CLUSTER “PLATFORM POWER TO GAS”

AGENTSCHAP INNOVEREN & ONDERNEMEN
POWERTOGAS Industry Cluster Flanders
Samen voor sterk innoveren

General meeting

March 28, 2018
Halle

AGENDA

AGENTSCHAP INNOVEREN & ONDERNEMEN
POWERTOGAS Industry Cluster Flanders
Samen voor sterk innoveren

13.30	General info for the Cluster members + Introduction new cluster member Elugie	*WaterstofNet*
13.50	Short introduction on H2 experiences in Flanders / Power-to-Gas cluster for guest speakers	*WaterstofNet*
14.00	FCH-JU project regions and cities: status, results and business case tool for cities	*WaterstofNet*
14.15	Climate/Energy/clean transport plans in cities and regions and possible link with hydrogen (10' per speaker) Energielandschap (Provincie Oost-Vlaanderen) Gent Antwerpen Vlaamse Vereniging van Steden en Gemeenten (link with Flemish network Convenant of Mayers) Roeselare Sint-Truiden	 *Moira Callens* *Arne Baert* *Geert Biesemans* *Cédric Depuydt* *Bert Vanhuyse* *Dirk Bronckart*
15.15	Discussion, questions, options for follow-up	*All*
15.30	Visit of the hydrogen refueling infrastructure at Colruyt, incl. the new public station	*Jonas Cautaerts*

GENERAL INFO PTG CLUSTER

AGENTSCHAP INNOVEREN & ONDERNEMEN
POWERTOGAS Industry Cluster Flanders
Samen voor sterk innoveren

- New cluster members: Elugie, EDF Luminus, ABC motors
- PtG conference on May 7 in Horta, Antwerp; registration open!
- H2-Flanders study (for VEA) finished – currently in review phase
- Strategic workshop June as follow-up
  - To be planned in week of June 11 or June 18
- Clustermeetings September (19) and November (28) fixed
  - Agenda to be defined

Power-to-Gas Conference, May 7th: new speakers announced and final programme

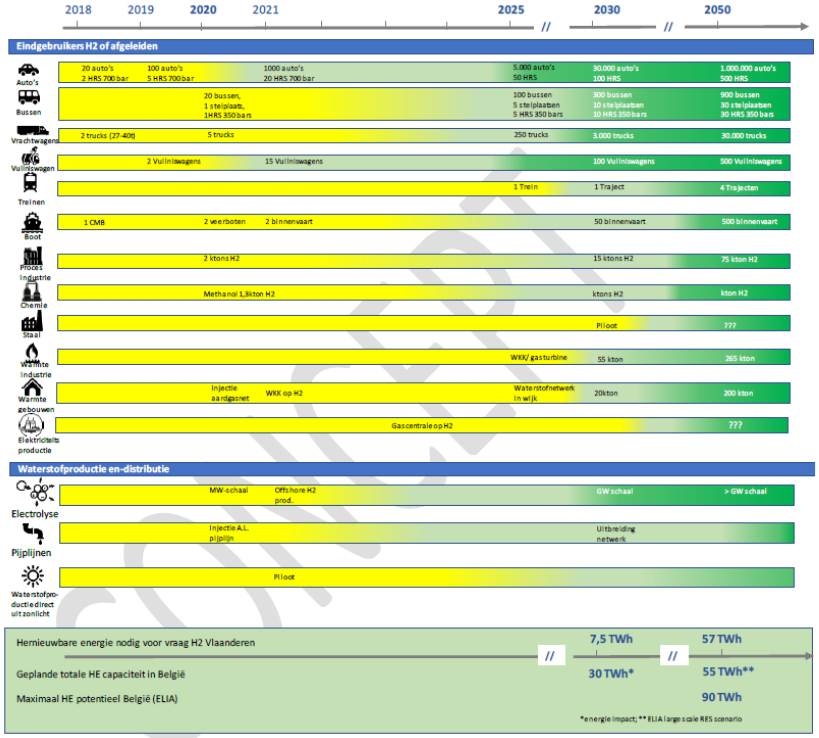
Join the Power-to-Gas Industry Cluster Flanders' international conference to be held on Monday the 7th of May in Horta Antwerp. T newly confirmed speakers are Colruyt Group, Engie and Cefic ar finalise the interesting programme During the conference the latest technology and international experiences with regard to power-to-gas will be presented, focussir on different aspects such as hydrogen production, storage, transpo legislation and the role in the future energy system. For the final programme please click below.

