HyDelta 2

Webinar

Hydrogen and transport assets

29-11-2022

Agenda

Time			Event
11:00	-	11:05	Welcome / Introduction by host
11:05	-	11:20	WP 7 – Analysis of the conversion of a natural gas network to hydrogen
11:20	-	11:30	**WP 7 – Discussion / questions**
11:30	-	11:45	WP 8 – Analyzing digitalization in network management
11:45	-	11:55	**WP 8 – Discussion / questions**
11:55	-	12:05	Topics are closed by the host

Who are the speakers?

Julio Garcia (Host)
HyDelta coordinator
New Energy Coalition

Martin Scheepers
Senior consultant
TNO

Huib Blokland
Senior Project Manager
TNO

HyDelta

HYDELTA 2

WP7

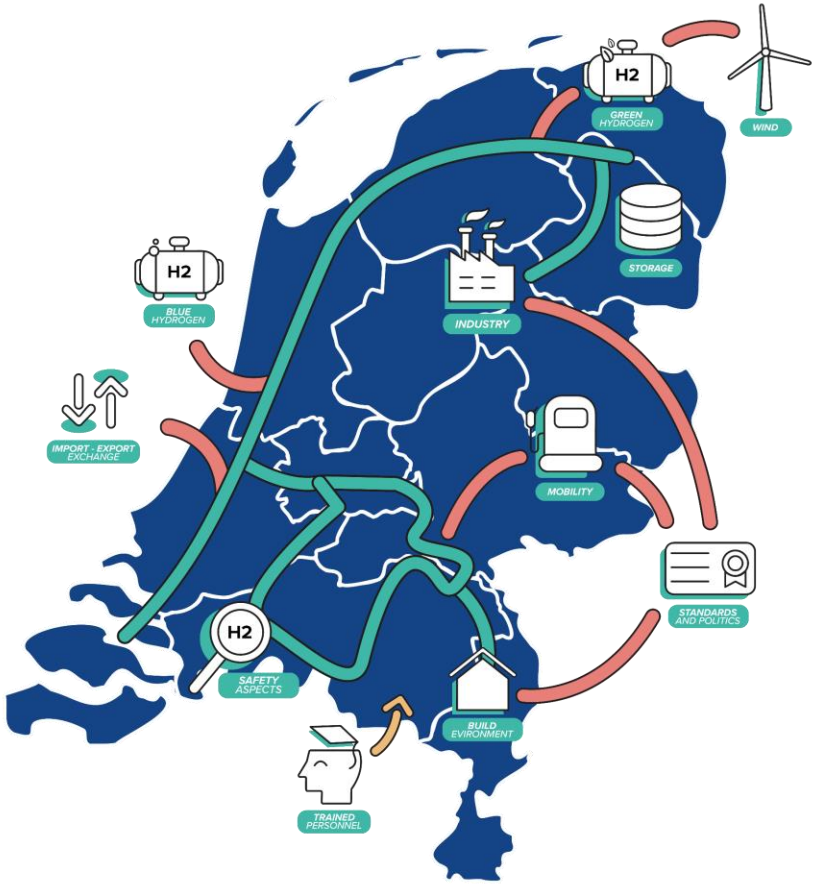
Analysis of the conversion of a natural gas distribution network to hydrogen

Martin Scheepers - TNO

martin.scheepers@tno.nl

Objectives

- A **model conversion plan** for conversion of a natural gas distribution network to a hydrogen distribution network
- **Inventory** of existing knowledge and experience
- Conversion plans for **concrete cases**



HyDelta

Inventory of existing knowledge and experience

Content of the inventory report:

1. Hydrogen projects and conversion studies
2. Regulation hydrogen markets
3. Materials and components and technical knowledge/skills for the conversion
4. Supply and delivery options
5. Step-by-step plan for conversion

