

U.S. Congressional Briefing

Global H2 Landscape:

Selected IEA HIA Member Programs and Initiatives – Commission of the European Union

Dr Ir Marc STEEN

Institute for Energy, Joint Research Centre, European Commission

IEA-HIA ExCo,

IPHE Co-Chair Regulations, Codes and Standards

1. EU Energy Policy Context
2. Strategic Energy Technology Plan (SET-Plan)
3. Policy evolution outlook
4. Public R&D on hydrogen and fuel cells in Europe
 - Fuel Cells and Hydrogen Joint Undertaking - FCH JU
 - Joint Research Centre activities and achievements
5. EU-US collaboration on Hydrogen and Fuel Cells

Additional info

- Priorities 2nd Strategic European Energy Review
- Forthcoming Policy Initiatives
- Scope of FCH JU

The European Union:
a supra-national
organisation
of
27 Member States,
493 million people

Legal basis:

Treaty of Lisbon, Dec. 2009



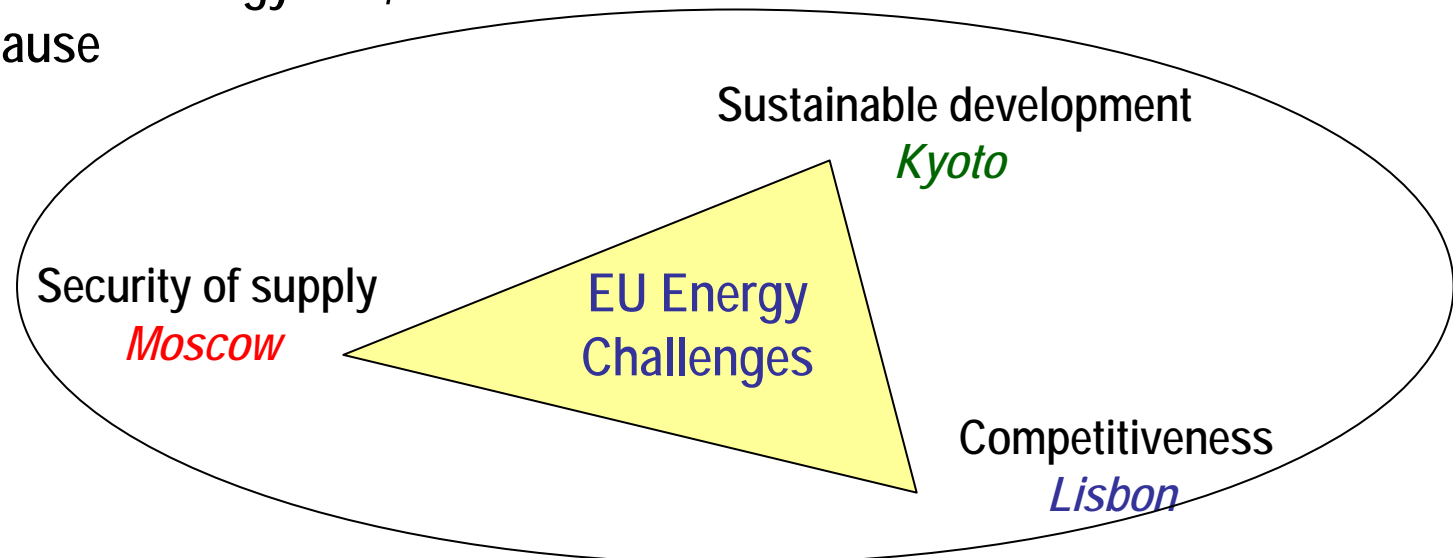
Energy

The Treaty of Lisbon contains a specific chapter on energy:
key EU competencies and overall objectives of energy policy:

- *functioning of energy markets,*
- *security of supply,*
- *energy efficiency and savings,*
- *development of new and renewable forms of energy,*
- *interconnection of energy networks*



Member States decide on their energy-mix,
subject to a solidarity clause



The **EU Climate and Energy Package** (March 2007) committed Europe to transforming itself into a highly energy-efficient, low carbon economy. **20-20-20 targets by 2020:**

- reduction in EU greenhouse gas emissions of at least 20% below 1990 levels
- 20% of EU energy consumption from renewable resources, 10% in transport
- 20% reduction in primary energy use compared with projected levels, to be achieved by improving energy efficiency



Energy Action Plan:

- Third internal energy market package;
- Renewables directive;
- Nuclear safety directive;
- CO2 Emissions trading directives;
- **Strategic Energy Technology Plan;**
- Energy efficiency legislation, regional infrastructural projects...



