Interreg
Euregio Meuse-Rhine
EMR BOOSTER H2
EUROPEAN UNION
European Regional Development Fund

EMR H2 Booster event

Shaping the energy transition in the Euregion using sustainable hydrogen

Agenda

13:00 - 13:15 Opening and introduction EMR-H2Booster project
Davine Janssen (WaterstofNet)

13:15 - 13:35 Need for green Hydrogen - and current projects Chemelot
Hans Linden (TNO)

13:35 - 14:00 The Hydrogen Industry Cluster and current Euregional projects
Adwin Martens (Managing Director WaterstofNet)

14:00 - 14:20 Financing possibilities for Hydrogen projects, Interreg EMR 6
Anna Ozerova (Interreg / Province of Limburg)

14:20 - 14:40 Coffee Break

14:40 - 15:00 Inland shipping and barges with Hydrogen
Yuriy Yanson (Air Liquide)

15:00 - 15:15 Hydrogen refueling, first experience owning a H2 refueling station and future plans:
Gerbert Vissers, (Vissers Energy)

15:15 - 15:30 EMR-H2-Booster Matchmaking, topics, process and wrap-up:
Jan Willem Tolkamp (LIOF)

15:30 - 16:00 Matchmaking & Drinks

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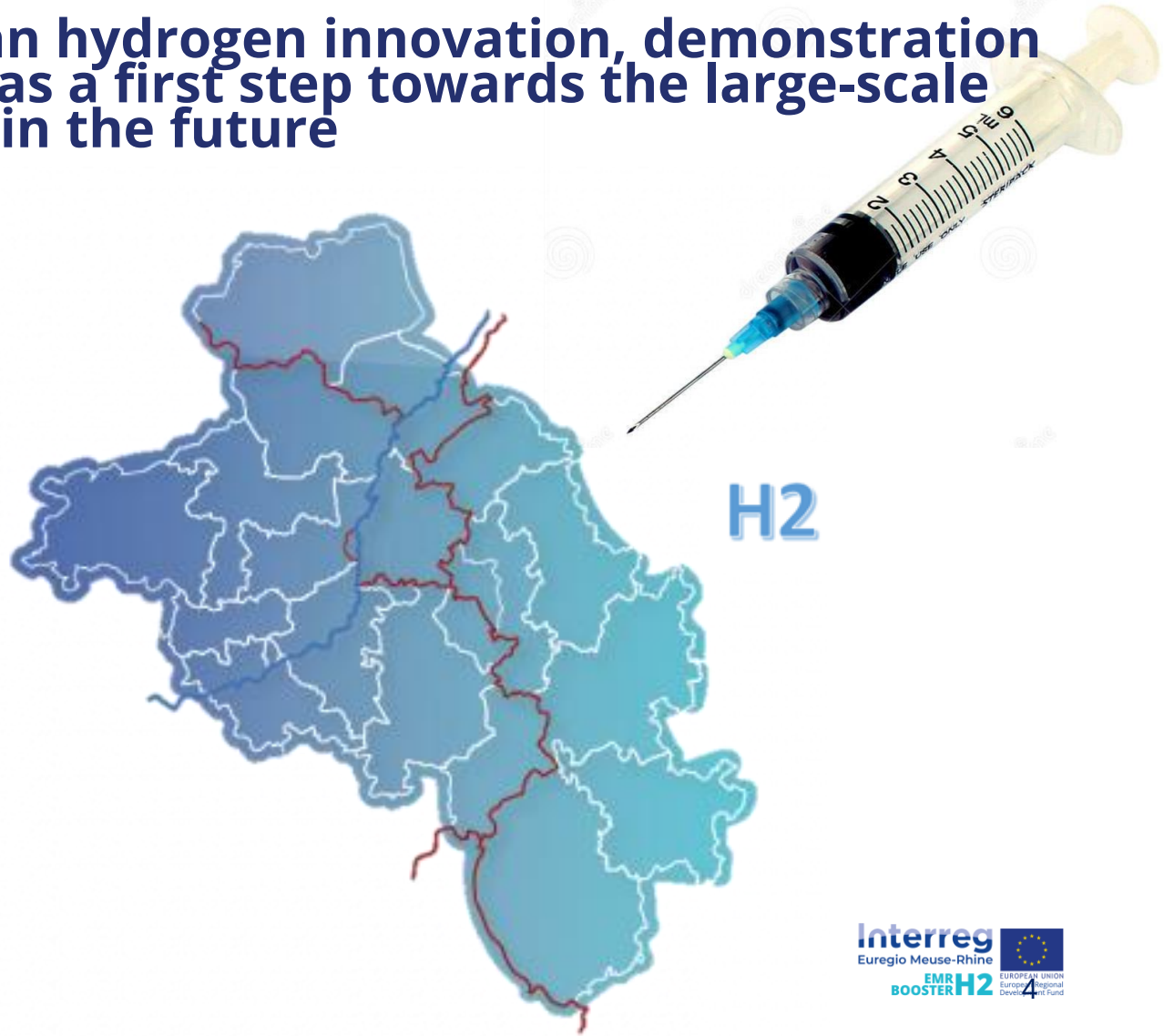
European Regional Development Fund

The EMR H2 Booster project

EMR H2 Booster

- **Aim: to boost the development of clean hydrogen innovation, demonstration and knowledge sharing in the region, as a first step towards the large-scale roll-out of a clean hydrogen economy in the future**



- Main target group: **SMEs**
- Duration: **18 months**
  January 2022 to June 2023
- Total budget: €1.065.066,13
- Total Interreg subsidy: €532.533,01

Partnership

Project partners

spi

IHK

TWEED

UHASSELT
KNOWLEDGE IN ACTION

WCL

stadt aachen

pom
Limburg economisch versnellen

WaterstofNet

LIOF

Co-financers

provincie limburg

Ministerie van Economische Zaken en Klimaat

LANDTAG NORDRHEIN WESTFALEN

Wallonie

Provincie Noord-Brabant

Associated partner

parkstad limburg
stadsregio

Main financer

Interreg
Euregio Meuse-Rhine

EUROPEAN UNION

Partnership

Region	Cluster	Development Agency	Other
Liège	TWEED	Spi	
Limburg (FL)	WN	POM Limburg	Univ Hasselt (Energyville)
Aachen	IHK Aachen	Stadt Aachen	
Limburg (NL)	WN/Waterstof Coalitie Limburg	LIOF	

Coordinator WaterstofNet

Supporting partner: Parkstad Limburg Limburg

Workpackages

WP 1: mapping

- Of plans, roadmaps, visions, views, R&D, etc.
- Of industrial players
- Of competences
- Integration in the Digital Innovation Platform

WP 2: cases

- 4 Matchmaking-sessions
- 4 Hydrogen project concept papers

WP 3: inspiration and demonstration

- 4 inspiration sessions (one per region)
- 4 demonstration events
- 4 workshops

WP 4: Booster

- Long term roadmap
- Definition of long-term governance structure and business model of the EMR H2 Booster

WP management | WP Communication | WP First Level Control

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Let’s boost

Let’s boost hydrogen in our region!

https://www.emrh2booster.eu/

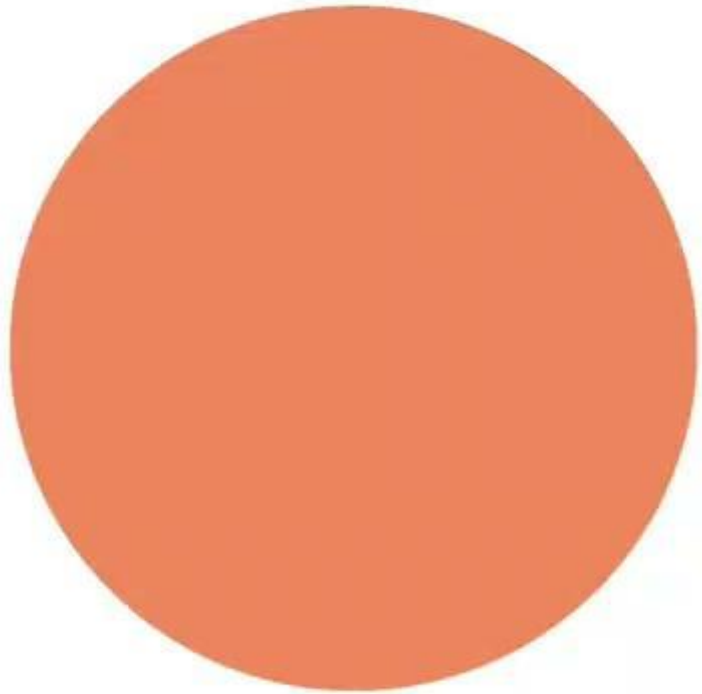
Brightsite

Transforming industry

Hans Linden

Production of Hydrogen and Hydrocarbons using Plasma Technology

Proud partners
Sitech Services
TNO
Maastricht University
Brightlands Chemelot campus



Brightsite Hydrogen key energy carrier versus hydrogen as feedstock

Transforming industry

Future fuel (intermediate)

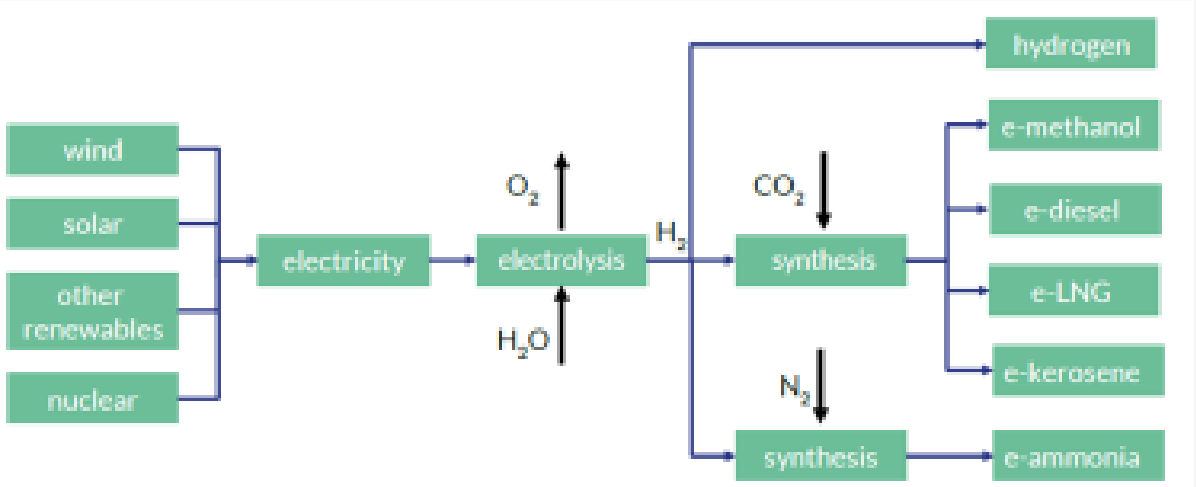
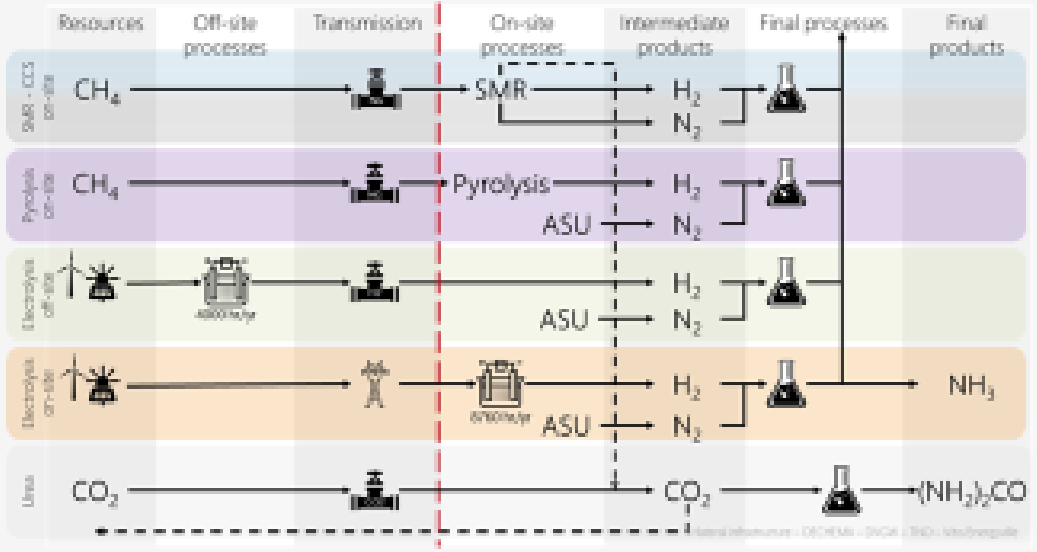


Figure 4: Schematic representation of the production routes of hydrogen and the most relevant e-fuels.

Source: Power-2-Fuels innovation outlook, TNO/Smartport (2020)

Future intermediate for chemicals



Source: Trilate, TNO/DECHEMA/DVGW/VITO (2020)

TNO innovation for life

Brightsite

Transforming industry

Plasma technology as game changing technology

TNO innovation for life

Brightsite
Transforming industry

Plasma

- Fourth state of matter
- Ionized gas with equal numbers of positively charged ions and negatively charged electrons
- Electrical conductive

Examples:

Lighting

Aurora Borealis

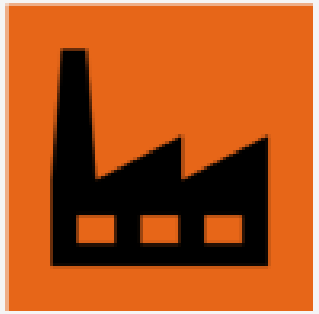
HR+ glass coating (Pilkington)

