



Hydrogen pilot projects with 100% H₂ boilers in building environment

Stronghouse Hydrogen Visit Hoogeveen

Date: 29th March 2023

Presented by: Ing. R.W. van den Tempel

Duration: approx. 20 minutes

Introduction

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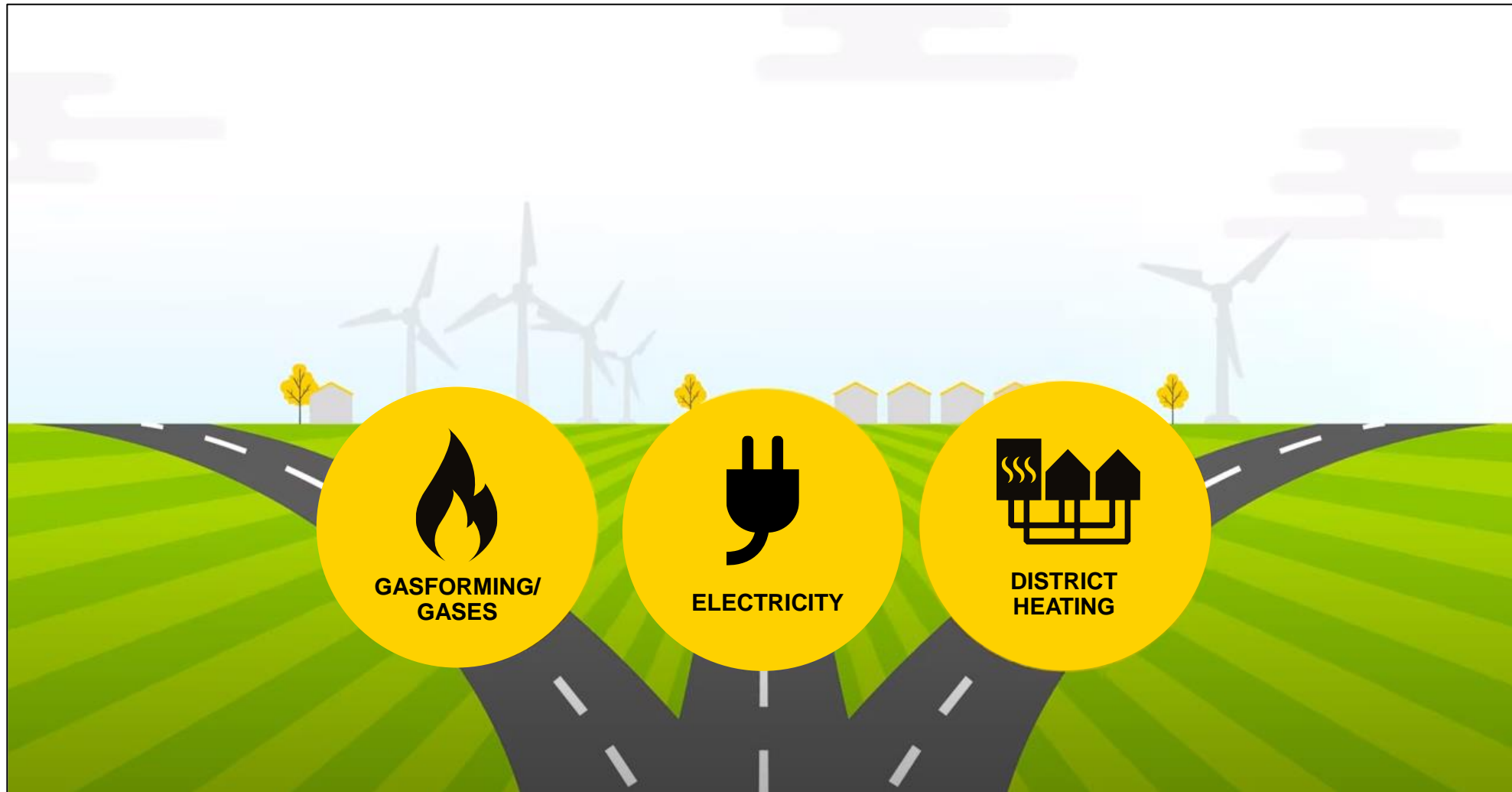
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Multiple paths to sustainability



Trias Energetica vs natural gas reduction

Main goal is CO₂-reduction

So not only reduction of the use of natural gas, solar panels or windmills!



