



# SHORT-SEA SHIPPING

## THE NEXT FRONTIER FOR HYBRID PROPULSION

Kjell Inge Drønen, Wärtsilä Marine, Norway

There is growing excitement within the maritime sector regarding the benefits to be had from operating with modern hybrid power, combining both conventional ship engines and energy storage systems. Certain vessel segments are already incorporating hybrid propulsion into their designs, while retrofitting hybrid systems has long been possible.

The rapid development of battery technology has evolved from automotive industry applications and is now being adopted for ships. By being able to switch from an engine based energy source to electrical storage power when sailing in harbours or close to population centres, environmental restrictions can be overcome and fuel can be saved. Lowering of fuel costs and reducing emissions have become global necessities and it is widely anticipated that hybrid propulsion solutions will account for a significant percentage of all contracted ships within the next decade or so.

### HYBRID RETROFITS FOR SHORT-SEA VESSELS

In December 2018, Wärtsilä was contracted to retrofit a general cargo vessel owned by Norway based Hagland Shipping for hybrid

propulsion. This will be the first retrofit project of its kind in short-sea applications. The industry's gradual market recovery has seen increases in both transport volume and freight rates for short-sea shipping. The economic foundation, therefore, would appear to be improving, thus making it likely that similar retrofit projects will be forthcoming.

There are several drivers for this trend, both environmental and technical. For tonnage buyers, a 'green' image is becoming increasingly relevant and they can impose environmental requirements on the tonnage providers so as to strengthen their overall image. Ship owners, therefore, may see it to be in their commercial interest to invest in eco-friendly solutions.

Then there are the emission and noise restrictions that are being imposed by local and regional authorities. In Norway, for example, nitrogen oxide (NOx) emissions are already taxed substantially and these taxes are set to become even higher. Government support for emission-reduction initiatives is also very apparent in Norway. The Norwegian NOx-Fund is encouraging NOx reducing methods, thereby helping investments to become financially viable. Furthermore,

Enova – the Norwegian government enterprise – is actively supporting electric and hybrid solutions.

On the technical side, a battery pack for short-sea tonnage can also be used for 'peak shaving', i.e. shaving the peak loads from the engine power curve. This allows the engine to operate with greater stability and efficiency. Apart from reducing fuel consumption, this imposes less wear and tear on the engine.

### A NEW ERA IN SHIP PROPULSION

Starting with the global economic crisis that erupted in 2008, which in turn had a devastating impact on world trade, the shipping industry has had to deal with major challenges in order to maintain profitability. Trimming operating costs and increasing efficiencies became the immediate priority. At the same time, local, regional and global environmental regulations have become increasingly stringent.

Despite the difficulties, these cost and compliance challenges have created opportunities, enabling the emergence of a new era of greater efficiency, improved safety and better environmental performance. The technology group

Wärtsilä is playing a prominent role in this. Its Smart Marine Ecosystem approach uses high levels of digitalisation and connectivity to introduce smart technologies to ships and to enable these vessels to sail to and from ports that are also digitally connected. In other words, the vision is to develop technologies that benefit not only the ships, but indeed the entire sector.

Within this ambition, the development of realistic hybrid propulsion solutions was one of the earliest projects. In fact, Wärtsilä's first hybrid conversion project was completed in 2014. A platform supply vessel (PSV), the 'Viking Lady', was retrofitted for hybrid dual-fuel engine and battery pack operations. The result has been a 15 percent reduction in the ship's fuel costs, thus hinting at the potential of this technology.

### THE WÄRTSILÄ HY CONCEPT

The Wärtsilä HY was the maritime industry's first hybrid power module of its type produced. Its development was facilitated by the company's unique position as a total solutions provider. With extensive in-house competences in both engine technology and electrical and automation (E&A) systems, Wärtsilä was able to leverage these capabilities to create a deeper level of product control. The result was an unprecedented innovation leap in this field with a groundbreaking hybrid power module. This combines engines, an energy storage system, and power electronics through a new, highly sophisticated and fully integrated energy management system (EMS).

The EMS works as the overall 'brain' for the Wärtsilä HY, whose embedded logic ensures an optimal flow of energy within the module. This guarantees performance, while operational control is elevated to a much higher level than is possible with conventional performance controls.

### MEETING MARKET REQUIREMENTS

Since load profiles and power systems have large variances in different vessel types, no single solution can meet every application. The Wärtsilä hybrid power module is, therefore, tailor-designed for individual vessel segments and specific operating profiles. Currently, hybrid propulsion is gaining popularity within four main vessel segments, namely cruise ships, ferries, tugs and offshore vessels.

Reductions in energy consumption and operating costs are common where hybrid solutions have been used for powering these vessels. In addition, a key motivating factor is compliance with environmental regulations. Restrictions on emissions and noise are increasingly affecting ferries because of their frequent port calls. Being



able to shut down the engines and operate on batteries while in harbour or close to shore overcomes such restrictions.

Cruise ships face similar challenges when visiting ports and sailing through emission controlled areas (ECAs) established by the International Maritime Organization (IMO).

Harbour tugs are continuously operating close to shore and are more affected by local restrictions than any other vessel type. They also benefit from the power boost provided by the engine and energy storage system delivering power at the same time when needed. This naturally improves their operational performance. Tugs are typically on and off duty many times during the day according to the harbour traffic. The Wärtsilä HY eliminates the need to wait for the engines to warm up and the system's instant load-taking enables immediate reaction to fast changes in power demand.

For offshore service and supply vessels, the main advantage of hybrid propulsion is in their dynamic positioning requirements. Batteries respond faster to power transients than marine engines and when in dynamic positioning mode, one or more engines can be shut down entirely. This has the added benefit of saving on fuel costs and prolonging engine life.

### CONCLUSION

The case for hybrid propulsion is fairly solid already for cruise ships, ferries, offshore vessels and tugs. For ocean-going vessels, the replacing of auxiliary engines with battery packs could be feasible and batteries could also be used to provide side thruster power when manoeuvring, and for hotel load when docked. However, for sailing in and out of harbour and for loading and unloading operations, the battery pack would need to be extremely large.

On the other hand, hybrid propulsion is indeed feasible for short-sea vessels. Now that owners are again beginning to invest

in new tonnage, there is definite interest in having 'green' solutions installed. It is likely that in the years to come, eco-friendly ships will have a competitive advantage, which makes short-sea vessels an exciting new frontier for hybrid propulsion.

### ABOUT THE AUTHOR

The author is a naval architect based in Bergen, Norway with 30 years' experience from the marine industry across different market segments. He has worked mainly with equipment and solutions sales in European markets before starting with Wärtsilä Services in 2009. He now focuses on Norwegian customers.

### ABOUT THE ORGANIZATION

Wärtsilä is a global leader in smart technologies and complete lifecycle solutions for the marine and energy markets. By emphasising sustainable innovation, total efficiency and data analytics, Wärtsilä maximises the environmental and economic performance of the vessels and power plants of its customers. In 2018, Wärtsilä's net sales totalled EUR 5.2 billion with approximately 19,000 employees. The company has operations in over 200 locations in more than 80 countries around the world. Wärtsilä is listed on Nasdaq Helsinki.

### ENQUIRIES

Wärtsilä Corporation  
Hiililaiturinkuja 2  
FI-00180 Helsinki  
Finland  
Tel. +358 10 709 0000  
Fax +358 10 709 5700  
www.wartsila.com