Liquid Nitrogen and Heat System Could Meet Emissions Rules

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Perryman Technologies is developing what it believes is the marine power source of the future – a source of powering marine engines that does not rely on combustion and does not result in any harmful emissions. Instead, steam, gas turbine can be powered by heat and diesel engines can be powered thermal energy, heat, stored as molten metal, combined with liquid nitrogen or highly compressed air.

Spokesman Shiva Vencat says the Perryman battery system is timely, considering the IMO has just agreed to cut emissions by at least 50 percent by 2050. He also cites Wood Mackenzie's prediction that global shipping fuel costs are likely to rise by a quarter in 2020 when the global sulfur cap takes effect.

Like furnaces and kilns, energy in the battery is contained within layers of refractory material. The core consists of trays and inertial dampeners. “These space-age and traditional refractory materials remains stable for millions of melts,” says Vencat. A solid-state thermal transfer material extracts the energy. The battery is charged using magnetic induction from any electrical source with energy conversion efficiency, electrical to thermal that exceeds 98 percent.

“Only nuclear power can store more energy than a Perryman battery,” says Vencat. “Yet our technology is safer than an art-class kiln.” With it, we can possibly increase the thermal efficiency of an engine by as much as 30 percent, and can retrofit any internal combustion engine old or new, he says.

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The battery works as a result of the properties of liquid nitrogen which expands nearly 600 times its volume when heated to room temperature 20°C (68°F) and when heated to 500°C (932°F) the expansion is extraordinary, far more than diesel combustion. In a large maritime application, the liquid nitrogen or compressed air can be manufactured on board using the lower temperature waste fraction of the energy stored in the battery between 500°C and 300°C. This energy can run a steam generator with sufficient to power for a small onboard liquefied nitrogen plant or compressor. These commercial liquid nitrogen plants are off-the-shelf and skid-mounted. All of the liquid nitrogen needed can be produced from the air while the vessel is in transit.

The combination of the high-temperature heat and liquid nitrogen's high energy density means that a ship could travel at least 10 times further than it could on the same amount of diesel if measured by mass and a bit less if measure by volume. With the lowered maintenance cost, the extended range between refueling and the saving of using inexpensive electricity instead of burning low sulfur diesel or natural gas, return on investment in the retrofit can be achieved within a few years, according to Vencat.

With over six years of development already undertaken Perryman Technologies is now converting a stationary four-cycle diesel generator. “We are doing this in collaboration with a group of colleges and a major U.S. university,” says Vencat. “The demonstration will allow careful monitoring of the economics, relative performance and operating parameters, using thermal energy stored in a Perryman Battery and liquid nitrogen as a propellant. We hope this demonstration will attract partners to assist in more aggressive development on marine and other mobile application of the technology.”

Last year, the concept was one of six finalists for the Orcelle Award at the seventh annual Ocean Exchange Convocation, which also showcased six finalists for the Neptune Award, held in Savannah Georgia. The Orcelle solutions were required to have the ability to generate economic growth and increase productivity while reducing the use of nature's resources and the production of waste, while the Neptune solutions were to reduce impact of the ocean’s ecology.

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