Civil
measures

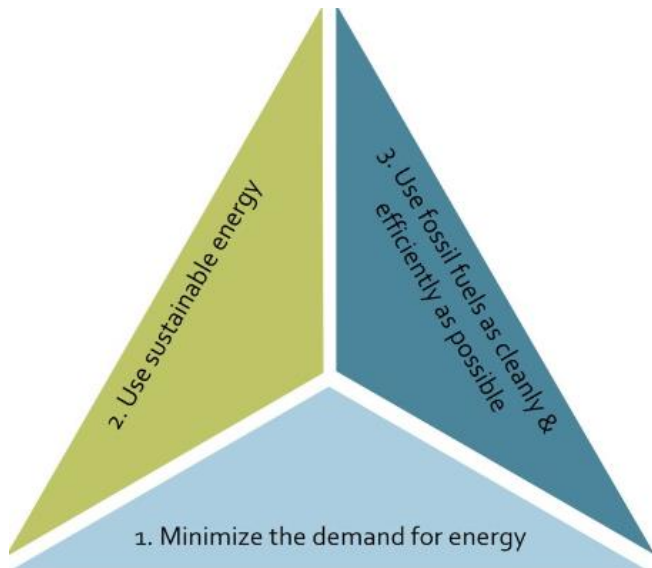
Electrotechnical
measures

Mechanical
measures

Controls
measures

Human
behavior

Landscaping

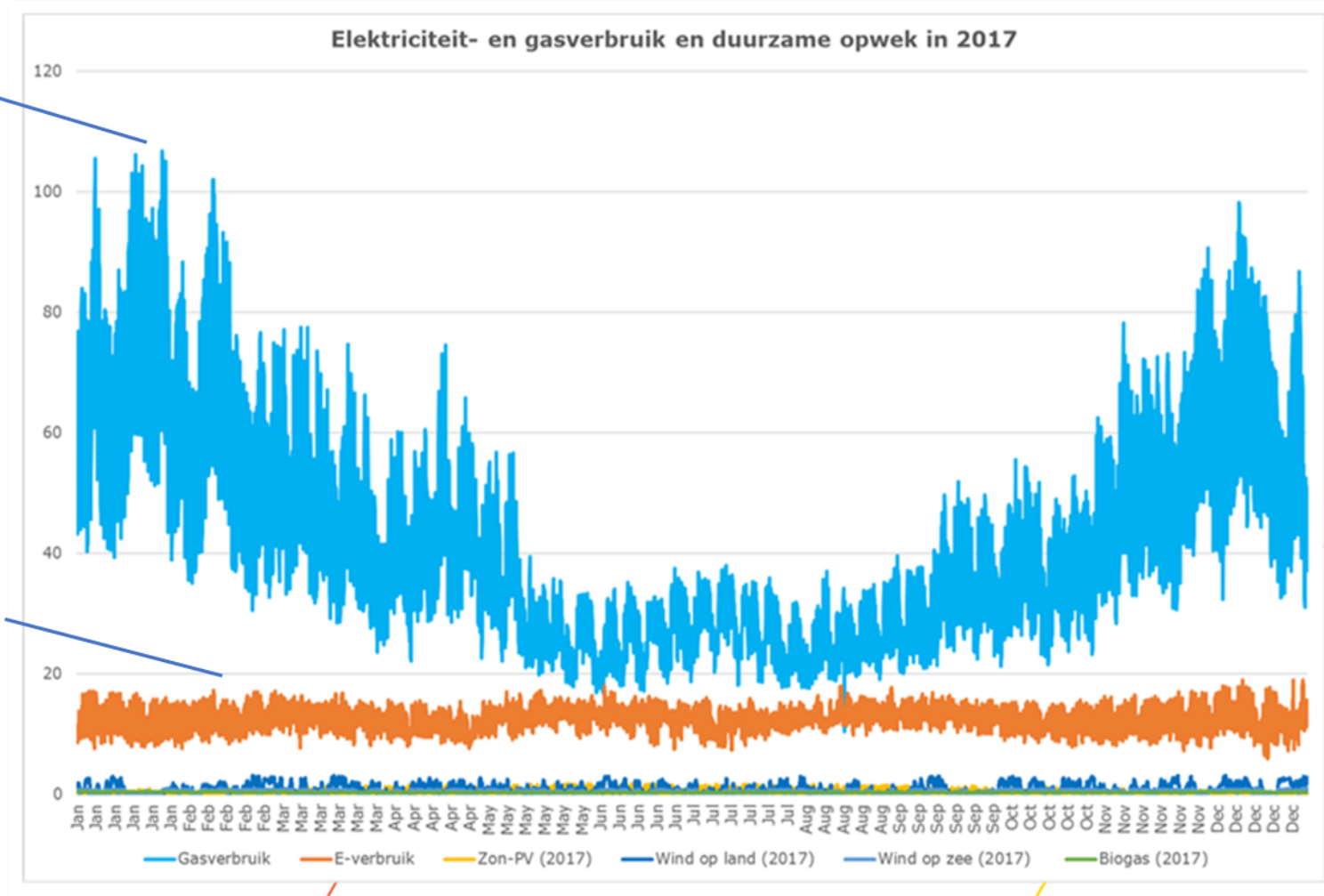


Trias Energetica first goal is to reduce the heat demand

Total energy consumption in The Netherlands (2017)

