

# Global Hydrogen Landscape: Selected IEA HIA Member Programs and Initiatives

*Mr. Antonio G. García-Conde (ExCo. Chair),  
Mr. Jan Jensen, Dr. Steven Pearce (ExCo. Vice Chairs)  
Ms. Mary-Rose de Valladares (ExCo. Secretariat Manager)*

**A Congressional Briefing on Thursday, 10 June, 2:00-3:30  
562 Dirksen Senate Office Building  
Washington, DC USA**

IEA HIA Congressional Briefing 10 June 2010



# IEA HIA Presentation

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- Introduction to the IEA HIA
- Denmark
- Korea
- Commission of the European Union
- Highlights of other IEA HIA Members' Programs and Initiatives



# International Energy Agency



Germany



Australia



Austria



Belgium



Canada



Korea



Denmark



Spain



United States



Finland



EC



France



Greece



Neherland



Hungary



Ireland



Italy



Japan



Luxembourg



Norway



New Zealand



Portugal



United Kingdom



Czechk Republic



Sweden



Switzerland



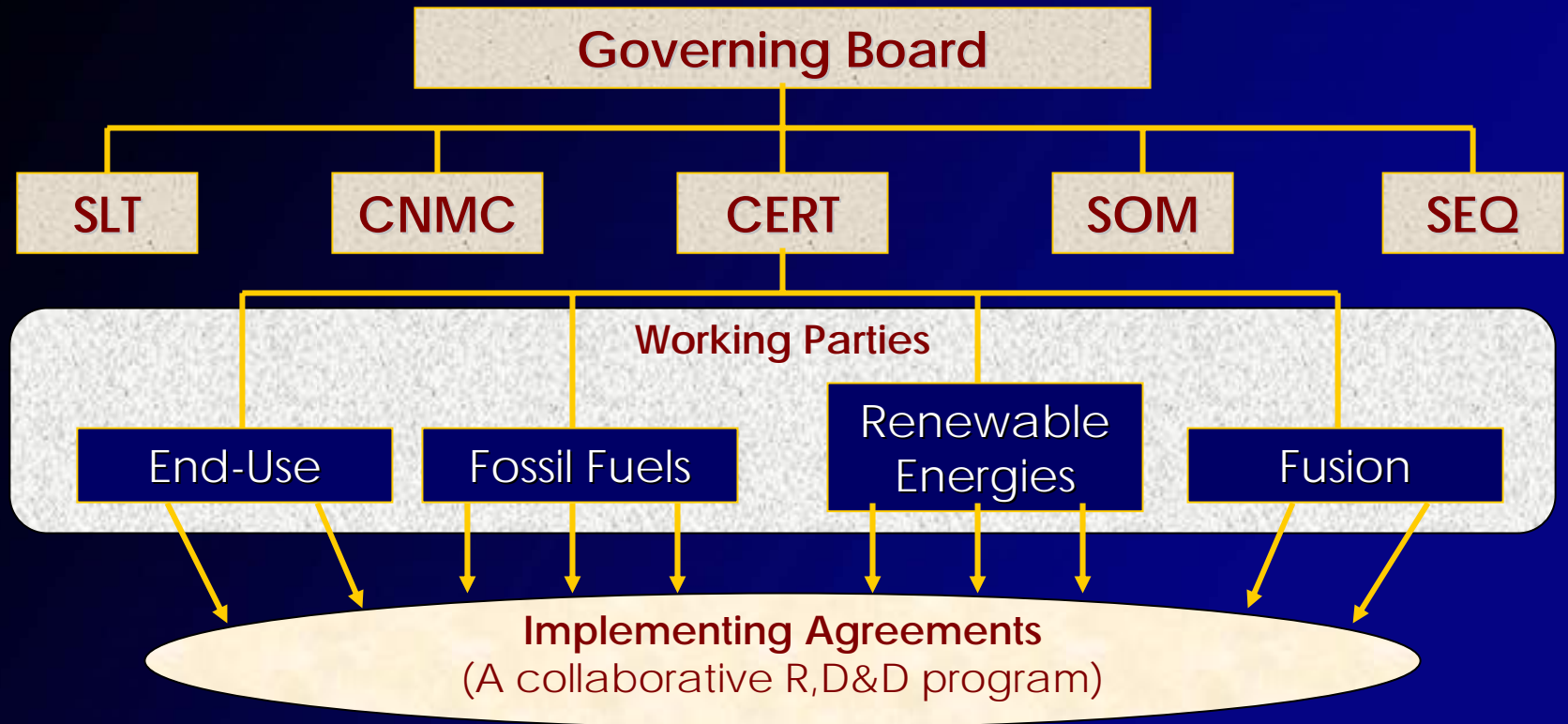
Turkey

**Autonomous body** within the Organization of Economic Cooperation and Development (OECD), founded in **1974** to carry out **energy cooperation** among member countries.

