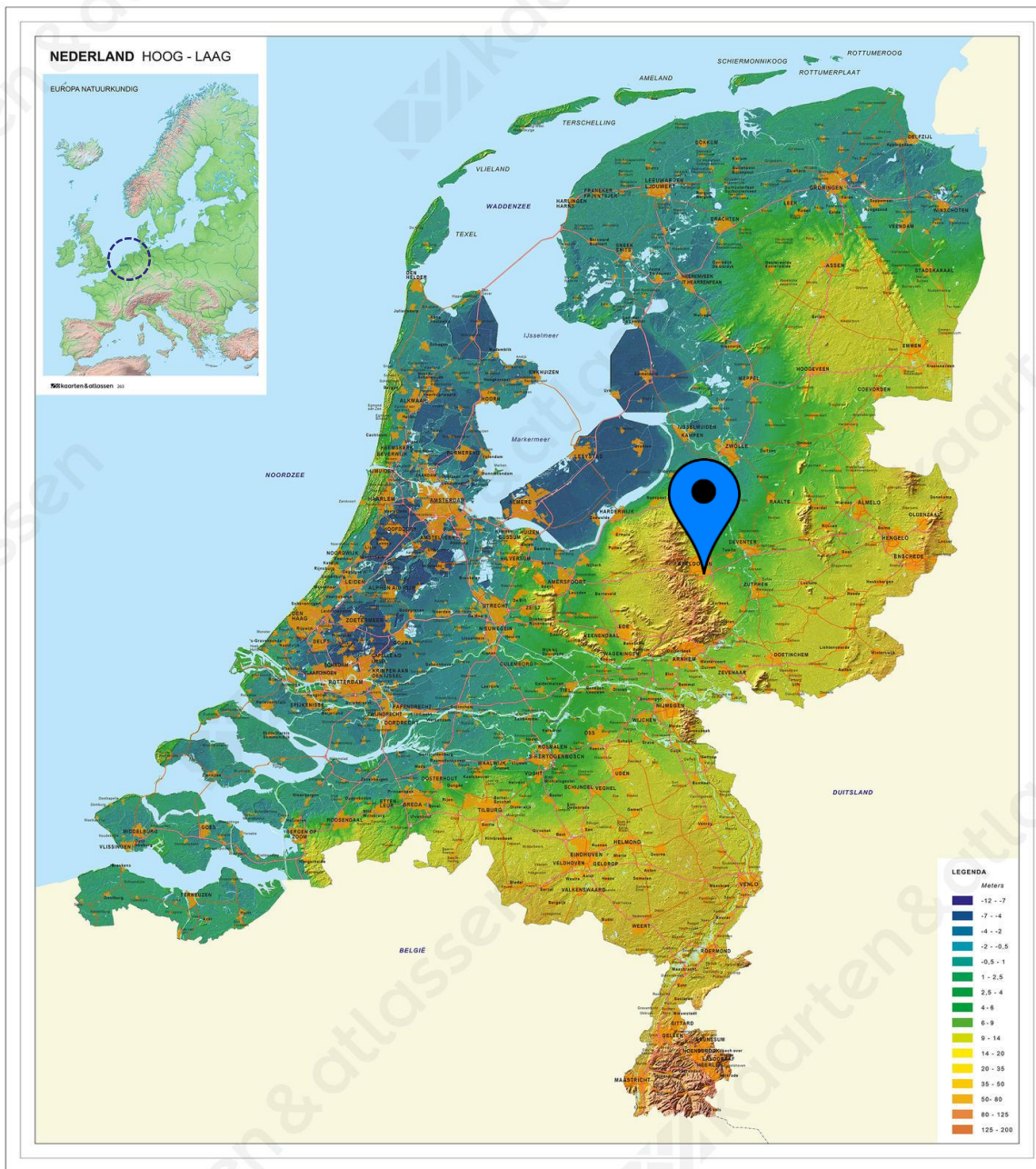


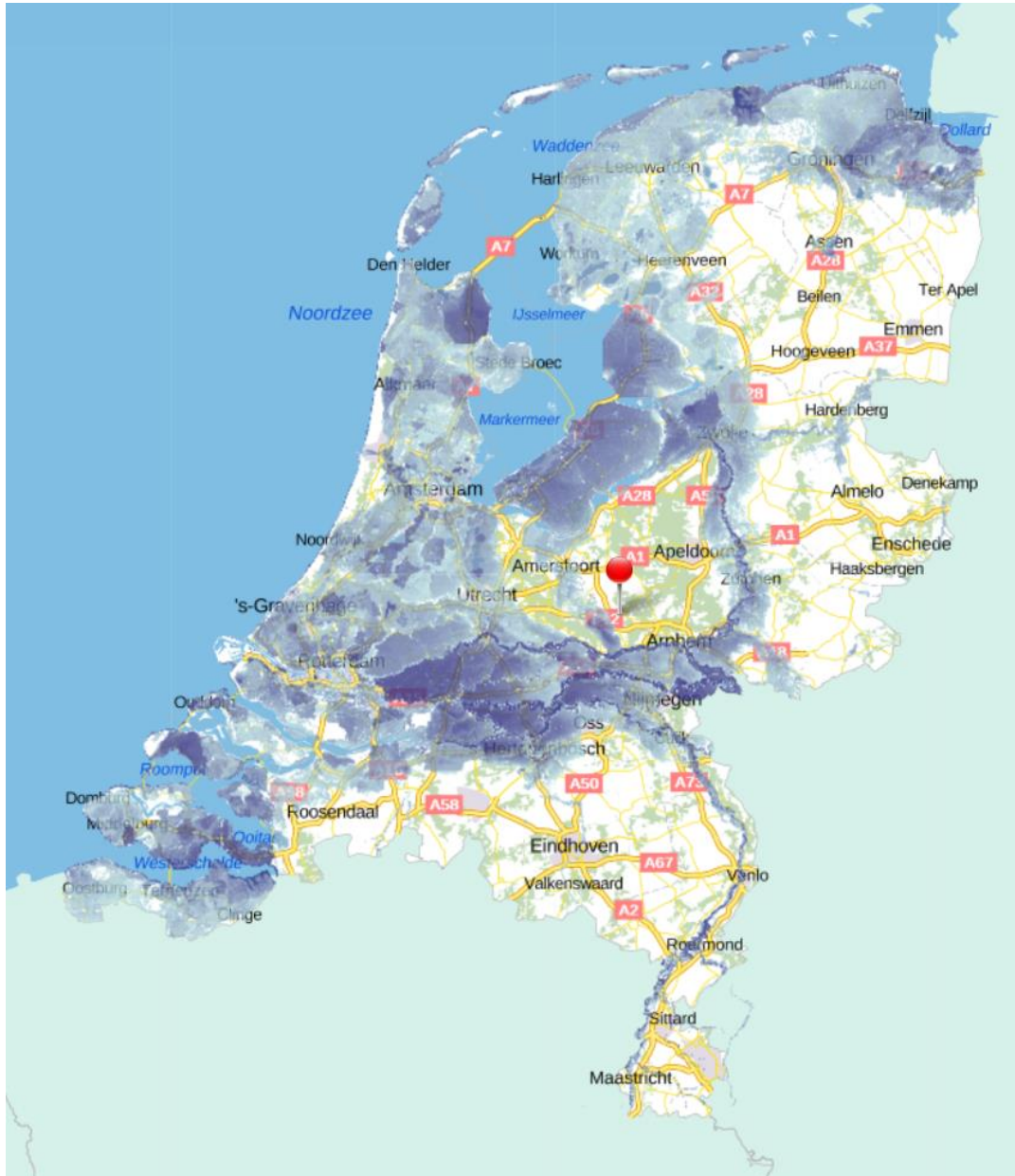
Overview of hydrogen initiatives in The Netherlands

