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Shipping Electrification and the Elemed project Case

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our future
charged



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Ports, Maritime Transportation
& Insularity Conference,
Milos 21-22 April, 2016



Drivers behind electrification in Shipping



Policies



Technology

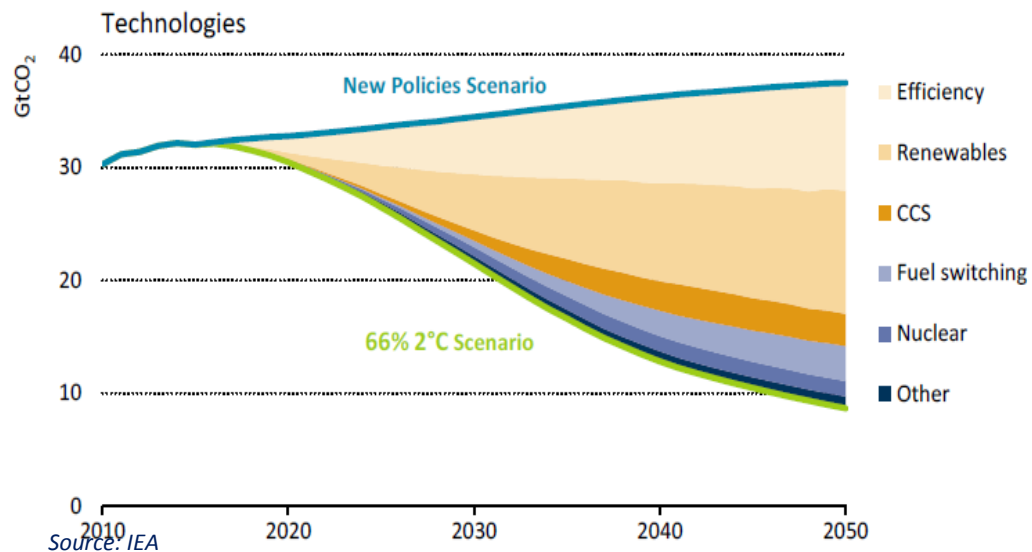


Societal
Needs

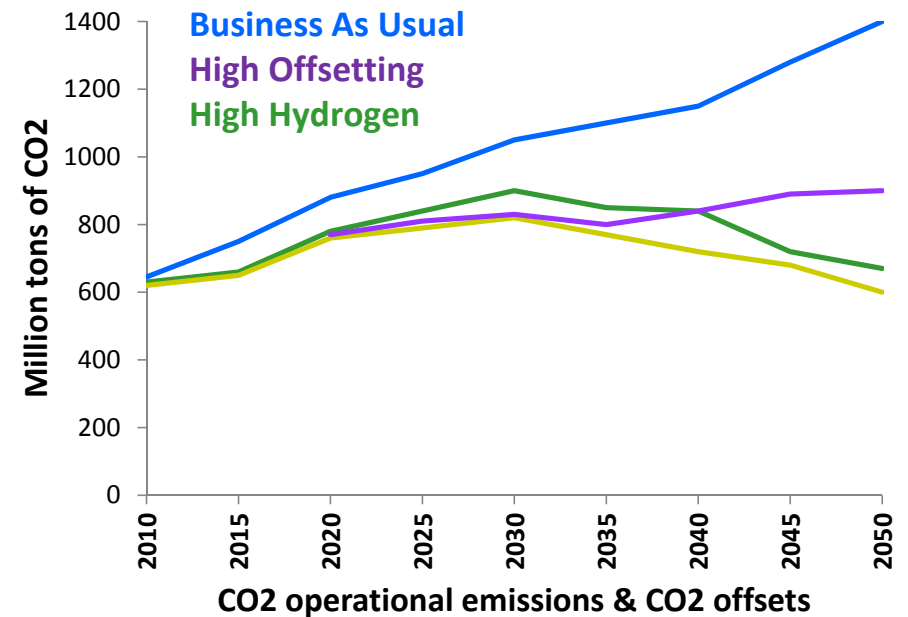


Decarbonisation

IEA Carbon Dioxide emissions under NPS and 66%2degC



