

CLUSTER “PLATFORM POWER TO GAS”

Kick-off meeting

14 September, 2016
Antwerpen

AGENTSCHAP
INNOVEREN &
ONDERNEMEN



Vlaanderen
is ondernemen



AGENDA

13.00: Welcome - lunch

13.30: Introduction and feedback VLAIO on PtG-cluster proposal

13.35 Presentation Cluster partners

14.45: Power to Methanol (PoA) – H2 Mobility (WaterstofNet)

15.00: Cluster activities and framework

- Roadmap for the cluster; projects and project teams
- Organisation and WOW cluster
- European demo-sites power to gas
- Link European power to gas/hydrogen associations
- Overview coming (EU) funding options

15.50: Next steps

16.00: End of meeting



INTRODUCTION - FEEDBACK VLAIO ON PTG-PROPOSAL

- Power to gas cluster can contribute to realisation of **Clean Power for Transport policy**
- **Participation of system operators Fluxys and Eandis** important to overcome hurdles w.r.t. regulations and permissions
- Joint set-up of **demonstration projects** will stimulate **cooperation** between companies, also after IBN period
- Targets **ambitious** but **realistic**
- **No research institutes** in the cluster, focus is on **business case** and **regulation** issues

CLUSTERPOTENTIEEL	Kritisch	Eerder zwak	Goed	Zeer goed
C1/ Competitiviteitsverhoging				X
C2/ Tijdslijn		X		
C3/ Duurzame Verankering			X	
C4/ Relevantie			X	
C5/ Noodzaak tot samenwerking en complementariteit			X	
C6/ Gedragenheid en engagement				X
C7/ Representativiteit			X	

Results demo's come "late" in the project
Economic valorisation is long term

KWALITEIT VAN HET PROJECT	Niet steunbaar	steunbaar
K1/ Organisatie en werking		X
K2/ Plan van aanpak		X

PRESENTATION CLUSTER PARTNERS

- Company name
- Main activities
- Experiences with H2
- Specific topics of interest within the cluster

PARTNER PRESENTATION: AIR LIQUIDE

Company name: Air Liquide Benelux Industries

Main activities:

World leader in gases, technologies and services for Industry and Health

Experiences with H2:

- More than 40 years expertise in the whole industrial chain of H2 applications , also in H2 Energy
- More than 75 Hydrogen Recharging Stations (HRS) worldwide ,
- First public AL HRS in Belgium, Zaventem in Flanders, on Toyota site as from 22-04-2016

Specific topics of interest within the cluster:

- Further implementation of P to H2 activities PtoH2, H2to Mobility, H2to Industry in Benelux.
- Further collaboration with stakeholders, Authorities and Automotive sector to create the market conditions for H2 mobility
 - Tax incentives for cars, taxis, buses,
 - Subsidies for investments
 - Modalities -regulations



Company name: Aspiravi

Main activities:

- developing, investing, realising and operating
- renewable energy production, mainly windturbines and biomass
- in Belgium, offshore (Northsea) and abroad

We are actual involved in the operation of 218 windturbines (560MW installed capacity).

Shareholder of different companies :

- Limburg Wind(t), Lommel Win(d)t, Groene Energie Haven Antwerpen
- Vleemo, A&P Windservices, A&S energie
- Wind@stroom, Northwind, Rentel, Seastar, Mermaid, Otary, ...

Experiences with H2: -

Specific topics of interest within the cluster:

- Power to Gas (Zeebrugge-Wuustwezel)
- Power to Chemicals/Industry (different windfarms nearby chemical industry or piping)
- Power to Power
- Owner of a large, diverse portfolio renewables (small/big–young/old–onshore/offshore)

Company name: Atlas Copco

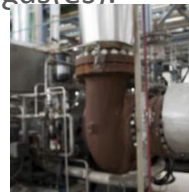
Main activities: Air and Gas compression

Experiences with H2:

- oil-free compression (< 30kW) up to 450 bar
- oil-lubricated compression (< 190 kW) up to 450 bar
- oil-free compression (< 600kW) up to 80 bar
- oil-free low pressure ratio (max2) up to 500.000 m3/h

Specific topics of interest within the cluster:

- topics needing compression of H2 and/or of other gas(es).



Company name: Colruyt Group

Main activities:

- 77% Retail (Colruyt, BioPlanet, Okay, Dreamland, Dreambaby, ...)
- 17% Wholesale & Foodservice (Spar, Alvo, Solucious, ...°)
- 6% Other activities (DATS 24, Symeta, Eoly, ...)

Experiences with H2:

- 2012 : Hydrogen filling station at distribution centre Halle
- 2012 : Hydrogen forklifts (start roll-out 200 end of September)
- 2014 : FCH-JU Don Quichote
- 2014 : FCH-JU CertifHy
- 2014 : Roadmap Power-to-Gas Flanders
- 2016 : InterReg WaterstofRegio 2.0

Specific topics of interest within the cluster:

Power-to-mobility | Power-to-Gas | Power-to-Power

Company name: DEME – Dredging, Environmental & Marine Engineering

Main activities: Offshore Global Solutions Provider

Dredging

Design and Build of Offshore Wind Farms, Artificial Islands, Ports, etc.

Environmental Contracting

Experiences with H2: none

Specific topics of interest within the cluster:

Viabile business models relating to Offshore Wind combined with Hydrogen.