Projects and case studies hydrogen distribution

Name	Location	Land	Type	Network operator	Hydrogen supply	Hydrogen use	Reference
Entrance	Groningen	NL	Project		Local electrolyser	CV boliers	[4]
Hydrogen district Wagenborgen	Wagenborgen	NL	Project	Enexis	Tubetrailer (fase 1) Local electrolyser (fase 2)	Hybride HP in 33 dwellings	[5]
Hydrogen pilot Hoogeveen	Hoogeveen	NL	Project	Cogas/Rendo	Tubetrailer/local electrolyser	80-100 dwellings, next more then 400 dwellings	[6]
Temporary conversion Uithoorn	Uithoorn	NL	Project	Stedin	Gas cylinders	14 dwellings	[7]
Hydrogen pilot Lochem	Lochem	NL	Project	Alliander	Tubetrailer	10 monumental dwellings	[8]
Hydrogen pilot The Green Village	Delft					Project dependent	[9]
Hydrogen pilot P2G	Rotterdam					Built environment	[10]
Hydrogen conversion	Stad aan 't Haringvliet					600 dwellings	[11]
Analysis on splitting up the gas network	Gouda					Urban area	[12]
	Noord-Beveland					Rural area	
H2.0	Haarlem					Built environment, old town district	[13] [14]
	IJmuiden					Harbour district	
	Drachten					Gebouwde omgeving	
Theoretical study	Heerenveen	NL	Study	Alliander/Gasunie	H2 backbone	5 industrial customers	[14]
LHyVE	Leipzig	D	Study		H2 backbone	Built environemnt	[15]
H2HoWi	Holzwickede	D	Project	Westnetz	Tubetrailer	4 business buildings	[16]
H2Direkt	Hohenwart	D	Project	Thüga	Tubetrailer with green hydrogen	10 dwellings and a business building	[17]
H21	Leeds	UK	Study		Blue H2 via HTL/RTL network	Built environment	[18]
H100 Five	Buckhaven and Denbeath (Schotland)	UK	Project	SGN	Local electrolyser	300 dwellings	[19]

- 11 projects and 8 studies
- 14 from the Netherlands, 3 from Germany and 2 from the UK

HyDelta

Hydrogen network regulation

Amendments EU Gas Regulation and the Gas Directive (proposal)

- Assumes delivery via backbone and competition between suppliers.
- No distinction between transmission and distribution system operator.
- Vertical unbundling: hydrogen network management independent of hydrogen production or supply
- Horizontal unbundling: hydrogen network management separated from natural gas distribution
- During conversion: transfer of natural gas distribution network assets to hydrogen network operator
- Regulated third-party access from 2031
- Few rules regarding the protection of small consumers (i.e. left to Member States)
- The gas supply security regulation does not apply to hydrogen (a certain degree of security of supply for small consumers is desirable)

Temporary framework for hydrogen pilots (ACM)

- For period until 2025 to ensure safety and consumer protection.
- The role of grid operators in hydrogen pilots is tolerated (separate hydrogen grid operator not yet required).
- Pilot concerns hydrogen for heat supply in the built environment.
- Temporary (max. 5 years) to gain learning experience; size not greater than necessary for the learning objective.
- Consumer protection equal to that of natural gas (i.e. same rules apply)
- Additional conditions: (i) contract (duration of the pilot), (ii) security of supply, (iii) the conversion of the indoor installation and (iv) the costs and rates.
- Security conditions: temporary policy framework EZK

Inventorty knowledge distribution networks

Are components and materials suitable for hydrogen (based on research) or is further research required?

