

Investigating the feasibility of Green Ships with electric propulsion

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Worldwide concern about air quality, greenhouse gas emissions, and oil supplies has led to stricter emissions regulations and fuel economy standards, as well as to exploration of alternative propulsion systems. Amongst certain alternatives, the electric propulsion can be proven under certain circumstances, a means towards greener shipping. Extending the electric propulsion concept, the modern concept of All Electric Ship (AES) includes the incorporation of multiple independent sources of power generation, as well as extensive electrification of main and auxiliary energy consuming systems (propulsion subsystem, oil/water/ballast/cargo pumps, ventilation fans, oil/cargo heaters, distillers, purifiers, navigation subsystems, general ship loads, hotel/lighting loads, etc.). The AES concept exemplifies the rapidly increasing trend in the marine industry to move from mechanical to electrical systems resulting to a clean, safe and efficient vessel. This is motivated by the additional flexibility that such systems offer. More specifically, propulsion systems comprise electric motors driven by associated power electronic converters, acting as their gear boxes. This combination results in several advantages as increased manoeuvrability, precise and smooth speed control, reduced machinery space, and low noise and pollutant emission levels. Furthermore, AES results in savings in running and maintenance costs.

As it is well known, every ship for which the application of diesel electric propulsion is under consideration should be treated as a special case because there is no much technical evidence and data from existing ships, which could be evaluated during the study, especially when dealing with ships where the diesel electric propulsion has not been particularly applied (i.e. typical bulk carriers, tankers, small passenger vessels e.t.c.). For that reason the diesel electric propulsion should be selected after careful consideration and evaluation of many technical and economic parameters. In this paper a new methodology on how to design a vessel with diesel electric propulsion developed in the PhD thesis of the first author is applied to the case study of a small passenger ferry. Via a detailed techno-economical analysis, it is shown that the electric propulsion can be an appealing solution, but only in certain operating conditions, such as when the fuel is Natural Gas.