PARLAMENTO EUROPEO EVROPSKÝ PARLAMENT EUROPA-PARLAMENTET
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PARLEMENT EUROPÉEN PARLAMENTO EUROPEO EIROPAS PARLAMENTS
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COMMITTEE ON INDUSTRY, RESEARCH AND ENERGY

WORKSHOP ON THE HYDROGEN AND FUEL CELLS JOINT UNDERTAKING

Chaired by Pia Elda Locatelli, rapporteur

European Parliament
Altiero Spinelli building, room ASP 5 E 1

Brussels, 5 March 2008, 10h00-12h00

AGENDA

Opening by Pia Elda Locatelli, rapporteur

Presentations

- Dr. Athanasios G. Konstandopoulos (Chemical Process Engineering Research Institute (CERTH/CPERI))
- Dr. Joaquín Serrano (Centre for the Development of Industrial Technology (CDTI))
- Prof. Raffaele Vellone (National Agency for New Technologies, Energy and the Environment (ENEA))
- Mr. Paul Lucchese (New Energy Technology Programme (CEA) - Involved in the building up of the Research Grouping)
- Mr. Gijs Vriesman (Shell Hydrogen - Chairman of the Industry Grouping)

Questions and answers

Conclusions and closure by the rapporteur

BRIEFING NOTE
TO THE EUROPEAN PARLIAMENT
On the Fuel Cells and Hydrogen JTI

by

Athanasios G. Konstandopoulos

Aerosol & Particle Technology Laboratory, CERTH/CPERI, Greece
And Dept. Chem. Eng. Aristole University, Thessaloniki, Greece

Including an Annex on
The Hydrosol Process for Solar Hydrogen Production


Production
Fuel Cells
Vehicles
Tech Validation
Safety
Codes & Standards
Education
Storage
Delivery
H_2 Economy

H_2 Technologies: Commercial/Near-commercial

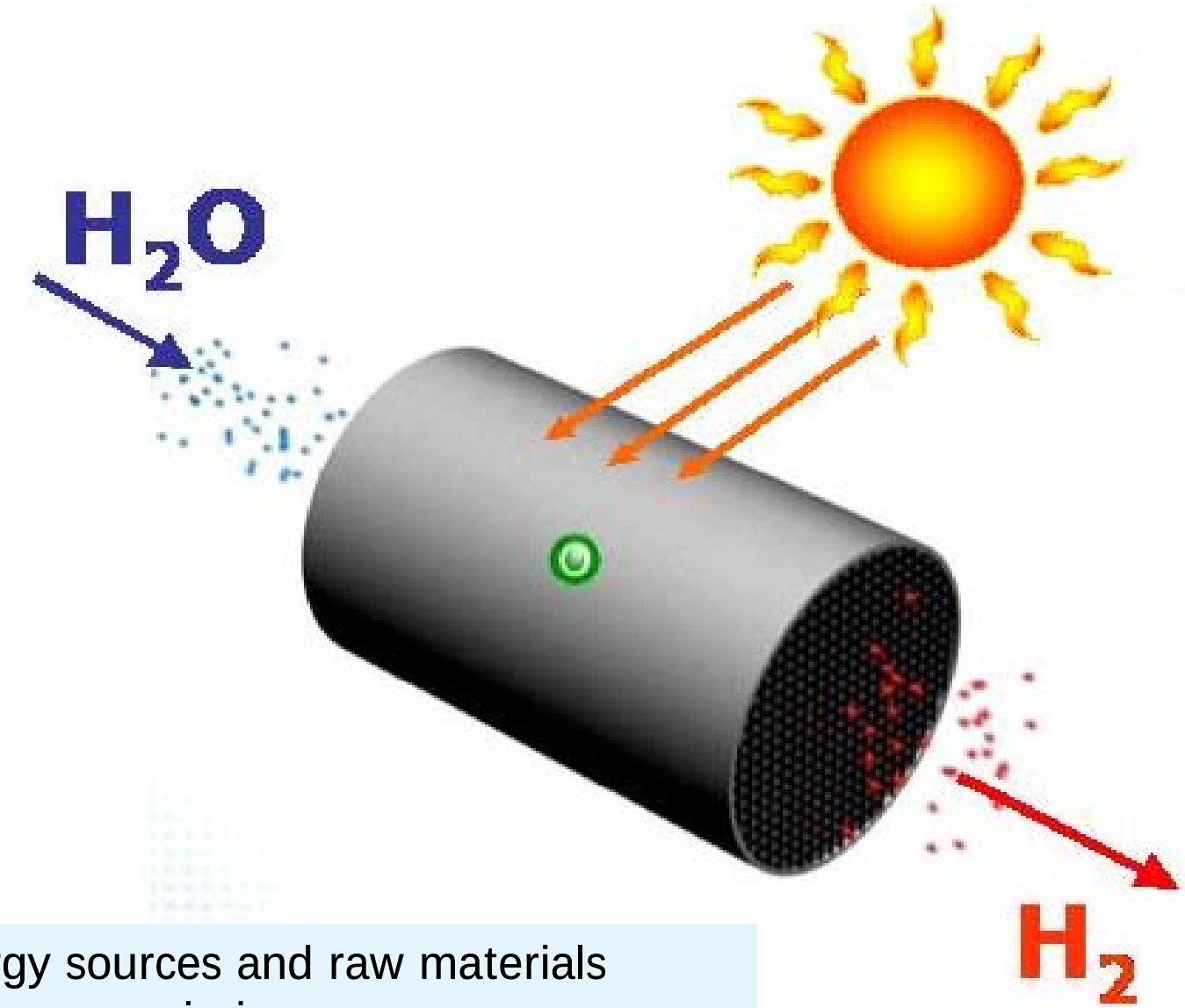
- Fuel cells for air independent submarine propulsion.
- Portable fuel cells for mobile phones and other handhelds
- Stationary power generation including CHP
- Portable hydrogen generators based on flexible fuel processing
- Auxiliary Power Units (APUs)
- Uninterrupted Power Supplies (UPS)
- Hydrogen refuelling stations
- Hydrogen internal combustion engine vehicles
- Off-road utility vehicles (e.g. forklifts)

