

# HyLaw Project - EU-level activities



**HyLAW**  
Hydrogen law

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Grant Agreement No 737977

# Hydrogen Europe and the Fuel Cell & Hydrogen Joint Undertaking



European Union represented by the European Commission

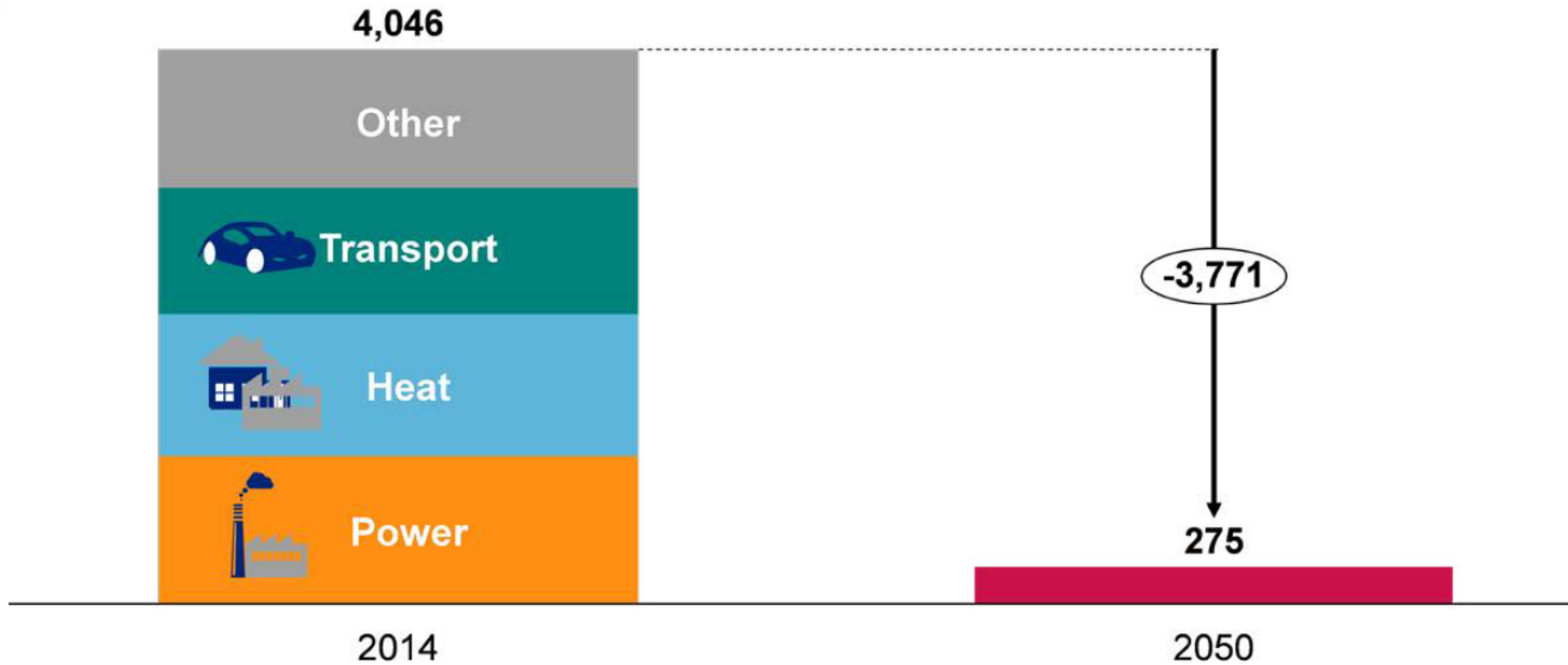


A portfolio of clean, efficient and competitive solutions based on fuel cells and hydrogen technologies in energy and transport



# The Challenge: How to decarbonise the European Economy

FIGURE 1 – THE SCALE OF EUROPE’S DECARBONISATION PROBLEM (MtCO<sub>2</sub>e)



Source: 2016 National Inventory Submissions (Common Reporting Format) for EU, Norway and Switzerland.