Company name: **EANDIS** (DSO)



Experiences with H2:

- **Research activities to determine the asset related impact of hydrogen injection**
- **Collaboration with Dutch DSO's on hydrogen related topics**
- **Participation in Synergrid (Belgian technical committee)**

Specific topics of interest within the cluster:

- **Hydrogen projects with an impact on grid assets**
- **Applications of hydrogen products and services for customers**

Company name: E-Trucks Europe

Main activities:

-Conversion of traditional diesel trucks (range 11-26T) towards full battery truck or hybrid hydrogen-electric truck, depending on the power, energy and range specifications

Experiences with H2:

-manufacturer of hybrid hydrogen-electric garbage trucks. The experience with hydrogen includes the storage tanks and the fuel cell system and their integrations on vehicles.

Specific topics of interest within the cluster:

-Hydrogen driven vehicles cannot operate without refuelling equipment. The deployment of both H2 vehicles and refuelling infrastructure should go together . E-Trucks is therefore interested to collaborate in the deployment of the equipment and any additional validation that can be made by this equipment.

Company name: Fluxys Belgium



Main activities: Natural gas Transmission System Operator (TSO)

- Transmission
- LNG Terminalling
- Underground storage
- Hub services

Experiences with H2: none

Specific topics of interest within the cluster:

- Monitoring :
 - ✓ Technological/legal developments
 - ✓ Understanding of business models
- Focus = injection in natural gas grids (H₂ or methane)
- Co-investment in infrastructure ?

HYDROGENICS EUROPE NV

- **Main activities:**

- Alkaline and PEM electrolyzers for industrial applications
- Hydrogen refuelling stations (HRS)
- Fuel cells for stationary and mobility applications
- P2G (renewable hydrogen) demo projects

- **Experiences with H₂:**

- Building electrolyzers in Oevel since 1987
- 500+ electrolyzers, 50+ HRS, 2000+ fuel cells, 10+ P2G

- **Specific topics of interest within the cluster:**

- Create of a P2G early market in Flanders which can serve as an example for other countries
- Build demo projects in Flanders
- Create synergies with industry actors and create export opportunities for Flemish industry

Company name: NPG energy, part of the Group Enovos(Luxemburg)

www.npgenergy.eu www.enovos.eu www.energie-blog.com

Main activities: investements in renewables, supply and networks in Belgium, Netherlands, Germany, Luxemburg and France

Experiences with H2: no operational experience just studies

Specific topics of interest within the cluster: storage, mobility, green power transfer to hydrogen

Company name: PitPoint

Main activities:

Distribution of clean fuels

Making Zero Emissions Mobility possible in 2030

Experiences with H2:

Member Waterstofnet

Engineering, construction and maintenance of H2 station in Helmond (NL)

Different projects ongoing regarding Hydrogen for public transport in BE and NL

Specific topics of interest within the cluster:

Making Hydrogen available for mobility (exploitation of fuel station)

Company name: Shipit NV

Main activities: Shipit organizes multimodal transport. As an external logistic manager we seek for the most efficient transport solution for our customers. We maximise the use of alternative transport modi as inland shipping, rail and shortsea.

Shipit continues to be a fast growing, dynamic organisation. We distinguish ourselves through a very customer oriented, knowledge based execution of the optimal transport chain. In order to remain the first choice of our customers, Shipit invests substantial efforts and means in her HR, It-systems, real estate and ships.

Experiences with H2: None

Specific topics of interest within the cluster: CO2 neutral multimodal transport by use of H2

Company name: Terranova Solar nv

Main activities: Largest solarplant of Benelux, producing 17 Mw/year of green energy

Experiences with H2: none

Specific topics of interest within the cluster: developing a power to gas unit on site with the goal to provide hydrogen to improve green mobility and storage (cars, trucks and ships).

Company name: Toyota Motore Europe

Main activities: Automotive, Mobility

Experiences with H2: Fuel Cell Vehicle → Mirai



Specific topics of interest within the cluster:

1. Gain experience on Renewables 2 Hydrogen
2. Technology improvement and H2 production cost reduction
3. Support the increase of H2 usage in sectors other than mobility
4. Improvement of regulatory framework for Hydrogen

Company name: Umicore

Main activities: 1)Energy and Surface technologies (5 Business Units: Cobalt&Specialty Materials,Electroplating,Electro-Optic,Rechargeable Batteries,Thin Film), 2)Recycling, 3)Catalysis (Automotive,Precious Metals Chemistries)

Experiences with H2: Production of electro-catalysts for FC's & Electrolyzers, Recycling

Specific topics of interest within the cluster: Development of Fuel Cell based e-mobility and water electrolysis markets

Company name:

VDL-ETS (Enabling Transport Solutions)

Main activities:

- E Mobility
 - Battery vehicles
 - Fast charging vehicles
 - Range Extenders (H₂)
- Autonomous vehicles
 - (Mini)Bus
 - AGV
- Operation
 - Consultancy
 - Chargers
 - ESS Systems
 - Electricity sales

Experiences with H2:

- Buses 2000 and 2009-now
- Trucks (now)

Specific topics of interest within the cluster:

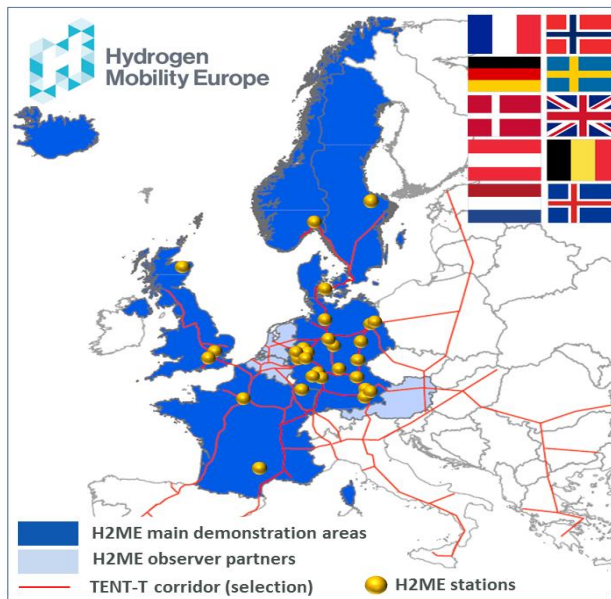
- For making Hydrogen a success one needs to solve some of the barriers

PROJECT INITIATIVES / RUNNING PROGRAMS

- ❑ Power to Methanol : PoA
- ❑ H2ME / H2 Mobility Belgium: WaterstofNet

H2ME

- Europees programma JU-FCH
- 29 tankstations, 325 auto's
- UK, D, F, Dk, N, S
- Benelux volger



Endorsers:



Project Coordinator: elementenergy

Infrastructure providers:



Car manufacturers: DAIMLER

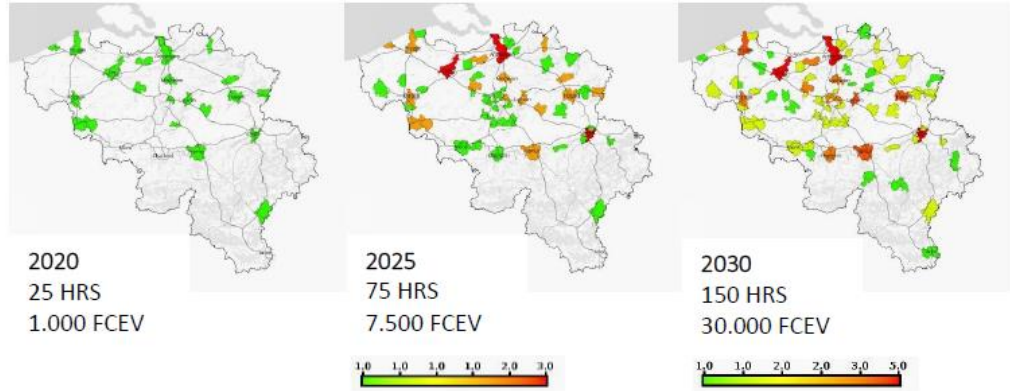


Data monitoring and dissemination:



H₂MOBILITY BELGIUM

- European TEN-T programme
- To develop a National Implementation Plan for the implementation of a hydrogen refuelling infrastructure in Belgium
- To prepare the Belgian market for the introduction of fuel cell electric vehicles, focussing on passenger cars and buses
- Funding: TEN-T & Vlaamse Overheid



Period	HRS	Flanders	Brussels	Wallonia
2015-2020	25	20	0	5
2020-2025	75	50	5	20
2025-2030	150	100	10	40

Period	FCEV	Buses	Hydrogen (ton)	Electricity (TWh)
2015-2020	1.000	50	650	0,04
2020-2025	7.500	250	3875	0,22
2025-2030	30.000	500	11500	0,67