LR Carbon Pathways – Shipping GHG Emissions Scenarios



X Factor – The Carbon premium

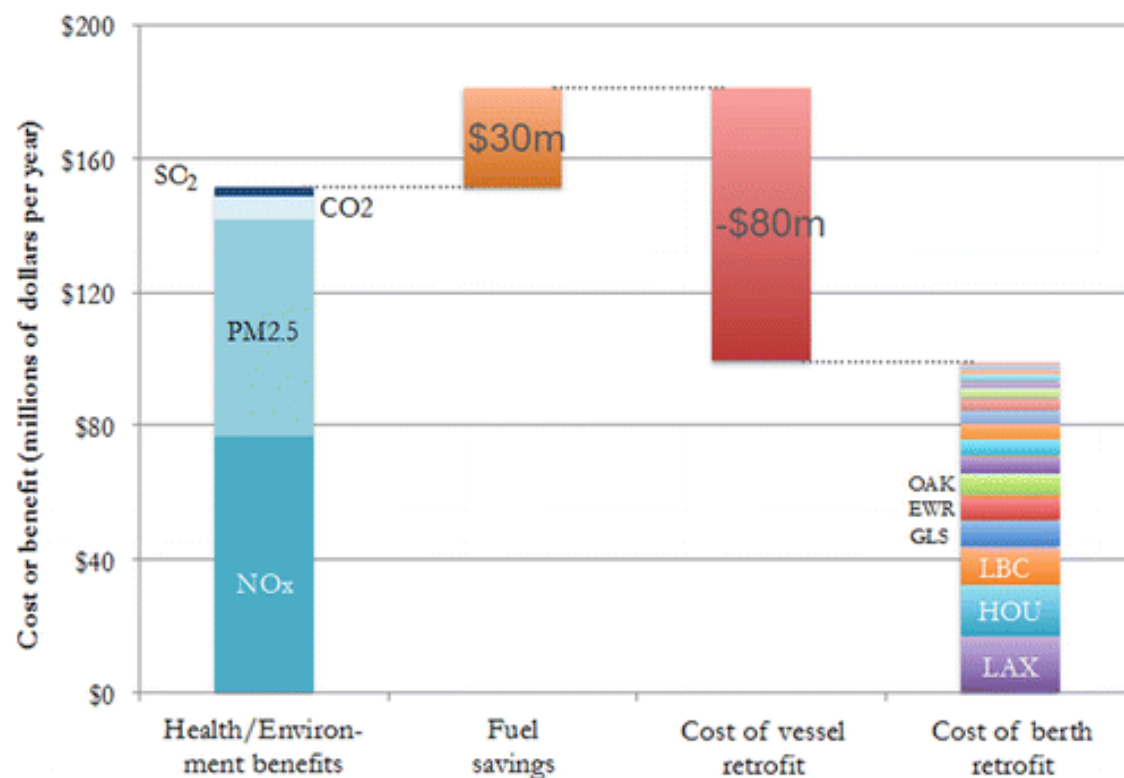
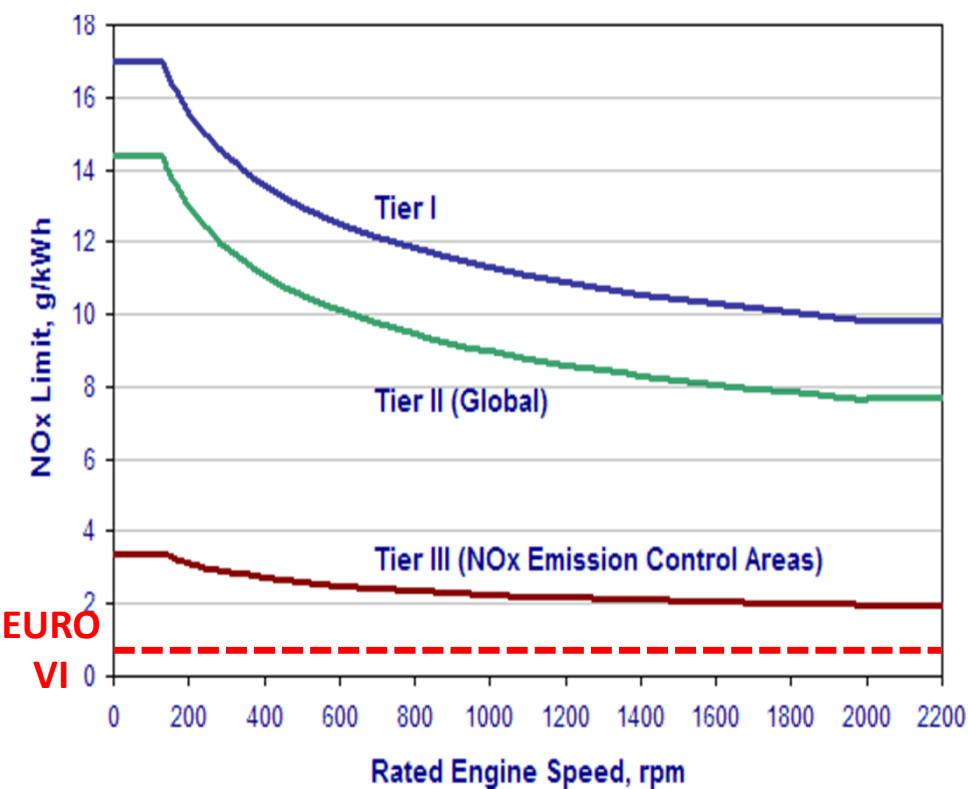
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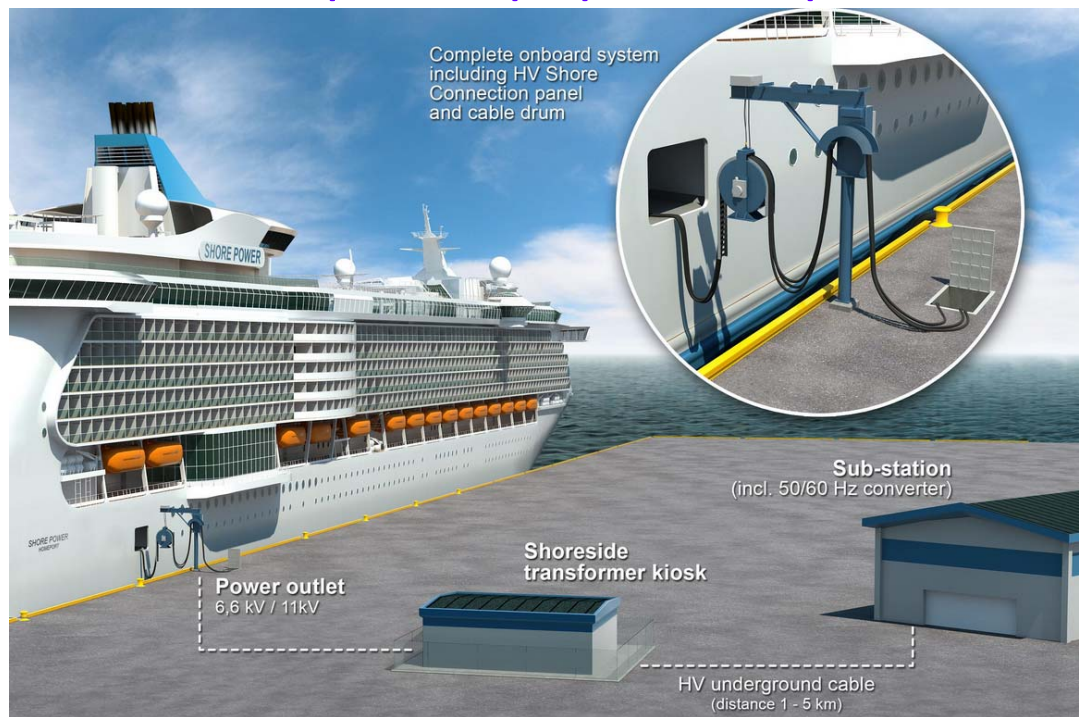
NOx Gap explained



