Environmental and economic analysis of alternative powering options for coastal vessels with respect to future emission reduction targets

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Abstract

Reduction of fuel consumption and lowering harmful gas emissions belong to the category of most important research topics in marine transportation. The former issue is important for all ships, while the latter one is even more emphasized for the vessels operating within highly inhabited areas like short-sea or inland waterway vessels. The International Maritime Organization aims to reduce total annual greenhouse gas emissions from international shipping by 50% by 2050 and to reduce the average carbon intensity (CO_2 per ton-mile) by a minimum of 40% by 2030, and 70% before 2050, all compared to the 2008 levels [1]. This paper considers technical, environmental and economic aspects of implementation of alternative power system configurations in the Croatian coastal shipping sector with respect to short- and long-term emission reduction targets, where existing diesel engine-powered Ro-Ro passenger vessel is taken as a test case. In this sense, operating profile of the considered ship and its power needs are analysed and viability of use of alternative powering options is considered [2][3]. While the environmental analysis is performed it Life-Cycle Assessment (LCA), Figure 1, the economic analysis is performed with Life-Cycle Cost Assessment (LCCA), Figure 2. In the analysis, the features of the Croatian energy sector are taken into account. Appropriate sensitivity studies of economic indicators with respect to input parameters are performed. The obtained results show that beside reduction in greenhouse and harmful emissions, the electrification of the considered ship leads to the financial savings over its lifetime. Although Croatian case study is considered, the methodology is applicable generally, but the conclusions will be case-specific, depending on the ship technical and exploitation performance and characteristics of energy sector of the considered country.

Figure 1. The LCA and life-cycle stages

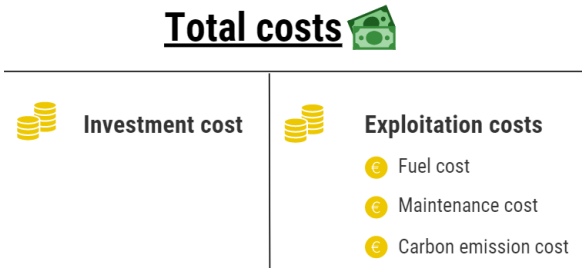

Figure 2. The costs included in the LCCA

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