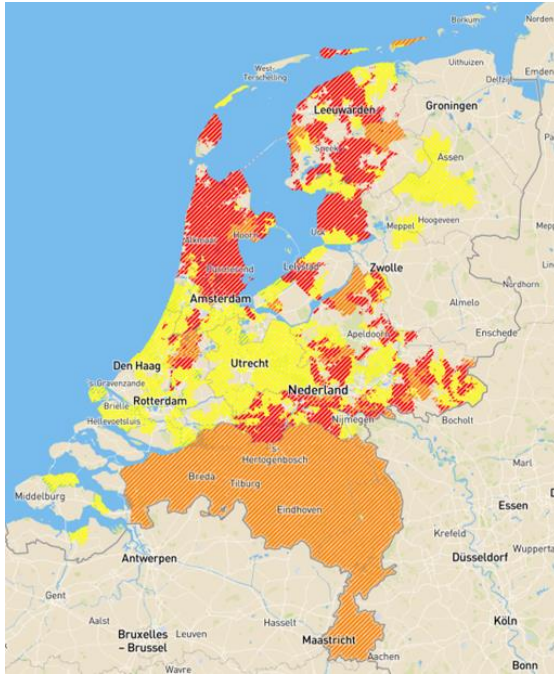
Piekvermogen
gas 108 GW

Piekvermogen
elektriciteit 18 GW

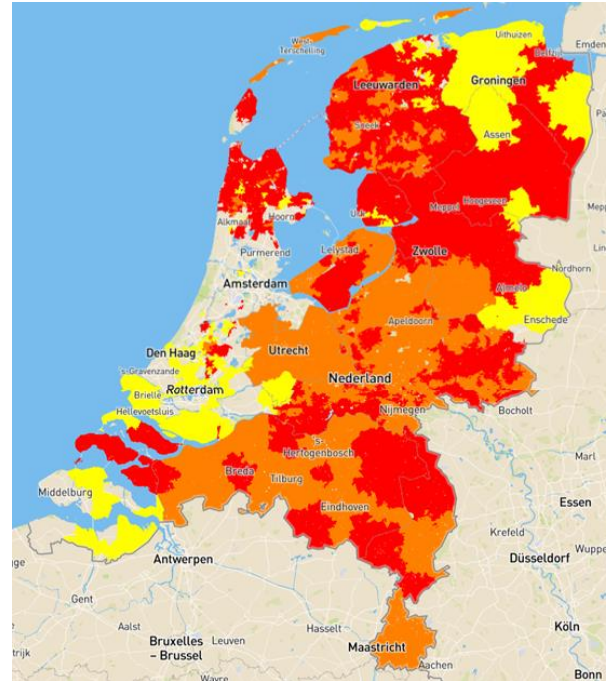


Sustainable energy production is causing unbalance in E-network

Supply back limitation ≥ 80 Ampère



Capaciteitskaart **afname** elektriciteitsnet
Bijgewerkt: 29-09-2022 09:01



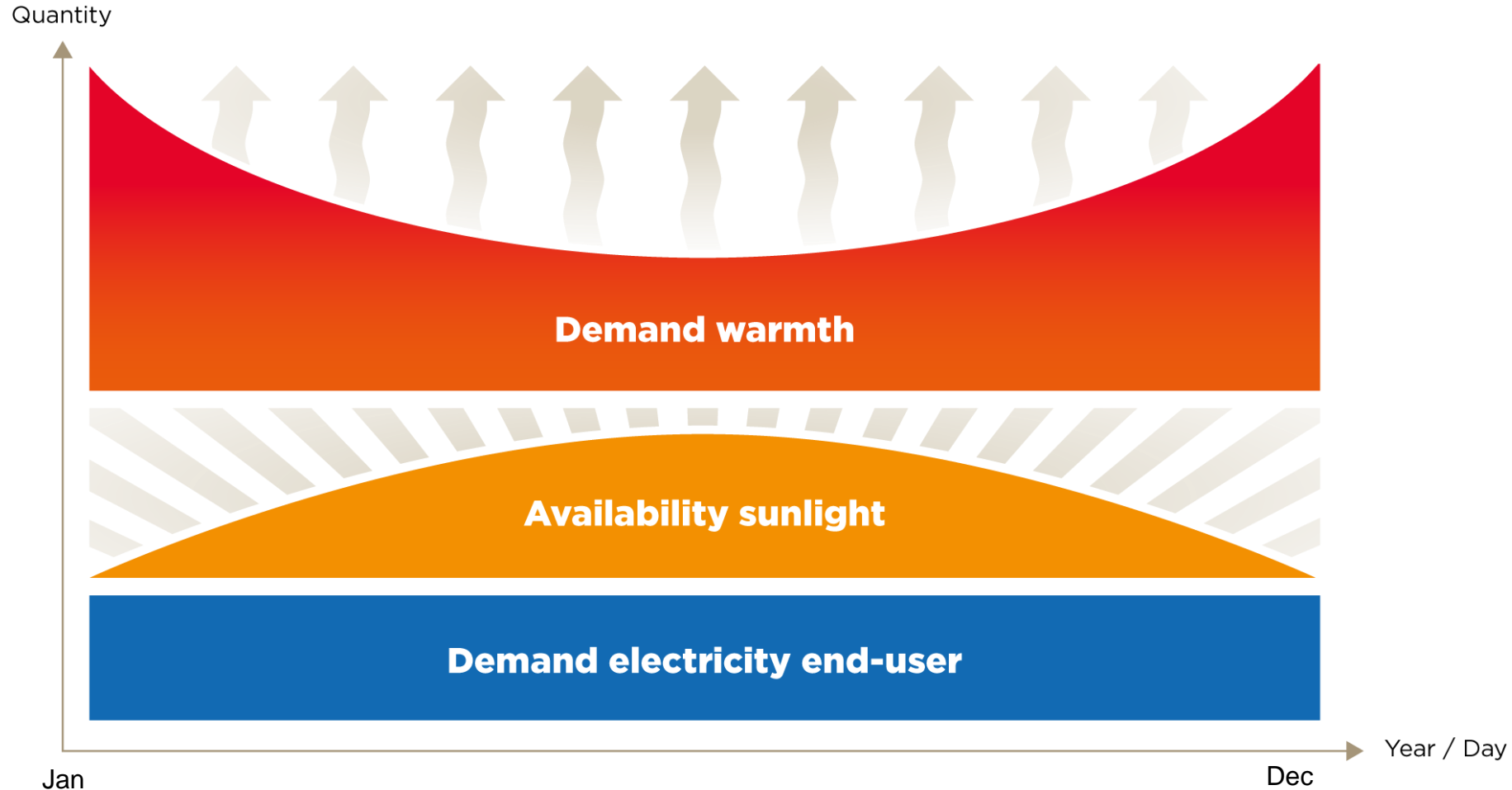
Capaciteitskaart **invoeding** elektriciteitsnet
Bijgewerkt: 29-09-2022 09:01