Shipping Electrification Technologies

Cold Ironing

Ηλεκτροδότηση στον Λιμένα



Electric Bunkering

Ηλεκτροφόρτιση



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Lloyd's
Register

Application to the South-eastern Mediterranean Corridor



Public Health



Growth



Environment



Mobility

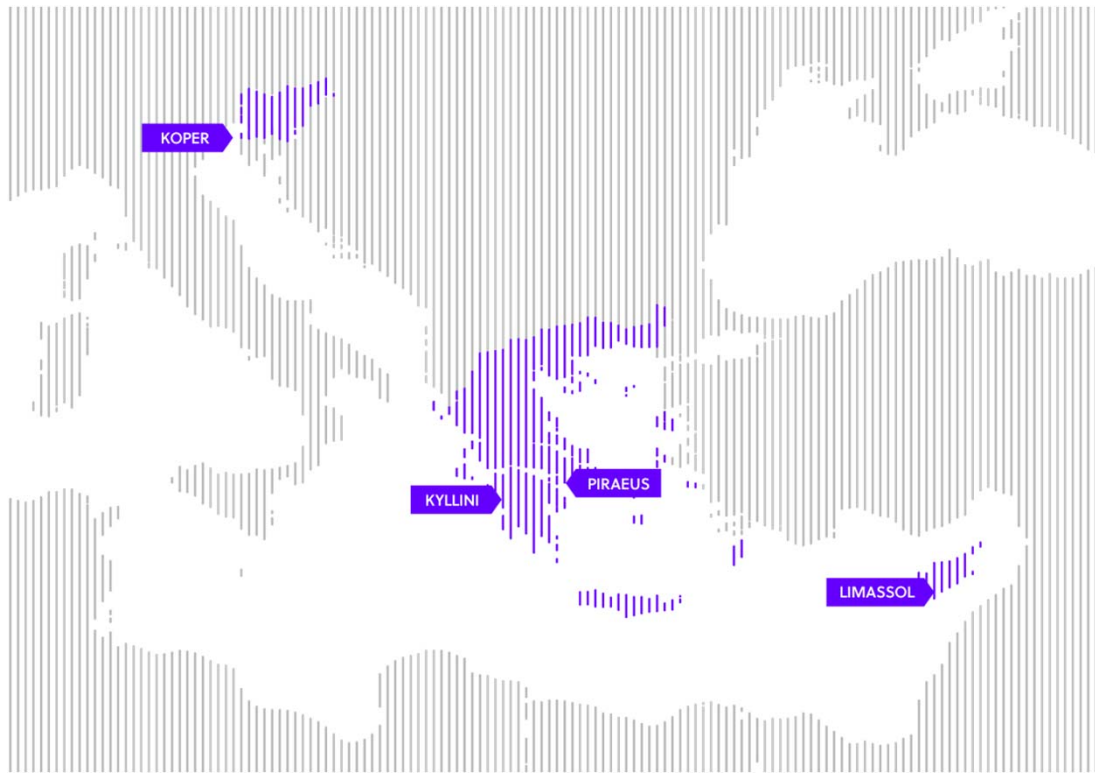
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Application to the South-eastern Mediterranean Corridor



3 Member States – Participating Ports:

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

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

eIemed Firsts and Vision

1st Cohesion Fund maritime project

1st Marine Med zero-emission project

1st on-shore power connection East Med

Vision

*Minimise impact of shipping in vicinity of populated areas
Bridge Renewable Energy with Shipping*

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Our Team



- / Hellenic Lloyd's SA
- / National Technical University of Athens
- / Piraeus Port Authority
- / Kyllini Port
- / Cyprus Ports Authority
- / Port of Koper
- / Hydrus Engineering Ltd
- / Spanopoulos Group
- / Protasis SA
- / Hellenic Centre for Marine Research