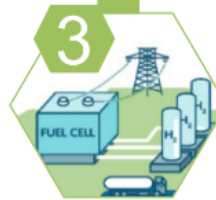
# ... Sectoral Integration through green hydrogen offers solutions

Enable the renewable energy system → Decarbonize end uses

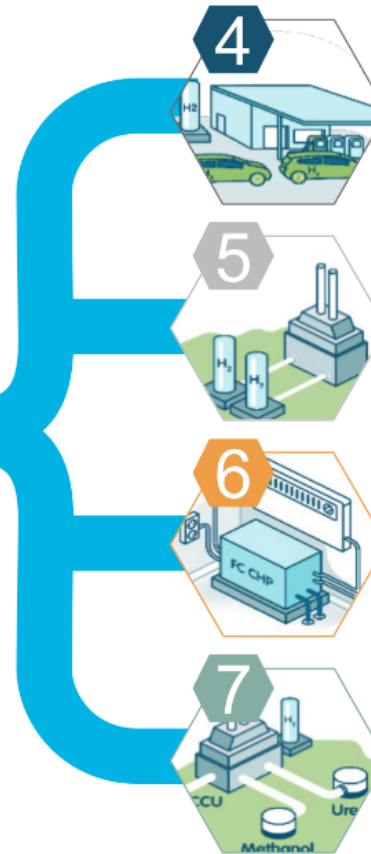
Enable **large-scale renewables integration** and **power generation**



**Distribute** energy across sectors and regions



Act as a **buffer** to increase system resilience



Help decarbonize **transportation**

Help decarbonize **industrial energy use**

Help decarbonize **building heat and power**

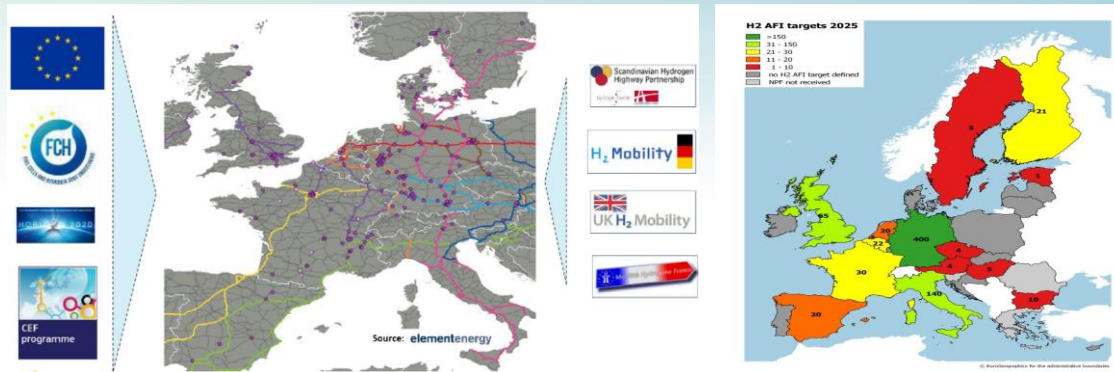
Serve as renewable **feedstock**

... Where do we stand on green hydrogen?

# Hydrogen for the Transport sector: Cars & LDVs



May 2018: ZEFER fleet of 180 taxis and police



2017: National plans for HRS deployment towards 2025



June 2018: ENGIE fleet of 50 hydrogen-powered Renault Kangoo Z.E. utility vehicles



H2ME: 1400 FCEVs for customers with the further deployment of 45 HRS

## EU-funded projects

- ◆ **CHIC (36 buses, plus 20 in Canada)**
  - ✓ Aargau, CH;
  - ✓ Bolzano, IT; London, UK; Milan, IT; Oslo, NO; Cologne, DE\*; Hamburg, DE\*