- Grid connection $\geq 3 \times 80A$
- Limiting demand remains necessary
- Applying hydrogen / sustainable gas will offer a solution

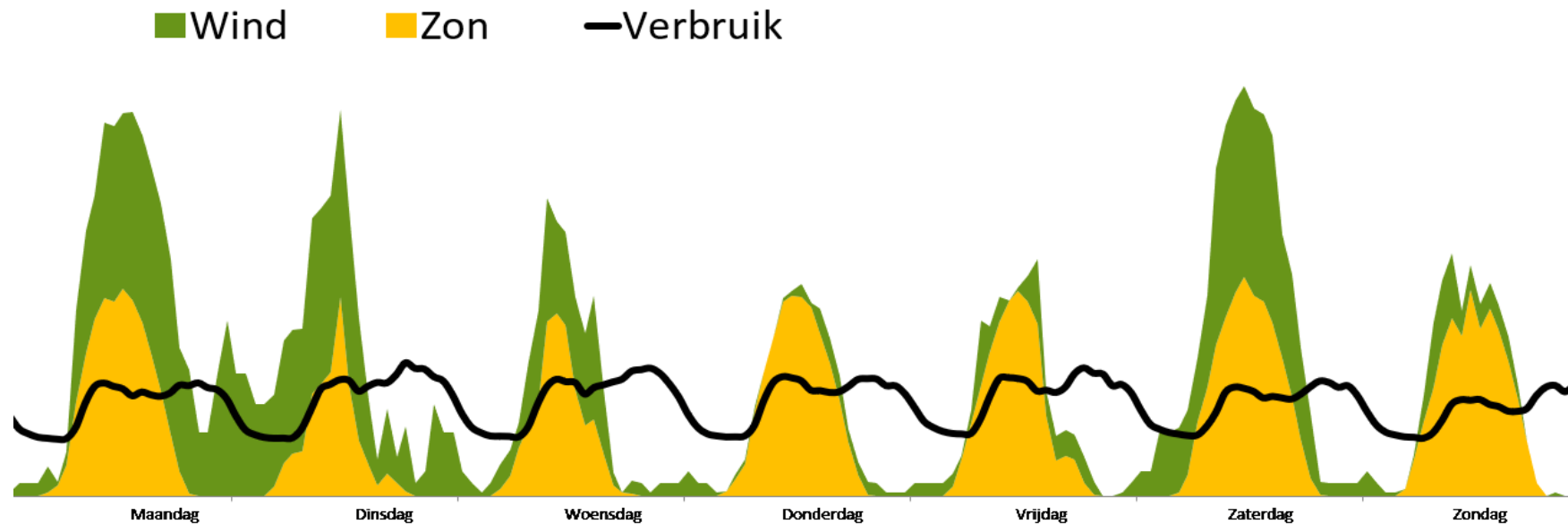
Betekenis van de kleurcodes

- Transparant: (nog) geen transportschaarste
- Geel: transportschaarste dreigt, er geldt een aangepast offerteregime
- Oranje: vooraankondiging structurele congestie bij ACM
- Rood: structureel congestie, nieuwe aanvragen voor transport worden niet gehonoreerd

