The French Hydrogen Strategy

Regional approaches of the Hydrogen Plan

Webinar
May 11th, 2021
11am

With the participation of:

Program

11h05-11h25	**French strategy for the development of renewable and low-carbon hydrogen (attached in another document)** Lionel Prévors, Hydrogen Project Director, General Directorate of Energy and Climate, Ministry of the Ecological Transition
11h25-11h40	**Hauts-de-France – Hydrogen, the solution for the structural transformation of industry in Hauts-de-France region?** Jean Gravellier, Managing Director, Pôlénergie
11h40-11h55	**Normandy – A leading territory for hydrogen production and mobility** Sylvain Gigliesi, Renewable Energy Innovation Manager, Normandie Energies
11h55-12h10	**Sud, Provence-Alpes-Côte d'Azur – The sunny side of hydrogen** Sylvain Brémond, Deputy Director General, Capénergie
12h10-12h20	**Engie – Feedback on the hydrogen plan from ENGIE Solutions** Marie-Perrine Durot, Innovation & Green Industry Director, Engie
12h20-12h30	**Q&A** – Ask your questions to our panel of experts!

Hauts-de-France region

Is Hydrogen the energy-solution for structural transformation of industry in Hauts-de-France?

Jean Gravellier

General Manager,

Pôlénergie

Hauts-de-France Region

A region with international appeal

Europe's largest concentration of consumers
78 million people within a radius of 300 km

Direct access to 5 european capitals

2nd French region Foreign Direct Investment

- **A young and densely populated region**

6 million inhabitants

- **A strong economy**

GDP of €159 billion

- **Dense, efficient transport network**

High speed trains

Motorways

3 major ports : Dunkerque, Calais, Boulogne

- **A unique industrial ecosystem**

1 Automotive, Rail, Logistics industry

2 Metals and machine manufacturing

3 Chemicals

Hydrogen in Hauts-de-France Region

240 km of hydrogen networks between Hauts-de-France and Northern Europe

- Total annual transit capacity estimated at a level of **250 millions Nm^3**
- 14 industrial sites feeded with hydrogen by Air Liquide since **1966**
- Among them: **ThyssenKrupp, ArcelorMittal, Arques**
- **Air Liquide**: liquefaction plant in Waziers, biggest liquefaction unit in Europe mainly dedicated to hydrogen fuel preparation for **Arianespace**

Main hydrogen storage areas

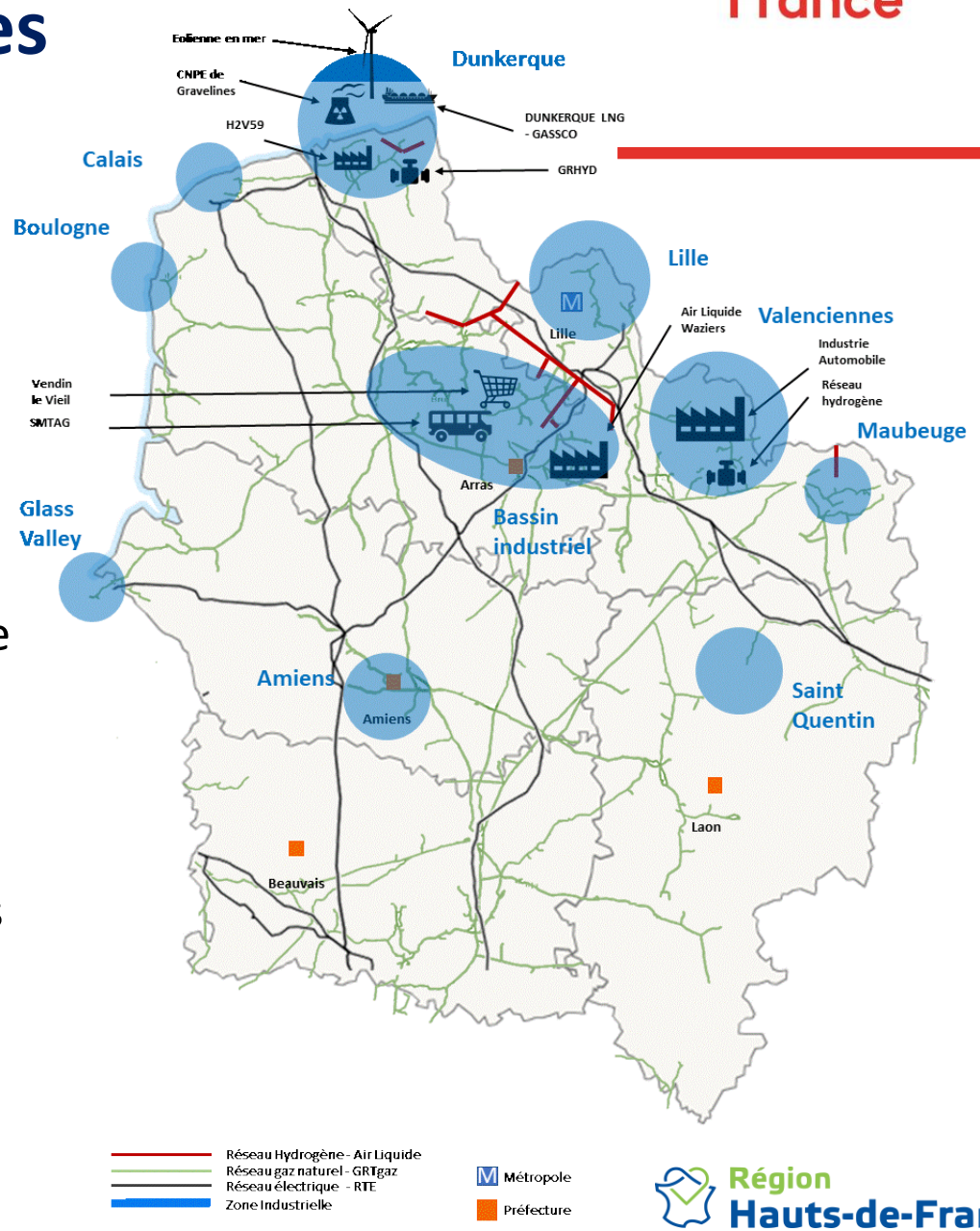
- **Chemistry and pharmacy**: Amphastar pharmaceuticals, Astrazeneca, Norchim, Siccanor chimie
- **Steel and metal industry**: ArcelorMittal, ThyssenKrupp, Specitubes
- **Production of capital goods**: Maubeuge Construction Automobile
- Valeo Equipements Electriques Moteur, Bic rasoirs, Plastipak Packaging, St Gobain Glass, Alcatel submarine networks
- **Energy**: Celest power, Cideme, Esiane
- **Food industry**: Tereos, Carrefour supply chain

Pilot projects

- Grhyd project: launched by ENGIE from 2010 by 2018 in Dunkirk
- Launch in 2019 of first 100% Hydrogen bus « TADAO » in Lens

Energy Infrastructures

- **Excess regional electricity production**:
  52,5 TWh vs 46,5 TWh consumption in 2019
- Electricity production is covered at 60% by the **Gravelines nuclear plant** and 20% by renewable energies
- Huge energy projects to be achieved:
  Evolutionary Power Reactor **(EPR)**
  Offshore Wind farms: 500 MW to be launched in Dieppe-Le Tréport by 2023 and 600 MW by 2026 in Dunkirk
- **8,700 km** of electrical transport grids connected to European grids
- **4,200 km** of natural gas grid with 2 inlets for Norwegian gas and Dutch Gas: Loon Plage and Taisnières
- Renewable energies are increasing
  Installed capacities: **4,900 MW** for electricity and 350 MW for biogas



Industry decarbonation
is a major issue for Hauts-de-France Region

Hauts-de-France Region:

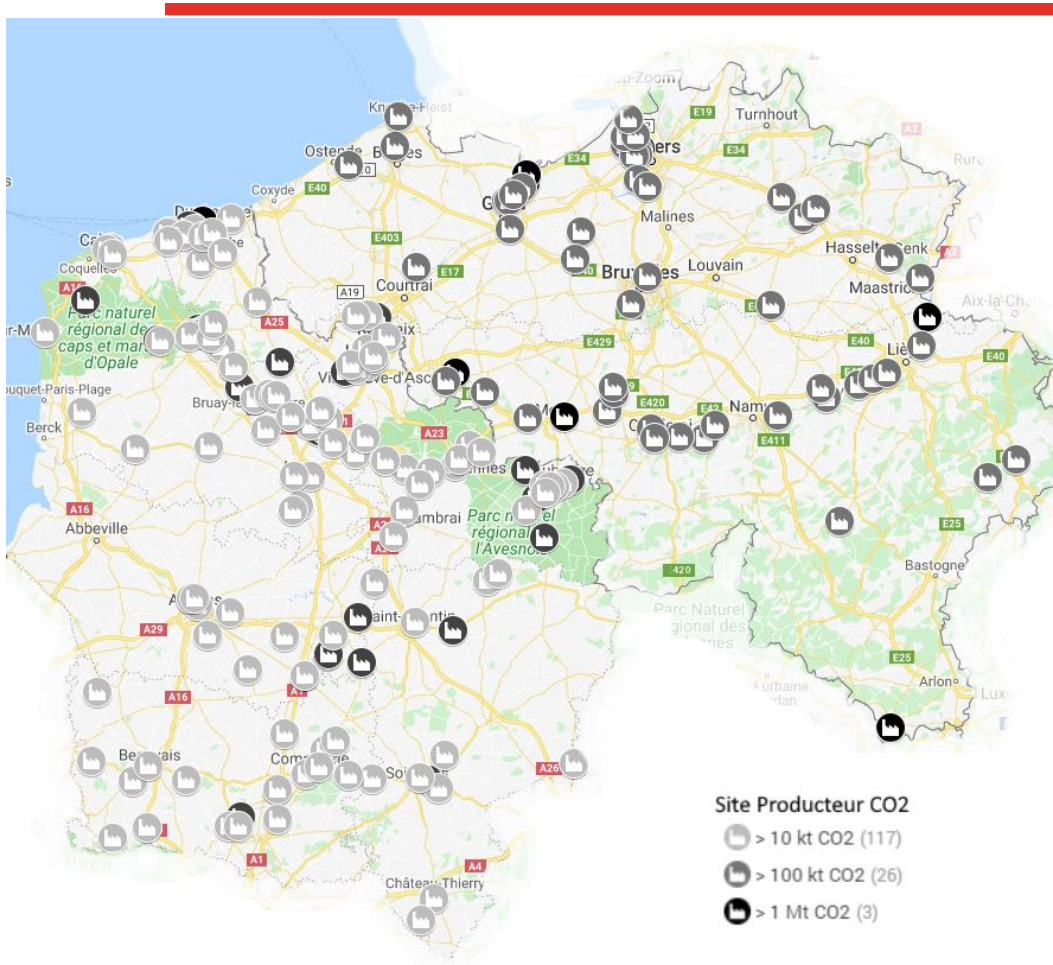
- **30 million tons** of CO_2 equivalent per year
  ➔ twice the French average

Belgium:

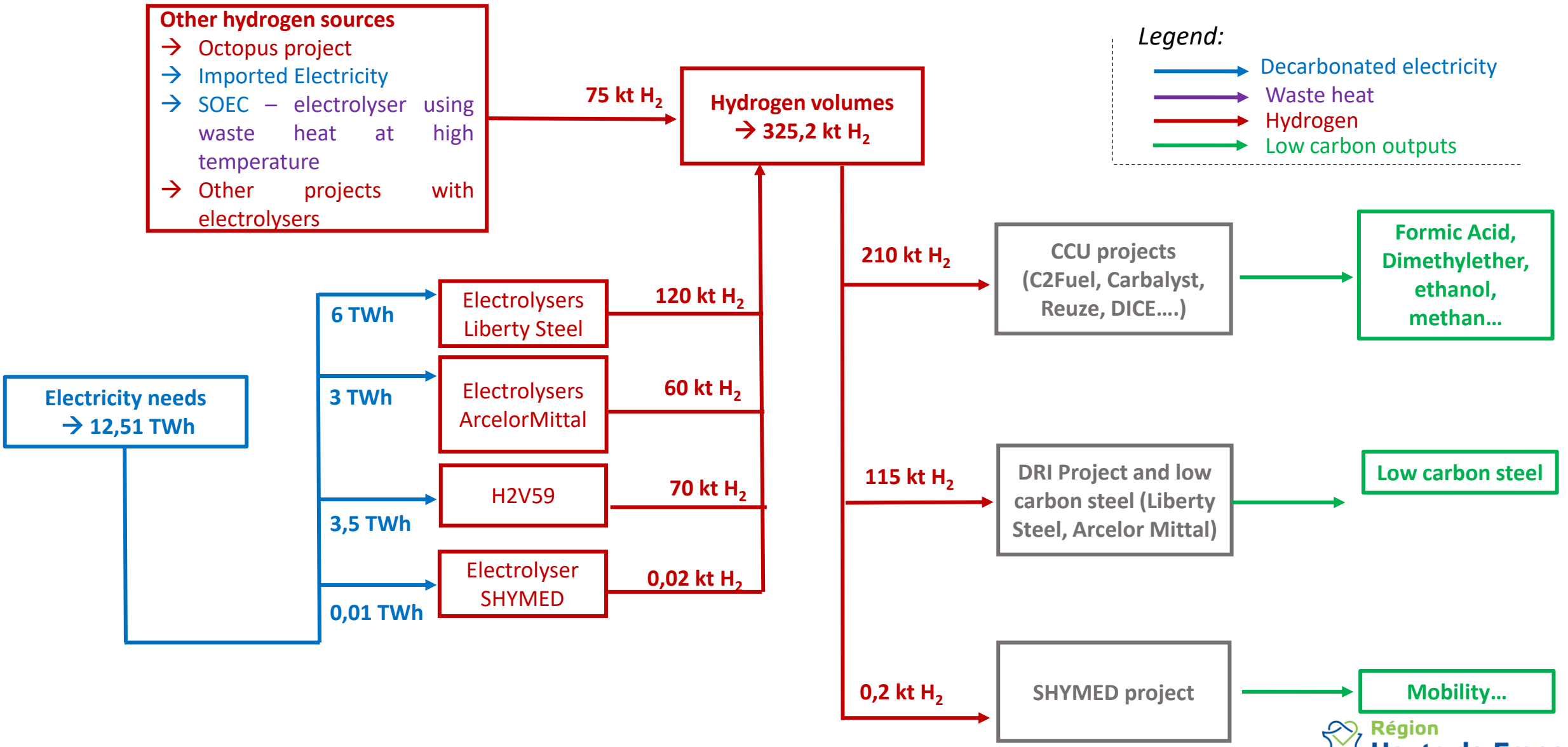
- **33,5 million tons** of CO_2 equivalent per year

Industrial application on a port area:

- **16 Mt of CO_2 equivalent** on Dunkirk port area
- Local authorities and industrials committed to get **carbon neutrality by 2040**
- Main industrials are integrating hydrogen in their decarbonation strategies
- H2V: first hydrogen massive production site by electrolysis in Dunkirk
- Decarbonated electricity: nuclear plant, offshore wind farm, EPR



Industrial application on a port area



Need more information?

We remain at your disposal for any further discussions:

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Normandy region

Normandy: a leading territory for hydrogen production and mobility

Sylvain Gigliesi

Innovation & Development

Normandie Energies

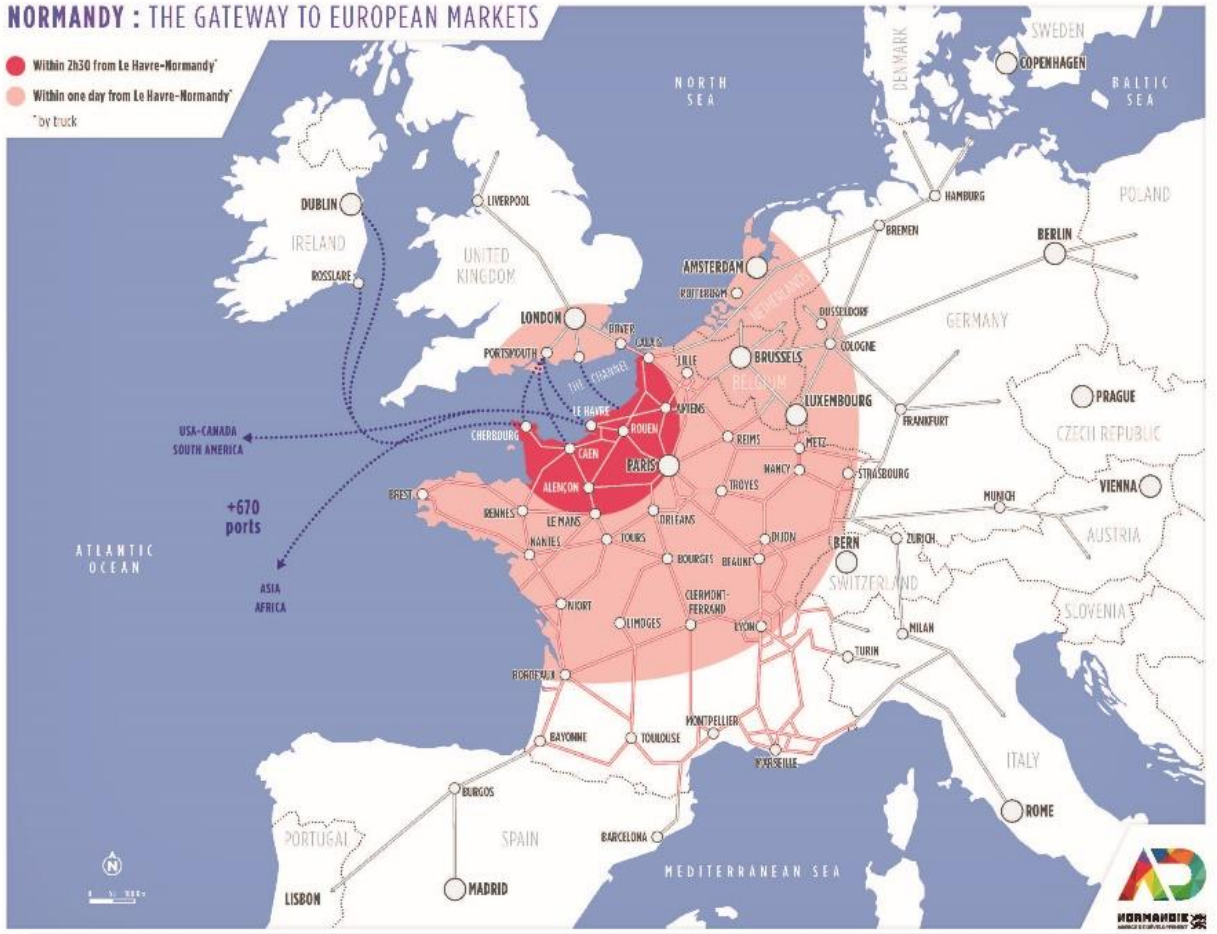
A leading French region for economic growth

