

CLUSTER “PLATFORM POWER TO GAS”

General meeting

November 18, 2016

Oevel

AGENTSCHAP
INNOVEREN &
ONDERNEMEN



Vlaanderen
is ondernemen



AGENDA

13.00

- | | | |
|-------|--|-------------------------|
| 13.00 | Introduction from VLAIO about Flemish clusters | Jozef Ghijselen (VLAIO) |
| 13.15 | Status project-teams | Isabel (WN) |
| 13.50 | End-result CertifHy 1.0 (Green H2) project +possible next steps | Denis (HYGS) |
| 14.10 | Running PtG-projects in which Hydrogenics is involved | Jan (HYGS) |
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Practical items (Website, banners, next meetings...)
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| 14.45 | Varia -Questions-discussions | All |

15.00-16.00

Introduction and visit to Hybalance equipment @ Hydrogenics



Vlaanderen
is ondernemen

Innovatieve bedrijfsnetwerken

Bart De Caesemaeker, Jozef Ghijsselen

Kick-off IBN Power to Gas
Hydrogenics Oevel, 18 november 2016

**AGENTSCHAP
INNOVEREN & ONDERNEMEN**

VLAIO: duurzame economische groei en jobcreatie

- ▶ Ondernemerschap stimuleren
- ▶ Verhogen van het innoverend vermogen van Vlaamse ondernemingen
- ▶ Het creëren van stimulerende omgevingsfactoren voor ondernemen



inspireren



informereren



ondersteunen



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**AGENTSCHAP
INNOVEREN & ONDERNEMEN**

VLAIO: in cijfers

370

aantal
medewerkers

127.260

maandelijkse
websitebezoeken

510 mio euro

Subsidie
budget



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AGENTSCHAP
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VLAIO: voor wie



rechtstreeks

voor de
(kandidaat-) ondernemer
langsheen hun
volledig ondernemerspad

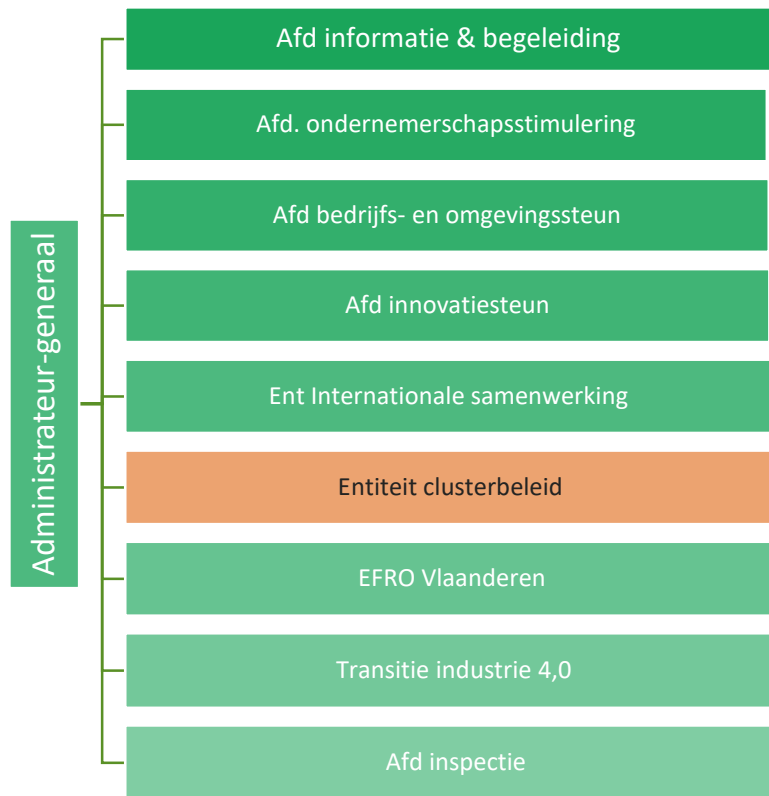


via

een vertrouwenspersoon
van de ondernemer

Vb: **CLUSTER** organisatie

VLAIO: structuur



Doelstellingen vernieuwd clusterbeleid

- Het ontsluiten van **onbenut economisch potentieel** en de realisatie van **competitiviteitsverhoging** bij Vlaamse ondernemingen via een actieve en duurzame **samenwerking** tussen actoren.
- Bijdragen aan de oplossing van **maatschappelijke uitdagingen** met een **directe economische meerwaarde** voor Vlaamse ondernemingen.

