

NFUEL UNITS OVERVIEW

Proton Ventures

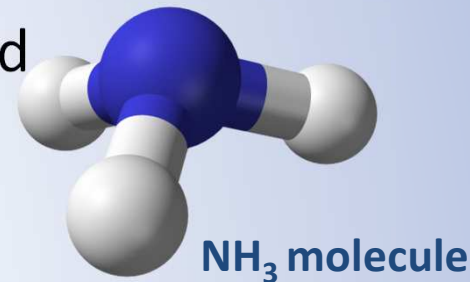
Schiedam, May 2011



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Ammonia Basics

- Chemical formula: NH_3
- Compound on Nitrogen and Hydrogen (1: 3 atomic ratio)
- Colourless, toxic gas with a strong pungent odour
- Lighter than air (0.6 times the vapour density of air)
- Pure NH_3 is not very flammable (poor lower heating value)
- The chance of explosion is very small, only occurs in places that are not properly ventilated



Ammonia Applications

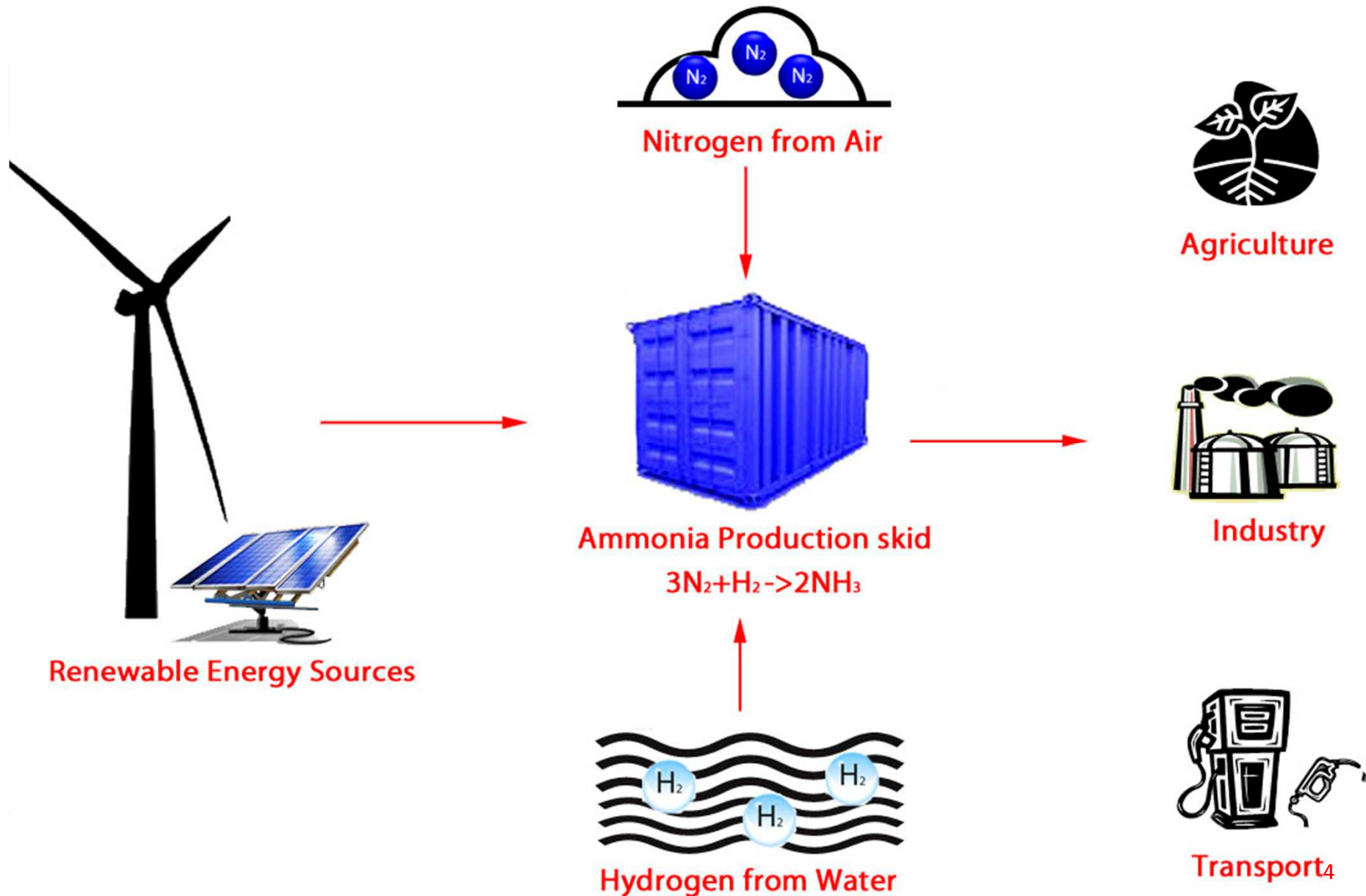
Agriculture: NH_3 as fertiliser

Industry: Denox in power plants, CO_2 capture, feedstock for chemicals production

