TECHNOLOGY

Need to get onboard with energy saving

***Nick Merrick*, Business Consultant for Vessel Technology Advice and Support (VTAS), looks at how the shipping industry can begin to overcome some of the barriers to adoption of energy saving technologies and work in collaboration to successfully transition to a low carbon future.**

Maritime transport emits around 1,000mn tonnes of carbon dioxide annually and is responsible for about 3% of global GHG emissions
Photo: VTAS

The International Maritime Organisation (IMO) has already adopted global, mandatory measures to reduce greenhouse gas (GHG) emissions from ships. However, uptake of energy saving technologies (ESTs) which offer potential fuel savings and carbon reduction in commercial shipping remains slow.

The transport industry is difficult to decarbonise. Because there is no easy alternative to fossil fuels, some parts of the sector, like shipping, prove even more of a challenge. Maritime transport emits around 1,000mn tonnes of carbon dioxide (CO_2) annually and is responsible for about 3% of global GHG emissions. The IMO has been clear in its ambitions to, for the first time, see a reduction in total emissions from international shipping by at least 50% by 2050 compared to 2008, with urgency to phase them out altogether.

This recognition could be the catalyst for change, but it will take time. Ambition alone won't provide sufficient stimulus for large-scale change in the shipping industry. In the medium to long term (to 2050), the best potential for achieving substantial CO_2 reduction is through reduced fuel consumption. As a result, the efficient use of fuel through the implementation of ESTs will be critical to the future affordability, security and sustainability of maritime transport.

Energy efficiency by design

Commercial shipping is complex, made up of many interdependent parties, all with their own interests and needs. That's why we need to ensure that everyone benefits from investment in ESTs. In 2011, the IMO introduced the Energy Efficiency Design Index (EEDI). This set specific ship-class fuel efficiency targets which are progressively tightened every five years to keep pace and encourage continued technical progress in the reduction of vessel fuel consumption. These targets are mandatory for all ships. However, relying on technical progress to drive commercial deployment and acceptance is unlikely to accelerate CO_2 emissions reductions – additional incentives for ship owners, operators and charterers will be needed to accelerate compliance with IMO and UK government emissions targets.

The Vessel Technology Advice and Support (VTAS) initiative was developed as a £1.8mn Energy Technologies Institute (ETI) project to develop a practical approach to predict the benefit of a range of carbon abatement/fuel efficiency technologies on marine vessels over real-world usage cycles. These can be used in business cases and financial metrics by vessel financiers and stakeholders involved in the vessel/fuel efficient technology procurement chain. Through the project we have been able to engage with a range of stakeholders, enabling us to assess the needs, attitudes and decision-making relating to the use of ESTs, and to identify the technical, financial and operational challenges that are preventing adoption of these technologies.

Currently there is a choice of ESTs within the commercial shipping market, designed to optimise fuel efficiency by reducing fuel consumption. High efficiency propellers (HEP) use recognised methods where the thrust and torque are calculated on the basis of the primary parameters, for example: propeller diameter, pitch to diameter ratio, blade area ratio and number of blades. Their design is tailored for particular operating conditions and computational fluid dynamics (CFD) is becoming more frequently used to understand wake fields and flow of water around the propeller. Analysis by the ETI shows that some high efficiency propeller technologies have the potential to be a low-cost solution that can be successfully fitted to most ships with good effect.

Similarly, Wingsails (WS), designed to improve a ship's propulsion efficiency and hence reduce fuel consumption and emissions, has been proven to have significant impact on a ship's performance. In 2017, BMT Ship & Coastal Dynamics modelled a 50,000 dwt (deadweight tonnage) ship with and without the WS for a performance assessment. The ship's resistance, including an allowance for resistance in waves, was estimated using standard methods. The additional resistance due to the drag of the WS, the air draft and the rudder angle correction were also considered. The study identified the thrust benefits for the whole 360° azimuth and uses the average to define the beneficial WS thrust at a given ship and wind speed.