## High V.LO-City (14 buses)

- ◆ ✓ Antwerp, BE; Aberdeen, UK; Groningen, NL; San Remo, IT

## HyTransit (6 buses)

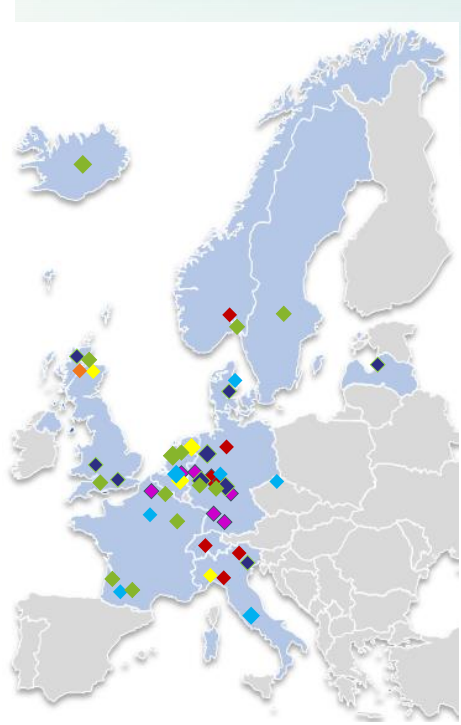
- ✓ Aberdeen, UK

## 3Emotion (21 buses)

- ✓ London, UK
- ✓ Aalborg, DK; Pau, FR; Rome, IT; South Rotterdam, NL; South Holland; Versailles, FR

## National/regional-funded projects

- ◆ ✓ Karlsruhe, DE; Stuttgart, DE; Frankfurt, DE;
- ✓ Arnhem, NL; North Brabant, NL; Artois Gohelle, FR



### Legend

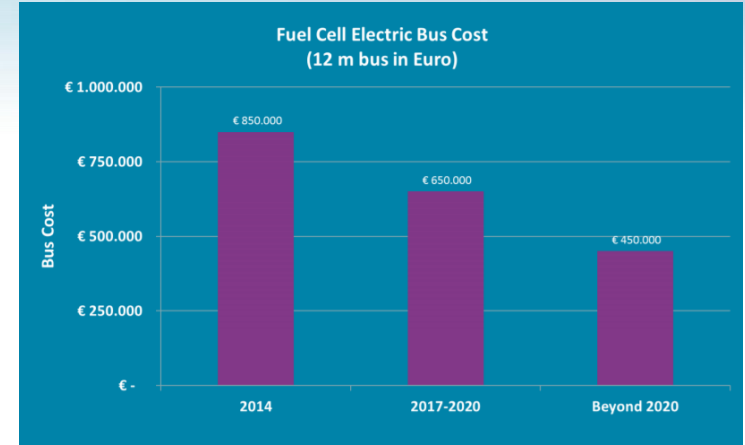
- Countries with (upcoming) FC buses
- ✓ In operation
- ✓ Planned or operation ended
- \* National funding

## JIVE (139 buses)

- ✓ Aberdeen, UK – 10 FC buses
- ✓ Birmingham – 20 FC buses
- ✓ Bolzano, IT – 12 FC buses
- ✓ Cologne region, DE – 30 FC buses
- ✓ Herring, DK – 10 buses
- ✓ London, UK – 26 FC buses
- ✓ Rhein-Main region, DE – 11 FC buses
- ✓ Riga, LV – 10 FC buses
- ✓ Wuppertal, DE – 10 buses

## JIVE 2 (152 buses)

- ✓ UK – 20 buses
- ✓ Dundee, UK – 12 buses
- ✓ Groningen, NL – 20 buses
- ✓ North Brabant, NL – 10 buses
- ✓ South Holland, NL – 20 buses
- ✓ Auxerre, FR – 5 buses
- ✓ Pau, FR – 5 buses
- ✓ Toulouse, FR – 5 buses
- ✓ Cologne region, DE – 15 buses
- ✓ Germany – 15 buses
- ✓ Iceland – 10 buses
- ✓ Sweden – 5 buses
- ✓ Akershus, NO – 10 buses



EvoBus

SOLARIS

VANHOOL

VDL

RIGHTBUS

Safra

Non European OEMs



Source : Element Energy/JIVE. Note: this list is not exhaustive.

next steps tbc



# Hydrogen for the Transport sector: HDV



## FCH-JU H2ME project Batt+RE



Location	France
Manufacturer	Symbio Renault
Autonomy	Tbc
Tank cap.	Tbc
Capacity	Tbc
Filling time	Tbc



## ESORO COOP



Location	Switzerland
Manufacturer	ESORO
Autonomy	400 KM
Tank capacity	31 KG
Capacity	34'000 KG
Filling time	10 min



## ASKO-SCANIA



Location	Norway
Manufacturer	SCANIA
Deployment	2018
Autonomy	500 km
Transport Capacity	27'000 KG



## VDL - COLRIJYT



Location	Belgium
Manufacturer	VDL Group
Deployment	2018
Transport Capacity	37'000 KG



FCH-JU started with FC in trucks by researching APU's (3 projects) then Range Extenders in H2ME, by end 2017 about 15 garbage trucks expect to be funded



Nicola Trucks



Toyota Truck @LA port



Kenworth FC drayage truck



Partners planning 2,000 commercial vehicles on the road in next 3 years.



