

Hydrogen production and usage in the agribusiness

Agropole online meeting
December 15, 2020.

Marcel Vogelsangs

14-12-2020



Hydrogen production and usage in the agribusiness



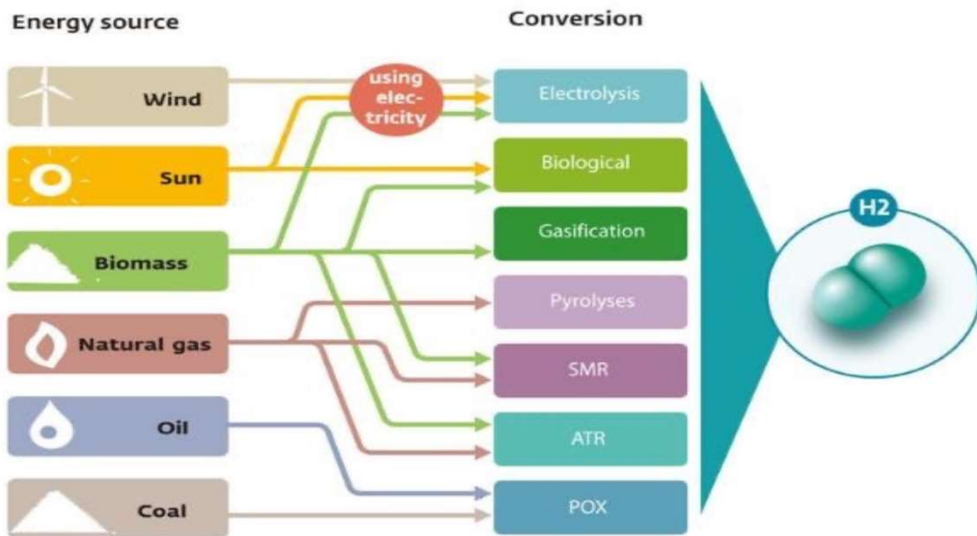
Hydrogen production and usage in the agribusiness

What about the Netherlands.....

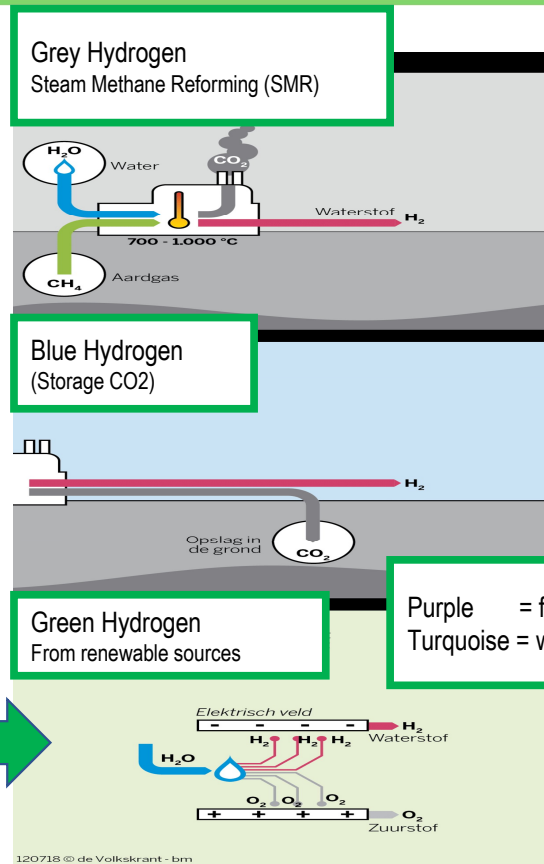
- Resume off mention technics.
- Background about the Dutch situation.
- Why Hydrogen is necessary.
- Developments on the Dutch site.
- Opportunities for the agribusiness.

Resume what the college's already told

Resume.