H_2 Technologies: Commercial/Near-commercial

Sustainable Commercialization Needs Sustainable H_2 Production Technologies

- Where will hydrogen come from?
- Fossil fuel derived hydrogen is not sustainable, even with Carbon Sequestration and Storage (CSS)
- Only hydrogen from renewable sources is sustainable.
- Most promising renewable option is **Solar Hydrogen**
- **Solar Hydrogen** may be a disruptive technology

Solar Hydrogen: The HYDROSOL Process

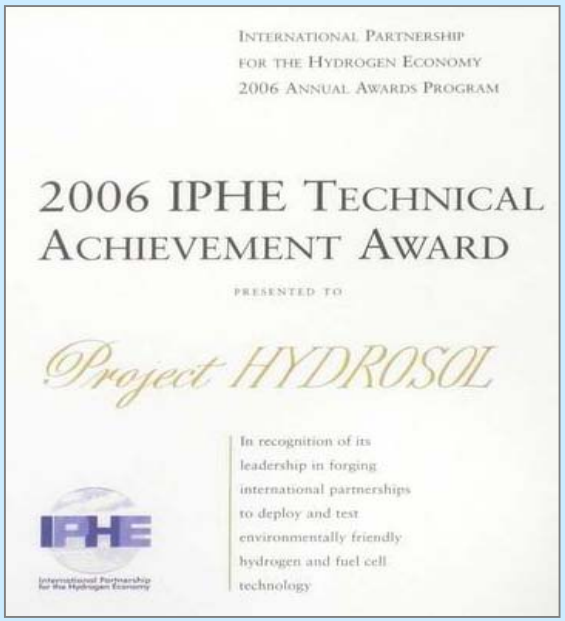


- Renewable energy sources and raw materials
- Zero greenhouse gas emissions
- Long-term potential

