

Electrification in ports and vessels: Towards sustainable sea mobility

Roadmap & Strategies for the ports' and islands' transition through Electrification

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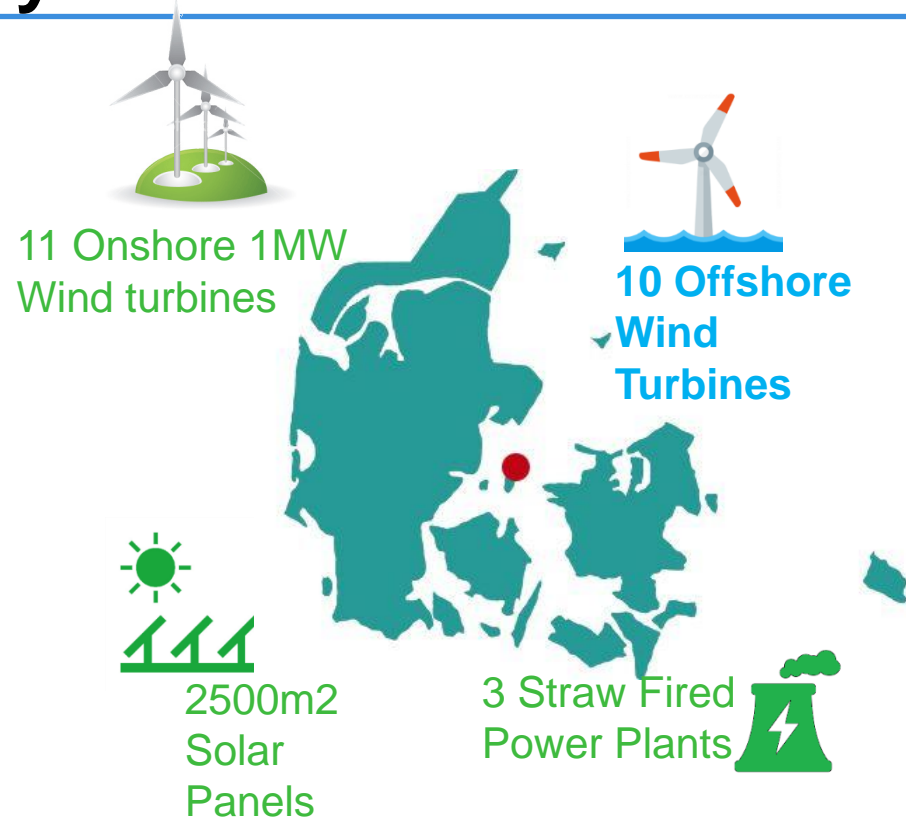


The Magic Cases of Orkney and Samso



- Electricity from Wind and Tidal Turbines
- Excess energy is used to produce hydrogen
- Fuel cells provide electricity on demand for ships and activity within Kirkwall Harbour.
- By-product heat is piped to community buildings

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Insularity : The Greek Case

An endless opportunity for synergies

Potential: More than 100 Short Sea Shipping connections in Greece –
30% under 5nm



More than 150 vessels
operate these routes



Huge potential for **Green**
Hybrid Technologies



5GW of RES installed in GR
Projection for more than
12GW by 2025



Marine transportation as a
consumer of excessive
RES electricity



Renewables Prospect

The vision for cheaper and clean electricity

Most Aegean Islands are not connected to the mainland grid and thus rely on polluting and costly-inefficient diesel generation

- Cost of Electricity can be 3-27 times more than System Marginal Price
- Santorini 0.2 €/KWh – Ikaria 0.4 €/KWh *
- Donousa : 1.34 €/KWh*
- Cost for Non-Connected Islands, approx. € 800 Mil/year