Toyota and 7-eleven study to use FC

# Switzerland orders 1000 hydrogen trucks



## World premiere: Alstom's hydrogen trains enter passenger service in Lower Saxony



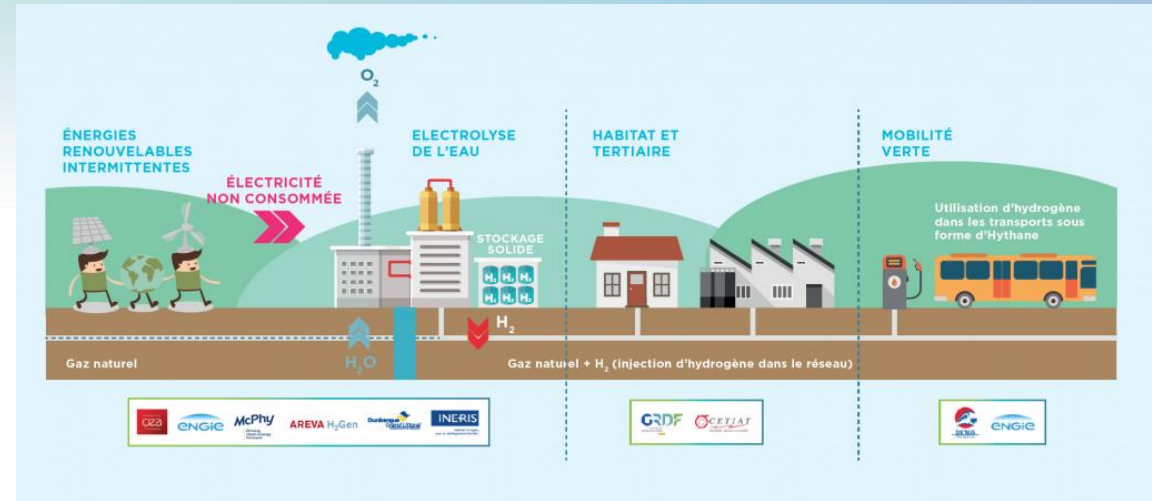
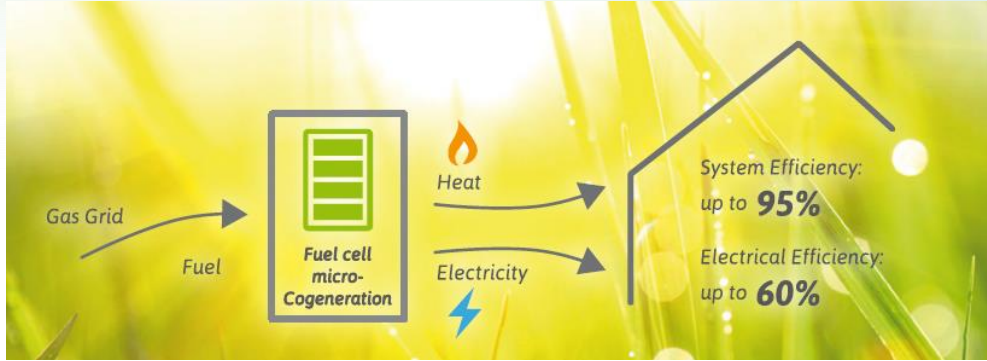
„This is a revolution for [@Alstom](#) and for the [#FutureOfMobility](#).

