



HYDROGEN VALLEY



Energy For Europe

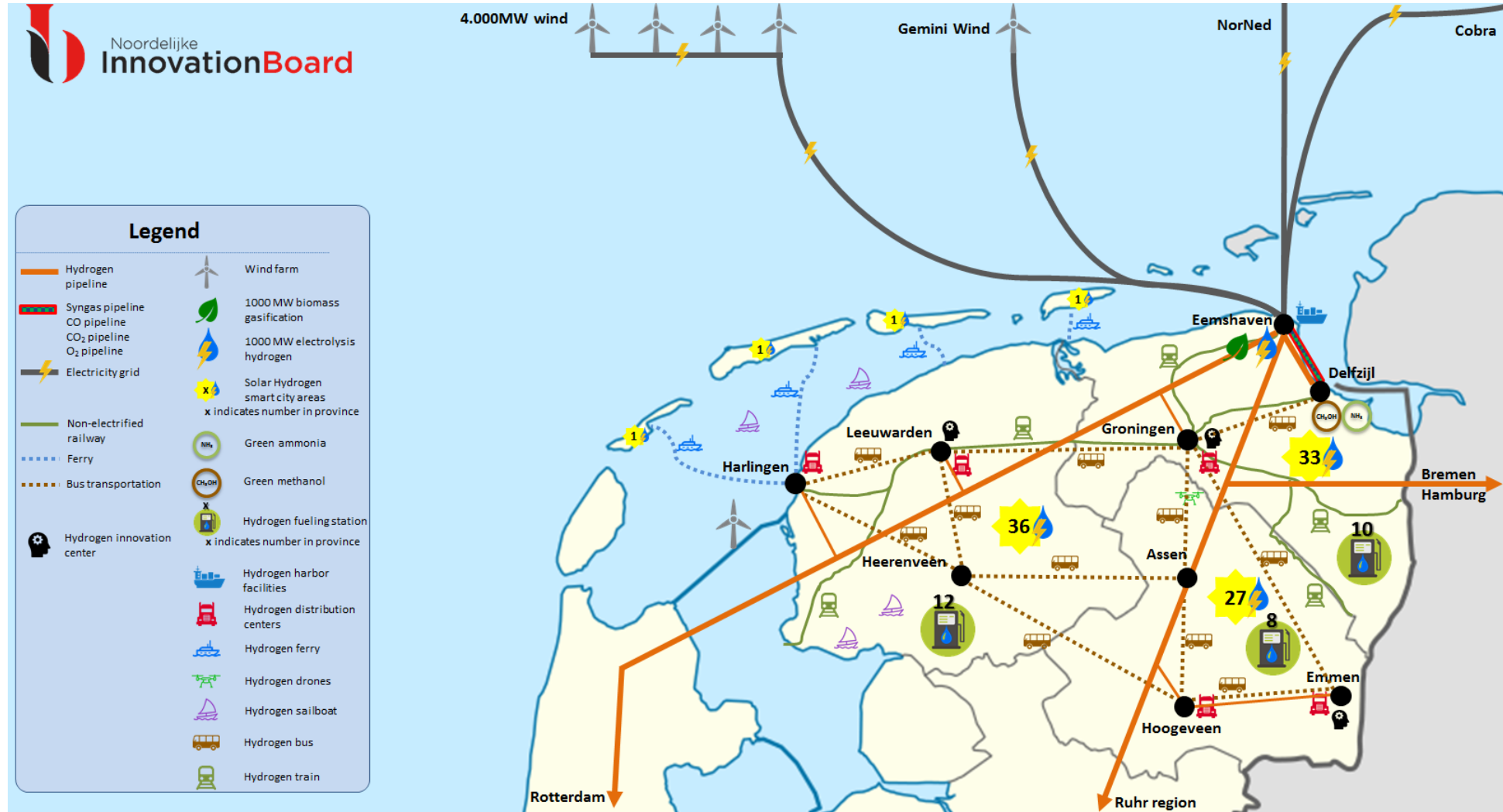
Hydrogen Valley Northern Netherlands

March 27, 2019

Luuk Buit
Province of Groningen