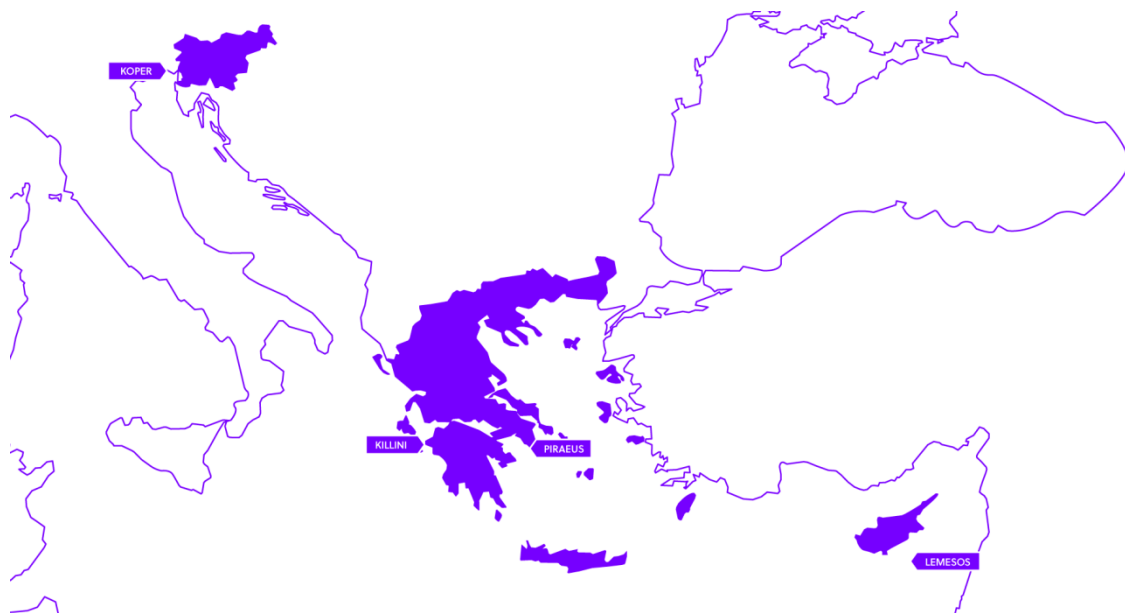
While :

Levelized Cost of Energy for Renewables:

- Wind: 2.8-5.5 cents €/KWh
- Utility Scale PV: 3.1-6.2 cents €/KWh
- Fuel Cells : 8.9-13.2 cents €/KWh



First Cohesion Fund project in Motorways of the Sea



3 Member States – Participating Ports:

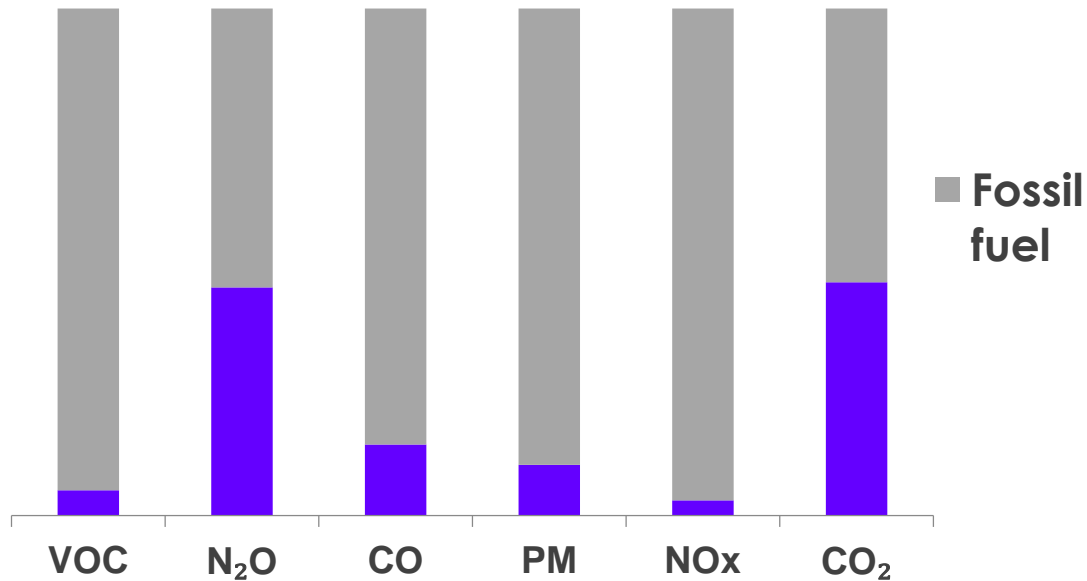
- Piraeus – Killini (Greece)
- Lemesos (Cyprus)
- Koper (Slovenia)