Liander



The Netherlands

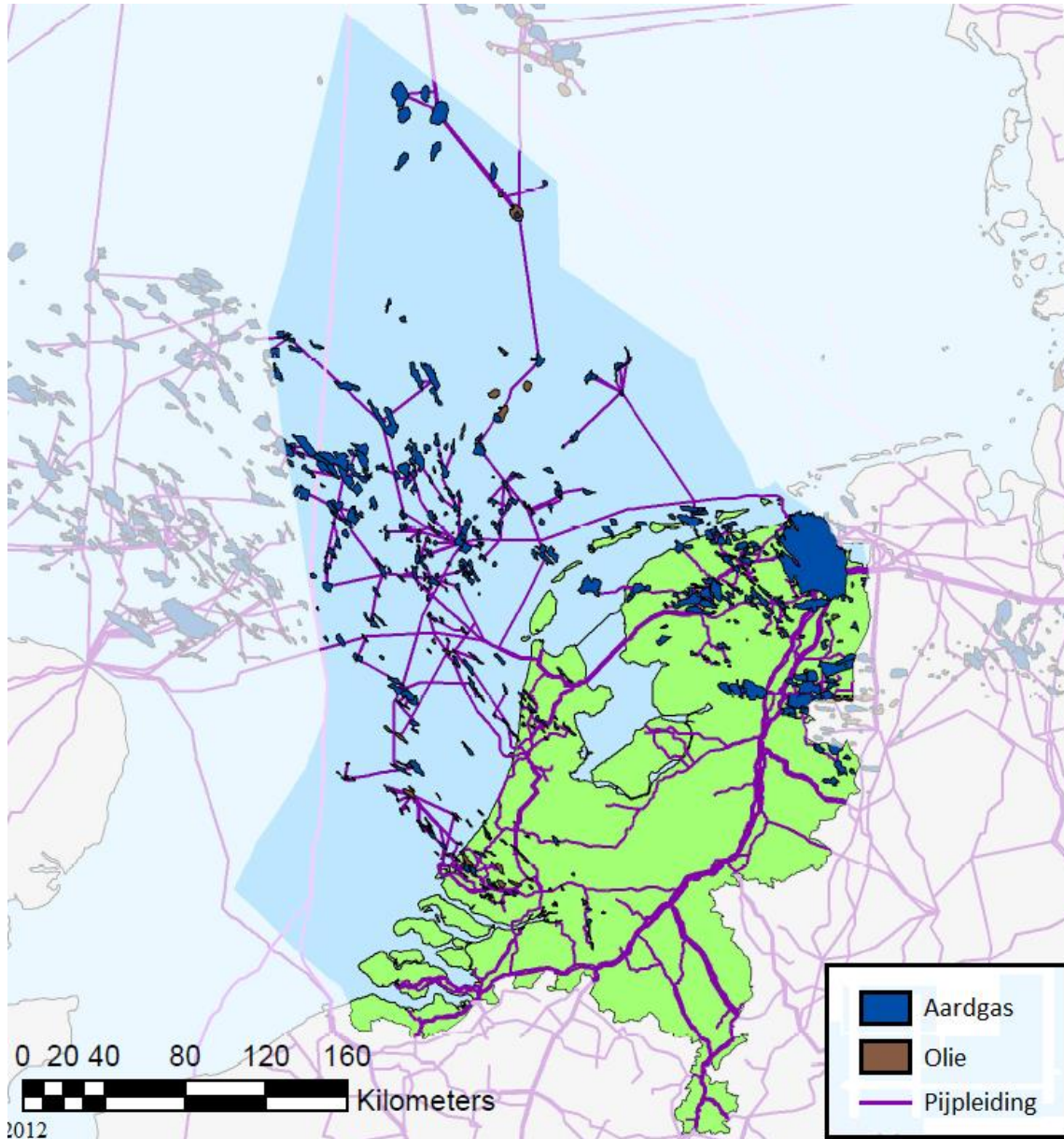
17 million people
16.000 square mile



The Netherlands

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~26% below sea level
~50% dependent upon dunes, dams and dykes



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1959: Discovery of the Groningen gas field

2018: 137.000 km gas pipe line
7 million points of delivery
95% of all buildings heated with natural gas