Er wordt van clusters verwacht dat ze **economische meerwaarde creëren** onder de vorm van omzetgroei door export en/of nieuwe markten, jobcreatie en competentieontwikkeling, investeringen, kostenreductie, ...

Verwachtingen van Innovatieve bedrijfsnetwerken

- **Actieve betrokkenheid** en directe sturing door **bedrijven**
- **Samenwerking** tussen bedrijven als rode draad
- **Gedragen** visie:
 - actieplan/competitiviteitsverhoging **op maat van leden**
 - wegwerken **gemeenschappelijke** (kennis)**drempels**
 - inspelen op **gemeenschappelijke opportuniteiten**
- **Dynamiek op gang brengen**
- **Clusterorganisatie** als facilitator

Stuurgroep

- ▶ **Representatieve vertegenwoordiging** clusterleden, voorgezeten door vertegenwoordiger van een bedrijf
- ▶ Taak: **Actieve rol bij aansturing en opvolging** IBN-project
- ▶ **Reglement van Orde**: samenstelling en werking van de stuurgroep
- ▶ Vergaderfrequentie: **minimaal 2x/jaar**
- ▶ Waarnemer van het Agentschap wordt uitgenodigd
- ▶ Verslag naar clusters@vlaio.be

Subsidie en cofinanciering

- ▶ Subsidie clusterprojecten op jaarbasis (50%)
- ▶ Cofinanciering op jaarbasis (50%)
 - ondernemingen actief binnen clusterwerking
 - cofinancieringsbronnen

Uw aanspreekpunt

Bart De Caesemaeker



Power to gas
Offshore energie

Marc Meeus



Innovatieve Coatings
Flanders Bike Valley

Jos Swinnen



Bouw Informatie Modellen
Off-Site construction

Jeroen Fiers



Euka
Air Cargo Belgium
Eggsplare

Digitising Manufacturing

Jozef Ghijsselen



Groen Licht Vlaanderen
Smart Digital Farming

Vicky Wildemeersch



IBN Composieten

Ria Bruynseels





Contact voor
IBN Power to Gas:

Bart De Caesemaeker
02/432.42.49

bart.decaesemaeker@vlaio.be

www.vlaio.be/clusters

AGENTSCHAP
INNOVEREN & ONDERNEMEN

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6 PROJECT TEAMS

Power to Mobility



H₂ refuelling stations/users

Air Liquide,
Atlas Copco
Colruyt
Eandis,
E-trucks,
Hydrogenics

NPG
Pitpoint
Terranova Solar
Toyota
Umicore
Van Wingen
VDL

Off-shore wind



Storage large energy volumes

Aspiravi,
Colruyt,
Deme,
Hydrogenics,
Toyota

Power to Gas



H₂ injection in gas grid

Aspiravi
Atlas Copco,
Colruyt,
Eandis,
Fluxys
Hydrogenics,

H₂ for marine application



H₂ or methanol in ships

Air Liquide,
Deme
Havenbedrijf Antwerpen,
Shipit
Van Wingen,

Power to Fuel



H₂ + CO₂ → methanol

Eandis,
Havenbedrijf Antwerpen,
Hydrogenics,
Toyota

Certification



be green

“Green” H₂, gas, methanol..

Air Liquide
Colruyt,
Eandis,
Havenbedrijf Antwerpen,
Hydrogenics
Polders Investeringsfonds

1. REFUELLING STATION OF THE FUTURE

□ Way of working:

Power to Mobility			
1	Propose a list of possible project locations (near wind/solar/biomass energy production) + send to partners for feedback	<i>WaterstofNet</i>	<i>October</i>
2	Meeting project team: discuss pro's/con's locations + make selection ; rough blueprint of possible projects; next steps	<i>Project Team</i>	<i>October-November</i>

□ Possible locations proposed / feedback from partners

□ Next week 25/11 meeting @ Terranova

- Start from Terranova Case => apply same way of working to other locations

POSSIBLE LOCATIONS FOR HRS

LOCATION	Energy source	Installed power	Assets	Potential users
Terranova solar Zelzate	Solar	15MW	Port of Ghent	
NPG biopower Tongeren	Biogas (corn)	2,8 MW	Nearby Motorway	
Antwerpen RO (Vleemo)	Wind (2 turbines > 10y)	15MW (2 oldest 2MW per turbine)	Port of Antwerp Nearby AL H2-pipeline	
Antwerpen LO (GEHA- WAS)	Wind	33 MW (3MW per turbine)	Port of Antwerp	
Noorderkempen Loenhout	Wind	22MW (2,3 MW per turbine)	Nearby Motorway Nearby gas storage	
Zeebrugge	Wind	12MW (850kW per turbine)	Port of Zeebrugge	
H2Benelux locations	Grid		Combination with H2Benelux project	