3.3 million inhabitants
30 100km² - **650 km** of coastline – **6** ports
GDP of **€91billion** (10th region in France)

High quality education and research facilities
A very good way of life with a dynamic young population
Very cheap real-estate contrary to Paris region

248,000 companies
1.3 million jobs
€1.2 billion in R&D

*More than **550** companies with foreign capital*
***€60m** of financial incentives awarded by the Regional Council in 2018*
***54** investments projects from foreign companies in 2018*
***€2.3 billion** of investments in 2018*
2nd French industrial region (21% of regional GDP)
6th French Region for export – **€33 billion**
Catchment area of **200 million** consumers
2nd most internationally open region in France
€900 million were invested in 2019 (+50%)



Close to **Paris** and **London**
Optimized road network
Pan-European rail connections.
Four regional airports and close from Paris airports
How to get to Normandy? *Click here*

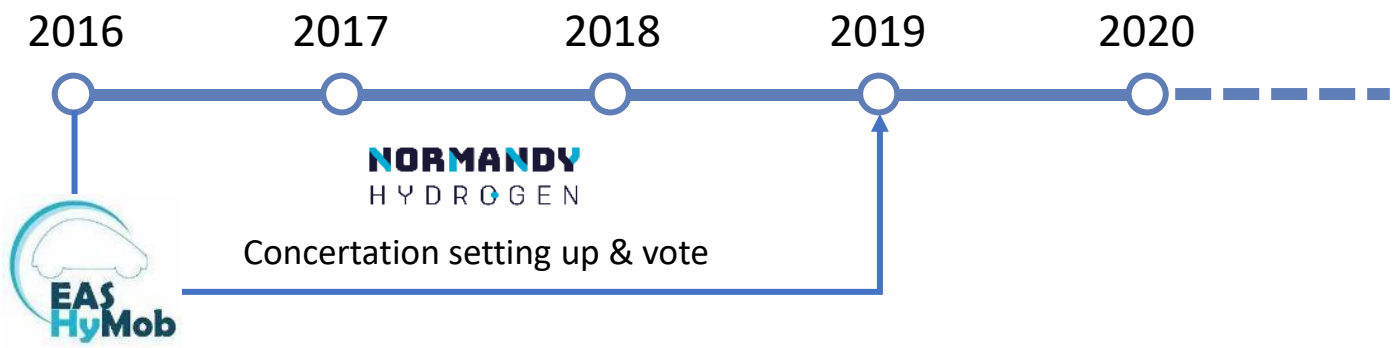
- 2 major seaports: Le Havre (GPMH) & Rouen (GPMR)
- 3 regional ports: Dieppe, Caen-Ouistreham & Cherbourg
- Logistics region with significant flows of goods and passengers mainly along the Seine axis
- Maritime region with the 1st potential for renewable marine energies (650km of coastline) in France. 4 projects out of 7 in France.
- Historical skill set related to the production, consumption and handling of hydrogen (petrochemicals, chemicals, aerospace)
- The Seine Valley concentrates 45% of national hydrogen consumption. It houses 3 of the 4 French ammonia production plants and 3 of the 8 French refineries. Consumption in the Seine Valley is 350 kt of H2 per year.

A regional strategy already engaged

NORMANDY HYDROGEN

Implementation

Decades of history in hydrogen production and consumption



Build on and capitalize on history and be the pioneer in new uses

Based on Normandy assets: industry/ logistics and transport / MRE

Goals:

Decarbonize the Norman economy

Strengthen and develop a strong industrial sector and foster job creation

Reinforce Normandy's attractiveness

Based on Norman's characteristics: industry / logistic & transport / renewable marine energies

Hydrogen in Normandy at European level

EUROPEAN HYDROGEN VALLEYS PARTNERSHIP

European Clean Hydrogen Alliance

Hydrogen Europe

Large regional ecosystem

ECOSYSTEM

More than 100 stakeholders

NORMANDY HYDROGEN

A new dedicated community platform

https://normandie.ccibusiness.fr/hydrogene

- High rate growth
- 15 Research units
- 4 Sector clusters
- 2 Competitive clusters
- 21 Public authorities

Regional infrastructure: the densest charging stations network in France

9 charging stations installed in 2021 with captive fleets

PARTNERSHIP

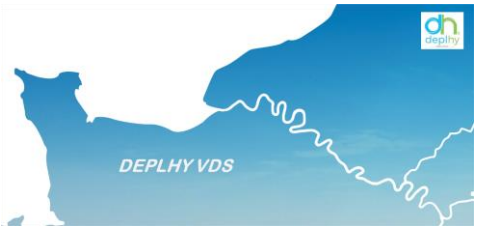
RÉGION NORMANDIE · SYMBIO · SERFIM GROUPE

50 % Co-financed by the European Union Connecting Europe Facility

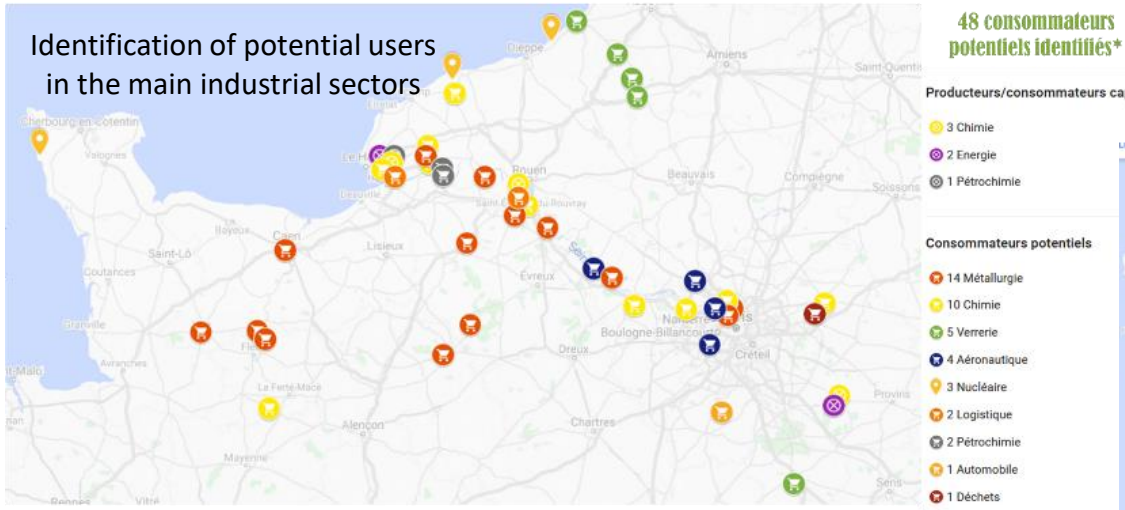
RÉGION NORMANDIE 20 %

Regional deployment strategy in the Seine Valley

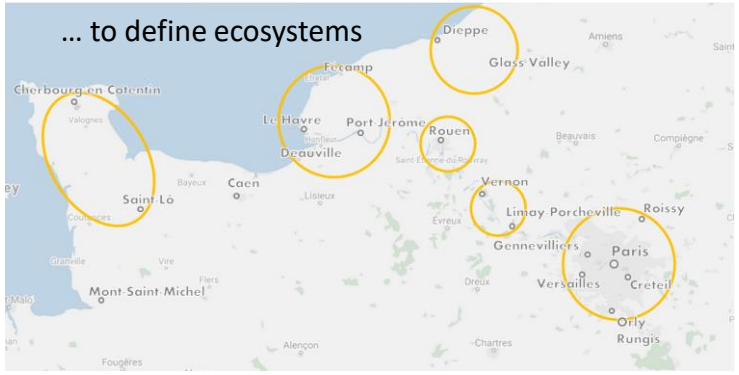
DEPLHY (Deployment of Hydrogen in the Seine Valley), studies the development potential in an industrial environment along the Seine Valley.



