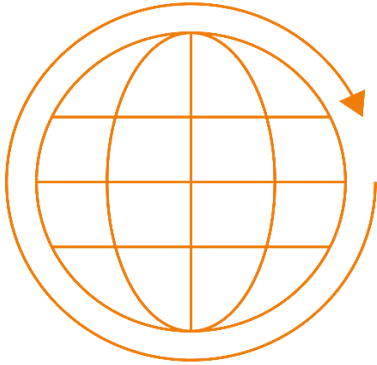


Development of green hydrogen projects for mobility and industry in Belgium

Michaël De Koster, Head of Innovation e-Mobility & Hydrogen



ENGIE: a global energy company with a strong Belgian anchoring



- Our ambition is to become the **world leader in CO2 free solutions** for our customers: companies, governments and families, both individually and collectively
- 3 energy activities are at the heart of the group's strategy: **gas, renewable energy and energy efficiency**
- Thanks to the **integrated services** we offer together with our partners, we bring our customers tailor-made solutions 'as a service'.

- Since **150 years**, ENGIE is active in Belgium and deeply anchored in society
- Almost **17.000 people** work for ENGIE in Belgium, and we are recruiting over 1.000 new employees. 225 employees are solely dedicated to R&D
- **Together we deliver** low carbon power production, mobility solutions, energy efficiency, energy management, gas and electricity supply, etc.