2. LARGE SCALE ELECTROLYSIS AND INJECTION IN GAS GRID (1)

□ Way of working:

Injection in gas grid			
1	Make a rough proposal for a possible H2 injection project (Zeebrugge)	<i>WaterstofNet</i>	<i>October</i>
2	Meeting project team: discuss feasibility of starting injection project in Flanders + necessary steps that are required to prepare	<i>Project Team</i>	<i>October-November</i>
3	Visit PtG plant in Germany to learn about results, reasons to do the project, problems etc...	<i>Interested cluster members</i>	<i>November/December</i>

□ Idea: Multi-functional hydrogen project in Zeebrugge

- H2- gas injection (in gas grid or H2 pipeline?)
- Mobility application (logistics , cars or ships)
- Grid balancing
- Industrial users?
- Large scale electrolyser (+/- 5MW)

□ Discussion with ELIA on Oct 14 (Menno Janssens, Head of innovation)

MULTIFUNCTIONAL PROJECT IN ZEEBRUGGE?

Location Zeebrugge

- **All off-shore energy** from the North Sea comes to land in Zeebrugge (**Stevin Hub**, exploited by ELIA) from where it is further transported into Flanders
- Proximity of the **BELWIND off-shore wind park** (partners Colruyt Group, Deme)
- **On-shore wind park Zeebrugge strekdam** (Aspiravi)
- Zeebrugge is “**Energy-HUB**” for natural gas with interconnects to Norway and UK.
- Presence of **Fluxys** terminal for natural gas .
- Presence of **Air Liquide hydrogen pipeline**
- Zeebrugge is an important **automotive** terminal (e.g. Toyota terminal)



MULTIFUNCTIONAL PROJECT IN ZEEBRUGGE?

Coming EU funding options:

❑ TEN-T synergy call (deadline Dec 13)

- Requirement = supportive to existing Proj. Common Interests
- Studies (1M€ < allowed project budget < 2M€; 60% funding)
- Pilots (< 10M€)
- No requirement on # member states
- **Very few candidates for this call**

Date of publication of call for proposals	28 September 2016
Deadline for the submission of proposals	13 December 2016 (17:00 Brussels local time)
Evaluation of proposals	December 2016 – March 2017
Consultation of CEF Coordination Committee; Information of European Parliament	April 2017
Adoption of Selection Decision	April 2017
Preparation and signature of individual grant Agreements	From May 2017

Submit request for study project?

= Preparation of real Pilot project to be submitted in future calls?

❑ FCH-JU (deadline May 2017)

- Large scale electrolyser
- Expected allowed budget +/- 10M; 50% funding?

Submit request for pilot project:
Electrolyser + injection?

MULTIFUNCTIONAL PROJECT IN ZEEBRUGGE?

TEN-T Synergy call: support synergy actions between the transport and energy sector:

- Ensuring **sustainable and efficient transport** systems
- **Smart energy grids**
- **Electricity storage and gas storage facilities** connecting to **high-voltage electricity transmission lines or to high-pressure gas transmission pipelines**, respectively, having the potential to contribute to the **supply of energy** for use in transport, including the **conversion to alternative fuels**,

Studies without pilot: feasibility, permitting studies, financial engineering, cost-benefit analyses.

Content study project:

- **Feasibility multifunctional hydrogen project (technical, financial, permitting...):**
 - Exploration of all interfaces:
 - Electrolyser ↔ HV grid Elia (balancing)
 - Electrolyser ↔ Gas grid / H2 pipeline
 - Electrolyser ↔ (multiple) transport applications
- Overall energy flow/ grid management
- **Market / Business cases:** Mapping of possible H2 users (industrial, transport, energy providers)
Business models / identify required market conditions
- **Implementation plan**
- **Further roll out across Europe**

} including pilot on factory scale?