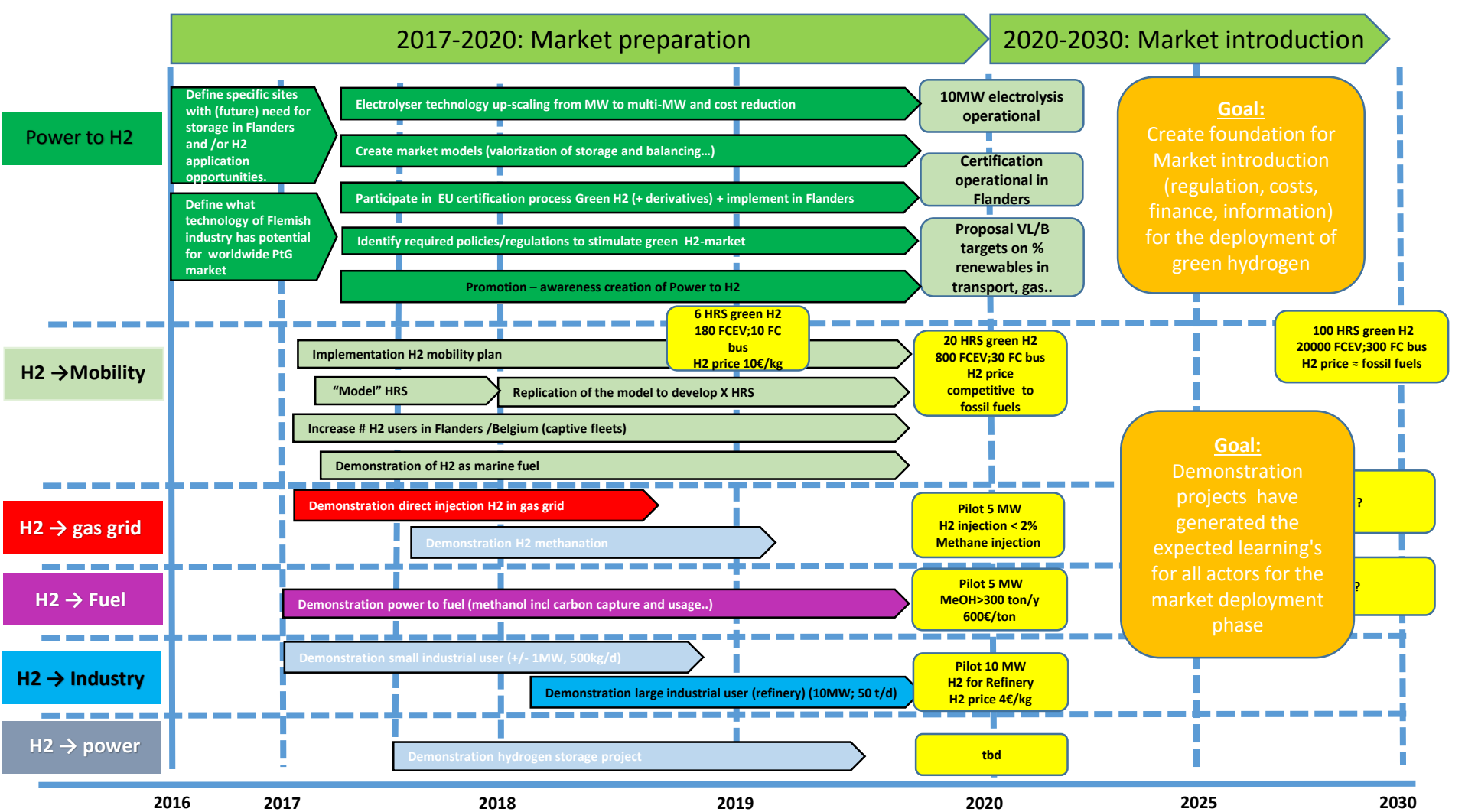


OBJECTIVES AND ACTIVITIES OF THE CLUSTER

- Development of power to gas **demonstration projects** in Flanders
- Creation of innovative **business models** to enable a future profitable power to gas market
- **Knowledge sharing** with respect to power to gas concepts
- Positioning of the Flemish industry in the **European** power to gas market
- Acting as **preferred contact point** for Flemish/Belgian policy-makers for role of power to gas in future energy strategy

ROADMAP POWER TO GAS FLANDERS (DRAFT)

- ❑ Most interesting valorisation pathways from roadmap study
- ❑ Input from partners

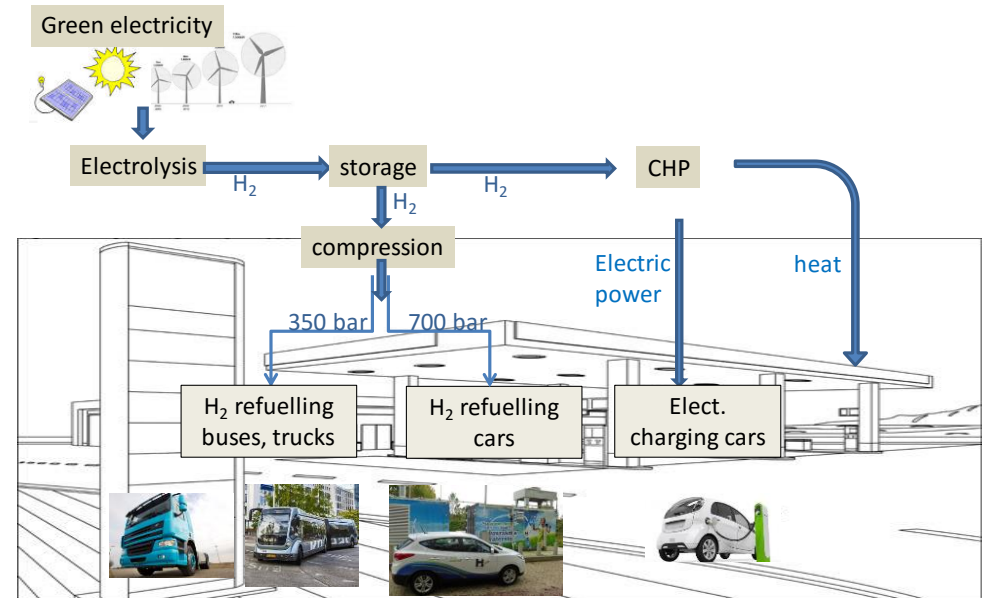


PROJECT IDEAS / TEAMS

1. Power to Mobility : refuelling station of the future incl. users: cars, buses, trucks
2. Power to gas: direct injection of H₂ in gas grid
3. Power to fuel: conversion of H₂ with recycled CO₂ into methanol
4. Off-shore wind energy to hydrogen
5. Use of Hydrogen as a marine fuel
6. Certification / regulations