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

The Vision of Elemed Project

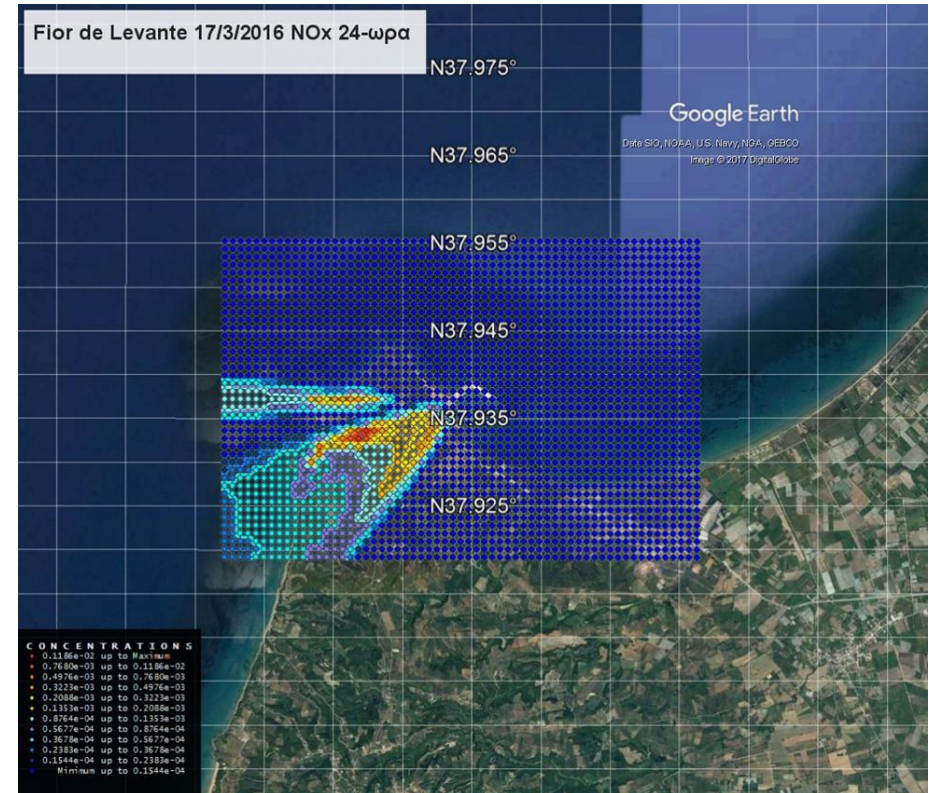
elemed

To reduce emissions in the vicinity of populated areas where it matters the most



**Emissions Reduction Potential from
the adaptation of cold ironing**

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**Snapshot from NO_x Emissions Simulation
for a berthed vessel at the Port of Killini**

The case of Killini Port

The first cold ironing installation in the East-Med Area

- Serving the Zakynthos and Kefalonia Islands
- Port Installation for 2-4 Shore Connections Projected
- Real life application – crash test for similar port works
- Record time permitting process



