



**AICHE conference
Ammonia Fuel Sessions**

Minneapolis, November 2017



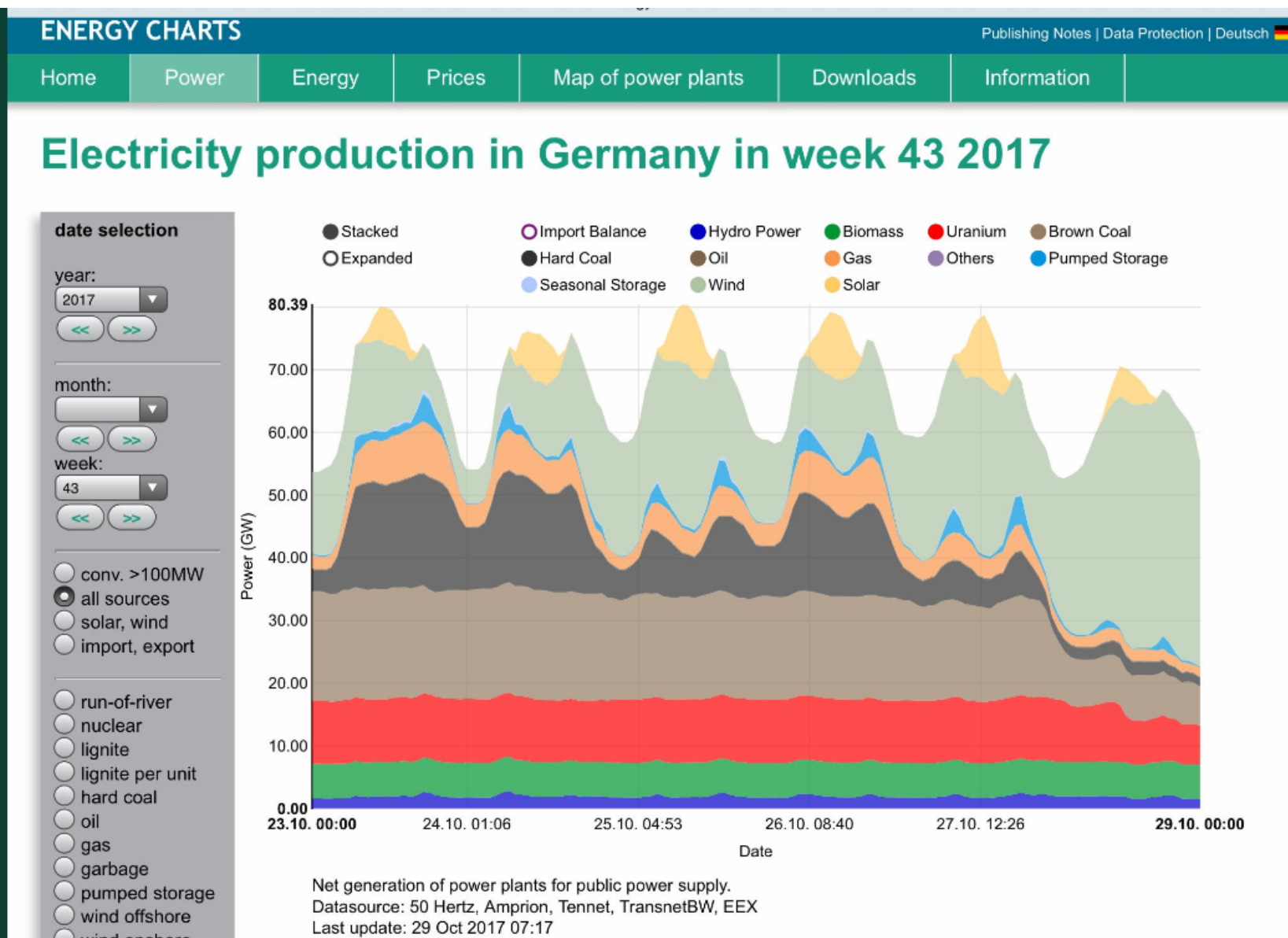
And here she is

MONIA

The Mascotte for Mini-ammonia



Historic news: App 60% power from wind in Germany for a full day, with negative pricing for a day!!!





