gasunie
crossing borders in energy

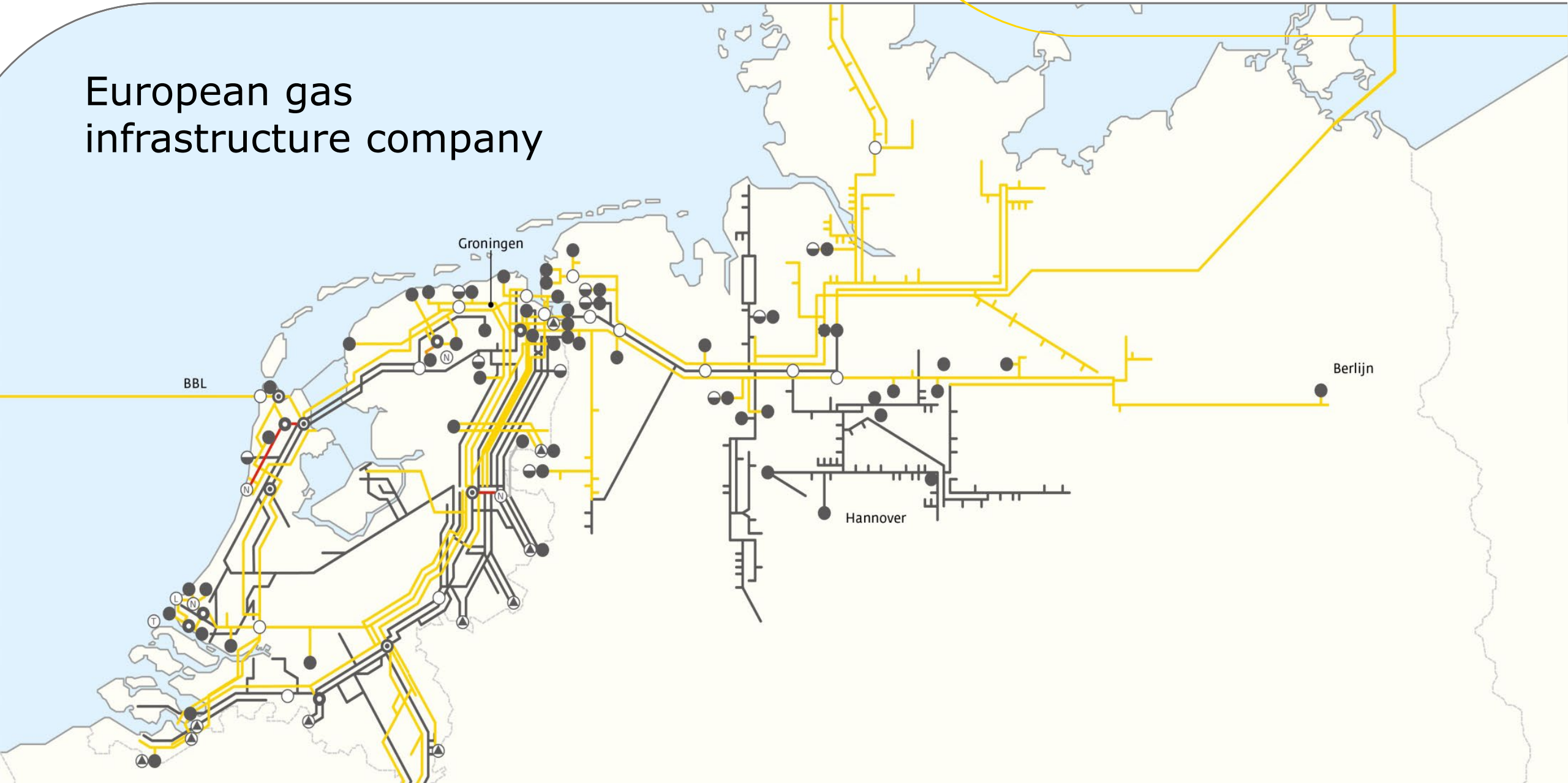
14 November 2019

Growing Hydrogen

10 jaar Vlaams-Nederlandse samenwerking rond waterstof: ervaringen en perspectieven