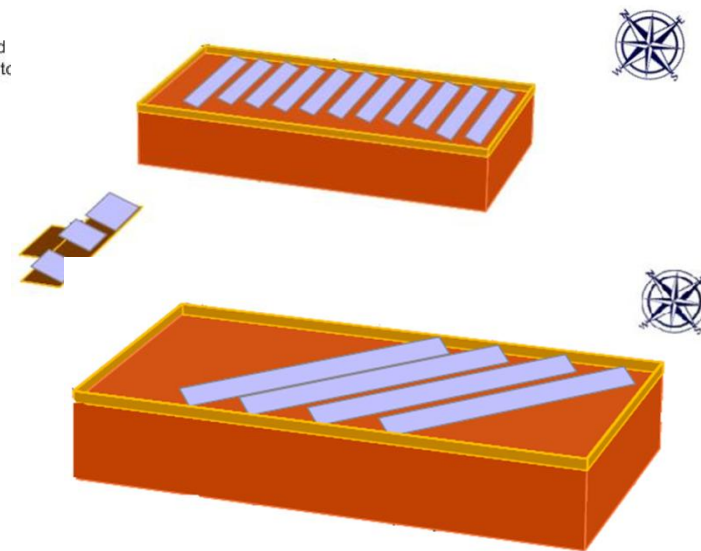
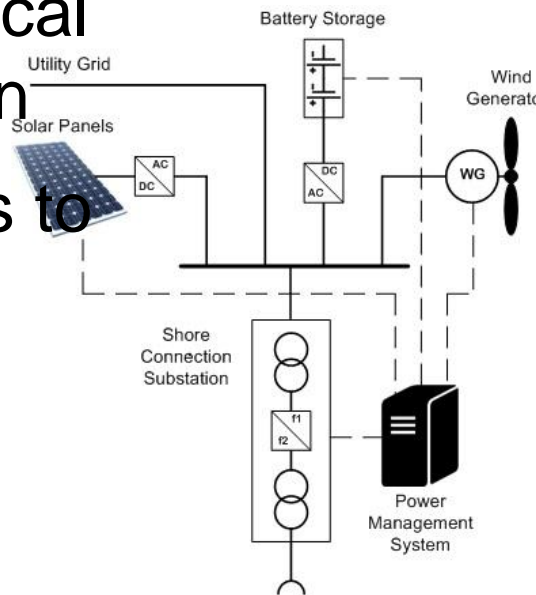
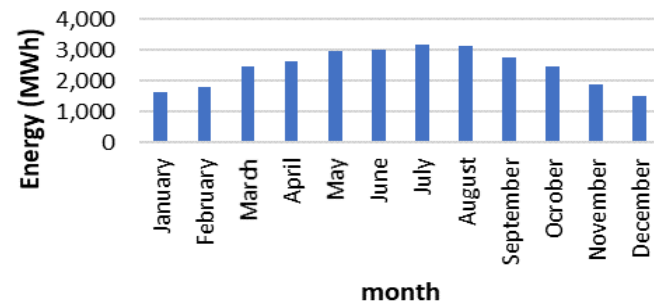
Pilot installation: 1 berth supplying one Ro-Pax vessel with approx. 500kVA needs during port stay

The case of Killini Port

Snapshot from the near future

- 4 cold ironing positions and 1 electric bunkering station
- Studies for PV and Vertical Wind turbines integration
- Energy from renewables to berthed vessels
- Surplus RES energy to energy storage system

Array Energy Production



A modern Regulatory framework

Electrification in Ships & Ports

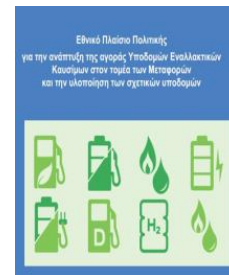
Elemed Proposal:

3 Pillar Proposal: Policy, Financial Incentives, Technical Requirements

Policy recommendations

- Ports supplying electricity for cold-ironing services (Eleftherios Venizelos Model)
- Support of renewable energy integration
- Simplification of permit procedure for installation & use of electric power within ports

National Policy Framework for Alternative Fuels Integration of Elemed Proposal



Recommendations on Funding/Financing

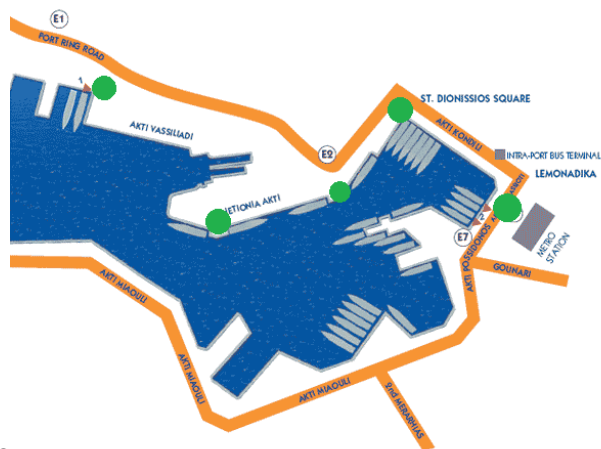
- Inclusion of electric power in the **marine fuels category** and application special taxation measures
- Design an efficient regulatory environment to ensure sustainable provision of Public Private Partnerships (PPPs), involving local insular communities
- Build an equivalent funding environment attracting investments in hybrid shipping for isolated insular routes

