Den Danske Maritime Fond

The ECO-Island Ferry Project - Concluding report:

Background:

The background for the project was public procurement in June 2010 for a new Danish ferry for a typical domestic route. The condition was already in the procurement act, that the ferry should be built from steel! For a growing part of the industry which for several years has been designing and building energy efficient ships in carbon and fibre glass reinforced composite materials, this was considered a (challenge to be meet.)

The project:

In late 2010 a group of small Danish companies set up a project to compare two ferries. An existing steel ferry compared with an alternative design of a ferry in carbon fibre sandwich composite (CFRP) with the same payload and speed with the purpose:

1. To demonstrate that by reducing the weight of smaller vessel hull structure, significantly reduction in fuel consumption and environmental impact can be achieved *(By designing a new vessel in Carbon fibre sandwich composite, with the same earning capacity as a reference ferry)*

2. To document that by calculating the accumulated cost of the vessel in its entire service life, there will be an economical benefit from selecting the more expensive composite material for construction *(by performing a complete life cycle cost analysis (LCCA) for the two ferries)*

3. To document that by calculating the accumulated environmental impact of the vessel in its entire service life – including disposal/decommissioning of the vessels, there will be a similar reduction compared to the traditional steel vessel *(by performing a complete life cycle analysis (LCA) for the two ferries)*

4. To perform a required and relatively new approval procedure for vessels built from other materials than steel, and obtain a formal approval from the maritime authorities *(by performing a full-scale fire risk analysis based on approval of the carbon fibre composite ferry)*

5. To inspire ship owners, ship yards and designers to consider this alternative material, when fuel consumption and environmental impact have high priority *(by publishing all project documentation and findings as widely as possible)*.

The alternative ferry was named “ECO-Island ferry” The term defines a ferry build of light weight carbon fibre materials (CFRP) where the weight saving on the hull is used solely for reducing fuel consumption and thereby lowering the environmental impact (CO_2 Foot print)

It was clear from the start of the project that the outcome of the various tasks had to be very credible to be acknowledged by the traditional industry, and therefore had to be performed according to recognised international standards. Some of the engineering disciplines required to perform these tasks is outside the traditional ship building skills, and therefore external assistance at considerable cost was expected.

In the process of funding the project, the EU Interreg IV a MARKIS project appeared at the scene, and the group decided to seek the project realised under the MARKIS umbrella. As MARKIS was a inter Scandinavian project, it was decided to form a steering group for the ECO-Island project with members from both Denmark and Sweden.

As the various task set up would require corporation between the industry, research institutes and the maritime authorities, the project organisation is called a “Triple Helix” organisation. The steering group worked out the project description (detailed tasks) and started searching for partners and possible funding of the project.

The search for funding of the project was much persistent done by Mr. Henrik Riisgard from the university of Aalborg and the MARKIS group (now MARCOD) Feedback from several interested Danish and Swedish partners offering their support in different technical areas and economical ways, resulted in a budget for the project. Most partners accepted to participate on a 50/50% basis, and others contributed without cost for the project. A major funding from Den Danske Maritime Fond finally made the project running.

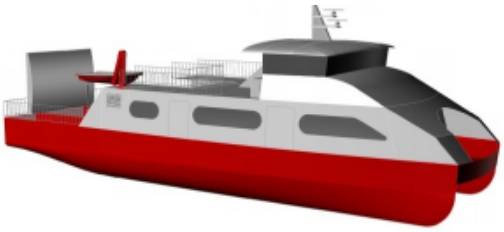
A reference ferry had to be chosen for the project. Odder kommune offered to participate with the necessary information on the technical details of Tunø-Færgen, and the running cost of it.

Results:

Re. 1:

The design work resulted in a catamaran type of ferry where the need for ballast water is avoided, and the resulting light weight is dramatically less than the reference ferry.

