



Overview of Fuel Cell Programs in IPHE Countries

Dr. Stian Nygaard



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

Industry

+ € 700 M

Industry co-payment

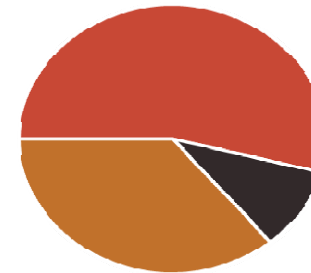


1,4 billion €
2007-2016

- 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

Transport:

- 54% of the NIP
- Includes H₂-production and H₂-infrastructure
- Extension of vehicle fleet (passenger cars and buses) and H₂-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



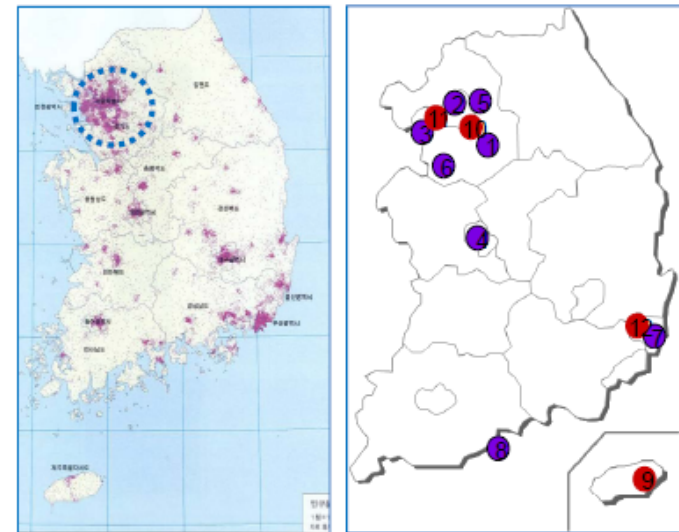
Several ministries are involved in hydrogen and fuel cell work:

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



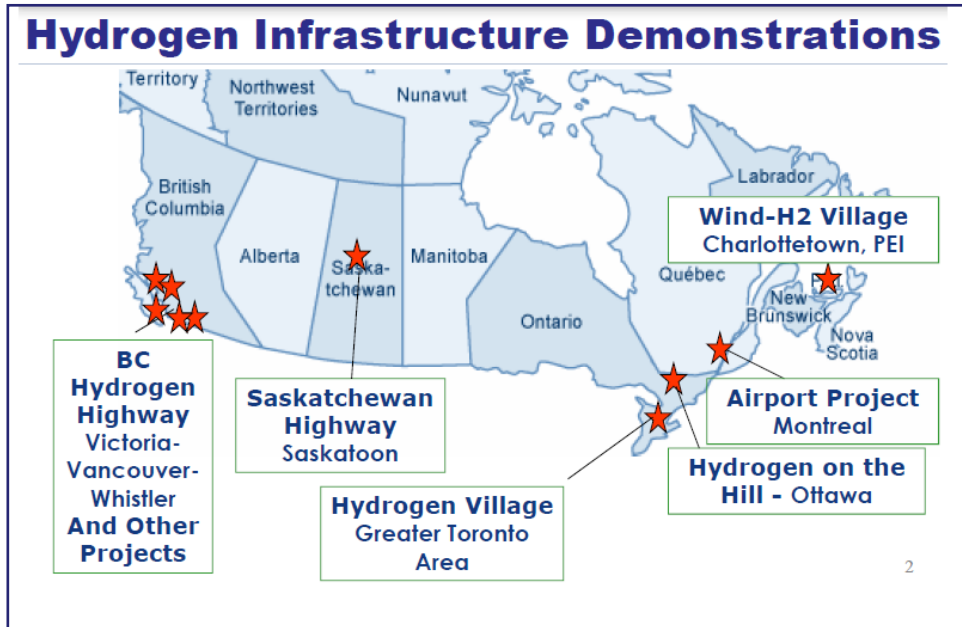
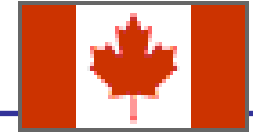
(•): 1,000 persons

*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

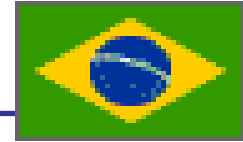
New Zealand



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



Brazil



Budget

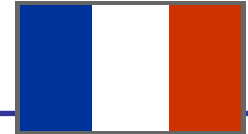
AREA	INVESTMENT USD (MM)
Production, Purification and Storage	6.7
Fuel Cell	15.6
Systems, Integration and Engineering	6.4
TOTAL	28.7

- 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



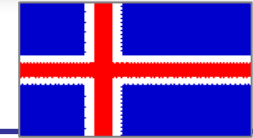
- Drivers include jobs and economic growth, as well as energy efficiency, clean technologies, and sustainable transport.
- The government is currently developing a long-term action plan which will drive funding for future demonstration projects.
- French National Research Academy (ANR) and the French 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

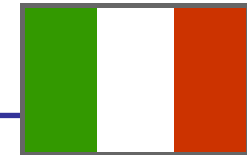


- Need for remote power
 - Several telecom companies have entered into large deals for small stationary.
- Development and demonstration of H₂ three-wheelers
- Opportunity to take advantage of existing CNG infrastructure
 - Hundreds of CNG stations; 350,000 CNG vehicles
 - Delhi: fueling station blending h₂ 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)