Commission estimates that an additional investment of €50 billion in energy technology research will be needed over the next 10 years.

- tripling the annual investment in the European Union, from €3 to €8 billion
- new instruments: public-private partnerships (European Industrial Initiatives)

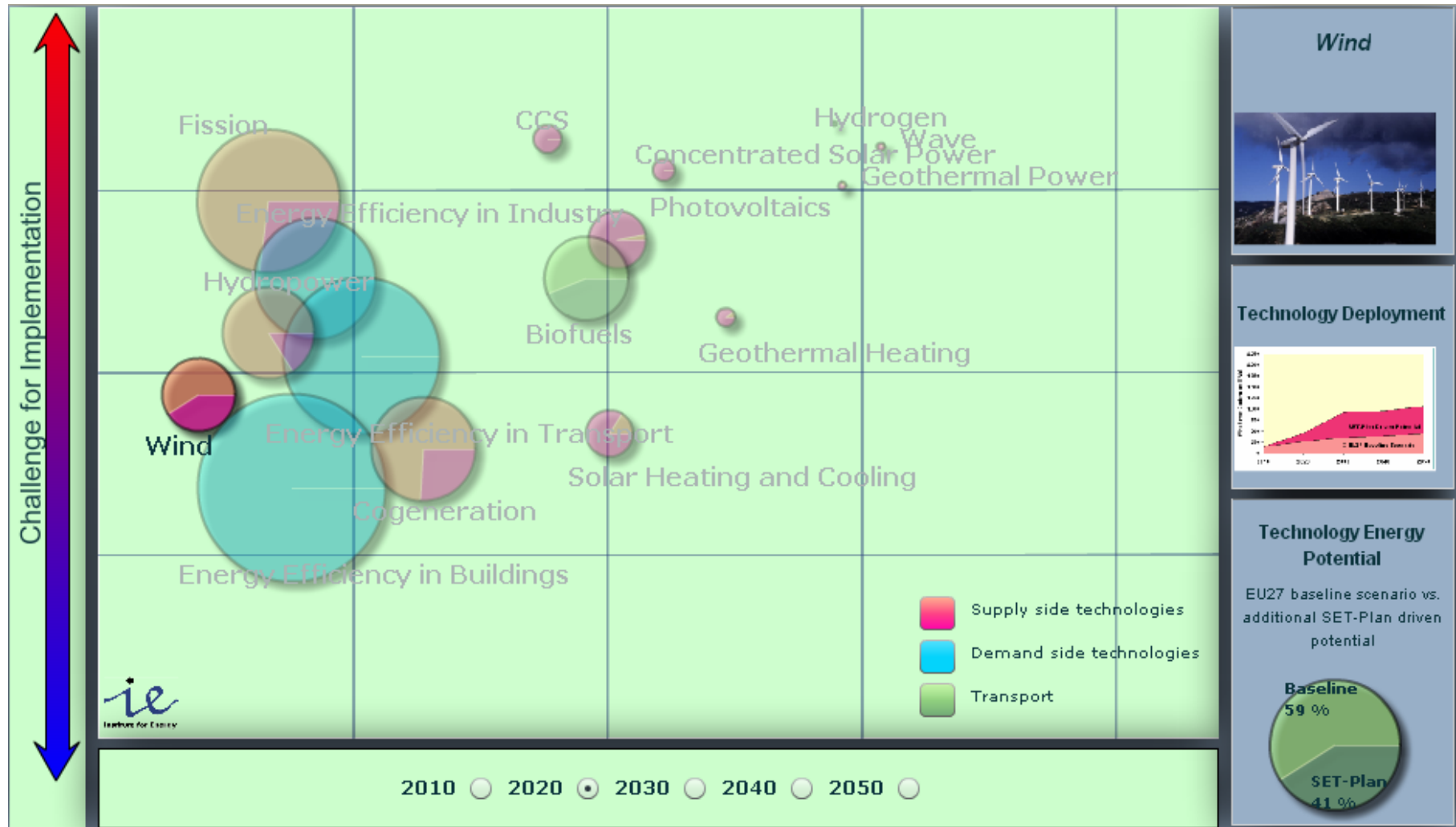
- European Wind Initiative
- Solar Europe Initiative (PV and thermal)
- European Carbon Capture, Transport and Storage Initiative
- European Electricity Grid Initiative

