Abstract

Ibramim S Sedek

An environmental and economic analysis of emission reduction strategies for container ships with emphasis on the improved energy efficiency indexes

The international maritime organization (IMO) has introduced several legislations to optimize the use of energy generated from machinery onboard ships to reduce the emitted exhaust gas emissions. The aim of the current paper is to study the effect of using emission reduction strategies for container ships with emphasis on the improved Energy Efficiency Design Index (EEDI) from environmental and economic points of view. As a case study, A19 and A7 class container ships are investigated. Three different options are considered including natural gas, treatment equipment, and ship speed reduction. The lowest annual emission rates per transported cargo are achieved by A19. These rates are 18.9, 0.93, and 1.8 kg/TEU for NOx, SOx, and CO2 emissions, respectively. In order to improve the EEDI value for the A7, the ship speed should be reduced by 22.5%. This will comply with the three phases of IMO requirements by reducing CO2 emissions with cost-effectiveness of 52.54 $/ton CO2. On the other hand, using the installed dual-fuel engine infrastructure onboard A19 container ship will improve the energy efficiency by 10.13% with annual fuel saving of 23.73 million dollars.