Source: <https://www.topsectorenergie.nl/tki-nieuw-gas/documenten>

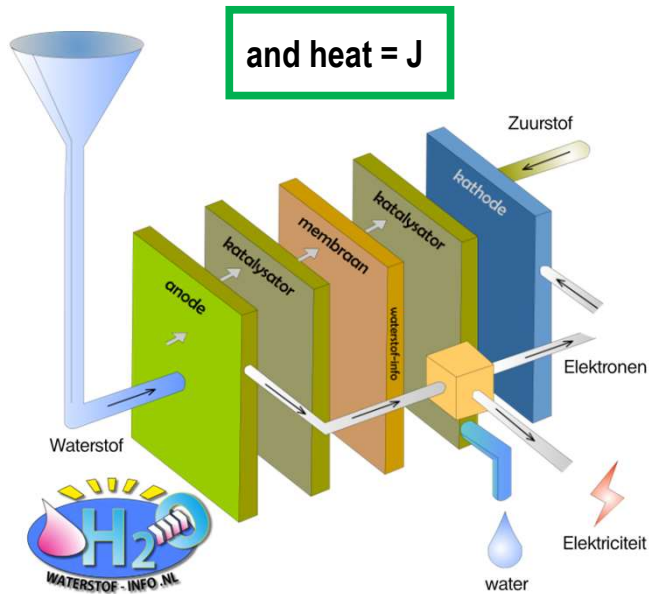


Purple = from nuclear energy
Turquoise = with pyrolysis technology (H₂ + C + O₂)

Resume.

Operation of a Fuel Cell (FC).

Electrolysis (EC) works with the same technique, but in reverse.



	PEM(FC) (Proton Exchange Membrane)	A(FC) (Alkaline)	PA(FC) (Phosphoric Acid Fuel Cell)	MC(FC) (Molten Carbonate)	SOFC (Solid Oxide)
Electrolyte	Ion Exchange Membranes	Mobilized or Immobilized Potassium Hydroxide	Immobilized Liquid Phosphoric Acid	Immobilized Liquid Molten Carbonate	yttrium-stabilized zirconia
Operating Temperature	50-80°C	120°C - 150°C	200°C	650°C	800-1000°C
Prime Cell Components	Carbon-based	Carbon-based	Graphite-based	Stainless-based	Ceramic
Electrical Efficiency	35%	40-60%	40-50%	50-60%	50-65%

Used FC-EC technics,

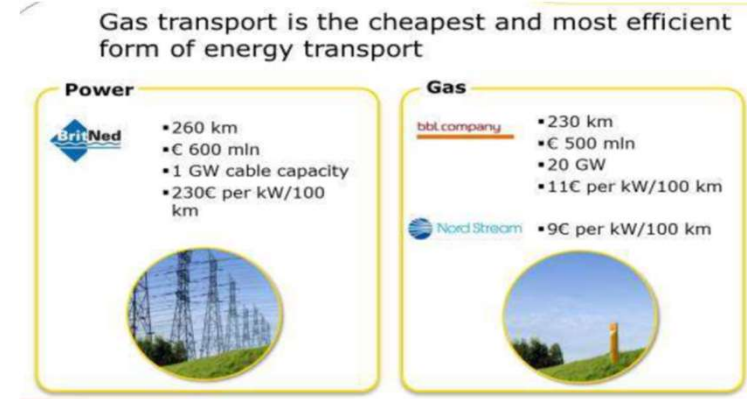
Resume.

Applications of hydrogen:

- Storage of energy, and transport of energy
- Industry; high temperature processes (glass / stone / steel and chemical industry)
- Mobility
- Heating of buildings

Efficiency improvements options:

- Purity (99.99% always needed?).
- Chain approach (view and link all processes).
- Linking different production techniques.
- Both central and decentralized networks.
- Produce at the right most efficient time.
- Increase production capacity



