (TCO)

- **Battery lifetime of 20+ years**
 - No reinvestment needed every 10 years
 - No increased hazard during battery's lifetime
- **High residual value after 20+ years**
 - High State of Health
- **Fast charging**
 - Charge-rate > 3 in repeated cycles
- **High cycle efficiency – less electricity consumed**
- **Lowest Life-Cycle CO₂ footprint**
 - No battery replacements needed
 - Deployed in second-life applications after marine EOL

Weight and Footprint - additional Echandia LTO advantages



Photo: Molslinjen

“The total cost of ownership, combined with the products high level of safety and low weight were key factors in selecting Echandia as battery supplier. In addition, choosing a system with longer lifetime makes perfect sense from a sustainability perspective.”

Ole Berg-Hansen, Chief Engineer Molslinjen

Superior Safety

- **LTO eliminates the safety hazards compared to Graphite**
 - No risk for Thermal Runaway
 - No dendrite formations – no short circuit risk
 - Not sensitive to ambient temperature fluctuations
- **IP44**
- **Type Approved**
 - Passive cell-to-cell level anti propagation approvals (highest safety level)



Copenhagen (7) water busses in operation since 2020



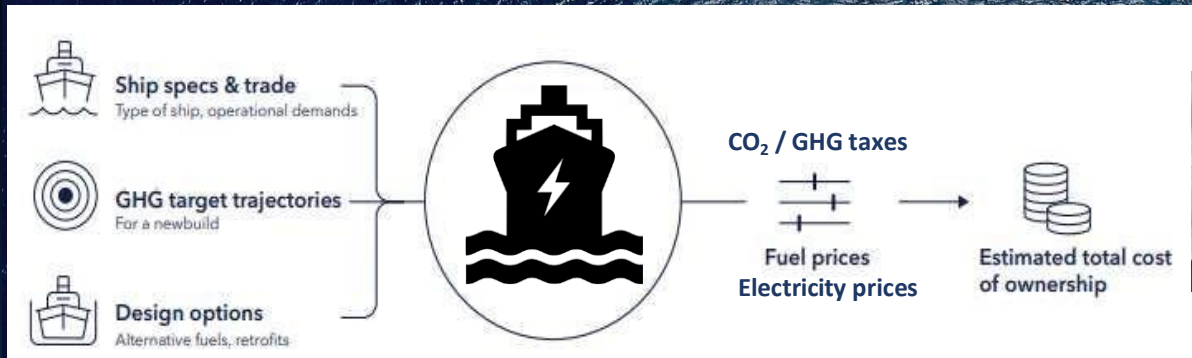
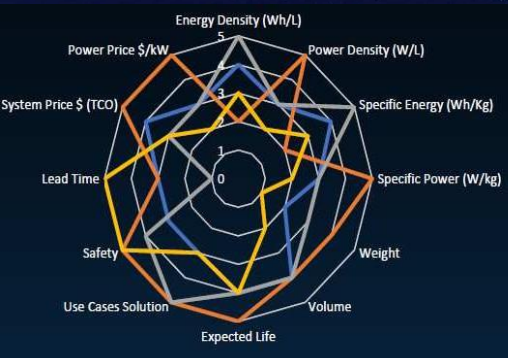
Designed for 12 years lifespan but latest capacity tests indicates an increased and considerably longer lifespan.

Other selected references



I cannot and will not stay here and tell you which way(s) you should chose for the future to decarbonize your fleet, but every shipowner must act to meet the requirements from now on towards 2050 and the price for emissions will only increase, with a full electrical vessel you could be 100% emission free and save a lot of worries, administration and maintenance costs.

Please have in mind that the efficiency of the stored energy to mechanical energy differs a lot between a conventional fossil installation compared with a fully electric system. For the fossil installation an efficiency incl. WHR systems etc. between 40 – 45% % can be reached compared to 90 % for the full electric installation. Based on this, it is clear that the energy cost will be much lower for the electric ship in all cases even when you add on possible extra investment for the full electrically powered ship.



My colleagues and I from Echandia will be more than happy to assist you with studies and to calculate a given installation based on your requirements and delivered operational profiles.

Thank you!

It will be an expensive green transition

Echandia can deliver a premium product which is safe,
reliable with a long lifetime and lots of energy.

Trusted supplier to



ABB

DAMEN

SIEMENS