} launched 3
June 2010

- European Industrial Bioenergy Initiative
- Sustainable Nuclear Fission Industrial Initiative
- Smart Cities Initiative

note: fuel cells and hydrogen already launched earlier (FCH JU, May 2008)

Technology potential of different energy sources



EU Council commitments on climate change (7562/10)
reduce emissions by 80-95% by 2050 (compared to 1990 levels)

Energy Strategy for Europe 2011-2020
ensure implementation of Energy Action Plan + new issues

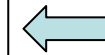
New Transport Whitepaper (2010-2020) + Strategic Transport Technology Plan
decarbonisation of transport as a main priority

Roadmap for low carbon energy system by 2050

additional info at end of presentation

EU Research Policy: 2 legs

- co-funded R&D (“indirect actions”)
- own R&D (“direct actions”)



note: current evolution from R&D to research and innovation

indirect actions

- R&D activities in Europe are funded at different levels: EU, national and regional.
- EU level funding: consecutive framework programmes, currently FP7
 - EU dimension and added value
 - competitive calls for proposals (sollicitations)

http://ec.europa.eu/research/fp7/index_en.cfm?pg=cooperation

for H2 and fuel cells: EU funding as of 2008 through public-private partnership: Fuel Cells and Hydrogen Joint Undertaking (FCH-JU), operating the Joint Technology Initiative:

- 1 B€ for R&D and demonstration (2008-2013)
- 50/50% cost share basis between EC and industry

An industry-led Public-Private Partnership between

- The European Union represented by the Commission
- European Industry Grouping for the Fuel Cells and Hydrogen Joint Technology Initiative (NEW-IG)
- New European Research Grouping on Fuel Cells and Hydrogen (N.ERGHY)