Goals

2030: minimum 49 % CO₂ reduction

2030: ambition 55% CO₂ reduction

2050: minimum 95% CO₂ reduction

2050: 100% CO₂ free electricity production



No place for Oil, Coal or
Natural Gas in 2050

The Netherlands

17 million people

16.000 square mile

~26% below sea level

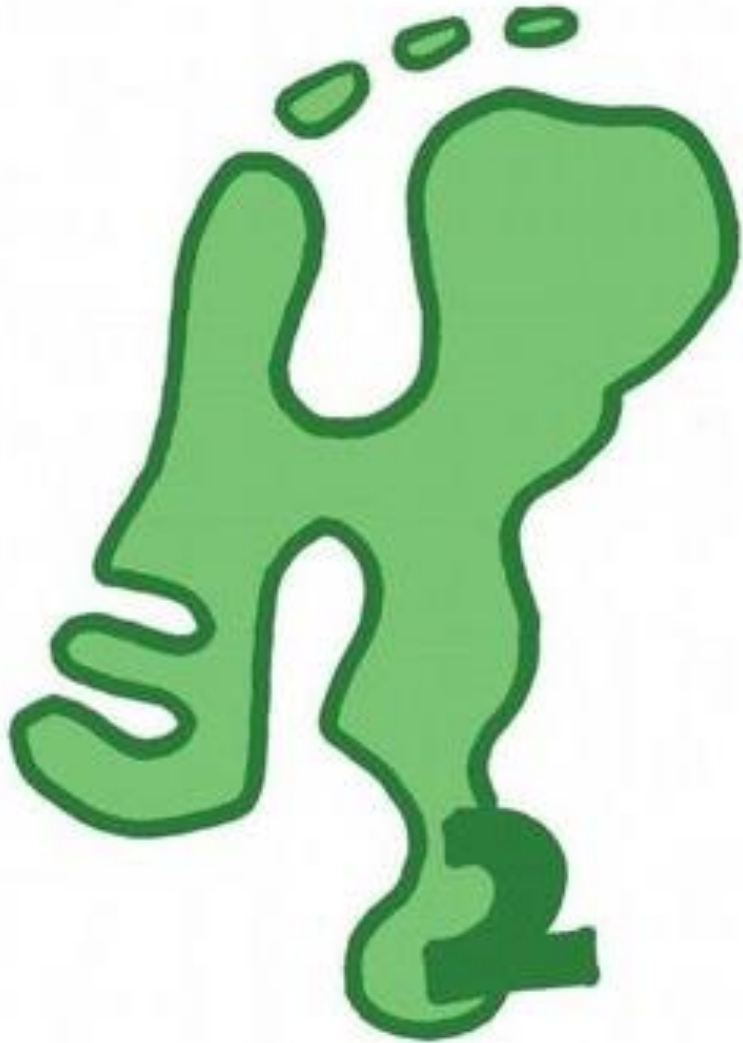
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Hydrogen: The new gas business?

- Green: By electrolysis from wind and sun
- Blue: SMR from natural gas with CCS
- Industry
- High-temperature heating
- Power production
- Mobility
- Complementary energy carrier for electricity
- Flexibility and seasonal storage
- Residential heating ?

Hydrogen Initiatives

No master plan. A lot of initiatives!



THE GREEN VILLAGE

Hydrogen Coalition

Coalition of 27 environmental organisations, knowledge institutes, government and businesses for the development of green hydrogen