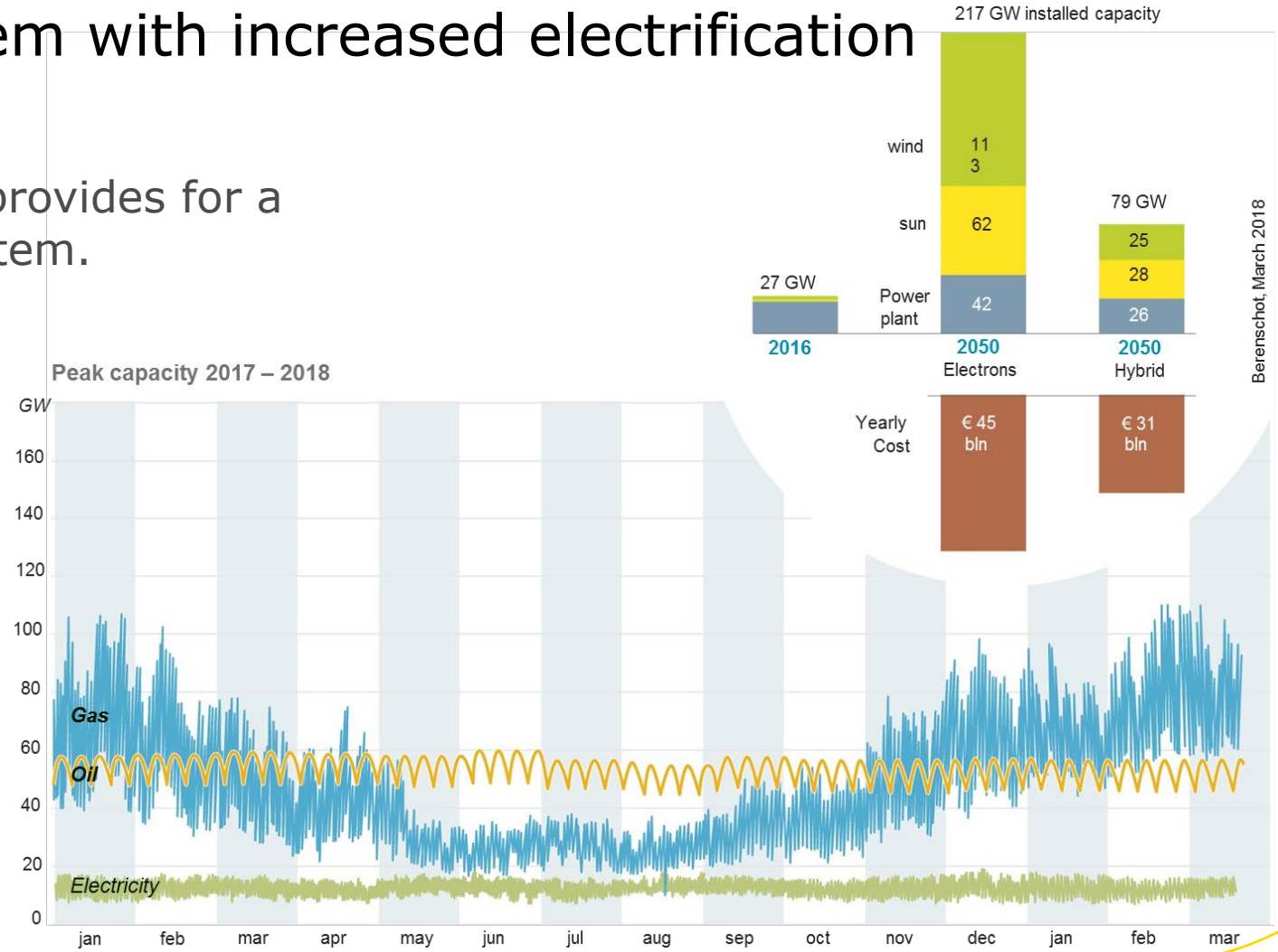
René Schutte

European gas infrastructure company

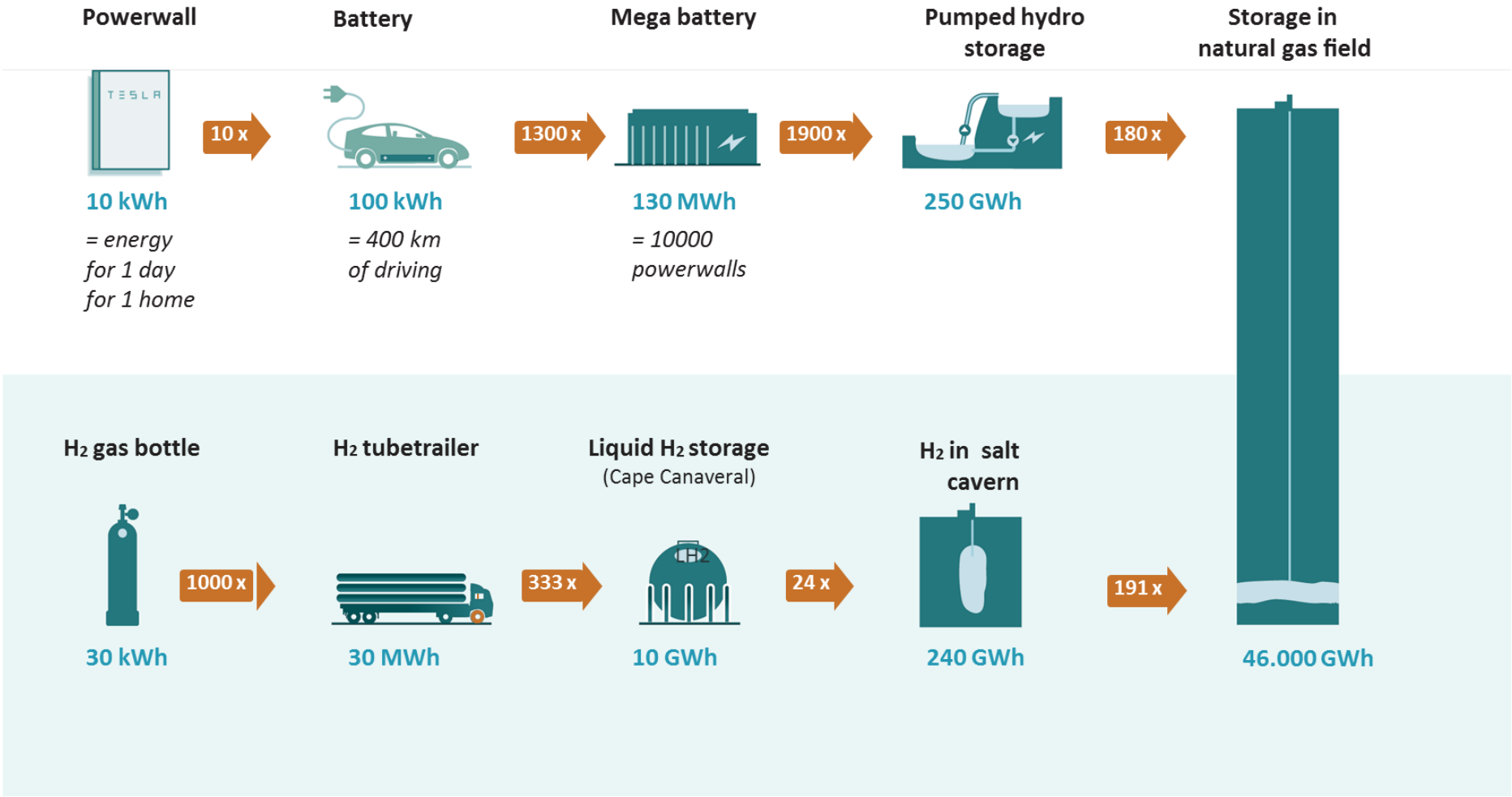


We foresee that gas infrastructure will play a key role in a decarbonised energy system with increased electrification

A smart role for green molecules provides for a reliable and affordable energy system.