Ammonia4fuel in RTL-Z
Dutch television program
“doe maar duurzaam”

With lots of hits on twitter and
linked-in

Link will be given later for
YouTube

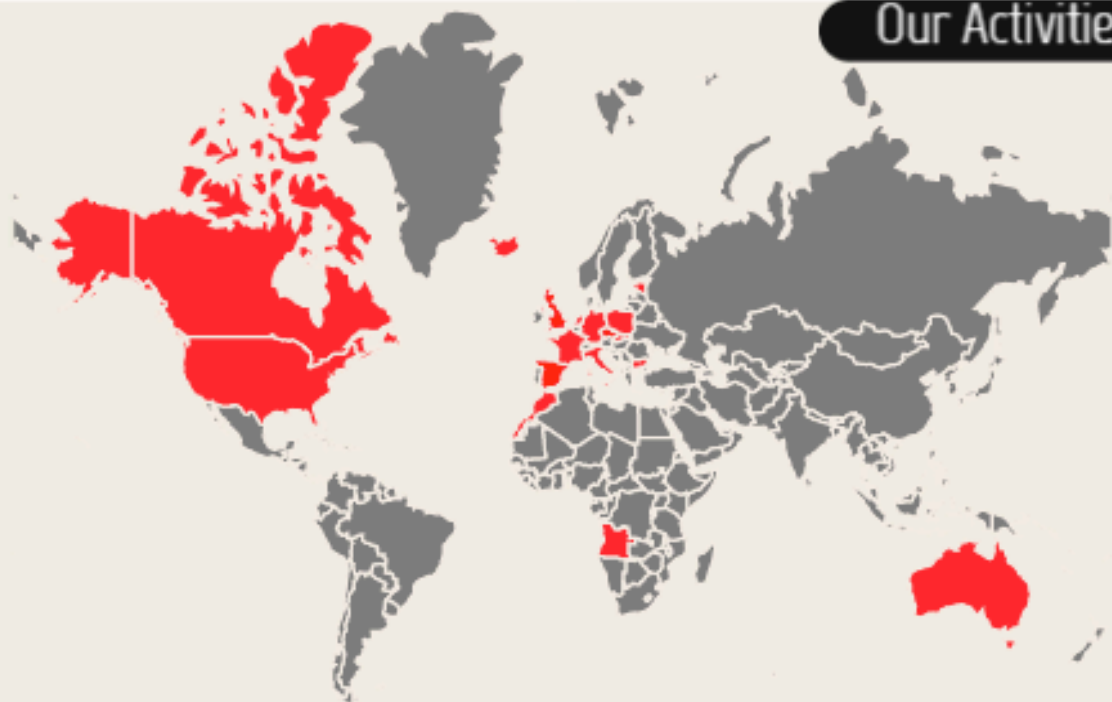
Ammonia in the news in the latest governemental act 2017-2022



**PROTON
VENTURES**

**Empowering Storage Solutions
Unique Ammonia Portfolio**

Our Activities



Our Company

20 EMPLOYEES



Speaking more than 6 languages

3 OFFICES

Netherlands (headquarter),
USA, Estonia



10 ENGINEERS



Process, Mechanical, E&I

PARTNERSHIP

with Vicoma



Development

ORGANISER 1st European Power-to-Ammonia
Conference



NH3 event
2017

LECTURES by International Fertilizer Society (IFS),
Energy Storage, NH3 Event USA and more