<http://ec.europa.eu/research/fch>

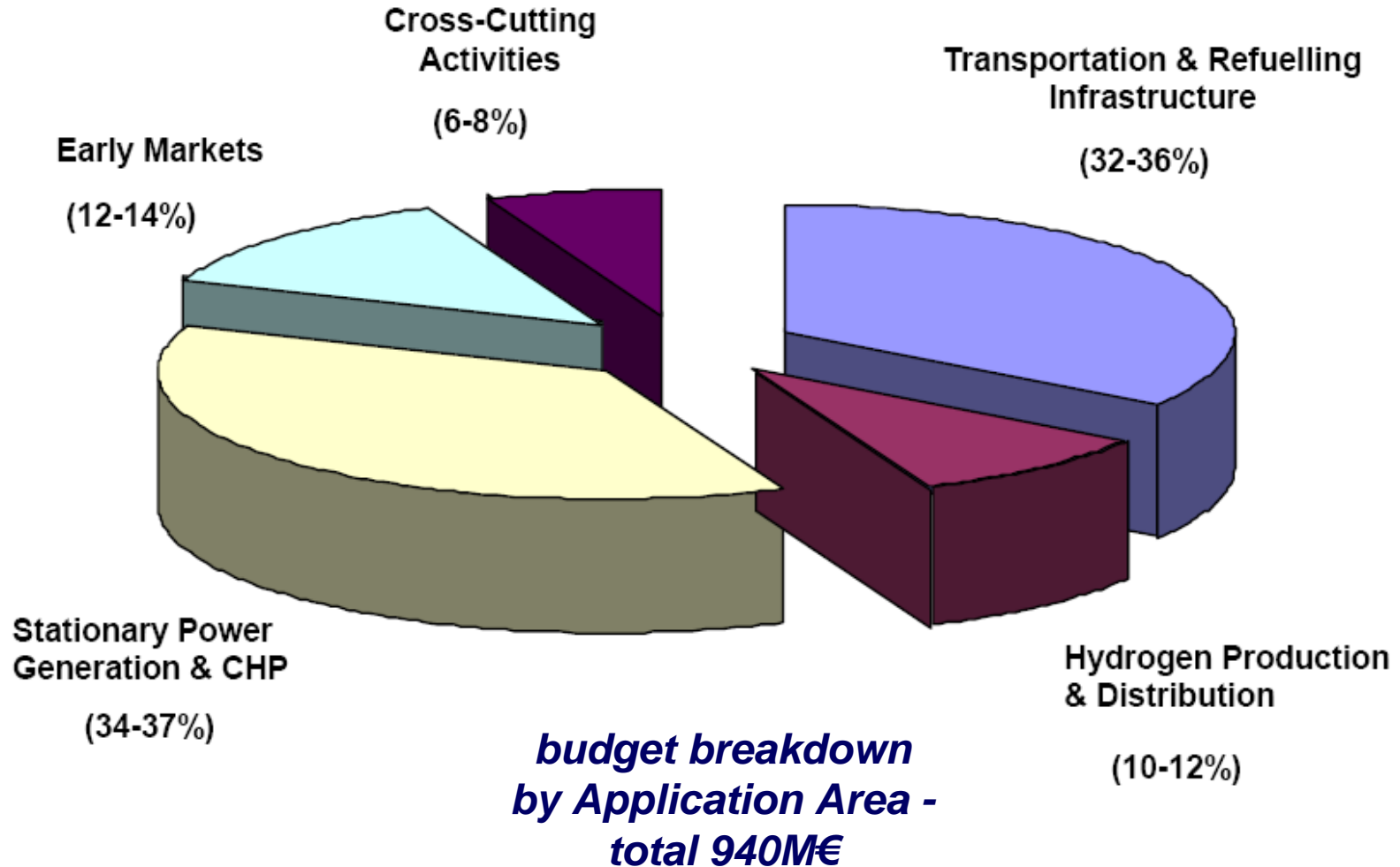


<http://www.fchindustry-jti.eu>



<http://www.nerghy.eu>

to accelerate technology development to achieve market introduction from 2015



- The FCH JU has the minimum critical mass needed to develop and validate efficient and cost competitive technologies
- However, meeting the market entry targets set by industry will require substantial additional effort
- *The additional public and private funding needed is currently estimated as €5 bn for the period 2013-2020*

COM(2009)519: Investing in the Development of Low Carbon Technologies (SET-Plan)

JRC Mission:

to provide customer-driven scientific and technical support for the conception, development, implementation and monitoring of EU policies

The JRC functions as a centre of science and technology (S&T) reference for the EU, independent of commercial and national interests...



R&D by JRC is limited in scope by full compliance with the Subsidiarity Principle:

- “enabling R&D” activities
- targeting EU and public interests
 - pre-normative and co-normative research, performance assessment (incl. LCA),
 - scenario-building, road-mapping, SET-Plan Information System, ...
- networking within and outside EU absolutely necessary



on hydrogen and fuel cells:

Framework Agreement FCH JU - JRC: provision of reference facilities and programme support