NEXT STEPS

- → 22/11 First indication of possible partners in Zeebrugge project
- 22/11 Visit port of Zeebrugge (with POM West-Vlaanderen) (WaterstofNet)
- 30/11 Team meeting gas injection @ Fluxys
- 13/12 Deadline for TEN-T Synergy call
Submit proposal for study?
- Jan/Feb 2017 Visit PtG project
- May 2017 Deadline FCH-JU call

3. POWER TO FUEL

□ Way of working:

Power to fuel / H2 as Marine fuel			
Remark	We propose to combine these two topics <u>initially</u>, since we see the marine application as an interesting first user for the methanol to be produced in the port of Antwerp. In parallel the PoA project proceeds with a more general application scope.		
1	Make a proposal for a project for ships on H2/methanol	<i>WaterstofNet</i>	<i>October</i>
2	Meeting project team: discuss proposal, next steps	<i>Project Team</i>	<i>October</i>

□ Running project Port of Antwerp.

- Current status: Project site selection
- 2017: Final feasibility analysis
Formation of investment partnership
Engineering
- 2018: Construction and start-up demo-plant

MARINE APPLICATIONS: H2 OR BIO-FUELS?

- JRC study 2016: <https://ec.europa.eu/jrc/en/publication/alternative-fuels-marine-and-inland-waterways-exploratory-study>

Conclusion:

- ❖ LNG and **Methanol** best alternatives (both have a “bio”-alternative)
 - ❖ Compressed H2: low energy density to volume ratio => tank size x 10 compared to Diesel
- Clean Power for transport – EU directive

Fuel	Mode	Road-passenger			Road-freight			Air	Rail	Water		
		short	medium	long	short	medium	long			inland	short-sea	maritime
LPG												
Natural Gas	LNG											
	CNG											
Electricity												
Biofuels (liquid)												
Hydrogen												

H2 / Methanol complementary solutions

POSSIBLE PROJECT SETUP “CLEAN FUEL FOR SHIPS”



Hybrid Diesel/H2 combustion (or Fuel cell?)



Revolve (UK)?

H2

Electrolysis Terranova Solar



Pipeline Air Liquide Gent



Methanol combustion



ABC ?

R&D: U-Gent (S. Verhelst)

Methanol

Power to methanol PoA

External methanol supply

CONCLUSIONS MEETING 27/10

- Both **H2** and **methanol** are interesting pathways for demonstration projects (combustion)
 - Proposals for ships to be converted to H2/methanol will be prepared
- We can start in **small project(s)** with **demonstration of both fuels** in ships, fuelled with available H2 from Air Liquide and industrial methanol
- In parallel we can work out/submit the larger projects for **green fuel production** (H2@ Terranova; methanol @ PoA) with larger budgets.
- Next step is gather **technical data** (power, autonomy..) about possible prototype ships for both H2 and methanol to **estimate budget**
- Possible funding option: **Horizon 2020 – Smart green transport / Waterborne**
(step 1 submission Jan 26, 2017)

4. OFF-SHORE ENERGY

- ❑ First team meeting wo 7/12

Off-shore wind			
1	Make an literature overview of relevant data/experiences related to electrolysis on sea, transport of H2 versus electricity to land	<i>WaterstofNet</i>	<i>October-November</i>
2	Meeting project team: define topics / opportunities to investigate	<i>Project Team</i>	<i>November</i>

6. CERTIFICATION / REGULATION

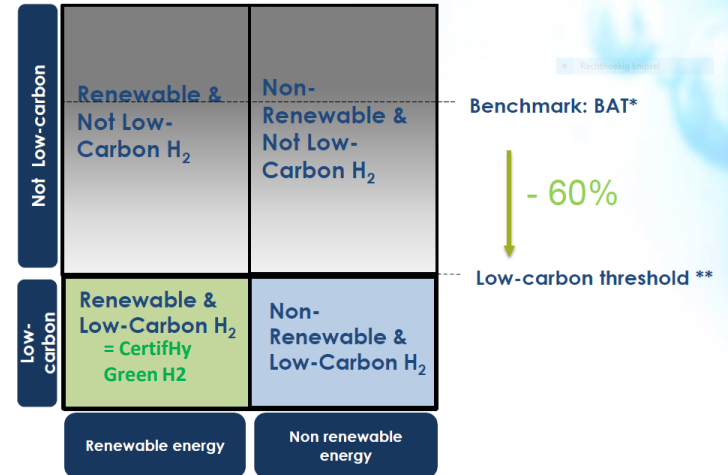
Green H2

- CertifHy 1 project finalized (see presentation Denis)
- Preparation for phase 2 (pilots) starting
 - WaterstofNet/PtG cluster involved

