



# Overview of Fuel Cell Programs in IPHE Countries

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# IPHE Overview

- Partnership of 17 countries plus the EC
- Forum for international collaboration on RD&D, policy, and education
- IPHE members share a long-term commitment to hydrogen and fuel cell research, development and deployment.
- The countries differ in their approaches, their drivers, and the structures of their programs.

## IPHE Priorities

- Accelerating market penetration and early adoption of hydrogen and fuel cell technologies and their supporting infrastructure
- Policy and regulatory actions to support widespread deployment
- Raising the profile with policy-makers and public
- Monitoring technology developments



## IPHE Countries

- ✓ European Commission
- ✓ China
- ✓ United States
- ✓ Japan
- Germany
- Korea
- Canada
- New Zealand
- Australia
- Brazil
- France
- Iceland
- India
- Italy
- Norway
- Russia
- South Africa
- United Kingdom





# Germany



## National Innovation Program (NIP)

### Politics

BMVBS / BMWi /  
BMBF / BMU

€ 500 M

for demonstration

+ € 200 M

for R&D



**1,4 billion €**  
**2007-2016**

- Preparing hydrogen & fuel cell markets
- Focus on R&D combined with everyday demonstration
- hydrogen & fuel cells driven by applications and markets: transport, stationary energy supply, special markets

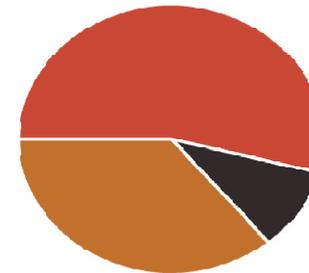
### Industry

+ € 700 M

Industry co-payment

### Transport:

- 54% of the NIP
- Includes H<sub>2</sub>-production and H<sub>2</sub>-infrastructure
- Extension of vehicle fleet (passenger cars and buses) and H<sub>2</sub>-infrastructure, starting from key regions (Berlin, Hamburg)



### Stationary applications:

- 36% of the NIP
- FC-heating-applications in privately owned homes
- FC in industrial CHP

### Special markets:

- 10% of the NIP
- Critical energy supply, IT, telecommunication
- Logistics, leisure and tourism markets



# Korea



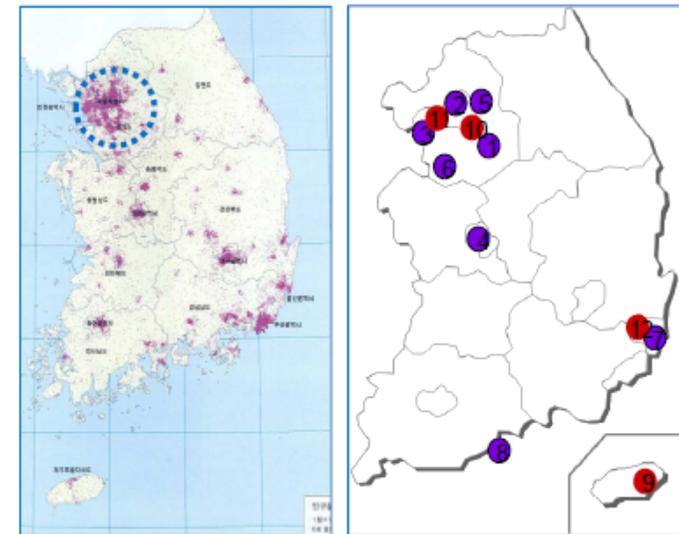
Several ministries are involved in hydrogen and fuel cell work:

Ministry	Focus	H2/FC Budget
Ministry of Knowledge Economy	R&D of Fuel Cells and Fuel Cell Vehicles	\$7 M/year
Ministry of Land, Transport and Maritime Affairs	R&D of Safety and Regulations of Fuel Cell Vehicles	\$32 M over 2007-2012, including 50/50 cost share
Ministry of Education, Science and Technology	R&D of H2 Production, Storage, Delivery and Utilization	\$100 M over 2003-2012 (\$86 M government and \$14 M industry)
Ministry of Environment	Deployment of Eco-Friendly Vehicles (Green Cars)	\$46.6 M for domestic fleet program (50% government), \$17.6 M for validation program (30% government)

