

The REShiP Project: Renewable Energy Ship Propulsion

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In recent years the acknowledgement of the relations between the emissions of exhaust gas, in particular CO₂, and their effects on climate and environment has grown to a wide level. Many countries and international organizations have begun to work to mitigate the problem and drive the society towards more sustainable sources of energy. Shipping is no exception and in 2018 the IMO – International Maritime Organization set the ambitious goal of reducing the CO₂ emissions of the shipping industries of at least 50% within 2050, compared to the levels of 2008. This has introduced the need to research and develop new, sustainable energy sources and power systems for ships. The REShiP project is aimed to identify a type of ship which would be suitable for an early adoption of a carbon free or carbon neutral fuel and a matching power generation system, tailored on specific routes. A small ferry powered by a hybrid combination of liquid hydrogen-fuelled fuel cells and Li-ion batteries has thus been identified. A mathematical model was developed to optimize the usage of fuel cell and batteries based on the ship operative profile. A multi objective optimization was implemented to minimize system performance degradation. To support the mathematical model a 7 kW PEMFC power generating unit was assembled and relevant data have been analysed. Following a regulatory framework research and in lack of comprehensive prescriptive rules, the design of the ferry and the prototype was done in accordance with the alternative design approach based on the risk assessment methodology, reaching a level of confidence appropriate to award an approval in principle.

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