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Vision



NIB 2017

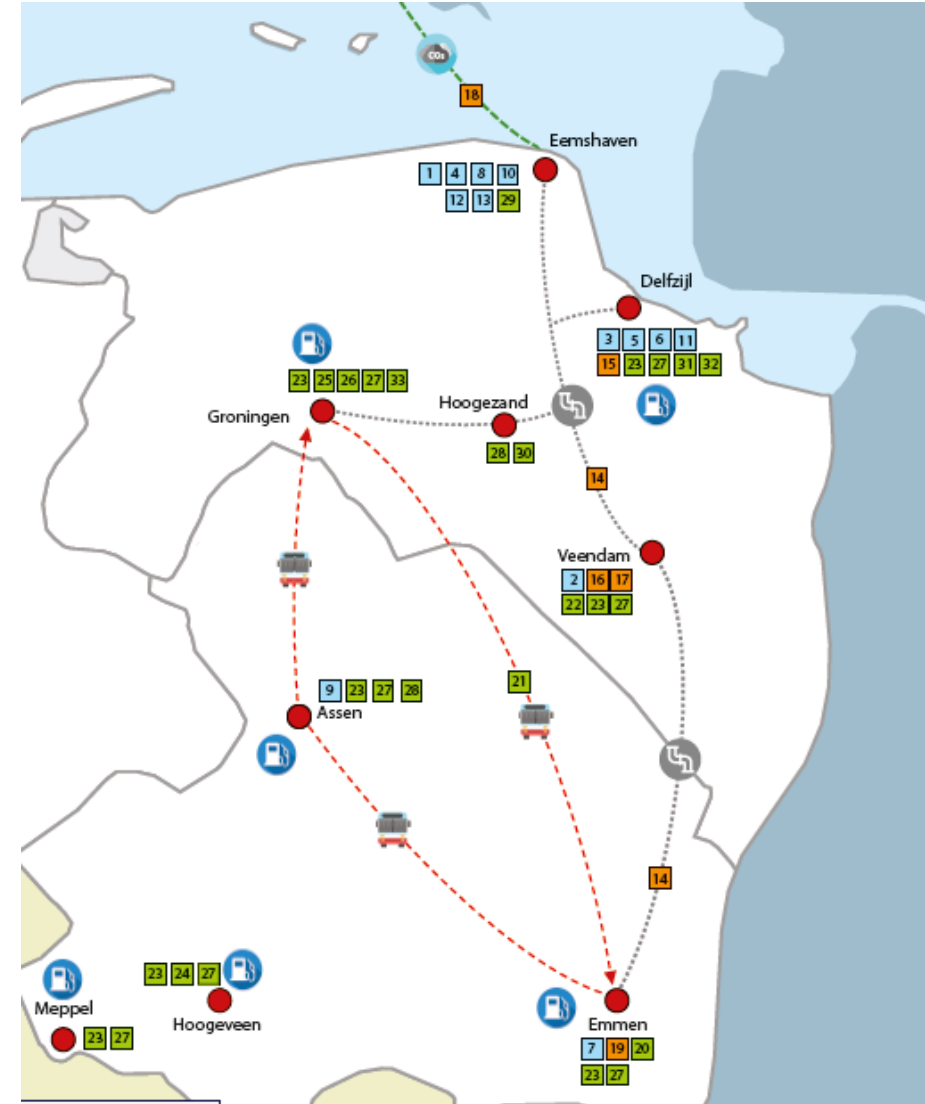
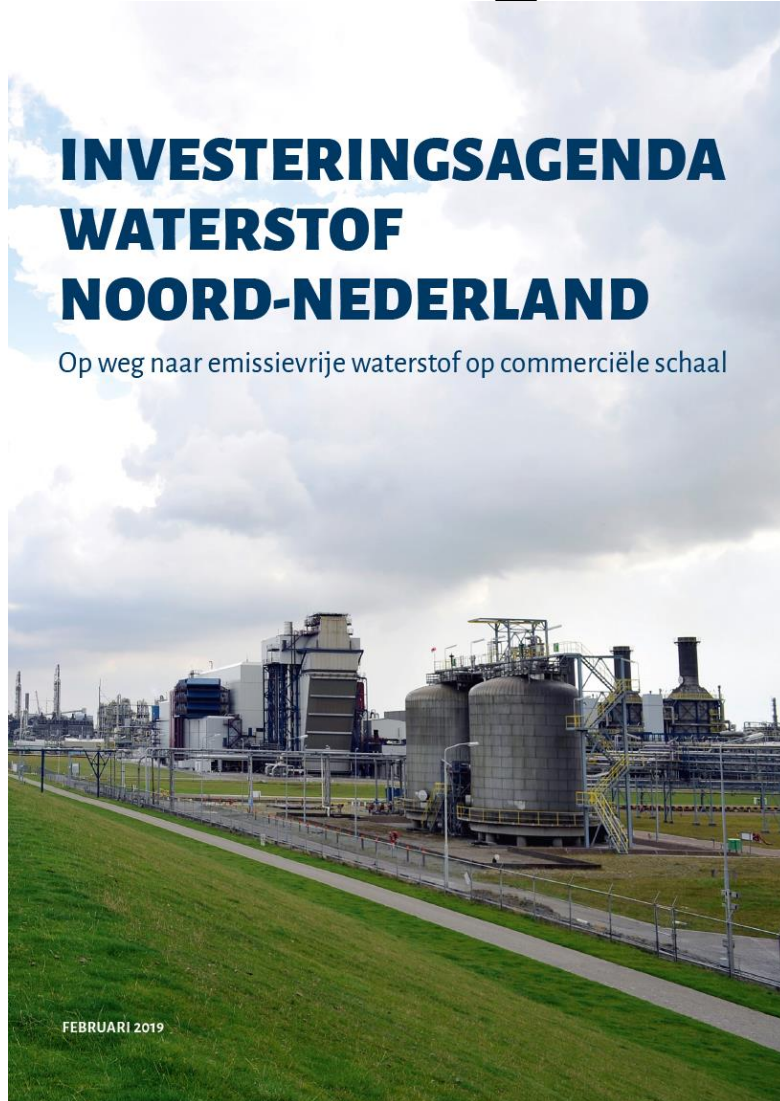
Linking chemical industry and mobility with green hydrogen



