# Green ammonia for the hydrogen economy

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Research in the *International Journal of Exergy* has looked at how a novel small-scale power-to-ammonia (P2A) system might be a useful tool in the move to a hydrogen economy. The work considers the energy efficiency and cost-effectiveness of this system compared with conventional systems. Ultimately, chemical analysis shows the potential of green ammonia as a hydrogen-storage medium, and thus an energy carrier.

The hydrogen economy refers to a proposed low-carbon economic system where hydrogen gas is produced, stored, and utilized as a primary energy carrier for various applications sidestepping the traditional carbon-rich fossil fuels. Hydrogen might be used in transportation, electricity generation, and industrial processes.

While there are issues with storage and safety, the true benefits are that the gas can be produced sustainably by the electrolysis of water or other chemical processes and when it is burned there is no carbon dioxide or noxious pollutants. Indeed, the only significant waste product is water.

The issue of safe storage of hydrogen is high on the agenda. As such, hydrogen-rich materials are being investigated as storage media. The conversion of hydrogen into liquefied ammonia ($NH_3$), for instance, offers a putatively safer way to store large quantities of the otherwise explosive hydrogen gas.

Pascal Koschwitz and Bernd Epple of the Technical University of Darmstadt, Germany, Daria Bellotti of the University of Genova, Italy, and Cheng Liang of Proton Ventures BV in Schiedam, The Netherlands used the software Aspen Plus, to first assess the suitability of an equation of state (EOS) known as HYSPR-mp in comparison to other commonly used EOS in ammonia process simulations.

They demonstrated that HYSPR-mp is a suitable choice for their analysis. They then evaluated the system using chemical exergy to show that this can produce accurate results quickly.

Finally, they carried out an exergetic comparison between this novel system and conventional P2A systems. This revealed improved exergy results and thus a greater cost advantage because of the lower initial investment costs needed.

**More information:** Pascal Koschwitz et al, Exergetic comparison of a novel to a conventional small-scale power-to-ammonia cycle, *International Journal of Exergy* (2023). DOI: 10.1504/IJEX.2023.134607

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