- Components GOS – gas meter

Gasontvangstation (GOS), Hogedruk afleverstation (HAS). Open eindlevering (OEL), Afleverstation (AS), Overslagstation (OS), Districtsstation (DS), Meteropstelling lagedruk (MOLD), Drukregelaars, Gasmeters, Verbindingen, Hulpstukken en gaszadels, Afsluiters, Gasstopper

- Gas pipes en materials

Kunststof: PE, slagvast PVC, hard PVC
Metaal: staal, grijs gietijzer, nodulair gietijzer, koper (aansluitingen en binnenleidingen)
Overige: rubbers, plastics, smeermiddelen, epoxyharsen en lijmen

- Working procedures

Werkzaamheden aan gasstations
In- en uit bedrijf stellen van waterstofleidingen
Persoonlijke beschermingsmiddelen

Inventorty knowledge indoor installations

Is replacement necessary and are these installations available?

- Dwellings

CV-ketel (combi), rookgasafvoer, kooktoestel, sfeerhaard, leidingen, koppelingen en appendages, overige gastoestellen

- Utility Buildings

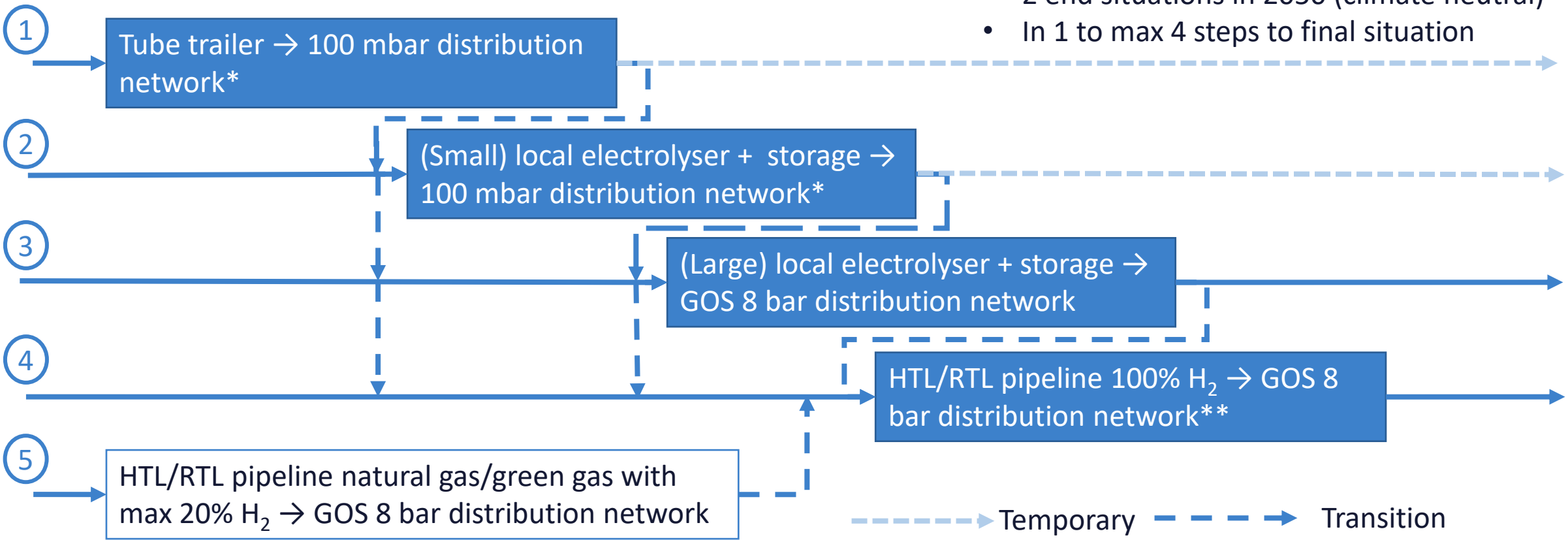
CV-ketel, tapwaterboiler, rookgasafvoer, kooktoestel, gasoven, gasfriteuse

- Business customers (incl. horticulture greenhouses)

Verwarmingsketel, stoomketel, CO2-kanon, CO2-doseringsinstallatie, gasmotor, industriële branders

Hydrogen supply options

- 5 starting situations
- 2 end situations in 2050 (climate neutral)
- In 1 to max 4 steps to final situation