Identification of potential users in the main industrial sectors



… to define ecosystems



Identification of hydrogen projects

Projects focus

Website : map of projects in Normandy

France's biggest electrolyser project

H2V NORMANDY

The project is located on Caux Seine Agglo territory, in the heart of the industrial zone. It is close to both potential clients and pipelines.

Through this project, H2V aims to help reduce the CO2 emissions of the petrochemical industry and participate in developping the renewable hydrogen industry in France.

28 000 tonnes of hydrogen produced per year (or 3% of French hydrogen production)

An investment between €230 million and €251 million

The water electrolysis: chemical reaction

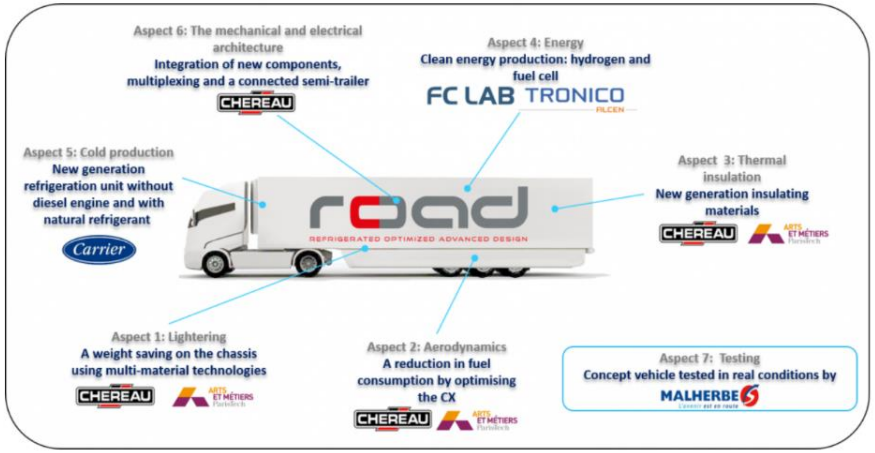
Under the effect of electricity... $2H_2O \rightarrow 2H_2 + O_2$

...two molecules of water break down into two molecules of hydrogen and one molecule of oxygen

70 direct jobs
100 indirect jobs

Commissioning between 2022 and 2023

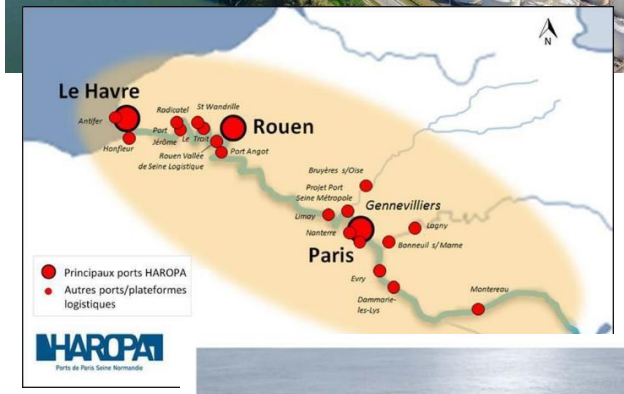
World's first hydrogen refrigerated semi-trailer



The semi-trailer developed CHEREAU is on the road since 2020. The firm wants to go further with H2Coldchain wich aims at transforming the largely diesel-based cold logistics chain into a fully decarbonated chain using green hydrogen

CHEREAU H2Coldchain

Hydrogen barges on the Seine -2021



RÉGION NORMANDIE

Need more information?

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Southern region

Region Sud, Provence-Alpes Côte d'Azur, the Sunny Side of Hydrogen

Sylvain Brémond
Deputy Director General
Capénergie

How you may see the Region Sud

5 million people

Nice Côte d'Azur airport: the 2rd largest international airport in France

How the Region Sud is, on top of that!

Education and Research

4 Universities (170,000 students)
4 Technopoles, 10 Eng. Schools & 10 public Research Units
2nd French region in terms of foreign R&D investments

French National Institute for Industrial Environment and Risks

National School for Fire Brigade officers

Arbois-Méditerranée
France's largest GreenTech technopole

French Alternative Energies & Atomic energy Commission

Sophia Antipolis
Europe's largest technopole
(~ 40,000 people, 2,500 companies, 80 nationalities)

Geoscience | Energy | Sciences | Buildings | Risks | Sea | Transport | Agronomy | Sustainable development | Health | Aerospace

How the Region Sud is, on top of that!