The world's first [#hydrogen](#) [#fuelcell](#) train is entering passenger service and is ready for serial production”

Henri Poupart-Lafarge,  
Chairman & CEO of Alstom

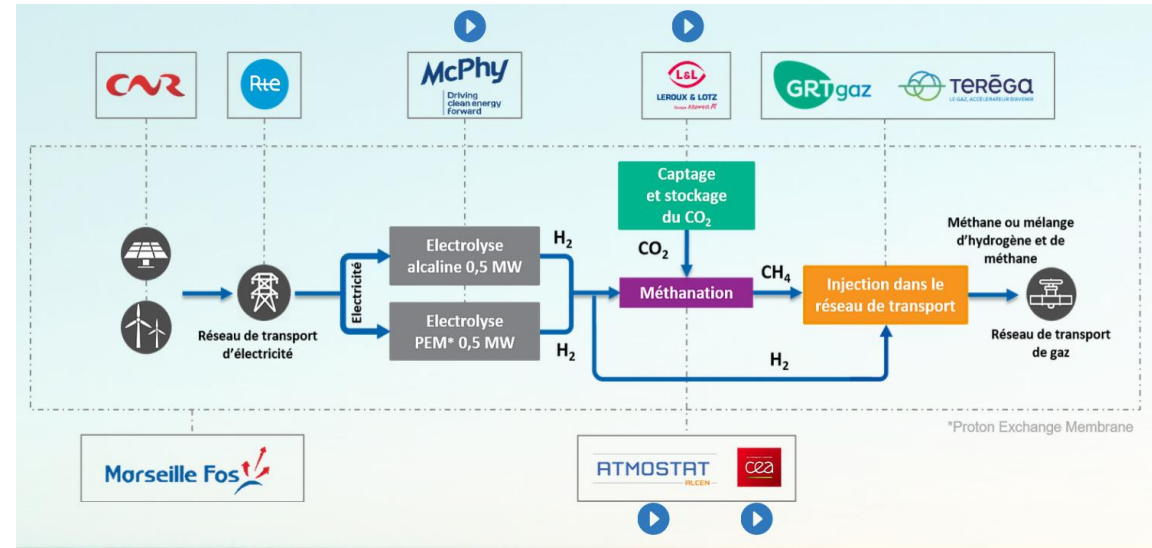
16 September 2018

# Hydrogen for the Gas sector

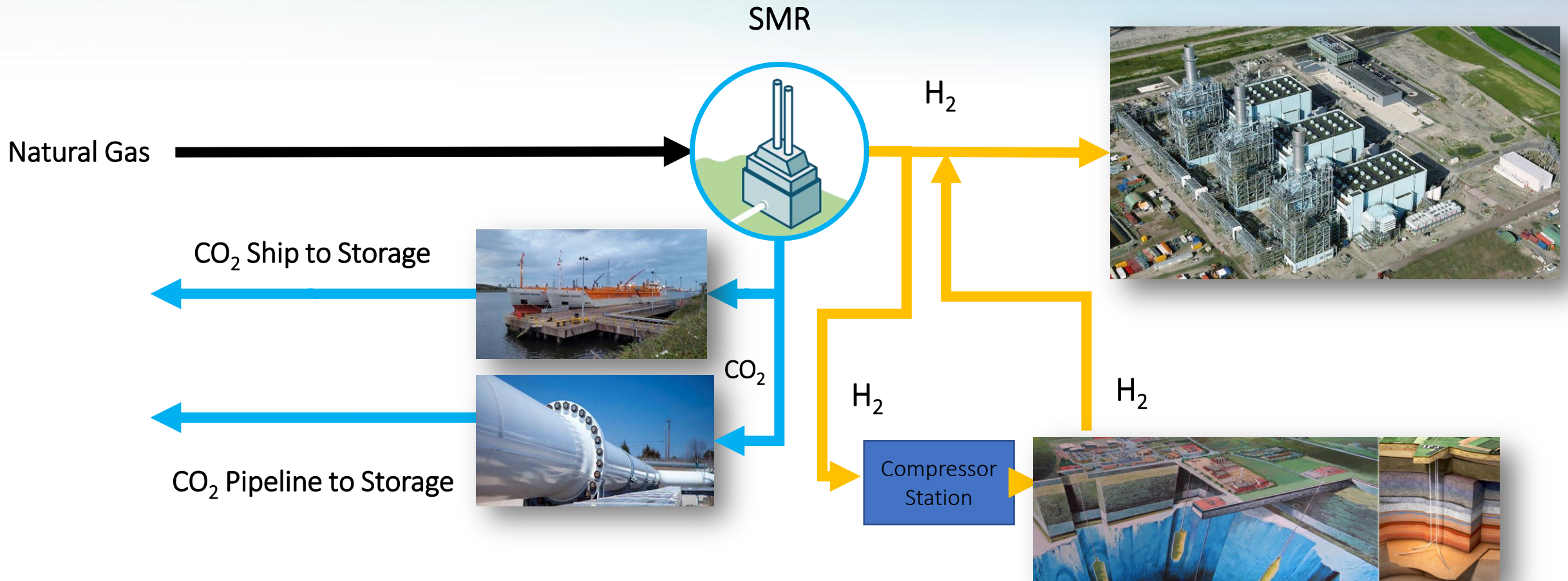


2018: Grhyd (FR)