* Options for pilots en demos

** Conversion RTL to hydrogen required; distance to H_2 backbone determines feasibility

HyDelta

Case studies

Nijmegen

- Hydrogen supply via 3 existing GOS connected to existing RTL
- RTL will supply hydrogen to ceremic industry
- Hydrogen distribution in urban and rural area

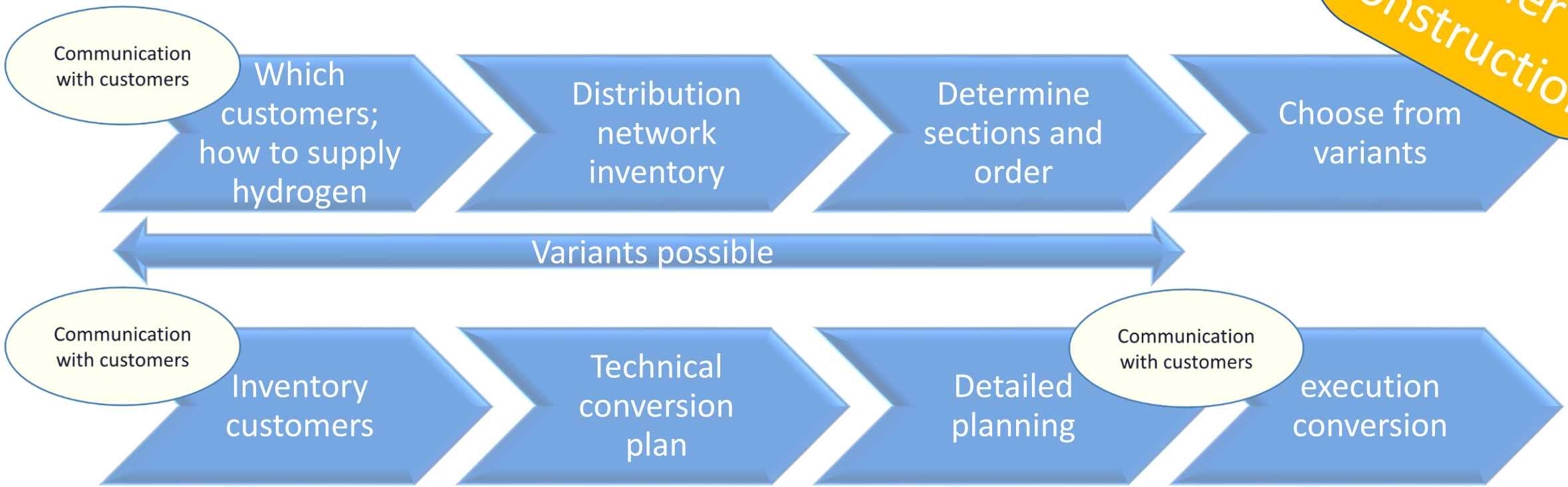
Kapelle

- Hydrogen supply via 1 new GOS connected to a new hydrogen transport pipeline
- Hydrogen distribution to Biezelinge (business park) and Kapelle (town)

HyDelta

Conversion plan outline

Under construction



Organisation

- Who are involved: municipality, distribution network operator, transmission network operator, hydrogen supplier, installation companies, contractors, consumers
- What are their roles & responsibilities? Who is the coordinator?

HyDelta

HyDelta

HYDELTA 2

THANK YOU FOR YOUR ATTENTION!