Industries

~ 25,000 industrial companies
2,300 international companies

Microelectronics & IT

life.augmented

Steel industry

ArcelorMittal

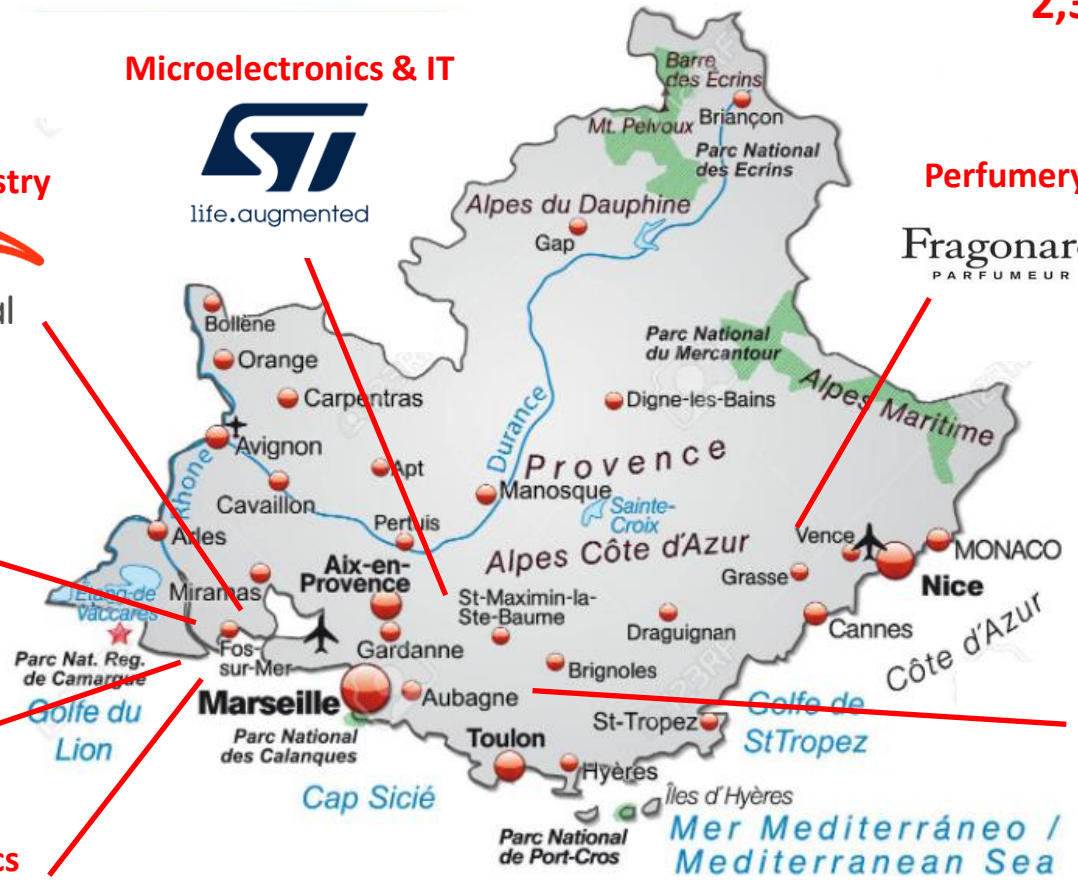
Perfumery

Fragonard PARFUMEUR

Chemistry

lyondellbasell Advancing Possible
covestro
Air Liquide
Infineum
KEM ONE

H2 yearly consumption ~ 60 000 tonnes



Refining

petroineos
TOTAL
Esso
INEOS

Logistics

CMA CGM

Mobility

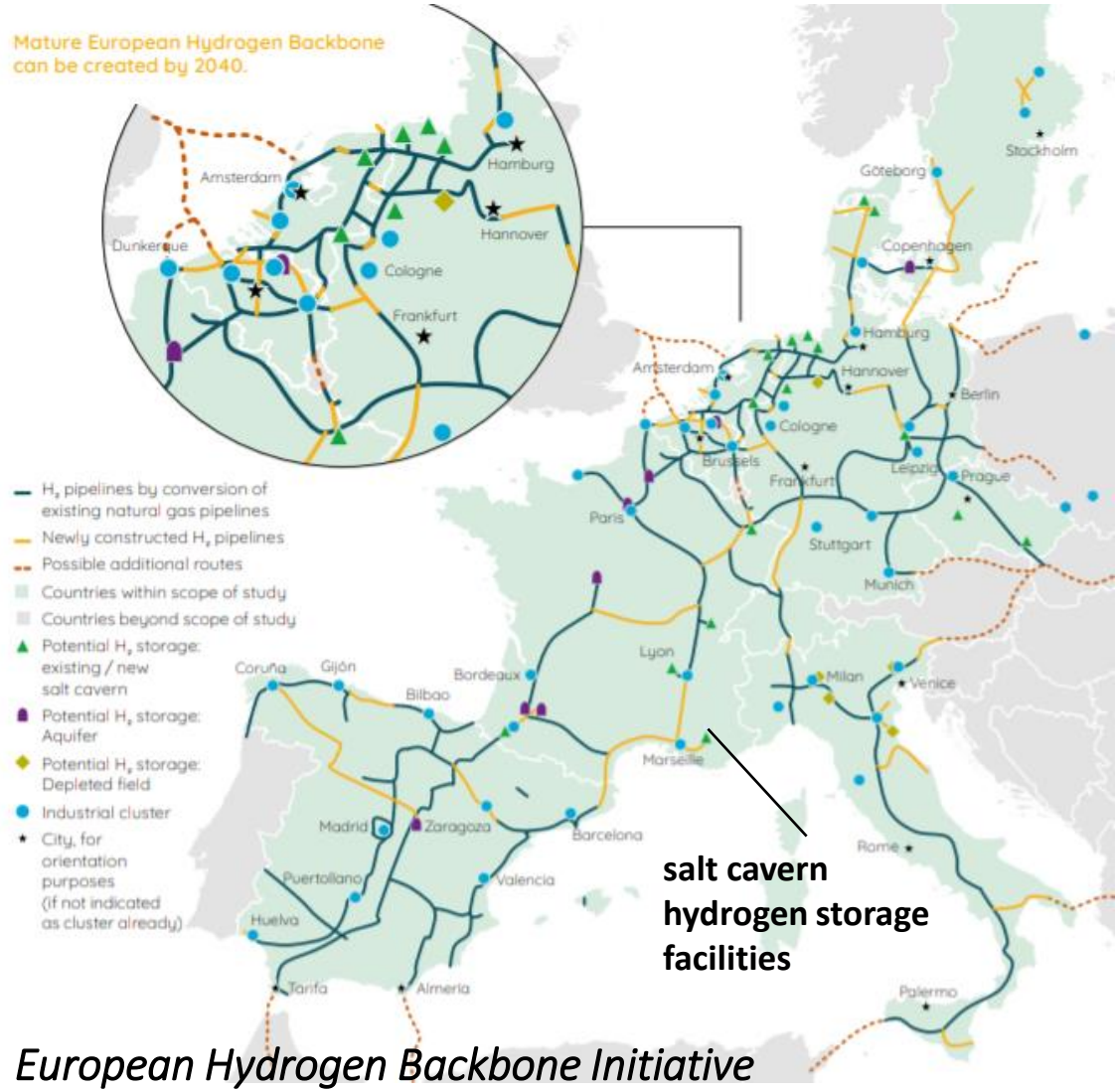
AIRBUS HELICOPTERS
La Ciotat SHIPYARDS
THALES

At the crossroad of the future hydrogen infrastructures

At the crossroad of :

- **A Mediterranean corridor** that is attracting European investment on H2 infrastructures (7 station projects already emerging in the region).
- **A Rhine-Rhône-Mediterranean corridor** with 17 large-scale projects, including 3 in the region Sud.

Hosting the **largest Mediterranean harbour** connected to the future **European hydrogen backbone**



European Hydrogen Backbone Initiative

Green – Low carbon energy supply opportunities

THE SUNNIEST REGION IN FRANCE

TOP 3 WIND DEPOSITS IN EUROPE

A LOW-CARBON NATIONAL GRID ELECTRICITY PROVIDER

More than 300 days (2,800 hours) of sunshine per year
Installed power : 1.2 GW (present) / 16.9 GW (target by 2050)

Off shore : 1 demonstrator under dev. ("Provence Grand Large“)
2 commercial calls for projects of 250 MW by 2022 (target 2050: 2 GW)

Low-carbon national grid electricity
gCO2e / kWh : 50-80 France vs. 300-350 EU27
Région Sud electricity production: ~40% from hydropower


La Colle des Mées solar farm : 100 MW


Port-Saint-Louis-du-Rhône (under dev.) : 25 MW


Serre-Ponçon hydroelectric dam : 380 MW

An attractive and supportive framework

An already existing H2 ecosystem of actor distributed over the value chain

> 80
COMPANIES

+/- 50
POTENTIAL CONSUMERS ALREADY IDENTIFIED!

A regional supporting plan

50 M€
REGIONAL DEDICATED SUPPORT PLAN (2021 – 2027)

A wide scope of pioneering projects already achieved and/or under development

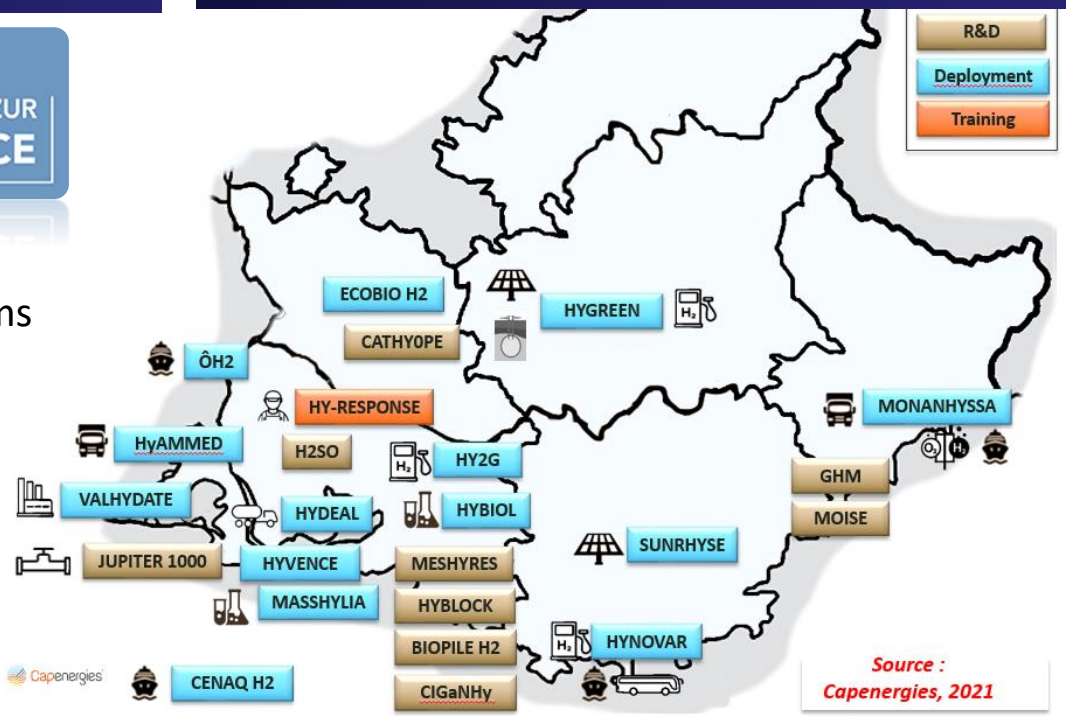
€ 25M€
ALREADY INVESTED

+30
HYDROGEN PROJECTS IN 5 YEARS

PLENESYS, CATALYSE, HY2GEN AG, ENSOSP, apere, HySiLabs, DURAGGROUP, HYSEAS ENERGY, CMR GROUP, Helion, CNR, Géométhane, greenG, AREVA, Air Liquide, storengy, cybernetix, GRTgaz, ENGIE, EDF, TOTAL

RÉGION SUD
PROVENCE-ALPES-CÔTE D'AZUR
UNE COP D'AVANCE

One ambition: to be one of the leading European regions in terms of sustainable development.



