Battery-Li: behind the scenes

This year saw the emergence of the first ever offshore support vessels (OSVs) to adopt battery power in the Gulf of Mexico – and the first to receive class society ABS' Battery-Li notation. Dr Wei Huang, director for OSVs at ABS, reports on the work undertaken to achieve this green goal

SEACOR Marine, a leading provider of marine and transportation support services to the global offshore sector, has opted for hybrid propulsion systems on 10 OSVs, making it the first company to operate hybrid OSVs in the Gulf of Mexico.

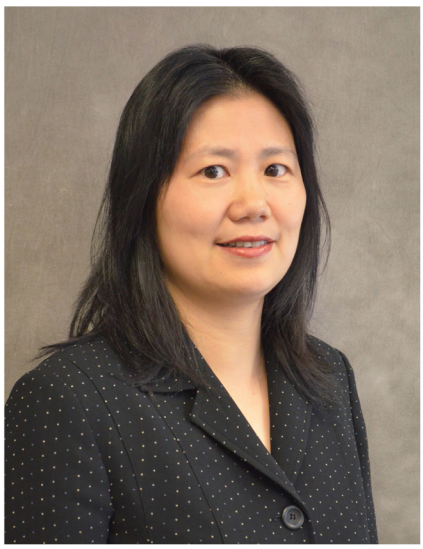
The Louisiana (LA)-based listed company completed the conversion of its first OSV, *SEACOR Maya*, to a hybrid diesel-electric solution (lithium-ion battery)in June; the vessel was delivered to ABS class and awarded the classification society's first Battery-Li notation.

The 5,100dwt, 86.9m dynamically positioned vessel is being operated in the Gulf by Mantenimiento Express Maritimo SAPI de CV (MexMar), SEACOR Marine's joint venture in Mexico. Given the complexity of integrating new technologies, SEACOR Marine called on ABS to support the conversion by assessing the energy storage system (ESS) to determine eligibility for the Battery-Li notation.

Fuel savings

According to SEACOR's manager of engineering, Tim Clerc, the hybrid solution has the potential to cut the ship's fuel consumption, reduce emissions and support the company's compliance with the ever-tightening environmental regulations in the US and abroad. Clerc said the principal driver for installing the ESS was to provide the 'peak shaving' capability that allows the vessel's generators to run more efficiently and, subject to operational constraints, reduce the number that are online at any one time while in spinning-reserve mode.

The lithium-ion battery ESS is designed to keep the generators running at between 75% and 80% of the maximum continuous rating. At higher power demands, the batteries supply power and, at lower power demands, the generators recharge the battery. The Corvus batteries, drives and transformers are enclosed in a Kongsberg-designed 20ft container with a combined weight of about 28tonnes.



Dr Wei Huang, ABS: the class society oversaw the development of this project from locations including Houston, Vancouver, Marseille, Augsburg and Oslo

The system, when operated by MexMar's experienced crews, will see its charter clients benefit from a reduction in fuel oil consumption and emissions, Clerc said. "While still in the early stages of remotely acquiring data for analysis, early indications show savings of between 10% to 20%, dependent on operations," he explained.

SEACOR also expects the electric-hybrid propulsion system to result in quieter ship operations for both the crew and the external marine environment. In peak-shaving mode, changes in load are for the most part taken up by the batteries, producing very little variation in engine note. Running fewer generator engines on steadier loads– and in some cases, such as when operating in 'harbour mode', when no generators are running at all – contributes to a quieter, more comfortable work environment.

Risk management strategy

Assessing the ESS of a precedent-setting hybrid-electric power system such as *SEACOR Maya*'s is a complex process. The systems allow for use of alternative energy sources (such as batteries) which can store energy as a back-up for the main power source. Part of their attractiveness is that they can enhance safety by allowing a response to emergency scenarios where all main power is lost.