Welding

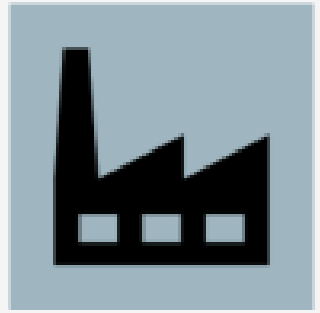
Neon Light

Brightsite
Transforming industry

Green house gas emission in the chemical industry



Ammonia Plant:
Typically 9 ton CO_2 is emitted per 1 ton of hydrogen

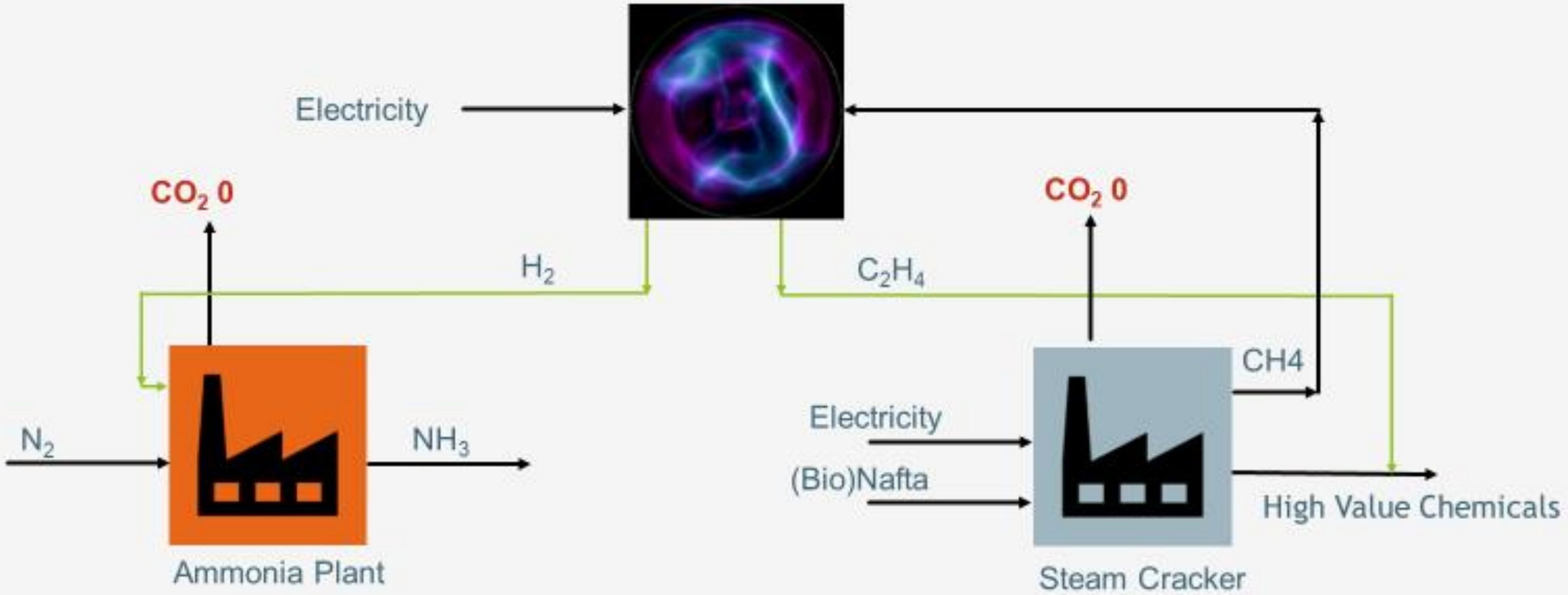


Steam Cracker:
Typically 1 ton CO_2 is emitted per 1 ton of olefins

TNO innovation for life

Brightsite
Transforming industry

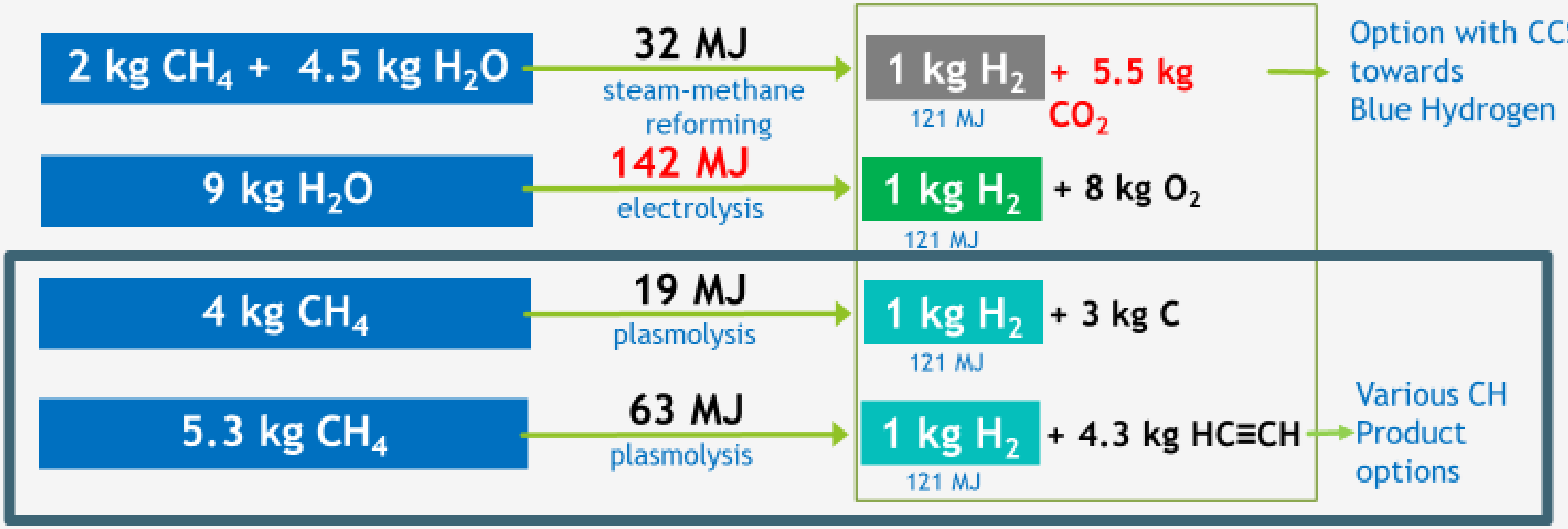
Combined Transition



TNO innovation for life

Brightsite
Transforming industry

Motivation for plasma decarbonization



Thermodynamic numbers, no heating or cooling

TNO innovation for life

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Plasma technology at Brightsite

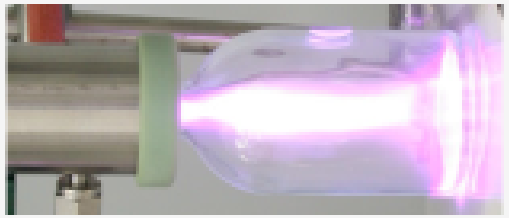
TNO innovation for life

Brightsite
Transforming industry

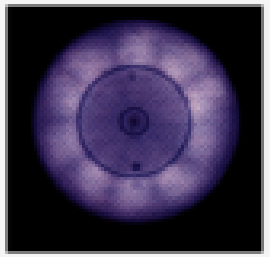
Plasma technology at Brightsite

Lab Plasma Trl 1-3	Benchscale Plasma Trl 4-5	Pilot Plant Plasma TRL 6-7
2020	2021-2022	2022-23
3 kWe	50 kWe	1-3 t/a H2
R&D program	R&D program	C2H4/C
Generation 3	Generation 2	Generation 1

Plasma lab at Brightlands



Generation 1:
- Hüls process
- Hydrogen and carbon
- Arc technology



Generation 2:
- Optmised Hüls process
- Arc technology and microwave

Generation 3:
- Direct formation of Ethylene
- Microwave

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Timeline plasma technology

2020-2040

Lab Plasma Trl 1-3	Benchscale Plasma Trl 4-5	Pilot Plant Plasma TRL 6-7	Demo Plant 10 kt/a H2 2025 TRL 7-8	Commercial Plant 0,2 Mt/a H2 TRL 9 2030-2040
2020 3 kWe R&D program	2021-2022 50 kWe R&D program	2022-23 1-3 t/a H2 C2H4/C Pilot gen 1 500 kWe	2025-2027 1-10 kt/a H2 Demo gen 2	2030-2040 0,2 Mt/a H2 Demo gen 3

Plasma lab at Brightlands

TNO innovation for life

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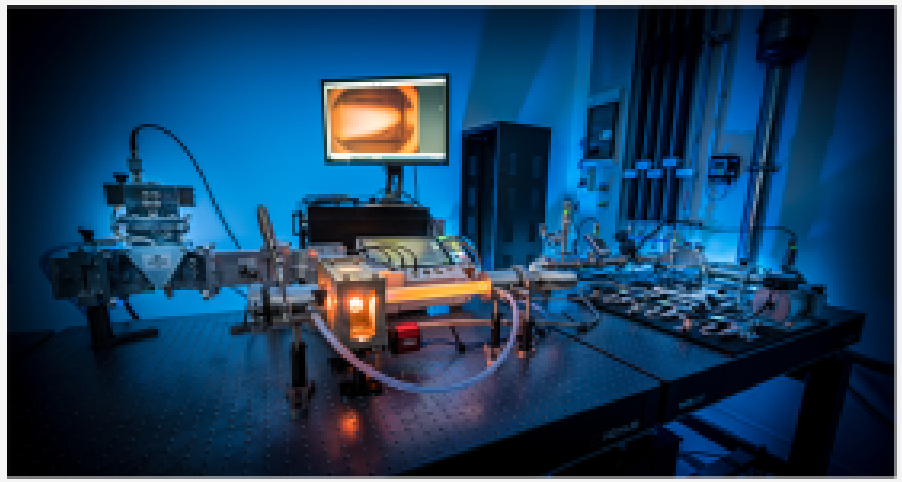
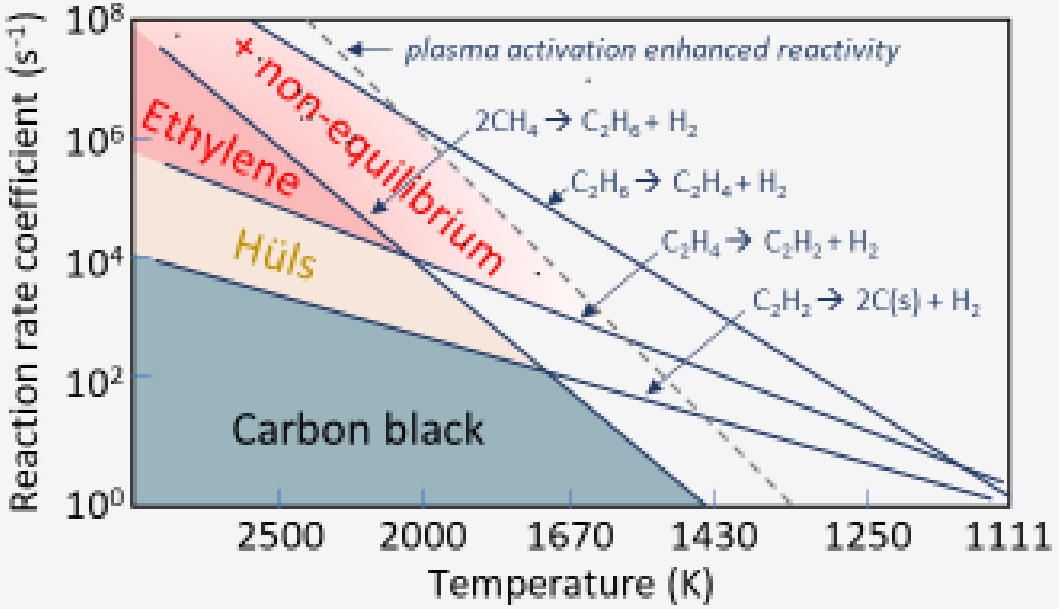
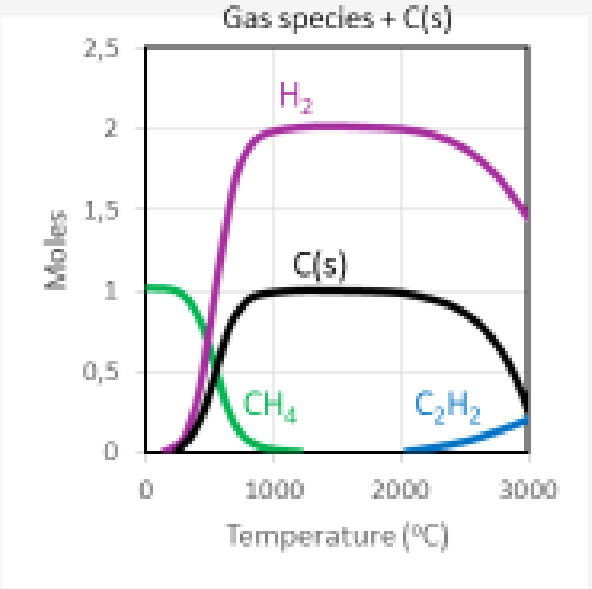
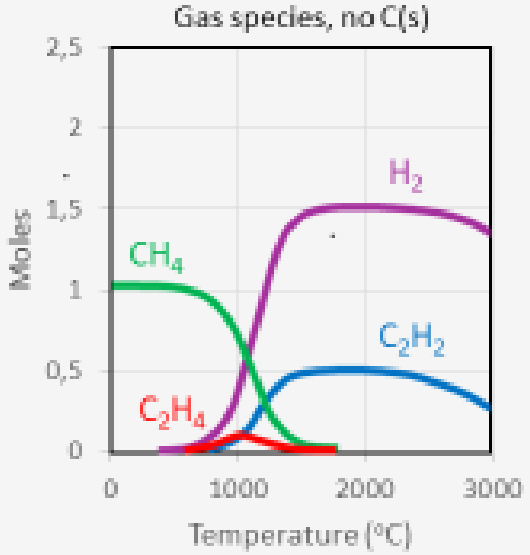
Transforming industry

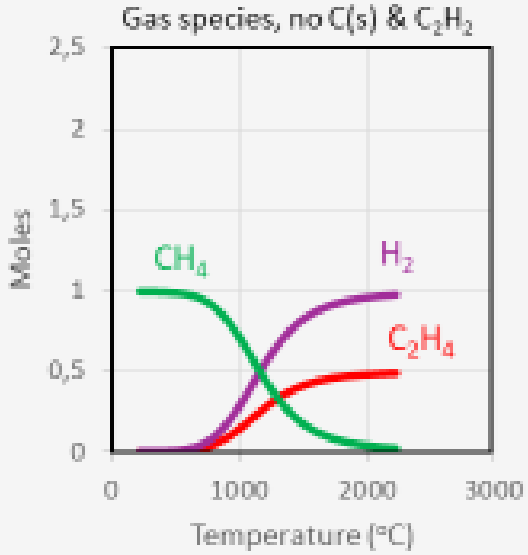




Courtesy G van Rooij



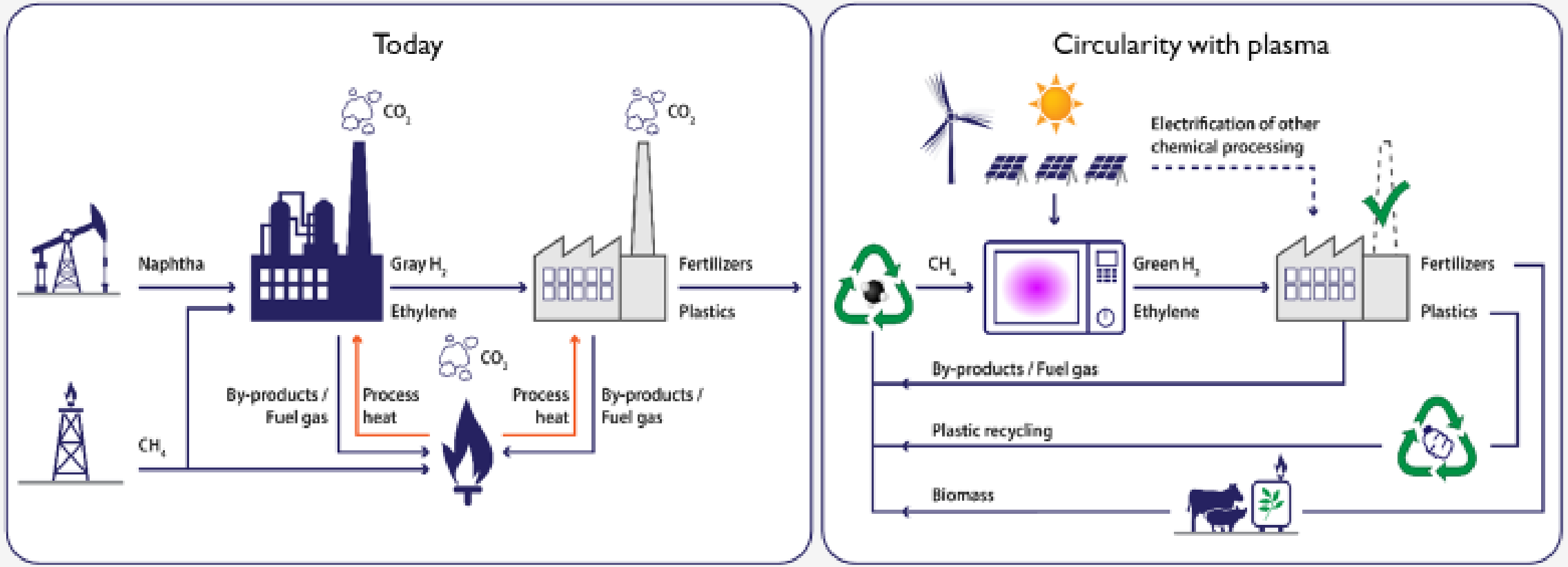




TNO innovation for life

Brightsite
Transforming industry

Plasma technology an important step towards the ultimate circular chemistry



Courtesy Gerard van Rooij

TNO innovation for life

Brightsite

Transforming industry

Proud partners
Sitech Services
TNO
Maastricht University
Brightlands Chemelot campus

www.brightsitecenter.com
Hans.Linden@TNO.NL

HYDROGEN

DRIVEN BY ENERGY

vissers
ENERGY GROUP

Vissers Energy Group B.V.

