Achieving sustainability in transport through the novelties of the 100% electrically powered ferry

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Facts and Figures about Ferries

• Ferries for passengers & cars (RO-PAX), are popular in Europe and beyond; 3 main passenger ferry markets are: the Baltic, the North Sea and the Mediterranean.

• *Highest share of passenger volumes → The Mediterranean*

• *Highest share in vehicles transported → The Baltic.*

• *Half of the routes are operated in the Mediterranean (2016).*

• Domestic market in Greece is the largest market for ferries (carrying more than 40 mil. passengers to and from Greek islands every year).
Facts and Figures on Ferries

• Economic recession in 2008 severely affected the market; Signs of recovery appeared in 2011.

• Today, the situation of the market reflects the financial state of each country and/or region:
  – Operators in UK, Denmark and Ireland perform adequately;
  – The ones having their core business in Greece, Finland and Estonia suffer significant losses;
Facts and Figures on Ferries

• European fleet is old and in need of newer, more energy efficient and less CO2 emitting and polluting ferries.
• Mediterranean ferries are on average 22 years old, those on the Baltic Sea and the North Sea are 16 and 14 years old, respectively.
• The number of new ferries dropped from 21 in 2008 to only 10 in 2014 (Shippax, 2013).
Towards the greening of EU ferry transport

Motives for ferry transport to go green include:

• compliance with current/future rules and regulations;
• improved competitiveness resulting from fuel efficiency and cost effectiveness;
• trade flexibility (ECA friendly vessels);
• branding;
• innovation and first mover perception (DNV, 2014).
Ferry electrifications: barriers & challenges

- Current ferry design **not optimised** in terms of **energy efficiency**
- **Reduction** in new ferries’ **weight** often **not considered**
- **Current regulations** make it difficult to apply carbon composite or other alternative materials to steel.
- Rates for delivery of **power from the local grid** to charge during short port stays are **high**.
- Transferring such **high powers** in a **safe** way in **all weather** and **operational conditions** is **difficult**.
- **Maritime industry, crews /unions** not convinced about electric ferries being part of the maritime transport solution
- **Crew competences** for fully electrical operation not clarified
- **Educational requirements** for future ferry crews not in place
E-Ferry: A Game Changing approach to medium range ferry connections

DESIGN/BUILD → VALIDATE/DEMONSTRATE → ACHIEVE IMPACTS → INVESTIGATE MARKET UPTAKE
**E–Ferry at a glance**

E-ferry is a project supported by the EU H2020 programme involving the **design, building & demonstration** of a **fully electric powered** ‘green’ medium sized ferry for medium range connections.

- **Start date:** June 1, 2015
- **Duration:** 48 months
- **Total cost:** 21,3 M€
- **EU funding:** 15 M€
- **10 partners**

E-ferry builds on the Danish Green Ferry Vision Project (awarded as **Initiative of the year**, 2015 Ship Efficiency Awards!)

**E-ferry team**

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Objectives
to design & built an innovative medium sized ferry combining energy efficient design, lightweight equipment & materials, state-of-the-art electric only systems with automated high power.
validate and prove the feasibility and cost effectiveness of the concept to the industry and ferry operators demonstrate: on 2 connections in the Danish part of the Baltic Sea

(a) Soeby-Fynshav and (b) Soeby-Faaborg
• life cycle assessment for a 30-year horizon
• reduce CO$_2$, NO$_x$ emissions and particulates
• test new materials (CFR modules in the superstructure)

• quantify the potential market up-take and CO2-reductions on EU scale and qualify the potential application of the concept on a larger scale;
• develop a business case/model and prepare the concept for market uptake starting soon after the end of its demonstration.
Operational characteristics/advantages

- Distance covered up to 22NM (compared to current max of 5NM)
- Speed up to 14 knots (compared to current max speed of 10 knots)
- Improved charging (at one end of the route)
- Improved sailing range between charging periods (2 x10.7 NM)
- Worldwide largest (yet light) battery capacity for maritime use (4.3 MWh)
- Record breaking high charging power capacity (4 MW) allowing short port stays.
Operational characteristics/advantages

- Faster re-charging (<15 minutes between trips)
- Reduced noise and wake even at higher speeds, benefitting communities and wildlife in the vicinity of the ferry routes.
- High safety standards (Category C &D normal trading areas for the typical island ferry).
Vessel characteristics

- Single ended, drive-through Ro-Ro passenger Ferry with 1 continuous main deck for trailers and cars
- Use of CFR composites in addition to the aluminium lightweight solutions for the superstructure.

- **Capacity:**
  - 31 cars or 4 (+8 cars) trucks (18.5m) on open deck
  - 147/196 passengers at winter/summer
  - Expected 3 crew members for 147 Pax and 4 for 196 Pax

- **Principal dimensions:**
  - Length (oa/pp) 59,50m / 57,00 m
  - Breadth mld. at vehicle deck /extreme: 12,80 m/13,40m
  - Depth to vehicle deck 3,70 m, Draught full loaded 2,50 m
 Innovative elements (I/II)

• **100% electric ferry** (no hybrid solutions) powered by electricity from wind power or other **RES** (green electricity market).
• **Electrical** equipment in place of hydraulics;
• **Reduction** of the weight of the ship by using a **lightweight** approach to all materials, machinery & equipment including CFR composites in part of the superstructure;
• **Modern** and **higher safety** standards in the **design** criteria;
• **Simple drive train design** also indicates that maintenance and repair cost will be lower.
Innovative elements (II/II)

• Innovative charging system including fully automated shore connection

• A full battery pack of 56 ton. (compared to estimates of up to 80 ton. for similar existing solutions)

• Worldwide largest battery capacity for maritime use (4.3 MW)

• Peak charging power up to 4MW

• Able to operate in ice conditions up to 15-20 cm
Targeting green

- CO2 emissions reduction (approx. 2,000 tonnes)
- NOx reduction by 41,500 kg
- SO2 reduction by 1,350 kg
- Particulates reduction by 2,500 kg per year*
- Reduced noise and wave heights even at higher speeds.

* from 2018 when the demonstration ferry is put into operation
Where we are now...

- E-ferry planned to be put into operation in early 2018.
- Visedo’s electrical drive train and motors, as well as Leclanché’s batteries have been type approved by the classification society DNV GL
- Charger in production
- Battery cells and racks in production
- On-shore facilities in tender
- Construction work on the shore side is about to begin.
- ARO is preparing for the data-collection to be done once the E-ferry is put into operation
- Hull under construction
Where we are now...

Section Building Plan

Hull Building
Where we are now...

Factory Acceptance Test of Visedo’s PowerDRUM motors

Red circles indicate the location of the 4 electric motors. The propulsion motors are located to the aft of the vessel, the thruster motors to the fore.

The DNV GL representative adding his certification stamp to one of the propulsion motors.
Where we are now...

E-Ferry consortium plans to substitute as much steel with light weight carbon fiber composites as possible, while still meeting the requirements of national and international authorities.

Production of carbon fiber panels at Tuco Marine
Engaging with policies and regulations

- The E-ferry - ELLEN - will be classed and approved according to the highest international standards (IMO & SOLAS), while working with policy-makers and regulatory authorities to:
  - reduce taxes on electricity
  - increase the amount of composite materials that can be approved according to international standards
  - set new standards for class and approval of fully electric vessels
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Sail with us@

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