HYDROSOL I & II Consortium

HYDROSOL Awards

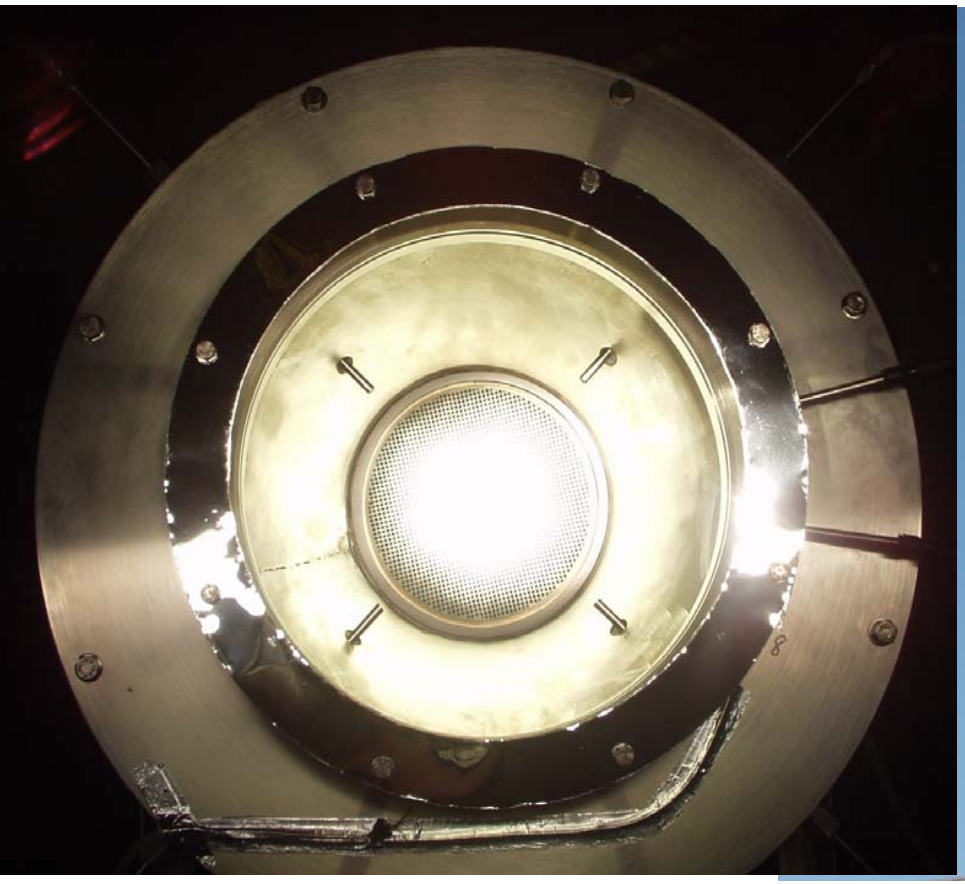
The 2006 Descartes Research Prize from the European Commission



The 2006 Technical Achievement Award from the International Partnership for the Hydrogen Economy (IPHE)