Bron: Gasunie

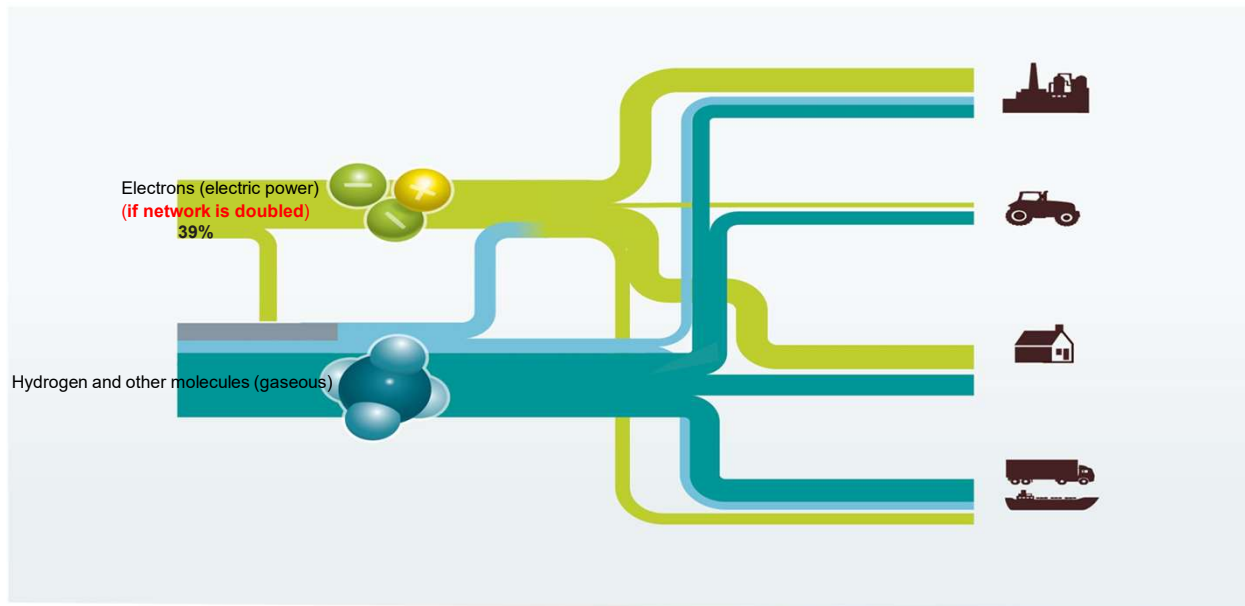
Dutch situation.

14-12-2020

Hydrogen production and usage in the agribusiness

Dutch situation.

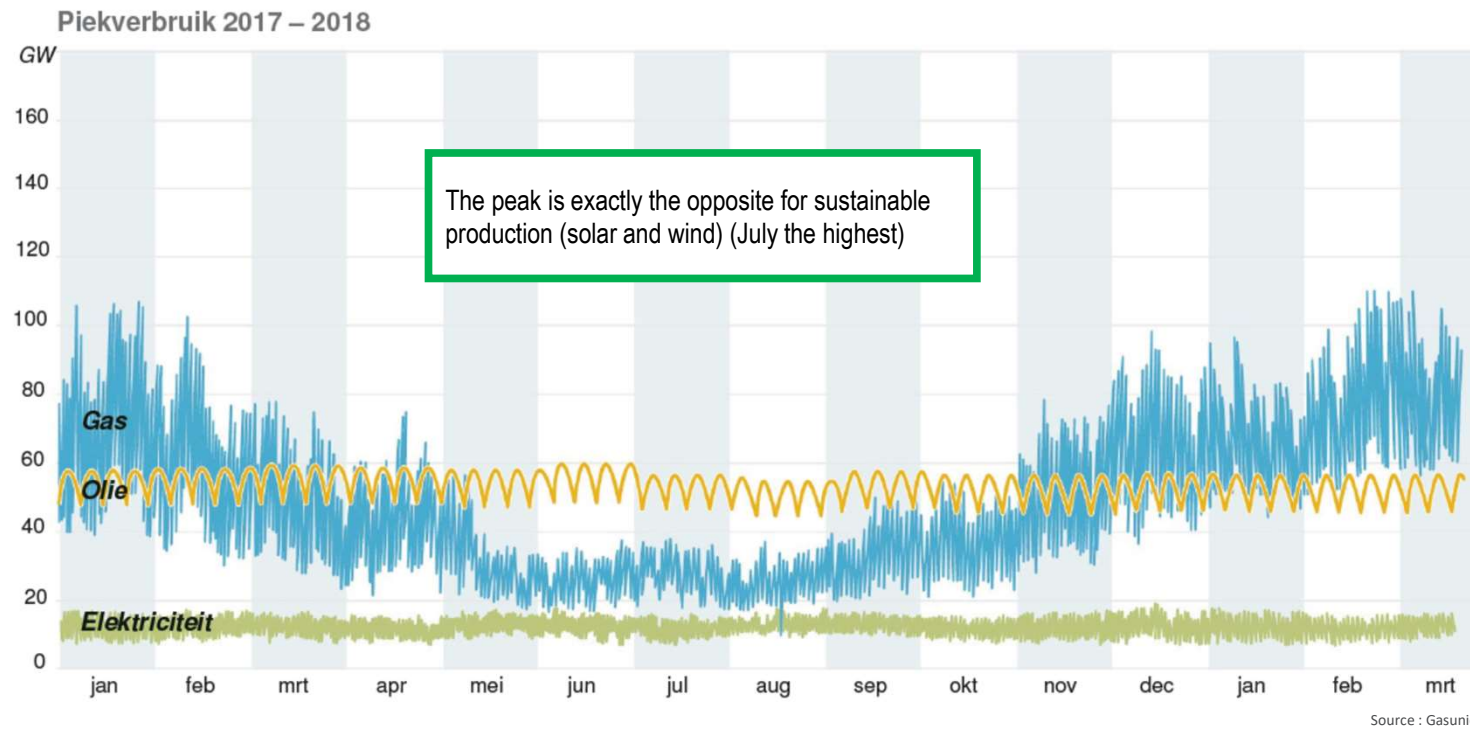
Situation of the transport network for transporting energy in 2050