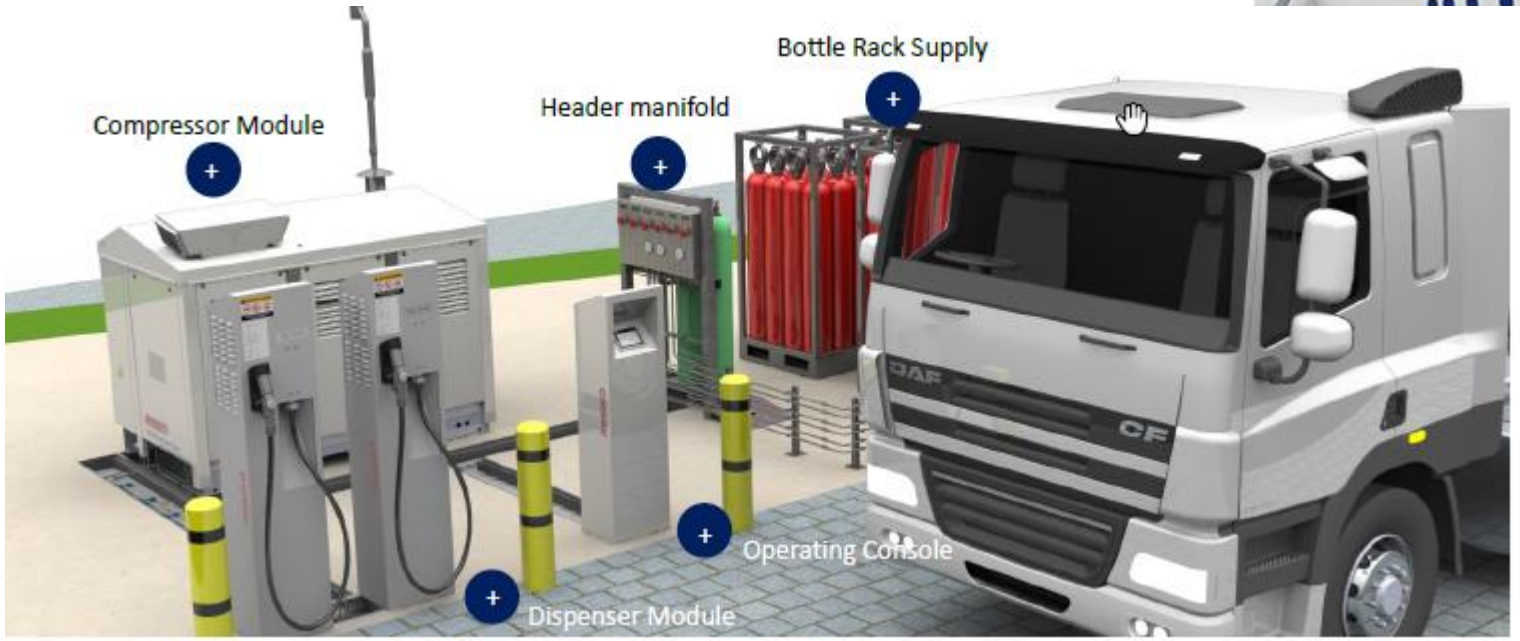
- Family business founded in 1917
- 4th Generation: Gerbert Vissers
  50+ petrol stations in South-Netherlands
- High-Way, manned and unmanned
- 350+ employees
- Retailconcept Moments & More / Delimore / Smaaksmederij

Vissers Energy Group B.V.

- In 2030 completely energy neutral within our own company
  Transition period CNG and HVO
  Expansion of EV-charging network
  First Hydrogen Filling Station in Horst
  End goal green electricity and green hydrogen

First Hydrogen Filling Station…

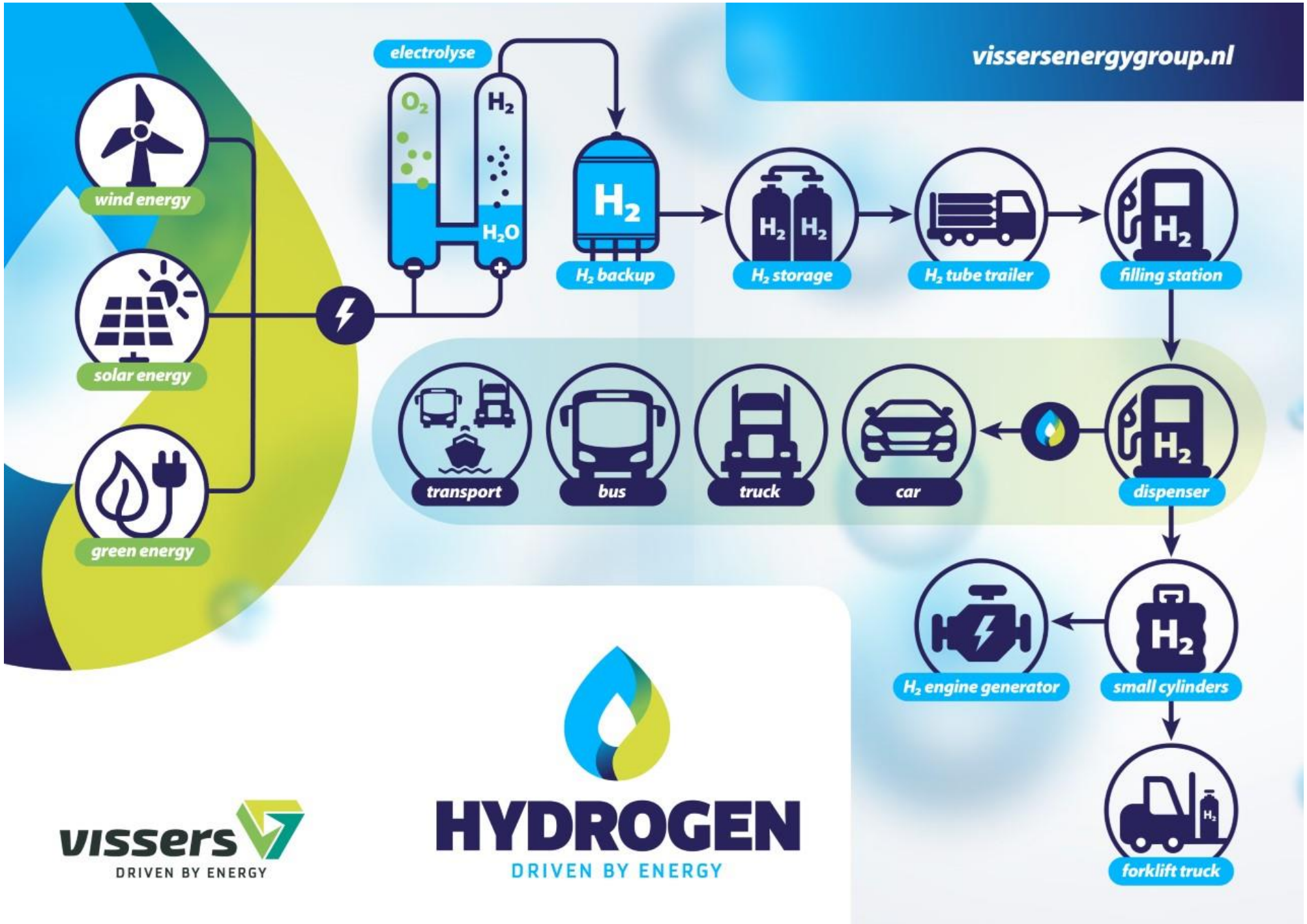
- New Technology
  Supply & Logistics of Hydrogen
  Regulations (Safety)
  Customers



vissers
ENERGY GROUP

First Hydrogen Filling Station in Horst

vissers
ENERGY GROUP


vissersenergygroup.nl
electrolyse
O_2
H_2
H_2O
wind energy
solar energy
green energy
H_2 backup
H_2 storage
H_2 tube trailer
filling station
dispenser
transport
bus
truck
car
H_2 engine generator
small cylinders
forklift truck
vissers
DRIVEN BY ENERGY
HYDROGEN
DRIVEN BY ENERGY


TOYOTA
SAS
Fuel Cell


HYDROGEN
ENGINE
ZERO
EMISSIE


JCB
HYDROGEN
PROTOTYPE
JCB HYDROGEN FUEL CELL TECHNOLOGY
JCB
HYDROGEN
ZERO EMISSIONS


ZERO
EMISSIE
ZERO
EMISSIE
HYZON

Hydrogen in Limburg

- Hydrogen Filling Station in Horst April 2022
- Hydrogen Filling Station Venlo-Tegelen February 2024
- Subsidies for Infrastructure (CEF)
- More to come

What do we need?

- Projects with Shippers, Trucking Companies etc.
- Subsidies for End-Users
- Suitable Cost Price Hydrogen
- Promotion by Local Government

→ Creating Demand for Hydrogen

Local Energy Hub

vissers
DRIVEN BY ENERGY

Project Partners:

Hy STREAM

MV Energietechniek
Advies & Inspectie

vissers ENERGY GROUP

Green Watts
Energy Solutions

van Kessel

Ondersteunende Regionale overheden:

gemeente HORST A/D MAAS

venlo

Gemeente Venray

Onderstaande regionale bedrijven zijn bereid te investeren in transportmiddelen op Waterstof!

beurskens all-round cargo

Van Dijck Groenteproducties

Driessen

provincie limburg

JEWA-GAS

SNEL

MUNCKHOF

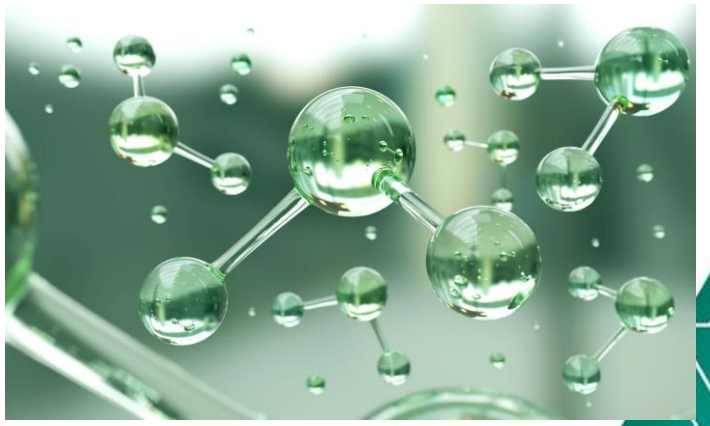
GEERETS DE LEEUW

vidaXL.nl

Ewals Cargo Care

LAARAKKERS

Are there any questions?



Adwin Martens, managing director WaterstofNet

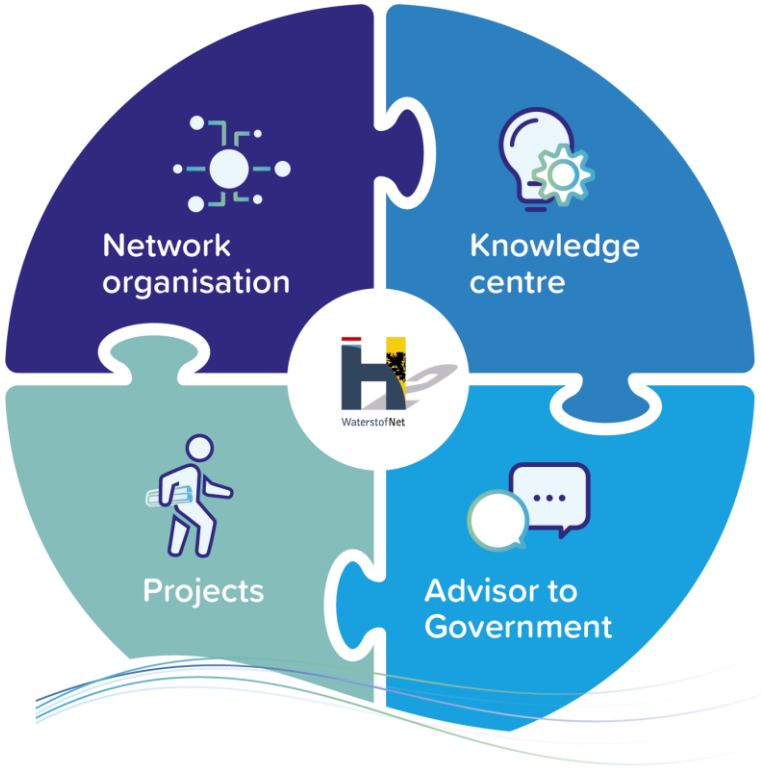
21 oktober 2022

The WIC Hydrogen Industry Cluster and current Euregional projects

WaterstofNet

WaterstofNet: over 10 years of H2 experience

- °2009, non profit, 14 persons
- Offices in Turnhout (B) and Helmond (Nl)
- 4 pillars
  - ✓ WIC: Industrial cluster > 140 members
  - ✓ Project organisation > 20 projects
  - ✓ Partner of governments
  - ✓ Knowledge center
- Hands-on experience



Hands-on experience WaterstofNet :
2 hydrogen refuel stations operated and 4 cars on hydrogen

2011: Opening hydrogen station at Colruyt in Halle (350 bar)

2013 : Opening hydrogen station in Helmond (350 and 700 bar)

refuelling, 5 kg in 5 minutes, over 500 km range

Cars:

2014: Hyundai ix35

2018: Hyundai Nexo

2021: 2 Honda Clarity

Euroregio Maas Rijn

WIC:
Unique hydrogen-ecosystem : started in Flanders, now growing to Benelux level

covering the value chain

Working groups WIC

Mobility 

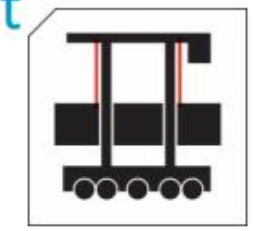
Policy 

Combustion 

Shipping 

(coll. With De Blauwe Cluster)

H_2 for all 

Port equipment 

Not only ‘logo’s’ but also pictures of realisations/demonstrations in the region

WaterstofNet

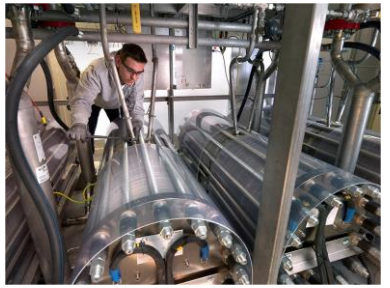


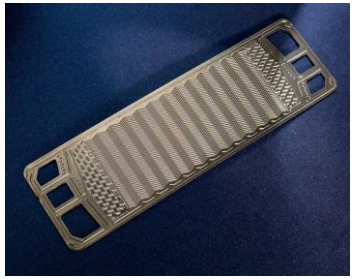
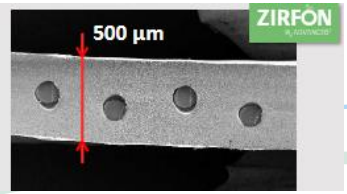













Flemish garbage trucks on hydrogen, demonstrated in NRW

SWH

Home Aktuelles Stadtwerke

STADTWERKE HURTH PROBEN UMSTELLUNG AUF ALTERNATIVE ENERGIEN

17.01.2020

Noch bis 24. Januar 2020 wird ein mit Wasserstoff betriebenes Müllfahrzeug getestet

HÜRTH (pü). Zwei vollkommen schadstofffreie Wasserstoff-Hybridbusse sind bei der Stadtverkehr Hürth bereits seit zehn Jahren im Einsatz. Und auch die dazu gehörige Wasserstoff-Tankstelle auf dem Knapsacker Industriehügel ist seitdem in Betrieb. Seit heute setzen die Stadtwerke Hürth in der Abfallentsorgung mit einem Müllgroßfahrzeug ebenfalls auf diese umweltfreundliche Technik, die keine Emissionen verursacht und geräuschlos ist – zumindest probeweise. Und damit sind die Stadtwerke Hürth derzeit bundesweit das einzige kommunale Unternehmen, das die Entsorgung über ein solches Fahrzeug ermöglicht.

