

HYDROGEN and FUEL CELL Stationary Applications in France

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- Electricity generation in 2003:
 - 542 TWh with low CO₂ emissions
 - 78 % Nuclear (Power 70 000 MW)
 - 12 % Hydraulic (Power 13 000 MW)
 - 10 % Fossil
 - Efficient Electricity grid everywhere in France
 - Export of electricity to UK, Spain, Italy, Germany (15 % of total production)
 - Increase of electricity consumption of 1,5 % /year (electricity peak power in February 2005 > 85 000GW)
- Main companies
 - EDF (Electricité de France)
 - Cogeneration: Dalkia, Gdf, Elyo ...
 - New actors in the future

Activities in Fuel Cells stationary in France

- Tests and Demonstration of different systems
 - Gaz de France(GDF) and Electricité de France(EDF), Dalkia
 - PEMFC, PAFC, SOFC
 - Natural Gas, Methanol, Biomass Gas
- Research and Development
 - PEMFC
 - SOFC
- Main actors in France:
 - End users: EDF, GDF, Dalkia, Elyo
 - System and fuel cells Suppliers: Air Liquide-Axane, Helion,
 - Components/stack: Saint Gobain for SOFC, others
 - SME for reformers, exchangers ... N'GHY, Irma, CETH
 - R&D: CEA, CNRS, Universities

« Portable power units »

- Replace UPS, batteries to supply High Quality current and reliable sources (Telecoms, buildings, industry): x 10 000 in France
- Off Grid units for insulated sites and biomass utilization (6000 Diesel-sites in France)

« Micro-CHP » (P < 36 kVA) :

- Production combinée de chaleur et d'électricité en résidentiel individuel, petit collectif, tertiaire (PEMFC / SOFC); market of 700 000 units for heating per year

« Decentralized production (P from 50 kW to few MW) :

- High power cogeneration (Gaz Natural gas, biomass, biogas)
- Decentralized Production with high efficiency (SOFC, MCFC, SOFC Hybride) (Gaz Natural gas, biomass, biogas)
- Improvement of renewable intermittent energy
- Use of by products Hydrogen from industrial plants

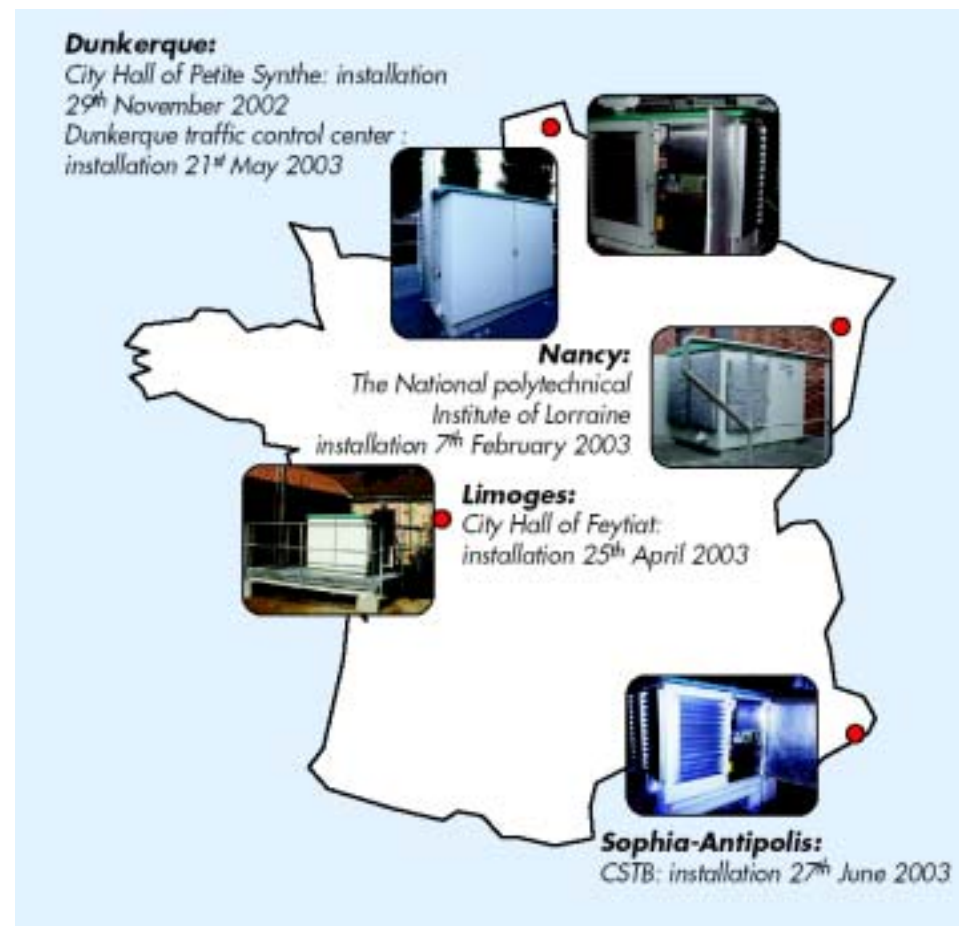


Global FC system building

TECHNICAL CHARACTERISTICS OF FC

Electric power:	10-200 kW
Thermal power:	10-200 kW
Type of FC:	PAFC
Model:	PC ONSI 25C manufactured by UTC Fuel cells
Size:	5,5 m (L) x 3 m (l) x 3 m (H)
Weight:	18 Tons
Start-up:	27 January 2000
Combustible:	natural gas- 20 mbar
Consumption:	50 Nm ³ /h at rated power
Estimated life duration:	40 000 hours.