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# IEA Organization



## CERT: Committee on Energy Research and Technology

**SLT:** Standing group on Long-Term co-operation  
**CNMC:** Committee on Non-Member Countries

**SOM:** Standing group on Oil Market  
**SEQ:** Standing group on Emergency Questions

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# Hydrogen Implementing Agreement (HIA)

A collaborative research and development (R,D&D) program  
Created in 1977 on a task-shared, "bottom-up" basis

## Strategic Framework

2009 - 2014

### Vision

A hydrogen future based on a clean sustainable energy supply of global proportions that plays a key role in all sectors of the economy

### Mission

To accelerate hydrogen implementation and widespread utilization to optimize environmental protection, improve energy security and promote economic development internationally while establishing the HIA as a premier global resource for expertise in hydrogen

### Strategy

To facilitate, coordinate and maintain innovative research, development and demonstration (RD&D) activities through international cooperation and information exchange



# Hydrogen Implementing Agreement (HIA)

## Collaborative R&D

- Annex / Task:** Basic unit of organization in HIA. Several members collaborate on each task.
- Operating Agent:** Manages Annex – **Experts** do work
- Taks-Shared:** Member countries fund their expert researchers directly according to the level of person hours agreed upon in each task.



# IEA HIA Members - Executive Committee

(May 2010)

## Europe



Commission of EU  
Dr Marc Steen



UNIDO  
Dr Nicolas Lymberopoulos



**Denmark**  
Mr Jan Jensen  
Co Vice-Chair



**Finland**  
Dr Heikki Kotila



**France**  
Mr Paul Lucchese



**Germany**  
Mr J.-F. Hake



**Greece**  
Dr Elli Varkaraki



**Iceland**  
Dr Agusta Loftsdottir



**Italy**  
Mr Agostino Iacobazzi



**Lithuania**  
Dr R. Urbonas



**Norway**  
Dr. Stian Nygaard



**Spain**  
Mr A. Garcia-Conde  
Chair



**Sweden**  
Dr Lars Vallander



**Switzerland**  
Dr Stefan Oberholzer



**The Netherlands**  
Mr Frank Denys



**Turkey**  
Dr Alper Sarioglan



**United Kingdom**  
Mr Ray Eaton

## North America



**Canada**  
Mr Nick Beck



**United States**  
Dr Carole Read

## Asia - Pacific



**Japan**  
Dr T. Itomi



**Korea**  
Dr Y. Tak

## Oceania



**Australia**  
Dr J. Wright



**New Zealand**  
Dr S. Pearce  
Co Vice-Chair

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# Feedstock and Process Alternatives for Hydrogen Production

**Gas:** Natural gas or bio-gas are H<sub>2</sub> sources with steam reforming or partial oxidation

**Oil:** H<sub>2</sub> is produced with steam reforming or partial oxidation from fossil or renewable oils

**Algae:** Methods for utilizing the photo-synthesis for H<sub>2</sub> production

**Coal:** With gasification technology H<sub>2</sub> may be produced from coal

H<sub>2</sub>

**Wood:** Pyrolysis technology for hydrogen from biomass

**Alcohols** like ethanol and methanol derived from gas or biomass – are rich in H<sub>2</sub> and may be reformed to H<sub>2</sub>

**Power:** Water electrolysis from renewable sources and nuclear

Source: Hydro

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# IEA HIA Tasks Since 1977

1. Thermochemical Production
2. High-Temperature Reactors
3. Potential Future Markets
4. Electrolytic Production
5. Solid Oxide Water Electrolysis
6. Photocatalytic Water Electrolysis
7. Storage, Conversion and Safety
8. Techno-Economic Assessment
9. Hydrogen Production
10. Photoproduction of Hydrogen
11. Integrated Systems
12. Metal-Hydride for H<sub>2</sub> Storage
13. Design & Optimization Integ. Systems
14. Photoelectrolytic Production
15. Photobiological Production
16. H<sub>2</sub> from Carbon-containing mat.
17. Solid & Liquid Storage Materials
18. Integrated Systems – II

