Maersk Ocean-Going Vessel Energy Efficiency Measurement Demonstration

Technology Manufacturer
Maersk Line

Co-Participants
Port of Long Beach, Port of Los Angeles

Project Objective

The objective of the Maersk Ocean-Going Vessel Energy Efficiency Measurement Demonstration Project (Maersk TAP Project) is to evaluate and quantify the benefits of energy efficiency improvements for ocean-going vessels. During this demonstration, detailed high frequency operational energy and fuel data are being collected onboard two classes of 9,000 twenty-foot equivalents (TEU) containerships calling at POLA and POLB to study ship efficiencies before and after major retrofits.

Technology Description

The ships in this demonstration are part of Maersk Line's $125 million Radical Retrofit Program (Radical Retrofit), which will retrofit existing vessels with multiple energy efficiency technologies, such as redesigning the bulbous bow of each vessel, replacing existing propellers with more efficient models, adding propeller boss cap fins to reduce the inefficiencies associated with the shearing of water at the end of the propeller, and "derating" the main engines to make them more efficient at lower speeds.

In addition to these propulsion-related retrofits, the program includes raising the bridge to increase each ship's capacity from about 9,000+ TEUs to about 11,000+ TEUs. This allows the Maersk Line G-Class ships to carry more containers per vessel while decreasing their environmental impact per container moved. It should be noted that the ships calling the San Pedro Bay Ports are already equipped with shore-power capabilities.

The Maersk TAP Project will have access to continuously recorded data showing how much energy each engine uses in conjunction with speed, engine power, weather, operational mode, and other operational variables through the use of the ship's engine management systems and newly installed mass flow meters to capture key performance data. The Maersk TAP Project will use the pre- and post-Radical Retrofit data from a minimum of four vessels to quantify energy and emissions improvements by operational mode. This will enable the results to be "apples-to-apples" comparison pre- and post-retrofit on a vessel basis and then compared to vessel results with the other vessel(s) in the same class.

Status

To date, four primary datasets were pre-processed and evaluated in 2016. These datasets are the core datasets for the project and include: port call schedule, MSPS or noon reporting, 10 minute frequency Control Alarm Monitoring System (CAMS), and high frequency flow meter. In addition, pre-Radical Retrofit data were collected from four ships, including the Gunhilde which has not undergone her Radical Retrofit and continues to provide pre-retrofit data. Radical Retrofits have been completed on the other 11 of 12 vessels. All vessels are now equipped with

digital flow meters and a number of the vessels have been doing data uploads via satellite. A team from Duke University provided baseline and temporal alignment on various data sets and presented their analysis to the project team.

It is anticipated that during 2017 data sets will continue to be collected and analyzed, critical data elements will be selected and used to quantify energy efficiency improvements and emissions, and data analysis procedures will be developed based on agreed quantification approaches.

Projected Benefits

The key benefit of the project will be demonstration of the use of detailed, real-world data to quantify energy efficiencies and emissions improvements. From an emissions standpoint, the Maersk Radical Retrofit (RR) is expected to reduce fuel consumption by 2,000 to 3,000 metric tonnes per year, with a total annual reduction of 10,000 tonnes of fuel for the four vessels evaluated in this project. This reduces the GHG emissions of these four vessels by an estimated 31,140 tonnes of CO2 per year. DPM, NOx, and SOx are also reduced as a result of lower engine loads and the associated reduced fuel consumption. In addition, an increase in carrying capacity will reduce the carbon footprint per container transported in line with globally accepted measurement of CO2 reductions from liner shipping activities. The planned capacity boost on each of these 9,000+ TEU vessels increases capacity by about 9%, thereby reducing fuel consumption and emissions produced per container by about 8% at full capacity utilization.

Project Costs

The Ports are contributing $500,000 each in co-funding to this project with a total project budget of $2.86 million.

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