Advanced biofuels (liquids)

- Input from PoA

First team meeting first half of January



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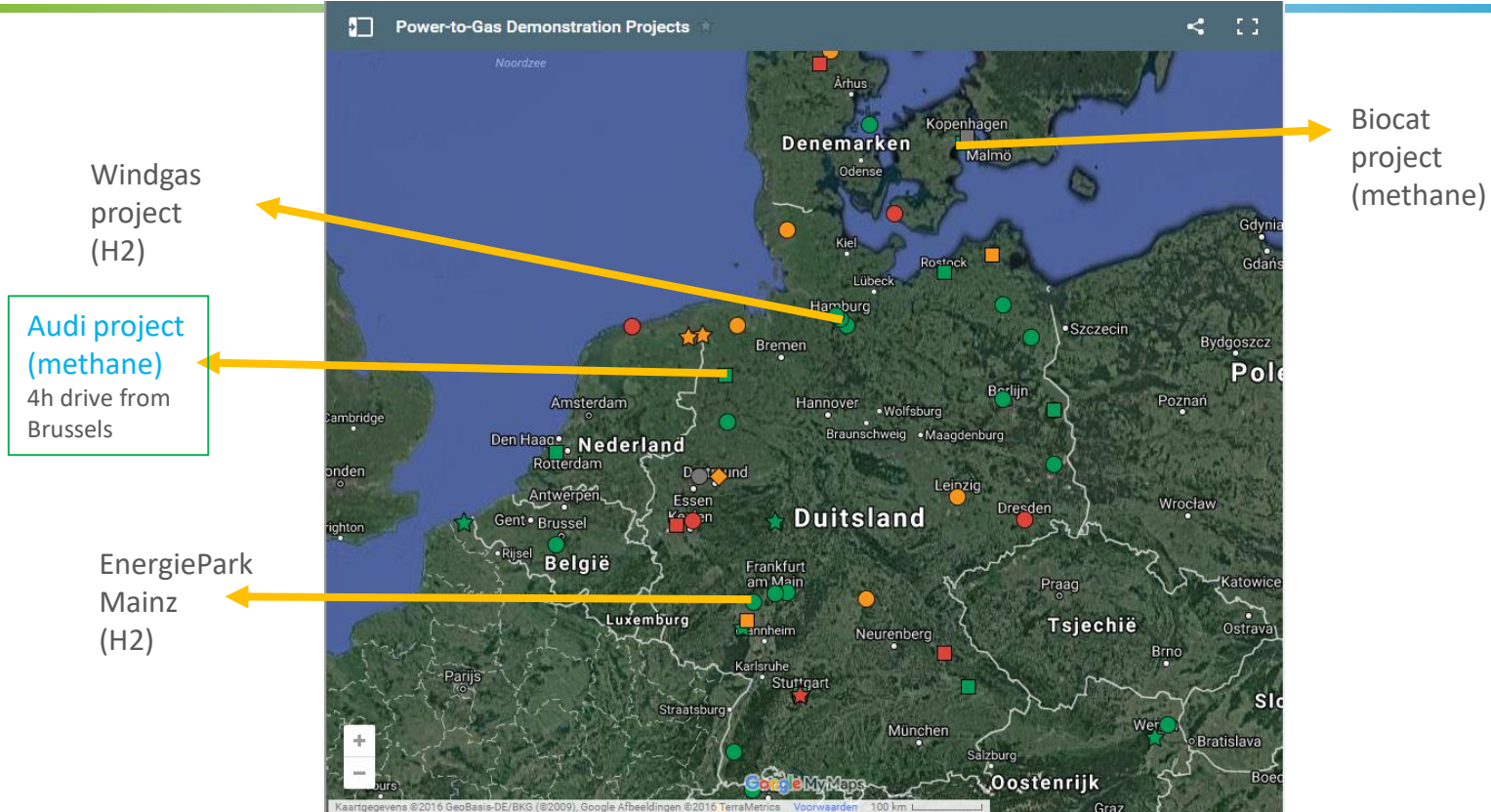
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PTG-SITES TO VISIT (GERMANY/DANMARK)