More recently, trials of Flettner Rotor Sails have demonstrated they are one of the few ESTs expected to offer double-digit percentage improvements through auxiliary wind propulsion, and could play a key role in supporting the shipping industry to improve its environmental impact. Flettner Rotors use the Magnus effect, the same principal that provides lift on an aircraft wing or allows a top spin tennis shot to dip rapidly, to provide propulsion. This technology allows the wind to generate useful thrust with a lift coefficient of up to eight when the rotor speed is suitably set. Depending on the freight size and the number on board, up to 15% thrust can be developed when the wind is on the best relative angle near the beam. Norsepower estimates that up to 20,000 vessels in the global fleet of internationally trading vessels could be candidates for Flettner Rotor Sails retrofits, which combined could reduce total emissions from the shipping industry by up to 5%.

Yet, to date, the uptake of ESTs in the shipping sector has been slow, as a result of the perceived technical and financial risks of implementation. Part of the problem is due to ship owners, investors and stakeholders being unsure of which technology is right for them. We believe that there's no single energy technology solution to decarbonising shipping and it is not a one-size-fits-all solution. It really depends on the ship's trade and its seasonal routes.

Opening the market

With energy efficiency measures available, we must open up the market to support ESTs from concept to deployment. Improvements in measurement and verification (M&V), reliability and confidence are needed to validate the benefits and establish a baseline. Through improved ship-based modelling, assessments and data validation, we can start to explore the options and provide independent evidence that stakeholders can trust to make an informed decision.

There is a clear demand for expertise based on the specific needs of the investor, helping them compare the market for a combination of energy-saving technologies that will provide the most benefit. We are developing VTAS to meet this need. With this support in place, the technical and operational challenges will be easier to overcome. The commercial challenge is more difficult. Stakeholders want to know who is paying and who benefits.

We know there are some energy efficiency measures that do have demonstrable benefits but are not yet extensively deployed, for example Flettner Rotors and the Mewis Duct, a pre-swirl device that is claimed to improve the wake field such that the propeller efficiency is closer to its open water efficiency. The Mewis Duct is best suited to ships which operate at speeds below 20 knots, with no moving parts. The technology is suitable for both newbuilds or retrofitting. Becker Marine claims that this technology can save about 5% on a very large crude carrier (VLCC), with some tankers and bulkers benefiting from 8% fuel saving when combined with a special rudder. Becker Marine suggests the payback period will be less than two years.

VTAS believes that if the benefits of ESTs can be demonstrated, take-up will increase. The challenge is to overcome the lack of financial investment. To accelerate this process, we need to demonstrate the potential to save money on fuel, while bridging the gap between stakeholders to establish the overall contract of agreement. With sufficient information provided by the original equipment manufacturers (OEMs) we can model and test similar products, helping to push them through to market.

Cross-party collaboration

Cross-party collaboration is how we will begin to unpick the individual stakeholder concerns and form a balanced and incentivised model. It is important that the contract works to the benefit of all stakeholders, without placing excessive risk on any one party. Providing the levers to gain knowledge, supported by experience, will result in a better understanding of each EST's viability.

A good example of this collaborative approach is the Flettner Rotor Sails project, developed as a partnership between the ETI, Norsepower, Maersk Tankers, and Shell Shipping and Maritime. The Flettner Rotor trial could potentially open up the market for the technology to a larger number of long-range product tanker vessels, paving the way for ship fuel efficiencies and ultimately reducing greenhouse gas emissions.

We need to learn from each other to form the right framework and approach, creating a low risk environment. Collaborative clusters help industry to learn and test the methodologies, protocols, contracts and technologies that will allow us to integrate sufficient information from the EST supply chain to inform the proposition.

Historically, progress made in decarbonising the shipping industry has been relatively slow compared to other industries. The push and pull factors that will help drive forward the adoption of fuel-efficient technologies in shipping will be a combination of more onerous targets from regulatory bodies and commodity companies looking for a more sustainable way to transport goods. However, with pressing urgency from the IMO to phase-out emissions from shipping entirely, we believe it will encourage investment in ESTs and will stimulate the shipping industry to get on board with a low carbon transition. Employing a collaborative approach to learning, considering the demands of the global consumer, will help all stakeholders – including ship owners, operators and charterers – to understand the right deployment, implications of commercial models and the optimal way forward. ●

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Photo: Norsepower, Shell, ETI and Maersk Tankers

For more on the IMO's 2020 sulphur cap rules for maritime fuels and analysis of the crude oil tanker market, please see the December 2018/January 2019 issue of *Petroleum Review*.