Ammonia Energy: From H2 Carrier to Low Carbon Fuel

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Largely overlooked by the international fervour around the “hydrogen economy”, the ammonia energy industry has been quietly developing its own infrastructure to take full advantage of the growing demand for low carbon energy sources. And clearly ammonia can complement hydrogen- with its higher energy density and lower cost transportation and storage capabilities.

Ammonia as a renewable energy commodity

The leading market worldwide for ammonia as an energy commodity is Japan, which endorses ammonia both as the *carrier* of carbon-free consumption energy and a *fuel* itself, as seen with the recent announcement of a co-firing large-scale commercial power plant using NH3 and coal.

Worldwide, technologies to deploy ammonia for reciprocating engines, gas turbines and propulsion, as well as fuel cells, are proceeding with some momentum. Removing the need to “crack” ammonia back into hydrogen, with its resulting energy loss, arguably brings ammonia energy out from under the shadows of H2.

Maritime shipping first port of call

In looking at where the opportunities for large scale commercial deployment may be, focus has been paid to long-distance maritime shipping - the International Maritime Organization has made bold commitments to address existing greenhouse gas emissions and global maritime shipping has been moving precipitously towards adopting ammonia as a principal means to achieve these goals.

Quebec’s Project Courant is one of Canada’s first responses to this opportunity - a plan to produce ammonia energy at scale for export markets such as the EU. Notably, both the hydrogen and the nitrogen will be produced using hydroelectricity - allaying any concerns in Europe over fossil fuel ammonia origins.

Canada’s blue ammonia may be the preferred export

In Canada, where excitement over hydrogen exports is found on both coasts, ammonia may provide the solution to the exorbitant cost of liquefying hydrogen for transportation. And much like the debate over “green” v. “blue” hydrogen, ammonia made with natural gas and CCUS using existing infrastructure such as the Alberta Carbon Trunk Line would appear to be the best low cost option, at least in the near term, while its production in the western provinces is tantalizingly close to growing Asian markets.

The recent Japan-Russia hydrogen/ammonia development agreement only makes the need for a Canadian export plan more urgent.

Ammonia standards and certifications coming

Market recognition of proposed carbon intensity (CI) scoring is vital to creating a market for most alternative fuels, and ammonia energy is no exception. To get there internationally, work is now being done on a globally harmonized framework for the accounting, reporting and verification of emission reductions associated with conversion to ammonia energy. Methodologies such as those developed under the Kyoto Protocol will likely serve as models.

Domestic regulatory emissions schemes, such as Canada’s Clean Fuel Standard, must also create clear CI scoring methodologies to foster ammonia energy market growth, much likely the recognition already given to hydrogen.

Ammonia to challenge hydrogen worldwide?

With ammonia energy’s emergence as a fuel in its own right and not merely an intermediary, the question becomes how and where ammonia may supplant hydrogen as the preferred zero emissions combustion fuel. Their chemical similarity and relative ease of conversion between them should not be understood as indefinite complementarity and not competition.

Until the hydrogen industry develops better transportation and storage solutions, these questions will continue to be asked across all sectors within the energy transition.

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