Outstanding opportunities in H2 development for boats and ports

5 COMMERCIAL PORTS

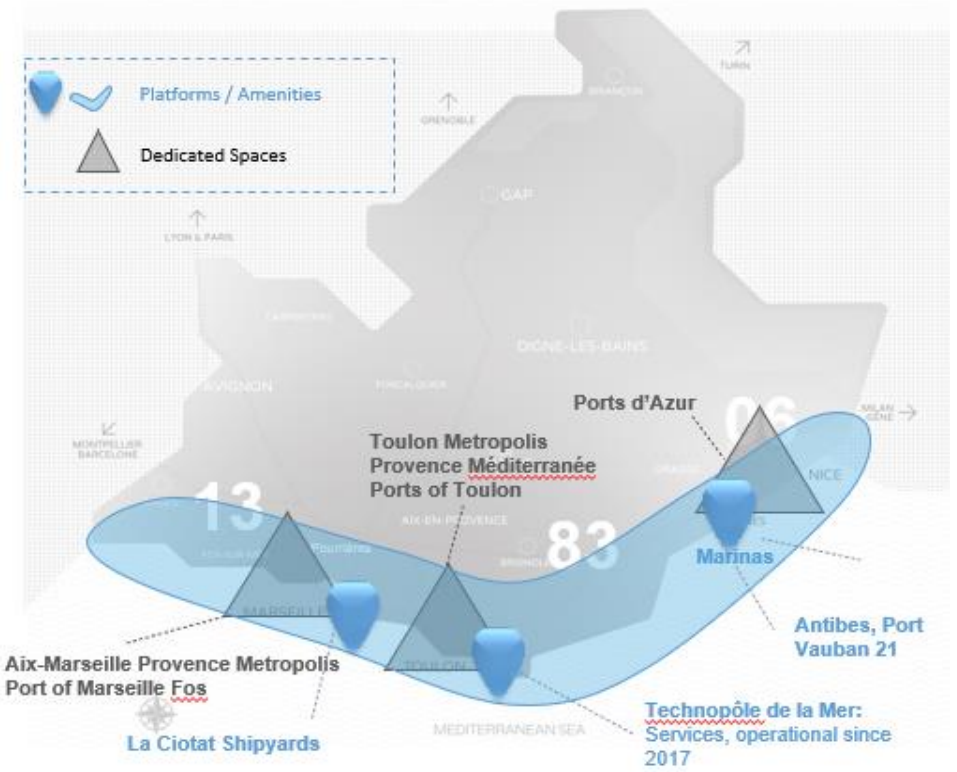
196 MARINAS

1,000 KM OF COAST

1st NAVIGATION ZONE IN THE WORLD (50% OF THE INTERNATIONAL YACHT FLEET EACH YEAR)

7,000 MARITIME COMPANIES

120,000 EMPLOYEES (26% OF NATIONAL JOBS IN THE SECTOR).



A few start-ups already developing

1st French harbour
1st Mediterranean harbour

Marseille Fos
Le port euroméditerranéen

1st yacht harbour in Europe

PORT VAUBAN
ANTIBES - CÔTE D'AZUR

1st military harbour in Europe

TOULON PORT DU LEVANT

Capenergies

RÉGION SUD PROVENCE ALPES CÔTE D'AZUR

Take it from the sunny side !

A gateway at the crossroad of Europe and Mediterranee

Outstanding opportunities for H2 production and off-take

A very interesting background of local industrial capabilities, know-how & skills

A fully supportive framework

Capenergies

The French cluster of low-carbon energies

540 members (companies, research units, territorial governing bodies, etc.)

Networking
Partnership
Project development
Innovation

Sylvain Brémond
Deputy Director General
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European Clean Hydrogen Alliance

Kick-starting the EU Hydrogen Industry to achieve the EU climate goals

Nathalie Ohayon
Project Manager
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RÉGION SUD PROVENCE ALPES CÔTE D'AZUR

risingSUD

The Region SUD economic development agency

Land search
Administrative processes
People hiring
Local supports

Feedback on the hydrogen plan from ENGIE Solutions

Sophie Thévenon
Marketing Manager
Engie Solutions

Marie-Perrine Durot
Innovation & Green Industry Director
Engie Solutions

ENGIE Solutions

ENGIE is a global player that supports industrialists to achieve a carbon-neutral transition by supporting a competitive and financed implementation.

160,000
Employees

61 Mds €
Turnover

5 Mds € Invested
in customer solutions
between 2019 and 2021

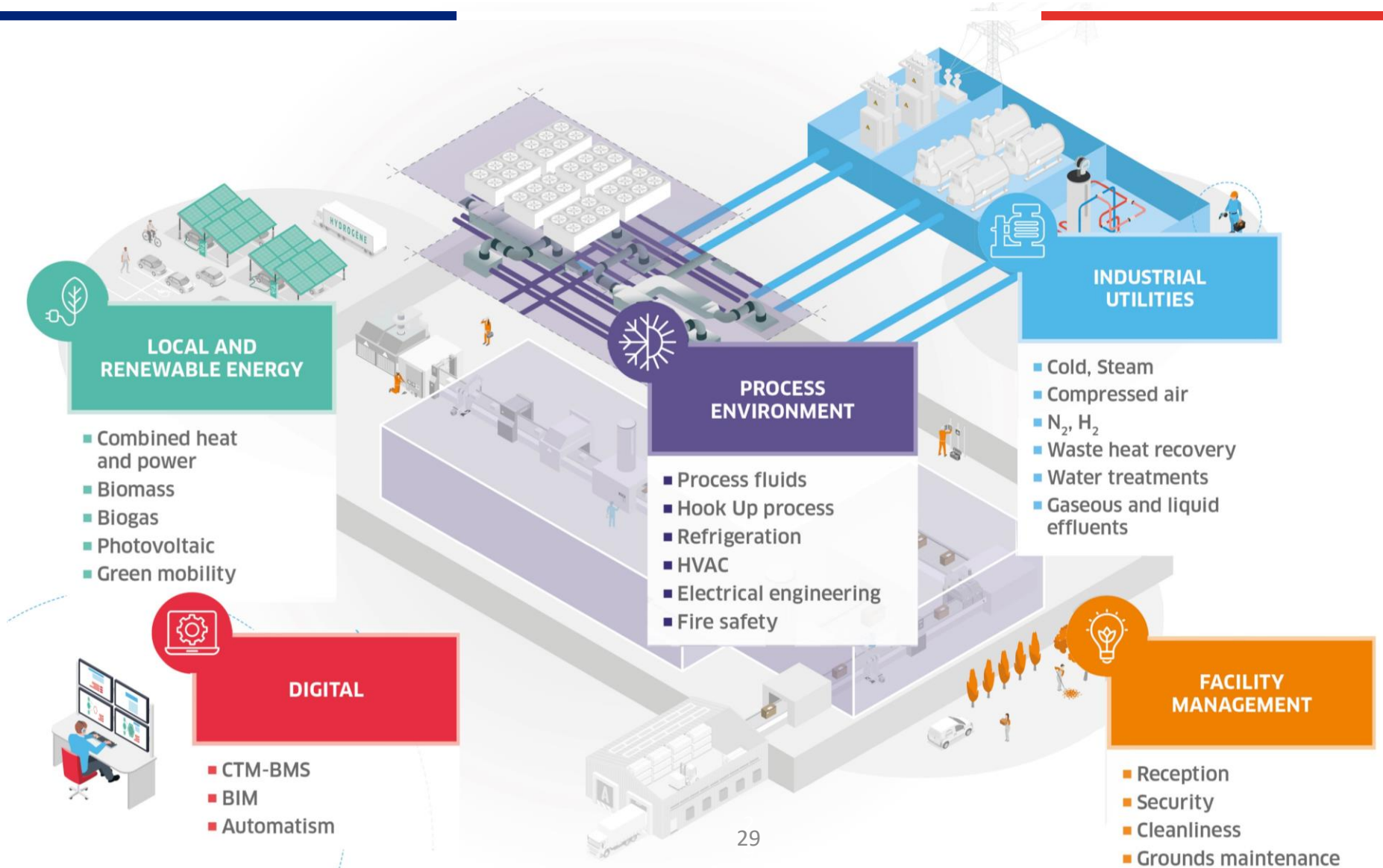
In France, ENGIE solutions is your trusted partner for tomorrow's factories

