A Bird's Eye View on French Hydrogen and Fuel Cells Activities

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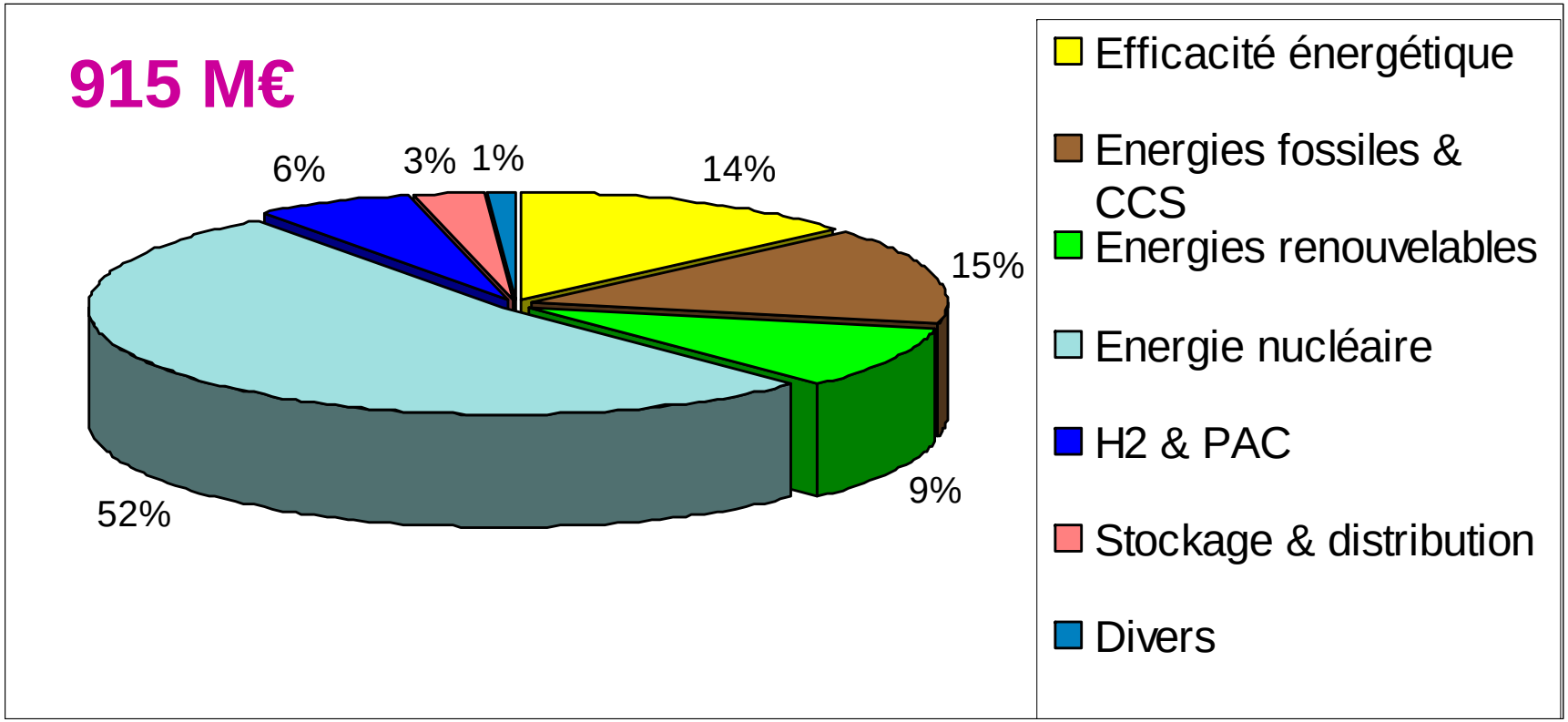
CEA - ANR