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Activities

- / **Regulatory Framework & Societal Benefits**
- / **Cold Ironing: Ports & Vessels**
- / **Shipping Electrification: Ports & Vessels**
 - Vessel Concept Design for Ro-Pax ferry for 20nm connections
- / **Financing Instruments & Public-Private Partnership (PPP) for investments**
- / **Training** on new technologies
- / **Pilot Action** for Killini Port
- / **Dissemination & Social Awareness**

Methodology

- Review of Global completed case studies and alternative electric interconnection solutions (Juneau & Los Angeles, Rotterdam, Gothenburg etc.)
- Examination of modern technological achievements (Smartgrid, Large batteries Installations etc.)
- FEED and Maturity of local studies for implementation

Upon the completion of the project:

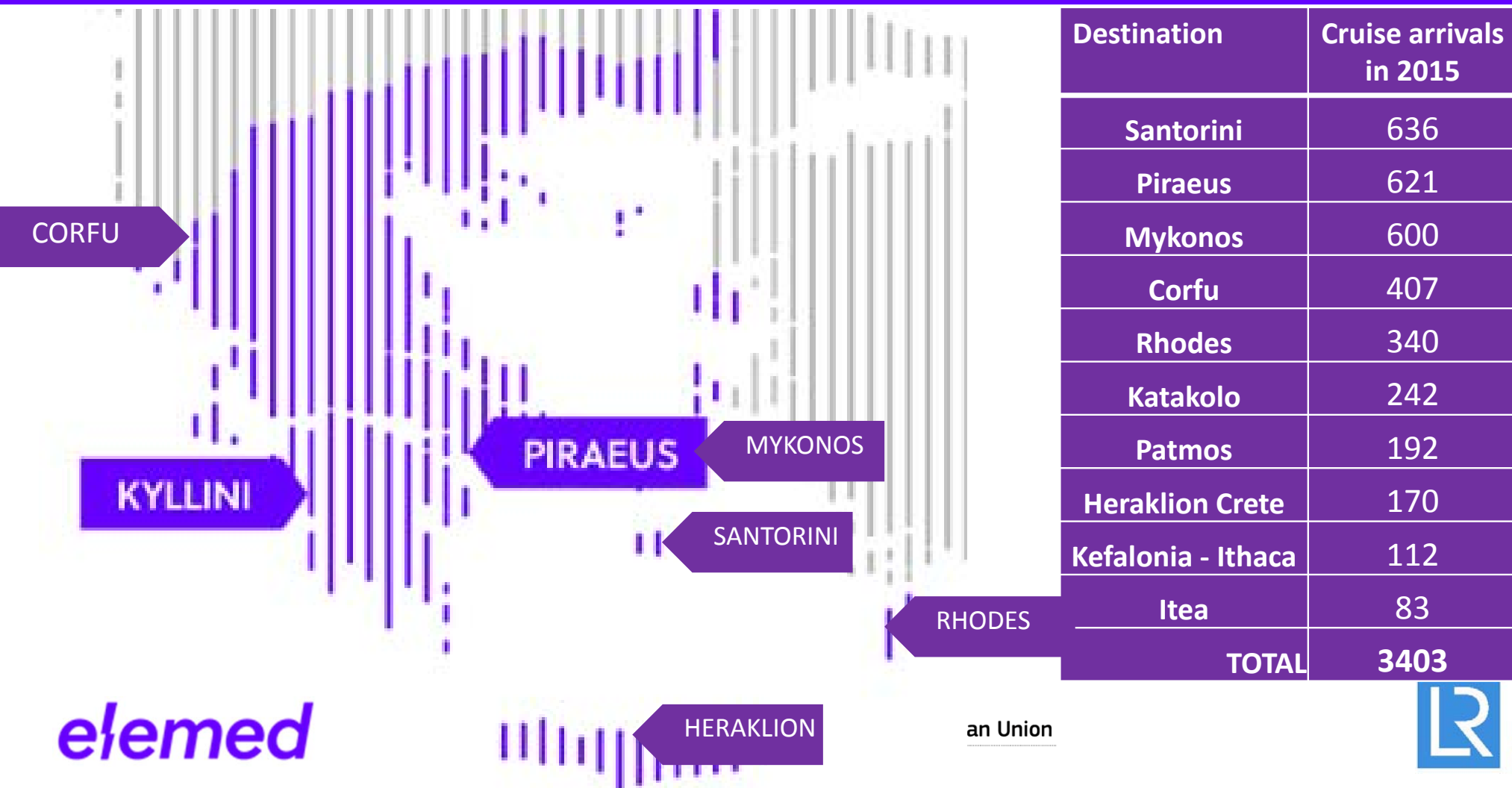
- ✓ the new electric bunkering infrastructure requirements for each port will be defined
- ✓ A strong , smart and flexible regulatory framework will be in place
- ✓ SE Med will be ready for the Global Project: development of a worldwide competitive new electric shipping cluster of connections and emissions free ports