Ship & Port Electrification Combined

Prospects and Benefits

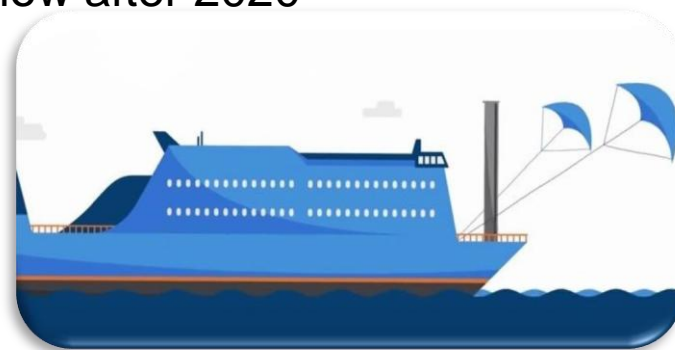
Snapshot from Piraeus Terminal

- More than 500,000 population in proximity to port
- Huge direct benefits from the adaptation of Cold Ironing
- 98% Elimination of NOx and PM

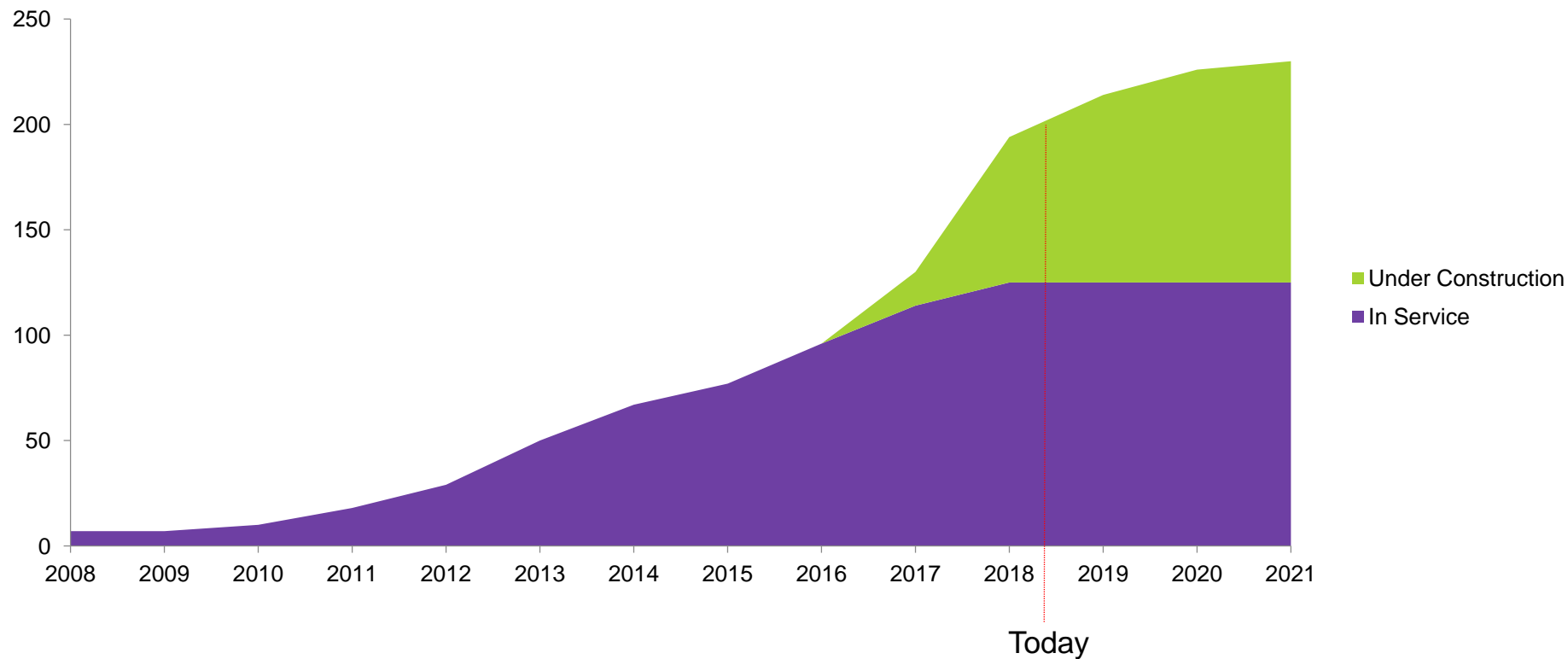


Electro-mobility at sea

- Battery Prices are dropping fast & New ultra density ESS will be on the market soon
- Estimated Electricity cost for an electric ferry 1cent/€ per PAX per Nautical Mile
- A Radical Technology Uptake Program to follow after 2020



