A review of the use of organic Rankine cycle power systems for maritime applications

Diesel engines are by far the most common means of propulsion aboard ships. It is estimated that around half of their fuel energy consumption is dissipated as low-grade heat. The organic Rankine cycle technology is a well-established solution for the energy conversion of thermal power from biomass combustion, geothermal reservoirs, and waste heat from industrial processes. However, its economic feasibility has not yet been demonstrated for marine applications. This paper aims at evaluating the potential of using organic Rankine cycle systems for waste heat recovery aboard ships. The suitable vessels and engine heat sources are identified by estimating the total recoverable energy. Different cycle architectures, working fluids, components, and control strategies are analyzed. The economic feasibility and integration on board are also evaluated. A number of research and development areas are identified in order to tackle the challenges limiting a widespread use of this technology in currently operating vessels and new-buildings. The results indicate that organic Rankine cycle units recovering heat from the exhaust gases of engines using low-sulfur fuels could yield fuel savings between 10% and 15%.

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