20. Hydrogen from Waterphotolysis

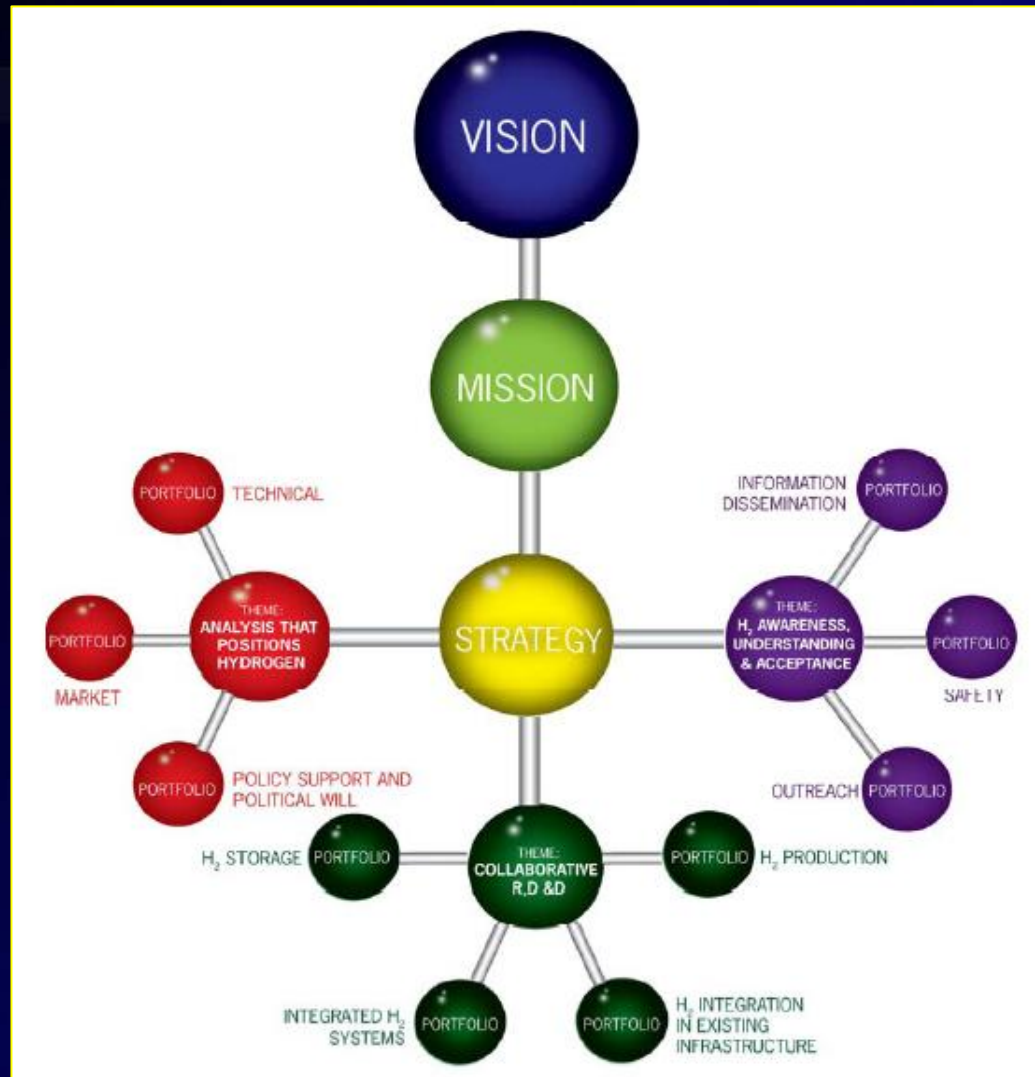
## Current Portfolio

19. Hydrogen Safety -II
21. BioHydrogen - II
22. Fundamental & Applied H<sub>2</sub> Storage Materials Development
23. Small-Scale Reformers for On-Site H<sub>2</sub> Supply (SSR for H<sub>2</sub>)
24. Wind Energy and H<sub>2</sub> Integration
25. High Temp. Processes for H<sub>2</sub> Production
26. Advanced Materials for H<sub>2</sub> from Waterphotolysis
27. Near-Market Routes to H<sub>2</sub> by co-utilization of biomass with fossil fuel
28. Large Scale Hydrogen Delivery Infrastructure
30. Global Analysis of H<sub>2</sub> Systems

