Driving Electrification: the Case of Elemed Project

What's next: a glance into the future of shipping

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30 May 2018

Lloyd's Register

Looking forward…

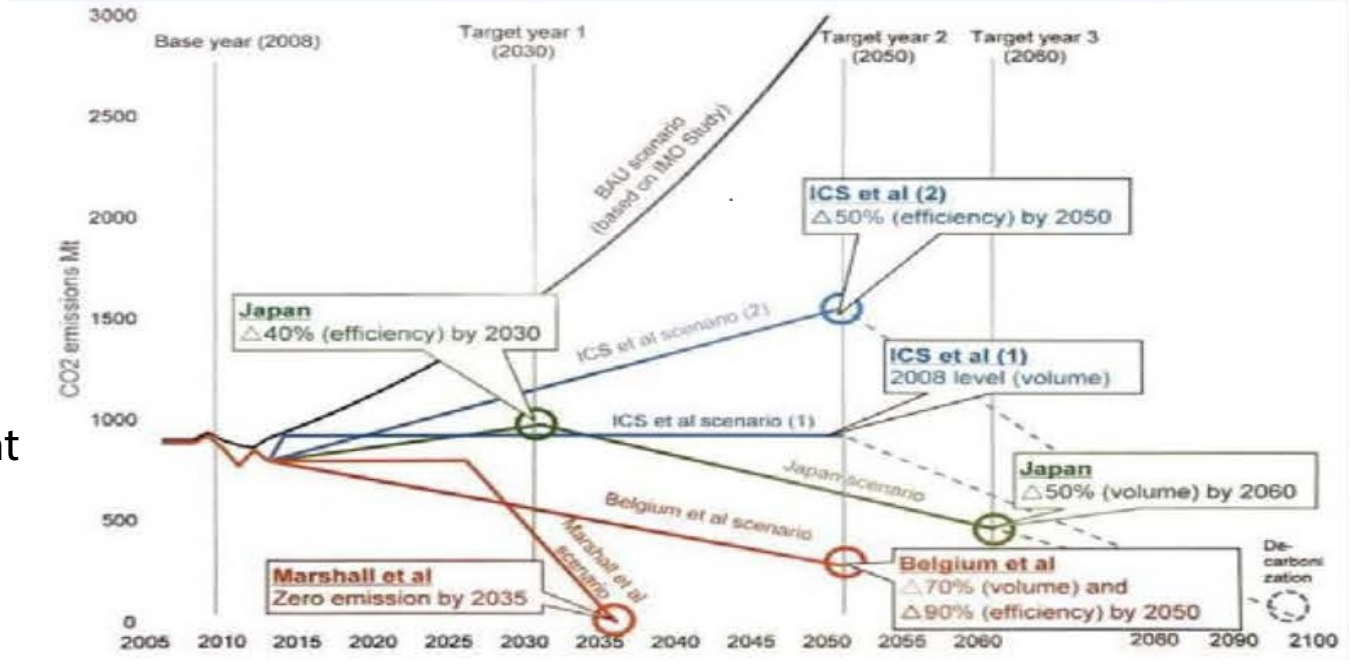
3 great challenges

- Ballast Water
  - Are the systems reliable? Are there benefits for early adopters?
- 2020 Global Sulphur Cap
  - 0.5% sulphur Fuel Oil is not a natural refinery product – it needs investment or to be blended
  - Currently less than 500 vessels (in service & on order) fitted with scrubbers, most in the Passenger ship sector
  - Most expect price differential to be large in 2020
  - No single "Silver Bullet" – factors to consider include, age, trade, size
  - A multi-fuel future is a certainty
- Low Carbon Future driven by UNFCCC and MEPC 72
  - ETS or Fuel Levy? Batteries, Hydrogen Fuel Cells, Sail, Hybrid…
- Does all this mean early renewals of part of the fleet in early 2020s?

Decarbonising shipping: navigating to 2050

"I encourage you to continue your work through the newly adopted Initial GHG Strategy, which is designed as a platform for future actions", IMO Secretary-General **Kitack Lim**

- MEPC 72, a historical move
  - Shipping GHG emissions reduction by 50%, by 2050 compared to 2008
- How?
  - Energy efficiency, equipment improvement
  - Zero-emission vessels, alternative fuels



Status changed for Climate change

We have an agreement on cutting emissions, now we need a strategy

Loud strains of the "Hallelujah Chorus" could be heard in London and around the world two weeks ago as a deal on greenhouse gases (**GHGs**) was agreed...been set for a reduction of **GHGs**, they will be coming down that channel during the lifetime of these assets. Ship design will be critical, as will a

ExxonMobil announces GHG reduction measures

24/05/18

American energy major ExxonMobil announced greenhouse gas reduction measures, including a 15% decrease in methane emissions and a 25% reduction in flaring. The company also revealed its intention to improve energy efficiency in refining and chemical manufacturing facilities.

ICS: Carbon targets to be met only with 'zero CO2' fuels

25/05/18

With respect to the IMO's recently adopted goal for 2050, which eyes a 70% efficiency improvement and a total 50% CO2 cuts by 2050, ICS Deputy Secretary General, Simon Bennett, noted that these targets can realistically only be achieved with the development and global roll out of genuine zero CO2 fuels.