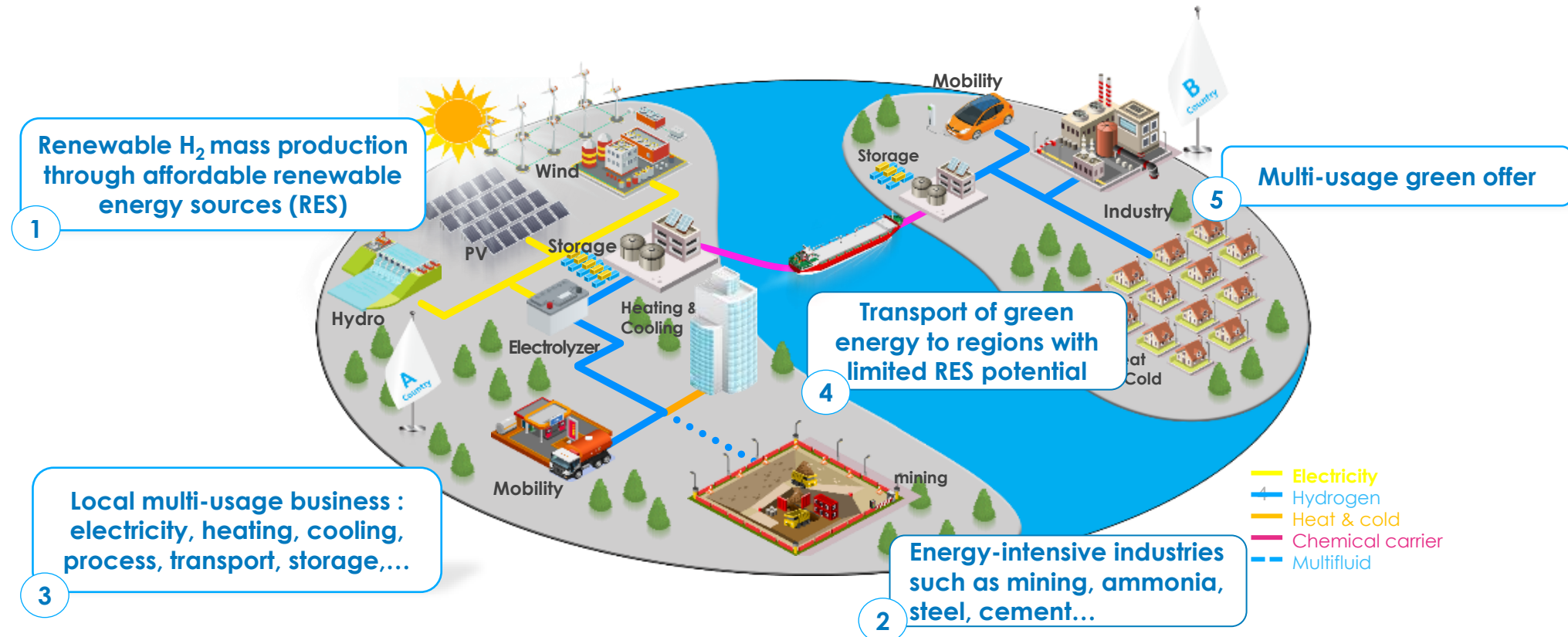


ENGIE in Belgium



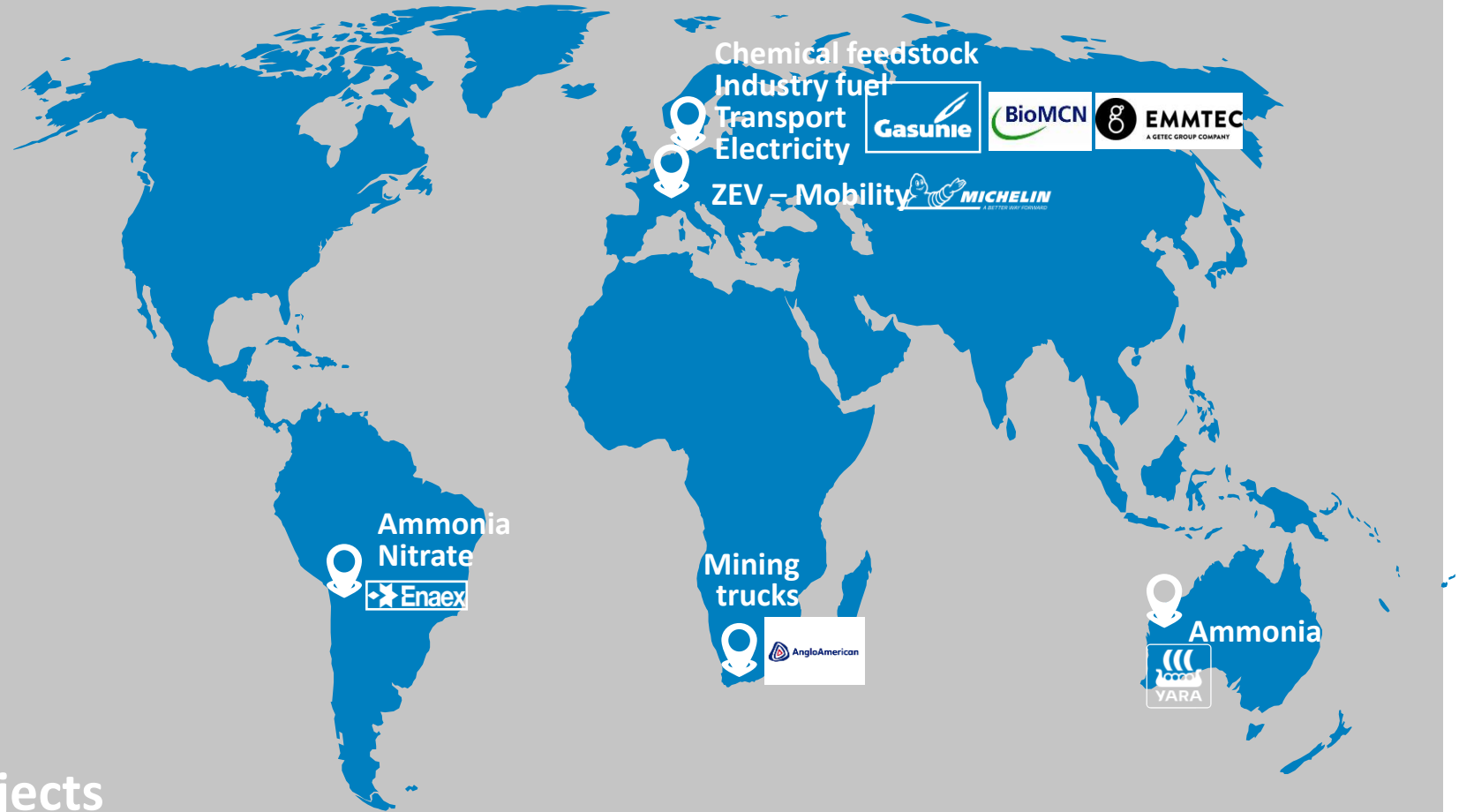
ENGIE's Hydrogen Business Strategy to develop industrial-scale renewable hydrogen solutions for regional and global markets

- To **design, invest in, build and operate** industrial-scale hydrogen solutions
- To provide **turnkey customer solutions** across the value chain



ENGIE is committed and in action globally

Industrial-scale projects



Demonstrator projects



H₂ mobility

ENGIE is developing H₂ mobility projects in BE

- H₂ mobility is a complementary solution to Battery Electric mobility, and ideally fitted to certain applications
- Public transport is the best opportunity to demonstrate the technology and to prepare the future for H₂ mobility
- For large fleets “habits” are more important than technology, with focus to change management & system efficiency.