Energy management is our problem
supply and demand are not in balance

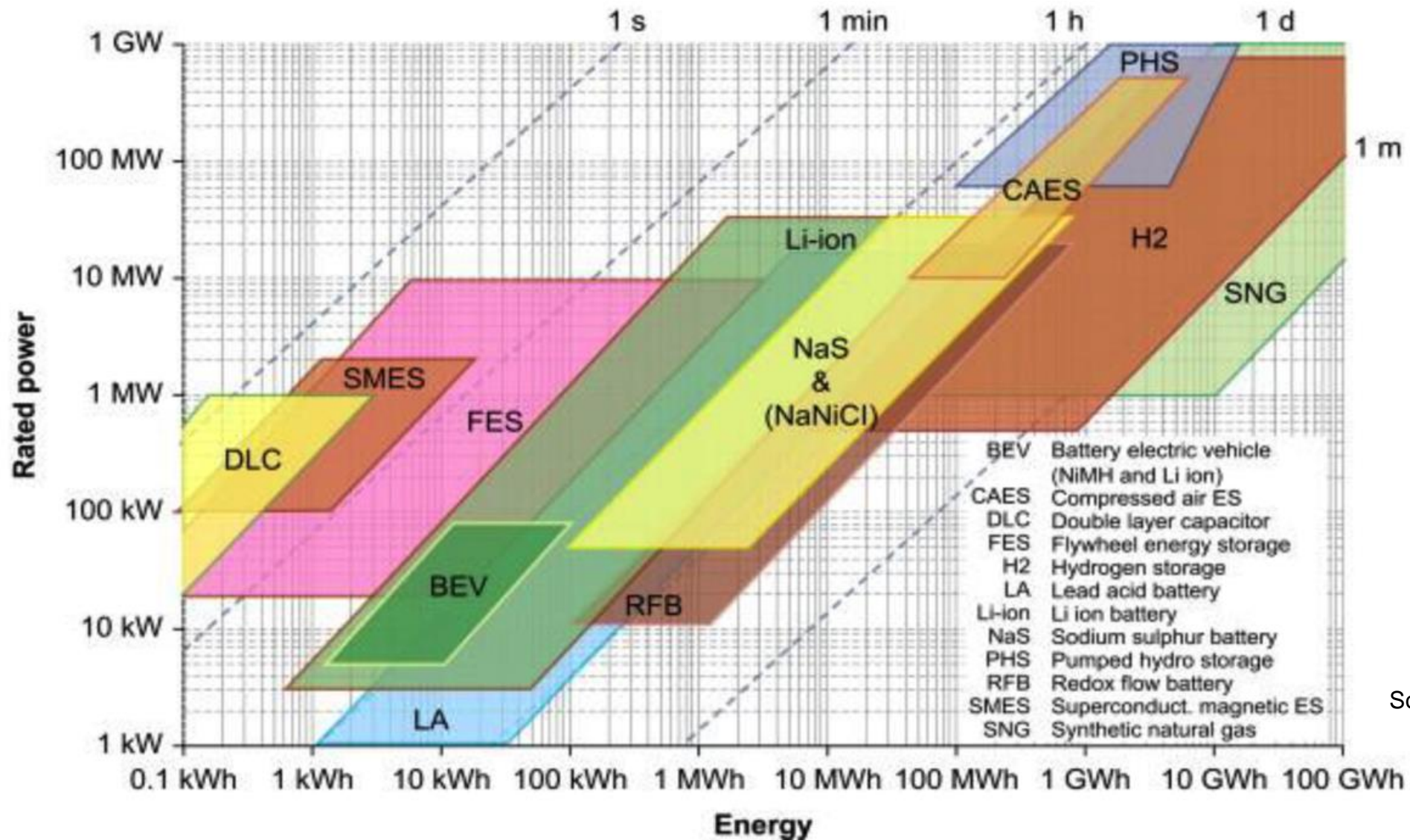


Energy management is our problem supply and demand are not in balance



Example: Energy-production and energy consumption during a summer week with solar and wind energy production