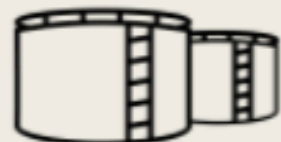
**ENERGY
STORAGE
EUROPE**



Our Work

STORAGE

NH3 HCL



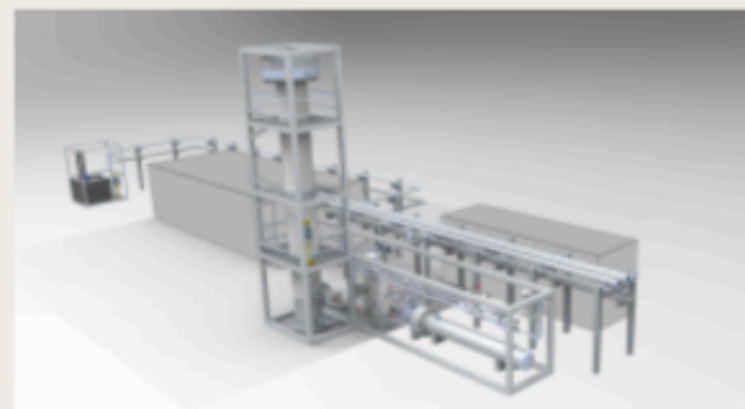
SERVICES

Engineering, Commissioning, Start up,
Training, Operations, Maintenance



PRODUCTION Small Scale Ammonia (NFUEL)

Unit	Kg/hr	MTD	ktpa
NFUEL 1	120	3	1.000
NFUEL 4	415	10	3.650
NFUEL20	2500	48-60	20.000



Proton's Management team



Geir Wedde

Proton Ventures BV Sales Director

- 30 years of experience as technology manager
- Entrepreneur / Owner of Norwegian Neatec – Air Pollution Control Technology



Hans Vrijenhoef

Proton Ventures BV Founder / CEO

- 25 years of experience in ammonia and fertilizers business
- Ammonia plant manager for Kemira Rozenburg
- Ammonia sales manager for Kemira
- One of the first visionaries of mini ammonia units concept

