



automotive center of expertise

Ammonia: the fuel of the future

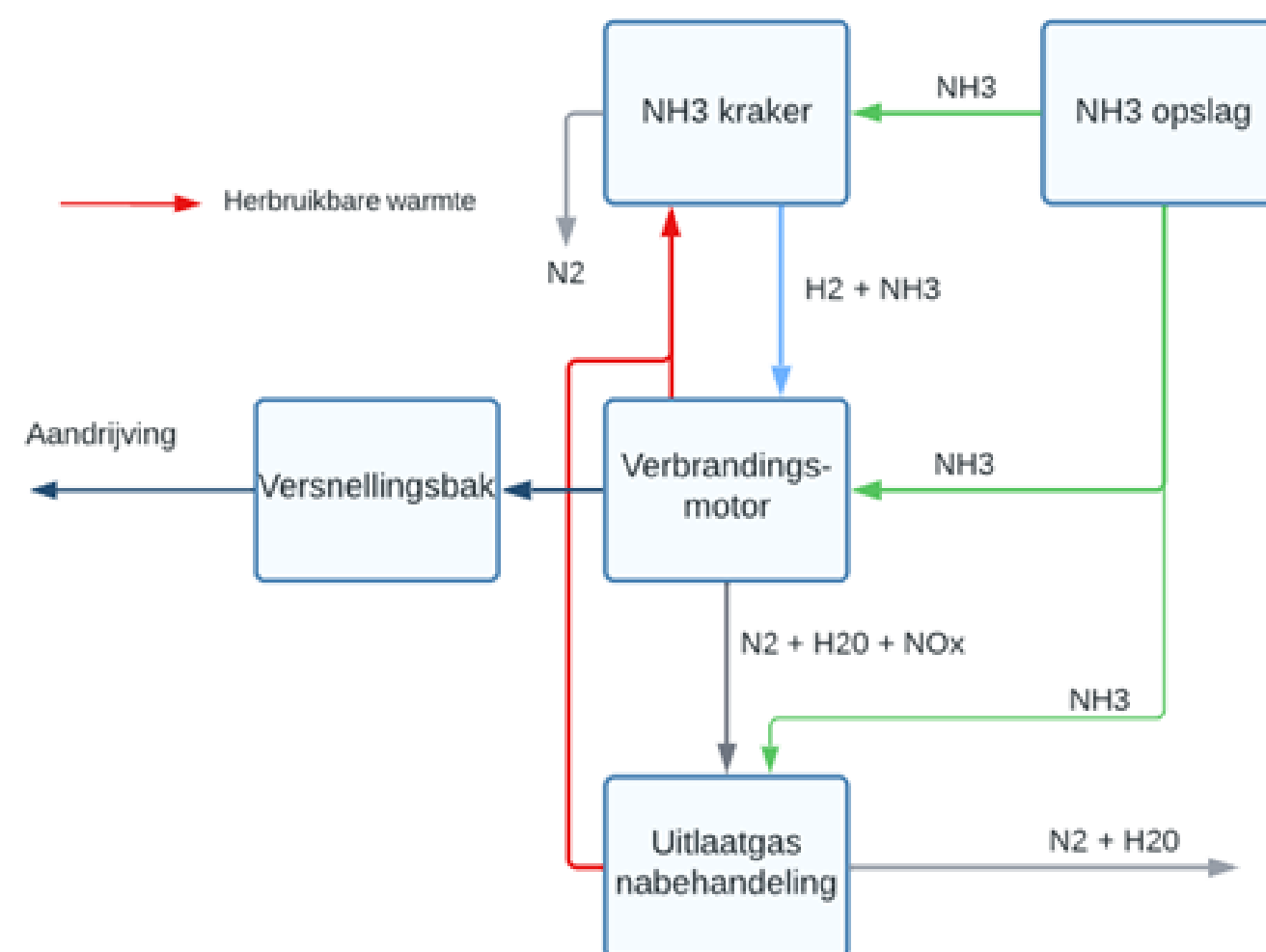
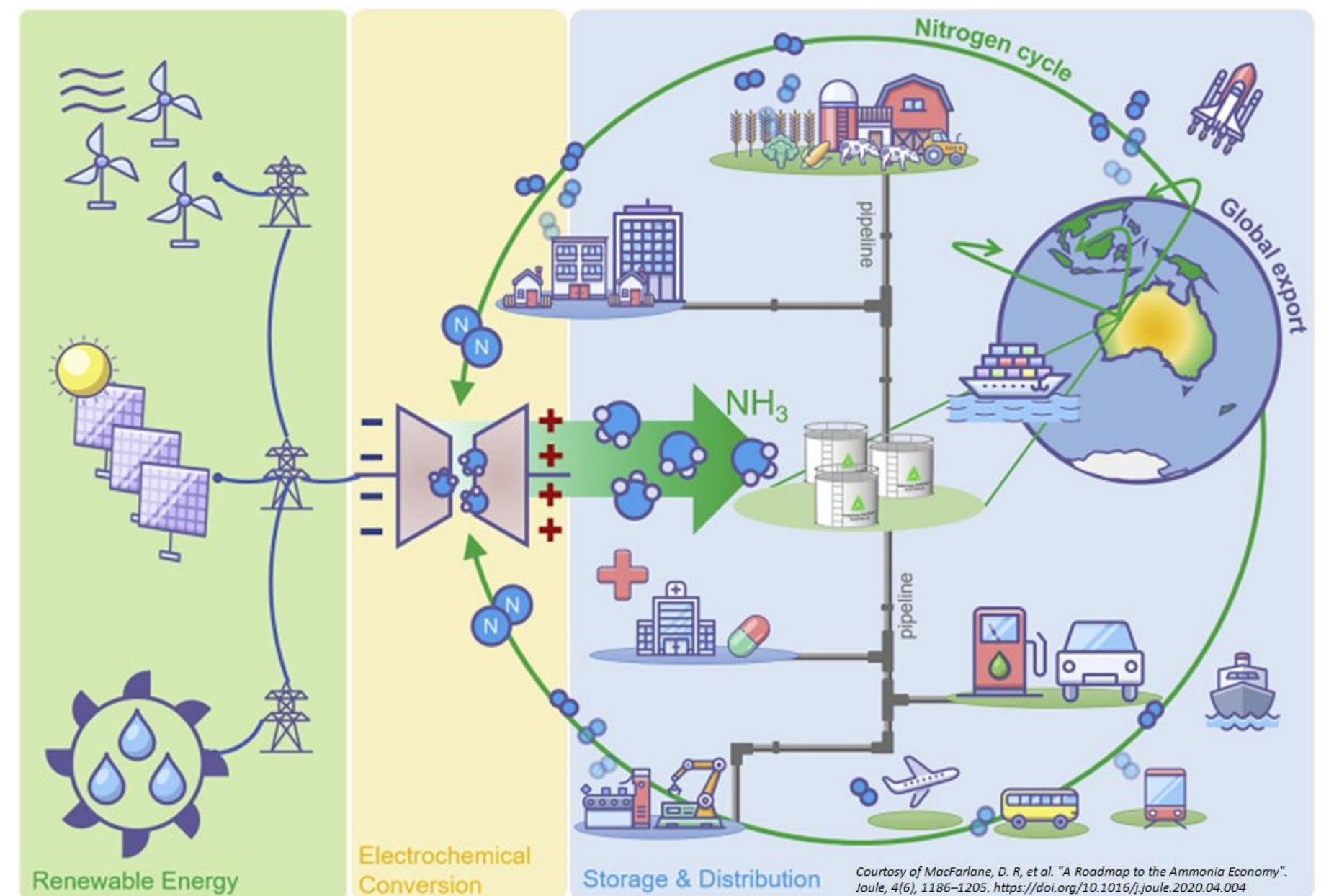
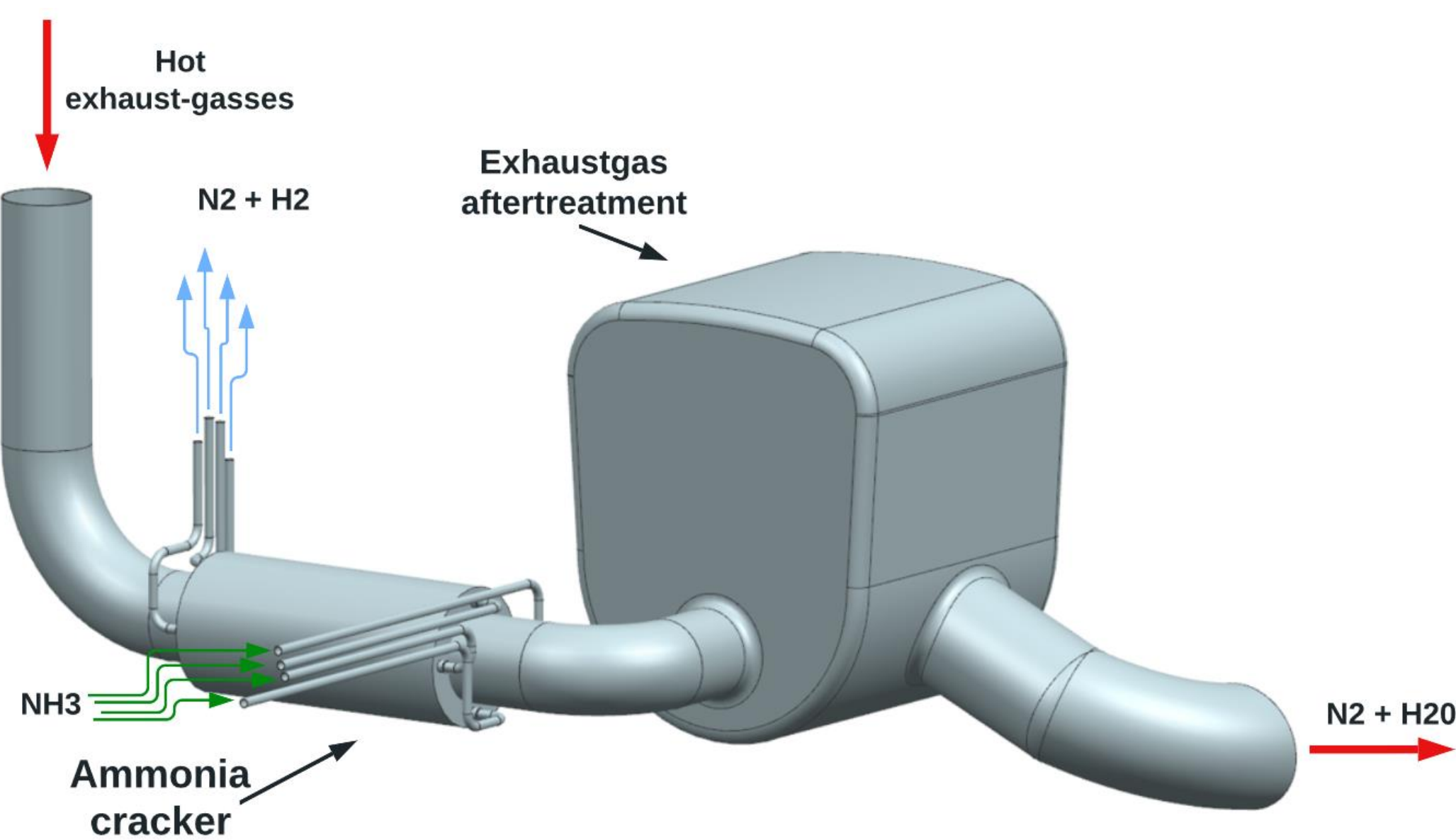
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The pollution of green house gasses is a big problem for the environment and one of the biggest emitters is traffic. Battery-electric and hydrogen fuel cells are developed in order to combat those CO₂-emissions. Due to the high cost of the powertrain and the low driving range, this is not the right answer for every sector. This research project focussed on the use of ammonia as a fuel for trucks that transport heavy goods over a long distance. Due to the higher energy density and the easier storage, ammonia appears to be a very good option.