Martin Scheepers, TNO
martin.scheepers@tno.nl

WWW.HYDELTA.NL

linkedIn.com/company/hydelta

HyDelta

HYDELTA 2

WP8

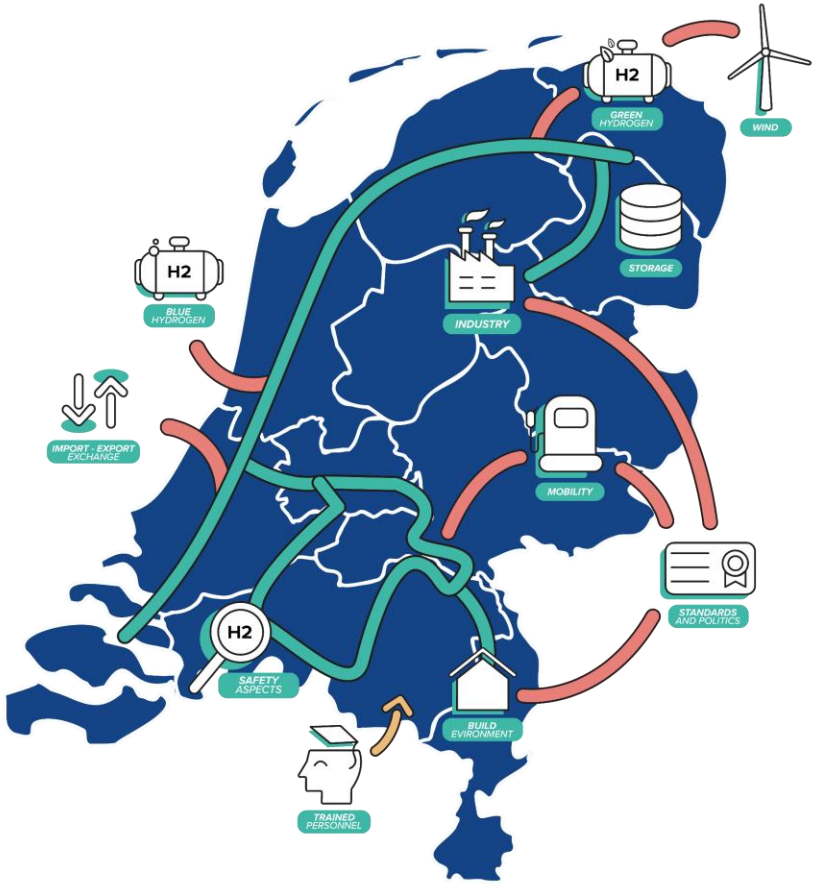
Analysing digitalization in network management

Huib Blokland, TNO

18 November 2022

Research objective & Impact

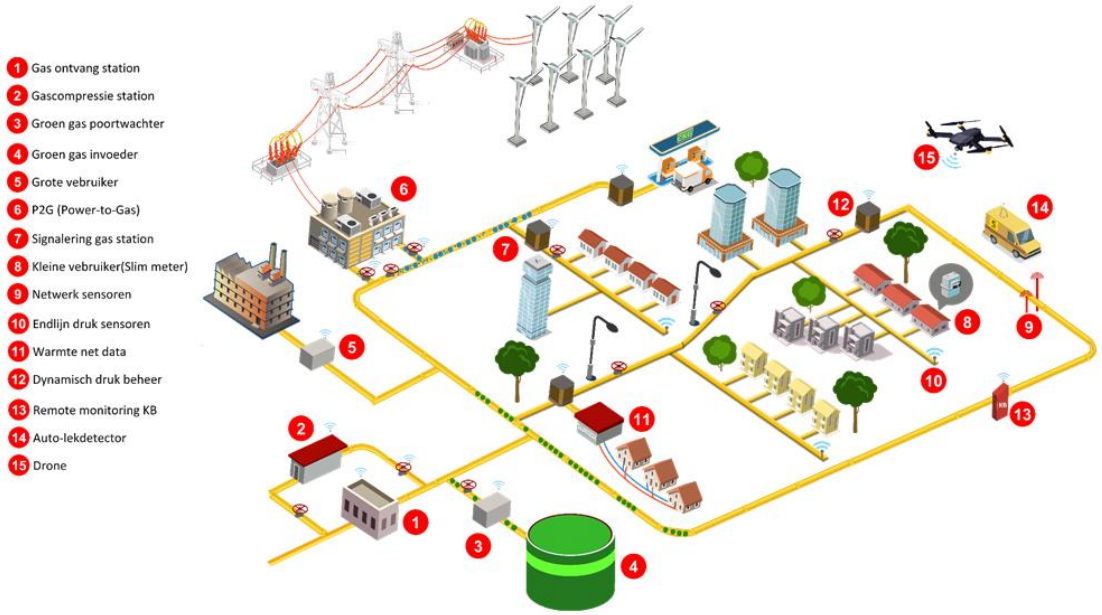
- How can digitalization contribute to an effective transition to hydrogen grids? While maintaining the needed security of supply.
- Creating insights in the need and potential benefits of digitalization of the grid. In all phases of the transition:
  - Design phase
  - During the transition
  - Operating of hydrogen grids