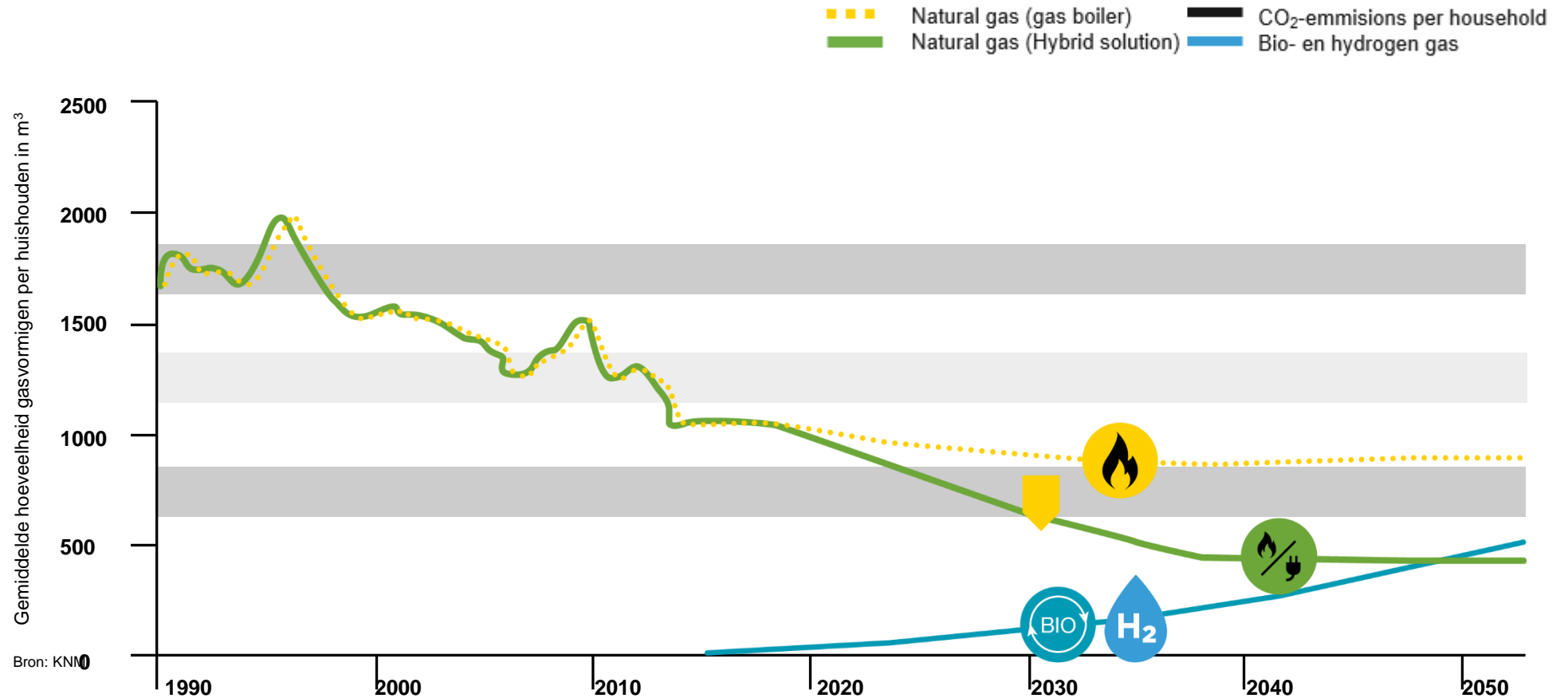
Energy storage options



Source: Fraunhofer Institut

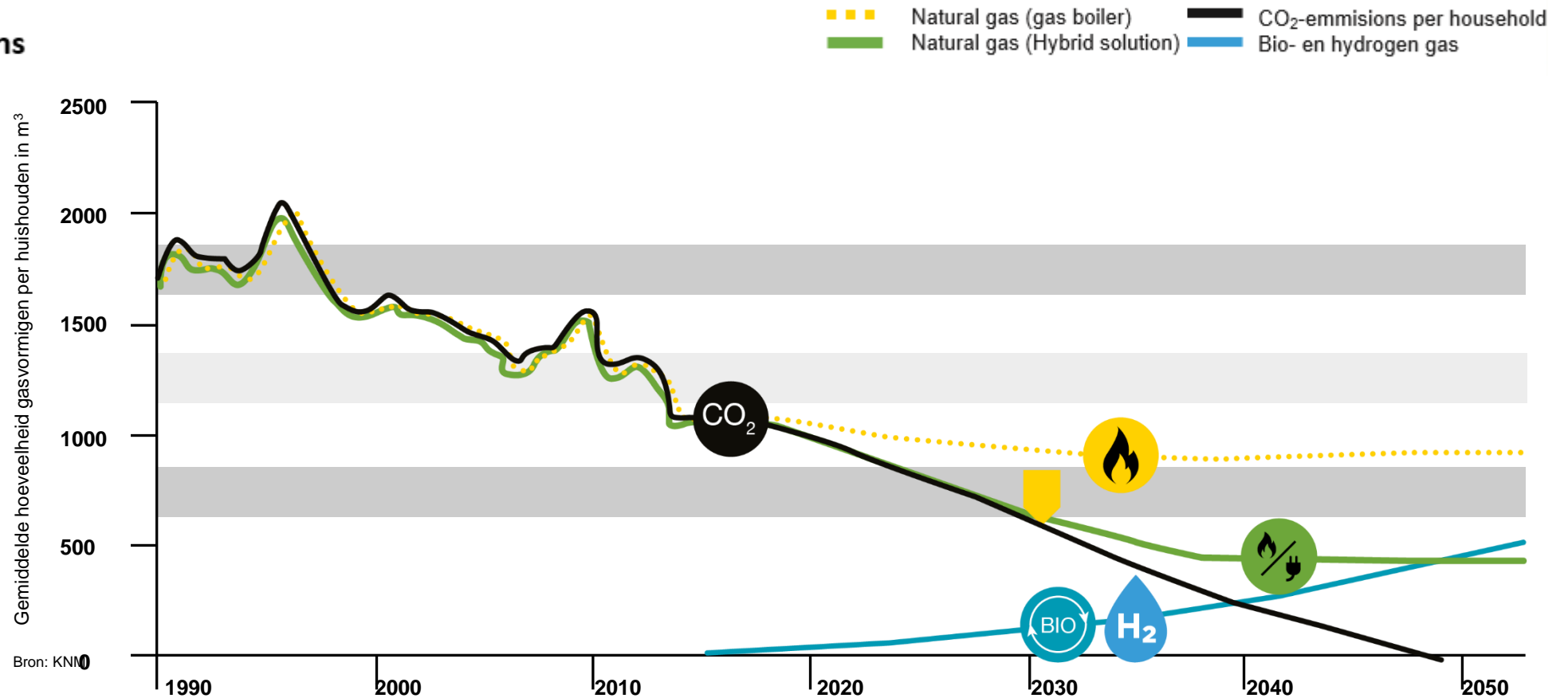
Hybrid heat pumps offers a solution for now and for the future

Development
of green gas.