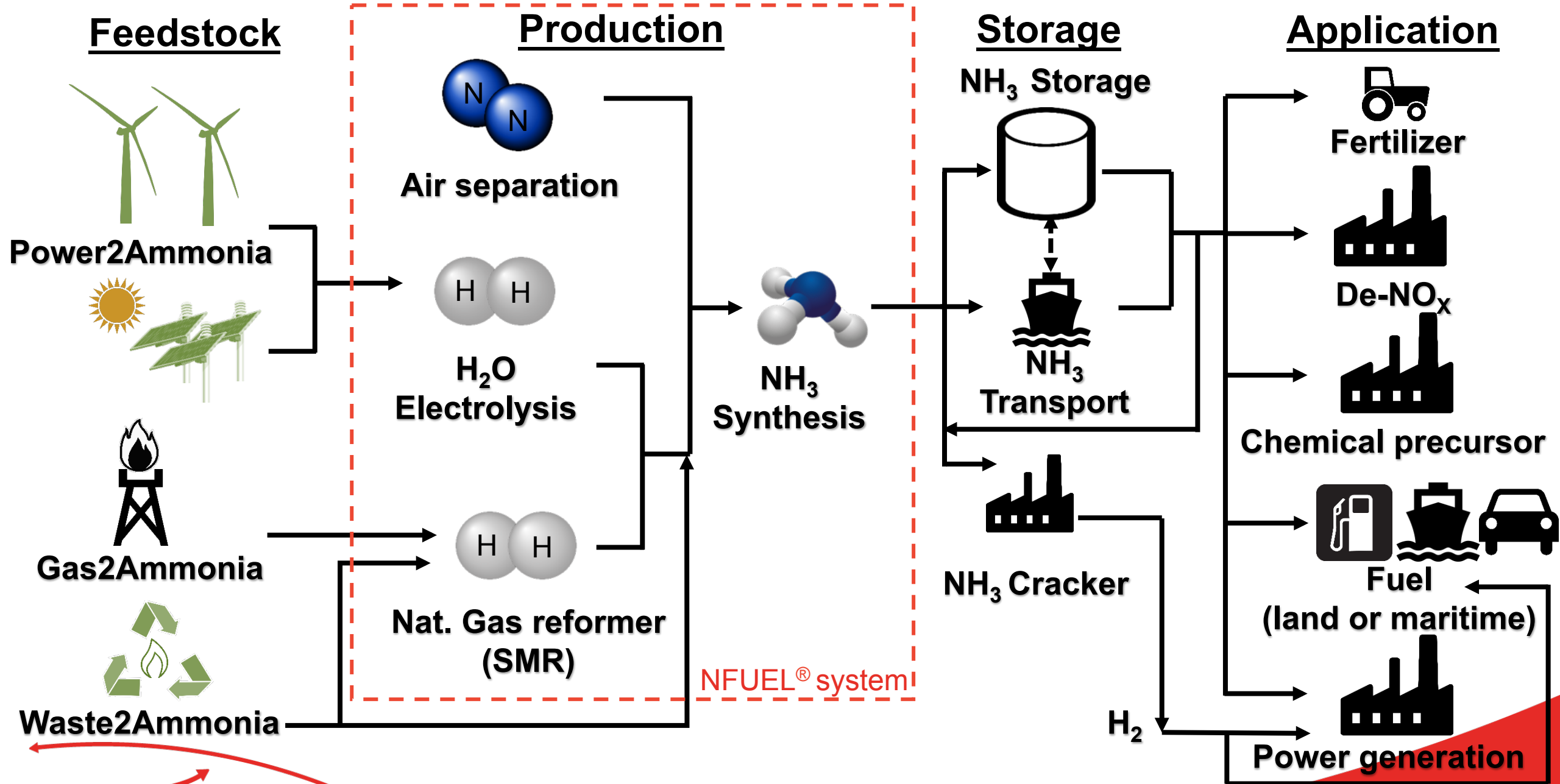


Ioanna Aslani

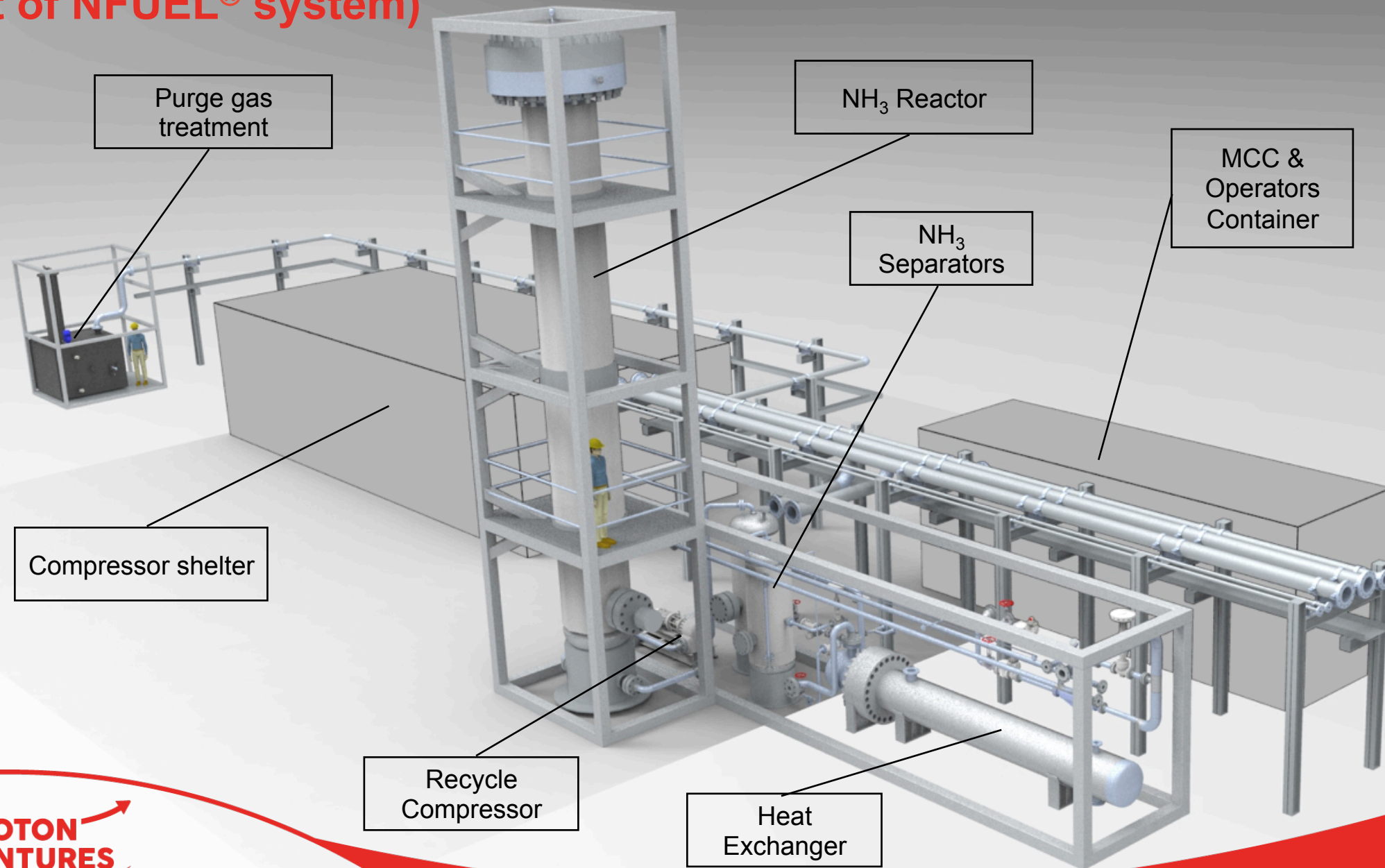
Proton Ventures BV Operational Director

- One of the first engineers at Proton
- Been involved in almost all functions in the company
- Guarantees the workload efficiency and quality of the projects





Proton proprietary ammonia synthesis unit (part of NFUEL[®] system)



NFUEL® Technology Summary

- **Small Scale Ammonia Production in three capacities:**

Unit Size	Kg/hr	Metric tons/ day	Metric tons/annum
NFUEL® 1	120	3	1.000
NFUEL® 4	415	10	3.650
NFUEL® 20	2.500	48-60	20.000

- **Decentralized production of ammonia:**

facilitating customers to be independent of transport costs and fluctuations of the ammonia price.