High Pressure H₂ Storage

GasTeF

Safety bunker for stationary & cyclic testing facility up to 800 bar



On-board safety sensors

SenTeF

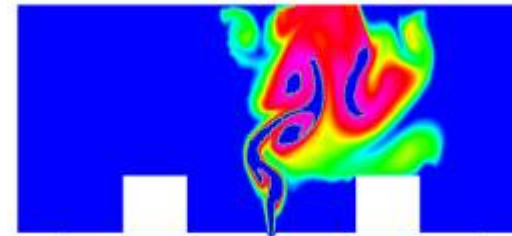
Laboratory for sensor testing



Modeling H₂ release

2D and 3D CFD codes

dispersion/explosion modelling



refuelling stations permitting

Solid-state H₂ Storage

SolTeF

Laboratory for storage capacity characterisation



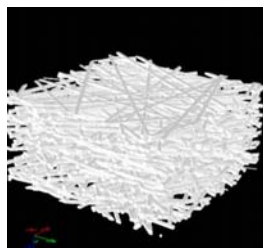
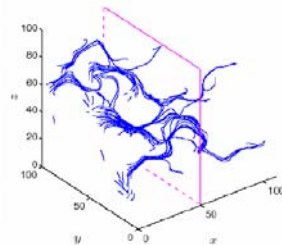
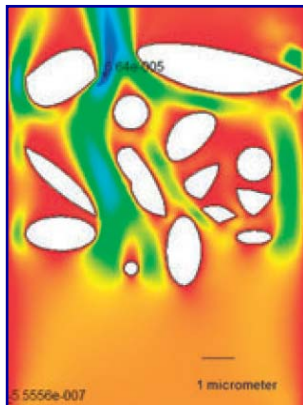
ISO TC 197
EC type approval HFCV
UN-ECE WP 29

IEA-HIA, IPHE (ICHS)
NREL, SNL, JARI, ...

Environmental and vibration testing of FC systems and their performance



efficiency, engine and evaporative emission testing

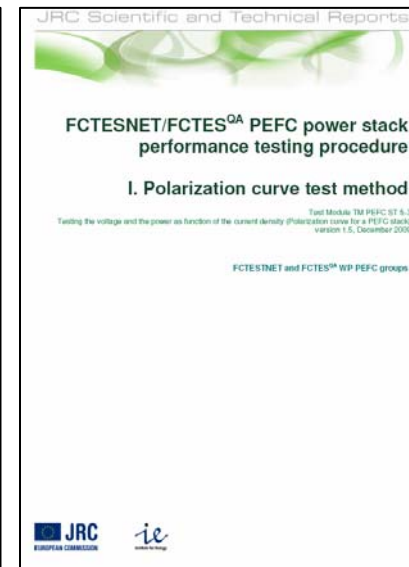
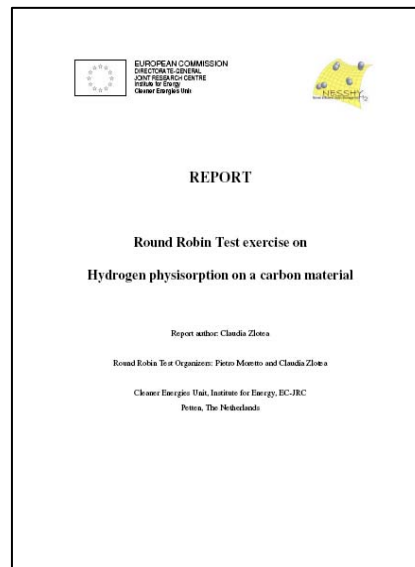


ISO TC 197, IEC TC 105
UN-ECE WP 29

IEA-AFC, IPHE,
ANL, LANL, NEDO,
KIST, Dalian Univ.,
RAS, ...

