

Ammonia flagged as green marine fuel alternative

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Potential future demand for ammonia as a low-risk choice of marine fuel could result in a requirement for additional ammonia production of up to 150 million metric tons/year (MMt/y) by 2050 to meet 30% of

worldwide demand, says a new report.

Worldwide ammonia production is about 180 MMt/y, with conventional production overcapacity of 60 MMt/y ensuring availability, according to the Ammonfuel report, a white paper compiled and issued by a consortium of Haldor Topsoe, Alfa Laval, Harnia, Vestas, and Siemens Gamesa. The paper describes ammonia as “an attractive and low-risk choice of marine fuel both in the transition phase towards a more sustainable shipping industry and as a long-term solution.” It also highlights the forecast availability of dual-fuel ammonia engines for the shipping sector from 2024.

About 80% of the ammonia currently produced worldwide is used for fertilizers, with urea the largest end-use product. To supply 30% of current marine fuel demand, the additional 150 MMt/y of ammonia required would necessitate a total production requirement of 330 MMt/y, the report says. “The additional capacity should be covered by both revamping existing plants and constructing new ones, it says.

The shipping industry is facing known and unknown environmental and climate regulations and requirements such as the MARPOL regulations and the International Maritime Organization (IMO) targets for greenhouse gas reductions, according to the report. “Many have suggested ammonia as a sustainable marine fuel that can deliver compliance,” it says. Dual-fuel ammonia engines are forecast to be available by 2024, with the benefits of using ammonia in an internal combustion engine including as a carbon- and sulfur-free fuel, meaning no SOX, carbon dioxide (CO₂), or particulate emissions. The installation of catalytic technology eliminates N₂O/NO_x emissions to very low levels, leaving an exhaust of nitrogen and water, the report says.

Ship investors’ concerns include the future cost of green ammonia and the worldwide availability and scalability of ammonia as a marine fuel, says the report. The conventional ammonia energy cost is similar to the very low sulfur fuel oil (VLSFO) en-

ergy cost, with future green ammonia expected to be the most economic carbon-neutral fuel, it says. Availability and scalability have been confirmed, with worldwide infrastructure “largely in place” and 120 ports already equipped with ammonia trading facilities, it says. A total of 17.5 million tons of ammonia is currently traded and transported yearly by ship, truck, and train, it adds.

Up to 400 gigawatts (GW) of renewable power would be needed to meet 30% of future marine fuel demand, with 184 GW of additional power production installed in 2019, the report notes.

In a separate announcement, NYK Line, Japan Marine United Corp., and Nippon Kaiji Kyokai (ClassNK) signed a joint R&D agreement for the commercialization of an ammonia gas carrier (AFAGC) that would use ammonia as the main fuel, in addition to an ammonia floating storage and regasification barge (A-FSRB).

The companies say that since CO₂ is not emitted when ammonia is burned, it is “viewed to have promise as a next-generation fuel.” Zero emissions can also be realized by utilizing CO₂-free hydrogen as a raw material for ammonia, they add.

“As demand for ammonia fuel is foreseen to expand, the need for a transportation infrastructure for stable supply is expected to increase,” the companies say. They add that this is the driver behind their decision to start the joint R&D project.

Large-scale marine transportation of ammonia is carried out by multi-purpose liquefied petroleum gas (LPG) vessels. The regasification barge in particular “is expected to contribute to the early introduction of ammonia fuel by utilizing the barge as an alternative to land facilities—storage tanks, regasification facilities—for the stable supply of ammonia fuel, the companies say.

The projects aim to utilize ammonia as a marine fuel and establish methods “for the mass transportation and supply of ammonia.” They will also be pursued as a solution for introducing a mixed combustion of ammonia into coal-fired power stations operated by Japanese electric power companies to help decarbonize the energy as well as maritime industries, according to the companies.

There are a total of 581 ammonia-producing units worldwide in 2020, with a total nameplate capacity of approximately 250 MMt/y, according to IHS Markit. Over the next five years, ammonia capacity will be rising at a much higher rate than production, leading to a growing surplus and reduced operating rates by 2021, it says.