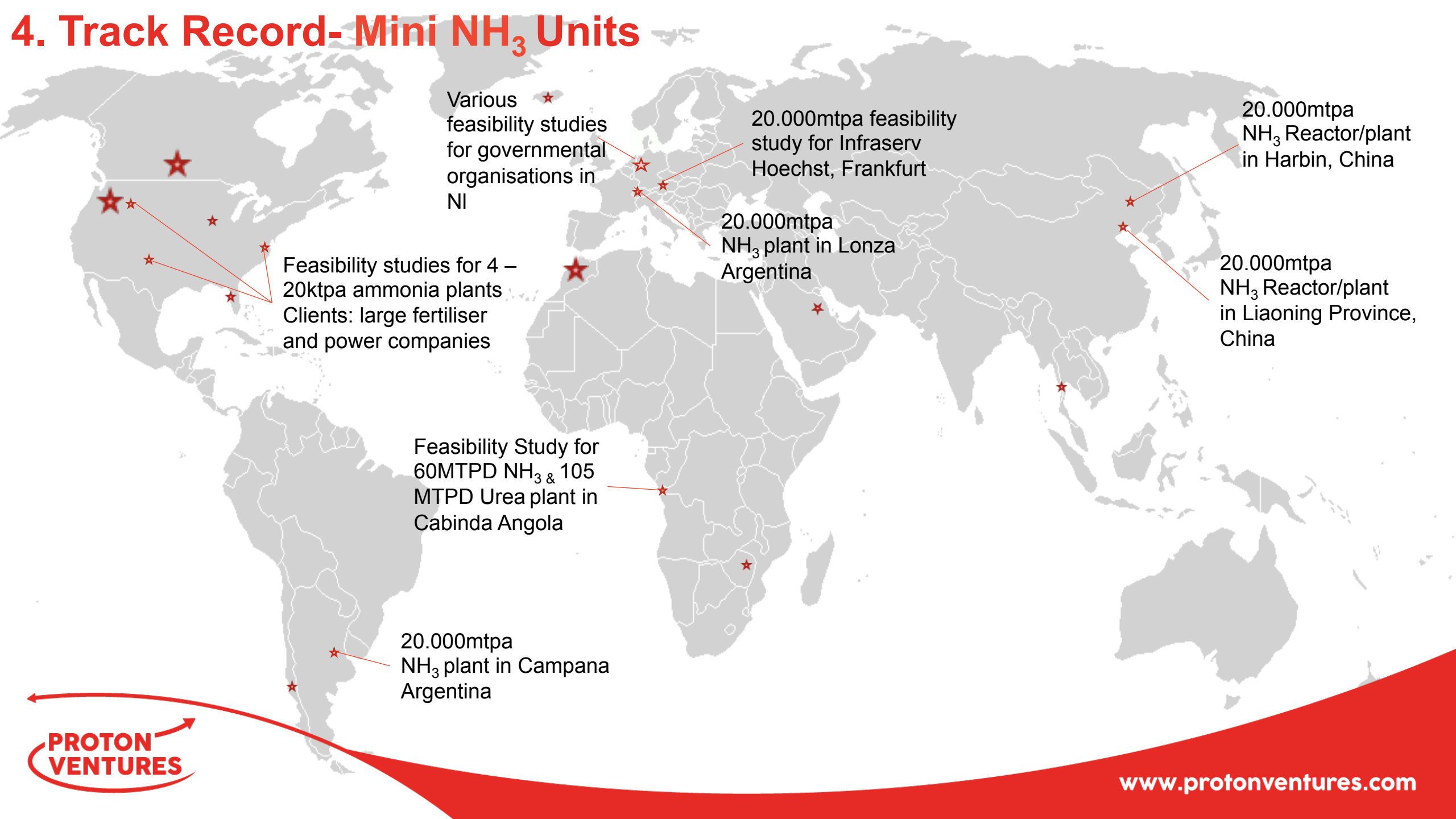
- **Three different feedstock sources:**

Gas2Ammonia, Power2Ammonia Waste2Ammonia

- **Key consumables:**

Key Consumables			
Natural gas	835	Nm ³	Per m-ton NH ₃
H ₂	2.080	Nm ³	Per m-ton NH ₃
Electricity (when H ₂ from NG)	1000	Kwh	Per m-ton NH ₃
Electricity (when H ₂ from H ₂ O)	11.000	Kwh	Per m-ton NH ₃