Pau Portes des Pyrénées
Syndicat mixte des transports urbains

ENGIE Flagship project in France: PAU hydrogen buses and station with electrolyser



- Installed and operated by GNVERT (ENGIE affiliate in supply of renewable fuels)
- Project duration 15 years
- Infrastructure capacity 250 kg/day, 2 compressors, 3 days storage
- Bus refueling at night
- 8 FCEV 18m buses of Van Hool
- Winner of Best Bus Award 2019
- Range: 250 to 350 km/day



H₂ mobility in Belgium:

- ENGIE answered to tender for H₂ bus mobility in Wallonia (2019): 12 FCEV buses in Charleroi with dedicated infrastructure (electrolyser & HRS station) → awaiting decision by Walloon Government
- ENGIE studies 10MW electrolyser @Brussel Energie to develop H₂ mobility for garbage trucks and public mobility

H₂ for industry

Demonstration projects are needed to pave the way forward

- Renewable H₂ can help to decarbonize industrial processes
- ENGIE wants to play a key role in the development of large scale electrolyzers and a possible Green H₂ Economy

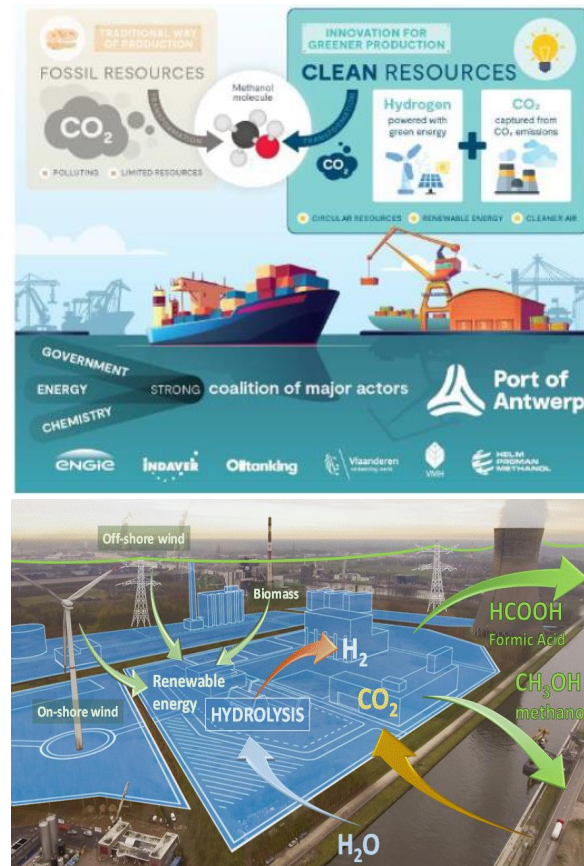
SOME PROJECT EXAMPLES:

Link large **electrolyser** to **large off-shore wind** deployments in order to help the absorption of the excess power

- Greenports Zeebrugge : consortium study 25MW electrolyser
- Eemshaven : feasibility 100MW electrolyser

Link large **electrolyser** to **CCU project** @ CO₂ source to produce e-methanol or e-methane.

