Joint Development of The World's Longest-Range Hybrid-Electric Vessel

Continued investment and commitment are essential to forging a sustainable future for the shipping industry. In 2024, we partnered Fleetzero to develop the world's longest-range hybrid-electric vessel to further advance our efforts to decarbonise our fleet.

AET management, AET Offshore crew and Fleetzero management at the hybrid-electric vessel signing ceremony on 19 December 2024

AET turning ambitions into action

In December 2024, we signed an agreement with Fleetzero, a developer and owner of modular marine batteries for hybrid and electric ships, for the development of the world's longest-range plug-in hybrid-electric vessel.

The signing ceremony took place at the AET Offshore office in Galveston, Texas, with representatives from both companies present. The agreement was signed by Capt. Ron Wood, AET's former Global Director of Commercial, and Mr Steven Henderson, Fleetzero's CEO.

Under the agreement, one of AET's Lightering Support Vessels (LSVs) will be retrofitted with a plug-in hybrid-electric system. The vessel will operate primarily on battery power, reducing Greenhouse Gas (GHG) emissions by about 82% when compared to conventional LSVs[1] on a tank-to-wake basis. This is estimated to avoid 1,220 tonnes of greenhouse gases, significantly reducing fuel consumption and maintenance costs while maintaining high safety standards.

The battery-hybrid system will retain the vessel's existing diesel generators for longer voyages where extended range and endurance are required. This will ensure operational efficiency. We are also exploring the purchase of 100% renewable power to charge the batteries, which would further reduce emissions across the full operational lifecycle (well-to-wake).

We also expect a 49% reduction in operational expenses as compared to using diesel based on our preliminary analysis.

Why is electrification beneficial for our lightering operations?

AET operates a fleet of Mid-Sized Tankers, which provide Ship-to-Ship (STS) transfers of crude and full-service lightering services (STS transfers and conventional voyage services). To complement this STS offering we operate a fleet of purpose-built LSVs that are used for the transportation of mooring masters and their assistants as well as equipment required by tanker vessels involved in a STS transfer.

Both the service ship (typically Aframax or Suezmax) that transfers crude to or from a tanker (typically a VLCC) and the LSV that supports the transfer operate short-haul trips. This means they have relatively high GHG emission intensity figures compared to other vessels operating longer trips. Unlike conventional internal combustion engines, electric propulsion produces zero emissions on a tank-to-wake basis, offering a pathway to reduce both absolute emissions and emissions intensity.

Other than emissions reduction, electric motors stand out for a few reasons. Firstly, simpler maintenance. A marine diesel engine has over 1,000 moving parts while an electric motor has less than 20 moving parts. Secondly, it presents no risks of overboard discharge and seafarer exposure to methanol, ammonia and hydrogen (compared with bunker fuels). Additionally, in AET's case, we chose an Lithium Ion Phosphate (LFP) battery chemistry, which has a lower risk of thermal runaway (fire) compared to other lithium-ion chemistries, making it well-suited for marine uses. Battery-electric hybrid engines can also be implemented now versus other green solutions such as the usage of alternative fuels, which are dependent on the availability and cost of the alternative fuels.

Current key limitations to electrification

Currently, this technology is limited to short-haul transportation or when vessels have frequent port stops and access to charging facilities. As vessels become more energy-efficient, battery and charging technology advances, and battery costs decline, the economics of this technology will improve, potentially making it viable for longer routes and larger vessels.

Electrification is seen as one of the strategies to reach the maritime industry's net-zero goals but presently, the greenhouse gas emissions reduction is primarily on a tank-to-wake basis. Achieving full decarbonisation on a well-to-wake basis requires electricity to be sourced from low-carbon energy, such as renewables. Additionally, power grids must scale up to meet the rising demand for electricity from the maritime sector.

What is electrification?

According to the International Energy Agency's definition, electrification is the replacement of technologies or processes that use fossil fuels — such as internal combustion engines and gas boilers — with electrically-powered equivalents. Electrification delivers both fuel and emissions savings.

Electrification of vessels spans from the use of fully battery-powered systems (full electrification) to various levels of hybridisation, where batteries are combined with generators or fuel cells.

Adoption by shipowners

Due to their short voyages, frequent port stops and access to dedicated shore-power connections, ferries are at the forefront of this technology. Most electric ferries operate on plug-in hybrid systems, incorporating internal combustion engines as backups and to extend their sailing range[2].

Other than ferries, other ship types typically operating short-haul voyages are also adopting this technology. For instance, in the shuttle tanker segment, six out of 103 vessels are currently fitted with battery-hybrid propulsion[3]. In the offshore wind farm support segment, more than 80% of commissioning service operation vessels fleet and almost 100% of the orderbook are fitted with hybrid-electric propulsion. We are likely to see an increasing number of vessels adopting this technology as shipowners and charterers attempt to meet short- to long-term decarbonisation targets and understand the benefits of electrification[4].

What else can we expect moving forward?

Under the agreement, we will work with Fleetzero to pioneer this technology on one of our LSVs. However, in the longer term, we see significant potential for scaling this solution across other vessels in our fleet engaged in short-haul transportation, such as our other LSVs, our Mid-Sized Tankers doing lightering and our Dynamic Positioning Shuttle Tankers.

Overall, this collaboration underscores our dedication to advancing sustainable maritime transportation and driving innovation in alignment with the industry's broader decarbonisation efforts.

(1) Reduction in fuel consumption, CO_2 emissions, and maintenance costs in comparison with conventional LSVs based on Fleetzero's operational assumptions
(2) DNV's Energy Transition Outlook, MARITIME FORECAST TO 2050
(3) Clarksons, February 2025
(4) Mærsk Mc-Kinney Møller, Battery-electric pre-feasibility study September 2024