At the dawn of a new era

A roadmap for an ambitious hydrogen strategy

INTERNATIONAL CONFERENCE ON MOBILITY CHALLENGES
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French Hydrogen Strategy (8. September 2020)

- **Priority 1 : To Decarbonize industry**
  Objective: to scale up a competitive French electrolysis industry

- **Priority 2 : To Develop hydrogen for professional mobility**
  - Vans, Buses, Trucks, Railways, Ships, Airplanes –

- **Priority 3 : To Develop R&D&I**
  - Implementation of a Priority Research Programme for hydrogen applications and a programme to increase competences and training

✓ In total: **7,2 + 1,9 billion €** up to 2030 (3,4 during 2020-2023 period)
  - **6500 MW** of electrolysers – **680 000** tons of Hydrogen

✓ Objective: to create between **50 000** and **150 000** jobs

✓ Cooperation with European partners (**IPCEI**)
Support of the French Government

➢ Through “Calls for projects” (managed by ADEME)
   ▪ Technological bricks: 350 Million euros
   ▪ Territorial ecosystems (mixing industry and mobility): 275 Million euros

➢ and also through an IPCEI (Important Project of Common European Interest) within the European framework (1,5 +1,7 billion euros)

➢ A support mechanism in order to fill the gap between the costs of low carbon/renewable hydrogen and grey hydrogen

➢ and also a specific mechanism for refineries (TIRUERT)
The use of hydrogen will be mainly concentrated within large industrial clusters for industry and mobility (for instance: big cities, harbours, airports).
Deployment by 2030:
Consumption is concentrated within 7 bassins

- 680 to 1090 kt of hydrogen
- 6.5 to 10 GW of electrolysis power
- 37 to 60 TWh of low carbon or renewable electricity
- 1000 à 1700 H2 refuelling stations, mainly public
Bus deployment by end November 2021

Total: 454 (27 + 63 + 364)
Deployment of garbage trucks by end November 2021
Occitanie Region: H2 Corridor project

By end 2023:

- 2 production units of renewable H2
- 8 HRS
- 40 H2 trucks
- 40 refrigerated trailers
- 15 H2 retrofitted coaches

Other initiatives: EAS-HyMob in Normandie and ZEV in AuRA
Hydrogen production cost as a function of the load factor

Electrolyser cost: 1000 €/kW – 2000 hours – Discount Rate: 5% - 20 years – Opex=2% → 2,75 €/kg
55 kWh → 1 kg H₂  Electricity cost: 50 €/MWh → 2,75 €/kg

⇒ TOTAL COST = 5,5 €/kg

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Power = 10 €/MWh → 0,55
Electrolyser: 350 €/kW (2500 hours) → 0,77
Total: 1,32 €/kg (at electrolyser)
Challenges for the French Hydrogen Sector

- To reduce costs: scaling up
- To promote technological neutrality
- To contribute to reindustrialisation:
SCALING UP

Objective: To reduce costs

- To contribute to the blooming of large-scale territorial ecosystems
- To develop industrial offer: electrolyzers, fuel cells, vehicles,..
- To develop transport and distribution (HRS) infrastructures
- To develop usages within downstream sectors (mobility, industry, energy).

.........in a nutshell, to build a new market!
Toward a European market for hydrogen
The European Hydrogen Backbone ("EHB")

21 countries (23 TSO)
40,000 km by 2040 / 11,600 by 2030
Investment: 43 up to 81 bn EUR
(Retrofit: 70 %)
Cost = 0,1 à 0,2 EUR/kg/1000 km
To Promote technological neutrality

➢ Not only renewable electricity ! GreenTaxonomy

➢ To consider also other means to produce renewable or low carbon hydrogen : NOT ONLY electrolysis !

- Steam Methan Reforming of natural gas (SMR) with Capture and Sequestration/Utilisation of CO2 (CCUS)

- Pyrogasification / Thermolysis of biomass (Haffner process)

- Methan Pyrolysis (Plasma torch, microwave)

- Native hydrogen

➢ Balance between Supply and Usages of renewable hydrogen by 2050

➢ (Sofar development of renewable is NOT sufficient)
To contribute to re-industrialisation

➢ To maximise the local content while reinforcing all the components of the value chain.
  (Public procurement is key)

➢ To develop competences and training

It is about TECHNOLOGICAL SOVEREIGNTY
As a CONCLUSION

➢ Without Hydrogen, we will NOT succeed

➢ Versatile energy carrier: holistic/systemic approach is needed

➢ Massifiing/Pooling usages in order to reduce costs: to build territorial ecosystem, to scale up, import of H2 ?

➢ To maintain R&D efforts and foster innovation

➢ Europe benefit from strong and valuable assets: it is also about an industrial challenge
  - Maximising the local content & reinforcing the whole value chain.

➢ Regulation AND public financial support (Carbon tax)
Thank you for your attention !