Same earning capacity



Existing steel ferry

New carbon ferry

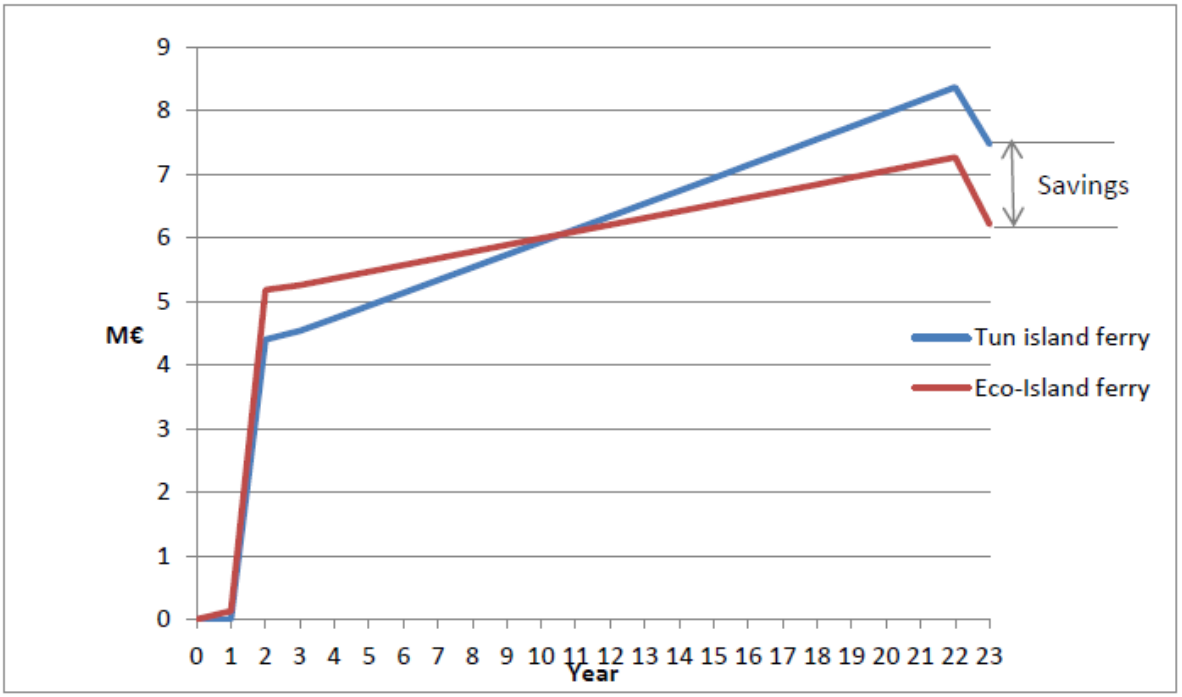
		Speed:	9.5 kts
		Passengers:	200
Displacement:	340 t	Cars:	6
Propulsion:	2x294 kW	Deck cargo:	3,075t
Consumption:	100l/h		

Displacement:	120 t
Propulsion:	2x110 kW
Consumption:	53,1l/h

The design work was performed by Danish Yachts A/S, Coriolis utvecklings AB og Niels Hjørnet – Yacht Design.

Re. 2:

The life cycle cost analysis (LCA) showed that the considerable savings in fuel cost was a result of the choice of lighter hull material.