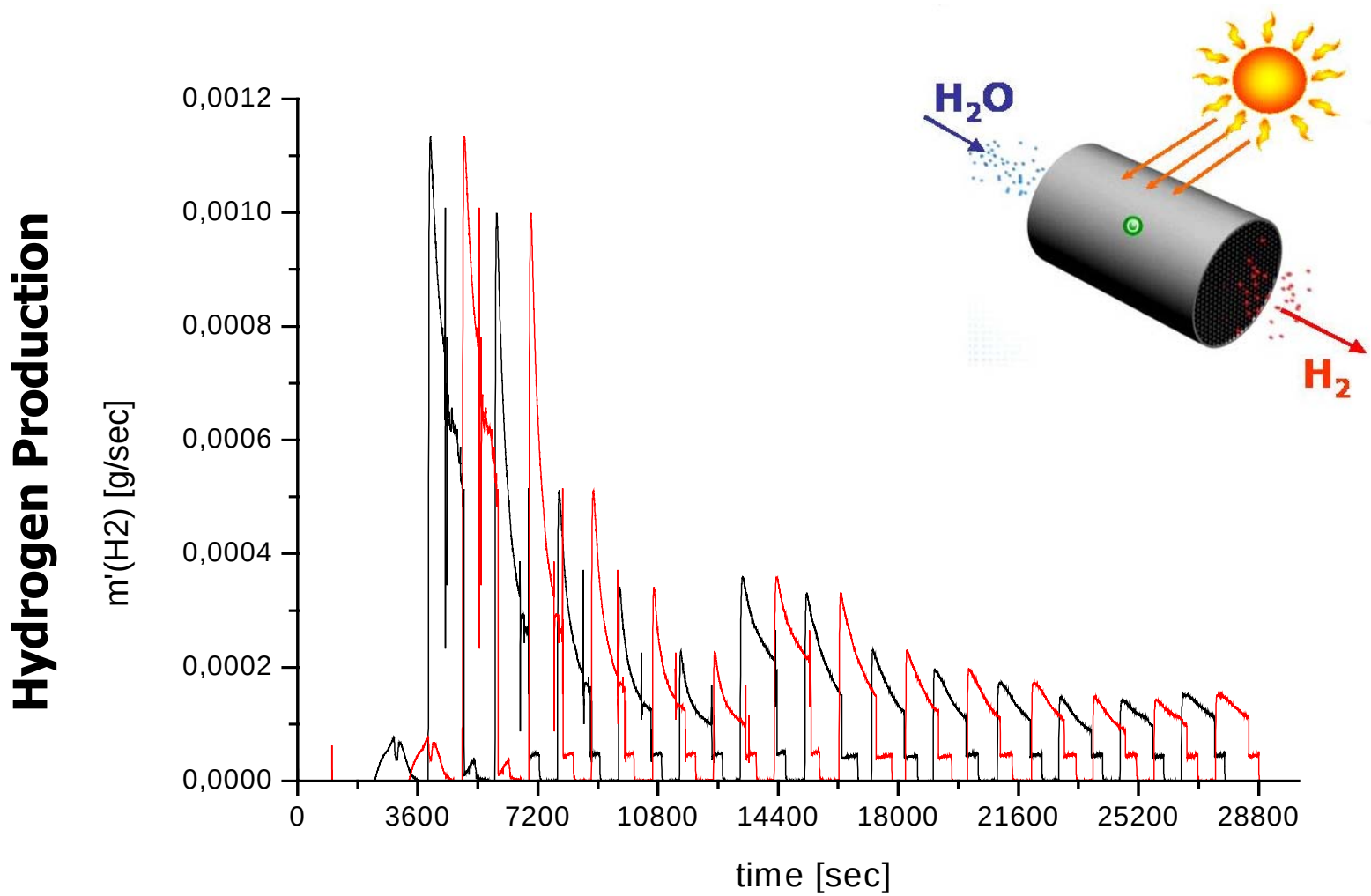
The Global 100 Eco-Tech Award at the 2005 EXPO in Japan