Port of Antwerp, Fluxys study ways to reduce Belgian CO2 emissions

10/05/18

In order to reduce Belgian CO2 emissions 35% by 2030, the Antwerp Port Authority and gas infrastructure operator Fluxys believe that carbon capture, storage and reuse by industry will play an important role against climate change. For this reason, the two will cooperate by taking further steps to shape the energy transition.

ECSA: EU budget proposal could support shipping decarbonisation

04/05/18

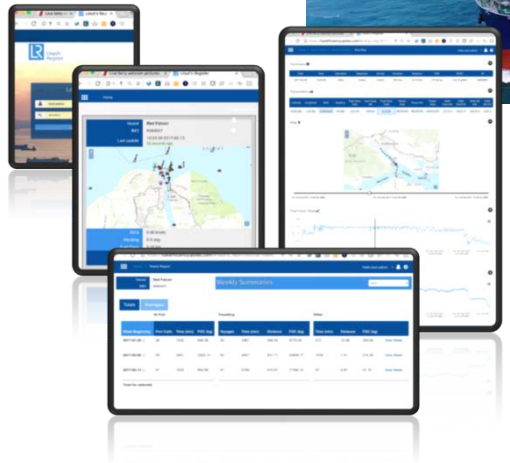
ECSA welcomed the proposal for the EU budget 2021 – 2027, published earlier this week, which foresees a large increase of the EU budget for Research, Innovation and Digital and for Climate and Environment. ECSA considers this increase could provide resources to support the European shipping industry in its transition to decarbonisation.

New approaches towards Zero Emissions Shipping

- Alternative energy sources
  - LR classed hydrogen-powered vessel launched.
  - LR joined the Quadriga sustainable shipping project – an initiative from Hamburg-based Sailing Cargo, which aims to build the world's biggest sailing cargo ship.

Smart Shipping: The ”talking hulls” of the future

- Harnessing digital technology: Carbon Footprint Reduction via smart energy management
  - ‘MV COSCO Shipping Aries’ is the first ever ULCS to receive LR's cyber-enabled ship descriptive note 'Cyber AL3 SECURE PERFORM' for its energy management system.
  - ‘Great Intelligence’, a 38,800 dwt modified version of the Green Dolphin fuel-efficient Bulk Carrier concept, is the pilot smart ship project within China.
  - Fuel consumption analytics



Is the zero-emission future electric?