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# Strategic Framework 2009 - 2014



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# 2009 – 2014 Themes

## Collaborative R, D & D

that advances hydrogen Science and Technology

- ❑ Hydrogen Production
- ❑ Hydrogen Storage
- ❑ Integrated Hydrogen Systems
- ❑ Hydrogen integration in existing infrastructure

## Analysis that Positions Hydrogen for

- ❑ Technical progress and optimization
- ❑ Market preparation and deployment
- ❑ Support in political decision-making

## Hydrogen Understanding, Awareness and Acceptance

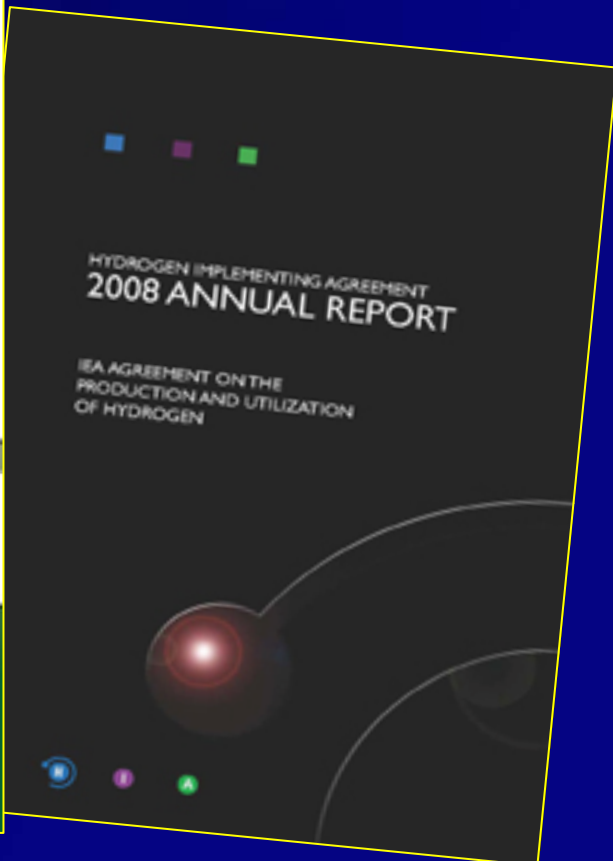
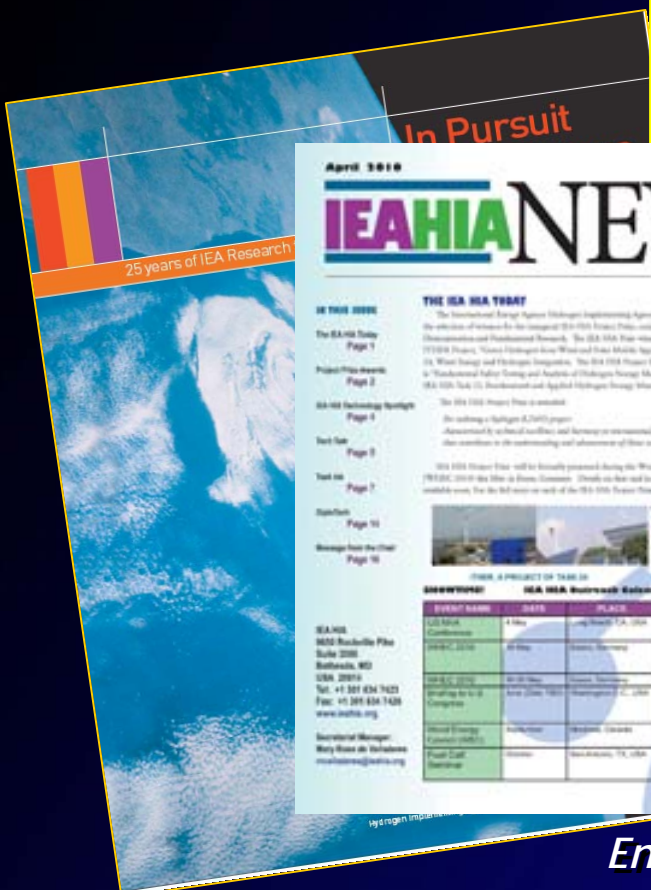
that foster technology diffusion  
and commercialization