HYDROSOL Pilot Reactor in Operation



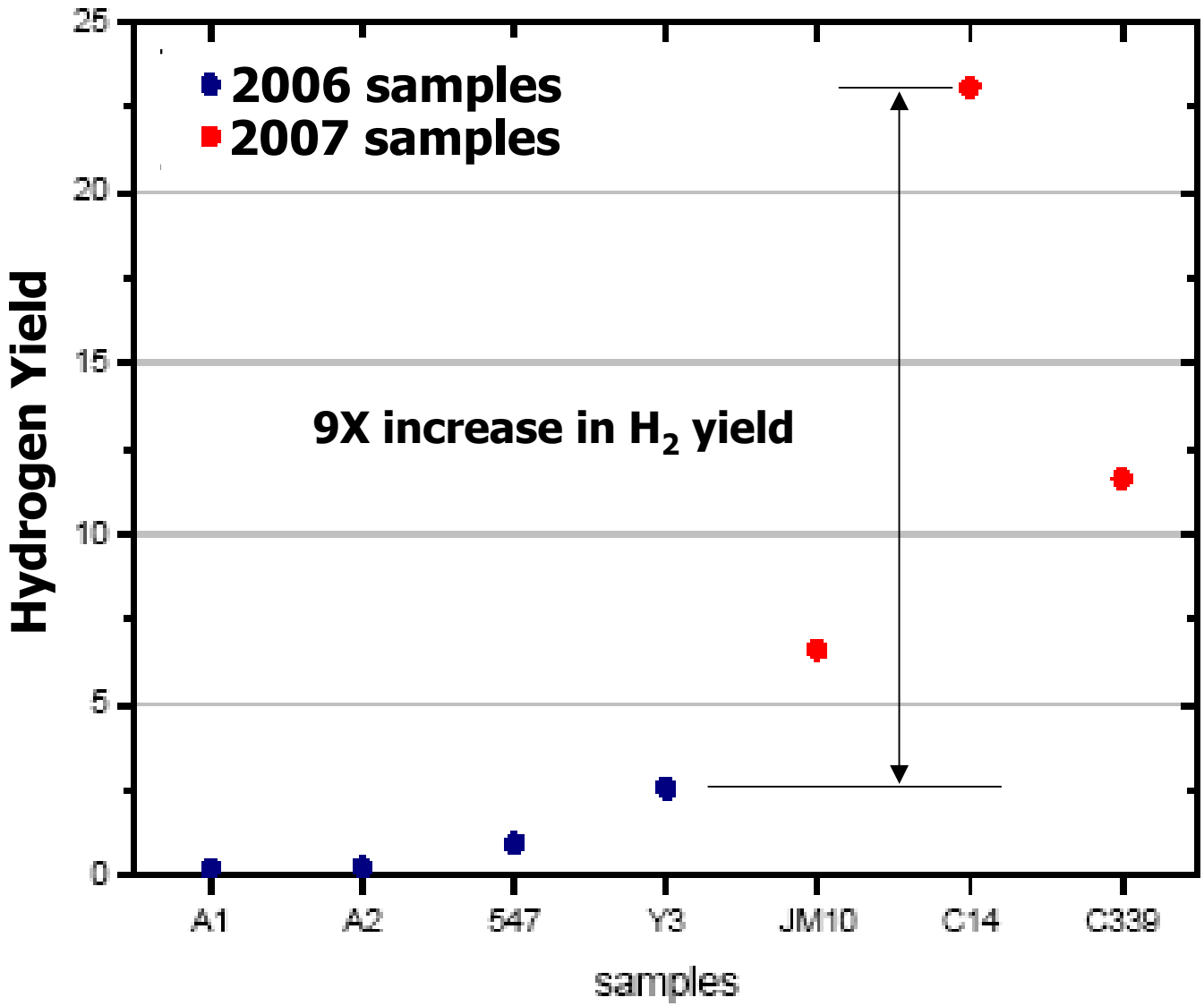
Solar Furnace, DLR Köln

Continuous Production of Solar Hydrogen



M. Roeb, N. Monnerie, M. Schmitz, C. Sattler, A. G. Konstandopoulos, C. Agrafiotis, V. T. Zaspalis, L. Nalbandian, A. Steele, P. Stobbe, "Thermo-chemical production of hydrogen from water by metal oxides fixed on ceramic substrates", *16th World Hydrogen Energy Conference, Lyon, France, 13-16 June, (2006).*

Step Improvement of H_2 Yield



Reactor Scale Up: HYDROSOL-II

To be started on March 31, 2008

SSPS Tower of Plataforma Solar Almeria, Spain

100 kWth

HYDROSOL is Compatible with Solar Thermal Plants

HYDROSOL could be commercial within 10 years

HFP Platform: SRA, DS. IP

- Securing energy supply, reducing greenhouse gas emissions and strengthening the European Economy are the visions expressed in the SRA, DS and IP documents
- The current Implementation Plan (IP) anticipates all technically mature technologies, but fosters incremental advances rather than step changes
- It is imperative **to foster a faster, exclusively renewable and efficient hydrogen production/supply path**

Opinion on JTI

- The industrial lead has many advantages, however the launching of high risk, innovative research projects should not be hindered, by over-emphasis on incremental technologies.