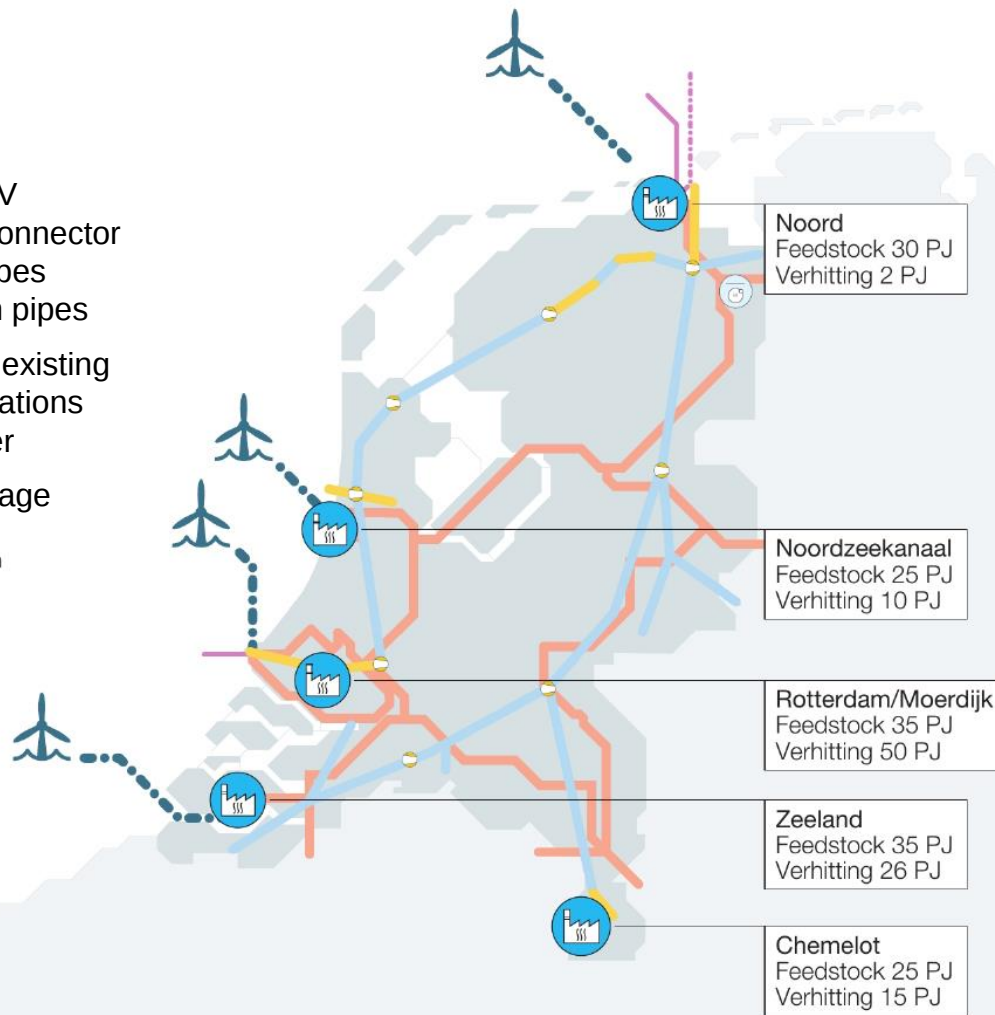
Hydrogen Coalition

Main perspective on role of hydrogen on national level

Legend

- Existing 380 kV
- Existing interconnector
- Existing gaspipes
- New hydrogen pipes
- Adjustment of existing compressor stations
- Industry cluster
- Hydrogen storage