„Unser Fuhrpark besteht überwiegend aus herkömmlichen Fahrzeugen,

Stadtwerke Hürth-Vorstand Stefan Welsch (5.v.r.) und Dirk Breuer, Bürgermeister und Vorsitzender des Verwaltungsrates der Stadtwerke Hürth (6.v.r.), informierten sich im Beisein von Kollegen über den probeweisen Einsatz des mit Wasserstoff

Flemish buses on hydrogen for Germany

- 2013- 2014 2 Van Hool buses RVK Köln
- 2018 – 2019 45 Van Hool buses RVK Köln en WSW Wuppertal

Dutch Truck in Germany

Interreg North-West Europe H2-Share

WaterstofNet

Press release, February 16, 2021

ABC Logistik demonstration a success in Düsseldorf

H2-Share hydrogen fuel cell truck well received

Düsseldorf – The H2-Share truck performed well in demonstration at transport company ABC Logistik in Düsseldorf from the beginning of November until the end of December 2020. The company concluded in its final evaluation that hydrogen trucks are the future of zero-emission heavy-duty logistics.

Thanks to the efforts and collaboration of ABC Logistik, VDL, the EnergieAgentur.NRW and H2 MOBILITY Deutschland, the 27 tonne truck demo was organised on short notice. It was just the second of six demonstrations within the international H2-Share project, dedicated to the development of hydrogen heavy-duty transport and refuelling technology. It transported up to 8 tonnes of general cargo (e-commerce products), mainly on motorways and in industrial zones. The truck refuelled under supervision of Air Liquide at the hydrogen refuelling station (HRS) Düsseldorf-Holthausen operated by H2 MOBILITY Deutschland.

Of course the demonstration also brought a number of points for improvement into focus for the next stage of development. Hills formed challenges at times and a more powerful electromotor may be required. The truck is also quite noisy, too much so for night deliveries. This could be improved by lowering the high compressor air intake. In general, the configuration of the H2-Share truck consists of a number of compromises given the need for multiple demonstrations at different end-users. ABC Logistik concluded that most of these challenges can be overcome and are keen to continue the tests in a following phase. This will be supported by the commitment of North Rhine-Westphalia to stimulate the deployment of fuel cell vehicles with green hydrogen in the region.

Michael te Heesen, General Manager at ABC Logistik: *"As a privately-owned logistics service provider with a strong interest in sustainable logistics concepts and technologies, we were very pleased to be invited to participate in the test phase. Although the vehicle is still a prototype, its use has left many positive impressions. We are convinced that hydrogen technology will soon be ready for daily operational use. Now the supply of hydrogen and the refuelling station network need to improve while refuelling costs need to drop."*

ABC-Logistik GmbH EnergieAgentur.NRW H2MOBILITY

Interreg as a key to play a role in large EU-projects

WaterstofNet

WaterstofRegio 2.0

Interreg VLANED

first 44t truck

FUEL CELLS AND HYDROGEN JOINT UNDERTAKING

FUEL CELLS AND HYDROGEN JOINT UNDERTAKING

16 trucks

HyTrucks

1000 trucks

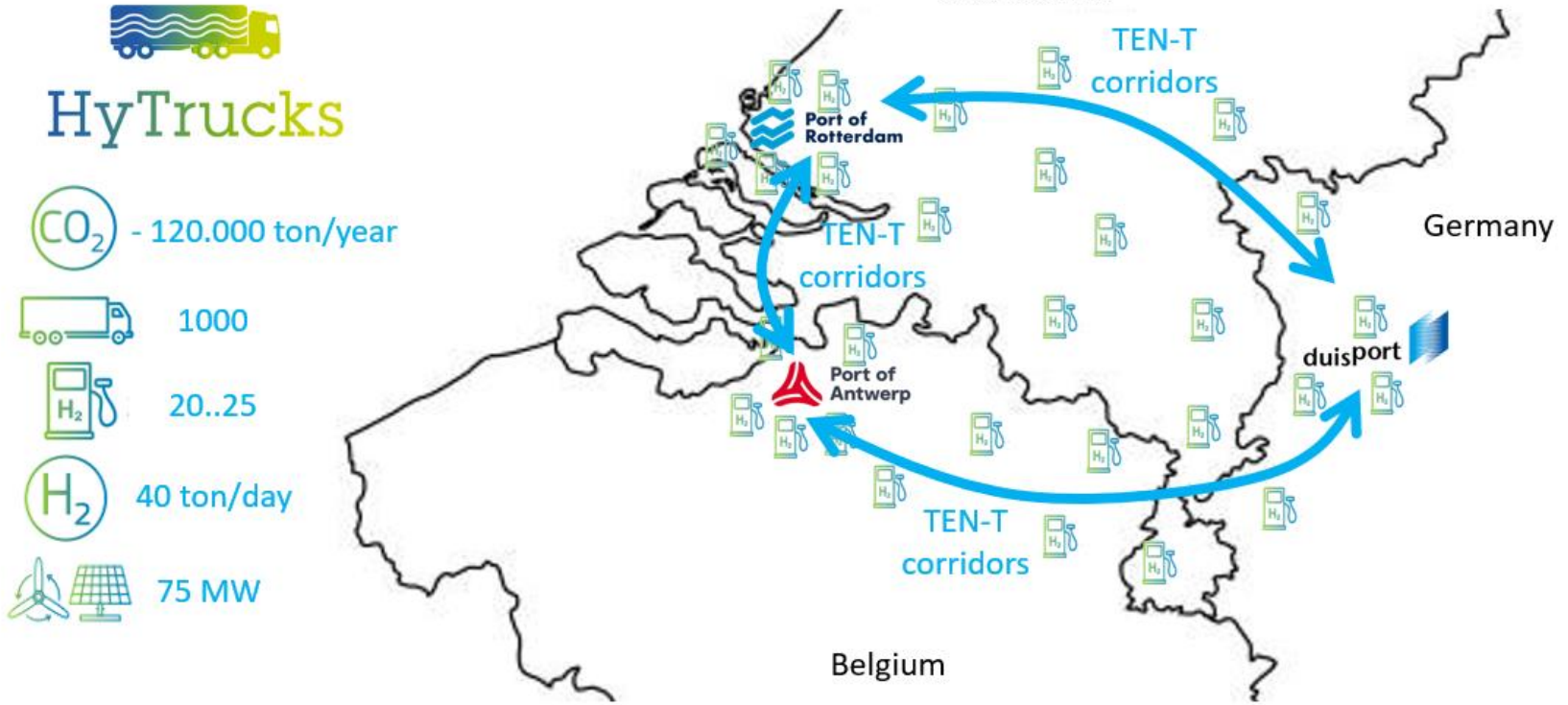
H2SHare

Interreg NWE

Interreg North-West Europe

first 27t truck

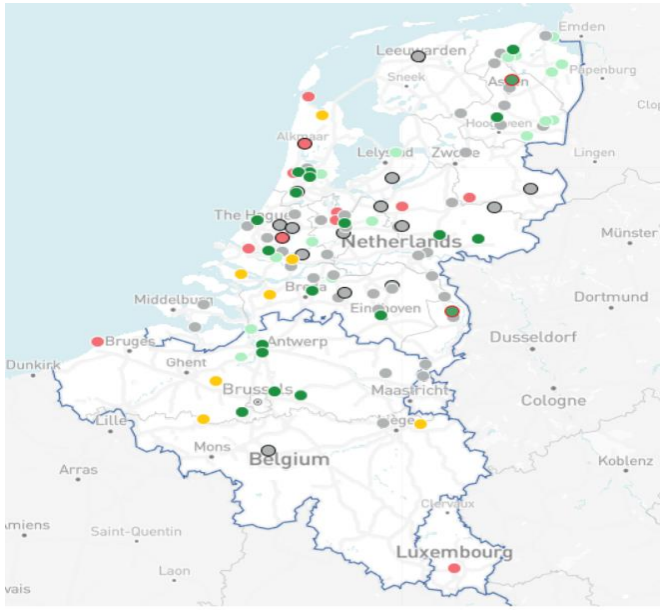
HyTrucks: Close cooperation Flanders/Netherlands/Germany



- Actual a limited amount of hydrogen actors in EMR-region
- Actual a limited projects on hydrogen in EMR-region

- but EMR-area is from strategic importance for hydrogen in Europe

Now: Network of hydrogen refuelling stations: 25 in Benelux, 100 in Germany



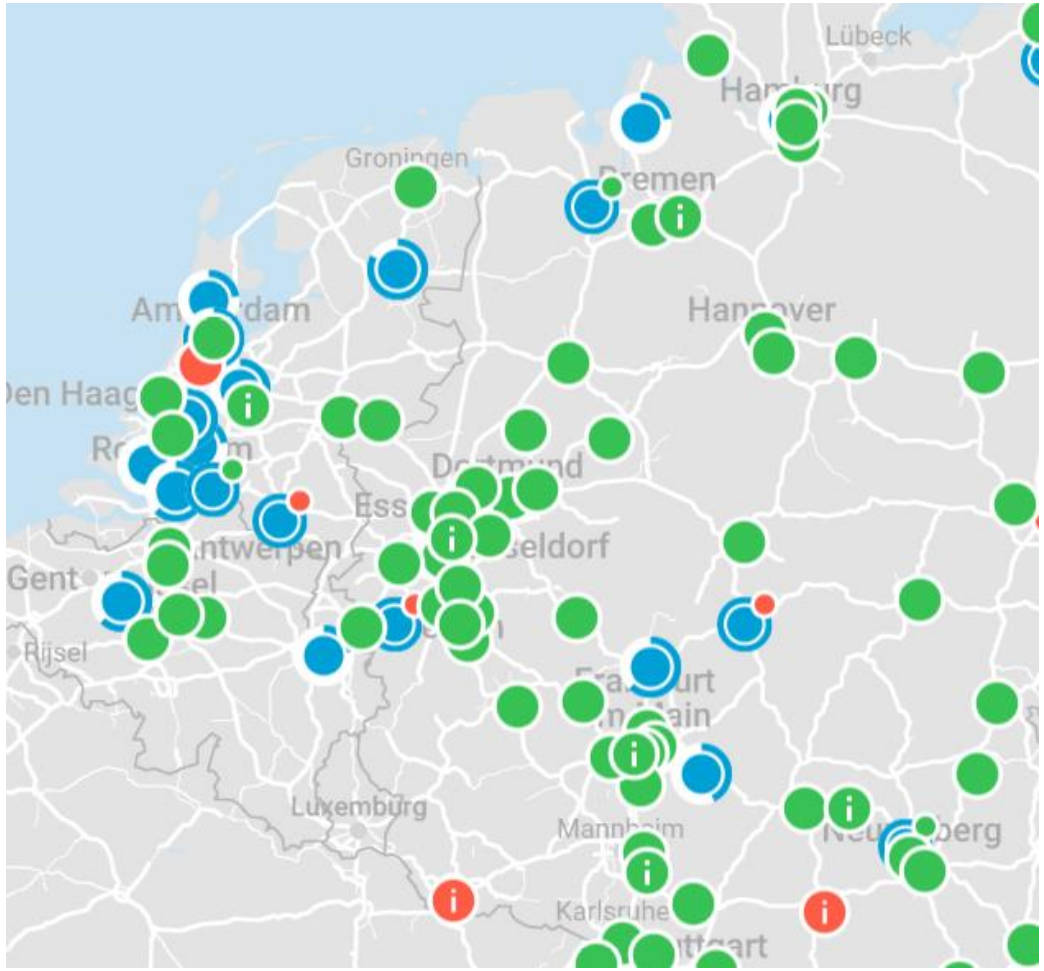
public public (slow-fill) non public
under construction funded initiative permit received

WaterstofNet H2BENELUX Co-funded by the European Union

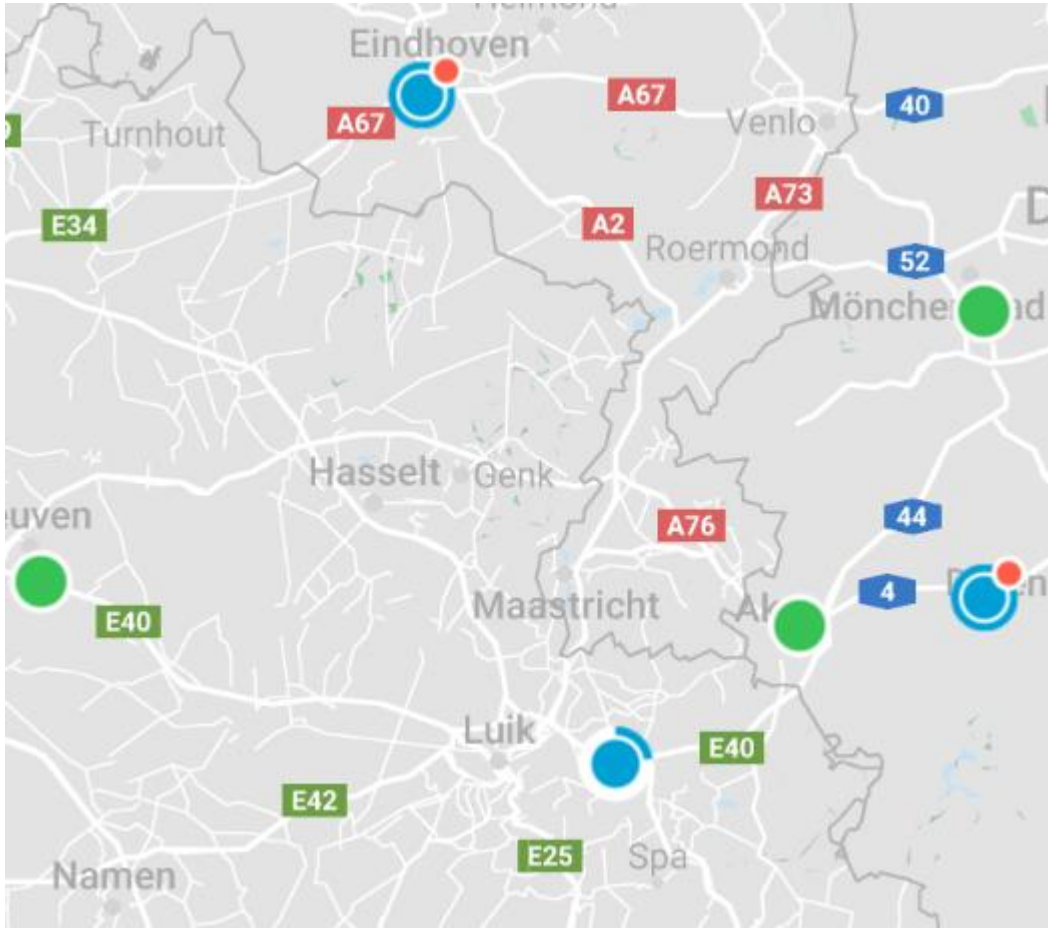
Operationele openbare waterstof tankstations (09/09/2022)