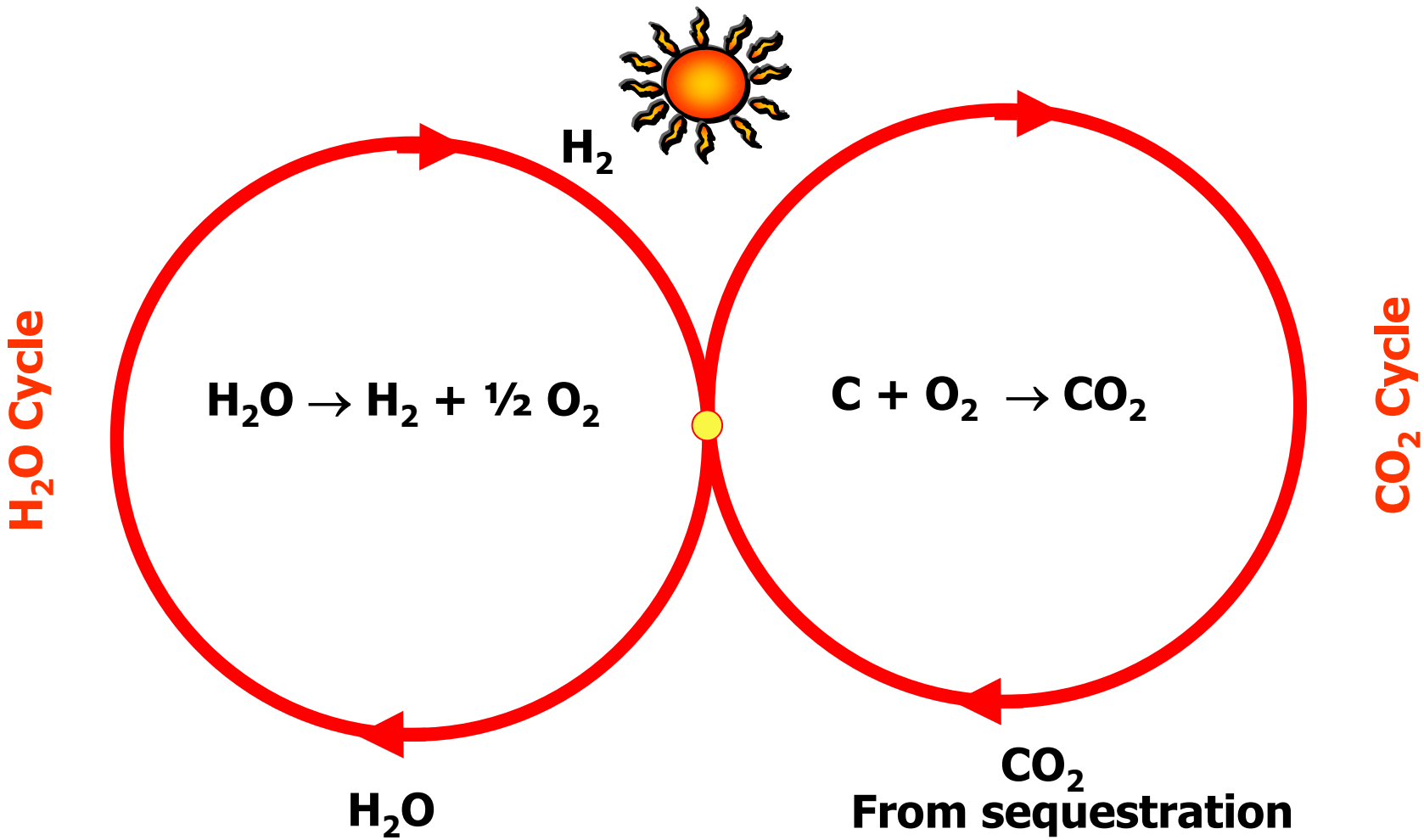
- The largest concern of a researcher active in the area, is the potential risk of exclusion due e.g. to higher barriers to enter in JTI projects than in Framework Programmes.