International Partnership for the Hydrogen Economy

2008 Energy R&D Funding in France

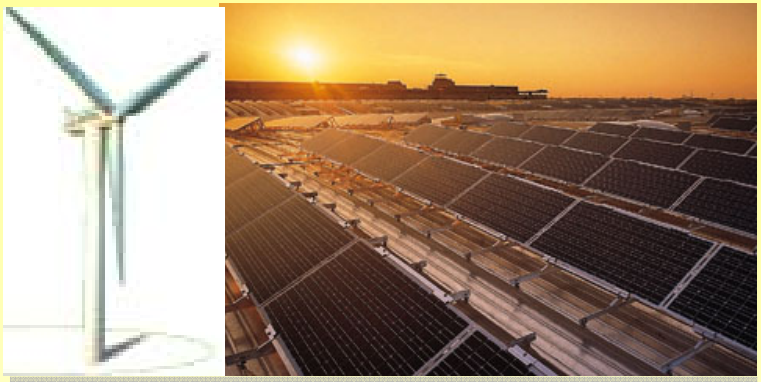


Source : MEEDDM

A strong policy to develop decarbonated energies

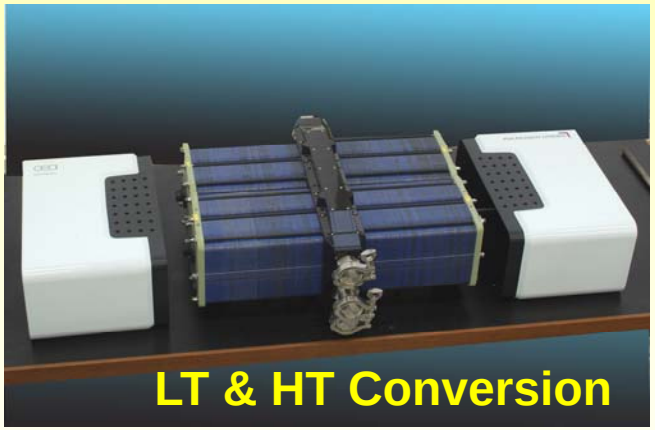
- **France has had from the beginning a major involvement in the H&FC Technology Platform and in the development of the JTI initiative.**
- **France has recently decided to be in the top EU countries for New Energy Technologies (Grenelle Meeting)**
- **Energy, Transport and Environment is now under only one State Minister (J.L. Borloo)**
- **2008 Strong support to the EU climate change policy from French Presidency (20% 20% 20% 20%)**
- **For 1€ spent on nuclear energy there should be 1€ for renewable energies**

French activities cover the whole H2 chain



On site H_2 production coupled with renewable energies

Storage



LT & HT Conversion

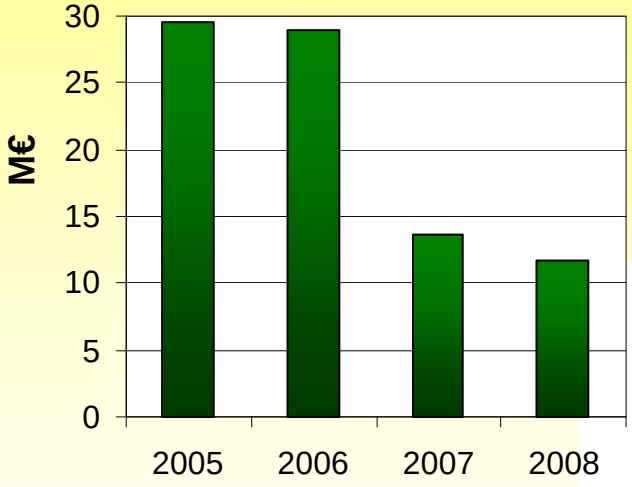
Large scale Production

Transport Distribution

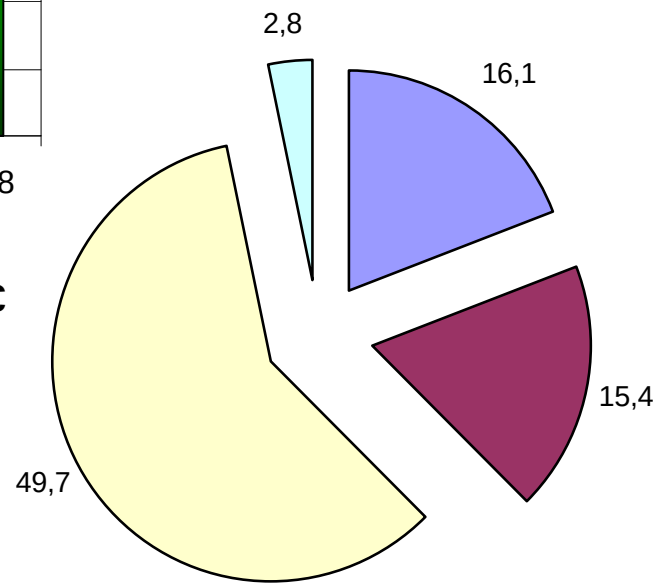
Public R&D incentive program in France 2005-08

ANR is the major source of public R&D funding for public-private partnerships

73 projects out of 235 proposals were funded following Calls in 2005, 2006, 2007 and 2008.
50 are still running. 61 Patents have been obtained.