Plaats	Adres	Vuldruk (bar)	Uitbater	Voertuig	Betaling
Rhoon (NL)	Groene Kruisweg 397	350/700	Air Liquide		
Arnhem (NL)	Westervoortsedijk 71	350/700	TotalEnergies		
Den Haag (NL)	Binckhorstlaan 100	350/700	Kerkhof & Zn		
Hoofddorp (NL)	Rijksweg A4-4	700	Shell		
Amsterdam (NL)	Australiëhavenweg 116	350/700	OrangeGas		
Nieuwegein (NL)	Morsebaan 1	350/700	Hysolar		
Amsterdam (NL)	Galwin 6	700	Shell		
Pesse (NL)	Bultinge 2	350/700	Green Planet		
Groningen (NL)	Bornholmstraat 35	350/700	Holthausen		
Assen (NL)	*Duitslandlaan 1*	*700 (slow-fill)*	*OrangeGas*		
Doetinchem (NL)	Braamtseweg 10	350/700	Kuster Energy		
Breda (NL)	Minervum 7001	350/700	TotalEnergies		
Horst (NL)	*Stationsstraat 92*	*350/700 (slow-fill)*	*Vissers Energy*		
Veldhoven (NL)	De Run 4232	350/700	TotalEnergies		
Amsterdam (NL)	Australiëhavenweg 116b	350	Holthausen		
Zaventem (BE)	Leuvensesteenweg 546	350/700	Air Liquide		
Halle (BE)	Zinkstraat 1	700	DATS 24		
Antwerpen (BE)	Mexicostraat 11	350/700	CMB.Tech		
Antwerpen (BE)	Boomsesteenweg 950	350/700	DATS 24		
Leuven (BE)	Geldenaaksebaan 448	700	DATS 24		

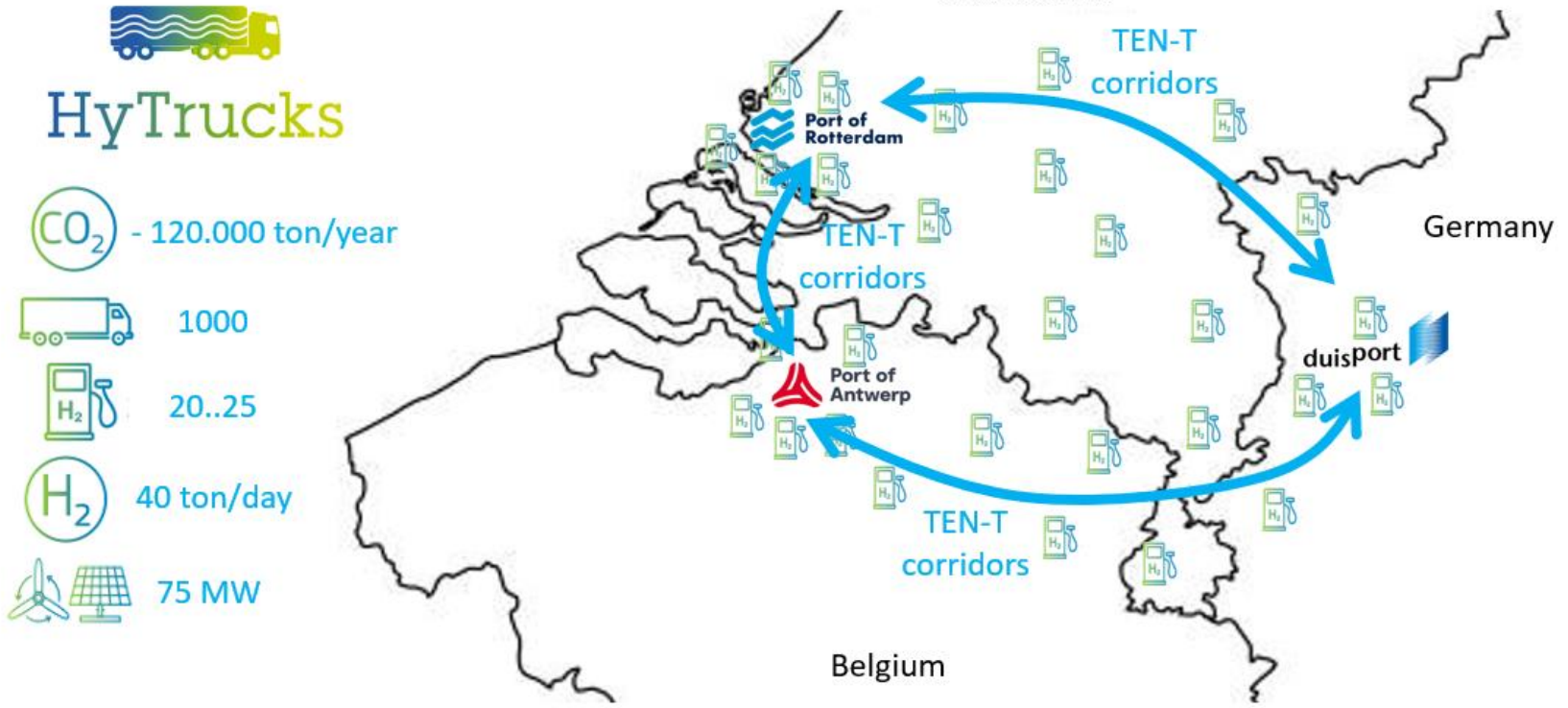
https://www.waterstofnet.eu/nl/overzicht-waterstoftankstations-benelux



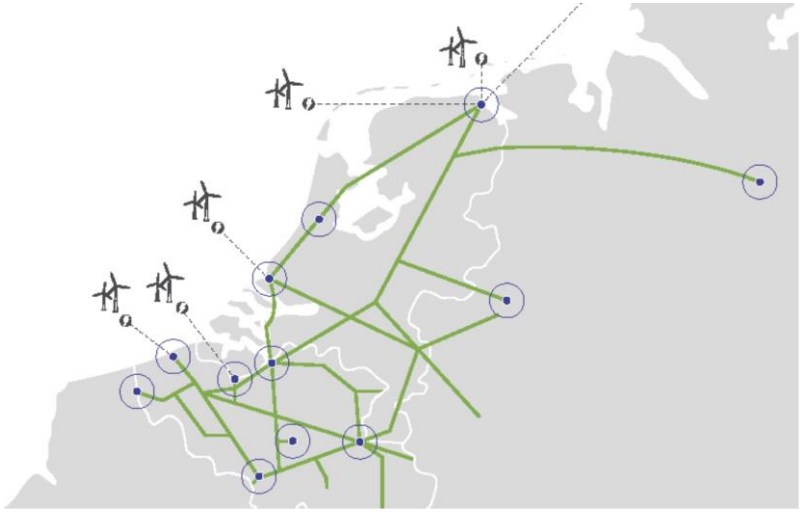
Network of hydrogen refuelling staions
25 in Benelux, 100 in Germany