	Interlaboratory exercise H2 solid state storage	Sensor response time testing	Interlaboratory exercise fuel cell stack testing
number	30 pcT curves and 20 isothermal kinetics curves	3 experimental set-ups @ various H2 conc, for 4 sensor technologies (50)	3
for	NESSHY-IPHE	ISO TC 197 WG 13	IEC TC 105
in request of	NESSHY-IPHE	ISO TC 197 WG 13	DoE, JARI
collaboration	international partners (SwRI)	BAM, NREL	ANL, FCTESQA partners, (JARI)

- ANL: Argonne National Lab
- BAM: BundesAnstalt für Materialprüfung
- NREL: National Renewable Energy Laboratory
- SwRI: Southwest Research Institute
- JARI: Japan Automotive Research Institute
- IPHE: Int'l Partnership for H2&FC in the Economy
- NESSHY: NEw Solid State Storage of H2
- FCTESQA: FC testing and quality assurance



framed within EU-US Energy Council WG Technologies (Dec. 2009)

possible areas of cooperation identified:

- *safety, codes and standards; risk assessment*
- *interlaboratory comparisons*
- *socio-economic studies*
- *harmonising technology readiness scales*

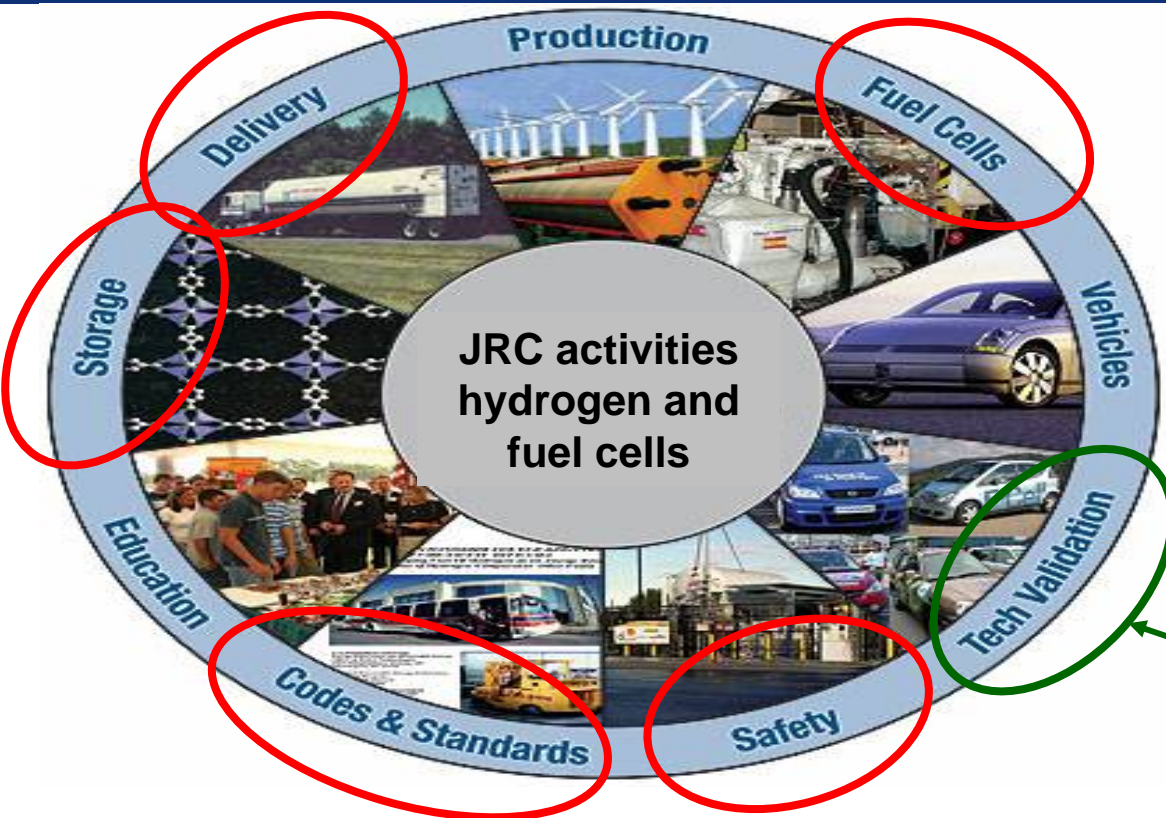
exchange call/solicitation info for forward planning

cross-participation at meetings and workshops (*in context of IPHE, IEA*)

exchange of scientists/managers

Visit of EU Commissioner Geoghegan-Quinn to DoE, 1 June 2010

- *development of common standards*
- *step-up cooperation in clean energy research*