CONFIRMED SPEAKERS: COLRUYT GROUP, ENGIE, CEFIC, HYDROGENICS, SIEMENS, HYDROGENIOUS, E-TRUCKS, TRACTEBEL, ISVAG, TOTAL/LAMPIRIS, FCH-JU, HYDROGEN EUROPE, UGENT, TU DELFT, TERRANOVA SOLAR, VLAIO, FLEMISH MINISTER PHILIPPE MUYTERS & WATERSTOFNET

Power-to-Gas Conference
Date: May 7th 2018, 8:30 AM – 6:00 PM
Location: Horta Antwerp, Belgium

H2 FLANDERS STUDY: ROADMAP

AGENTSCHAP INNOVEREN & ONDERNEMEN
POWERTOGAS Industry Cluster Flanders
Samen voor sterk innoveren



Figuur 0.4: Routekaart voor H_2 implementatie in Vlaanderen, met indicatie van mogelijke pilootprojecten, opschaling en uitrol voor de verschillende sectoren.

NEW PARTNER PRESENTATION

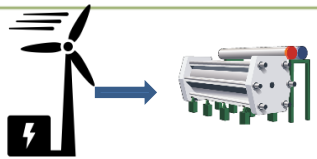
H2 EXPERIENCES IN FLANDERS

AGENTSCHAP INNOVEREN & ONDERNEMEN
POWERTOGAS Industry Cluster Flanders
Samen voor sterk innoveren

- H_2 refuelling infrastructure

- Vehicles

- H_2 production



- Power-to-Gas cluster

AGENTSCHAP INNOVEREN & ONDERNEMEN
POWERTOGAS Industry Cluster Flanders
Samen voor sterk innoveren

H2 REFUELING STATION HALLE

AGENTSCHAP INNOVEREN & ONDERNEMEN
POWERTOGAS Industry Cluster Flanders
Samen voor sterk innoveren

- Operationeel: sinds 2012
- Locatie: Halle, België
- Groene waterstof uit zon/wind
- Vlaamse leverancier, Hydrogenics
- Drukniveau: 350 bar
- Toepassing: heftrucks, 1 – 2 -12 - 75
- Grootste vloot in Europa
- **Publiek station voor auto's-trucks in 2018**

Interreg
EUROPESE UNIE
Vlaanderen-Nederland
Europees Fonds voor Regionale Ontwikkeling

PUBLIC H2 REFUELLING STATION ZAVENTEM

- Operationeel: sinds 2016
- 350 bar en 700 bar
- Bouw/exploitatie: Air Liquide
- Site: Toyota Motor Europe

- Uitrol van Toyota Mirai voor Europa wordt gecoördineerd vanuit Zaventem

- Binnen Europese programma SWARM (Joint Undertaking FC&H)

H2 REFUELLING STATIONS PLANNED

- **H2 BENELUX** : 8 stations in 3 countries

  - **3** Belgium (regio Gent-Leuven-Luik) ,
  - 4 NL, 1 LUX
  - Shell, Colruyt, PitPoint, Stedin Dcberkel
  - Belgium: Colruyt/DATS24-> green H2
  - 80 cars on H2
  - Realisation in 2018 – 2020

- **WATERSTOFREGIO 2.0**: **1** station @ ISVAG Wilrijk

  - Electricity from waste incineration
  - Realisation 2018-2019

HIGHVOCITY: 5 BUSES IN ANTWERP

Buses built by Van Hool

With fuelling station in the port of Antwerp (Innovyn).

CARS

Hyundai (ix35 Fuel cell)

Toyota (Mirai)

Typical autonomy 400-500 km - 5 kg H2 - 5 minutes refuelling

About 10-15 cars in Belgium

New Hyundai NEXO introduced, autonomy 600-800 km

GARBAGE TRUCKS

AGENTSCHAP INNOVEREN & ONDERNEMEN
POWERTOGAS Industry Cluster Flanders
Samen voor sterk innoveren

1st generation garbage vehicle (2012-2014)

- Garbage trucks built by E-trucks.
- Typical autonomy = 350 km

2nd generation project Life & GrabHy 2016-2018

- Demonstration of two new second generation garbage trucks with fuel cell within 10 EU cities
- Two different types

Upscaling Revive project 2018-2020

- Development and demonstration of 15 garbage trucks in 7 EU cities; a.o. Antwerp.