Regulatory Framework – Key to success

- Electrification should be treated as **one infrastructure** (Cold Ironing, Electric ships & bunkering, Leisure)
- Raise awareness and engage the local communities **tackle the NIMBY effect** to the uptake of new technology and investment
- Electric supply for Marine use is practically clean energy, there should a provision for **Marine Electricity** *(On the basis of emissions differential)
- A robust regime for **incentives** should be in place , (ports, consumers, communities)
- **Public Private Partnership schemes** , key to investment

Shipping could explore ways to make good use of the electricity production by-product in the same manner it has done so far for the oil refinery industry

Greece Shipping Electrification Potential



The Piraeus Case

- 621 Cruise ship arrivals 2015
- Approx 1000 Berthdays
- At 8 MW load per ship and 10 cents /KWh saving



✓ 190 GWh / year, 19 million Euro in savings

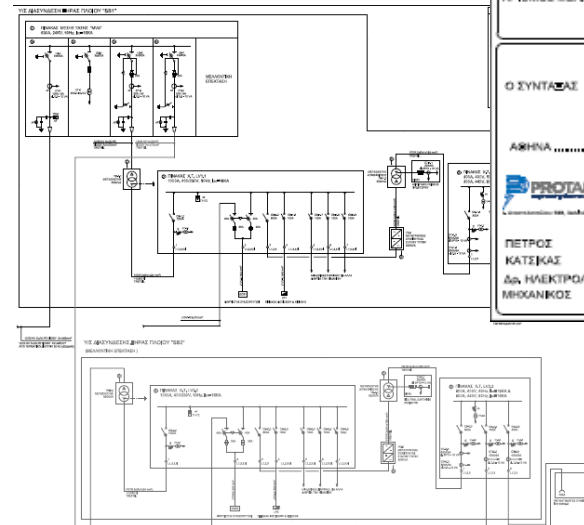
- ❑ Port lacks electrical infrastructure , critical to growth
- ❑ Significant electric bunkering potential in short sea connections and support vessels (e.g. tugs)

Pilot Port of Kyllini

- 1st Pilot OPS for a Ro-Pax vessel at port
- Serving the Zakynthos and Kefalonia Islands
- Port Installation for 2-4 Shore Connections Projected
- First Electric Bunkering connection
- Maximum anticipated load 1-2 MW depending on Charging patterns use of energy buffer



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| ΣΤΑΔΙΟ: ΟΡΙΣΤΙΚΗ ΜΕΛΕΤΗ | | |
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Societal & Environmental Benefits

- Reduction of **air emissions** in the ports surrounding areas
- Reduction of **noise and vibrations** from ships at berth
- Upgrading of the **quality of life** with prospective **benefit** in other sectors: trade, tourism
- Alignment with **EU directive** for **SOx** emissions (2020) and potential upcoming requirements for **NOx** emissions and **particulate matters**
- Alignment with International goals for air emissions (**Paris Agreement 2015 – COP21**)
- Evolution of **sustainable connectivity** and support of **insular communities** of the Archipelago