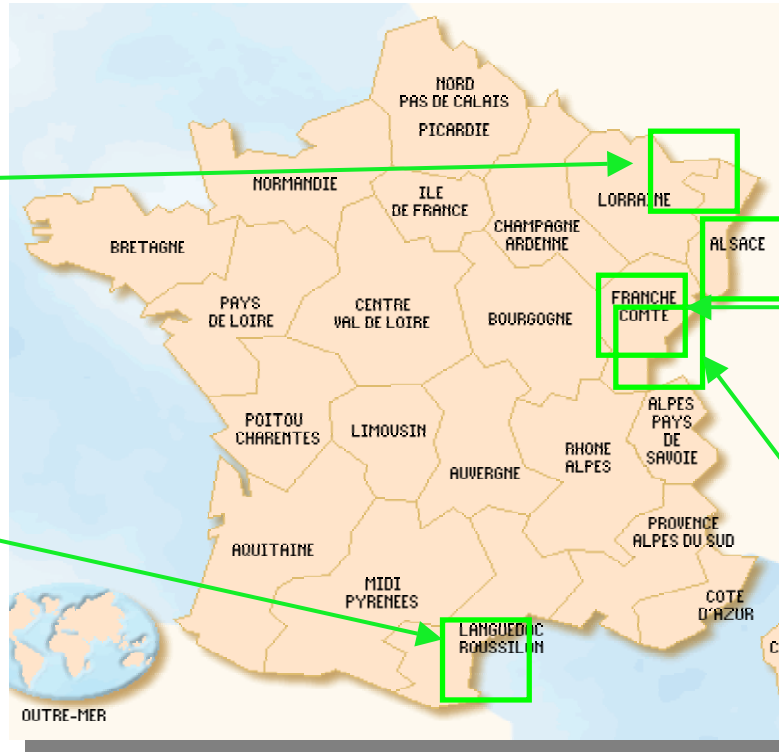
- Tests/Demonstration: **Gaz de France**, Universities, Ademe
 - 5 PEMFC HPOWER 2002-2005
 - Natural gas
 - 4 kW elec, 5,6 kW Thermal
- Project of 2, 4 M€



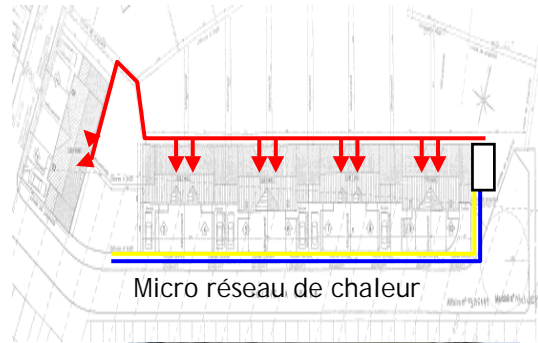
Experiments/ Tests/Demonstration: **Electricité de France**

- **1. Portable Power Supply**
 - 5 PEMFC Idatech 1 kW/Methanol in France :
 - 1 site PV en Vallée d’Aude (février 2003)
 - 2 sites PV en Franche-Comté (janvier 2004)
 - 1 site PV à Strasbourg (juillet 2004)
 - 1 site déconnecté du réseau à Forbach (avril 2004)
- **2. Micro-CHP**
 - 4 PEMFC Vaillant/natural gas 4,6 kW in France :
 - Sarreguemines (April 2004) EDF/Dalkia
 - Giromany (December 2004) partenariat avec Dalkia
 - Orléans (December 2004)
 - Liévin (1er semestre 2005)
 - 3 PEMFC 5 kW in Germany/Austria, 1 PEMFC 1 kW , 2 SOFC 1 kW in Germany
- **3. Fuel Cell in Paris EDF/Dalkia for residential**

Portable power unit



Micro-CHP



- R&D projects on PEMFC and SOFC
 - New materials to decrease operating temperature (SOFC)
 - New catalyst for internal reforming (PEMFC)
 - New design to reliable and temperature cycling SOFC
 - Coupling Biomass gases and SOFC (Biostar, Greenfuel cell)
 - Efficient reformer multi fuel without catalyst (N'GHY)
 - Research Partners: CNRS, Universities, CEA
 - Industrial partners: Saint Gobain, EDF, GDF, Dalkia
 - National and european projects: RealSOFC, SOFCnet ...
- Development of 5 kW prototype SOFC for Cogeneration applications in 2008: Gecopac Project (6 M€)
 - CEA, Dalkia, Snecma, N'GHY
 - New design
 - Using Natural gas
- Development of portable power system
 - AsiPac(helion), Helps, Axane ...

- 2004: Industrial, R&D and ministry Task Force to define priorities in France for H₂ and Fuel cells : Report in October 2004
- Priority: transport applications with intermediate applications on stationary necessary
- For stationary applications:
 - Portable power unit
 - Micro-CHP (Niche markets in France): few kW for Residential
 - Decentralized Cogeneration: 100-few MW for industrial applications,
- Seek for synergies for PEMFC between transport and stationary
- SOFC program (even less money than PEMFC)
- Demonstration/Tests program to be continued and reinforced
- Call for order for:
 - R&D
 - Create/promote a Early market for stationary and niche markets for the next 5 years:
 - Example of possible objective : installation of 50 MWe between 2005 and 2010