HEAVY DUTY TRANSPORT

Samen voor sterk innoveren

WaterstofRegio 2.0

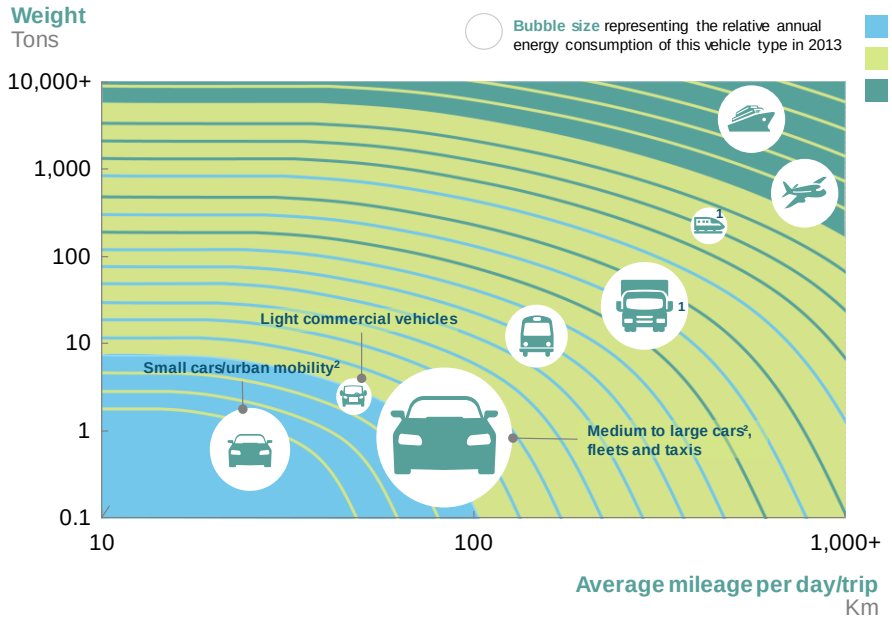
Development, demo and test program 40 ton **truck on H2 (VDL)**

H2share

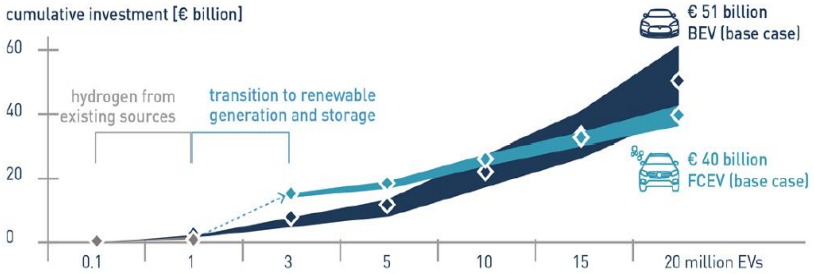
Development, demonstration 4 countries & 6 cities of 27 ton **truck on H2 (VDL)**

2018-2019

FUEL CELL VERSUS BATTERY ELECTRIC VEHICLES



- FCEV for maximal flexibility – will be important in future car sharing systems (less vehicles but more frequent use)
- Investments for large scale refuelling infrastructure for FCEV might be lower than for BEV charging infrastructure



GREEN H_2 PRODUCTION

AGENTSCHAP INNOVEREN & ONDERNEMEN
POWERTOGAS Industry Cluster Flanders
Samen voor sterk innoveren