2018: Jupiter1000 (FR)



# Hydrogen for the Power sector





## REFHYNE

CLEAN REFINERY HYDROGEN FOR EUROPE



One of the largest hydrogen electrolysis plant at Rhineland refinery, Germany.

4 t H<sub>2</sub>/day (1% of demand)

With a peak capacity of 10 megawatts the hydrogen will be used for the processing and upgrading of products at the refinery's Wesseling site as well as testing the technology and exploring application in other sectors.

- Design and installation of a **6 MW PEM electrolyzer** at the voestalpine steel plant in Austria
- Industrial integration of **renewable hydrogen production** in the steelmaking process
- **Two-year demonstration** of the electrolyzer system
- Long-term goal of **replacing coal and coke with green hydrogen**
- **Grid services** with electrolyzer
- Revenues from **electricity intraday and spot markets**
- **Peak shaving and storage options**



Other steel projects:

**HYBRIT**: SSAB & others (Sweden)

**SALCOS**: Salzgitter & others (Germany)

Sector	Requirement	Legislative Tools	Financial Tools	Hydrogen's role
<b>Transport</b>	-CO <sub>2</sub> -PM/NO <sub>x</sub> /SO <sub>x</sub> reduction -integration of RES	1. Fuel Quality Directive 2. Renewable Energy Directive (RED2) 3. CO <sub>2</sub> emission standards 4. Clean vehicle Directive 5. Alternative Fuel Infrastructure Directive	CEF Transport	-H <sub>2</sub> as a fuel -H <sub>2</sub> made fuels -green hydrogen for refineries
<b>Energy-intensive industries</b>	Decarbonisation	EU ETS	Modernisation Fund / Innovation Fund	Green/Decarbonised hydrogen as feedstock switch
<b>Gas/Heating</b>	Decarbonisation (to remain a player)	(1. RED (2)) 2. Upcoming Gas Regulation (2019/2020)	Possibly CEF Energy	1. Green/Decarbonised hydrogen as feedstock 2. Fuel cell as energy converter
<b>Power</b>	Storage / ancillary services	Electricity Market Design Directive / Regulation		Rapid response electrolyzers + Sectoral Integration

## A political milestone: the Hydrogen Initiative



*„We, the signatories of this initiative, gathered in Linz, Austria, on the 17th and 18th of September 2018, collectively aim to maximise the great potentials of sustainable hydrogen technology for the decarbonisation of multiple sectors, the energy system and for the long-term energy security of the EU.*