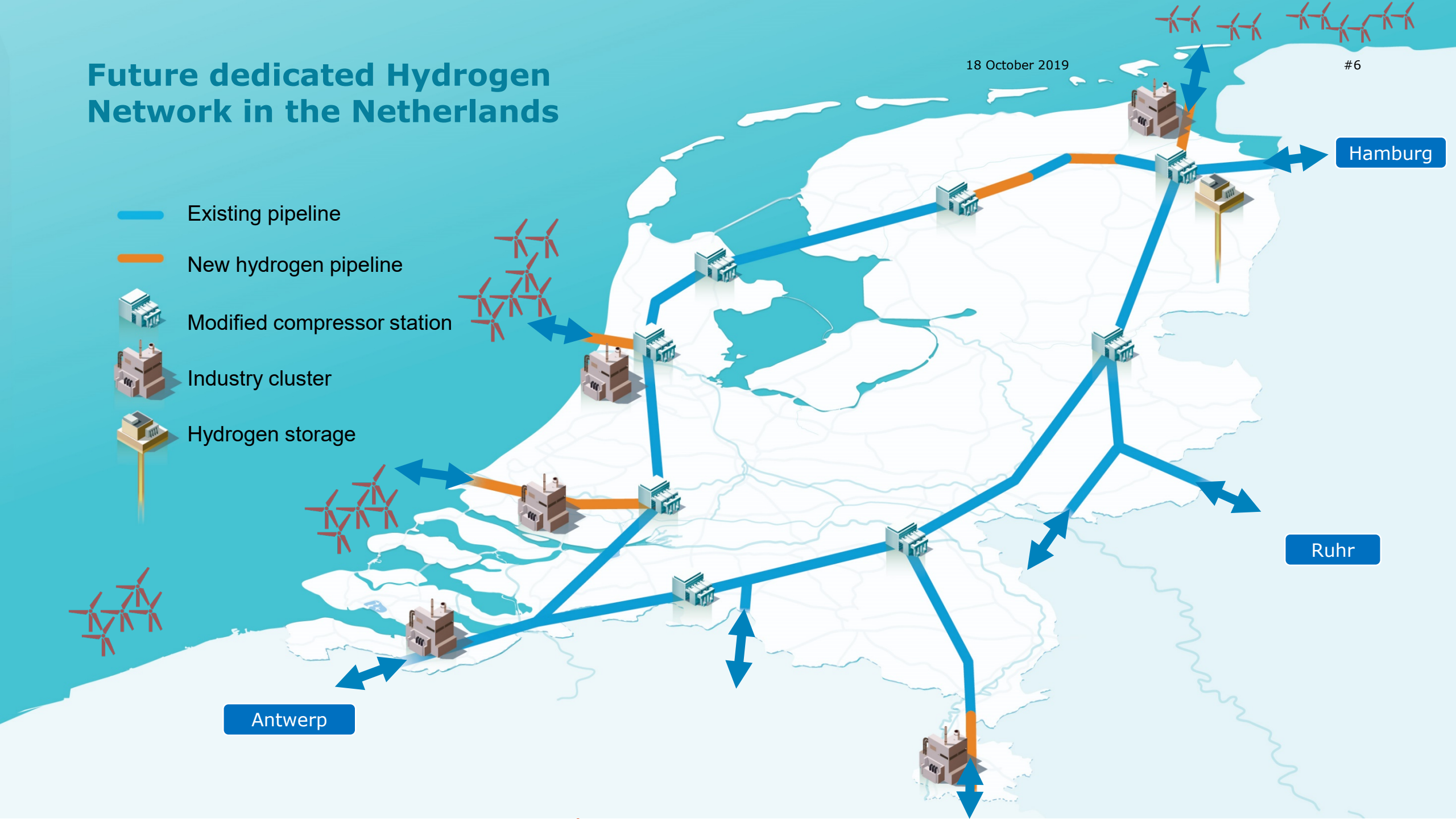
Electron and Molecule Storage in perspective