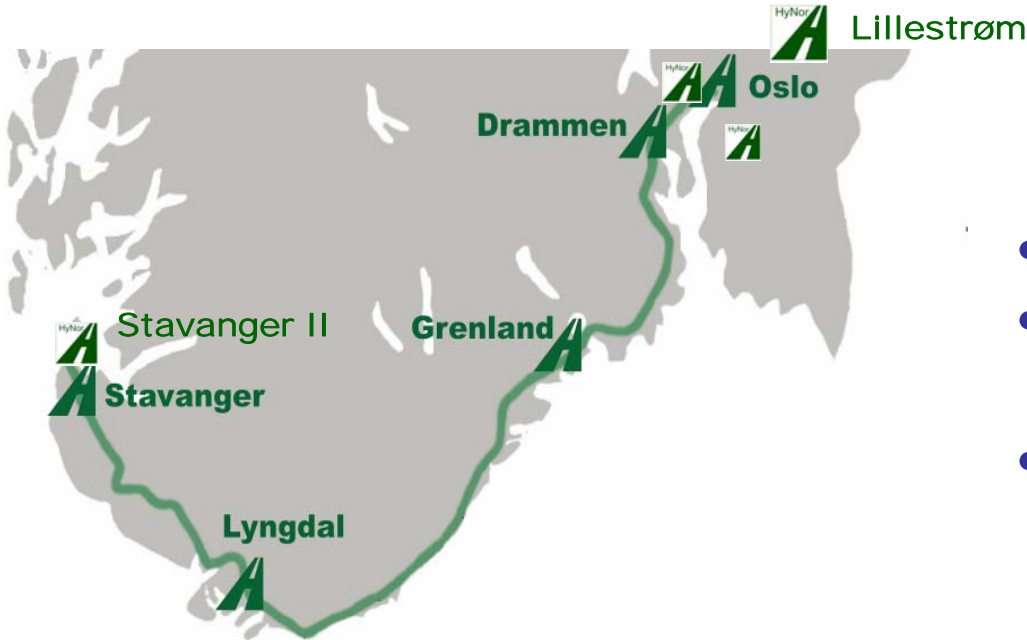
MSE funding: 30,1 M€

Total cost of the projects: around 70 M€

Duration: 3 years



Norway



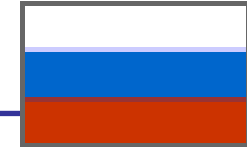
- Activities in Norway includes:
- 4 hydrogen stations in operation
 - 4 additional stations to be opened in 2010/11
 - Strong capabilities in hydrogen production from electrolysis

Abundant resources of natural gas and hydropower, active in CCS

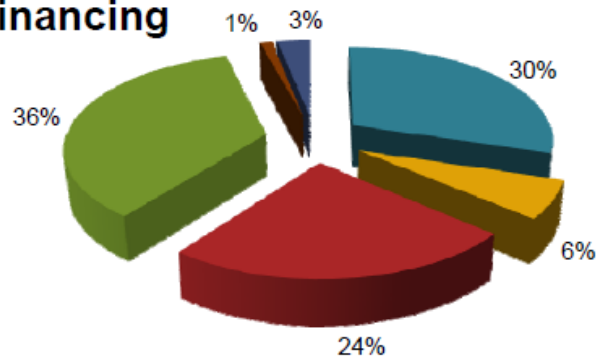




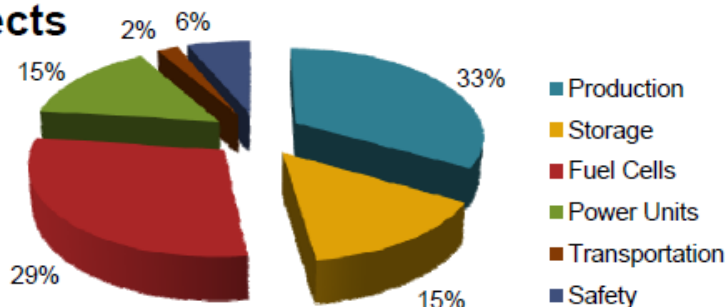
Russia



Financing



Projects



Government Funding: 1 billion rubles

Areas of focus

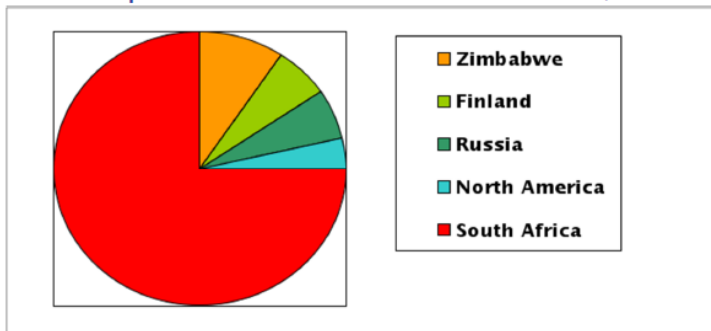
- Hydrogen production
 - Electrolyzers
 - Fuel processors and microprocessors
 - Advanced liquefaction
- Hydrogen storage
 - On-board, hybrid vehicles
 - On-board, FC vehicles
 - Reversible for stationary applications
 - Irreversible for stationary and portable
- Fuel Cells
 - Alkaline FC and co-generation units
 - PEM FC and co-generation units
 - High temperature FC
- Hydrogen combustion technologies
 - H₂/O₂ 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:

- Hydrogen and fuel cell technologies play an important role in the future energy and transportation system (IEAs Blue Map Scenario)
- Success in deploying H₂&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!

More information is available on the IPHE
website at:

<http://www.iphe.net>