Public funding: 84 M€ over 4 year calls.
Total budget: 154 M€



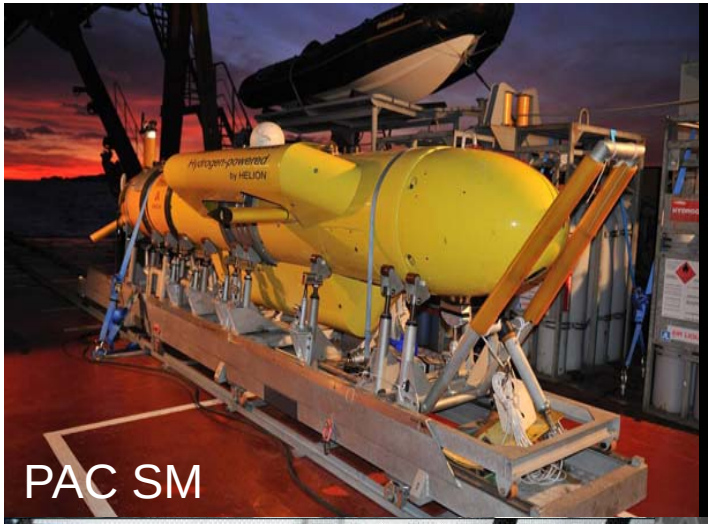
4 thematic areas:

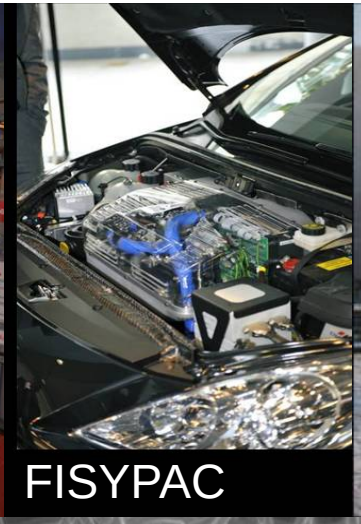
- Hydrogen production
- Hydrogen storage and delivery
- Fuel cell system
- Safety, regulations and socio-economic activities

A large, lively and enthusiastic community has emerged stimulated by significant financial support

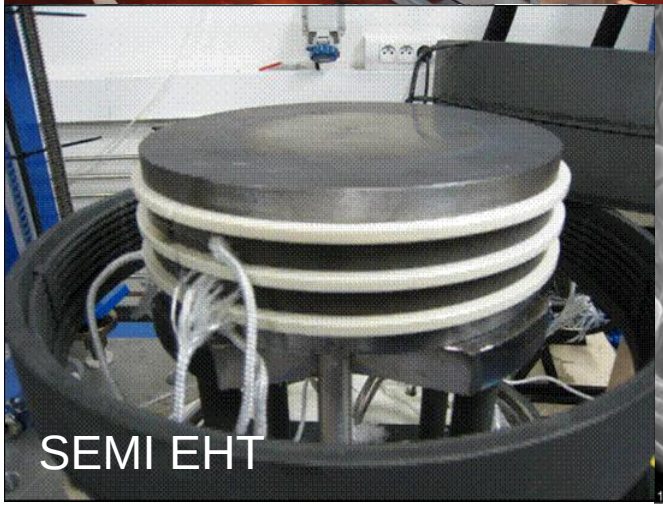
Yearly meeting of the R&D Community
Grenoble 2007