Refit from natural gas to hydrogen pipeline

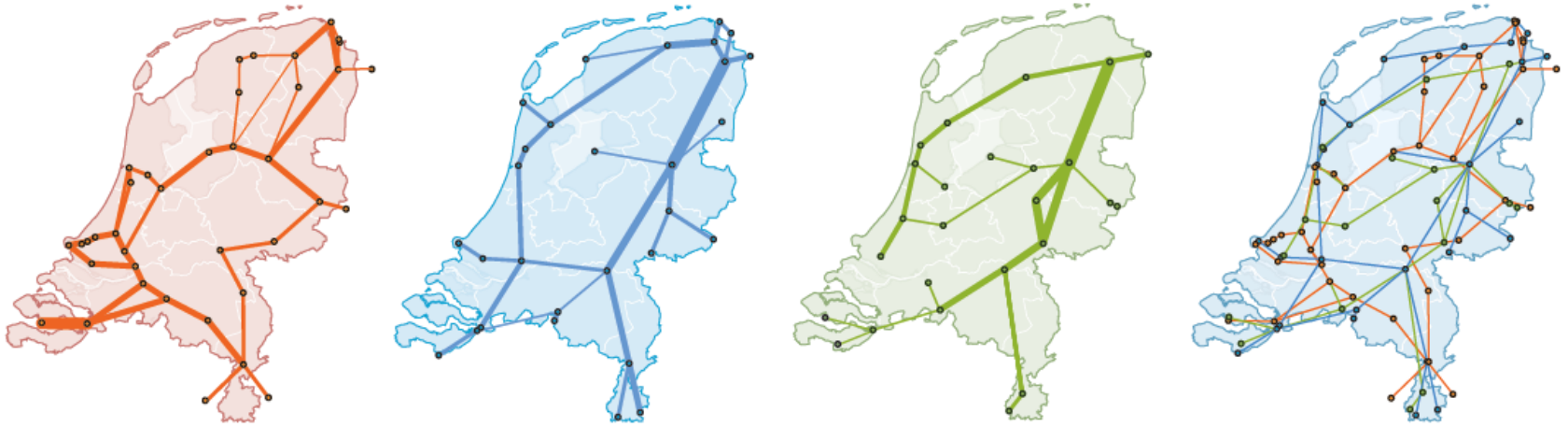
- Smart Delta Resources (Zeeland): Hydrogen for the region
- Energy savings
- Road transport savings
- CO_2 emission reduction

Future dedicated Hydrogen Network in the Netherlands



Existing grids as starting point

Electricity Grid + **Hydrogen Grid** + **Methane Grid** = **Combined Grid**



Capacity 20 GW

Capacity 350 GW

Tennet

Electricity grid (220 & 380kV)

Investment plans:

Reinforcement exisiting grid

New connections wind at sea

Gasunie

H-gas grid (80 bar)