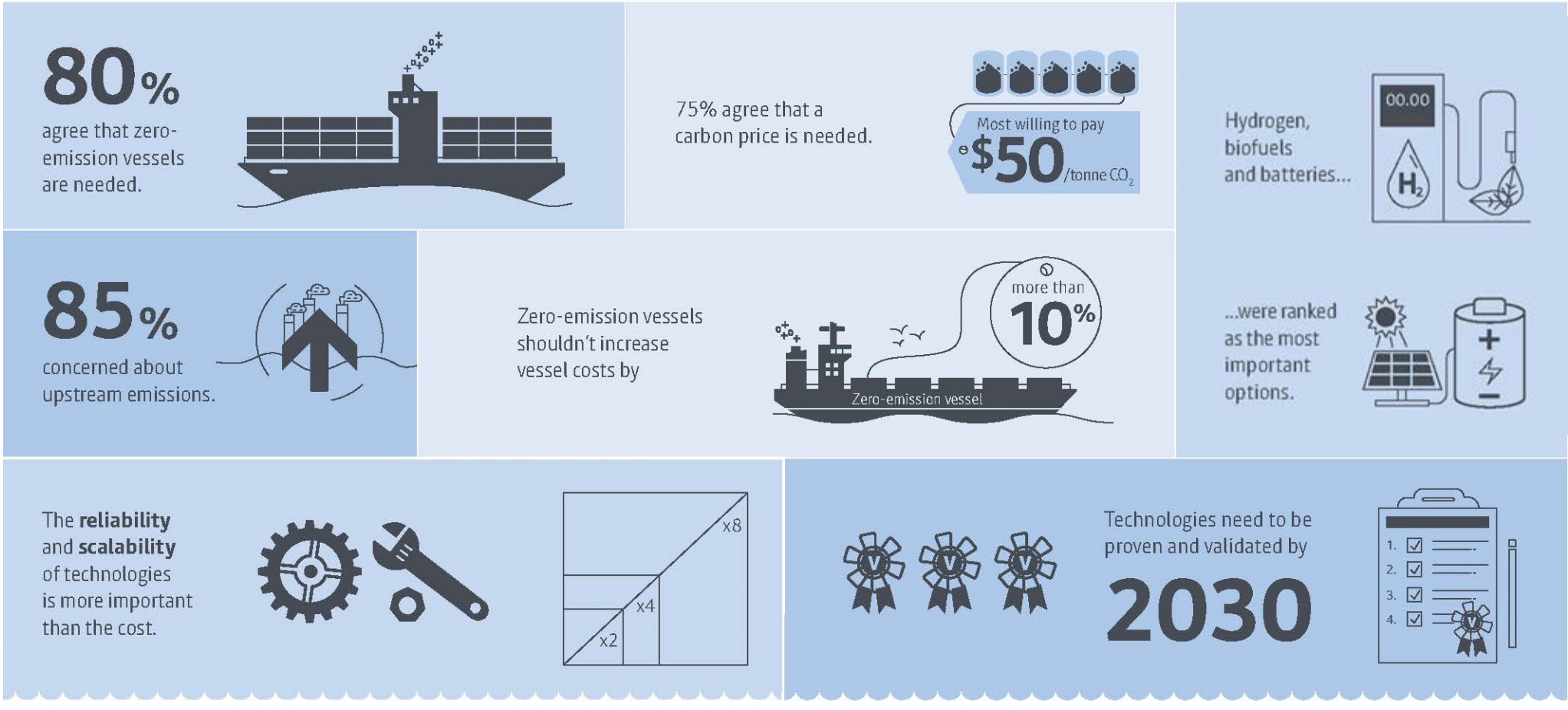
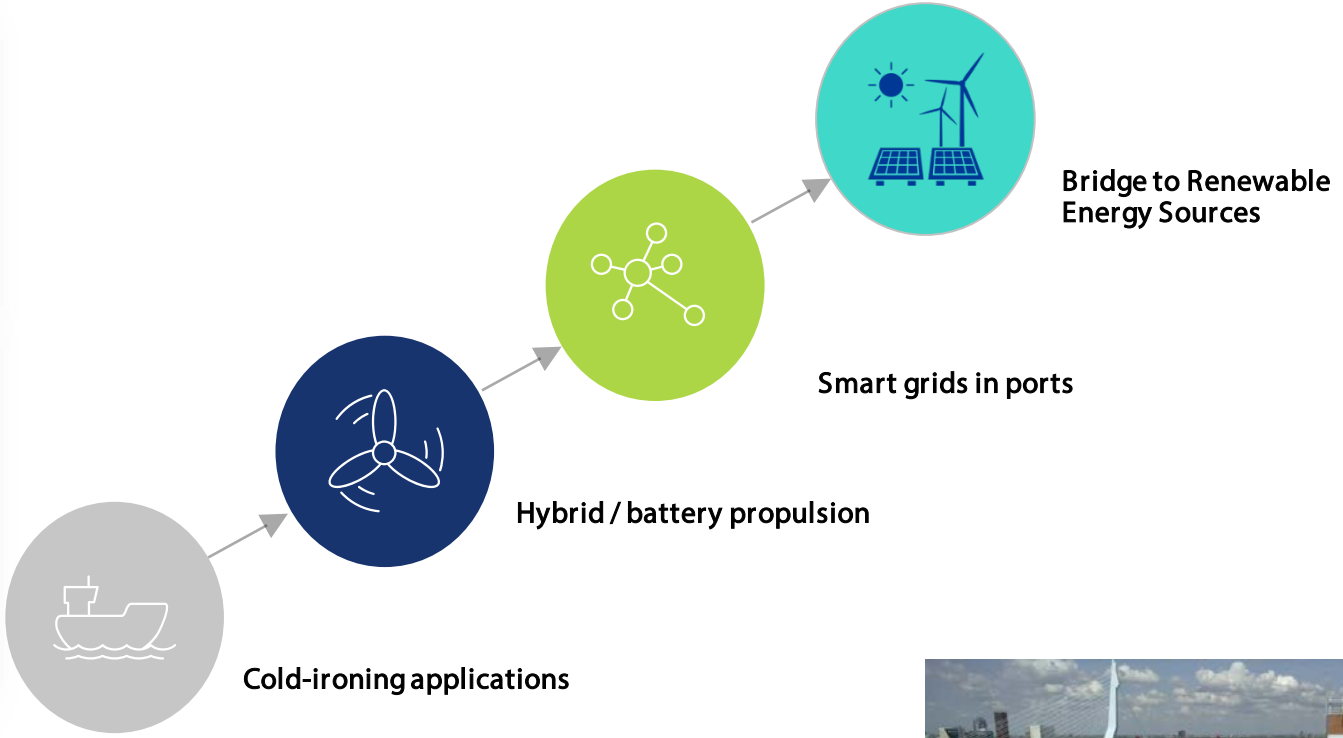


Figure Shipping stakeholders survey responses

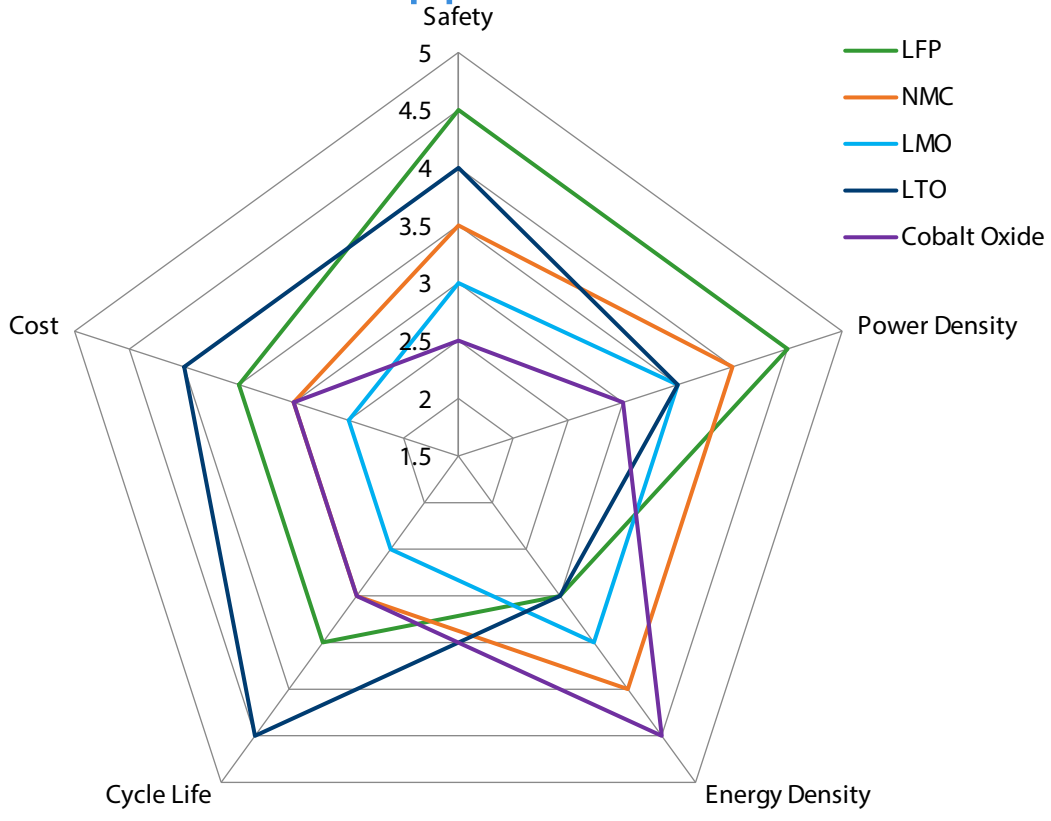
Research conducted jointly by LR Group Ltd and UMAS