HyDelta

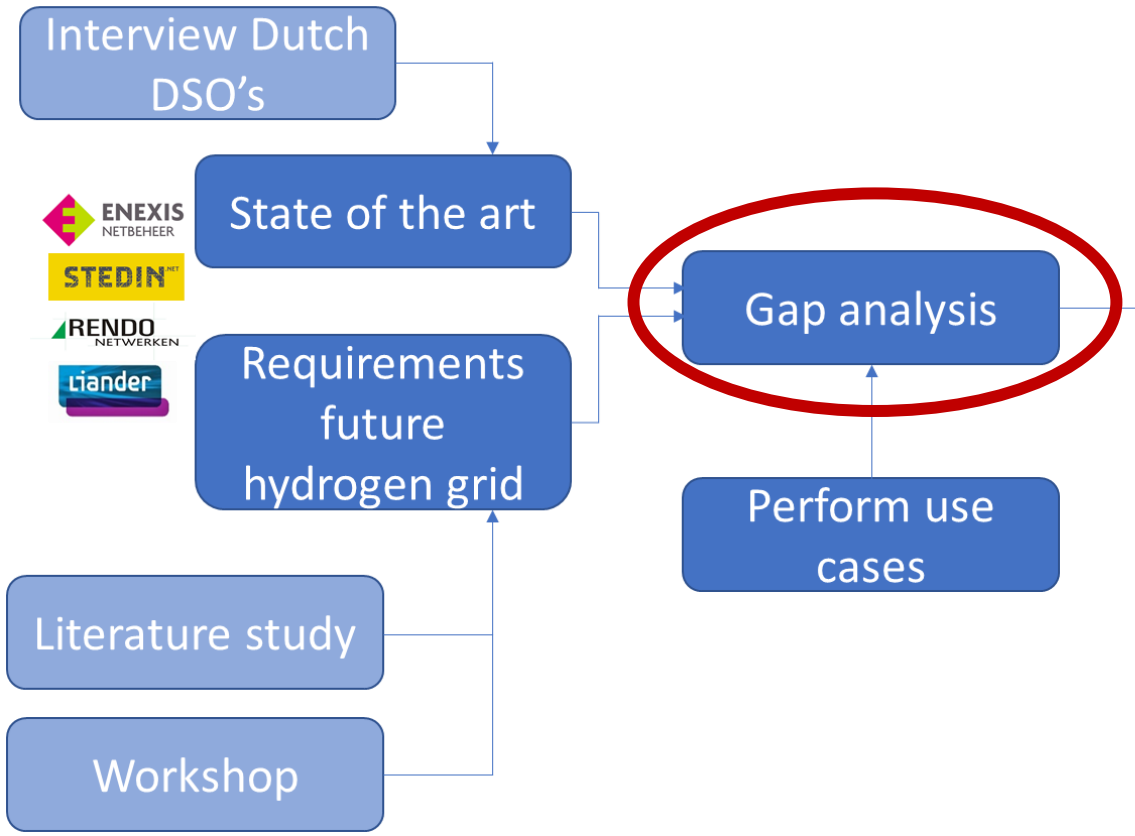
Scope

- Pure hydrogen grids
- Distribution grids (Gasunie benchmark)
- All phases: design, transition, operation
- Grid capacity and hydrogen quality
- Systems:
  - Modelling
  - Monitoring
  - Control