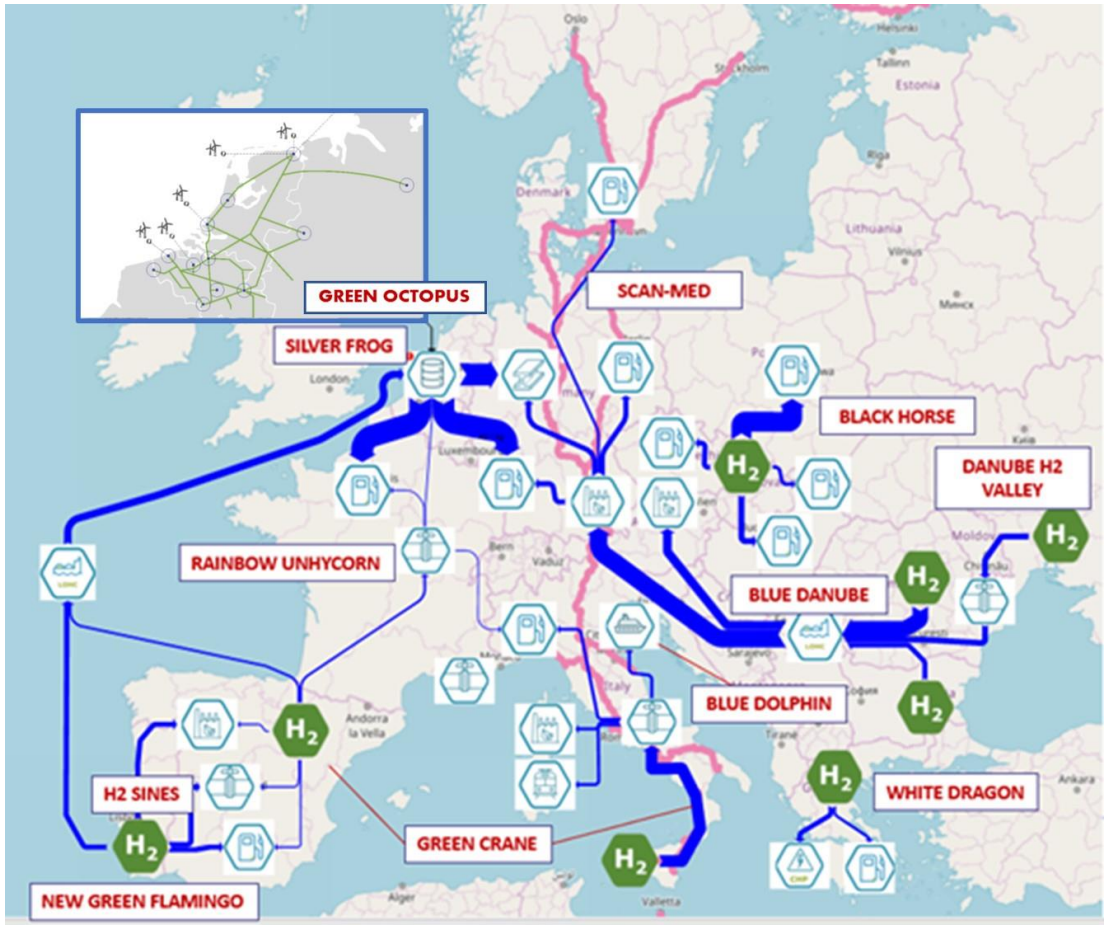


HyTrucks: trucks on hydrogen

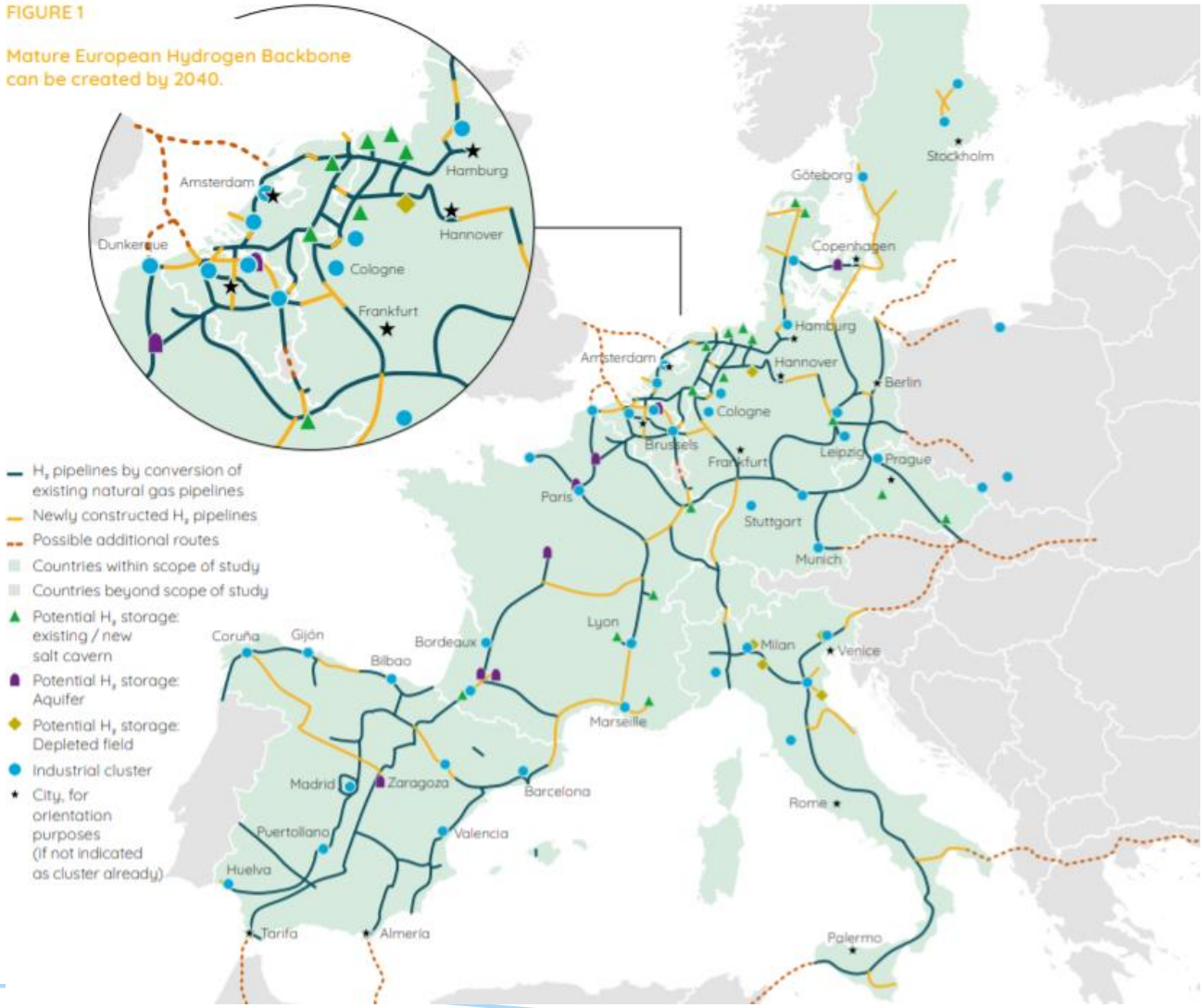


Not only mobility but also industry (steel/chem), infrastructure

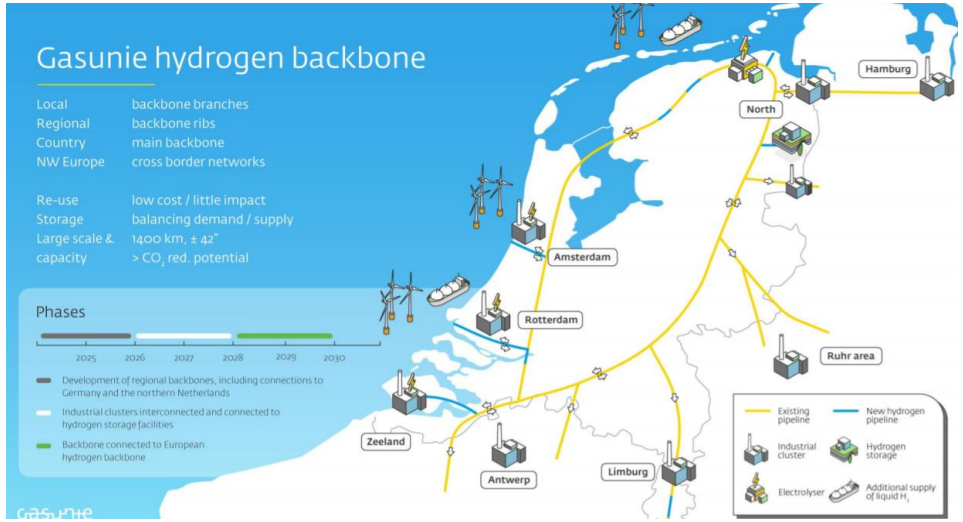


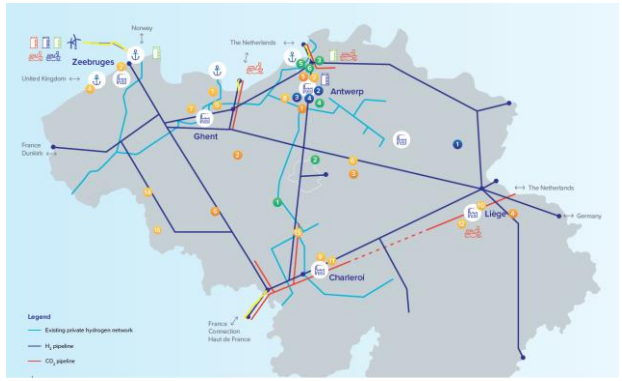


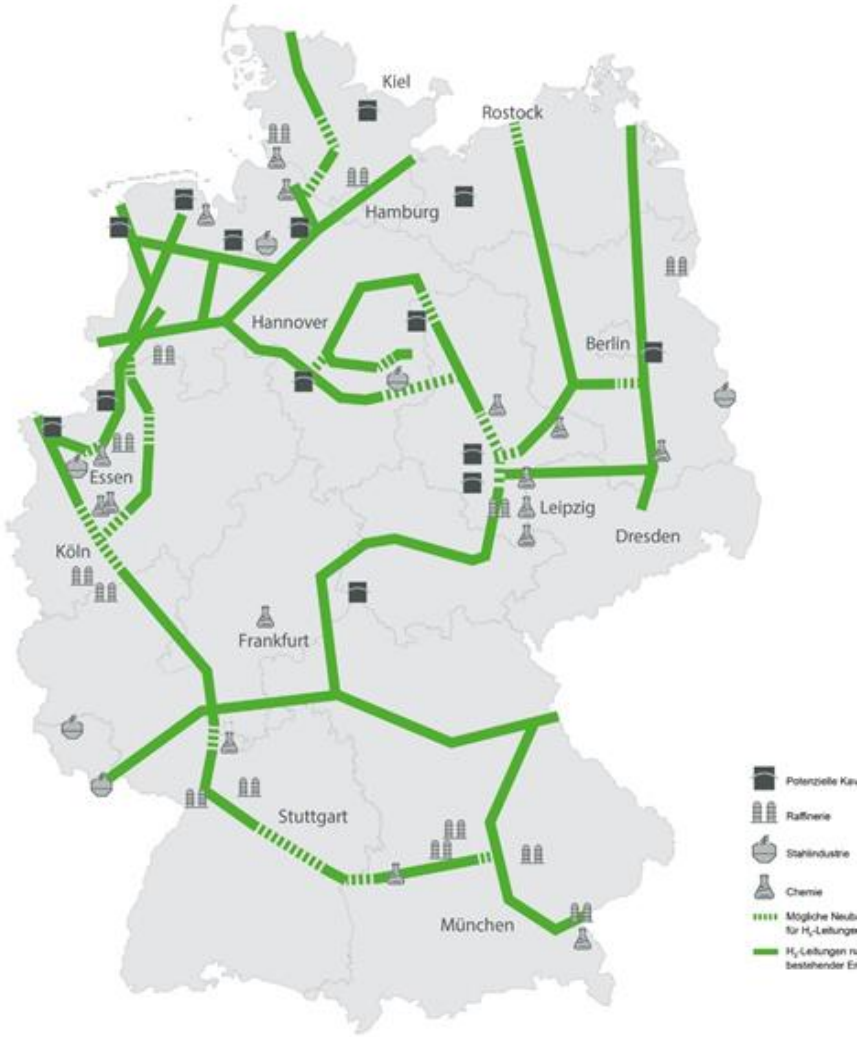
EMR and the European hydrogen backbone



Hydrogen backbone: Netherlands/Belgium/Germany to be connected







New hydrogen projects to be developed

WaterstofNet

Interreg Euregio Meuse-Rhine
EMR BOOSTER H2
EUROPEAN UNION
European Regional Development Fund

PRESS RELEASE

Cross-border ‘EMR H2 Booster’ consortium to accelerate hydrogen developments in Euregion Meuse-Rhine

Project partners

stadt aachen · LIOF · pom Limburg economisch versnellen · spi · IHK · UHASSELT · TWEED · WCL · WaterstofNet

Associated partner

parkstad limburg

Co-financers

provincie limburg · Ministerie van Economische Zaken en Klimaat · Provincie Noord-Brabant · Wallonie · Landtag Nordrhein Westfalen

Conclusions

- EMR is geographical strategic region in Europe on hydrogen
- Europe promotes crossborder cooperation on hydrogen
- We need:
  - Crossborder thinking on hydrogen
  - Crossborder projects on hydrogen
- Looking forward for the next steps in cooperation

WaterstofNet

Open Manufacturing Campus
Slachthuisstraat 112 bus 1
2300 Turnhout
België

T +32 (0)14 40 12 19

Kantoor Nederland

Automotive Campus
Automotive Campus 30
5708 JZ Helmond
Nederland

WaterstofNet
WaterstofNet

WaterstofNet.eu

Adwin Martens

adwin.martens@waterstofnet.eu

Bedankt voor uw aandacht!

Thank you for your attention!

WaterstofNet


WELCOME
TO WIC CITY

A smarter
&
Greener, low carbon

Meuse-Rhine area

21.10.2022

Anna Ozerova (Regional Antenna Limburg NL)

Interreg
Co-funded by the European Union
Meuse – Rhine (NL – BE – DE)

Agenda

14h00: Introduction

14h05: Presentation of priority 1 & 2 and specific objectives

14h15: Questions & Answers

14h20: End of the presentation

Interreg Meuse-Rhine (NL-BE-DE)

What is Interreg?

Interreg is part of the **European Union's cohesion policy** and is financed by the **European Regional Development Fund (ERDF)**. This fund strengthens economic and social cohesion in the European Union by **eliminating imbalances between regions** and **promoting cross-border cooperation**.

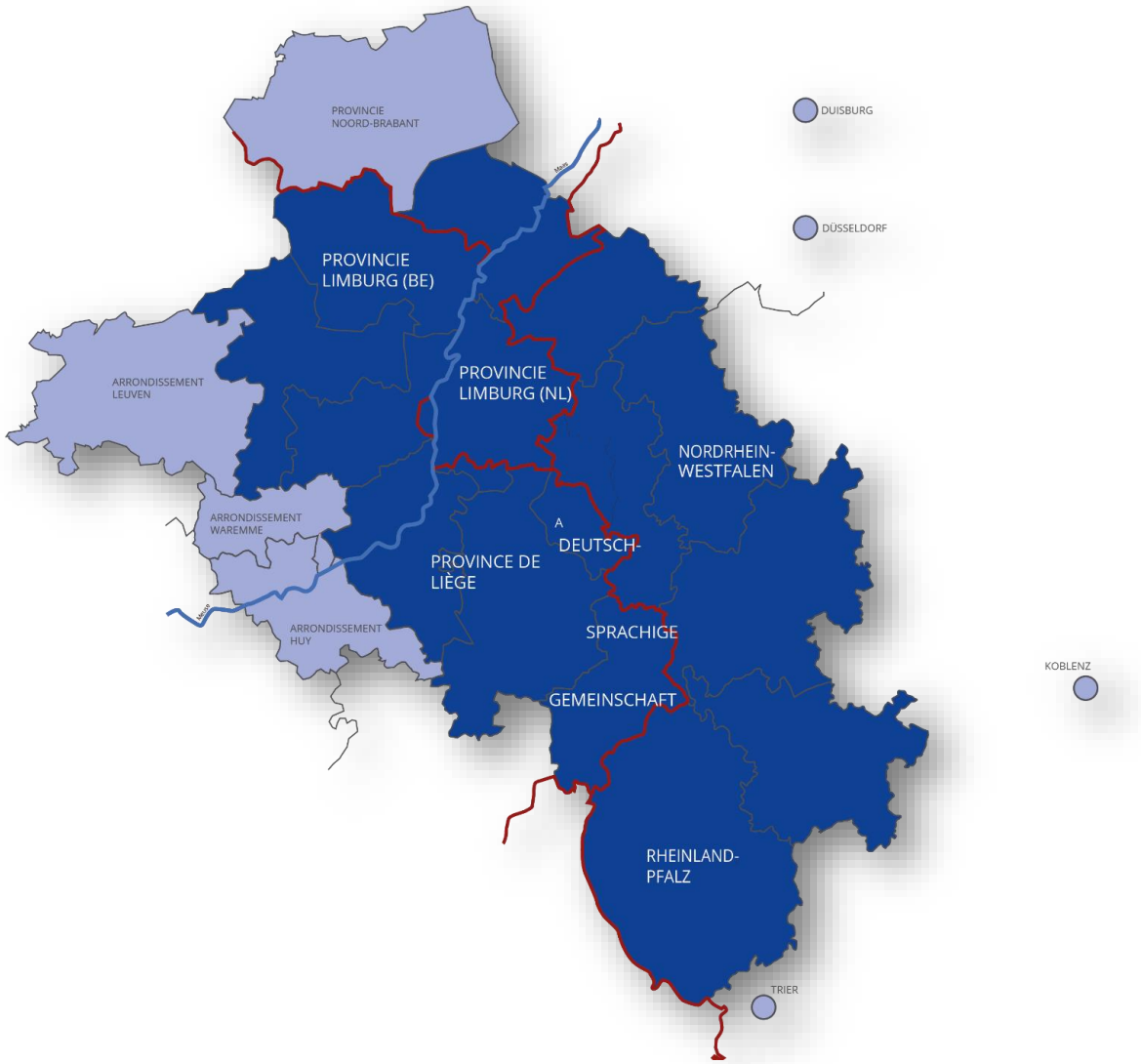
6th consecutive program, named Interreg Meuse-Rhine (NL-BE-DE)

Interreg
Co-funded by the European Union
Meuse – Rhine (NL – BE – DE)

Planned cooperation according to the principle of "**Functional Areas**" with:

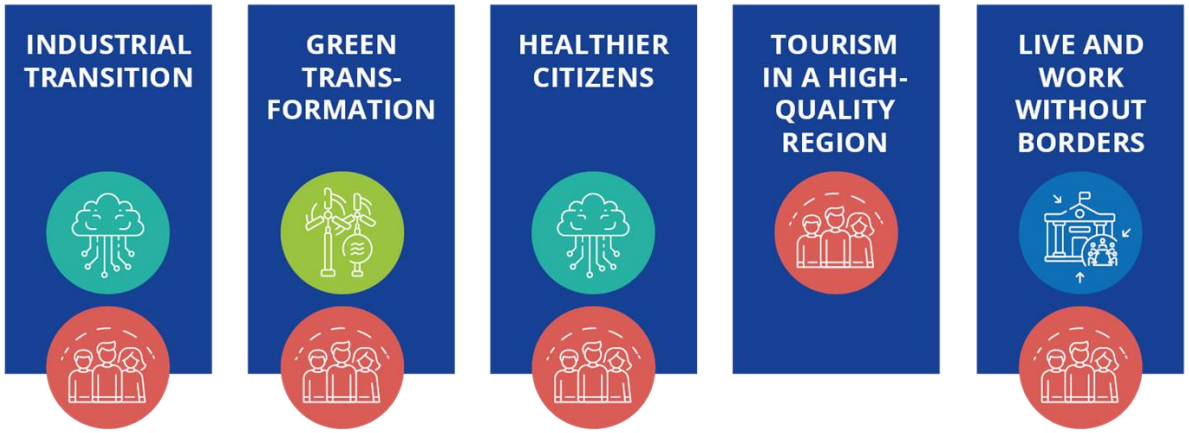
- Arrondissement Leuven (B)
- Arrondissements Huy and Waremme (B)
- Region Zuidoost-Noord-Brabant (NL)
- Düsseldorf, Duisburg (DE)
- Koblenz, Trier (DE)

 Does not affect PO 6!

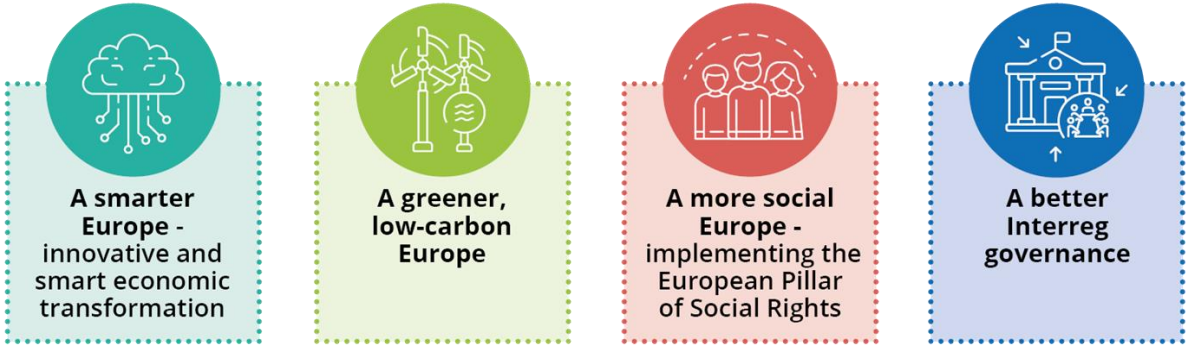


Content of the Programme

Our 5 grand societal challenges



4 priorities



Priority 1

A Smarter Meuse-Rhine area:

- Promoting Industry 4.0 and key enabling technologies
- Developing and enhancing research and innovation capacities and the uptake of advanced technologies
- Enhancing sustainable growth and competitiveness of SMEs and job creation in SMEs, including by productive investments
- SO 1.ii en 1.iii

Enhancing sustainable growth and competitiveness of SMEs and job creation in SMEs, including by productive investments

- Collaboration: knowledge and training institution with the industry (lifelong learning)
- Development and implementation of an innovation scheme, stimulating sustainable cross-border development and cooperation on promising innovation projects between SMEs (business-to-business)
- Innovation projects adapting to changing circumstances, creating new solutions, generating new business;
- Digitalisation of products, processes and services (e-commerce and e-business);
- Cross-border innovation processes, technology transfer and business aimed at introducing new products and services to the market

Priority 2

A greener, low carbon Meuse-Rhine area:

- Renewable energy
- Adaptation to climate change
- Circular energy economy

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Type of actions

- Cross-border cooperation and knowledge exchange on topics like hydrogen, building integrated PV, large scale (energetic and circular) renovation of buildings, green heat/cold and woodchip production);

- Experimentation with new models for generation of renewable energy and demonstrating these renewable energy solutions in a real environment. SMEs and inhabitants in the Meuse-Rhine area also need support with setting up innovative organizational structures for organizing and financing investments in sustainable energy generation, overcoming differences in regulations.

