

Ammonia as an energy carrier – update from the Netherlands

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Today's talk...

- Update the audience about the activities with regards to “ammonia as an energy carrier”
- Past: Highlight what Proton has done and achieved so far
- Today: What Proton is currently doing
- Future: What are the gaps, and how would we like to address them

The Past

- Once upon a time...long time ago

When we started talking to different actors about ammonia as an energy carrier, we were met by apprehension and disbelief

Keep talking...



**I'm not
listening!**

GraphicsDB.com



ures.com

Today

- Many relevant actors see the potential of ammonia as an energy carrier (or hydrogen carrier).



The Future

- ... one day the investors signed the contracts and there were sufficient funds to establish an ammonia future... and we all lived happily ever after...
- That's a great story, isn't it!

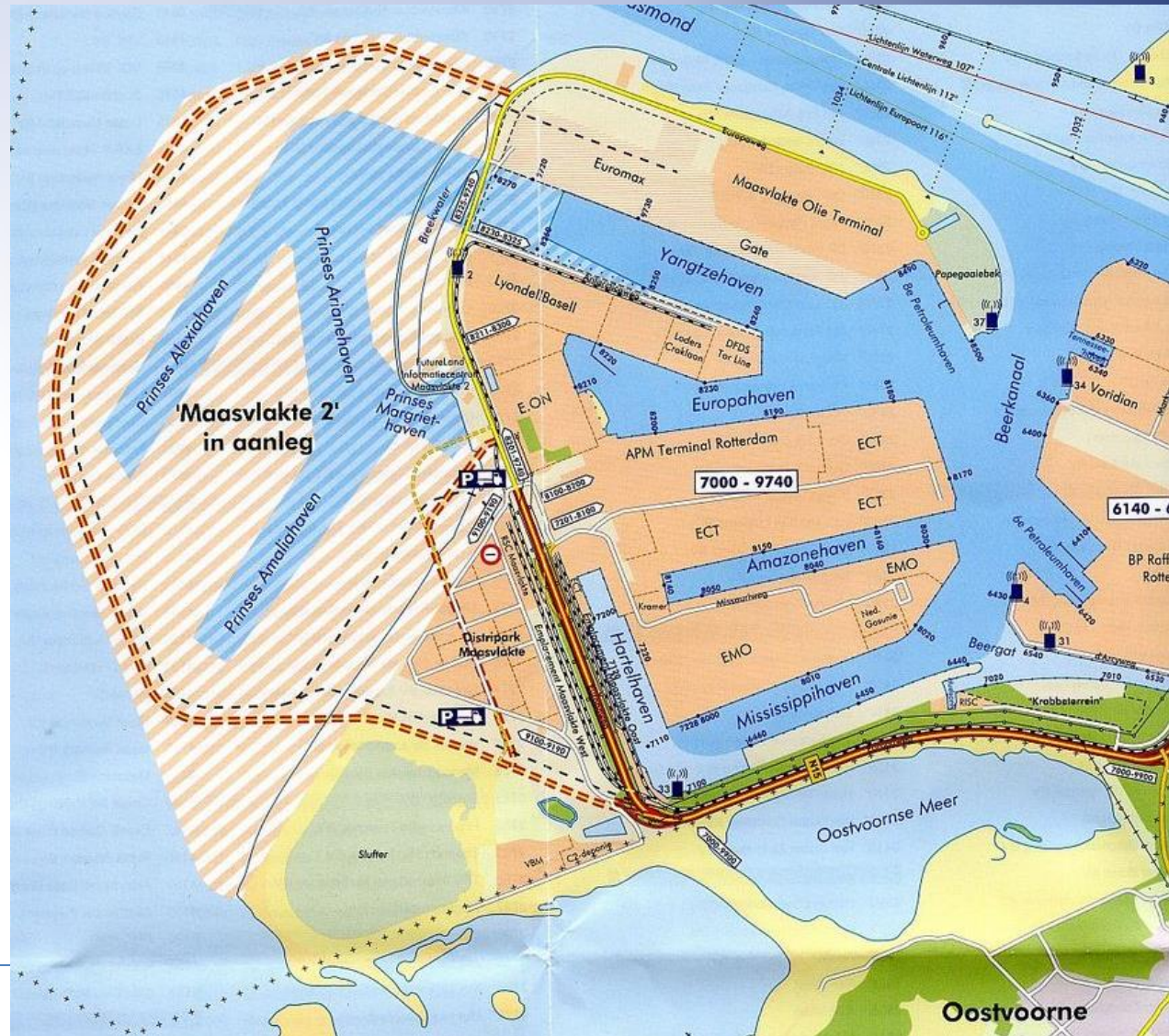


Not so fast, I think

- What I would like to say is that over the past 6 years Proton has been working hard to publicize the advantages of using ammonia as an energy carrier.
- At the beginning, while talking to the other relevant stakeholders within the energy sector about ammonia as an energy carrier, we were met by disbelief and apprehension.
- Many stakeholders believed that ammonia is a fertilizer or an industrial commodity, with limited potential as an energy carrier.
- Over the last few years Proton has worked on different projects, platforms, workgroups, etc at various levels with regards to ammonia as an energy carrier.