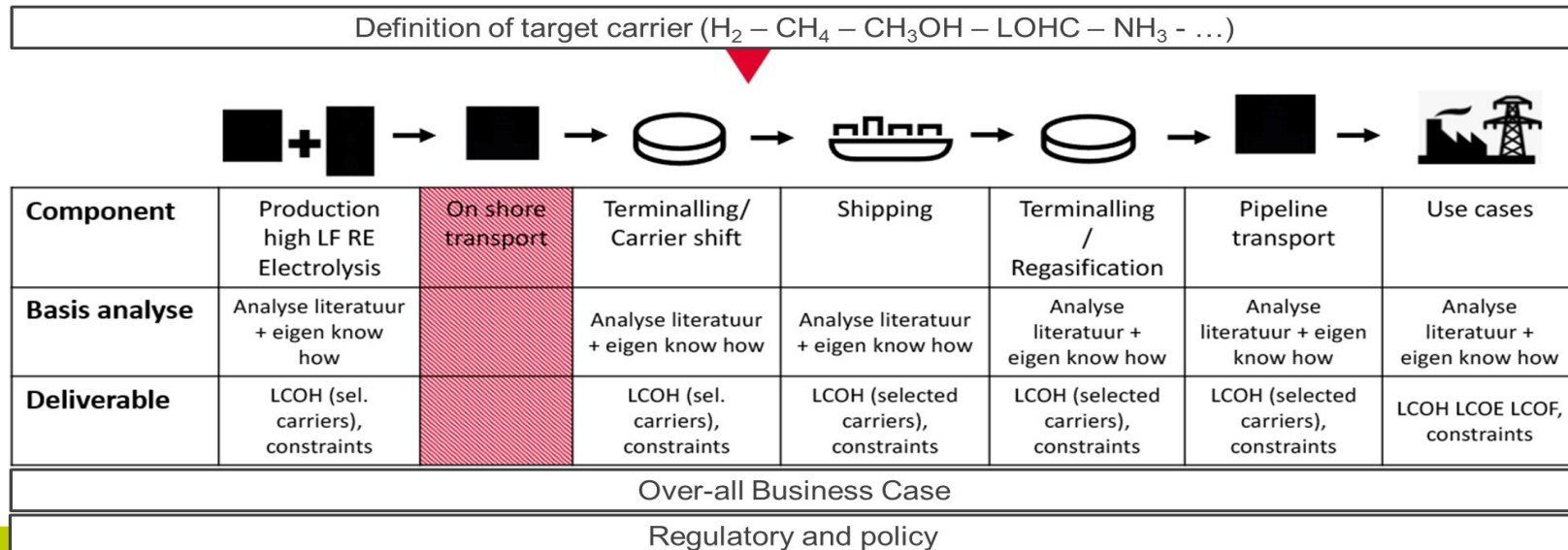
- Port of Antwerp : consortium feasibility 5 MW electrolyser (e-methanol)
- Port of Ghent : potential for 300 MW electrolyser in Rodenhuize to produce e-methanol for local consumption
- Amercoeur : potential for 50 - 200 MW electrolyser to produce e-methane
- Les Awirs : potential for 100 MW electrolyser to produce e-methane