Hydrogen grid 2030,

To connect industrial clusters and storage

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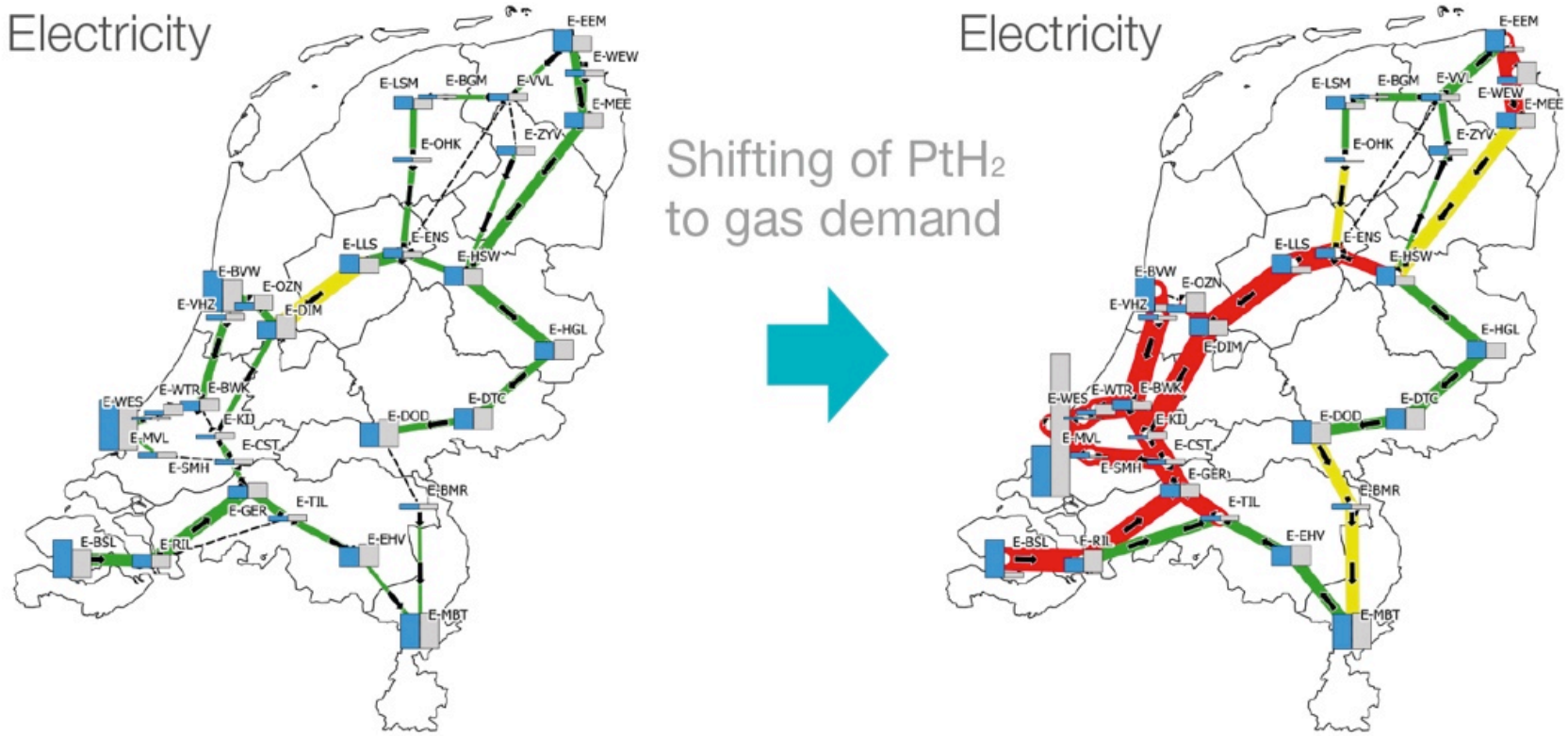
G-gas grid (67 bar)

Feed in green gas via manifold line

Connection Points

1. **Power Plants: methane of hydrogen -> electricity**
2. **Electrolysis: electricity -> hydrogen**

Location P2G



Key insights

1 An energy system based on domestic renewables will need a firm integration of gas and electricity networks.

2 Great need for hydrogen and methane storage.

Expansion of cavern storages for hydrogen in NL foreseen.

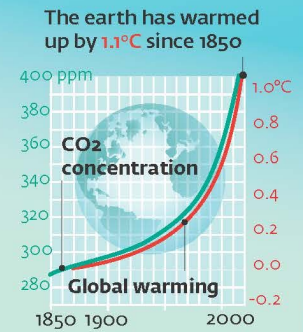
3 Need for further expansion of electricity grids after 2030 due to growing demand, but smart sector coupling can decrease it.