Pathways towards shipping electrification



Li-Ion Battery Technologies

It's all about the application



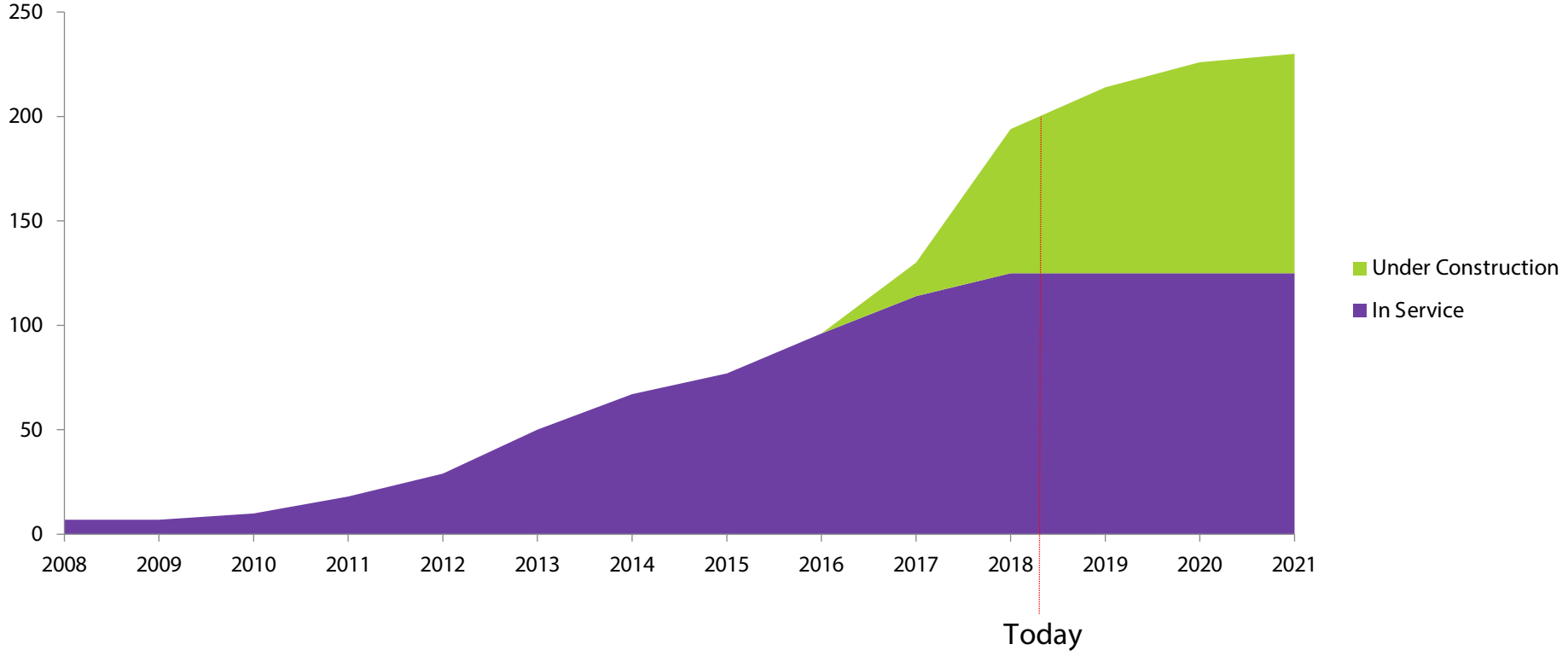
BC Ferries Hybrid: 1.5MWh NMC Batteries
Small Distances – Hybrid Profile