Source : Gasunie

Dutch situation.

Energy consumption during the year



Dutch situation.

38.556.536.821 m³n
Use of Gas in the
Netherlands 2019
(Source CBS)

**Aardgas/Groen
gas**

1356,1

PJ



De jaarlijkse productie van
408.039 voetbalvelden met
zonnepanelen

Waterstof

9563

kilo...



De jaarlijkse productie van 143
offshore windparken

Elektriciteit

376,7

TWh



116 jaar lang de huizen in een
stad zo groot als Utrecht van
energie voorzien



Het energieverbruik van alle
industrie in Nederland in 863
dagen



Het jaarlijkse verbruik van
144.882.479 Tesla's

You can use:

<https://www.gasunieenergyconverter.nl/>

14-12-2020

Hydrogen production and usage in the agribusiness

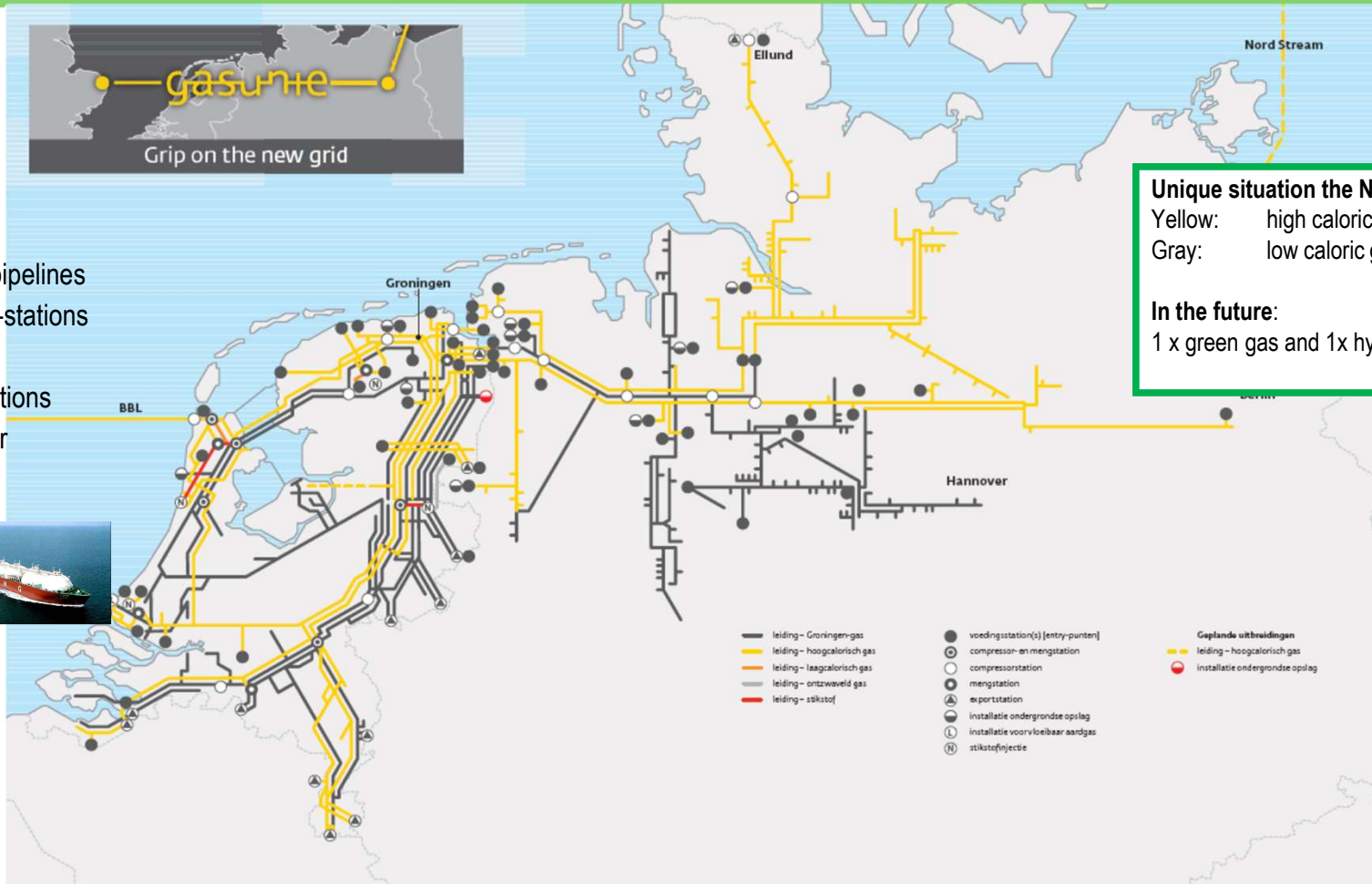


MV Energietechnik
Advies & Inspectie

10

Dutch (and part of Germany) situation.

Situation of the Gasunie Gritt for transport of natural Gas today (main gas transport):



Unique situation the Netherlands has a double network:
 Yellow: high caloric gas
 Gray: low caloric gas (to households, among others)

In the future:
 1 x green gas and 1x hydrogen gas network