Global State of Play in Hybrid Vessels

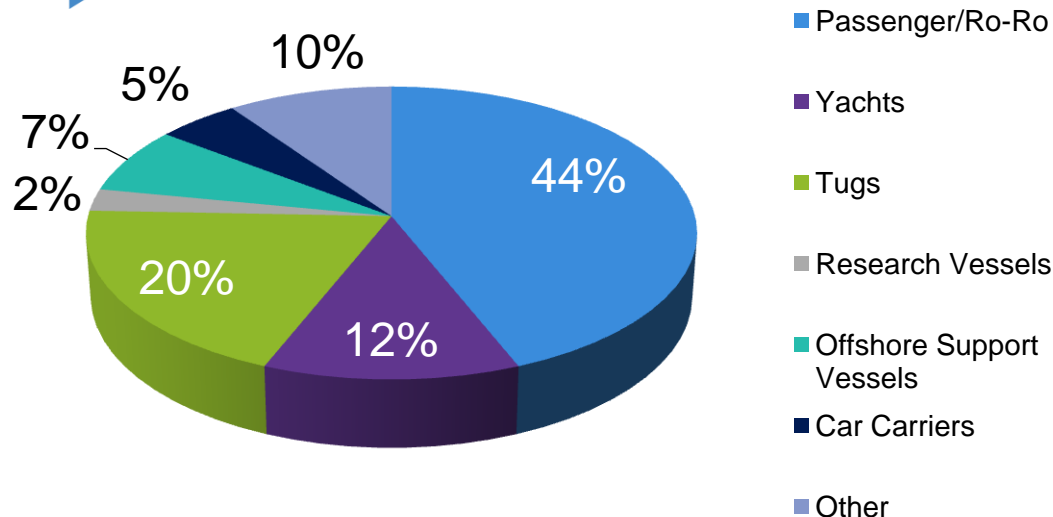


LR and Hybrid Ship Technology

- LR has an extensive - nearly 20-year - experience of battery installations on board ships and yachts
- Integrated approach to the acceptance of battery installations