Transportation fuel: Direct injection in the internal combustion engines, Fuel Cells (Direct NH_3 Fuel Cells, H_2 Fuel Cells)

Energy carrier: easier stored & distributed than electricity or hydrogen

NFUEL UNIT: Basic Concept



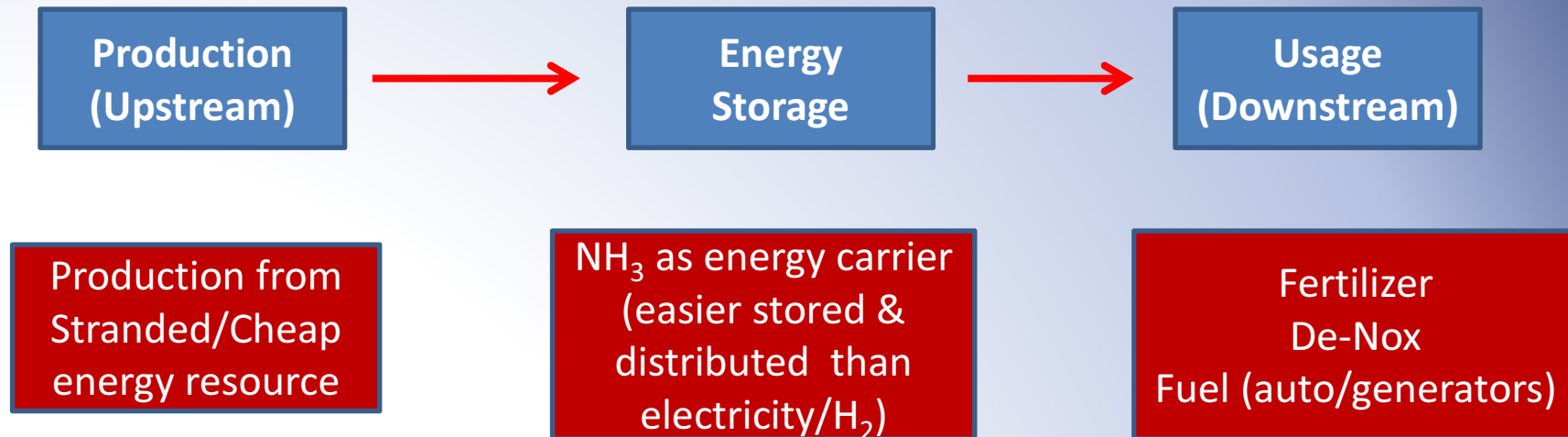
NFUEL UNIT: Basics

Containerised & Easily transportable mini ammonia unit

Capacity: 120 kg per hour NH_3

Note: Different systems for smaller and larger capacities have been designed for (3-1000kg per hour NH_3 production). More info upon request.

NFUEL UNIT: Highlights



Nfuel influencing the entire energy supply chain

NFUEL UNIT: Power & Electrical

- Powered from renewable energy sources
- Designed for energy fluctuations and rapid on-standby cycles
- US & European power requirements are taken into account
- NFUEL Unit Power Consumption: ca. 1,5MW