Only the Dutch part:

- About 12.000 km pipelines
- 1.100 gas delivery-stations
- 14 export-stations
- 10 compressor-stations
- 1 LNG peak shaver
- 1 LNG terminal



14-12-2020

Why hydrogen is necessary for the Energy-transition



Why hydrogen is necessary for the Energy-transition



=



Why hydrogen is necessary for the Energy-transition

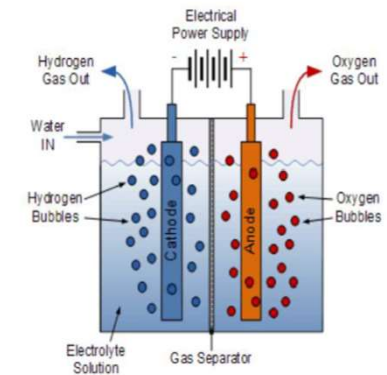


=

- Water electrolysis:



- Power to Gas



Why hydrogen is necessary for the Energy-transition

Not only for power to gas (P2G)

but also

To storage energy (big amounts and longer periods)

And also

To transport big amounts of energy

(Film at the end if there is enough time)

Developments on the Dutch site (a few)

14-12-2020

Hydrogen production and usage in the agribusiness

Developments on the Dutch site: Backbone-Hyway 27

Waterstof backbone 2030

Als onafhankelijk netbeheerder en verbinder kan Gasunie waterstof transporteren en de grote industriële clusters in Nederland verbinden in een waterstofnetwerk. Gasunie maakt hiervoor zoveel mogelijk gebruik van bestaande infrastructuur.