MV Hallaig: Calmac's first Hybrid Ferry



the **world's first** sea-going roll-on roll-off vehicle and passenger **diesel-electric hybrid** ferry



incorporates a **low-carbon hybrid** system of **diesel electric** and **lithium ion battery** power



developed under the Low Emission Hybrid Ferries Project



more than **£20m** of Scottish **government investment**
created **175 jobs** and **20 apprenticeship** positions for the local community

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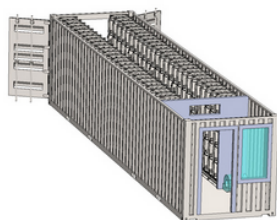


Current State of Technology

Batteries Cost

- Down 80% in 6 yrs at **227 \$/Kwh**
- Tesla Gigafactory to attain **125\$/KWh**
- Next stop **100\$/KWh before 2020**

40' Container Configuration



- Battery Only, 1365 kWh
- Battery & Power Electronics, 819 kWh



MAR 17, 2017 @ 06:00 AM 17,312

The Little Black Book of Billionaire Secrets

The Beguiling Promise Of John Goodenough's New Battery Technology

James Conca, CONTRIBUTOR
I write about nuclear, energy and the environment. FULL BIO

Google's Eric Schmidt tweeted this week about a new fast-charging battery technology from John Goodenough, the inventor of the lithium-ion battery. Dr. Maria Braga and his research team in the Cockrell School of Engineering at the University of Texas in Austin.

4KW 14 SolarWorld Solar Panels - £6995 inc Free Battery Storage
High Performance, Double Sided Cell, Free Remote Survey, No Sales People.
firstsolar.co.uk

| Ship name | Ship type | Year of build |
|---------------------|----------------------|-----------------------------|
| Savannah | Yacht | 2015 |
| Hybrid III | Passenger/ro-ro ship | 2015 |
| Perentie | Tug | 2015 |
| Euro | Tug | 2014 |
| Dugong | Tug | 2014 |
| Boodie | Tug | 2014 |
| RT Emotion | Tug | 2014 |
| RT Evolution | Tug | 2014 |
| Lochinvar | Passenger/ro-ro ship | 2013 |
| Hallaig | Passenger/ro-ro ship | 2013 |
| Rainbow | Yacht | 2012 |
| RT Adriaan | Tug | 2010 (hybrid retrofit 2012) |
| Deutschland | Passenger/ro-ro ship | 1997 |
| Prinsesse Benedikte | Passenger/ro-ro ship | 1997 |
| Schleswig-Holstein | Passenger/ro-ro ship | 1997 |
| Prins Richard | Passenger/ro-ro ship | 1997 |