22,000
Employees

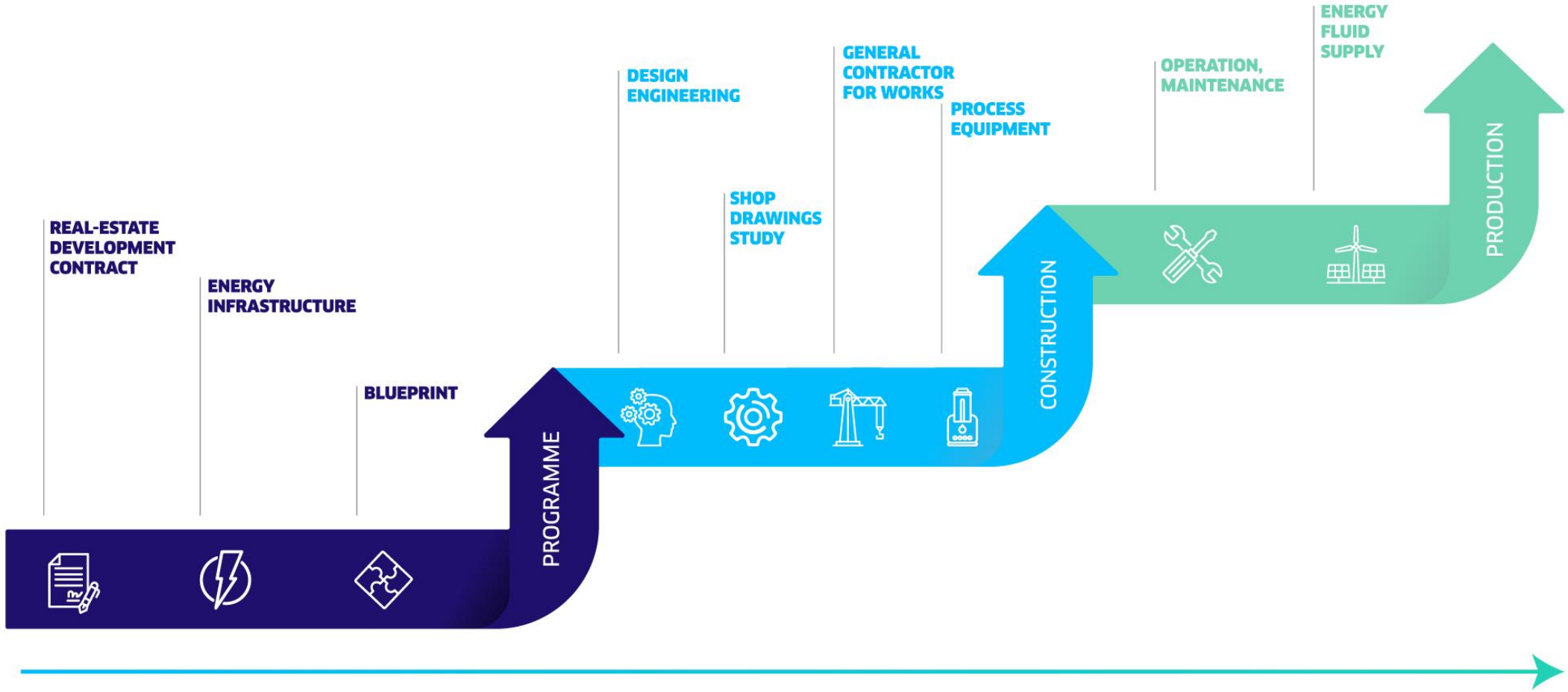
3.8 Mds €
Turnover

Territorial mesh
Business expertise
Skills in energy infrastructure and process environment

Our expertise for turnkey plants



Unique partner across the entire value chain of your project



FINANCIAL ENGINEERING
ESC, Recovery plan,
Leasing, ENGIE Fund
SPV

ENGIE H2 Strategy
Developping Green H2

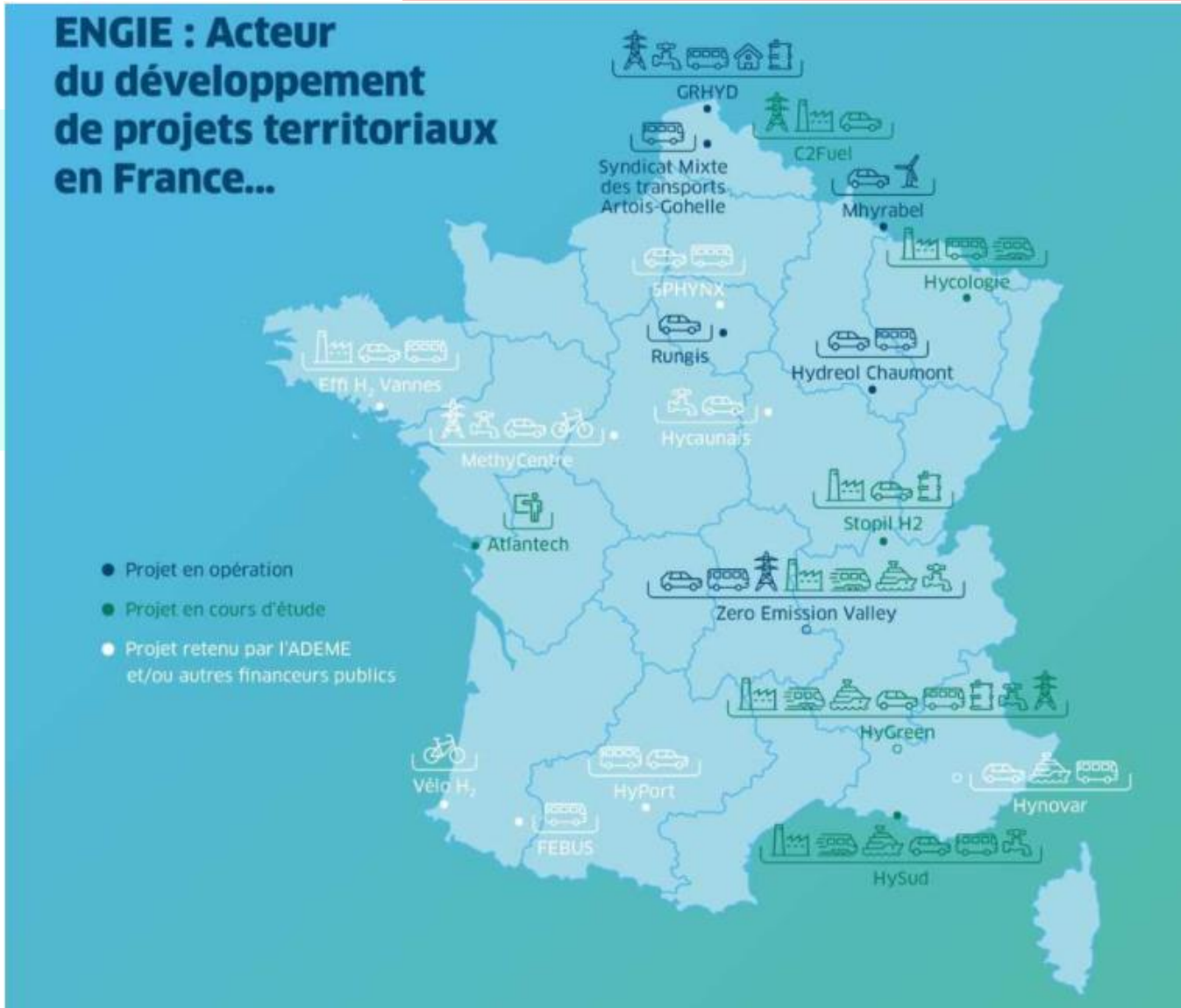
Electrolyze GREEN H2

Methane reforming (GREY H2)