Victoria of Wight: 1.1MWh Batteries
Designed for optimum life cycle

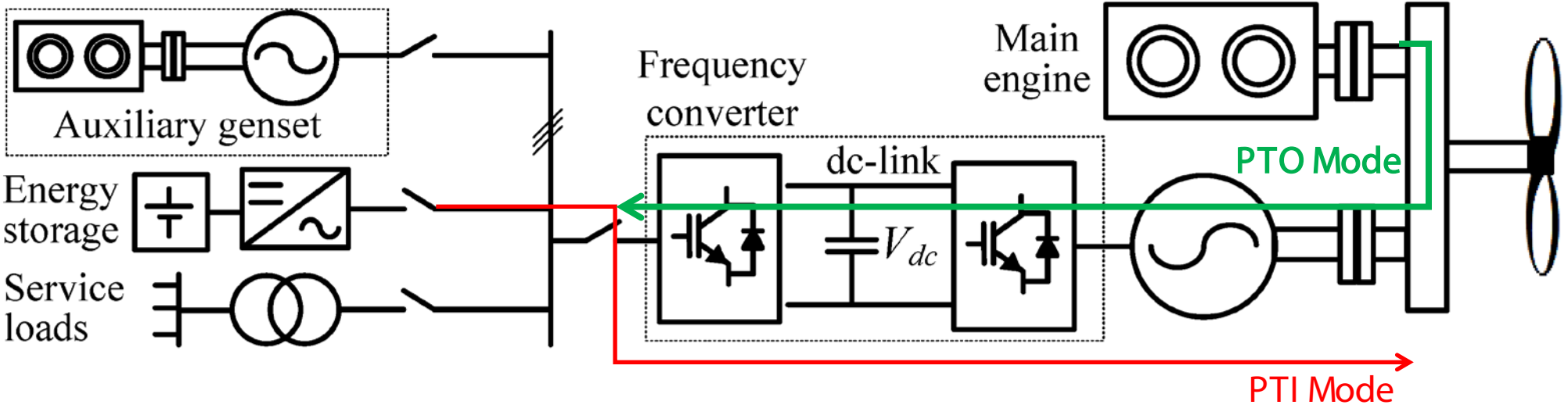
From Electrochemistry to Marine Energy Storage

Plug n' Play Containerized solutions for marine applications

Global State of Play in Hybrid Vessels



Integrating Batteries to vessels' powertrain



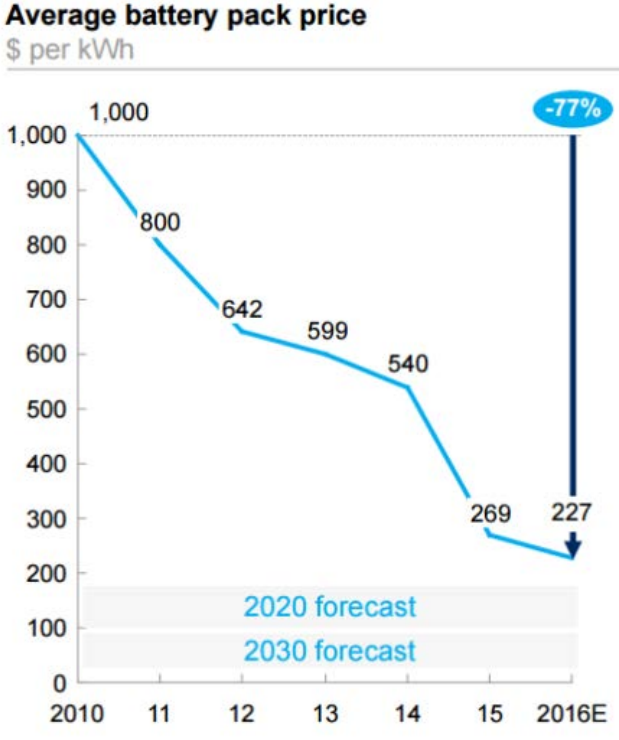
- Dynamic Positioning
- Load Levelling
- Peak Shaving
- PTI/PTO Modes

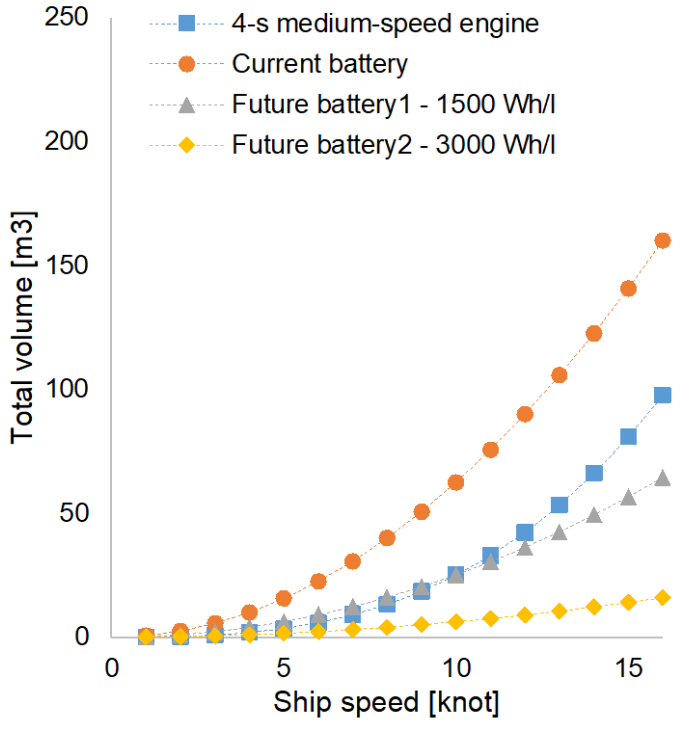
- Better equipment performance
- Maintenance optimization
- Significant Fuel Savings Potential
- Zero Emissions Mode in ECA zones