Type of actions

- Close-to-market eco-innovation projects from SMEs: developing business cases, pilot projects and demonstration projects in relevant environments, translating innovations into scalable products and services;

- Innovative processes by which multiple enterprises within a shared market segment collaboratively plan, implement and manage renewable energy in a way that increases the share of renewable energy in sectors that are more difficult to decarbonize;

Getting started

- Define theme and check compatibility with program objectives
- Reflect on specific challenges, necessary impacts and corresponding products/services (deliverables)
- Search for cross-border partners support from the Regional Antennas
- Weigh up costs and financing: 50% EU contribution, raise remaining 50% yourself (possibly public co-financing -> contact the Regional Antennas)
- Monitor information / updates of the program: Home | Interreg Euregio Maas-Rijn (interregemr.eu)

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Meuse – Rhine (NL – BE – DE)

Regional Antennas

The Netherlands - Maastricht
Anna OZEROVA

Germany - Aachen
Fabian THIMM

OstBelgien - Eupen
Celine MARCHAL
Michel MARGRAFF

Belgium - Hasselt
Frederik LOY

Belgium - Liège
Axel NOEL
Cristina JORS
Jessica KRIESCHER
(Executive assistant)

Interreg Meuse-Rhine Team

Interreg

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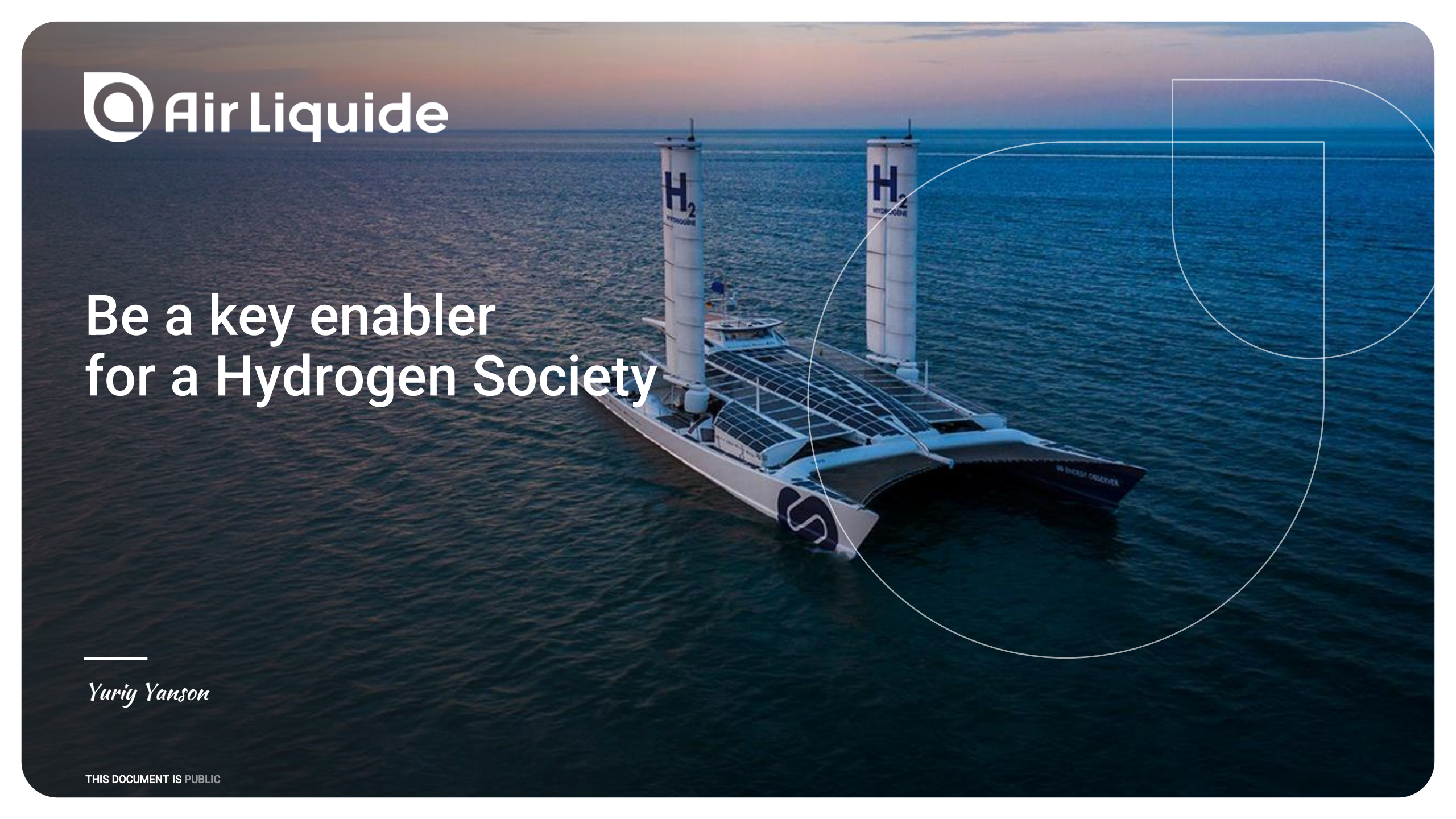
Questions and Follow-up.

Please contact us !

interregemr.eu

Air Liquide

Be a key enabler for a Hydrogen Society



Yuriy Yanson

01

Air Liquide in Brief

Air Liquide Group 2021 Key Figures

~66,400
EMPLOYEES

PRESENT IN
75 COUNTRIES

MORE THAN
3.8 MILLION
CUSTOMERS &
PATIENTS

REVENUE
€23bn

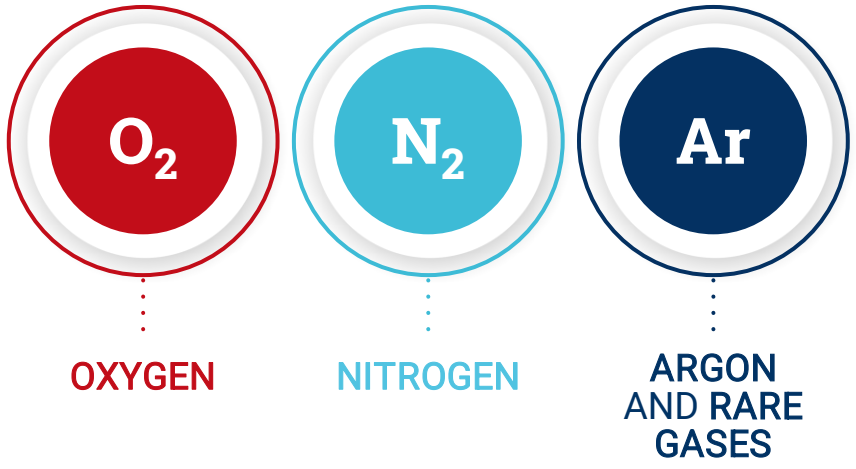
NET PROFIT
(GROUP SHARE)
€2.6bn

INVESTMENT
DECISIONS
€3.6bn

Our scientific territory: Essential small molecules

Oxygen, nitrogen and hydrogen are essential small molecules. They embody Air Liquide's scientific territory and have been at the core of the company's activities since its creation in 1902.

Separating the components of **air** to take advantage of their properties



Producing molecules from the **natural resources** of the planet

02

Hydrogen Markets and The Role of Air Liquide

Hydrogen makes it possible to address major challenges

One molecule, multiple uses

- A molecule used in various industrial processes, including refining, chemicals, electronics…

But it can also be used:

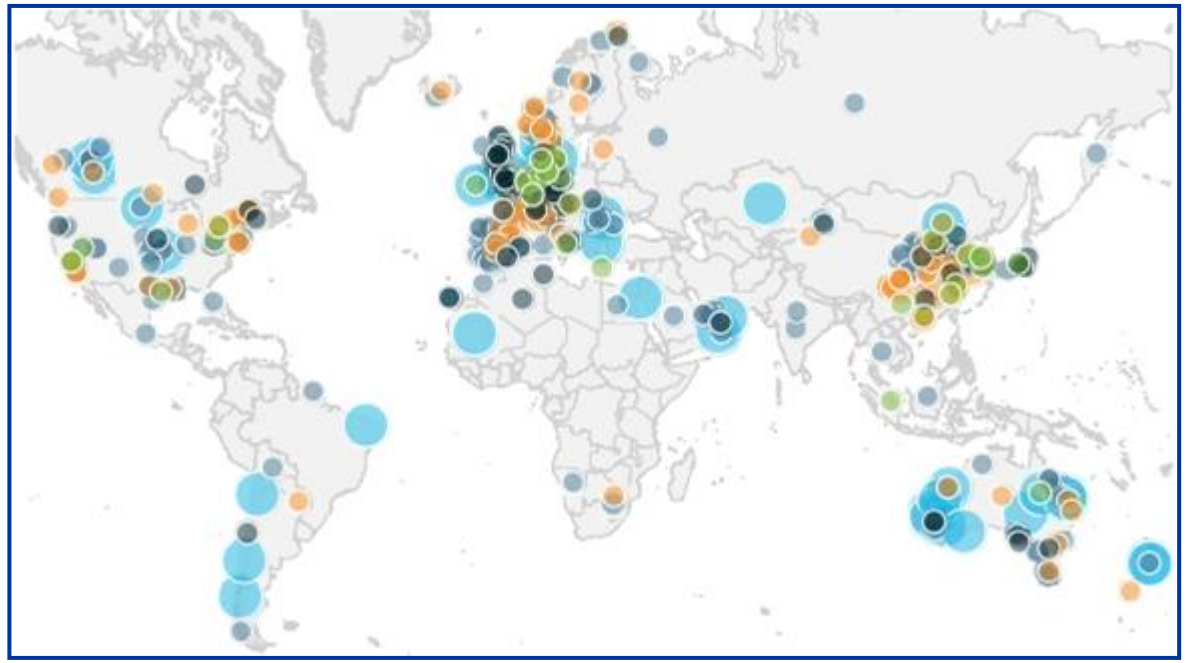
- As a feedstock to decarbonize industry
- As an energy carrier for industry and clean mobility

A solution for a better future

Hydrogen plays a role in:

- Fighting against climate change
- Tackling the energy transition
- Reshaping industry
- Deploying clean mobility

Significant international momentum



- **60+** Giga-scale production *(renewable and low-carbon projects)*
- **330+** Large-scale Industrial usage *(refinery, ammonia, methanol, steel and industry feedstock)*
- **150+** Transport *(trains, ships, trucks, cars and other mobility applications)*
- **75+** Integrated hydrogen economy *(cross-industry, projects with different types of end-uses)*
- **60+** Infrastructure *(hydrogen distribution, transportation, conversion and storage)*

~700 projects announced with **investments** of **$240 bn** (and a target of $610 bn by 2030)

48% industry | **22%** transport

+ large infrastructure projects emerging

Updated in September 2022

Hydrogen: a unique expertise and experience

60
YEARS OF EXPERTISE

>1,000
EMPLOYEES IN HYDROGEN

€2.2bn
ANNUAL SALES

1.2 Mt
ANNUAL PRODUCTION

~200
STATIONS DELIVERED

~2,000
KM OF PIPELINES

We think BIG for hydrogen

By 2030[(a)]

~€8bn

INVESTMENT DECISION

3 GW

ELECTROLYSIS

Before 2035

>3x

SALES

(a) Including a confirmed capacity of 1 GW still under construction

We address two major challenges: decarbonation of hard-to-abate industries and clean transport revolution

Our key markets

- Refining
- Metals
- Chemicals

Our key markets

- Road mobility
- Rail
- Maritime
- Aviation

03

Hydrogen in Mobility
Inland Waterway Transport

We need a combination of solutions to decarbonize different needs

Use case

Best solutions

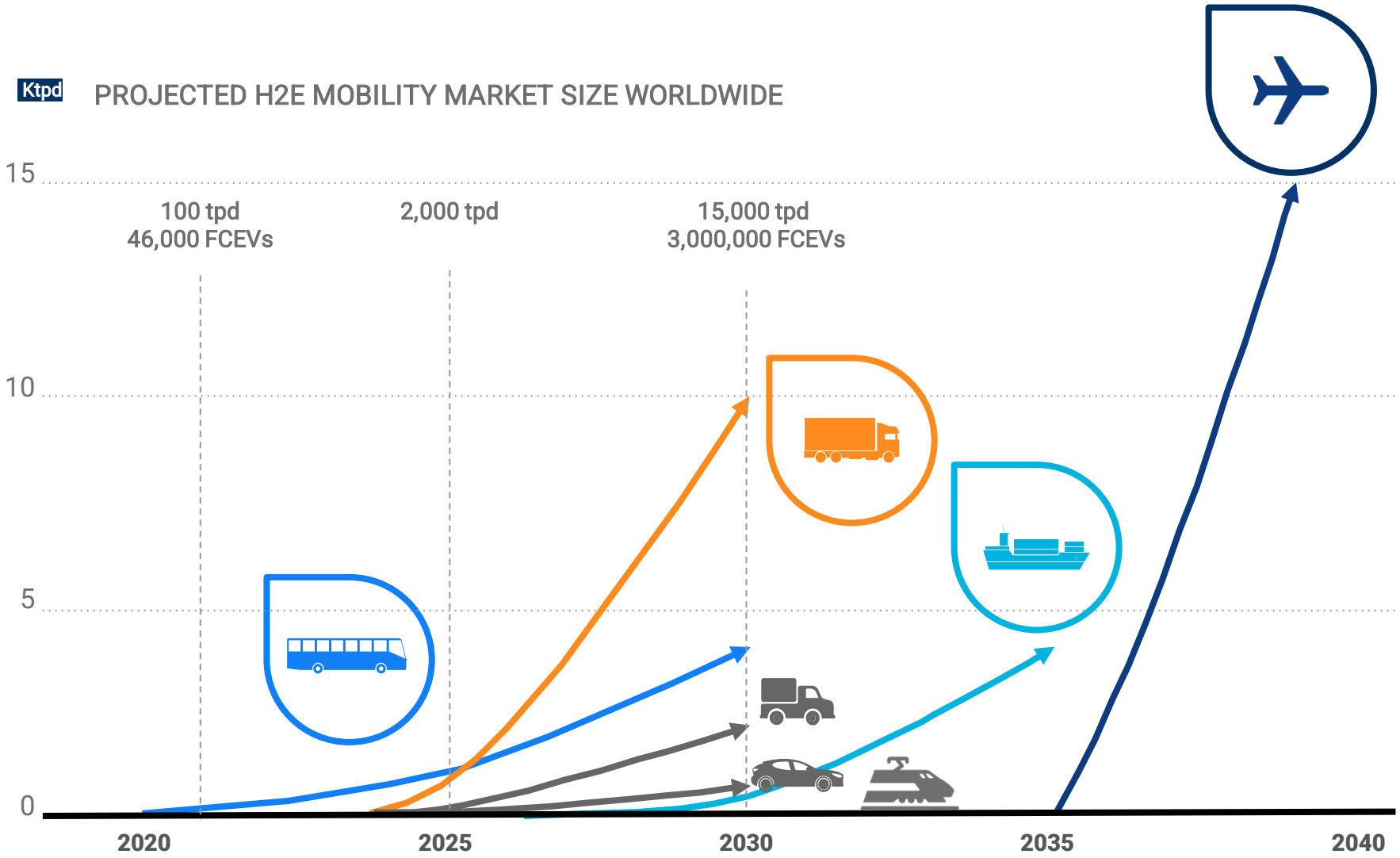
	Ground (light, low intensity)	Ground (heavy, high intensity)	Rail	Waterborne	Aviation
Battery electric	✓	✓	✓	✓	
Hydrogen	✓ Long distances, Isolated areas, Large vehicles	✓	✓ Isolated areas	✓	✓
Overhead wire			✓		
Ammonia				✓ Toxicity issues	
E-fuels				✓ CO_2 emissions, Cost	✓ CO_2 emissions, Cost