Where it all started

Maasvlakte 2 Project in the Netherlands



Maasvlaakte 2

- *God created the Earth, but the Dutch created the Netherlands.*
 - A large part of the country is reclaimed from the sea



Maasvlakte2.com

Maasvlakte 2

- Maasvlakte 2 is a major civil engineering project in the Netherlands, constructing a new port and supporting infrastructure on reclaimed land adjoining the Maasvlakte.
- Once completed, approximately 2000 hectares will be reclaimed
- Focus on sustainability
 - Design
 - Operations
 - Cositing

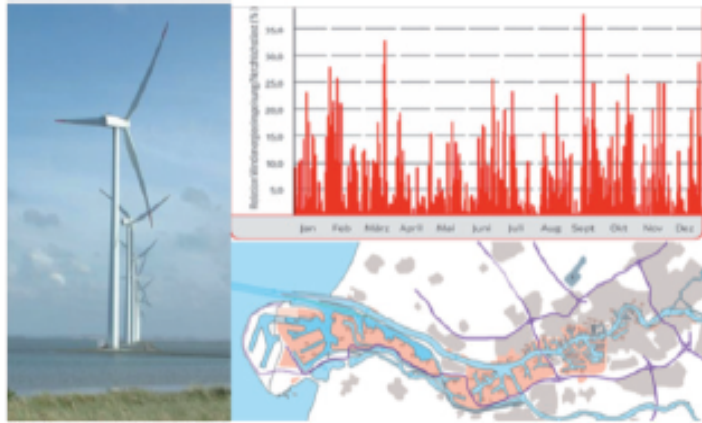


Project		Projectleader
1	Simulation of cluster development of Maasvlakte 2	Rob Stikkelman
2	Flexibility in port development and management	Michiel Nijdam
3	Development and greening of a syngas infrastructure	Rob Stikkelman
4	3D Spatial Data	Sisi Zlatanova
5	Dubrovnik	Larissa van der Lugt
6	Asset Life Cycle Management	Telli van der Lei
7	Masterplan+	Lori Tavasszy
8	Apps development in Port of Rotterdam	Wout Hofman
9	Industrial capture of surplus wind energy	Rob Stikkelman
10	BeneGrids	Pieter Bots

Next Generation Port Infra, powered by Maasvlakte 2 is a four year alliance between Projectorganisation Maasvlakte 2 (PMV2) and researchprogramme Next Generation Infrastructures (NGInfra). The goal of the alliance is valorisation of NGInfra's excellent knowledge on infrastructural systems together with expertise of the Port of Rotterdam, focussed on a sustainable and efficient port. It is mainly focussed on infrastructural systems which will be part of the development, realisation and establishment of 'Maasvlakte 2' and an optimal exploitation of the port area. PMV2 and NGInfra are working together in projects to gain and expand knowledge. The financial scope of this alliance is 2 million Euros.

INDUSTRIAL CAPTURE OF SURPLUS WIND ENERGY

- Flexibility
- Business case model
- Smart industrial grid



The production of wind energy varies. Surplus amounts may occur and will remain unused until extra demand is created. In this project we explore the opportunities within the Rotterdam harbor industrial cluster to create additional flexible demand.

Examples are the production of green chemicals and the charging of automated guided vehicles. We have an eye for technology, economics, sustainability and stake holders.

Our final goal is to describe show cases for improving the environmental footprint of the Port of Rotterdam by using wind energy.



NEXT
GENERATION
INFRASTRUCTURES

Next Generation Port Infra, powered by Maasvlakte 2

PROJECT TEAM E-on Benelux NV: Sander Fijn van Draat, Daniel Lauwen, Menno Ros TenneT TSO BV: Hans van Hooijdonk Proton Ventures BV: Hans Vrijenhoef, Anish Patil PoR: Nicole van Klaveren-Pleumeekers, Wilco Van der Lans TU Delft: Rob Stikkelman, Kas Hemmes
PROJECT LEADER Rob Stikkelman, r.m.stikkelman@tudelft.nl

It was an award winning project

- Our project received first prize during the Port Research poster session
- Followed by a lot of media attention
- Our final project report was well received



This was a starting point

- We received a lot of feedback
- Actors were interested in working with us
- We collaborated on a couple of EU level proposals for a pilot plant
- Further we had applied for a couple of Dutch grants earlier this year
 - Fortunately, both have been approved, and we have been granted funds for 2 feasibility studies
 - Wind 2 ammonia
 - Ammonia as an energy carrier

Project 1: Wind 2 Ammonia in Zuid Holland region

- Zuid Holland region consists of the Port of Rotterdam area industrial cluster
- This project will focus on answering the following broad questions
 - Under what conditions (technical, economic and institutional) wind 2 ammonia conversion will take place.
 - What are the economic and environmental benefits in capturing intermittent wind into ammonia?

