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## FCSHIP

# Marine application of fuel cells

### Objectives

The project "Fuel Cell technology for SHIPs" (FCSHIP) aims to enable EU fuel cell technology providers to be more competitive in the prospective market for maritime applications, enable EU ship owners to utilise this new technology and have the competitive advantage, and assist the EU in meeting sustainable development, energy saving and air pollution reduction objectives.

The project main objectives are to define the end users' demand for the application of Fuel Cells on board ships for both main propulsion and auxiliary applications, to evaluate safety and operational demands for ships equipped with Fuel Cells, and to assess both economically and environmentally, the potentials of Fuel Cells application for waterborne transport. In short, the project objective is to provide, a roadmap for further R&D on Fuel Cell application on ships taking into account safety, operational, environmental, cost, infrastructure and market aspects.

### Problems addressed

In order to put the problem areas into perspective, the technical and scientific objectives considered are:

- Trade-off experience from other industrial fields to waterborne transport through the inventory and synthesis of fuel cell research and demonstration actions relevant for waterborne applications
- Development of safety and operational requirements for fuel cell application in commercial ships
- Development of end user's (ship owners) specification and functional requirements for FC application to waterborne transport
- Develop examples of FC ship conceptual designs
- Comprehensive assessment, through Life Cycle Analysis (LCA) techniques, of logistic, supply and consequence with regard to cost-effectiveness and environmental impact aspects
- Develop plans for future R&D aiming at filling the gaps towards application of FC in waterborne transportation (both inland and sea navigation).

### Project structure

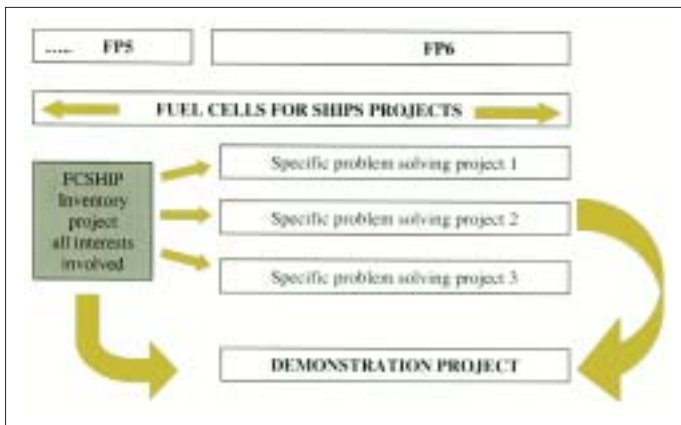
The FCSHIP project has a two-year duration, and the work commenced in July 2002. The project consortium consists of 21 partners headed by the Norwegian Shipowners' Association. The consortium represents the major stakeholders in the European shipping industry, including ship owners, shipyards, classification societies, universities and research institutes.

### Expected impact and exploitation

In the past decade, the increasing demand for safety, efficiency and a lower environmental impact from shipping has dominated the development of the industry. The European Commission has been strategically and actively seeking solutions to meet the social and industrial requirements. The FCSHIP project will produce basic safety and operational requirements for applying fuel cells in waterborne transportation. This will provide the first guideline for the application of fuel cells on ships and contribute to the development of international legislation and standards for safe, efficient and environmentally friendly shipping. This will be further supported and materialised by the conceptual design of FC ships with an assessment of infrastructure availability and requirements in the EU leading to a final recommendation report on the application of fuel cell technology in commercial ships.

Although substantial research and development has been performed on fuel cells for use in the automotive industry and stationary power generation, limited work has been carried out on marine applications. There is presently no large-scale design and production of fuel cell systems for marine purposes, and the requirements for such systems in order to be competitive for marine applications have not been defined. Moreover, safety and operational requirements as well as industrial standards suitable for fuel cell design and application in ships are presently lacking. These presently represent major barriers towards commercial application of fuel cells in ships.

The FCSHIP project will draw a roadmap for further R&D on Fuel Cell applications on ships taking into



R&D plan to foster fuel cells application in shipping.

account safety, environment, operation, infrastructure, and market aspects. Introduction of new technology must be based on proven design, verified and approved by an independent verification body. In an early phase this will require interaction between safety requirements set by such bodies and development of new designs. For fuel cell application in ships, no such basic requirements currently exist. Such basic requirements are vital for the future implementation of the new technology, and an important element in the FCSHIP project work.

### Progress to date

- Project web-site established ([www.fcship.com](http://www.fcship.com))
- Case ships identified and mobilised for measurement of operational load profiles and other important parameters
- Ship type defined for first conceptual design and design work started
- Method of working and basic principles for definition of basic safety requirements established
- Work started to establish a framework for LCA analysis.

## INFORMATION

References: G3RD-CT-2002-00823

Programme:

**FP5** - Competitive and Sustainable Growth

Title:

Marine Applications of Fuel Cells (FCSHIP)

Duration: 24 months

Partners:

- Norwegian Shipowners Association (NO)
- Germanischer Lloyd (D)
- University of Applied Sciences Hamburg (D)
- University of Strathclyde (UK)
- Norwegian Marine Technology Research Institute (NO)
- MTU Motoren und Turbinen Union Friedrichshafen (D)
- Delft University of Technology (NL)
- D'Appolonia (I)
- Ludwig-Bölkow-Systemtechnik (D)
- Finantieri Cantieri Navali Italiani (I)
- Wartsila Corporation (FIN)
- Lloyd's Register of Shipping (UK)
- Det Norske Veritas (NO)
- Rina (I)
- University of Genova (I)
- Ansaldo Fuel Cells (I)
- Norsk Hydro (NO)
- Netherlands Organisation for Applied Scientific Research TNO (NL)
- Imtech Marine and Industry (NL)
- Knutsen OAS Shipping (NO)
- Color Line Marine (NO)

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Status: Ongoing