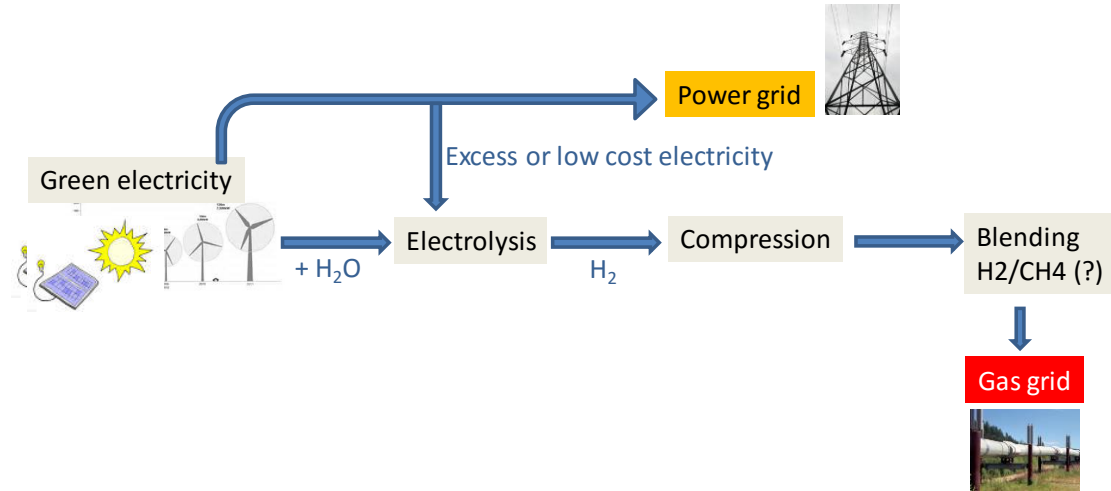
1. REFUELLING STATION OF THE FUTURE

- Model HRS
- Direct coupling to green energy production?
- Include captive fleet in project
- Location defined by energy prod. and fleet
- Smart grid environment



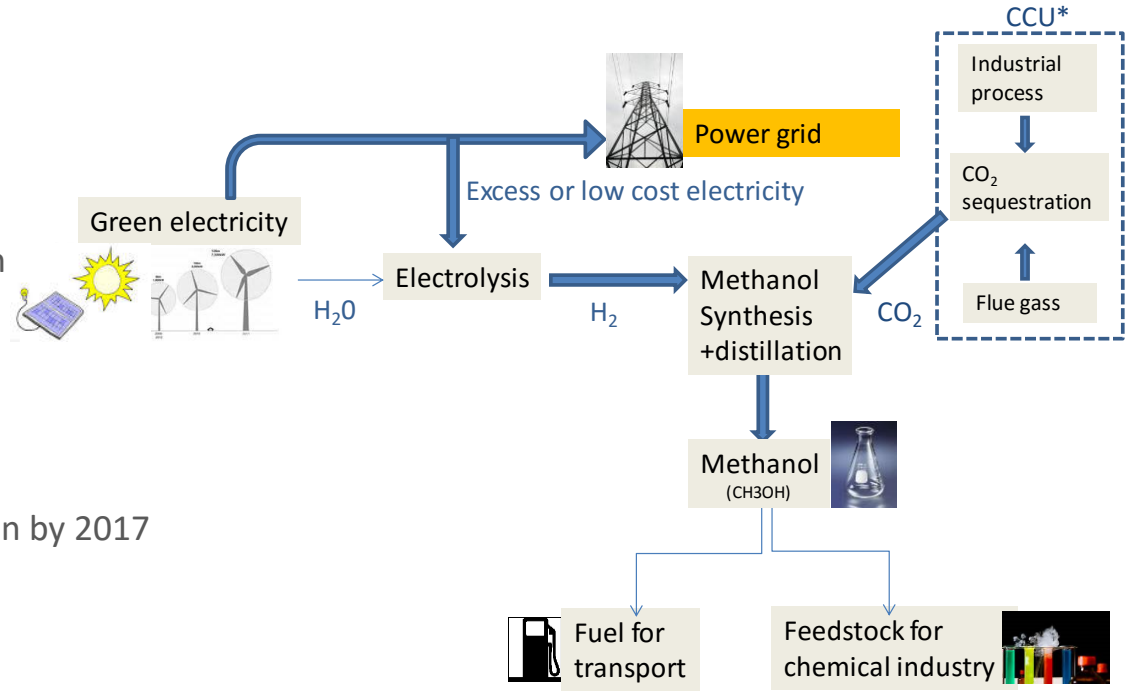
2. LARGE SCALE ELECTROLYSIS AND INJECTION IN GAS GRID

- ❑ Multi-MW electrolysis
- ❑ Location:
 - windfarm + gas terminal (Zeebrugge?)
- ❑ “Green” gas
- ❑ % of H₂ that can be injected
(technical issues and regulations)