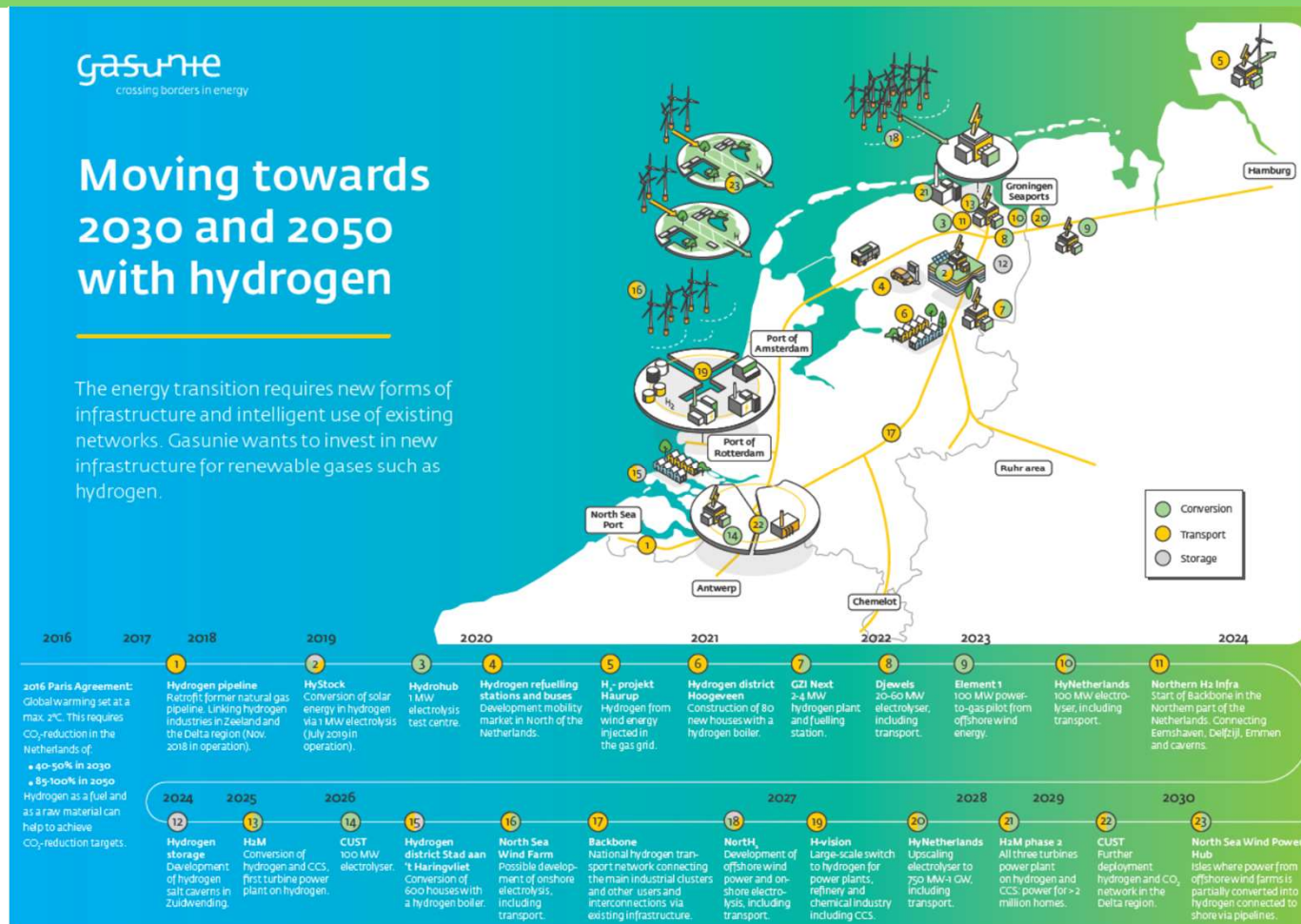


Indication of a planning schedule: depending on permitting and commercial progress

- 2020: Feasibility study
- 2021: Basic design and start permitting
- 2022: Small scale tests and detail design
- 2023: Material supply
- 2024-2025: Construction
- 2026: Commissioning, debrining with hydrogen and start up
- 2027-> Upscaling based on demand

Source: Gasunie

Developments on the Dutch site.



14-12-2020

Developments on the Dutch site.



Developments on the Dutch site.



Chemelot and RWE:
Making Hydrogen from plastics
with pyrolysis-technic.
They hope to spare 200 milj/m³
natural gas.

Developments on the Dutch site.



Source: Gasunie

12 km, operational since 2018

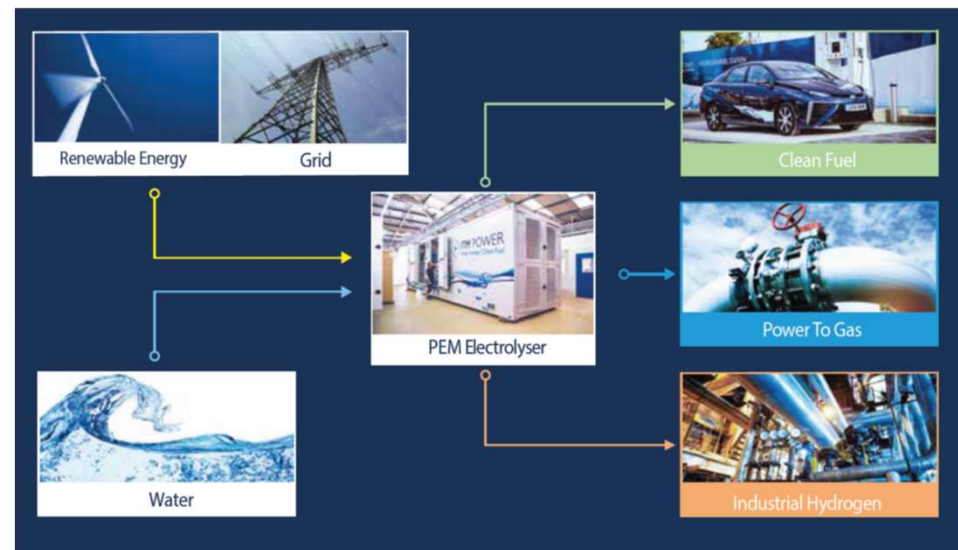
Opportunities for the agribusiness.