## Hydrogen Infrastructure in Korea

- 2009: #1 ~ #8
- 2010: #9, #10, #11
- 2011: #12

## 700bar Station: #1, #6, #12



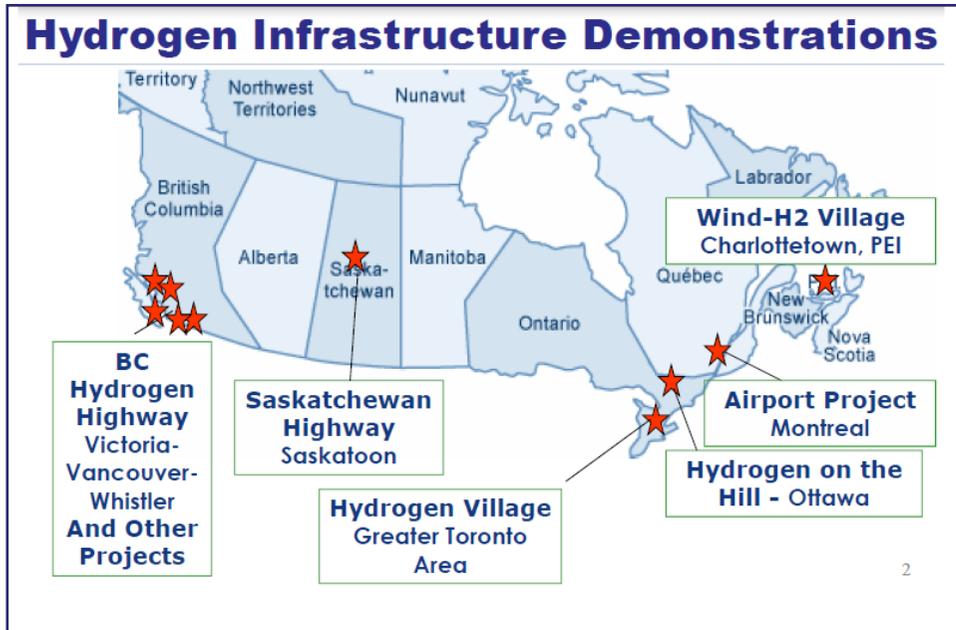
(•): 1,000 persons

\*Ref.: National Geographic Information System (2005)

Vehicle demonstration and residential demonstrations are now entering Phase II



# Canada



Activities in BC include:

- 7 hydrogen fueling stations
- Integrated waste hydrogen utilization project
- H2/CNG buses, H2 ICE pick-up trucks, and utility vehicles
- World's largest fleet of fuel cell buses (20)
- Largest hydrogen fueling station in the world (1000 kg/day)
- Hydrogen used as energy storage from PV



# Australia



- Hydrogen activities fall under the Department of Resources, Energy, and Tourism
  - Hydrogen as a fuel in the transport sector
  - Coal gasification with CCS

# New Zealand



- Hydrogen activities fall under the Ministry of Economic Development
- Research interests include
  - Production from coal and renewables
  - Hydrogen storage
  - Fuel cell demonstrations



# Brazil



## Budget

AREA	INVESTMENT USD (MM)
Production, Purification and Storage	6.7
Fuel Cell	15.6
Systems, Integration and Engineering	6.4
TOTAL	28.7

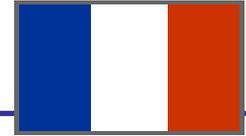
- Program for hydrogen and fuel cells includes projects in five areas:
  - Hydrogen production (focused on biofuels reforming)
  - PEM fuel cells
  - SOFC fuel cells
  - Systems, integration and engineering
  - Utilization, applications and use

Fuel cell buses will be deployed in Sao Paulo and Rio de Janeiro starting in 2010.





# France



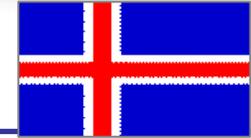
- Drivers include jobs and economic growth, as well as energy efficiency, clean technologies, and sustainable transport.
- The government is currently developing a long-term action plan which will drive funding for future demonstration projects.
- French National Research Academy (ANR) and the French Environment and Energy Management Agency (ADEME) are performing analysis to guide strategy.