The future of Energy Storage

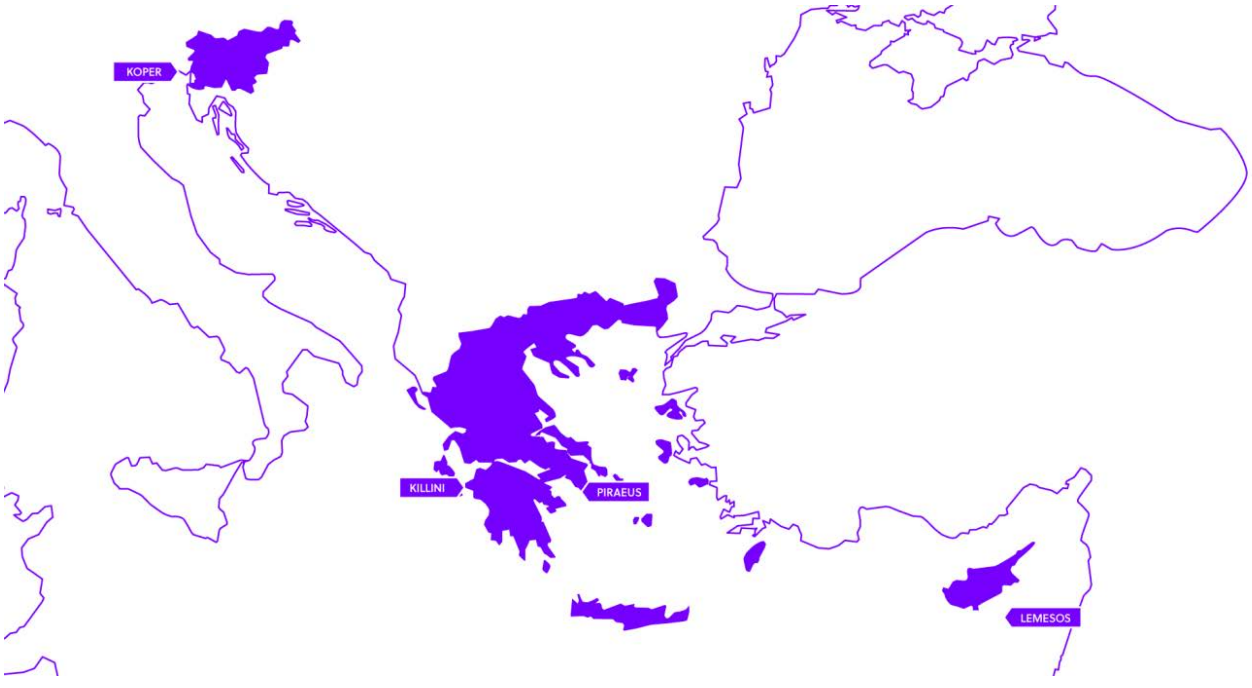
Batteries are becoming lighter, cheaper and more energy dense

- OEM's announced that in the next 5 years Li-Ion battery density would be double compared to current solutions
- Israeli Startup Phinergy has Launched ultra light and ultra dense Al-Air batteries: 1 TEU approx. 200MWh





Electrifying the East Med: The case of Elemed



3 Member States – Participating Ports:

- Piraeus – Killini (Greece)
- Lemesos (Cyprus)
- Koper (Slovenia)

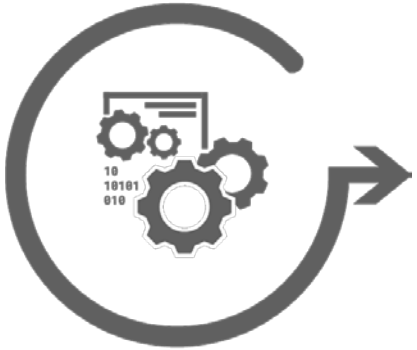
Cross-european maritime network and **macro-regional strategies** for Adriatic-Ionian Seas

First Cohesion Fund project in Motorways of the Sea

Co-financed by the European Union
Connecting Europe Facility

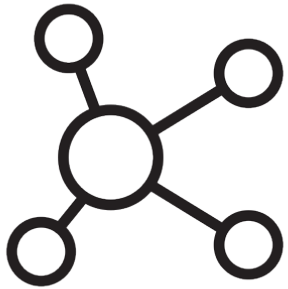
Project Highlights

elemed



- Front End Engineering Design for **Piraeus, Limassol & Koper**
- Detailed Design for the Port of **Killini** and 1 Ro-Pax Vessel

- Risk Assessment studies for cold ironing and hybrid ships
- Shipyard Preparedness assessment



- Regulatory Analysis and Proposal for Port & Ship Electrification
- Operation, Safety and Training Requirements

- Techno-economic assessment tool for hybrid solutions
- Reports on port emissions, renewable integration and smart grid deployment

our future charged

Co-financed by the European Union
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All-Electric Ferry Concept Design

elemed

Principal characteristics:

Length: abt. 85m

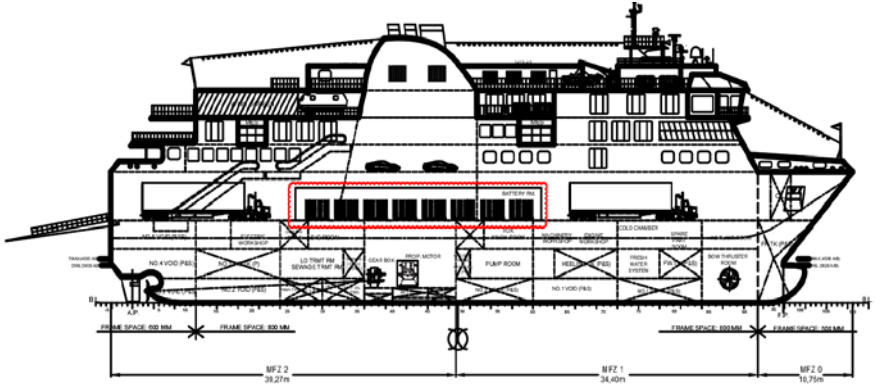
Capacity: ~1200 Pax

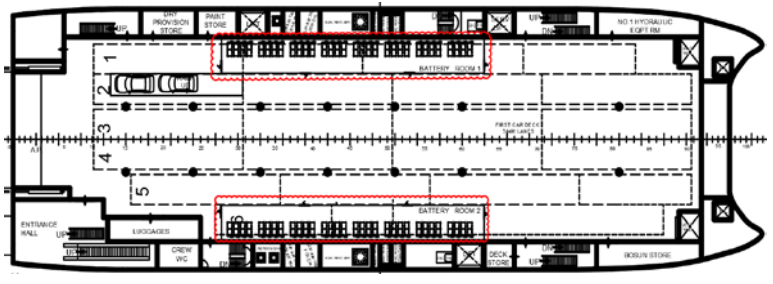
abt. 87 cars

288m of Truck Lanes

Speed: 17 knots

Projected Battery Installation: 8MWh





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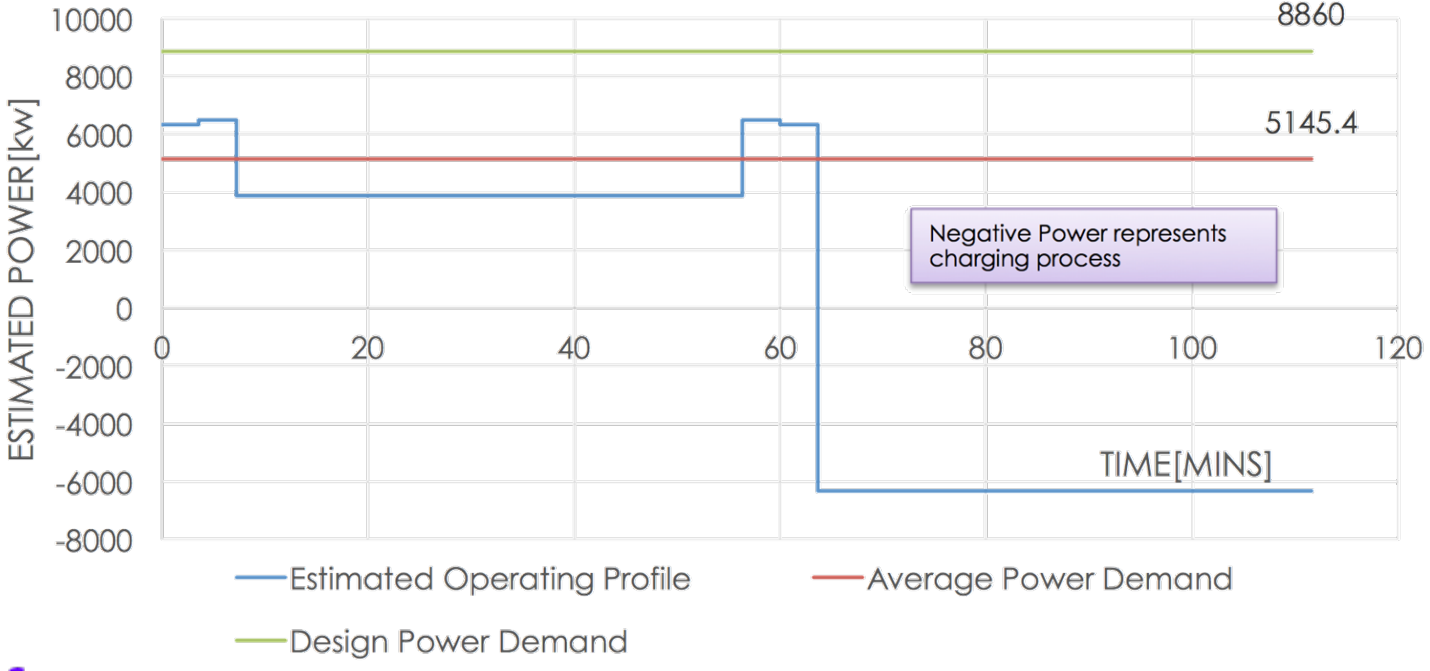
All-Electric Ferry Concept Design

elemed

The Battery Energy Storage System is expected to provide reliability in terms of adequate embedded energy and weight minimization:



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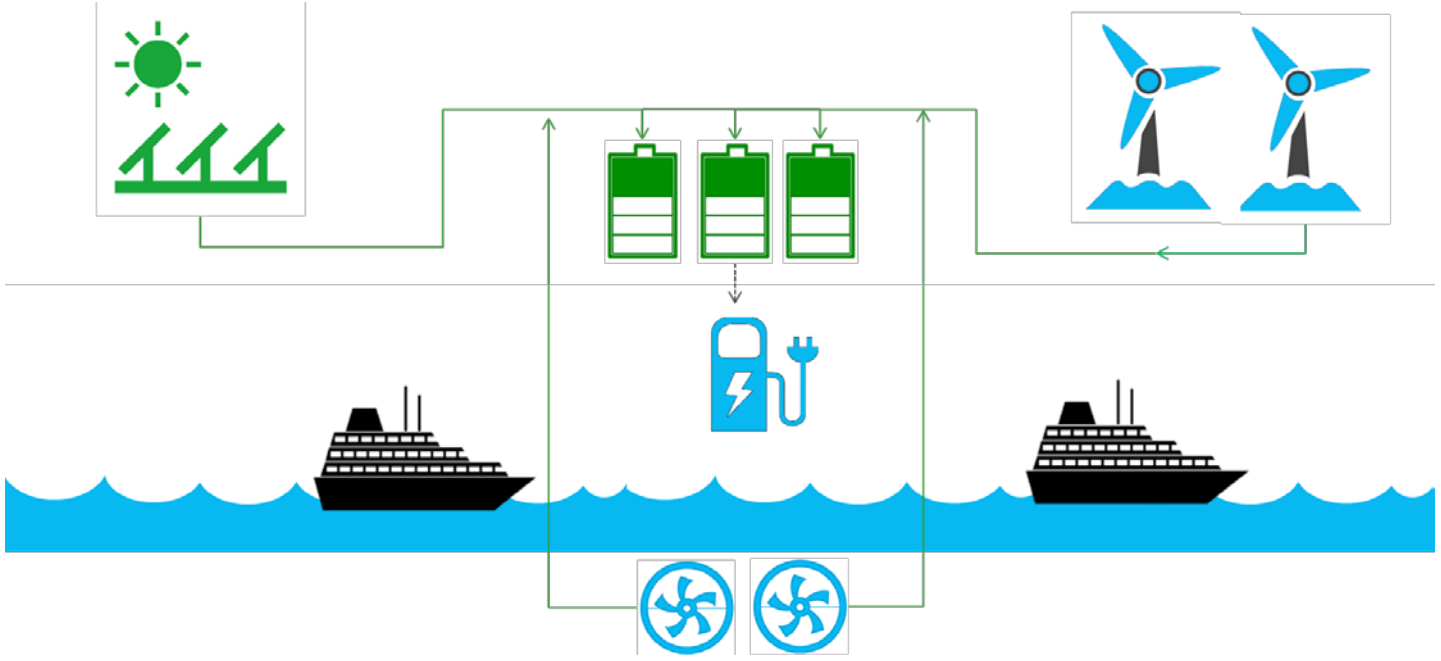
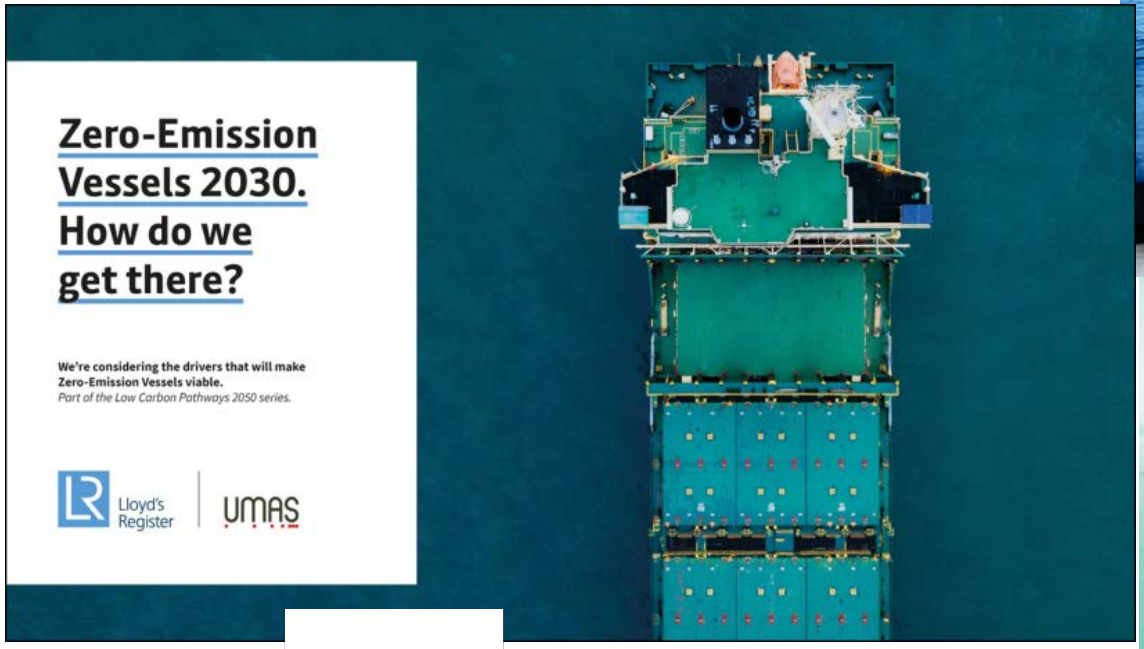
Conclusions

- Electricity: Part of the future shipping energy mix
- Power Management key to future vessel efficiency
- Sustainable coastal mobility based on electric vessels



Where next?

New technologies.
Smarter working.



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Thank you

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