- ❑ Information Dissemination
- ❑ Safety
- ❑ Outreach



# Information Dissemination

Download free at [www.ieahia.org](http://www.ieahia.org)



*End-Of-Term Report 2004-2009 & Strategic Plan 2009-2014*

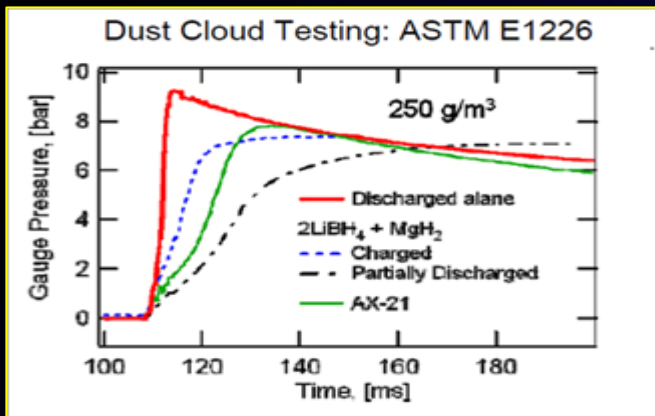
*2008 Annual Report*

*25<sup>th</sup> Anniversary Report: In Pursuit of the Future*

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# IEA HIA Project Prize



Fundamental  
Research

## Fundamental Safety Testing and Analysis of H<sub>2</sub> Storage Materials

and Systems (H-25), a project of Task 22, Fundamental and Applied H<sub>2</sub> Storage Materials Development

- ❑ 4 country (Canada, Germany, Japan, USA) collaboration
- ❑ Project Leader: Dr. Don Anton



Technology  
Demonstration

## IHER (Infraestructura Tecnológica del Hidrógeno y Energías Renovables)

“Green Hydrogen from Wind and Solar

Mobile Applications, a project of Task 24, Wind Energy and Hydrogen Integration

- ❑ Developed by Fundación para el Desarrollo de Nuevas Tecnologías del Hidrógeno en Aragón



# IEA HIA Project Prize



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# IEA HIA Member Presentation

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## DENMARK



# IEA HIA Member Presentation

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## KOREA



# IEA HIA Member Presentation

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## COMMISSION OF THE EUROPEAN UNION



# Highlights

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## OTHER IEA HIA MEMBERS' PROGRAMS AND INITIATIVES



# Member Program and Initiatives Highlights

## News from the Opening Ceremony at WHEC 16 May 2010



*JAPAN and GERMANY  
sign Memorandum of Understanding (MOU)  
on future collaboration*

# Highlights - Japan



Fuel cell residential cogeneration system-Ballard Power

# Highlights - Japan

## HOT Topic #2

□ At September UN Summit on Climate Change Japan announced it will aim to reduce emissions by 25% compared to 1990 levels.

□ Japan & US agree to cooperate on Clean Energy Century Plan for clean energy technologies

## HOT Topic #3

□ Long-Distance (1,100 km-637 miles) 3 vehicle Demo Drive

□ 2 refuelings; total H<sub>2</sub> – 28.kg; average fuel efficiency 118.4km/kg

## HOT Topic #4

□ ~1000 unit demo stationary fuel cells for residential use launched in 2009

## Targets, Policies, Funding

□ FCV – commercialization starts in 2015

□ Stationary FC – 20-100MW (2010); 2,500 MW (2030)

□ 2010 budget ~18 billion Yen for H<sub>2</sub>, Fuel cells, demo, codes & standards, subsidy



# Highlights - Germany

**NIP** (National Innovation Program)

**2007-2016**

- ❑ Government, industry, science
- ❑ 1.4B € budget (50% industry; 30% Ministries of Transport, Bldg & Urban Affairs – focus on demonstration; 20% Ministry of Economics – focus on R&D)

## Initiatives

- ❑ Lighthouse projects & clusters
- ❑ Clean Energy Partnership II Berlin
- ❑ New H2 station in Hurth provides final link in 600 mile hydrogen highway (Munich to Amsterdam)



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**Focus on Strategy & Innovation**