Project 2: Ammonia as an energy carrier

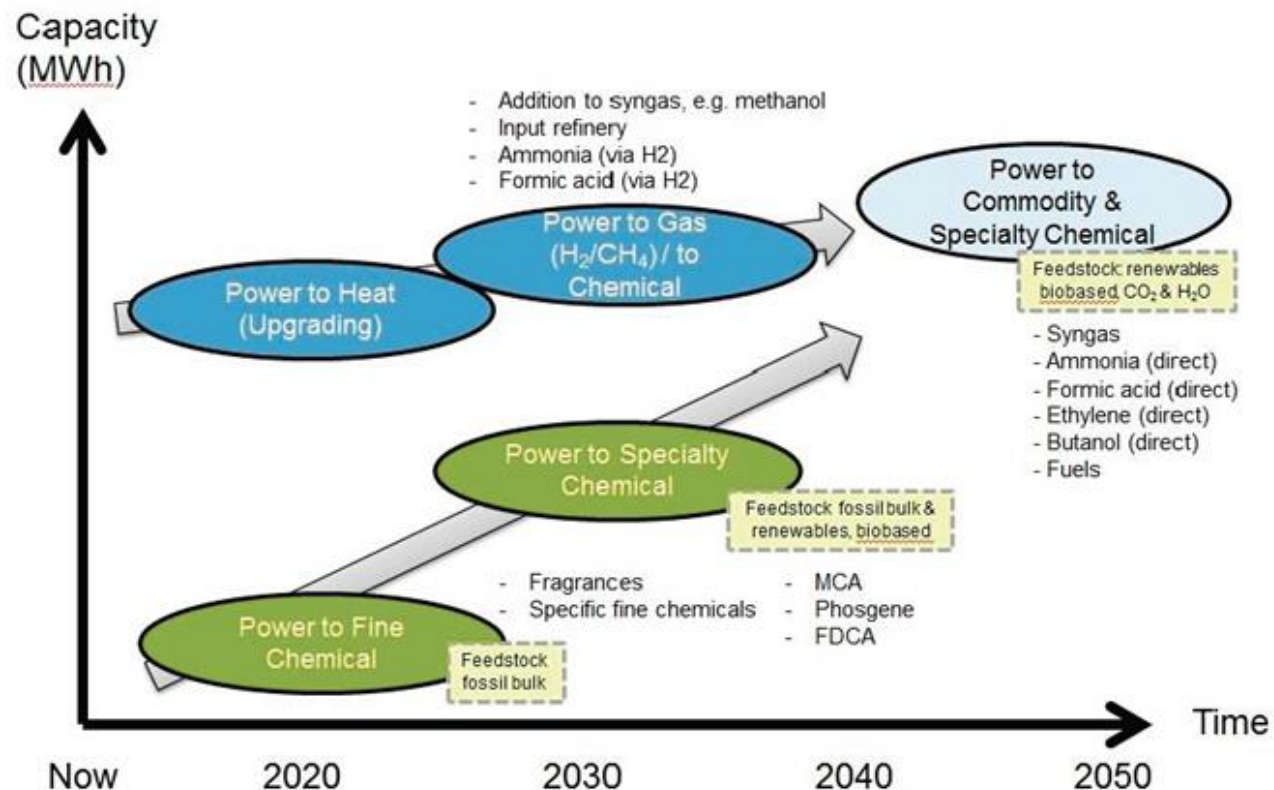
- Working with two other partners: Hanze University & Energy Valley
- Aim of this study is broader than just ammonia production technologies, but rather the entire value chain of ammonia as a future energy carrier
- This project will focus on answering the following broad questions:
 - What are the conditions for storage, transport and handling of ammonia?
 - What are the conditions under which ammonia is used in diverse applications?
 - What is the public perception of ammonia as a flexible energy carrier?
 - Under which conditions will ammonia be of added value for renewable power production?

Current situation in the Netherlands

- Today we see a rising interest in ammonia as an energy carrier in the Netherlands.

- Various Power 2 gas projects are carried within Topsectors (Chemicals and Energy).
- The graphic on the right was presented during the ECN-TNO Electrification of Chemical Industry Symposia

High level Road Map of Electrification



Source: <https://www.tno.nl/en/focus-area/industry/sustainable-chemical-industry/efficient-processing/electrification-of-the-chemical-industry/>

Future

- Still a long way to go
- Proton is working with other stakeholders – Research institutes + Universities + Industries to start an Ammonia centered association.
 - Comparable to the Ammonia fuel network, but on the other side of the pond.
 - If this comes through then half of the funds will come from the consortia and the other half from the Government

NH3 Europe Conference

- Eventually, we would like to arrange an annual NH3 Europe conference in the Netherlands (probably Spring 2017)



Thank you

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