Project	Location	Technology	Main partners	Applications / Aim of the project
Audi e-gas project	Werlte (D)	Methanation 6,3MW Alkaline	Audi ETOGAS	Carbon neutral mobility for Audi customers Technical feasibility Public attention to technology Proposal: Visit 2017
Windgas project	Hamburg (D)	Direct injection of H₂ in gas grid 1MW PEM	Uniper Hydrogenics	Testing of PEM > 1MW Business models
Biocat	Kopenhagen (DK)	Methanation via biological process 1MW Alkaline	Electrochaea Hydrogenics Audi	Ancillary services by varying power intake Techn. + Economic viability of oxygen and heat recycling in the on-site wastewater operations.
Energiepark Mainz	Mainz (D)	Direct injection of H₂ in gas grid 6MW PEM	Siemens Linde	Development, testing,application of innovative technologies (large scale PEM, ionic compressor) Gas grid: heating and CHP To steam-turbine for re-electrification Trailer filling for mobility applications Proposal Visit 2018

PTG VISITS TO VISIT



INTERNATIONAL PTG COMMUNITY

❑ IEA/HIA (Hydrogen Implementing Agreement)

- **Task 33** Local H2 supply for energy applications (WN / HYGS)
- **Task 38** Power-to-Hydrogen and Hydrogen-to-X
System Analysis of the techno-economic, legal and regulatory conditions
4 years program (started Jan 2016)
Phase 1: Survey of existing studies Phase 2: Detailed (new) case studies
- **Task 39** (new): Hydrogen in maritime transport



❑ FCH-JU

- Initiative to help regions and cities to realise their decarbonisation goals
- Step 1 = MoU with cities and regions => official signing on FCH-JU stakeholder forum Nov 23
- Flanders has not signed yet; Wallonia close to signing.
- Next steps 2017-2018: setting up special working groups to define business models and roadmaps

❑ European Power to Gas: ??

PRACTICAL ITEMS CLUSTER (1)

“STUURGROEP” CLUSTER

- 2 meetings / year (to be combined with general meetings)
- Active cluster members
- “Solve issues” if that would be the case
- 1 chairman + 3 representatives

APPLICATIONS:

All members can apply -> before the end of November

PRACTICAL ITEMS CLUSTER (2)

WEBSITE POWER-TO-GAS.BE

- Website operational
- Member presentation :
please check and send required modifications

BANNER

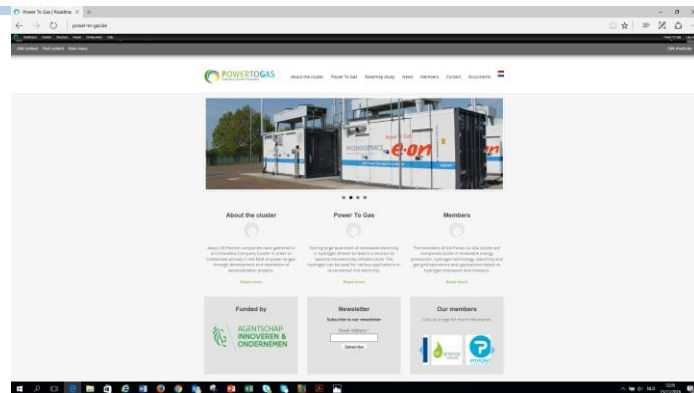
- Banner available for members (6 pcs)