Example of a smart gas grid (source: Stedin)

Approach



Team
TNO: Ryvo Octaviano, Ruud van der Linden, Huib Blokland
Review group
Stedin: Iman Pishbin (lead)
NBNL: Stefanie van Kleef
Alliander: Reon Baars, Ben Lambregts
Enexis: Ruud Busscher

State of the art - Summary

- Modelling:
  - Commercial tools for design, capacity calculation and risk assessments.
  - All based on extreme cold conditions and StandaardJaarVerbruik
  - No smart meter data is used
- Monitoring
  - Limited pressure measurements in the grid, no flow sensors.
  - Need for extra measurements and coupling to simulation tools.
  - GOS and Green gas feeder data available, mostly manually accessed.
- Control
  - Grid is robust wrt capacity.
  - Need for advanced control for green gas supply, e.g. boosters and dynamic pressure management

Future hydrogen grid - Challenges

Main challenge is balancing the hydrogen grid. Trends:

- **Dynamics in supply and demand**
  Changing user profiles, increasing local supply and local storage and line-pack
- **From a stand-alone gas grid to a multi-connection grid**.
  Connection to other DSO's, connection to Gasunie backbone and connection to E-grid (bi-directional)
- **Need for real time data**
  On both Demand and Supply

Future hydrogen grid - Topics

Topics from workshop and literature survey

- Monitoring.
  - Real-time data of Supply, Demand and Storage.
  - Measurements in the grid: Flow, Pressure, Quality.
- Modelling.
  - Real-time capacity models
  - Coupling to externals: E-grid, Gasunie, other DSO's.
  - Tooling for short term transition planning from natural gas to hydrogen.
- Control.
  - Controlling the priority of suppliers to feed into the network