## Five important hydrogen/fuel cell markets for France:

- Clean hydrogen production for industry (chemistry, synfuel, biofuels, oil refineries, cement, steel, ...)
- Hydrogen as a temporary storage for increasing the share of renewable energies or direct use (Mix with natural gas, biogas,...)
- Stationary
- Transportation and niche markets
- Automobile



# Iceland



- Icelandic New Energy (INE), a private company, is focused on demonstrations and public awareness
- Smart-H2 project conducted from 2007-2010
  - 27 hydrogen cars have been demonstrated, with 22 still in service
  - Demonstration of marine operation (whale watching boat APU) began in 2008
- Focus on education: Master's degree in fuel cell systems and hydrogen available





# India



- Need for remote power
  - Several telecom companies have entered into large deals for small stationary.
- Development and demonstration of H<sub>2</sub> three-wheelers
- Opportunity to take advantage of existing CNG infrastructure
  - Hundreds of CNG stations; 350,000 CNG vehicles
  - Delhi: fueling station blending h<sub>2</sub> and CNG
- Roadmap focuses on utilizing waste hydrogen from industry
- Tata Motors developing fuel cell buses and vehicles





# Italy



## FISR PROGRAMME “HYDROGEN AND FUEL CELLS”

supported by the **Ministry of Education, University and Research** and **Ministry of Environment** through the **Special Integrative Fund for Research (FISR)**

- **14 projects (8 on hydrogen technologies, 6 on fuel cells)**

*FISR funding : 90 M€*

*Total cost of the projects: 120 M€*

*Duration: 2005-2010*



## INDUSTRIA 2015

**Ministry of Economic Development** has launched in the 2007 the “Industria 2015” Programme aimed at assisting **Industrial innovation projects** in different thematic areas

### ENERGY EFFICIENCY

- **MICROGEN 30 / ICI Caldaie** -30 kWe CHP system with PEFC for residential applications
- **EFESO / Merloni Termosanitari** - 1-2.5 kW micro-CHP prototypes with SOFC
- **HYDROSTORE / Venezia Tecnologie** - Study and development of storage systems

### SUBSTAINABLE MOBILITY

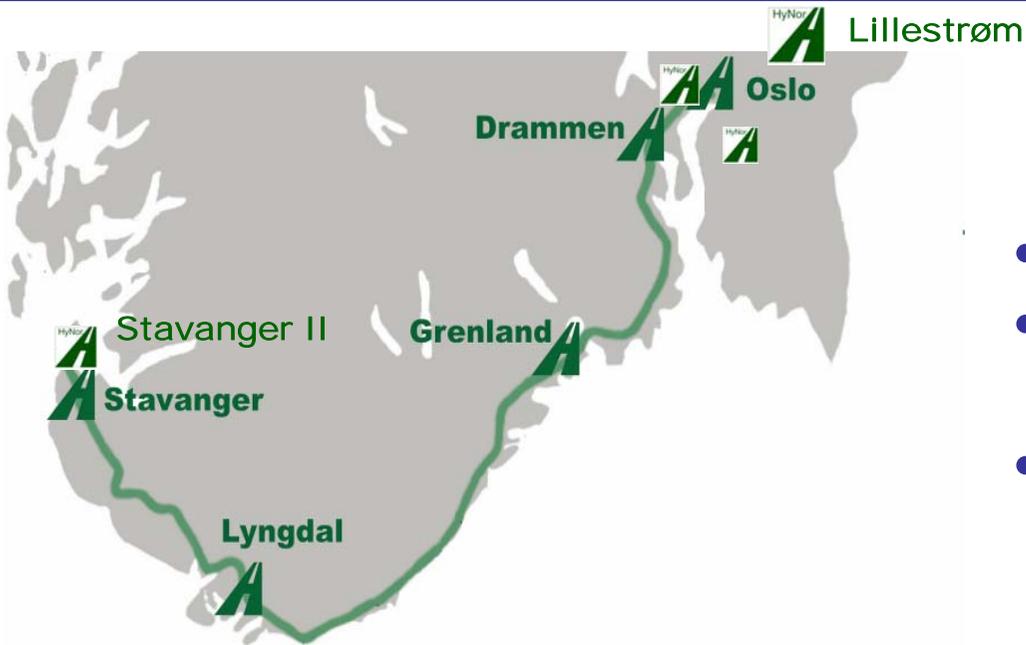
- **VISION /Fincantieri** – Hydrogen ferry for Venice lagoon with fuel cell hybrid system
- **PBI (Innovative Bus Platform /Breda Menarinibus-** Systems for the safe and integrated mobility (vehicles and infrastructures for passenger and/or freight transport)

*MSE funding: 30,1 M€*

*Total cost of the projects: around 70 M€*

*Duration: 3 years*

# Norway



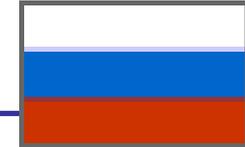
- Activities in Norway includes:
- 4 hydrogen stations in operation
  - 4 additional stations to be opened in 2010/11
  - Strong capabilities in hydrogen production from electrolysis