NFUEL UNIT: Parts

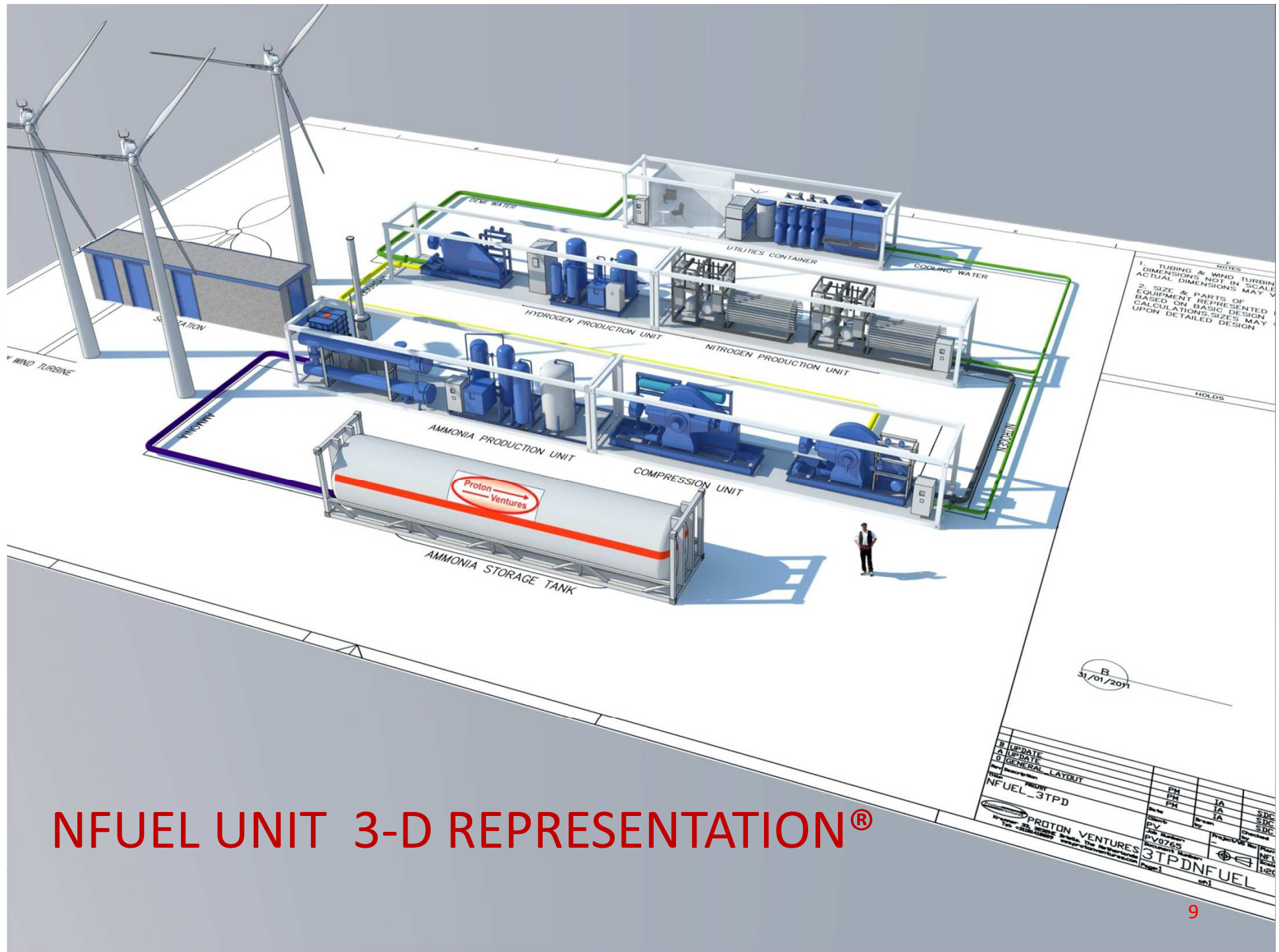
H₂ Generation unit: Alkaline H₂O electrolysis system with demi H₂O production unit

N₂ Generation unit: Pressure swing adsorption technology

NH₃ Production unit: Feed & Recycling Compression stage, Reactor stage based on Haber Bosch Technology)

NH₃ Storage : pressurised storage tanks

Cooling Water on site production if not available



NFUEL UNIT 3-D REPRESENTATION®

NFUEL UNIT: Operation & Maintenance

- **Minimal labour costs:** remote monitoring & control through a wireless secure internet connection
- **Maintenance costs:** spare parts replacement needs for the H₂ & N₂ production units and the compressor systems used
- Maintenance agreement with Proton upon request

NFUEL UNIT: Life Expectancy

- NH_3 production unit can operate efficiently for more than 30 years,
- H_2 & the N_2 production units have around 20 years life expectancy

The above can be extended depending on the proper operation of the unit.

NFUEL UNIT: Safety & Emissions

- Fully automated process, design & control logic based on safe operation
- Automated shut off valves in case of emergency
- NH₃ sensors installed throughout the unit
- NH₃ scrubber capturing NH₃ gas released
- Zero Carbon process
- Zero No_x emissions

NFUEL UNIT: Partners

- N₂ Production: Air Products
- H₂ Production: Casale
- Demi-H₂O Production: Hatlenboer
- Ammonia Production Engineering & Construction: Zeton
- NH₃ Reactor: Proton
- Overall Engineering & Project management: Proton

For Additional Information



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