Hybrid heat pumps offers a solution for now and for the future

Decline of CO2 emissions



Short-term solutions

Lot of subsidies from government available for energy reducing solutions

- 1) Reducing the demand by isolating houses and buildings
- 2) Reducing water consumption for domestic hot water
- 3) Active hydronic balancing of heating systems
- 4) Installing Hybrid heat pumps or All Electric heat pumps

In second phase (5-10 years) using hydrogen instead of natural gas

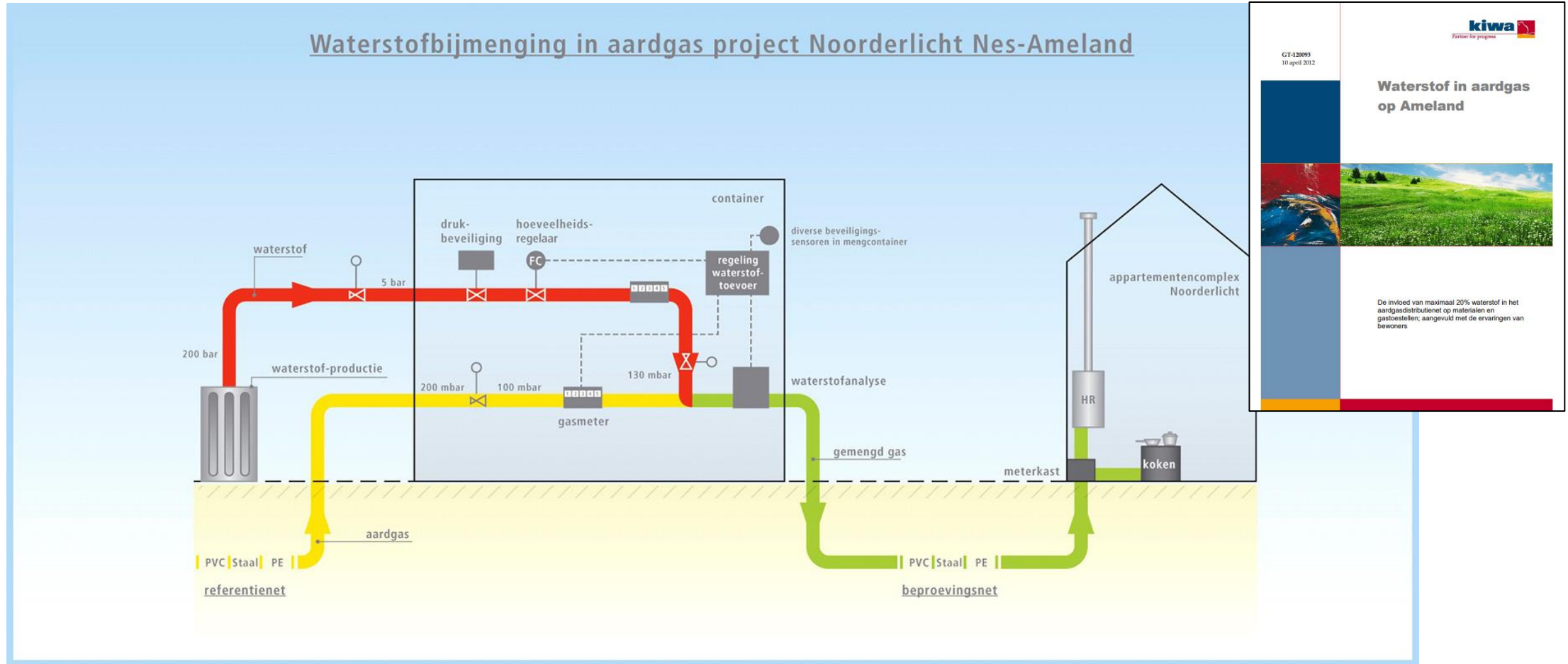
Pilot projects are needed to gain experience and to improve new techniques!



Keep in mind:
Not every solution is possible everywhere

In year 2012 first H2 pilot project with hydrogen mixture

Positive test results



Pilot projects in The Netherlands with 100% hydrogen boiler



Rozenburg (2019)



Uithoorn (2020)



Apeldoorn, Hydrogen
Experience Center 2021



Delft, The Green Village (2021)



Stad aan 't Haringvliet,
Inspiration house (2022)



Lochem, 12 monumental
buildings (2022)

Overview of upcoming hydrogen project in The Netherlands 2023 - 2025



Lochem, 2-4 monumental houses (2023)



Hoogeveen, new build 100 residential buildings + 8 to 16 existing houses (2023/2025)



Stad aan 't Haringvliet, existing houses >600 pieces (2025)



Demonstration project with 45 kW 100% hydrogen boiler for utility building 2023

The Remeha 100% hydrogen combi boiler

Second generation

- 24/28kW CW4 100% hydrogen combi boiler
- Further development with larger capacities
- Assembled on newly developed production line with end of line test
- Similarities natural gas boiler
 - Dimensions
 - Gas pressure (20-30mbar)
 - Comfort software
 - Performance and efficiency
- Deviations from natural gas boiler
 - Boiler sealed
 - Flame / flash back protection built-in
 - H2-leakage sensor built-in
 - Extra safety software
 - 1 power output available
- 100% hydrogen central heating boiler is an advanced stage of development



Now and near future

Now



Now available central heating boilers with **20%** mixing of hydrogen.