Hydrogen can address all mobility segments

✓ Best suited solution

✓ In certain situations

Ready to accompany the growth of hydrogen mobility



25%
transport CO_2 impact

80+
CO_2 regulations worldwide

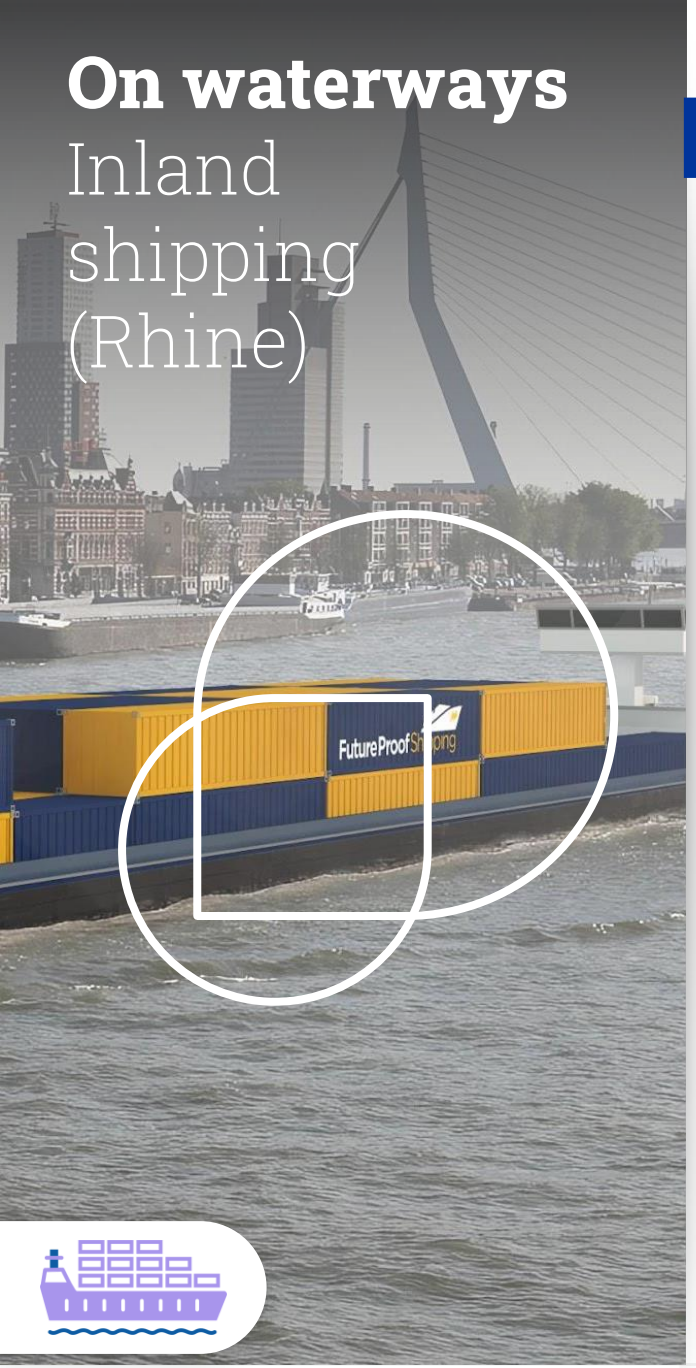
3 M
hydrogen vehicles by 2030

10
min to refuel a bus

50%
of hydrogen demand dedicated to transport by 2050

Estimates as of end of 2021

On waterways
Inland shipping (Rhine)



Market outlook

Inland waterway transport is considered as an environmental friendly mode of transport and seen as a key factor in reducing road traffic congestion and pollutant emissions in the transport sector.

Even if the inland shipping industry is not facing stringent regulatory constraints:

- Environmental regulations, roadmaps & declarations have been catching up in the past years.
- Emerging pressure from inland water transport customers looking to reduce their value chain's carbon footprint.

If as of now, almost the entire fleet uses diesel engines, new and greener propulsion systems are an increasingly important subject for the sector.

By switching to hydrogen as fuel, ships can minimize emissions, limiting air and water pollution.

Several projects have demonstrated the feasibility of zero-emissions hydrogen propelled inland shipping and are being implemented.

Benefits of hydrogen

- Zero-emission
- Higher operational range vs batteries
- Suited for the average power requirements

Key figures (2021)

15k
inland commercial vessels in Europe

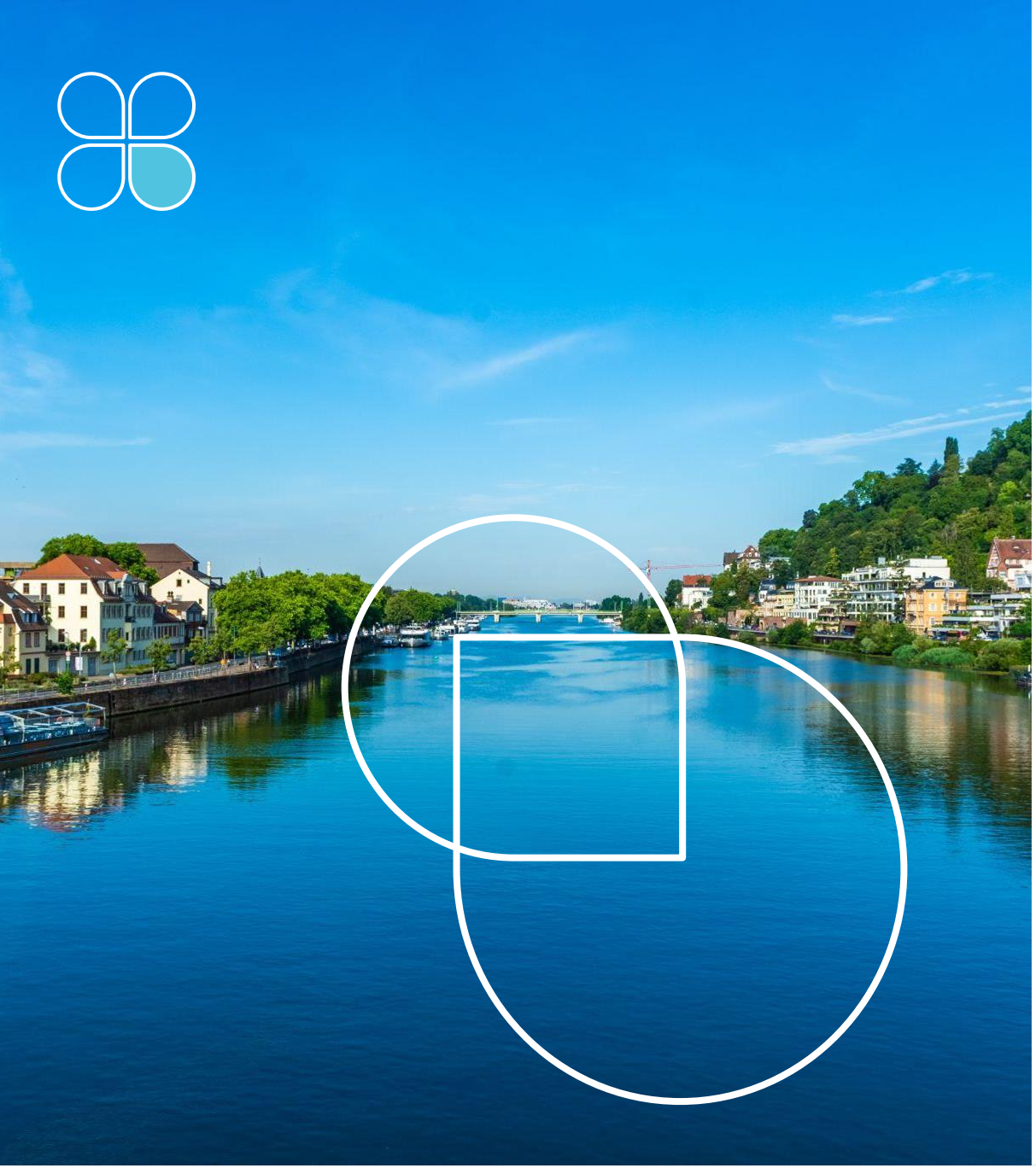
523mi
tonnes of goods transported via inland (EU)

40
year average lifetime of an inland vessel

150
zero-emission vessels target by 2030 in Netherlands

Our customers

FutureProofShipping



Consortium

RH2ine

Decarbonizing shipping industry in Europe

Hydrogen

- Renewable hydrogen

Capacity

- 40-50 H_2 tons/week (total consortium)

Market

- Rhine-Alpine corridor

Key figures

- +12 H_2-powered ships should be railing on the Rhine by 2026

Emission reduction

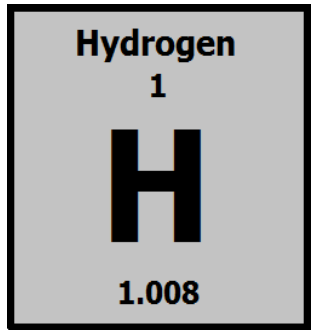
- 22 ktons CO_2 reduction in 2026 and reduction of air pollutants (NOx and SOx)

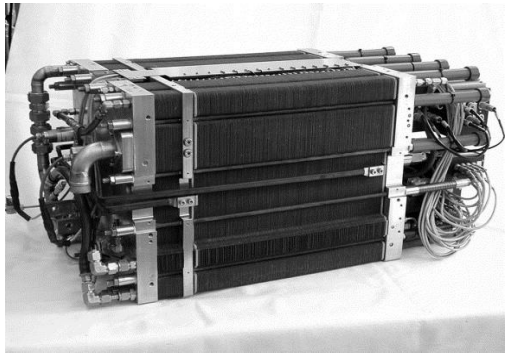
3 key challenges for H2 propulsion in shipping

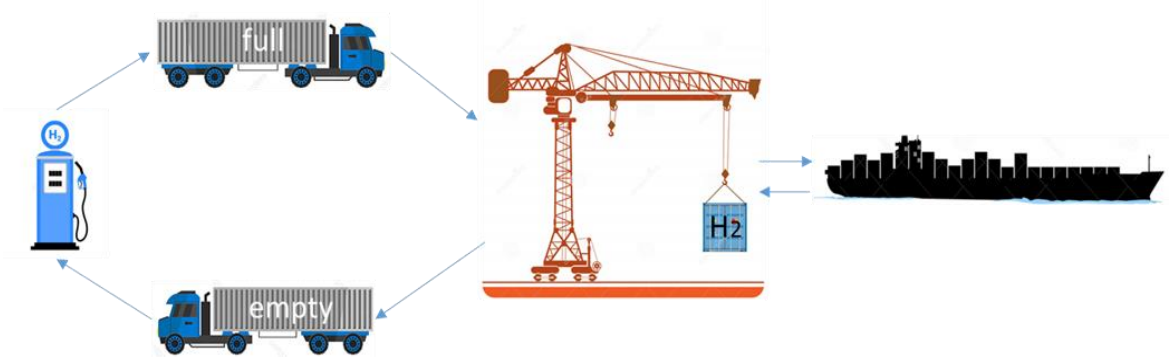
1. Hydrogen price, color, and availability.

2. Bunkering technology, infrastructure & logistics

3. Fuel-cell and hydrogen technology on-board







Future Proof Shipping: first hydrogen container ship

Air Liquide will supply hydrogen for the first H2-propelled container ship to sail between Belgium and the Netherlands in collaboration with FPS, expected to start sailing end 2022

- Air Liquide developed swappable hydrogen containers to store, supply, and use hydrogen on-board of the ship
- Full certification by Lloyd’s Register to use as fuel tank
- Robust supply chain by utilization of hydrogen production, distribution, and filling

Challenges for Hydrogen in Inland Shipping

- Lighter and stronger hydrogen containers for higher payload
- Container swapping infrastructure: equipped terminals, swap locations, mobile swap vessels
- Optimized container fleet management solutions
- Utilization of containers outside of shipping sector
- Ways to monetize on zero-emission shipping services

Thank you

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Interreg
Euregio Meuse-Rhine
EMR BOOSTER H2
EUROPEAN UNION
European Regional Development Fund

Matchmaking Sessions

Brightlands Chemelot Campus 21st of October

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EMR BOOSTER H2
EUROPEAN UNION
European Regional Development Fund

Get connected to participate in future hydrogen projects!

Matchmaking Themes

- The EMR-Hydrogen Booster Consortium selected 4 themes on which we like to focus and develop new projects around:

1. ***Hydrogen for inland shipping and barges***
   - Possible follow up for RH2INE, Zellie and future proof shipping?
2. ***Hydrogen Production***
   - Production @ Saint Gobain Herzogenrath/ use of heat in homes
   - Several local electrolyser projects
3. ***Setting up Local Hydrogen Hubs***
   - Hydrogen Hub or Lab Avantis?
4. ***Crossborder Hydrogen Bus connections***
   4. A connection with H2-Busses between Aachen, Liege and Maastricht?

Matchmaking process and follow up

Process:

1. 4 spaces, one per theme, themes are on displays.
2. Get a drink, go to the table or room with the theme of your interest by following the theme-manager.
3. Hand your bussiness-card or badge to the theme-manager
4. Exchange your idea's, desires, plans and questions
5. All contacts and idea's will be gathered, to form future consortia and projects.

Next steps:

1. There will be 2 more matchmakings; Aachen region and Franchorchamps
2. All contacts and idea's will form the bases for new projects and future consortia.
3. Latest in June next year, we hope to have at least 4 new project-plans and consortia to work with, get finance for, and develop further

Themes per Room

1. Arthur presentation room :
   - **Hydrogen for Inland shipping and Barges**
   - Theme-manager: Yuriy Yanson, AirLiquide
2. Room Tristan:
   - **Hydrogen Production**
   - Theme-manager: Davine Janssen, WaterstofNet / Martin Schreurs, LIOF
3. Room Bors:
   - **Local Energy (H2)Hubs**
   - Theme-manager: Arjan Rensma
4. Central hall (2nd floor):
   - **Cross-border H2-Bus connections**
   - Theme-manager: Jan-Willem Tolkamp, LIOF

Get connected, get involved, go to the tables!

QUESTIONS?

Matchmaikng T2 Campus Genk

Interreg Euregio Meuse-Rhine EMR BOOSTER H2 EUROPEAN UNION European Regional Development Fund

Interreg
Euregio Meuse-Rhine
EMR BOOSTER H2

EUROPEAN UNION
European Regional Development Fund

Project partners

stadt aachen

LIOF Empowering innovation and business in Limburg

pom Limburg economisch versnellen

spi

Industrie- und Handelskammer Aachen IHK

UHASSELT Knowledge in action

TWEED

WCL Waterstof Coalitie Limburg

WaterstofNet

Associated partner

parkstad stadsregio limburg

Co-financers

provincie limburg

Ministerie van Economische Zaken en Klimaat

Provincie Noord-Brabant

Wallonie

LANDTAG NORDRHEIN WESTFALEN