Hydrogen & ENGIE

Stakeholders' Meeting
FCH JU H_2

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CONTENT

01

INTEGRATION OF RENEWABLE ENERGIES

Hydrogen: a Response to the Need for An Increased Integration Of More and More Intermittent Renewable Energies

- The transformation of the energy mix, named Energy Transition in France, offers a growing place for intermittent renewable energies and decentralized production of electricity. The integration of renewable energy in power systems requires **more and more flexibility.**

- At the same time, issues related to climate change and air quality in cities promote the **use of low-emitting energies**.

=> Hydrogen has all the qualities to become the energy vector of the energy transition. Using it emits only water vapor and its production via water electrolysis is based on an extremely flexible “electricity consumer pattern”.

The Development of Renewable Energies: a Real Opportunity for the Development of Hydrogen Markets

- The main "Power to H_2" business is not to store renewable energy but to produce hydrogen in the best possible technical and economic conditions and then sell it on the most profitable markets.

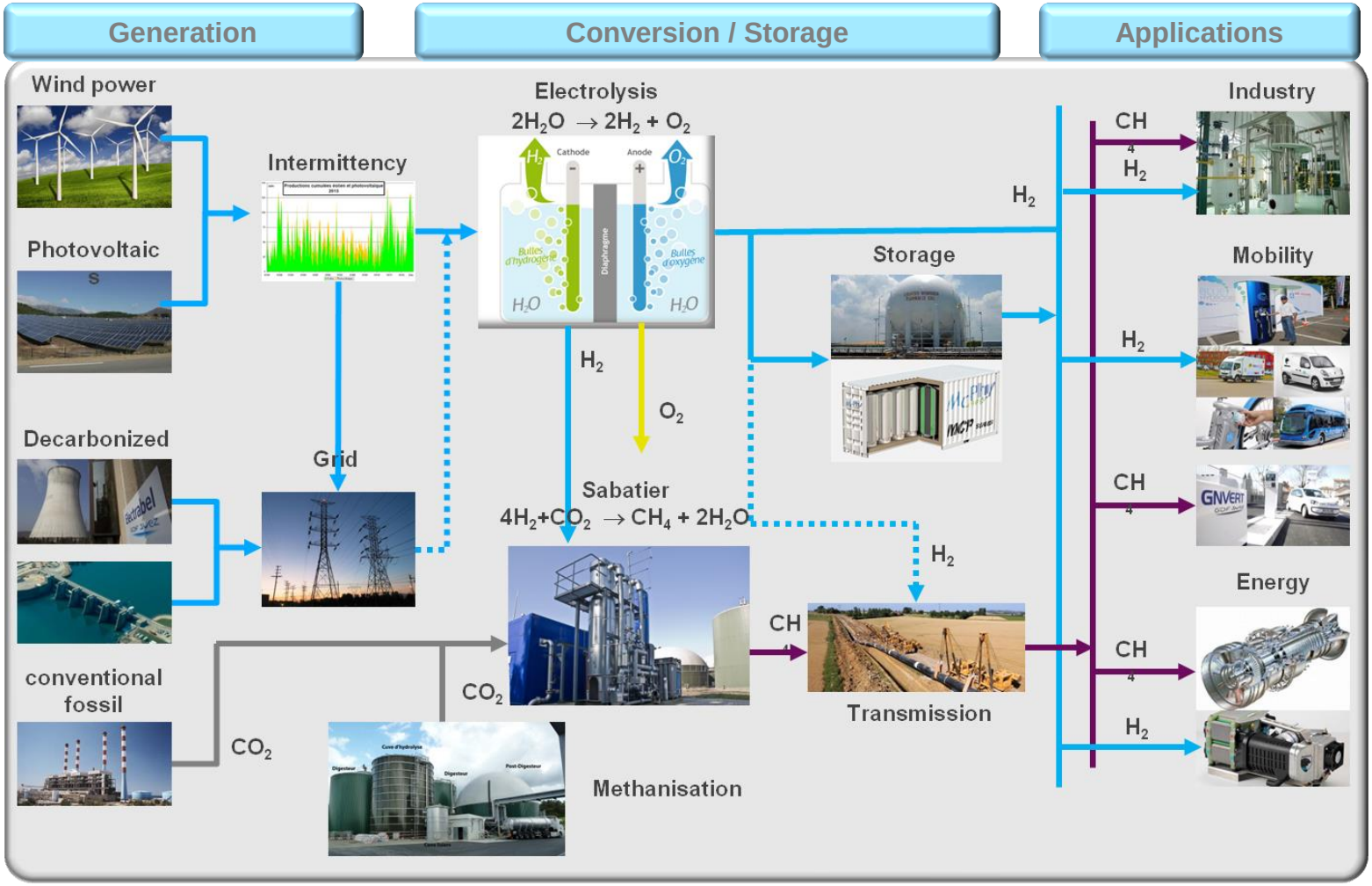
- The development of renewable energies is first characterized by high CAPEX injection, but then the low marginal costs of producing additional energy allow very flexible electricity consumers to source it at very favorable conditions.

- **The fact that hydrogen can be stored and electrolyzers are very flexible are real strengths in this environment.**

02

MARKETS FOR HYDROGEN

The Conversion of Electricity Into Hydrogen – a Multipurpose Vector



The Markets of Hydrogen (The Vision of ENGIE)

Market	Maturity
Industry: small industries (hydrogen delivered today by truck) Semiconductor, Glass, Chemical, Food & Beverage, Metals, etc..	☺
Industry: large industries (hydrogen delivered by pipe and produced in a SMR) refineries, ammonia, heavy chemicals	☺/😐/☹
Energy: on site storage of renewable energies (**remote** sites)	☺
Energy: large energy storage	☹
Energy: power to H_2 or to CH_4 with injection into gas grid (Europe)	☹
Mobility: on site production for **small** hydrogen refueling stations	☺/😐
Mobility: on site production for big fleet vehicles busses, city trucks, etc.	☺
Mobility: centralized production (region/district) & distribution for HRS but on shorter distances	☺/😐
Industry & Mobility: centralized production (region/district) and distribution to customers and HRS by truck but on shorter distances	☺

03

WHAT IS DONE BY ENGIE?

ENGIE is preparing the future and is involved in many projects

3 examples of project in which ENGIE is involved :

- **GHRYD project in Dunkirk:** injection of H_2 into local gas grid and use of Hythane© (a mixture of H2 & natural gas) into NGV fleet of urban busses
  - http://www.engie.com/en/innovation-energy-transition/smart-energy-management/power-to-gas/the-grhyd-demonstration-project/
- **HyWay project in Lyon & Grenoble:** HRS for commercial vehicle fleets
  - http://www.tenerrdis.com/en/News/hyway-europe-s-largest-hybrid-electric-hydrogen-vehicle-fleet-in-grenoble-france.html
- **Jupiter 1000 in Fos sur Mer:** production of H_2 & SNG and injection into transmission grid
  - http://www.smartgrids-cre.fr/index.php?p=jupiter1000