Running

Colruyt distribution centre
From wind-solar

Planned

Wilrijk ISVAG
From waste-electricity

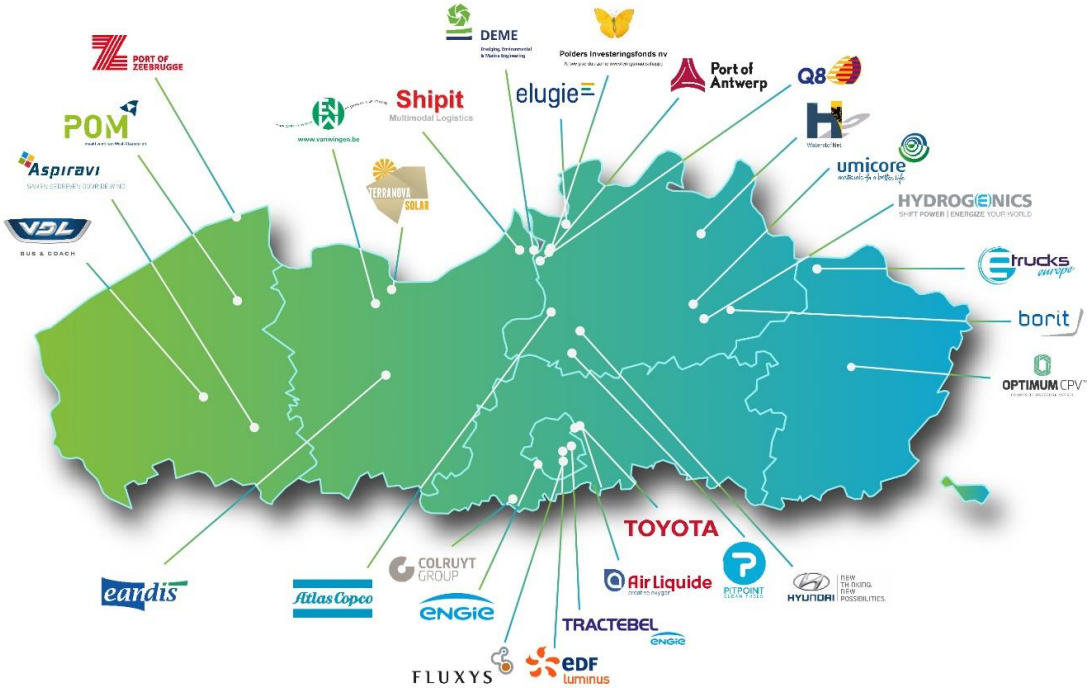
Remo-stort Houthalen
From waste via plasma gasification

Study phase

Terranova Solar Zelzate
From Solar-wind

Port of Zeebrugge
From (offshore) wind

IBN POWER-TO-GAS

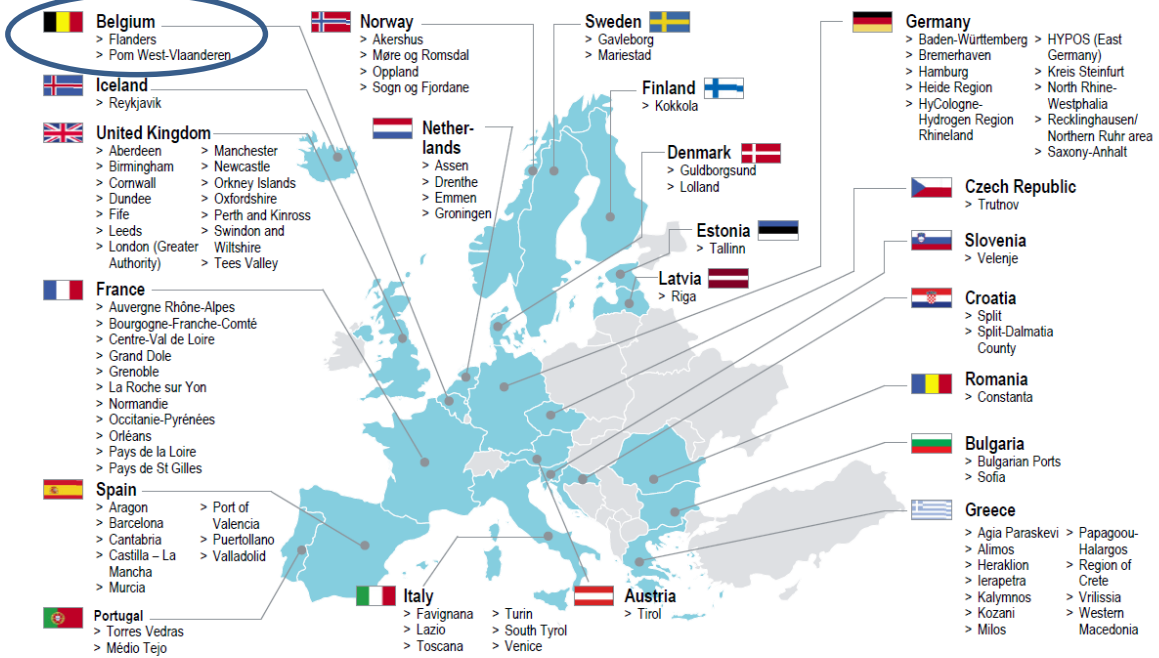


- Develop projects in Flanders
- Facilitate funding
- Ad hoc support
- Knowledge exchange
- Link with policy makers