# Highlights - Germany

**NOW GmbH** (National Organization of H2 and Fuel Cells)  
**H2 Mobility** – Industrial Alliance of several auto manufacturers and energy industry partners leads to **MOU on build-up**; two phase plan begins 2010

- ❑ phase 1: standardization and planning
- ❑ phase 2: roll out with serial production starting in 2015



## MOU between NOW and NEDO

- H2 and Fuel Cell commercialization (May 2010)

- ❑ info exchange, applications (stationary and transport) and infrastructure
- ❑ commercialization planning, project management, Policy and technology “trends”

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Focus on Strategy & Innovation

# Focus on Strategy and Innovation

## Canada

- ❑ largest per capita OECD H2 producer- 3 million tons annually.
- ❑ program targets: H2 production, storage, fuel cells; safety, codes & standards
- ❑ Chair of ISO Technical Committee 197
- ❑ 20 fuel cell buses at Winter Olympics
- ❑ Ontario H2 Village in Toronto & remote sites



## France

- ❑ 7 year R&D investment; 200M €; 20 partners
- ❑ R&D focus on nuclear hydrogen
- ❑ Voilà! EDF is promoting fuel cells in the press!

# Focus on Strategy: Innovation & Targets

## US

### ❑ Major milestones and critical path technology goals:

- H2 produced from domestic resources for \$2-3.00 per gallon gasoline equivalent
- On-board H2 systems for light-duty vehicles with 300 mile range
- PEM fuel cell technology: \$30/kW; durability 5,000 hours of service = 150,000 ml/240,000 km
- Stationary – 40,000 hours at \$750/kW

❑ 11 patents in 2009; 21 others in progress

❑ 1000 fuel cell systems – mixture of uses

❑ **FY10 Budget** - \$174M + \$40M fuel cell deployment by 2012

❑ **Tax regime:** more favorable tax credits or grants in lieu of credit; manufacturing credit



**Congratulations to DOE on 2010 AMR!**



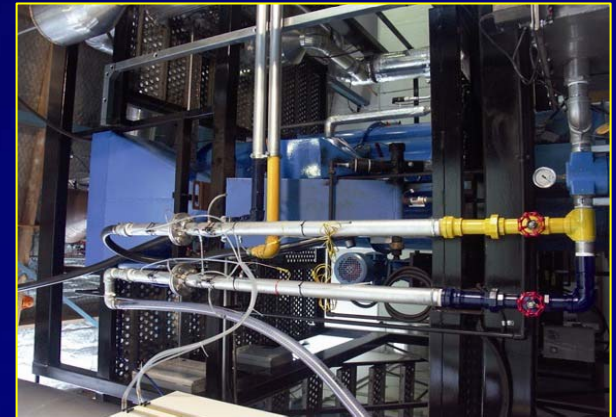
# Focus on Strategy: Policy Priorities and R&D

## Lithuania

- ❑ H2 a priority in new (2007) National Energy Strategy
- ❑ 2006 creation of Lithuanian H2 & Fuel Cell Technology Platform
- ❑ Focus on Storage and Education

## Turkey

- ❑ Renewable H2 an important alternative fuel
- ❑ Clean coal, catalysis and biomass
- ❑ Robust R&D regime
- ❑ Home base - UNIDO ICHET



# Focus on Clean and Sustainable Energy

## Australia

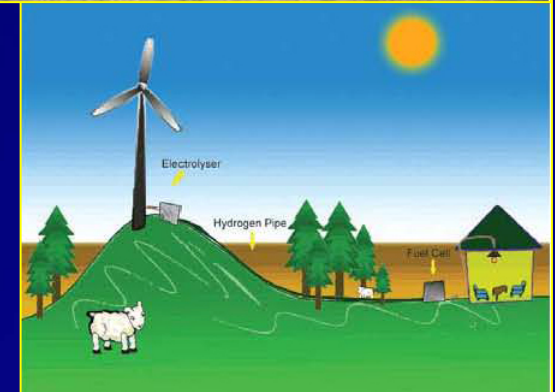
- ❑ Emissions plan: 5-25% reduction by 2020
- ❑ Clean Energy funding: \$A652 M RE future fund; will expand to \$A5.1B clean energy initiative

## New Zealand

- ❑ **HOT NEWS:** pushing ahead with ETS (emissions trading scheme), which comes into effect July 1 with carbon price of NZ\$12.50 CO<sub>2</sub>e (equivalent CO<sub>2</sub>) per tonne