BROCHURE

- To be made mid next year

MEMBERSHIP FEE

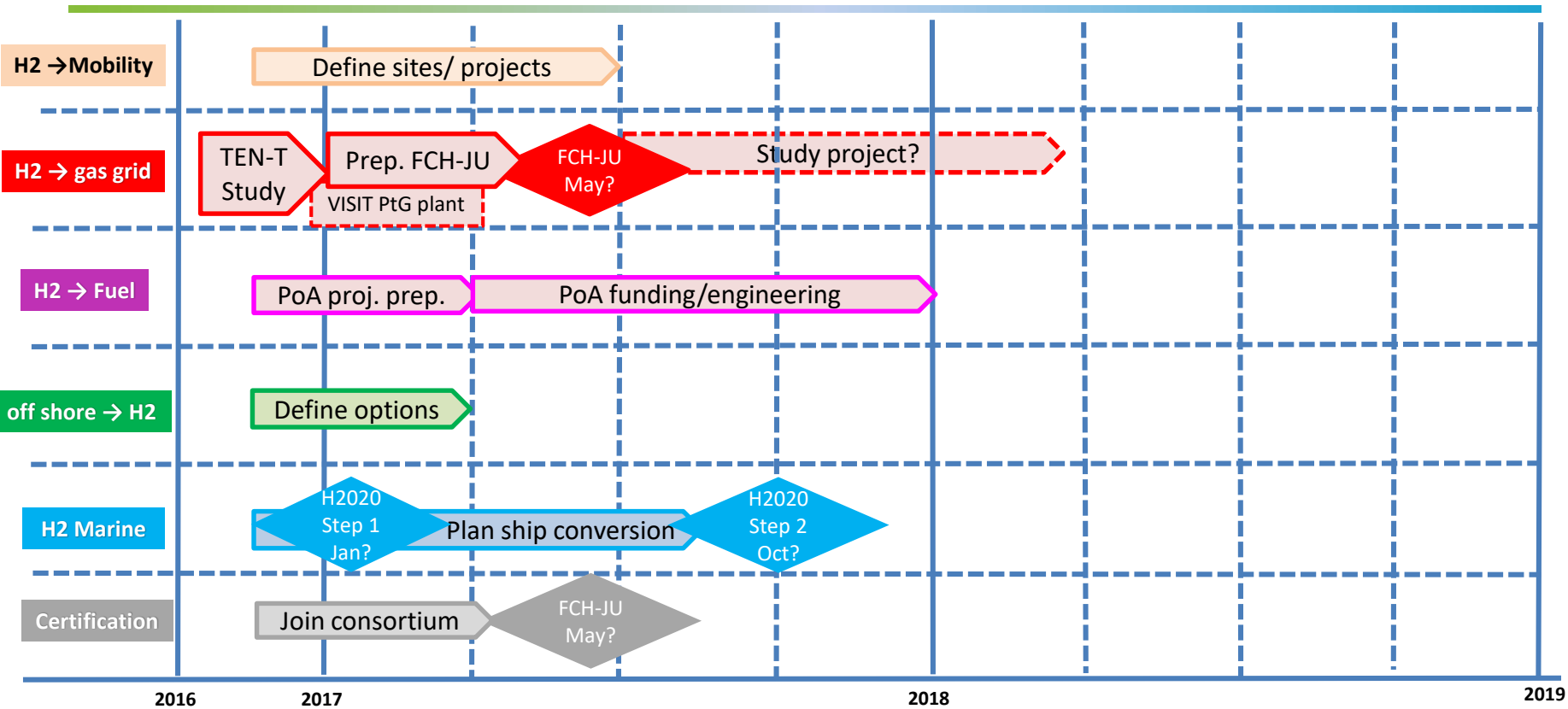
- Invoices have been sent this week



EVENTS WITH PRESENTATION OF PTG CLUSTER

- Oct. 3: Presentation of cluster (banner) on “Open bedrijvendag” @ Aertssen, @ ISVAG
- Oct 12: Presentation of Cluster on, “Innovation event” at C-Mine Genk
- Oct 25: Congres WaterstofNet in Antwerp (Horta)
- Kanaal Z series of 4 broadcasts on H2 (October)

POSSIBLE PLANNING / AMBITION



ACTIONS

- ❑ ZEEBRUGGE STUDY PROJECT (URGENT!!):
 - Indicate if you see yourself as a possible partner + which role (at the latest Mo 21/11; 17.00)
 - Be prepared for next steps in coming 3 weeks
 - Input for application document/work packages
 - Provide required documents (e.g. financial statements)