No major expansion of gas grids foreseen.

4 Adequate allocation of P2G sites needed to stay within the financial and spatial planning limits for investments in electricity grids.

5 Import of green gas (methane or hydrogen) can significantly reduce the need for investments in electricity infrastructure.

Moving towards 2030 and 2050 with hydrogen



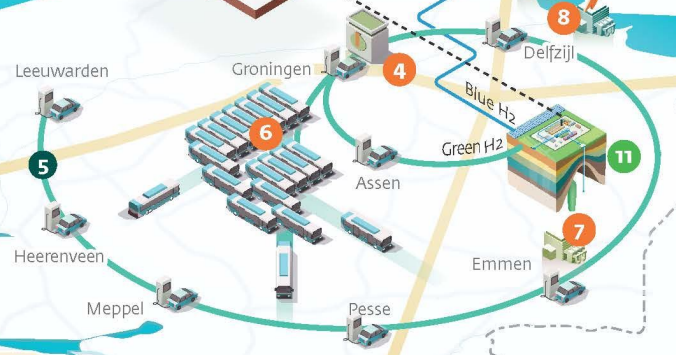
If we do nothing the global temperature will rise by another 4° C by 2100

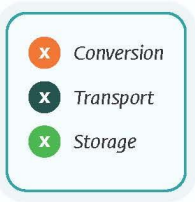
22 April 2016
Paris Agreement
Global warming set at a max. 2° C. This requires **CO2 reductions** in the Netherlands of:
- **40-50%** by 2030
- **85-100%** by 2050

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





Port of Amsterdam

Port of Rotterdam

North Sea Port

Antwerp

Chemelot

Ruhr area

18

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: H_2 combustion yields only water vapour.

2015 2016 2017 2018 2030 2031 2032 2033 2034 2035

19 North Sea Wind Power Hub
An island where power from offshore wind farms is partially converted into hydrogen that is piped onshore

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

2019
3 **Wind turbine** generating hydrogen

2020
4 **Hydrohub ISPT** 1 MW test centre
5 **Hydrogen refuelling station network** North of the Netherlands
6 **20 H2 buses** Province of Groningen

2021
7 **GZI Next** Hydrogen plant including a hydrogen fuel station
8 **20-40 MW electrolyser** Green power into H2. 100 MW in 2024

2022
9 **Element 1** Gasunie / TenneT/ Thyssengas power-to-gas pilot

2023
10 **Green hydrogen value chain** with Engie: towards a 100 MW electrolyser

2024
11 **Hydrogen storage** in salt caverns

2025
12 **Magnum power station** First turbine on hydrogen (± 700,000 households)
13 **100 MW electro-lyser**

2026
14 **IJmuiden Ver** Wind farm, possible onshore electrolysis

2027
15 **H-vision** Large-scale switch to hydrogen for power stations and chemical processes. Capture and storage of CO2

2028
16 **Magnum power station** All three turbines on hydrogen: > 2 million homes supplied with power

2029


thanks
for
your
attention
questions?
arigato
gracias
merci
spasiba
danke
grazie
cheers
mèsi
nkosi
wado
danki
sobodi
vinaka
mahalo
talofa
shukran
saha
zikomo
buznyg
dėkoju
dziekuje
stuutiyi
spas
gràcies
matondi
misaotra
bayarlalaa
tenki
grassie
obrigada
tanmirt
shakkran
gratzias
dankewol
maururu
soolong
bedankt
meharbani
welalin
blagodaria
dakujem
chokrane
shukriyaa
multumesc
supas
manjuthe
köszönöm
shukria
miigwech
dziakuju
dankegon
rahmat
omol
kinisou
marahaba
yekeniele
barkal
blagodaram
saðol
matondo
nandri
modupe
ngiyabonga
dekuji
taiku
obrigado
waybale
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