Aan deze kaart kunnen geen rechten worden ontleend.
November 2018



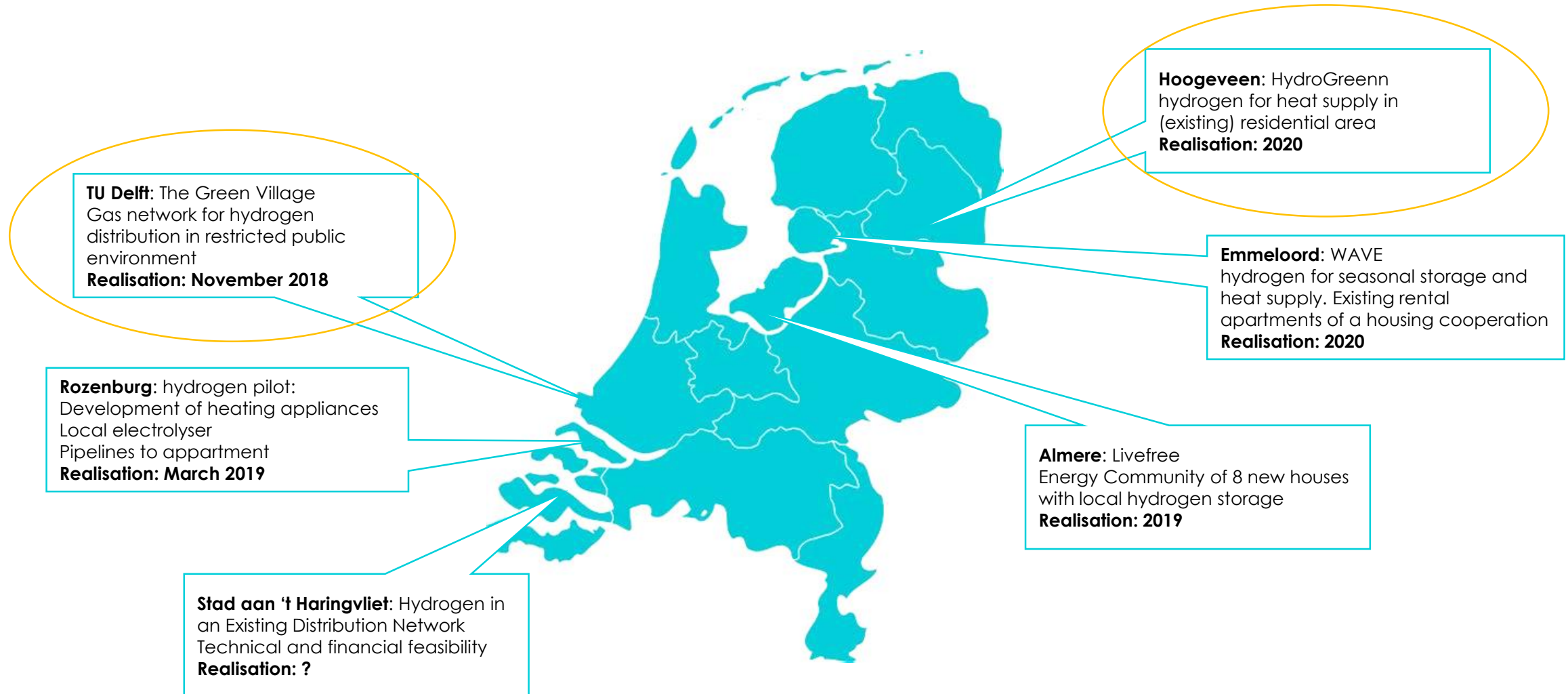
Manifest (November 2018)

Four pillars

1. Supply and demand of green hydrogen
2. Infrastructure
3. Production scale-up and cost reduction
4. Finance and policy instruments

Hydrogen in built environment

Numerous initiatives to realise production, distribution and utilisation of hydrogen on householdlevel.



The Green Village

Living lab for sustainable innovation on the campus of TUDelft.
Realisation of test facility for distribution of hydrogen

Goal:

Enexis Groep, Stedin and Alliander realise and test a hydrogen network with similar specifications of current natural gas.

Design of the network:

- High pressure (8 bar) and low pressure (100mbar). Use of materials known for distribution of natural gas: PE, PVC, Steel.
- Mantel tubes with measuring points
- Valve schemes
- 1 household connection (prêt-à-loger)





HYDROGREENN

“The Green Hydrogen Economy in the Northern Netherlands”
20 consortium partners in case “hydrogen Hoogeveen”



provincie Drenthe



Visser & Smit Hanab





Goal

1030 houses: Existing residential area Erflanden

Starting demonstration in Nijstad-Oost (80 new houses)

Currently design sessions; estimated realization in 2020



What

Local generated green power (mainly solar PV), local power-to-hydrogen conversion, local stored hydrogen, existing distribution network used, hydrogen for domestic heating.

Combination with local power grid congestion.



Hydrogen Standardisation Platform

Goal	Coordination of Dutch standardization needs, normalization activities, on EU and national level, for industry and built environment.
Start	kick-off december 2018, 40 participants
Secretary	NEN (Royal Dutch Normalisation-institute)

Take Aways

Main external driver: Regulation (Paris Agreement, restrictions on natural gas)

Main internal driver: Economical (staying in business, new opportunities)

Observations

- Hydrogen economy development up to now is 'unplanned'
- Broad playing field
- Need for practical knowledge and best practices
- There is a drive to fulfill the 'hydrogen promise'

Hydrogen is here to stay!?

International collaboration key to live up to the expectations!