+ international outreach: IPHE, IEA-HIA, IEA-AFC, ISO, IEC,

FC TESQA: Validation of test procedures for FC systems *US DoE*

HYAPPROVAL: Handbook for approval of H2 refuelling stations *National Renewable Energy Laboratory*

HYPER: Installation Permitting Guidance for stationary FC systems *Sandia Corporation*

HYWAYS: Comparison of Roadmaps for H2 in the energy system *MidWest Research Institute*

NESSHY: H2 solid storage development *Southwest Research Institute*

International Conference on Hydrogen Safety (*ICHS 2011 in San Francisco*)

External Review at Annual Merit Review Meetings of H2&FC programme

Thank you for your attention!

<http://www.jrc.ec.europa.eu/>

<http://ie.jrc.ec.europa.eu/>

marc.steen@ec.europa.eu

- Priorities 2nd Strategic European Energy Review (*COM(2008)781*)
- Forthcoming Policy Initiatives
- Scope of FCH JU

- Decarbonising the EU electricity supply by 2050
- Ending oil dependence in transport
- Low energy and positive power buildings & energy-efficient industry
- A smart interconnected electricity network
- Promoting a high-efficiency, low-carbon energy system throughout the world



- further shift to renewable energy, carbon capture and storage and, for those countries that so choose, nuclear.
- implementation of the emissions trading scheme will facilitate shift to low carbon electricity
- need for rapid strategic investment decisions



nearly two thirds of EU electricity generation could be low carbon in the early 2020s (current level 44%)

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- Commission Communication (COM(2008)433)
"Greening Europe's transport": shifting to electric, hydrogen and alternative fuel cars
- A European Strategy on Clean and Energy Efficient Vehicles (COM(2010)0186)

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- 40% of final energy is consumed in buildings. Buildings can be designed and used in such a way that they do not consume more energy than they are able to produce, and indeed, to become net energy producers
- establish common principles for defining low or zero carbon and energy buildings
- retrofit of the existing stock of buildings: financial schemes and Energy Service Companies (ESCO)

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- Today's centralised grid: electricity from large power plants to national retail distribution networks. Tomorrow's grid must serve an integrated European market with multiple small suppliers of renewable energy.
- Concepts such as an offshore supergrid ring around Europe to connect southern solar, western wave and northern wind or hydro energy with the main consumption centres needs to be explored further.
- Smart meters and controls can increase energy efficiency, and encourage development of electric vehicles.



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- Promoting a high-efficiency, low-carbon energy system throughout the world

- The beneficial effects of an ambitious European energy agenda for 2030/2050 can be multiplied by convincing and helping the rest of the world to follow.
- An early and ambitious energy transformation agenda in Europe will help to make Europe's automotive, construction and energy engineering world technology leaders.



New issues:

- Evolving international environment (e.g. new energy importing countries);
- Ongoing economic crisis (low demand, low investments);
- Oil price volatility (EU diversification to increase resilience is moving too slowly)



President Barroso's **Political guidelines** of the **European Commission**:
“...maintain the momentum towards a low emission economy, and in particular towards **decarbonising our electricity supply and the transport sector** – [...], as well as the **development of clean and electric cars.**”



- Legislative programme on vehicles' CO2 and pollutant emission reduction; guidelines for demand-side incentives; support for research and innovation in green technologies: **Strategy on Clean and Energy Efficient Vehicles** (28 April 2010)
- Decarbonisation of Transport: **New Transport White Paper 2010-2020** in late 2010
- Research and innovation of transport: **Strategic Transport Technology Plan STTP** in 2011

Objectives:

- to improve information for policy makers and investors on development paths to a low-carbon energy system by 2050
- to allow decisions needed today of strategic importance (e.g. infrastructure planning) to be better understood
- to clarify options for the energy sector as a main sector in the EU's climate strategy