## United Kingdom

- ❑ Named for commitment: **Department of Energy and Climate Change**



# Focus on Strategy, Innovation & Demonstration

## Switzerland

- ❑ Innovation in research – SFOE (photoelectrochemical [PEC] watersplitting)
- ❑ Innovation in products – Swiss Innovation Promotion Agency (CTI)
  - Minibars on Swiss Railway trains (SBB) powered by PEM fuel cells with solid state metal hydride storage
  - 1<sup>st</sup> H<sub>2</sub> street-cleaner – demo in Basel



## Finland

- ❑ Moving toward **demo** - FinnHy
- ❑ National program at Tekes targets industry opportunities to create **breakthrough fuel cell products**

# Focus on Strategy, Innovation & Demonstration

## Spain

- ❑ Spanish Technology Platform for H2 and FC – 2005 launch
- ❑ Aggressive 2008-2012 Action Plan for energy efficiency
- ❑ Big player in **wind** energy
- ❑ Strong **regional H2 investment**

## Italy

- ❑ 5 year national plan includes H2 & fuel cells
- ❑ Regional focus on Demos
- ❑ Industry 2015 – H2 and Fuel cell projects in **sustainable mobility**



# Focus on Strategy, Innovation & Demonstration

## Sweden

- ❑ One of world's best addresses for **BioHydrogen**
- ❑ Fuel Cell & H<sub>2</sub> – Joint Technology Initiative launched 2008



## The Netherlands

- ❑ DutchHy launched 2009
- ❑ Emphasis on infrastructure

## Iceland

- ❑ SMART H-2, SMART H<sub>2</sub> Boat (Sustainable Marine & Road Transport)



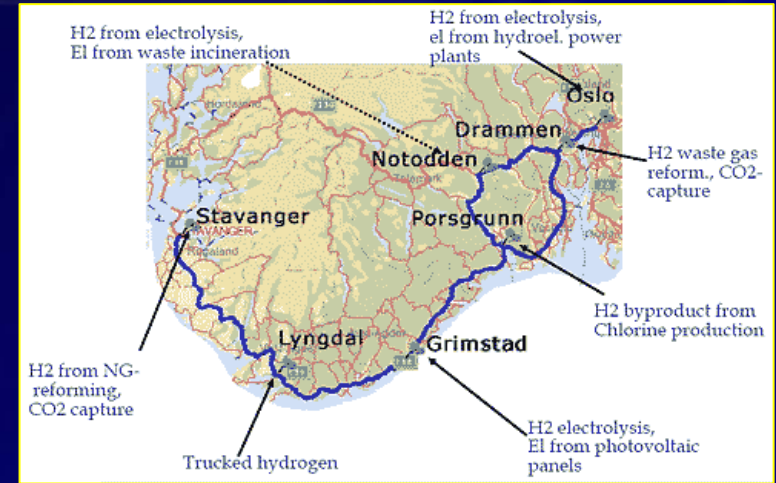
# Focus on Strategy, Innovation & Demonstration

## Greece

- Renewables and remote site projects for sustainability

## Norway

- Starting to pursue long-term climate policy
- HyNor – multiple stations (route extends into Denmark and Sweden) and large vehicle fleet (H2 Prius, Think H2, Mazda)



# Focus on Connection with the Developing World

## UNIDO

- ❑ Represented by its project, UNIDO ICHET, whose mission is to demonstrate viable implementation of hydrogen energy technologies and facilitate their widespread use in developing countries
- ❑ UNIDO-ICHET located in Istanbul, Turkey
- ❑ Funding Instruments: pre-feasibility, pilot, R&D
- ❑ Demonstration activities:
  - H2 3-wheelers, New Delhi, India
  - Bozca Hydrogen island, Turkey
  - Aitutaki, Cook Islands
  - FC-based UPS, Turkey
  - Fuel cell fork-lift, Turkey
  - Hydrogen FC boat, Turkey
- ❑ R&D – Test labs; Education; Conferences



# *International Energy Agency Hydrogen Implementing Agreement . . .*

*. . . A premier global resource for technical expertise in H<sub>2</sub> RD&D*

For more information contact:

**Mary-Rose de Valladares**

[mvalladares@ieahia.org](mailto:mvalladares@ieahia.org)

+1 301 634 7423

[www.ieahia.org](http://www.ieahia.org)



# Thank you very much !

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