FCH-JU PROJECT: DEVELOPMENT OF BUSINESS CASES FOR FCH APPLICATIONS FOR REGIONS AND CITIES

AGENTSCHAP INNOVEREN & ONDERNEMEN
POWERTOGAS Industry Cluster Flanders
Samen voor sterk innoveren

88 Regions and Cities from 22 countries have signed the MoU – Additional regions and cities have participated in first workshops



Legend: Map shows all Regions and Cities which have signed the MoU

FCH-JU PROJECT: DEVELOPMENT OF BUSINESS CASES FOR FCH APPLICATIONS FOR REGIONS AND CITIES

Ordered by JU - FCH, carried out by Roland Berger

Targets:

- Platform for regions on hydrogen: information, experiences
- Inventory of regional policy and regional demand for hydrogen applications
- Tools for defining regional interest in hydrogen

FCH-JU PROJECT: DEVELOPMENT OF BUSINESS CASES FOR FCH APPLICATIONS FOR REGIONS AND CITIES

Results

- 88 regions (cities to real regions)
- Flanders (min. Muyters) and West-Flanders (gedep. Bethune) signed
- Very diverse background/knowledge/experience:
  - tier 1, tier 2, tier 3
  - Collection of information (technology)
  - Exchange of experiences
  - Attempt to define collective market demand
  - On what sector governments have impact: buses, garbage trucks,….
  - Calculation tool for regions
- Final report in May 2018

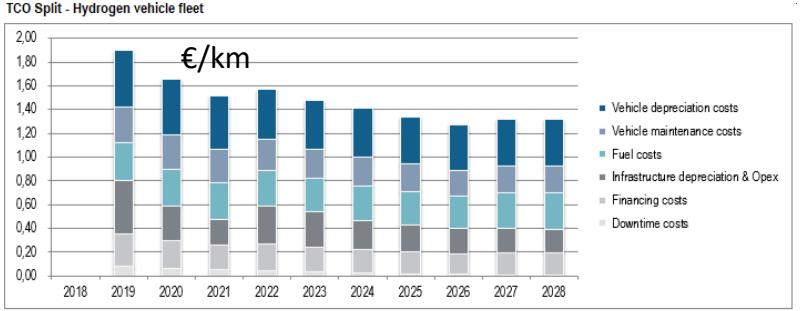
FCH-JU PROJECT: DEVELOPMENT OF BUSINESS CASES FOR FCH APPLICATIONS FOR REGIONS AND CITIES

Flanders:

- Flanders is one of the leading regions regarding actors/experiences
- Next JU-FCH call, a topic on 'Hydrogen Valley' might be defined:
  - Definition of 'Hydrogen Valley' is still unclear
  - Project might be one of tens of million €
  - Different demonstration projects, connecting markets (power to gas)
  - Combination Flanders/Netherlands can be a strong coalition
  - To be continued

“BUSINESS CASES FOR REGIONS AND CITIES”

- **Detailed business case tool**:
  Calculates TCO development - High level evolution of cost of infrastructure + vehicles
  - For different sizes of FC vehicle fleets and associated HRS/H_2 production
  - FC vehicles included : Urban buses, Cars, Delivery vans, Garbage trucks, Trains
  - Detailed cost assumptions for vehicles, HRS and H2 production



- **Funding and Financing Navigation Tool**
  - Overview of funding options
    - Per country, region, type of project beneficiary and application

REGIONS AND CITIES: BUSINESS CASE TOOL

AGENTSCHAP INNOVEREN & ONDERNEMEN
POWERTOGAS Industry Cluster Flanders
Samen voor sterk innoveren

Input parameters (calculation for 10 years):

- Number and type of vehicles per year
- Use case for the vehicles — # days of operation, daily mileage
- Number of HRS to be installed per year — # 350 bar/#700 bar
- Production method H_2 — SMR / electrolysis
- Number of green H_2 production facilities — on-site/off-site
- Depreciation period HRS / H2 production
- Electricity - water price
- Financing cost assumptions — WACC, repayment period