100% hydrogen central heating boiler only available for pilot projects.

2025



100% hydrogen central heating boiler available for commercial introduction.



Central heating boiler in basic natural gas and can be converted to **100% hydrogen** boiler by means of conversion kit.

New H₂ production line Bassano (Italy)



We have confidence in hydrogen, have invested in assembly line with end of line test.

Type of homes participants H2 pilot Lochem (protected cityscape)



Specific (H₂)-components used in pilot project Lochem



Gas stopper



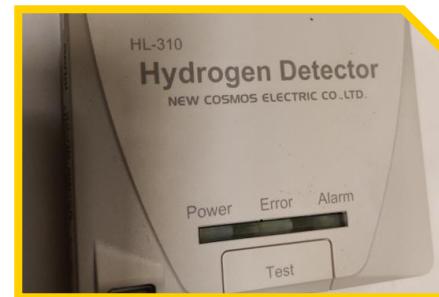
Notification sign at front door



Gas pressure regulator green cap



Hydrogen gas meter with H₂ designation



CO / H₂ detector



Designation H₂ on boiler



Sticker on gas pipe



PPE measuring & detection meters

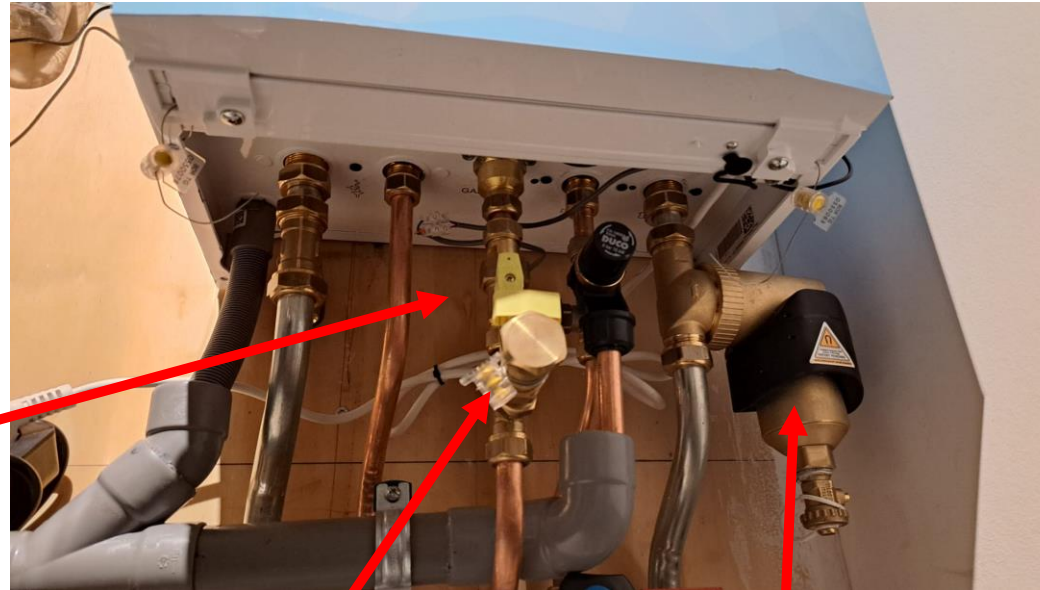


Very low-pressure reducing valve
0- 150 mBar



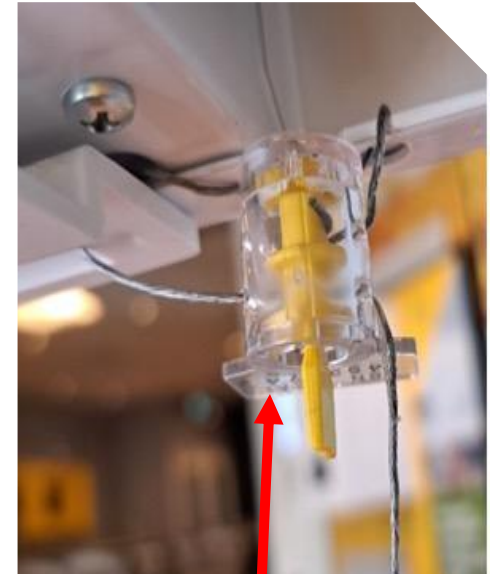
Powder extinguisher - type C

Indoor installation



Flushing
point

Magnetic filter



Seal

Safety

Access to H2 boiler is sealed for 3 reasons:

1. Prevent opening of the front casing by unknowingly incompetent people
2. Protect Intellectual Properties due to pending patent applications
3. When commissioning, calibration takes place



Flare installation needed for safe operation during installation, modification and disassemble works



Natural gas



Hydrogen



Gas stopper



Very low-pressure reducing valve 0- 150 mBar





**Thank you
for your
attention**