4. Track Record- Mini NH₃ Units

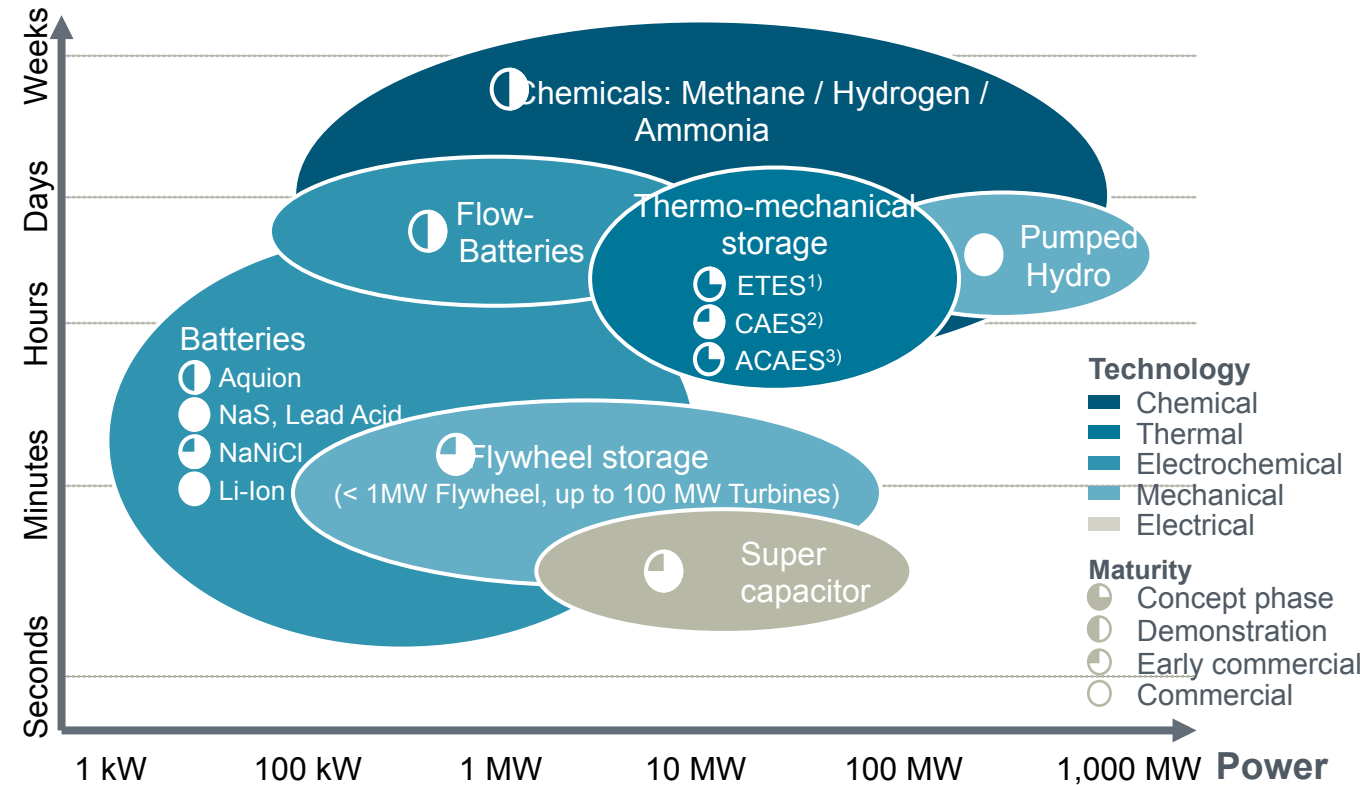


6. NFUEL® Innovative Business Case B: NH₃ as an energy storage

NH₃ - ideal green solution for long term energy storage because of:

1. Utilization of **Stranded** sources (eg. Solar, wind, tidal energy)
2. Peak energy saving by **flexibly** producing NH₃ when **excess** available renewable energy cannot be put back in the grid
3. **No** CO₂ emitted when utilising ammonia or producing it from electrolysis
4. NH₃ has a **45% higher** vol. energy density than H₂
5. NH₃ stored in **inexpensive** pressure vessels (@ ambient conditions of e.g. 20 °C NH₃ is liquid @ 7,6 barg)
6. NH₃ solves the **long term** storage issue as opposed to batteries that self-discharge after a short period of time (see graph)

Storage time



¹⁾ Electro-Thermal Energy Storage ²⁾ Compressed Air Energy Storage ³⁾ Adiabatic Compressed Air Energy Storage

Source: Siemens presentation, 1st European NH₃ Conference 19/05/2017



Maritime fuel

Schiedam:
Power for
port

battolyser

NUON
eemshaven

Co2 capture

Oude Tonge



The next NH3 event in Rotterdam:



2nd European Power to Ammonia[®] Conference

May 17 & 18 | 09:30 - 17:00 hours

Rotterdam | The Netherlands

More information and registration:

www.nh3event.com



www.protonventures.com



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