*Linz, Austria 18 September 2018“*

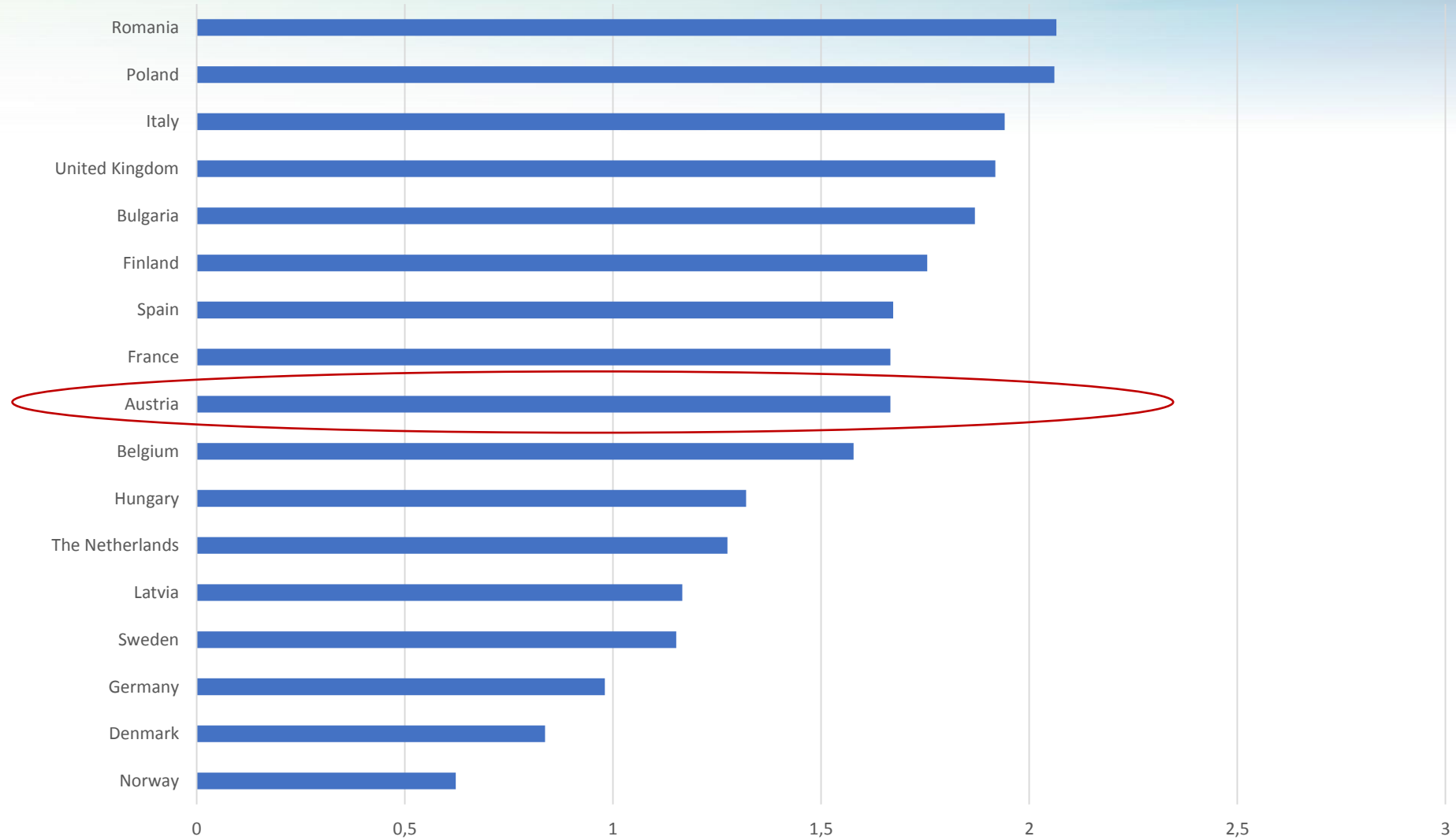
... but we are only at the start: further barriers will have to be removed