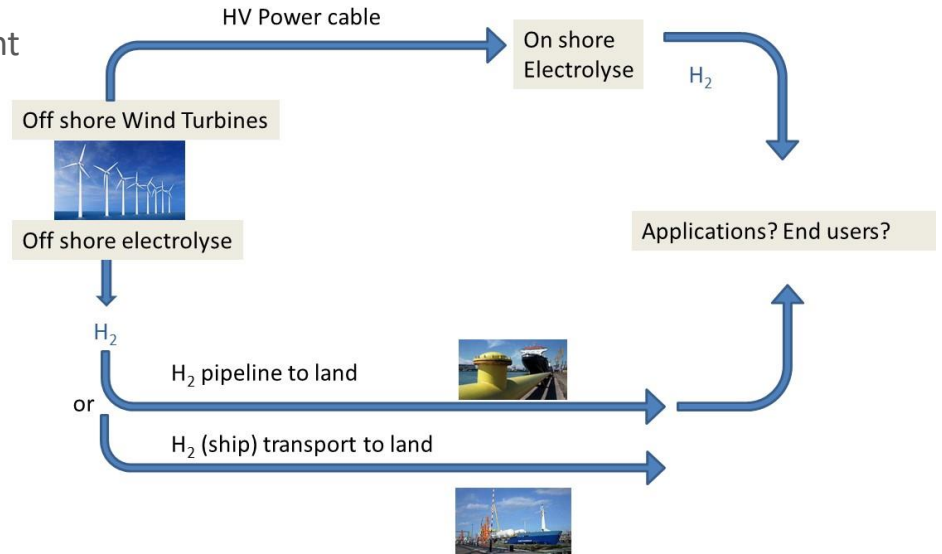
3. POWER TO FUELS

- ❑ Multi-MW electrolysis
 - ❑ Location:
 - Port of Antwerp
 - ❑ “Advanced fuel” fitting in EU regulation
 - RED (10% RE in transport)
(double counting of A.F.)
 - FQD (6% CO₂ reduction fuels)
- ⇒ To be translated into national legislation by 2017
- ❑ Marine application ?



4. OFF-SHORE ENERGY

- ❑ Multi-MW electrolysis
- ❑ Application of electrolysis in maritime environment
(Electrolysis with sea-water..)
- ❑ Cost of transporting electricity versus H2 to land
- ❑ Use of H2 on sea (marine applications)

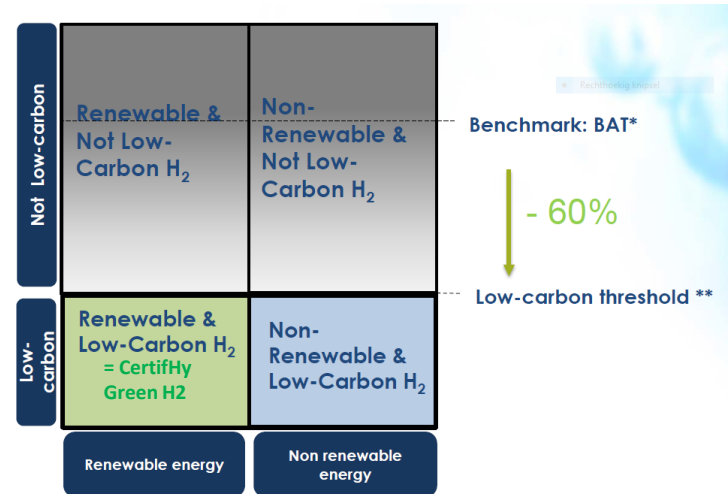


5. USE OF HYDROGEN AS A MARINE FUEL

- ❑ Driving force to decarbonise marine fuels
 - More stringent regulation on heavy fuel
 - Air pollution emissions from ships are continuously growing (in contrast to land transport)
- ❑ Combination with renewables ; availability of wind-energy along waterways
- ❑ Fundamental questions to explore:
 - Fuel cell or combustion (hybrid with fossil fuel)?
 - Desired power/action radius and amount of H₂ required?
 - Supply of hydrogen (given required quantity)? Pipeline?
 - Liquid fuel (liquid H₂ or methanol)?

6. CERTIFICATION / REGULATION

- ❑ Monitoring and/or participation in EU CertifHy project (?)
 - CertifHy 1.0: Definition of Green Hydrogen + design and implementation of EU wide robust GO scheme
 - Aim: Create a market for Green H2
 - CertifHy 2.0: Development and pilot implementation (3 member states) of a green H2 G.O. scheme
- ❑ Target: Make Flanders/Belgium one of the pilot regions in this project
- ❑ Next steps: formation of / join project team for FCH-JU call



- Best Available Technology
= Natural gas steam methane reforming,
= >95% of the provided merchant hydrogen market
** cfr RED reduction requirement

OVERVIEW COMING EU FUNDING OPTIONS

	Subjects	Remarks	% support	Call open	Submission
Interreg NW-Europe (call 4)	Low carbon technologies, Transport	Step 1: Call for concepts Step 2: full proposals	Max. 60%	Oct 17, 2017 Tbd 2017	Nov18, 2016 Tbd 2017
TEN-T Synergy	Interoperability of electricity and gas networks across borders	Limited to "PCI" sites	Max. 60%	Sept 2016	Dec 2016?
JU-FCH	Transport/Energy	Limited to fixed list of topics	40-100%	Jan 2017	May 2017
Interreg VL-NL	Low carbon technologies		Max. 60%	tbd	tbd
Interreg F-Wall-VL	Environment	Step 1: Call for concepts Step 2: full proposals	Max. 60%	Sept 1, 2016 Tbd 2017	Nov3, 2016 tbd 2017
Interreg Noordzeeregio (call 4)	Green transport and mobility	Step 1: prep./expr. of interest Step 2: full proposals	Max. 60%	Nov 2016 Jan 2018	Aug 2017 March 2018
Interreg 2 seas (call3)	Low carbon technologies, maritime dimension	Step 1: Call for concepts Step 2: full proposals	Max. 60%	Sept 1, 2016 Feb1, 2017	Oct 28, 2016 May 2, 2017