Abundant resources of natural gas and hydropower, active in CCS

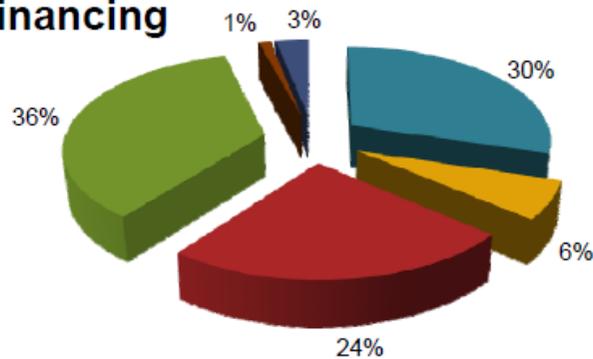




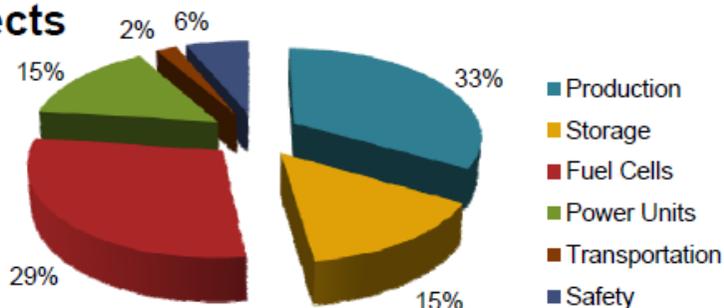
# Russia



## Financing



## Projects



Government Funding: 1 billion rubles

## Areas of focus

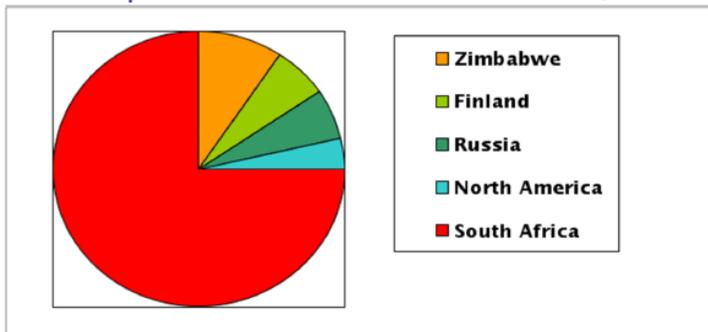
- Hydrogen production
  - Electrolyzers
  - Fuel processors and microprocessors
  - Advanced liquefaction
- Hydrogen storage
  - On-board, hybrid vehicles
  - On-board, FC vehicles
  - Reversible for stationary applications
  - Irreversible for stationary and portable
- Fuel Cells
  - Alkaline FC and co-generation units
  - PEM FC and co-generation units
  - High temperature FC
- Hydrogen combustion technologies
  - H<sub>2</sub>/O<sub>2</sub> steam generators
  - High temp steam turbines and power units
  - Hybrid high temp power units
- Safety, codes and standards



# South Africa



World platinum resources: Cawthorn, 1999



- Newest IPHE member
- Unique drivers:
  - Over 75% of platinum group metal reserves
  - Socio-economic benefits from value-addition of minerals

## Vision

To create knowledge and human resource capacity that will develop high value commercial activities in hydrogen and fuel cell technologies utilising local resources and existing know-how.



The program consists of three centres of competence and a fuel cell education and training center.



# United Kingdom



- Hydrogen is seen as an important long-term energy option for the UK, particularly in transport.
- Hydrogen policy was set out in the UK Strategic Framework Report (2005)
- Currently developing H2 Action Plan for the next 5 years
- Demonstration projects include:
  - 3 fuel cell buses in London
  - Stationary units in Birmingham
  - 6 fueling stations to be established in London by 2012
  - Fleet of hydrogen taxis planned for 2012



## Conclusion:

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- Hydrogen and fuel cell technologies play an important role in the future energy and transportation system (IEAs Blue Map Scenario)
- Success in deploying H<sub>2</sub>&FC technologies into global markets requires that countries exploit their national advantages, it requires international cooperation and sharing of best practice experiences
- The IPHE constitutes such an arena for exchange of practices and priorities, and thus helps accelerate market penetration and early adoption



# THANK YOU!

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More information is available on the IPHE  
website at:

<http://www.iphe.net>