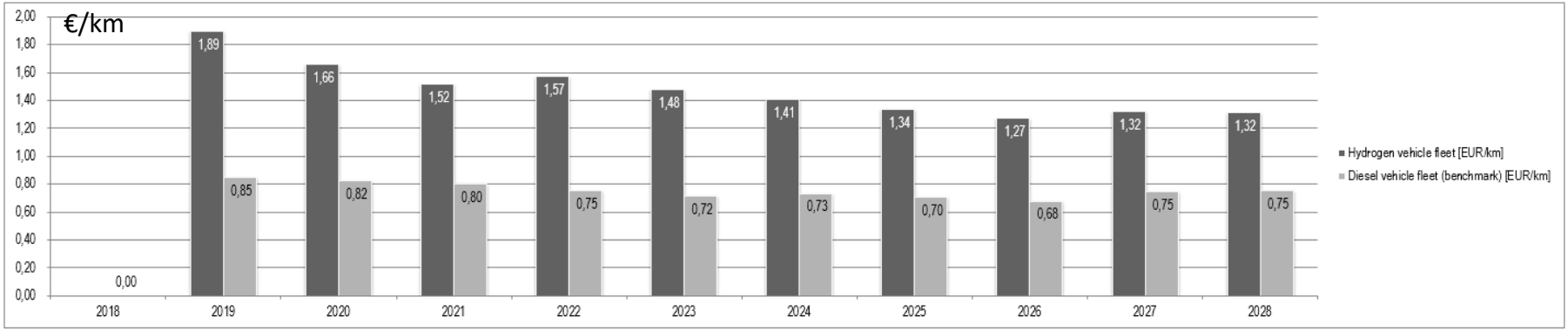
Output

- Total annual costs for H2 fleet and infrastructure (compared to reference Diesel) — total costs + cost/km
- Cash flow and NPV
- CO_2 and NOX emissions saved

REGIONS AND CITIES: BUSINESS CASE TOOL

AGENTSCHAP INNOVEREN & ONDERNEMEN
POWERTOGAS Industry Cluster Flanders
Samen voor sterk innoveren

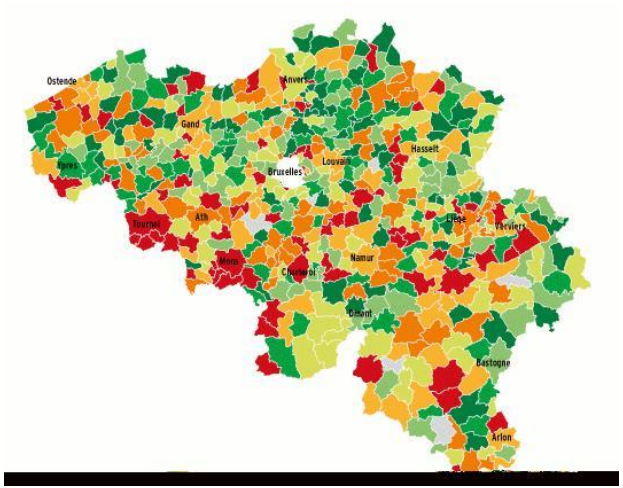
TCO comparison – Hydrogen and Diesel vehicle fleet



REGIONS AND CITIES IN FLANDERS

AGENTSCHAP INNOVEREN & ONDERNEMEN
POWERTOGAS Industry Cluster Flanders
Samen voor sterk innoveren

Energielandschap (Province of Oost-Vlaanderen)	*Moira Callens*
Gent	*Arne Baert*
Antwerpen	*Geert Biesemans*
Vlaamse Vereniging van Steden en Gemeenten	*Cedric Depuydt*
Roeselare	*Bert Vanhuyse*
Sint-Truiden	*Dirk Bronckart*



DISCUSSION

- What is the reason that H2 is not considered yet by cities?
  - Lack of knowledge and experience?
  - Lack of refuelling infrastructure?
  - Lack of suited affordable vehicles?
  - Are other technologies (e.g. batteries) sufficiently performing?

- What are most suited applications within the city fleetsfor hydrogen?

- What kind of information is needed to enable decisions?
- What is the time period for which fleet investments in the future are planned?

- Follow-up actions?