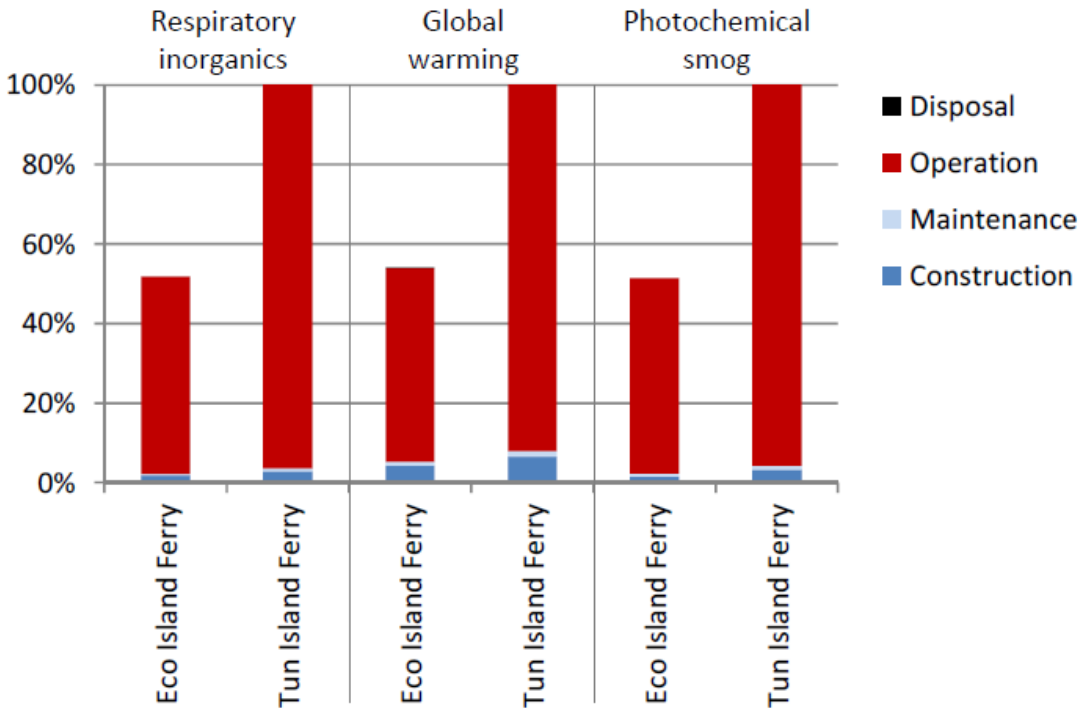


The life cycle cost for the two vessels was compared for a period of 20 years. The return of investment depends largely on the operating hours of the vessel. With only 4 hours of operating per day, the break-even point where the cost of the reference ferry exceeds the cost of the composite ferry is approximately 8½ year after entering into service.

The life cycle cost analysis was performed by Åsa Lindqvist at SP Technical Research Institute of Sweden, Energy Technology department.

Re.3:

The life cycle analysis assessment (LCA) comparing the two vessels impact on the environment "from cradle to cradle" confirmed our expectations that the consumption of fossil fuels through its lifetime, is the major argument for choosing the lighter construction material.



This analysis was performed by Schmidt and Watson, 2.-0 LCA Consultants, Aalborg, DK, and the critical review was done by Mr. Henrik Wenzel of Syddansk Universitet.

Re. 4:

One major and time consuming task has been the approval of the composite ship by the maritime authorities. International conventions and EU directives has prescriptive regulations only for ships build from steel or equivalent non-combustible material.

With the amendment of Part F, (Regulation 17) in SOLAS chapter II-2 in 2002, the use of alternative design and arrangements was made possible on condition that an engineering risk analysis was performed. The Maritime Safety Committee (MSC) has issued a guideline – MSC/Circ. 1002 on how to perform the analysis in a general way.

This possibility was apparently also present in EC Directive 2009/45/EC - The "Ferry directive" and which the new design had to comply with (In Denmark: Meddelelser D)

However, during the course of the project, it was realised the wording of the Directive where the "Regulation 17" option is written into the annex to the directive could not be used for this design. The directive thereby precludes the utilisation of modern lightweight materials for improving the energy efficiency in modern ships. This condition has been confirmed by both Danish and Swedish maritime authorities.

It was therefore decided to continue the project according to SOLAS. This makes a rescue boat and a dedicated emergency generator mandatory, where the ferry directive opens up for alternative solutions for this.

The approval procedure has also changed during the course of the project. Initially (in 2010) the procedure for approving the alternative design was as described in MSC/Circ. 1002. However, already in 2009, Denmark submitted a proposal to IMO on general guidelines for approval of risk-based ship design. (MSC 86/5/3) The guideline describes a procedure to be followed when a risk analysis has to be performed on several areas of ship construction where SOLAS over the years has opened up for alternative designs.

The guideline was approved by IMO in June 2013 as MSC.1/Circ. 1455. The Danish maritime authorities will require this procedure to be followed in future projects where alternative designs must be approved.

At the time of writing, no final approval has been received from DMA.

Re. 5:

During the project, there has been considerable interest for the project from the maritime community and politicians.

In the fall of 2012, MARCOD presented the project for the Danish business and growth minister (Ole Sohn). The result of this approach was that the Financial act for 2013, which included allocating funding for demonstration projects in the "maritime conversion pool" now specifically pointed to *shipbuilding in new lightweight materials* as an area entitled to support.

From this followed the later "Næssund" ferry project, where the people behind the ECO-Island ferry project designed a new carbon fibre ferry for this domestic Danish crossing. At several occasions the project has been presented at conferences and events in Denmark and Sweden where energy efficient shipping has been on the agenda.

Similar there has been interviews with several magazines and a newspaper describing the project and two scientific articles has been written. One entire chapter in a new text book "Eco-Innovation and the Development of Business Models" (Springer, Germany) is describing the ECO-Island project.

Most efficient in publishing the results, has been the establishment of a WEB - site for the project WWW.ECO-Island.dk and WWW.ECO-Island.SE, Here all technical documentation and reports has been made available to the public.

The project has been referred to in a number of research projects

Recently, the project results have been made available as reference material in an upcoming IMO" guideline on the use of FRP within ship structures".

On behalf of the steering group:

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Skagen, 20. February 2015

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