The battery system itself requires a risk management strategy that includes: temperature control; power management, back-up and redundancy; and modulation of charging and discharging. It is surrounded by heating and cooling systems to keep those factors in check. A battery management system also works to guard against large charges and discharges, modulating the flow of power. The systems will have remote monitoring capability to track power flow and usage.

The conversion was conducted at Bollinger Shipyards in Morgan City, LA and, after a series of mid-May sea trials – and tests that supported the analysis of failure-mode effects – the ship was issued an interim class certificate.

Global involvement

The lithium-ion based Orca energy storage systems were supplied by Corvus Energy. Kongsberg Maritime designed the supply and integration of the hybrid power into the vessel's control, power monitoring and dynamic positioning systems. Corvus, as storage system vendor, submitted the system's test reports, specifications and safety features, which were reviewed and approved by ABS' engineering team in Houston. The Houston team also reviewed and approved the structural

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Retrofitting the OSV *SEACOR Maya* with a hybrid propulsion system could result in fuel savings of up to 20%

documentation for the battery's 20ft container, built by Trans Construction AS.

SEACOR was responsible for the installation of the container aboard the vessel. The technical review of related documents, such as stability calculations and structural/electrical drawings, was also completed by the ABS team in Houston. Factory testing of the battery and the management system was overseen by the ABS survey office in Vancouver, Canada.

A division of Siemens AG supplied the converters used to convert the battery voltage to ship system voltage, documentation for which was submitted to ABS' engineering office in Hamburg for technical review; the converters were factory tested and witnessed by the ABS survey office in Augsburg.

Factory testing of the transformers was witnessed by ABS' survey office in Marseille.

Kongsberg, as systems integrator for the conversion, provided the vessel's energy management system. The associated technical documentation for those structural, electrical, HVAC and safety systems was submitted for technical review to ABS in Houston; the testing of the system (batteries, converters, transformers, HVAC units, etc) integrated into the container was witnessed by ABS specialists in Oslo.

The technical review undertaken by ABS for the conversion was comprehensive, drawing on the organisation's extensive global network of technical specialists and experience with vendors such as battery manufacturers, in addition to shipowners, designers and operators. The review process also included the survey verification of vendor equipment and installation on board the vessel.

There were further technical reviews associated with the complex project. After the vessel's modification to hybrid lithium battery power propulsion, ABS provided the Battery-Li notation.

Competitive advantage

As demand for OSVs slowly awakens from an extended slumber, putting the global fleet back to work, owners/operators are looking for ways to differentiate their products from those of their rivals. The reduction of environmental impact is fast becoming a key selection criterion for charterers, as regulators ramp up demand for a new level of environmental management across the maritime industries.

Given the potential economic and performance benefits, SEACOR Marine's decision to convert part of its fleet to what Clerc calls "the most advanced hybrid powertrain available" offers another competitive advantage.

In announcing the *SEACOR Maya* conversion, SEACOR Marine chief executive John Gellert called the installation "a big milestone" for the company. "We have long believed that cutting-edge hybrid power technology has the potential to improve vessel efficiency while reducing fuel consumption and emissions by as much as 20%," he said. "The new hybrid lithium battery system will also help us improve safety, drive energy efficiencies and reduce our overall environmental impact.

"As governments tighten emissions standards, this technology will be a key competitive differentiator, leaving us well placed to take advantage of an upturn in the market."

SEACOR Marine subsequently asked ABS to support the conversion of another three MexMar-operated OSVs – including the Battery-Li notation – to similar electric-diesel propulsion systems. Conversion of *SEACOR Azteca*, *SEACOR Warrior* and *SEACOR Viking* is expected to start by the end of 2018. Kongsberg and Corvus will again provide complete ESS and integration to support these projects.

SEACOR Marine also recently signalled its intention to install the hybrid propulsion technology onboard six additional vessels it has under construction at COSCO Heavy Industries in Guangdong, China. The first two vessels, which have been ordered in partnership with COSCO, are due for delivery by the end of 2018, with the remaining vessels set for delivery in 2020. ***SBI***

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