Key project characteristics

- Extensive portfolio of projects covering a wide spectrum of innovation and investments
 - Sourcing of feedstocks
 - Production
 - Transportation, distribution and utilization of hydrogen
 - Strong knowledge and innovation infrastructure
- Dominant locations:
 - Delfzijl (electrolysers, chemical industry)
 - Eemshaven (electrolysers, power plants)
 - Emmen (chemical industry, electrolysers)
 - Groningen (mobility applications, research centres).
- The total investment up to 2030: in the order of magnitude of € 2.8 billion
- Scale: expected increase of hydrogen production and uptake to c. 70 PJ by 2030 (part blue, part green).

Investment agenda



Promotors and financing

- Some companies involved
 - BioMCN
 - Engie
 - EMMTEC
 - Gasunie
 - NAM
 - Nouryon
 - Nuon
 - Shell
 - Qbuzz
- Public partners
 - Provinces: Drenthe, Fryslân, Groningen
 - Municipalities: Emmen and Groningen
 - Support by Ministry of Economic Affairs and Climate and RVO (Netherlands Enterprise Agency)
- Proposal preparation: New Energy Coalition

Key drivers for unique added value

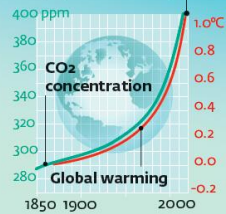
- The Northern Netherlands is driven to green the Northern Netherlands economy in order to:
 - contribute to the climate change objectives
 - strengthen the economic position of the Northern Netherlands
 - moving away from natural gas production
 - creating sustainable employment opportunities in the region
 - build upon a long time experience in the handling of energy carriers
- We consider hydrogen makes it possible to integrate ever larger amounts of renewable electricity via its use in industry, mobility and to serve as a storage medium for energy