1kg H2 = 10kg eq CO2

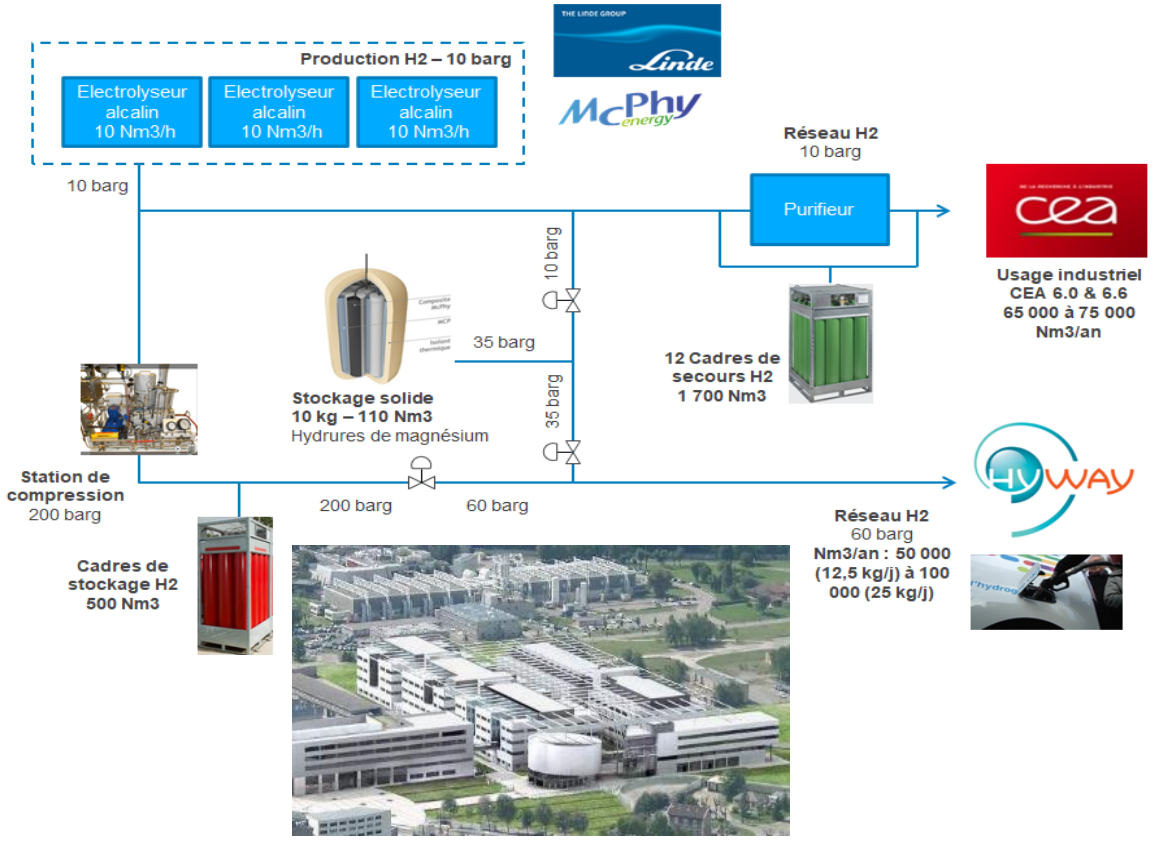
$CH_4 + H_20 \rightarrow CO + 3H_2$

$CO + H_20 \rightarrow CO_2 + H_2$



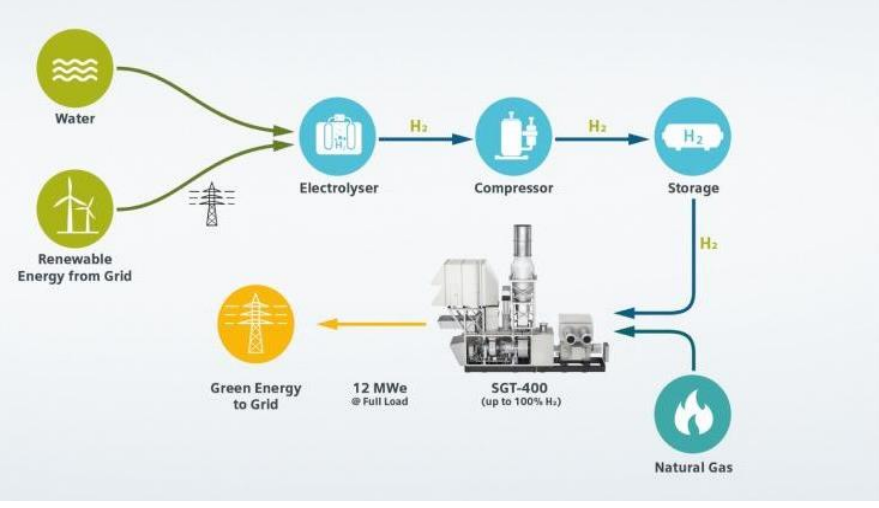
Hydrogen applications and project exemples

1. Greening H2 for industrial applications: H2 for micro-electronic in Grenoble



2. Developing new H2 usages: mobility applications

3. Developing new H2 usages: industrial applications



What are French major strengths for H2 development?

1. Low-cost – low carbon intensity of the grid
2. World-class expertises in H2 research and innovation
3. Local territories engagement

Figure 15 Carbon intensity of hydrogen produced from grid electricity, compared to selected benchmarks

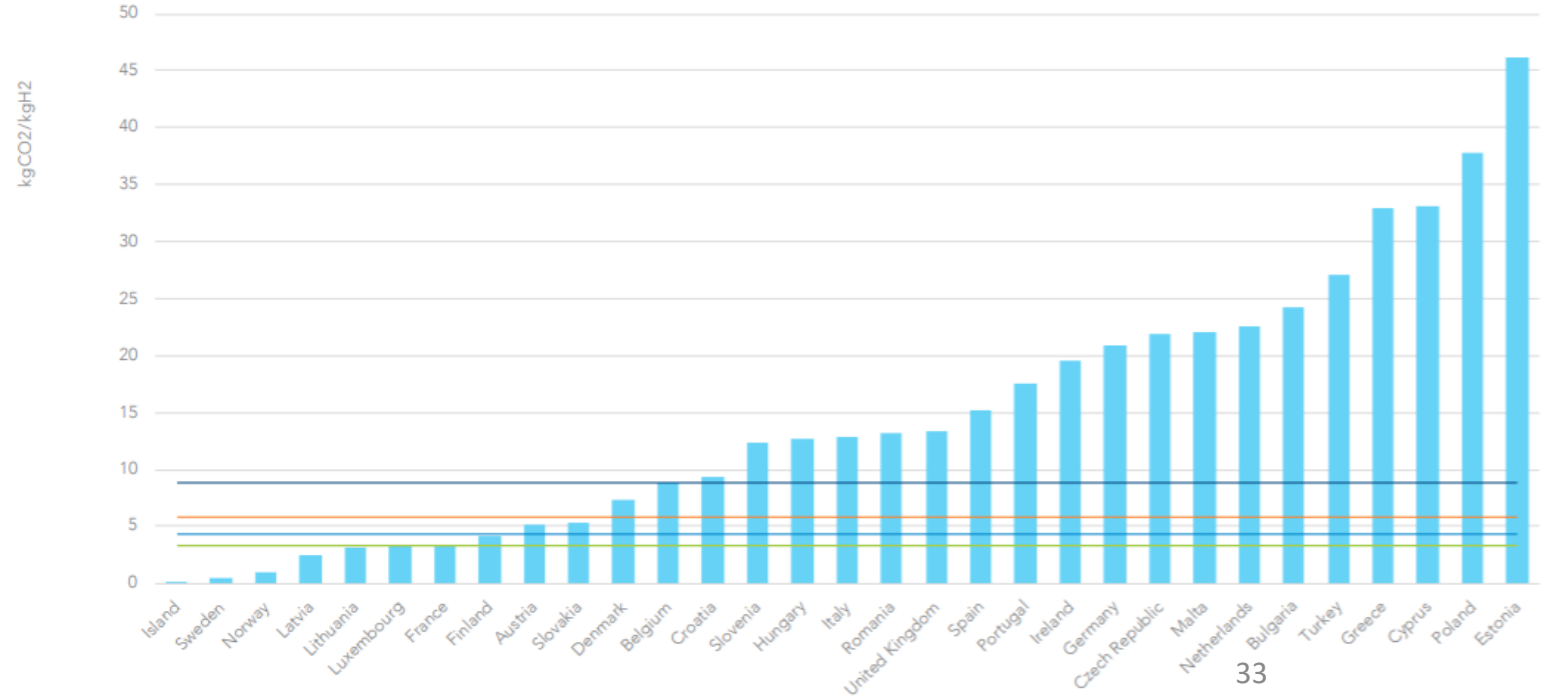
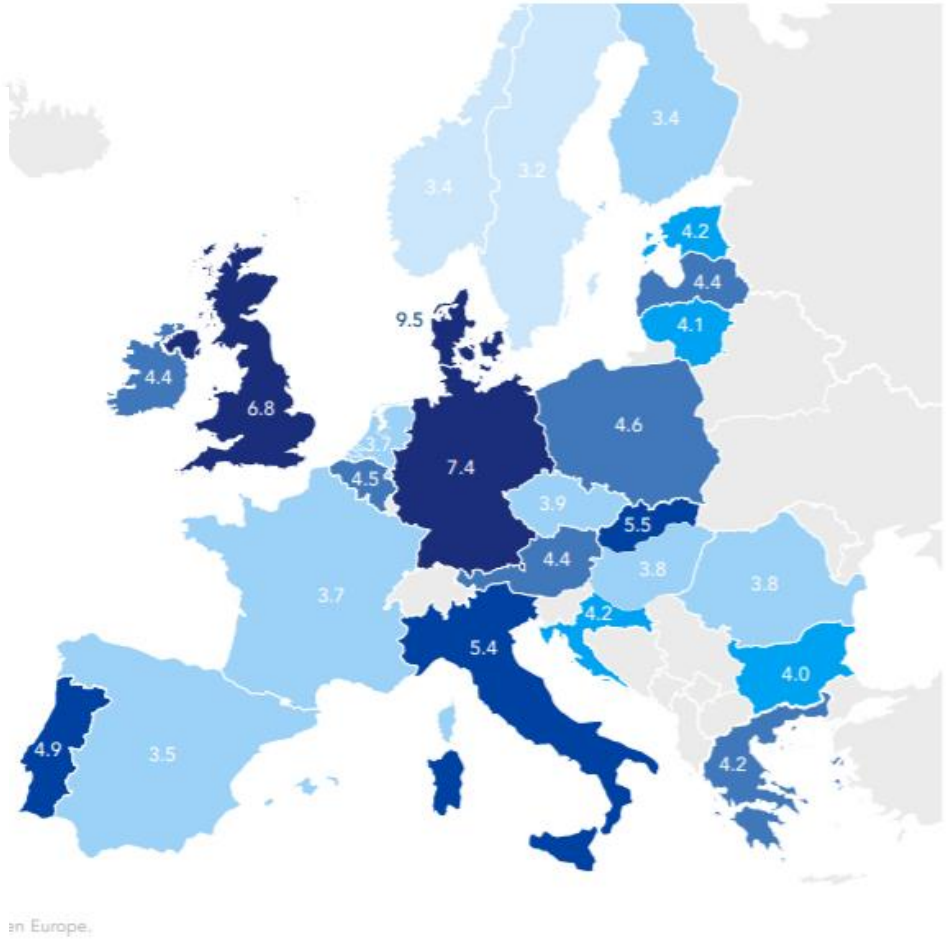


Figure 11 Map of grid connected electrolysis hydrogen production costs in the EU in 2019



The French Hydrogen Strategy

Do you have any question?

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With the support of our interns Sara Chollet and Jeanne Blain.

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