

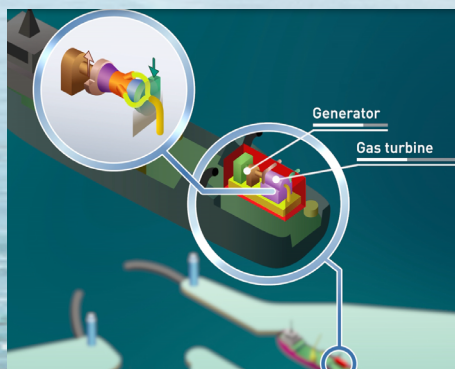
## Nr. 2 Plug and Play Energypack for Inland Shipping and Short Sea

### Background:

Liquefied natural gas (LNG) and hydrogen are seen as future-oriented fuels for ships. Cargo ships in inland and coastal shipping often have a power requirement of less than 700 x(1-3) times kW. In these power ranges, the costs per kW for a conversion or new construction are significantly increased. Therefore, business models are difficult to realize at low power levels.

### Content:

The project was originally intended to develop an energy pack based on gas turbine technology. The idea was that for vessels that need an average power demand for propulsion lower than 700 kW, an LNG-based propulsion system would be ideal, both from an environmental and purchase price point of view. It appeared, however, that a suitable gas turbine would not be available on the short term and is not yet ready for the market. In addition, emission requirements got more and more urgent. As a consequence, it was decided to switch from an LNG approach towards a fuel cell (hydrogen) approach. The decision was already made to use a demonstrator for the system that meets all technical specifications. So for this purpose a training ship, the EMELI, of the Maritime Academy Harlingen was used.



This ship had two diesel engines from which one was replaced by an electro-motor/hydrogen fuel cell system and a diesel generator set. It was required to have a certification for this new situation on the EMELI. Furthermore the market and fleet structure analysis and a fundamental study of gas turbine technology and combustion in methane and hydrogen mixtures have been developed.

Leadpartner:

Co-partner:

## Results:

A transition mode with a diesel electric drive train of 200 kW. This mode is used when the ship is brought from the school Harlingen to the school in IJmuiden. Working with the students in training Harbour manoeuvres in Harlingen or IJmuiden they have a boating profile in which they use max 60kW. Based on this boating profile there is developed the zero emission Harbour mode. This mode is build up with the following specifications\*:

- A LiFePo4 battery pack of 60 kWh
- A hydrogen based PEM Fuel cell of 30 kWe continuous
- The E-motor is restricted in this mode to a capacity of 60 kW

\*all details with reservation



## Advantages:

- Emission reduction
- Detailed test-phase onboard the training ship „EMELI“
- Direct comparison to the traditional propulsion system

An innovative solution for the green shipping of tomorrow.

## Partners:



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