Opportunities for the agribusiness.

- Storage of energy, and transport of energy, small grit:

Wind/solar/biogas → Hydrogen → Storage → Power

- (If the electricity is cheap, the hydrogen is cheap too!)



14-12-2020

Hydrogen production and usage in the agribusiness

Opportunities for the agribusiness.

- Mobility

Cars(FC) / Trucks(FC) / Heavy duty transport (FC or Diesel/H2) / (Emergency-)Power (aggregate) supply (FC)

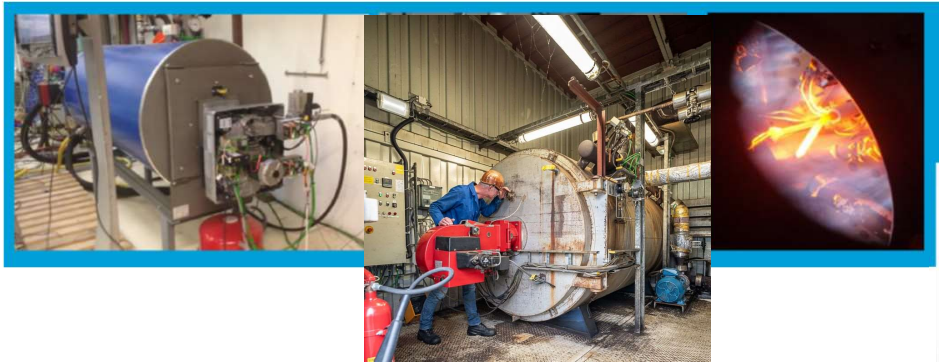


Opportunities for the agribusiness.

- Heating of buildings and green houses

Hybrid heating,

Burners for boilers in the green houses or for the industry



14-12-2020

Hydrogen production and usage in the agribusiness

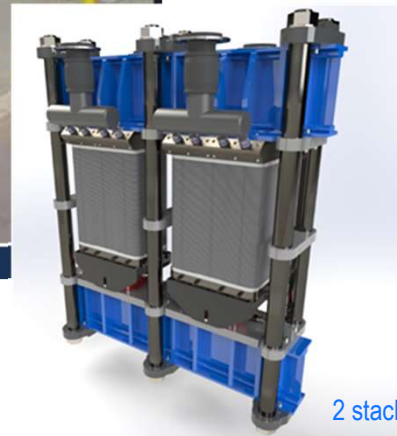
Opportunities for the agribusiness.

First green hydrogen production in the Netherlands



**1100 kW Electric power in
(small part of PV panels plant, Gasunie Zuid Wending)**

**408 kg/24 hr- 17 kg/hr, pressure 20 bar
(Electrolyser out before compression)
(200 m³n/h, 2x electrolysers)**



2 stacks from ITM Power PEM electrolyse operating principle



Thank you for your attention, and if you also want to continue with the hydrogen mission:

Wij helpen u graag:

- Met al u energietransitie- en waterstof-vraagstukken
- Conceptleverancier
- Beoordeling technische integriteit
- Ondersteuning met subsidie en vergunning
- Projectbegeleiding en ondersteuning
- En meer:



Elektrolyzers,
(Waterstofopwekkers)
0-∞ MW

Fuel Cells
(Waterstof _ Elektriciteit)
(H2-ready)



Opleiding/
Onderzoek/
Kennisdeling/
Regelgeving



Waterstoftankstation
(Slow Fill-Fast Fill)



MV Energietechnik
Advies & Inspectie

Marcel Vogelsangs
Albionstraat 13a
5809AB Leunen (Venray)
marcel.vogelsangs@mv-energietechnik.nl
06-28724662

