Electrochemical processes and energy systems towards step-wise emission reduction of maritime transport

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Abstract

A paradigm shift is needed both in on board energy systems and in the marine fuels to reduce the emissions from waterborne transport and to comply with the International Maritime Organization (IMO) strategy and regulations of the Emission Control Areas (ECAs). Electrochemical processes and energy systems can offer some solutions. The Consortium of the NAUTILUS project is developing a pilot marine genset using LNG as a fuel. This highly efficient and dynamic genset consists of a Solid Oxide Fuel Cell (SOFC) coupled with a battery and will be hybridized with the existing Internal Combustion Engines (ICE). The technology and the concept enable a step wise scale-up through mild hybridization, balanced hybridization and full replacement of the ICEs. A complete integrated design and digital-demonstrator of the on-board energy system of a size between 5 to 60 MW has been developed. The viability of this energy system is qualified for passengers' ship of 1000 and 5000 capacity. SOFC system inclination testing has been completed. Laboratory proof of concept experiments of 30 kW have been completed, and a demonstrator of the genset of 60 kW has been developed for its validation in 2024, including emissions measurement. The project brings in a consortium of key actors in maritime passenger transport including ship operators, ship builders, marine engine builder, marine regulatory company, as well as technology developers supported by research organizations from across the Europe. Overall, the technology has the potential to reduce CO2 emissions by at least 40 % and particulate emissions by 99 % in a vessel meeting the targets of the IMO of 2030.