Scalable and replicable

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- P
- I

Moving towards 2030 and 2050 with hydrogen

The earth has warmed up by 1.1°C since 1850

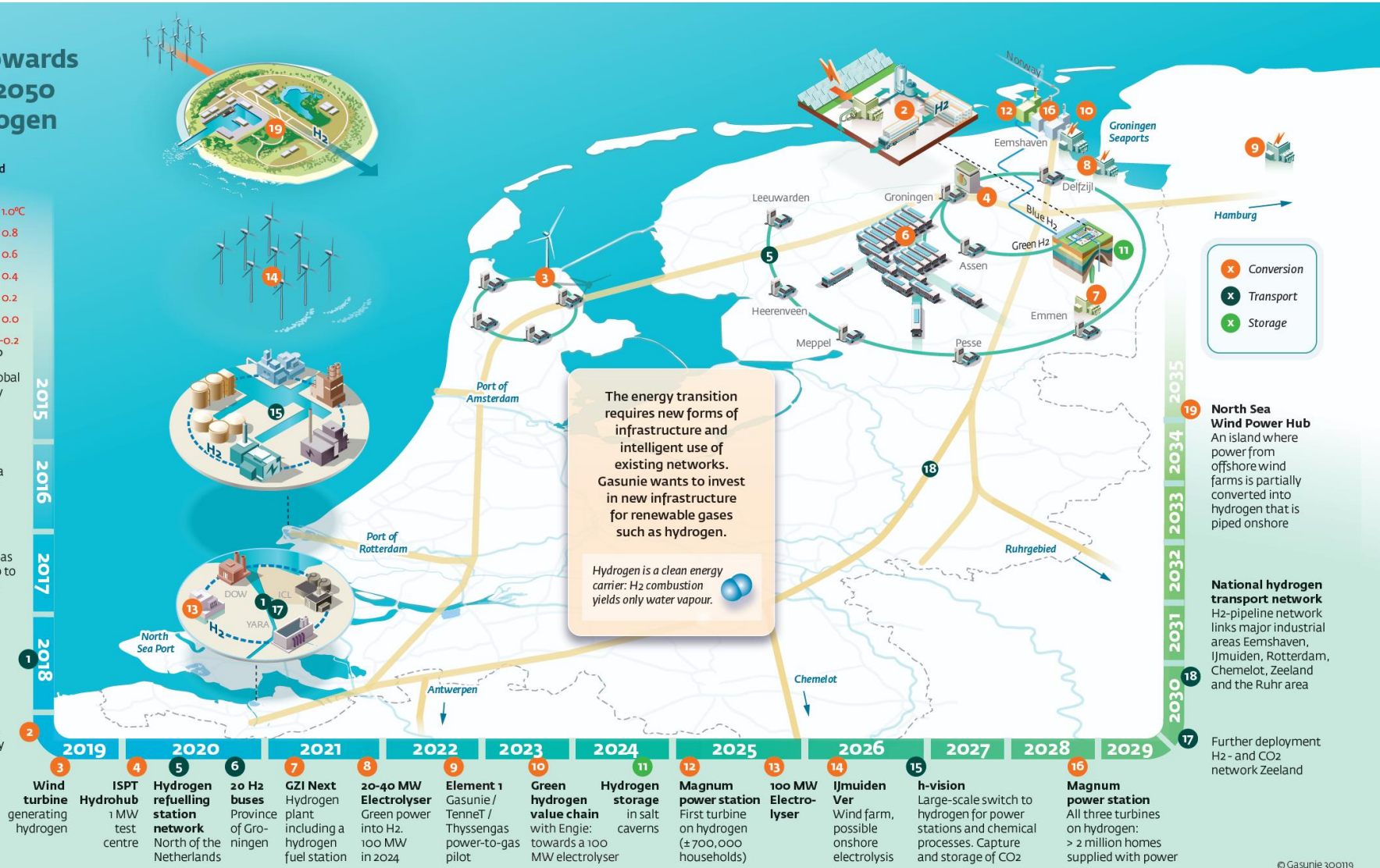


If we do nothing the global temperature will rise by another 4°C by 2100

22 April 2016 Paris Agreement
Global warming set at a max. 2°C. This requires **CO2-reductions** in the Netherlands of:
 • 40-50% by 2030
 • 85-100% by 2050
 Hydrogen as a fuel and as a raw material can help to achieve CO2-reduction targets

Hydrogen pipeline
Linking hydrogen industries in Zeeland and the Delta region

Pilot project HyStock
Converting solar energy into hydrogen in Zuidwending



The energy transition requires new forms of infrastructure and intelligent use of existing networks. Gasunie wants to invest in new infrastructure for renewable gases such as hydrogen.

Hydrogen is a clean energy carrier: H₂ combustion yields only water vapour.

chain

- 19 North Sea Wind Power Hub**
An island where power from offshore wind farms is partially converted into hydrogen that is piped onshore
- 18 National hydrogen transport network**
H₂-pipeline network links major industrial areas Eemshaven, IJmuiden, Rotterdam, Chemelot, Zeeland and the Ruhr area
- 17 Further deployment**
H₂- and CO₂ network Zeeland

- 3** Wind turbine generating hydrogen
- 4** ISPT Hydrohub 1 MW test centre
- 5** Hydrogen refuelling station network North of the Netherlands
- 6** 20 H₂ buses Province of Groningen
- 7** GZI Next Hydrogen plant including a hydrogen fuel station
- 8** 20-40 MW Electrolyser Green power into H₂. 100 MW in 2024
- 9** Element 1 Gasunie / TenneT / Thyssengas power-to-gas pilot
- 10** Green hydrogen value chain with Engie: towards a 100 MW electrolyser
- 11** Hydrogen storage in salt caverns
- 12** Magnum power station First turbine on hydrogen (± 700,000 households)
- 13** 100 MW Electrolyser
- 14** IJmuiden Ver Wind farm, possible onshore electrolysis
- 15** h-vision Large-scale switch to hydrogen for power stations and chemical processes. Capture and storage of CO₂
- 16** Magnum power station All three turbines on hydrogen: > 2 million homes supplied with power

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Thank you for your kind attention!



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