Hybrid Fleet Around the Globe



Hybrid Ferries

Prominent Examples from LR Experience



Scandlines Prins Richard –
2.6MWh



BCFerries Hybrid Concept – 1.5
MWh

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Victoria of Wight– 1.1MWh



Teso Texelsroom – 900kWh

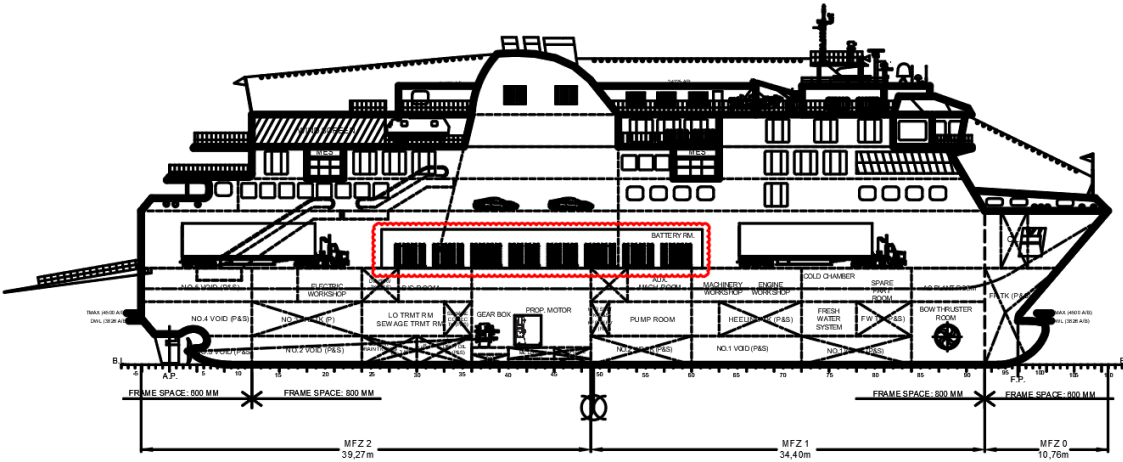


CalMac Hallaig– 500 kWh



Tycho Brahe– 4160kWh

elemed Hybrid Vessel Design

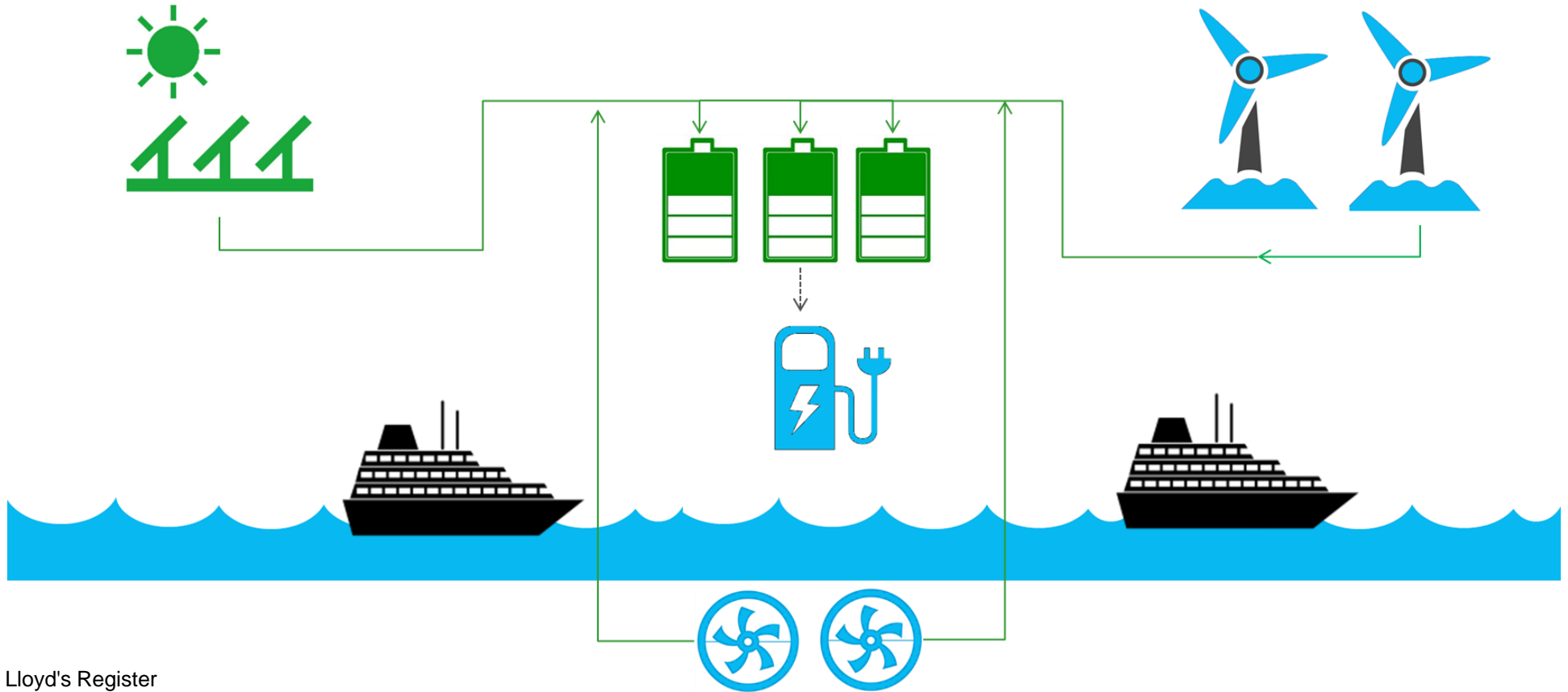


- Twin Screw/Twin Hull Ro-Pax
- LOA **84.4m**
- **1000 Pax**
- Service Speed : 17 kts
- All Electric Configuration
- Top Tier Deck allocated for solar panels

- Projected battery Needs 5MWh @ 17kts
- Projected Installation **8MWh**
- DC power distribution for space and performance optimization
- **50% CO2 reduction, NOx, SOx & PM elimination**

Wind & Sun to Propeller:

Shaping a sustainable future



Snapshot from a sustainable insular ecosystem

New Energy and Transportation Markets

- Potential for the islands to meet more of their own energy demands
- Enhanced Electro-mobility
- Drastic improvement in power availability and Grid Reliability
- Improved environmental conditions and GHG reduction
- Direct financial benefits in an emissions and noise free environment



Thank you

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