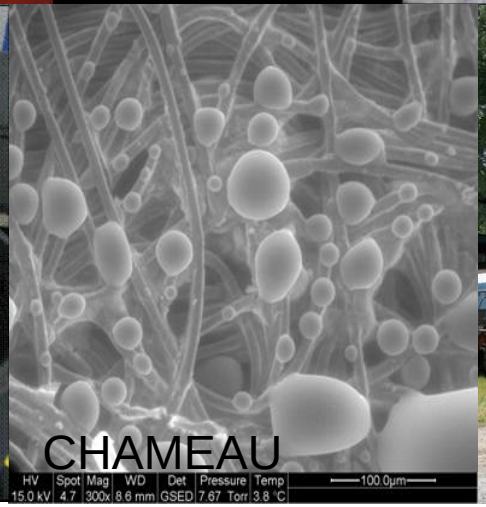
Some projects funded by ANR


PAC SM


FISYPAC


EOLHY


SEMI EHT



CHAMEAU


SPACT 80

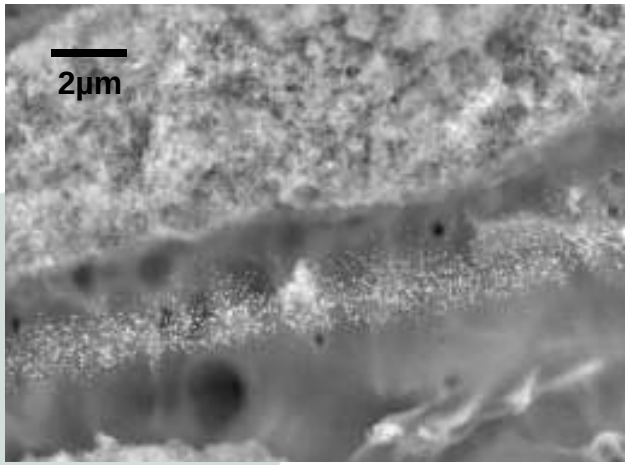
The HYPAC National Platform

- **Created in early 2009, the national HYPAC platform has the following objectives:**
  - **Define a national Hydrogen & Fuel Cell Road Map consistent with the European HFC-JU**
  - **Propose Public Authorities documents about regulation in order to increase industrial achievements**
  - **Create national standards in order to improve industry competitiveness**
  - **Improve consistency between actions initiated by local authorities**
  - **Support French Representatives in international organisations**
- **The HYPAC platform works will be supported by the « Hydrogen and Fuel Cell observatory » led by ADEME, ALPHEA and AFH2**

Some typical projects funded by the French National Research Agency (ANR) complementary to FP7

Semi-EHT (2005) : High temperature electrolysis.
Partners: CEA, EDF, Garlock France, Saint-Gobain
Budget: 3,9 M € **Funding :** ANR

Cathy GDF (2005): H2 transport in existing gas pipelines.
Partners: Gaz de France, Air liquide, CEA, CNRS-LIMHP.
Budget: 2,6 M € **Funding :** ANR



Rhône-Alpes, Drôme, Isère, Savoie

- **MDM (2007):** MEAs Degradation Mechanisms in PEMFC systems for stationary back-up applications
  Partners: AXANE, AL, NPG LEPMI, CNRS LMOPS, SOLVICORE
  Budget: 1,9 M€ **Funding:** ANR

- **AMEIRICC (2007) :** MEA's
  Partners: CEA LITEN, ERAS Labo, CNRS IAM, LMOPS et SPRAM, Univ Lyon IMP, Univ Cergy Pontoise LPPI
  Budget: 3,5 M€ **Funding :** ANR

From stack to system

- **2008 :** evolution of the system trough innovations & modifications:
  - H_2 distribution circuit
  - cooling circuit,…

- **Results:**
  - ⇨ same net power (1.8 kW)
  - ⇨ decrease of 25% of the weight
  - ⇨ decrease of 20% of the volume

Presentation to Valérie Pécresse, French Minister for Research & Universities in April 2008’

Coupling with renewable energies

Island grid peak-shaving : MYRTE Project

- **Experiment the association of a photovoltaic plant and an hydrogen system in an electrical grid connection condition**
- **Main objective is to control the system power output on the grid during critical hours : peak load shaving**

6 years project

<u>Phase 1:</u>
Fuel Cell : 50 kWe
Electrolyser < 10 Nm^3/h H_2

<u>Phase 2:</u>
Fuel Cell : 200 kWe
Electrolyser < 40 Nm^3/h H_2

Heat recovery and storage will be implemented

- **200 kW system based on 600 kW PV and H_2**
- **Peak shaving during local grid peak hours**
- **Partners: CNRS Corsica, HELION, CEA, RAFFALLI**

H2E: Horizon Hydrogen Energy

An ambitious deployment program of 200 M€ coordinated by Air Liquide
A Public-Private-Partnership federating national competencies

19 partners, 150 FTE

7 years, 2009 - 2016

Funding: Private - 123 M€ & Public via Oseo Innovation- 67 M€

Implementing the use of competitive solutions

Air Liquide launches the Horizon Hydrogen Energy (H2E) program

- The H2E program represents an overall investment in research and technology of almost 200 M€ over 7 years. It aims at building sustainable and competitive hydrogen energy solutions. The research and development will cover the full hydrogen energy value chain. In particular, it will investigate the development of innovative technologies for hydrogen production using renewable energy, hydrogen storage and industrialization of fuel cells. H2E will also contribute to the setting up of a suitable regulatory framework, and will include a program of demonstrations and educational measures to familiarize the wider public with this new, clean energy vector.
- This ambitious program brings together around Air Liquide twenty partners in the field of hydrogen energy: industrial groups, small and medium-sized companies and French public research laboratories. This is a unique opportunity to place France and Europe at the leading edge of this key sector for sustainable mobility.
- TheH2E program aims at markets with wireless energy needs not met by any current solutions. For example, captive vehicle fleets, portable generators or the supply of backup energy.

Conclusions

- Significant funding has considerably stimulated Hydrogen RD&D.
- Public-Private Partnership is a great success. Results have triggered the H2E demonstration project (200 M€)
- A large community is now involved in RD&D.
- A new Hydrogen Platform (HYPAC) has been created
- Industrial and regional efforts need a boost.
- RD&D programs are developed in a coherent way with EU priorities.
- The German infrastructure initiative has been very well received in France.