EU FUNDING OPTIONS –DETAILS AND LIMITATIONS

- **TEN-T Synergy:** limited to “PCI’s” => in Belgium: high Voltage sub-sea “Nemo link” between Belgium (Zeebrugge) and (Richborough) UK.
- **FCH-JU:** subjects to be determined but expected to contain:
 - Large scale HRS + FCEV
 - Upscaling electrolyser (10MW) with injection of hydrogen in gas grid
 - Follow-up of CertifHy
- **Interreg projects** require partners from different member states
 - E.g. 2seas => UK partner required

OTHER FUNDING OPTIONS

- **VLAIO**: KMO-innovatie-projecten ; support up to 35% + 10% (D.O.; cooperation etc..)
- **Horizon 2020**: Demonstration of the most promising advanced biofuel pathways
 - 2017: biofuels from the carbon content in flue gases of industrial wastes through biochemical and/or biological conversion
- Co-funding from **Flemish Government** and **Provincial development organisations**
 - Typically 10%

ORGANISATION AND WOW CLUSTER (1)

- **Project teams**
 - Sub-groups within cluster, per project-idea
 - Separate planning / meetings
- **Meetings**
 - 3-monthly meeting, organisation WN
 - Varying location (@ different partners)
 - Will be planned for 2017 ; next meeting mid november
 - Content: Status project teams- overview “news” from projects – contributions of partners...
 - Limited to cluster partners
- **Website/knowledge sharing**
 - Website of Power to gas Roadmap => transform into Website Power to Gas cluster
 - Content? (discussion)

WEBSITE

About the cluster Roadmap study News Documents (members only)

www.power-to-gas.be

POWERTO GAS
Roadmap for Flanders

Home About the project Power To Gas Partners Contact

● ● ● ●

About the project

The objective of the project 'Power-to-gas' is to develop a roadmap which will analyze the different Power-to-Gas options available today and determine how the Flemish industry can position itself in this future promising market.

[Read more](#)

Power To Gas

Storing large quantities of renewable electricity in hydrogen (Power-to-Gas) is a solution to balance the electricity infrastructure and keep the energy supply in control.

[Read more](#)

Partners

The following partners participate in the project.

[Read more](#)

Funded by Agentschap Ondernemen and Vlaamse Overheid

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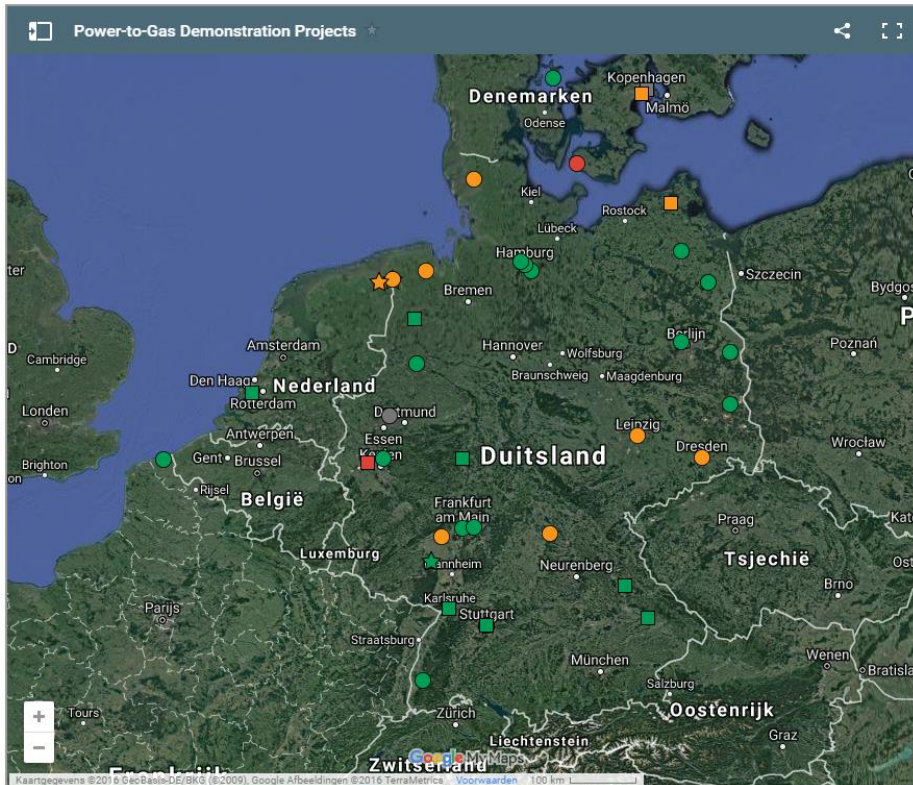
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13/09/2016

ORGANISATION AND WOW CLUSTER (2)

- **Visit relevant Power to Gas project** (1/year)
- **Promotion material and –activities**
 - Banner + same text on paper is being made
 - More extended brochure will be made after +/- half year
- **Procedure for candidate cluster members**
 - In principle the cluster is open for new candidates
 - Presentation of new members in 3-monthly meetings