- ❑ STEERING GROUP CLUSTER: candidates apply before end of the month

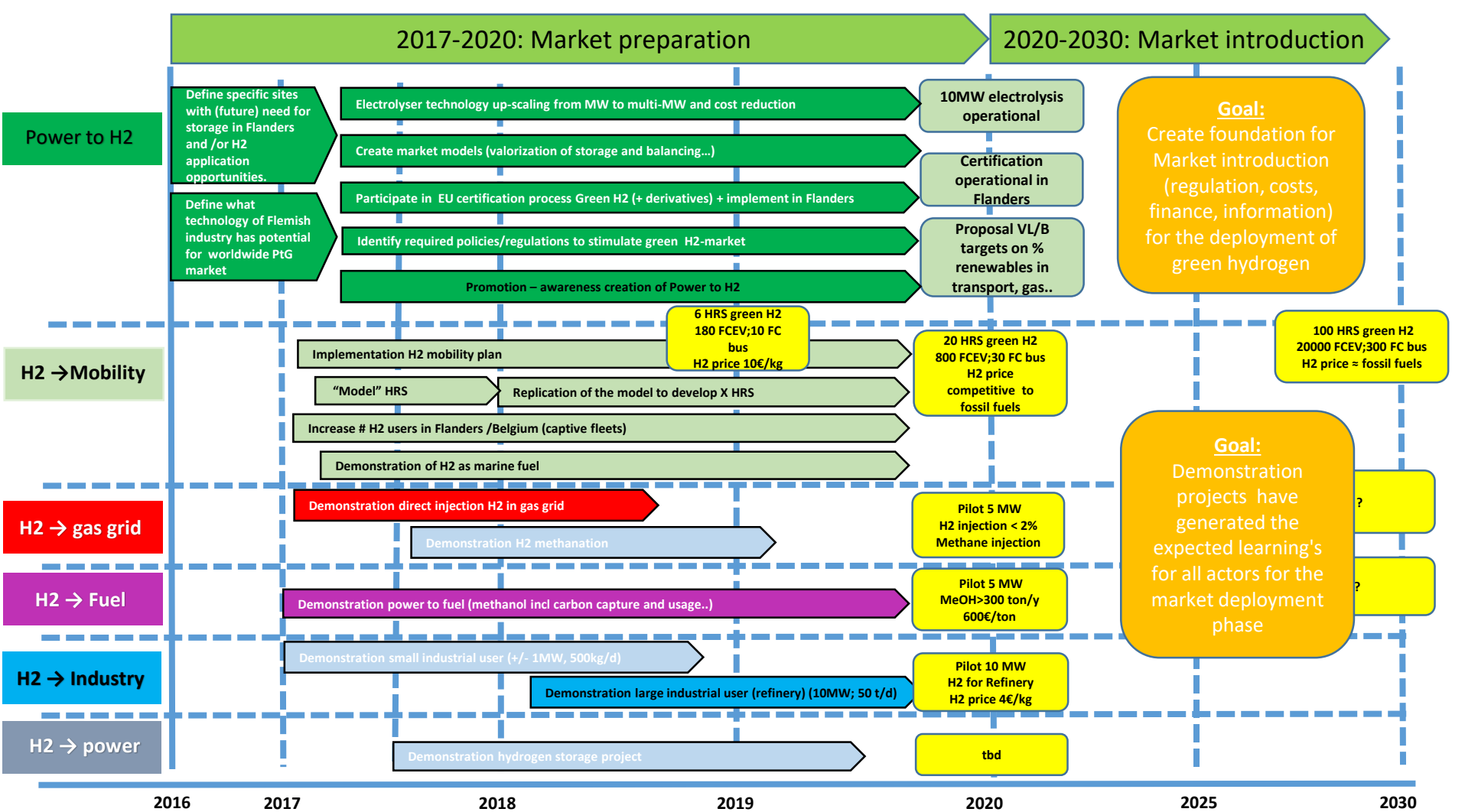
- ❑ VISIT PtG PROJECT (January): apply if you want to join

- ❑ Check company info on power-to-gas.be website and send modifications

Separate mails will be sent for all items.

CLOSURE





METHANOL FOR SHIPS

S. Verhelst U-Gent:

- Stena-lines already ship on methanol (Stena Germanica)
- Petrol engine better suited for methanol than diesel engine (but non retrofit)
 - Higher efficiency possible
 - Less emissions
 - But lower lifetime
- Volvo Penta also exists in petrol type

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

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

[LCE-19-2016-2017: Demonstration of the most promising advanced biofuel pathways](#) deadline Sept 2017

Types of action: IA Innovation action

DeadlineModel: single-stage

Planned opening date: 11 May 2017

Deadline: 07 September 2017 17:00:00

Co-funding from **Flemish Government** and **Provincial development organisations**

- Typically 10%

ADMINISTRATIVE DOC'S NEEDED FROM PARTICIPANTS

Financial capacity check form available at the following link:

<https://ec.europa.eu/inea/en/connecting-europe-facility/2016-cef-synergy-call>

AND

Financial statements (i.e. balance sheet, income statement and cash flow statement) for the last financial year for which the accounts were closed,

Operational capacity:

Appropriate documents attesting the capacity of completing the action (e.g. organisations' activity report, proof of the experience in carrying out infrastructure actions).