Anticipate the future

A study on H₂ import and open access backbone

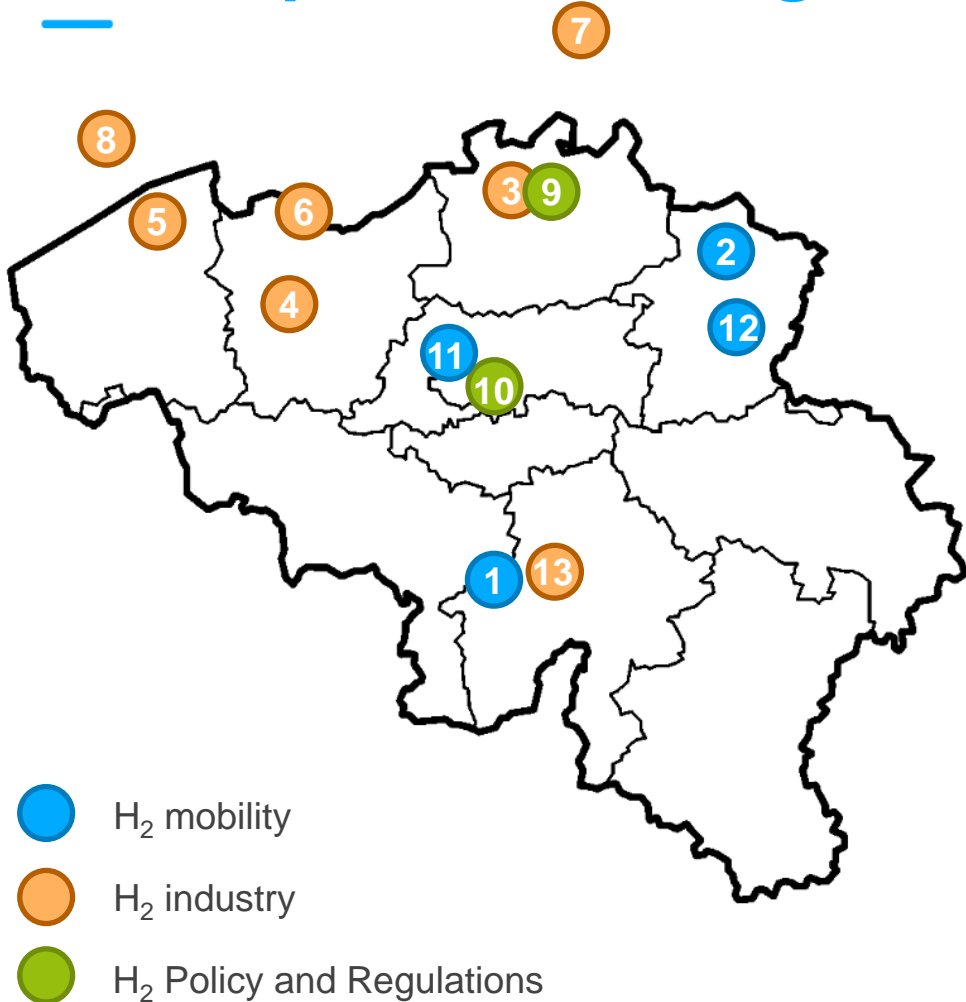
- W-Europe will not be able reach 2050 targets based on electrons only:
 - Insufficient wind- and solar-potential
 - Insufficient HV-transmission capacity
 - Not all processes can be electrified
- Molecules (H-carriers) will be part of the future solution (industry feedstock & energy applications) but need a large scale open-access backbone infrastructure
- A partnership of industrial players (Port of Antwerp/Port of Zeebrugge, Fluxys, DEME, ENGIE, EXMAR, Waterstofnet), active on the complete value chain, have launched a study to investigate the full supply chain (production, storage, import, supply) of H₂ based on renewable energy to NW-Europe.



Key success factors to get the renewable H₂ project development started

- **Need for further development of Renewable electricity production**
- **Dedicated guarantees of origin scheme for green gasses, incl. hydrogen**
- **Strong (local) authority's commitment to support pilot and demonstration projects**
- **Public funding or subsidies**
- **H₂ included in greenify targets of public mobility operators**

ENGIE's H₂ project developments in Belgium



- 1 **Waste-to-Wheels Wallonia**, 0,7 MW electrolyser for 12 FCEV buses (OTW-TEC), tender file submitted 06/2019, awaiting decision by Walloon Region
- 2 **REVIVE** (FCH-JU program), Tractebel is project coordinator, demonstration project with 15 H₂ refuse trucks (e-Trucks Lommel) in 8 European cities including Antwerp, deployment ongoing.
- 3 **Power-to-Methanol**, 2,5 – 5 MW H₂ production linked to CO₂ capture to produce E-methanol (= CCU), feasibility study ongoing
- 4 **CCU hub Gent**, H₂ production linked to CO₂ capture to produce E-methanol (= CCU), feasibility study ongoing
- 5 **GreenPorts Zeebrugge**, research project (ICON VLAIO 2018-2020), H₂ production based on offshore electricity + injection in Fluxys network
- 6 **Smart Delta Resources/North Sea Port**, 1 GW electrolyser, part of IPCEI project “Green Octopus” for BE/NL, feasibility study ongoing
- 7 **HyNetherlands (Groningen Province NL)**, 100 MW – 1 GW electrolyser, part of IPCEI project “Green Octopus” for BE/NL, feasibility study finalized
- 8 **Blauwe Cluster – Offshore H₂ production**, Tractebel part of consortium, feasibility study ongoing
- 9 **H₂ Import Coalition**, study (end 2020) on the possibilities to import large quantities of renewable H₂, covering production, transport, shipping, terminaling, bunkering and distribution
- 10 ENGIE is active partner with Power-to-Gas Cluster, Hydrogen Europe and FCH-JU to propose policy papers on H₂ and to advise on regulations on BE and EU level
- 11 **Waste-to-Wheels Brussels Energy**, 10 MW electrolyser, feasibility study ongoing
- 12 **Genk H₂ Valley**, feasibility study ongoing for H₂ mobility
- 13 **Amercoeur**, H₂ production linked to CO₂ capture to produce E-methan (= CCU), feasibility study ongoing

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