LNG Is Equalizer

With General Electric (GE) recently having signed a memorandum of understanding (MOU) with Lloyd's Register (LR), Jeremy Barnes, commercial marine director for GE Marine, told *Cruise Industry News* that they will jointly be looking at possible marine applications of gas turbines in commercial shipping. "Through this agreement," he said, "we are combining GE technology with LR market access. We will have more access to market data and be able to better define what the applications may be, as well as identify customers willing to be pioneers."

Covering commercial shipping, the effort is not limited to cruise, although Barnes expects there to be opportunities for cruise ships as well.

"When we were winning (cruise) contracts," he said, "fuel prices were much closer. That may change again as we move forward and LNG becomes more readily available. Low-sulfur fuel will also close the price difference," he added.

"With LNG there will be no difference in fuel costs between gas turbines and diesel engines. In addition, the gas turbine takes much less space and is more environmentally friendly, already meeting Tier IV emissions. So, we see (commercial) marine application scenarios for the turbine."

The Queen Mary 2 has two LM2500 gas turbines rated at 25 MW each in addition to her diesel engine powerplant.

The LM2500 gas turbine

COGES on LNG Carriers

Separate from the MOU, GE, Dalian Shipbuilding and LR have already been working on the joint development of COGES (COmbined Gas turbine Electric and Steam) approval for installation on LNG carriers. The design will include one 30 MW gas turbine, one steam turbine generator set and two dual-fuel diesel generator sets for low power operation and backup. The total installed power will be 50 MW.

GE's industrial LM2500 family of turbines have logged nearly 70 million hours on natural gas, of which 20 million hours were dual-fuel applications, according to company information, which also stated that land-based operators have reported a 99.9 percent reliability rate.

Supercritical CO2

Making the turbine even more efficient, GE is developing the Echogen heat-to-power system for use on commercial and military vessels worldwide. Explained Dave Nelson, military marketing director for GE Marine: "With Echogen, we have a solution for recovering energy from the exhaust to produce electricity. We have migrated from steam to supercritical CO2, using CO2 instead of steam," he said. "We take the energy out of the exhaust and convert it to electricity in a closed loop."

Converting energy that traditionally goes up the smoke stack into useful power allows the overall system efficiency to increase by up to 30 percent, according to Nelson. Thus, making a gas turbine as efficient as a diesel plant.

He said the combined plant is very compact and fits with GE's power density story. Introduction of the Echogen technology to the marine market is expected in the 2016–2017 time frame.

Built before fuel prices took off, several cruise lines run gas turbines on their ships today in COGES or CODLAG (combined with diesel engines) configurations.

No Methane Slip

As LNG becomes more available and more vessels move to LNG, another advantage of the turbine is that it does not suffer methane slip, said Nelson. He noted that shore-based industry was more heavily regulated and that methane slip could be an issue at sea once stricter regulations are introduced there too.

Gas turbine combustion leaves virtually no unburnt hydrocarbons in the emissions – and with exhaust heat recovery, a gas turbine is as efficient as a diesel engine, according to Nelson, plus it has a smaller footprint, higher power density and generates lower emissions, requiring no after-treatment of exhaust for compliance.

As for cruise ship applications, Barnes said installations would depend on ships' operating profiles, whether they need steam and a COGES combination, or a CODLAG configuration.

The footprint of a turbine is small enough so it can be installed in the funnel, eliminating inlet and outlet ducts for air and exhaust ducts going through the ship. He said the Queen Mary 2, for example, has two turbines mounted in the funnel. The advantage of the power density of the turbines allows them to be placed in other parts of a ship – not necessarily in the traditional engine room.

For a full turbine plant, big ships requiring some 80 MW of power could need three to four turbines, depending on their power block, using more powerful turbines at sea, and smaller versions in port. Turbines are rated up to 52 MW. Other combinations would include turbines and smaller diesel engines.

"It gets down to the ship's profile," Barnes said, "on its power and steam requirements, and the total cost picture." ■