Lehrstuhl für Wirtschaftliche Staatswissenschaften, insbesondere Energiewirtschaftslehre

Staatswissenschaftliches Seminar
Mikroökonomik, Institutionen und Märkte

Bachelor thesis

On the current state of knowledge on Ammonia as a fuel

Ammonia (NH_3) is a colourless gas commonly found in the nature, produced from nitrogenous animal and vegetable matter. It can also be synthesized for mass production using, for example, the Haber-Bosch process, which combines hydrogen (H_2) and nitrogen (N_2) under moderately-elevated temperature and high pressure.

The use of ammonia includes many applications, such as the production of pharmaceutical and cleaning products, as a fertilizer or in fermentation process, among others. As a fuel, ammonia can be used directly through combustion, which generates nitrogen and water ($4NH_3 + 3O_2 \rightarrow 2N_2 + 6H_2O$). Because it contains no carbon, its combustion does not generate carbon dioxide, which turns it into a potential player in the fight for climate change. However, it cannot be easily used in current engines based on the Otto cycle (typical spark ignition piston engines) due to its very narrow flammability range.

Alternatively, ammonia can also be used to fuel hydrogen cells by converting ammonia back to hydrogen and nitrogen. This allows storing hydrogen at a higher efficiency rate than gaseous hydrogen under pressure, reducing the overall costs for storing and delivering. Ammonia can also be used to power fuel cells directly, by using a catalyst inside the fuel cell to separate ammonia into nitrogen and hydrogen. However, these technologies are still young and research is still required. Also, the production of ammonia in a global scale is very small compared to petroleum usage, meaning that considerable investments need to be done before it can start being used as a fossil fuel substitute.

This thesis aims to explore the current developments in the use of ammonia as a fuel with respect to technologies, costs, potentials, learning curves, environmental impact, etc., as well as future trends.

Literature

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