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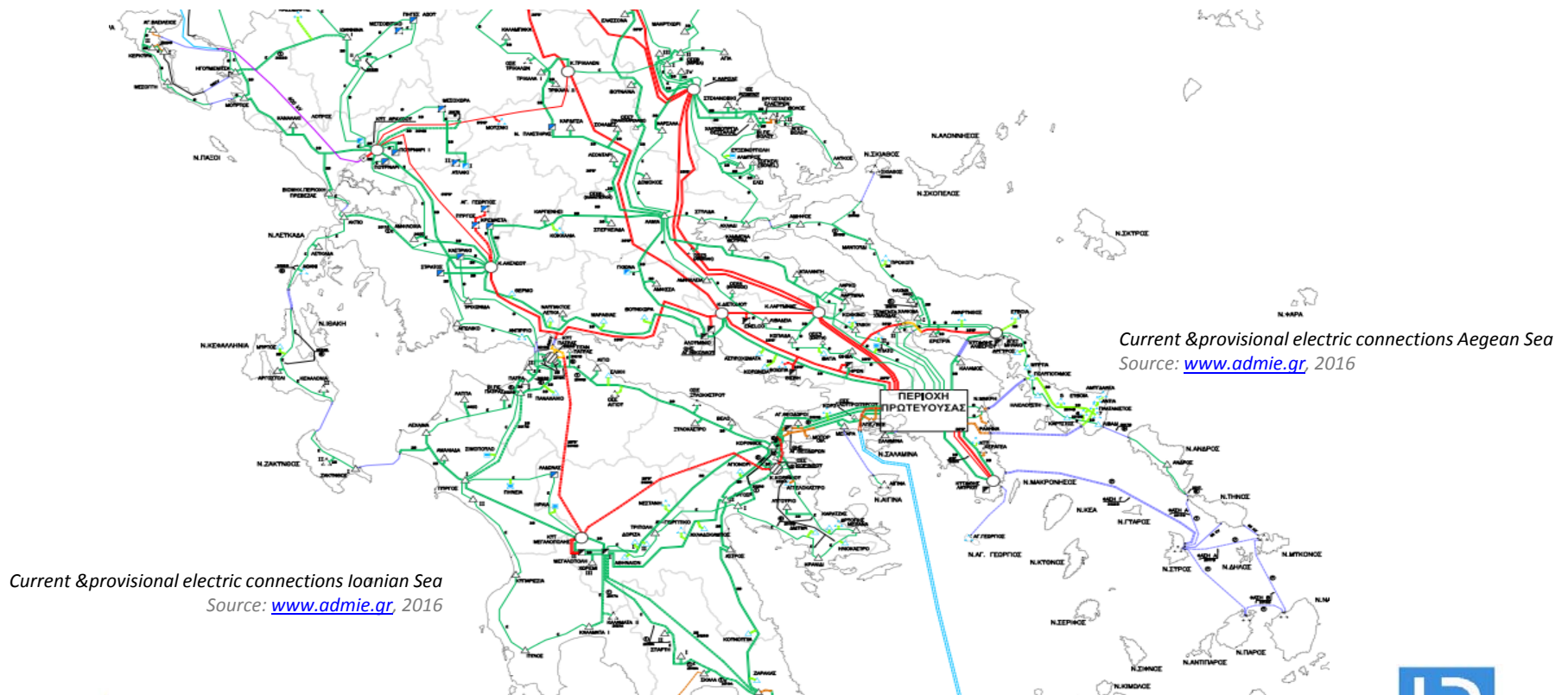
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Map on mainland grid connections 2026 projection

Significant infrastructure under development



Take Aways – Shipping Electrification

❑ Electrification is

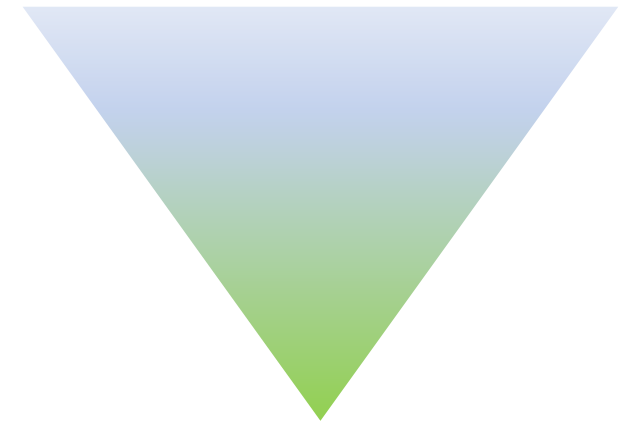
- ✓ The means to attain the zero emission port and vessel,
- ✓ One of the most efficient measures to tackle the shipping societal impact
- ✓ The decisive step to the sustainable ship and sea connection – Αειφόρο πλοίο

❑ Next Steps – What is needed

- ✓ A Green - Efficient – Smart – Generous – Modern **Regulatory Framework**
- ✓ **One Infrastructure**
- ✓ **Pilot Projects** – Lead by example

Ports,

Shipping



Energy

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**our future
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Working together
for a safer world

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