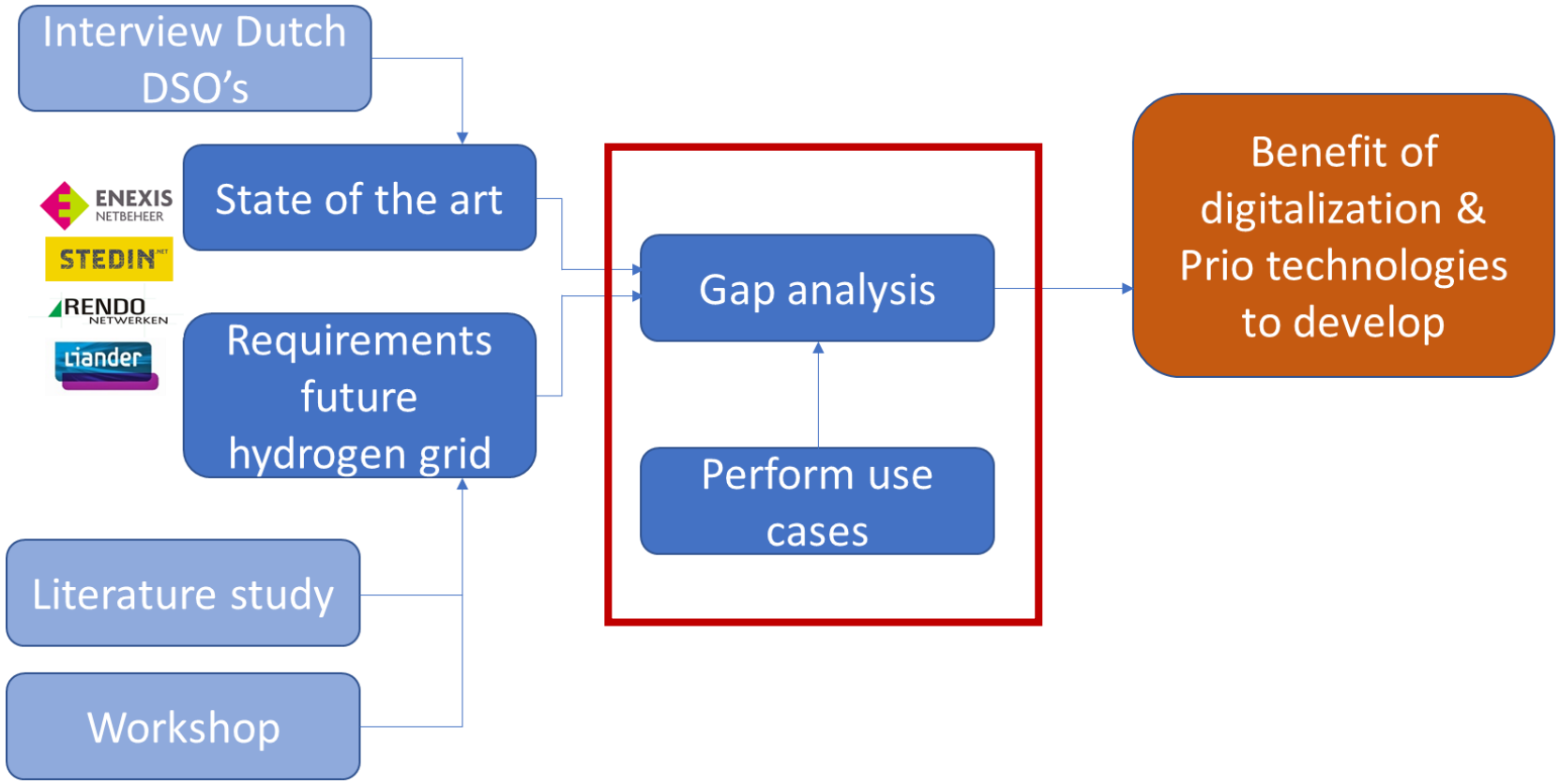
Wordcloud from the workshop

Preliminary gap analysis

Technology readiness. Together with timeline the priorities can be defined.

Tech	Topic	Gap
Monitoring	Realtime supply data	
	Realtime consumer data	
	Realtime storage data	
	Flow measurements in assets	
	Pressure measurements in assets	
	Quality measurements in assets	
Modelling	Tool for modelling a large complex network	
	Tool for modelling multi-commodity interaction	
	Tool for modelling transient effect in the network for high pressure	
	Tool for modelling a storage	
	Direct integration with real-time sensor data	
	Modeling tool for transition from natural gas to hydrogen	
	Tool to enable simulation of dynamic profiles	
Control	Optimization algorithm for source allocation or network operational strategy	
	Actuators that can be controlled remotely	

Next steps


Interview Dutch DSO's
State of the art
Requirements future hydrogen grid
Literature study
Workshop
Gap analysis
Perform use cases
Benefit of digitalization & Prio technologies to develop

Next steps

- Prioritizing the technology gaps
- Run use cases to generate quantitively info about the main gaps
- In collaboration with WP7
- Parameters that could be incorporated in the use cases:
  - Households and small industry
  - Several local hydrogen suppliers with varying profiles
  - Storage
  - Realistic domestic demand profiles and industrial profiles;
  - Bi-directional connection to a GOS or other DSO
- Report

HyDelta

HYDELTA 2

THANK YOU FOR YOUR ATTENTION!

Huib Blokland, TNO
huib.blokland@tno.nl

WWW.HYDELTA.NL

linkedIn.com/company/hydelta

What's next?

Social aspects of hydrogen

Thursday 8 Dec. 11:00 - 13:00

Curious? Sign up at https://hydelta.nl/news

HyDelta

HyDelta

HYDELTA 2

THANK YOU FOR YOUR ATTENTION!

WWW.HYDELTA.NL

linkedIn.com/company/hydelta