Waterstof branders
(Industriële toepassingen)
(H2-ready)



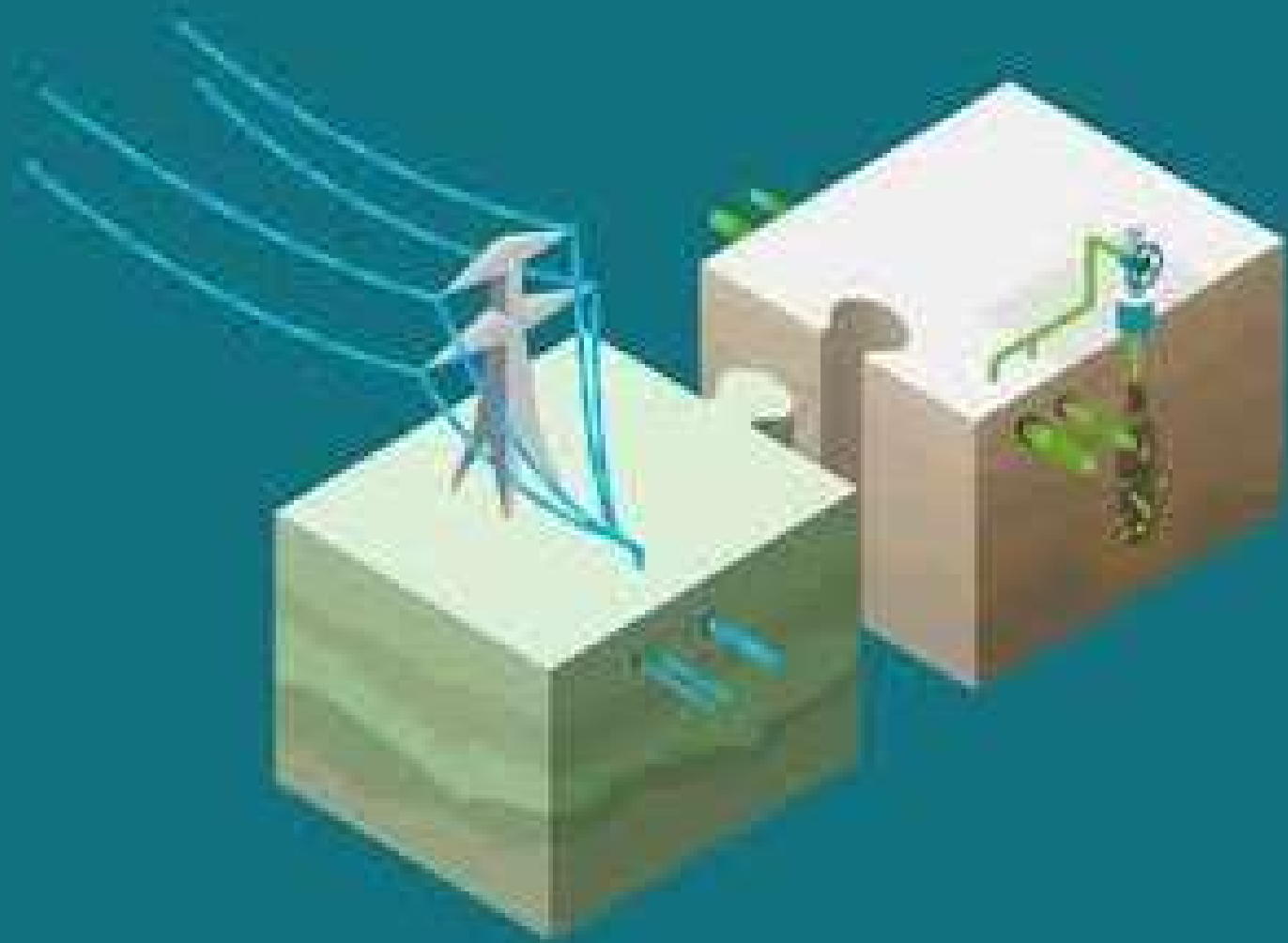
Hybride CV-ketels
(Warmtepomp-CV ketel)
(Utiliteit & Industrie)
(H2-ready)



Klimaat neutraal en CO2-0!
(Huishoudelijke toepassingen)



Energieopslag



Dutch Vision

https://www.youtube.com/watch?v=g6HjT8tk8_s&t=52s