Question: are there obvious partners we miss in the consortium?
- **Administration – Member fee etc.**
 - Vlaio meeting 29/9 => further details
 - Invoices will be sent to members

INTERNATIONAL PROJECTS POWER TO GAS



<http://www.europeanpowertogas.com/demonstrations>

INTERESTING DEMO-PROJECTS POWER TO GAS

Project	Location	Description	Scale	Status
Audi e-gas project (power to gas)	Werlte (D)	<ul style="list-style-type: none"> Electrolysis and methanation CO₂ from Biomethane plant exhaust Methane injected in natural gas grid Audi customers can fuel e-gas at 650 locations in Germany 	6,3MW Electrolysis (3 Alkaline electrolyzers)) 1,000 metric tons of e-gas per year	Operational since 2013
Wind-gas project (power to gas)	Hamburg (D)	<ul style="list-style-type: none"> Electrolysis; injection of H₂ in gas grid 	1MW Electrolysis (PEM) 290Nm ³ /h H ₂	Operational
Biocat project (power to gas)	Kopenhagen (DK)	<ul style="list-style-type: none"> Electrolysis and biological methanation Methane injected in gas grid Ancillary services by varying power intake 	1 MW Electrol.(Alkaline) Produces from grid when prices are low	Operational since mid 2016
Myrte project (power to power)	Ajaccio (Corsica, F)	<ul style="list-style-type: none"> The coupling of a solar power plant to a hydrogen energy storage system. 	110kW -23Nm³/h Electrolyser and the related gas storage 150 kW fuel cell unit,	Operational
Don Quichote (power to mobility + power to power)	Halle (B)	<ul style="list-style-type: none"> Electrolysis Fuelling of forklifts Fuel cell to re-convert H₂ to power 	150kW – 30Nm³/h Alkaline electrolyser 150kW -30Nm³/h PEM electrolyser 120kW fuel cell	Operational

INTERACTIONS WITH OTHER ORGANISATIONS

Organisation or Task Force	Aim	Cluster member participation
European Power to Gas platform	Explore the viability of power-to-gas in Europe	Fluxys/Hydrogenics
HIPS-NET Hydrogen in Pipeline Systems	Aims to establish a common European understanding on the H₂tolerance of the existing natural gas grid.	Fluxys via Synergrid
HyReady	Engineering Guidelines for Preparing Natural Gas Networks for Hydrogen Injection	-
IEA/HIA International Energy Agency / Hydrogen Implementing Agreement	Management of coordinated hydrogen research, development and demonstration activities on a global basis. 10 tasks running; task 38= Power to H2 and H2 to x <ul style="list-style-type: none"> Understanding of the various technical and economic pathways for power-to-hydrogen applications in diverse situations Assessment of existing legal frameworks General guidelines and recommendations that enhance hydrogen system deployment in energy markets 	WaterstofNet Hydrogenics/Air Liquide
ISO/TC197 CEN/CENELEC /TC6	Standardization in the field of systems and devices for the production, storage, transport, measurement and use of hydrogen	-WaterstofNet Contact via JRC
CEN/CENELEC Sector Forum Energy Management Working Group (WG) on Hydrogen	Identify the needs for standardisation regarding Power to Hydrogen	Eandis, Hydrogenics WaterstofNet Contact via JRC

NEXT STEPS + PRACTICAL ARRANGEMENTS

- Before Sept 30, partners indicate in which PT they want to participate
- Mail will be sent to partners with request for:
 - project team(s) to participate in
 - contact person for project team(s)
 - financial responsible (cluster member fee)
- October-Nov-Dec: work out possible project proposals in PT's + indication of possible EU funding programs

COMING EVENTS

- Oct 12: Presentation of Cluster on, “Innovation event” at C-Mine Genk
 - proposal for banner will be sent around in coming weeks
- Oct 25: Congres WaterstofNet in Antwerp (Horta)
- Kanaal Z series of 4 broadcasts on hydrogen (Z-Energy, on Tuesday)

LIST OF PARTICIPANTS

Name	Company
Didier Van Osselaer	Port of Antwerp
Geert Schrooten	Port of Antwerp
Bart Goddyn	Aspiravi
Stefan Cauwels	Van Wingen
Jonas Cautaearts	Colruyt
Christian Nachtergaele	Air Liquide
Wim Velghe	Air Liquide
Vincent Vancaeyzeele	Eandis
Rik Vreys	Hydrogenics
Denis Thomas	Hydrogenics
Filip Smeets	Hydrogenics
Despoina Chatzikyriakou	Toyota
Jan Winters	Polders Investeringsfonds
Hans Magits	Atlas Copco

Name	Company
Andre Jurres	NPG Energy
Christijn Vanmol	NPG Energy
Noel D' hondt	Aertssen/Terranova Solar
Yannick Renier	Aertssen/Terranova Solar
Greg Aertssen	Aertssen/Terranova Solar
Frank Verschraegen	Deme
Johan Maes	Deme
Geert Degroote	Pitpoint
Marcel Meeus	Umicore
Ben Cornelis	E-trucks
Hany Aouad	Fluxys
Ruud Bouwman	VDL
Jan D'Haeyer	Shipit
Adwin Martens	WaterstofNet
Isabel François	WaterstofNet

CLOSURE