My name is Robin Huijers, and I am an Automotive Engineering student from Fontys Hogescholen Eindhoven. I have done my graduation internship at VIRO in Echt under the watchful eye of Anouk Damhuis-Benink from VIRO and Cynthia Morin from Fontys. VIRO is an engineering bureau with customers ranging from vehicle manufacturers like DAF to big industrial companies like ASML. For my graduation internship I have done a research project called: "Ammonia: the fuel of the future".

The project I was asked to do at the start of my graduation internship is pretty different from the project I ended up to do. At first the project was to develop an ammonia fuel tank in 3 different sizes. During my research I quickly found that the storage of ammonia is relatively easy to do, and I was afraid that my project would be too simple. In consultation with my graduation counsellors Anouk and Cynthia, I have chosen for a broader research project. In my new project I researched the possibility of ammonia as a fuel for trucks, especially for trucks that travel long distances. To get an answer on my research question I collected a lot of data regarding the use of ammonia as a fuel.

Ammonia can be used in different engines and fuel cells only not always as ammonia itself. Ammonia can be cracked, onboard of the vehicle, into its primary molecule 's nitrogen and hydrogen. The hydrogen can then be used in a fuel cell or together with pure ammonia in a combustion engine. Ammonia has an energy density that is more than double that of hydrogen per litre of fuel. And where hydrogen needs to be stored at 700 bar, ammonia only has to be stored at a pressure of 10 bar. The only big difficulty of working with ammonia is its toxicity and a leak can cause a lot of problems. Many other studies have already shown that the use of ammonia is as safe as the use of petrol. With current technologies that are available and when the ammonia is handled with care, the risk of a leak is minimal. The conclusion of my research project is that ammonia could be a great possible fuel in the future, especially in the use case that I have used. In the current time and with the currently available technologies, a combustion engine running on ammonia and hydrogen would be the best option. The ammonia cracker can be installed in the exhaust and can use the available exhaust gas temperature to crack the ammonia. The ammonia will be stored in cylindrical pressure tanks that would look a lot like the CNG or LPG tanks that are already in use. Due to the resistance to heavy loads and the possibility to use ammonia and hydrogen together, the combustion engine is preferred over a fuel cell. But the development and improvement of fuel cells can change the outcome of this research in the future.



Partnerbedrijven