A positive regulatory framework for hydrogen requires 2 elements

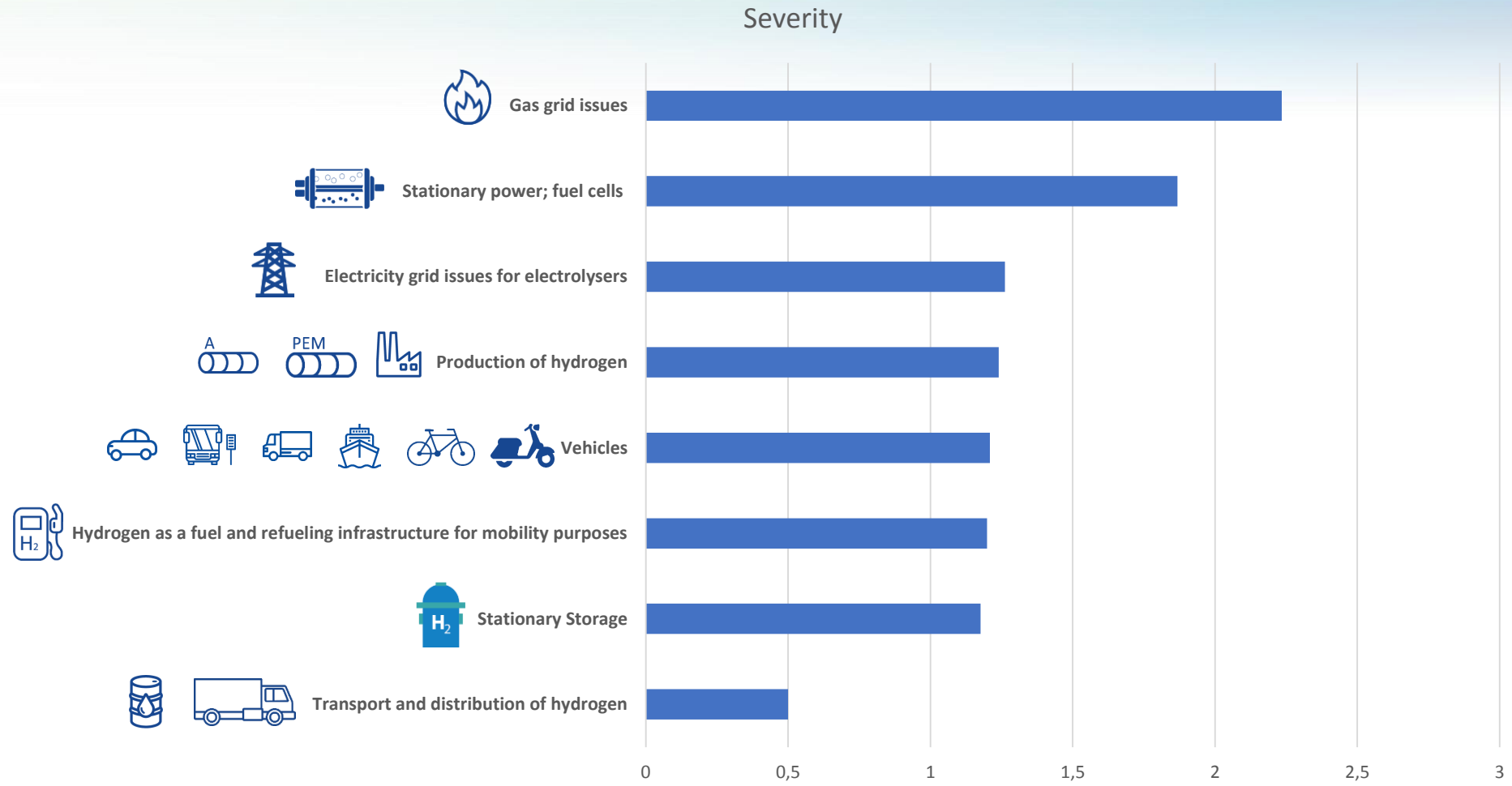
1. Positive legislation which acknowledges and supports the role of hydrogen → Hydrogen Europe's advocacy work

2. Removing barriers that will hinder the deployment  
→ HyLAW project

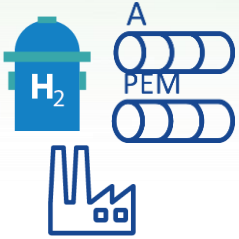
# Overall assessment across countries



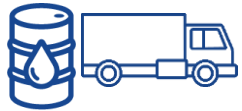
# Severity of barriers in each category



## HyLaw: Horizontal Findings – an overview



Directives designed to regulate large scale emitting chemical processes end up applying also to small scale, non-emitting processes / national permitting processes



Standards for compressed hydrogen receptacles (e.g. trailers) would need to be adapted to world with a higher demand for Hydrogen



- A guarantee of origin system for green and low carbon hydrogen at European level is essential;
- Infrastructure development encouraged at EU level / Common standards and definitions;
- Consumption of hydrogen (as a fuel) encouraged at EU level



Type approval and registration of hydrogen road vehicles appears to be quite clear and well regulated; this is not the case for maritime applications. However, there is a lack of incentives

## HyLaw: Horizontal Findings – an overview (II)



There is no clear and unequivocal legal position for P2G facilities recognized across both e-grid and gas grid networks



There are fundamental barriers severely constrain or prevent H2 injection in EU Gas Grids

The framework for permitting Power to Gas (P2G) plant and grid connection / injection requirements between the hydrogen supplier and the gas grid operators **should be included within relevant EU regulatory frameworks** to ensure comparable treatment across the EU.



There is no common EU framework for installation of FC micro-CHP units, however, no significant operational barriers were identified

Large Scale (industrial) stationary power fuel cells not covered by HyLaw, however, would the EU ETS apply to Solid Oxide Fuel Cells producing over 20 MW of power?

# THANK YOU!

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