- A certain fraction of the JTI budget should be devoted into higher risk/higher return, innovative research following the example of the NEST programme of FP6

Solar Fuels from CO_2 and Solar H_2

$4H_2 + CO_2 \rightarrow CH_4 + 2H_2O$ (methane)

$3H_2 + CO_2 \rightarrow CH_3OH + H_2O$ (methanol)



Recommendations

Many of the advances anticipated in the current IP are already occurring in the world, especially in the USA therefore:

- Europe should aim to lead rather than follow, exploiting and extending any specific competitive advantages that European research has created.

- It is imperative to foster non-incremental R&D that will lead to fast market introduction of exclusively renewable and efficient hydrogen production technologies. This should also include simultaneously, sustainable hydrogen storage and sustainable CO_2 recycling/reuse.

The Hydrogen Economy is the Solar Economy

Solar thermochemical hydrogen production is an area of European excellence that has all the potential to develop in an area of European commercial dominance.

(Khosla, 2005)

Acknowledgments

- European Commission for supporting our solar H_2 research with projects: HYDROSOL, HYDROSOL-II, SOLREF, SOLHYCARB, HY-CYCLES

- My colleagues

  C. Agrafiotis, S. Lorentzou, C. Pagkoura, A. Zygogianni, V. Zaspalis, L. Nalbadian, A. Evdou (CPERI, Greece)

  C. Sattler, M. Roeb, M. Monnerie, M. Neises, P.M. Rietbrock, L. De Oliveira, J.P. Säck (DLR, Germany)

  P. Stobbe (STC, Denmark)

  A. Steele, S. Ellis (Johnson Matthey, UK)

  M. Romero (CIEMAT, Spain)

Thank you for your attention!

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http://apt.cperi.certh.gr

Comments and suggestions to the EC Proposal Fuel Cells and Hydrogen Joint Undertaking

1	Article 4: Bodies
2	Article 5: Governing Board
3	Article 8: Scientific Committee
5	Article 12: Sources of financing
6	Article 13: Participation in activities
7	Article 14: Implementation of RTD
8	Article 15: Funding of activities

Dr. Joaquín Serrano Agejas

Centro para el Desarrollo Tecnológico Industrial

Article 4: Bodies

1. The bodies of the FCH Joint Undertaking shall be:

(a) the Governing Board,

(b) the Executive Director,

(c) the Scientific Committee.

3. The FCH States Representatives Group, the Stakeholders General Assembly shall be external advisory bodies to the FCH joint undertaking in order to ...

EC Proposal FCH JU provides a **very weak role to the MMSS**, represented by the FCH States Representatives Group.

This circumstance does not match with the objectives of:

✓Strengthening the ERA by gathering together stakeholders, public institutions, regulators and users in a joint effort to develop FCH technologies

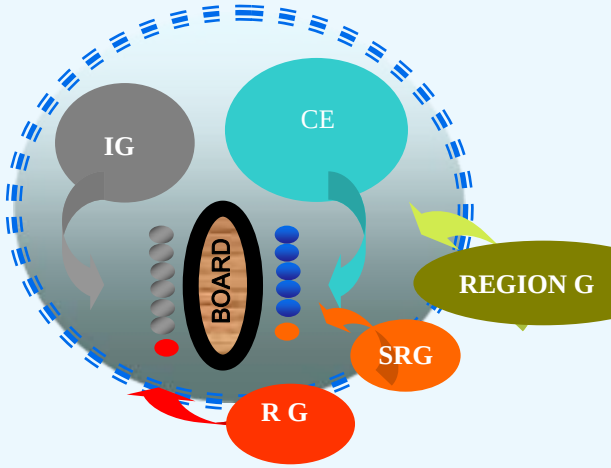
✓SET plan of creating a new way of working together in Europe; Member States, industry and the research community working collectively with the aim to optimise individual efforts.

Article 5: Governing Board

> ***1. Composition and decision-making process***
>
> *The Governing Board shall be composed of six representatives of the Industry Grouping and of six representatives of the Commission….*
>
> ***3. Rules of procedure***
>
> **…**
>
> *..The Chairman of the FCH States Representatives Group shall have the right to attend meetings of the Governing Board as* ***an observer***

It is of utmost importance that a Representative of the FCH Representative Group **takes part in the deliberations of the Governing Board** in order to assure the **best coordination with national** fuel cell and hydrogen programs and handling of existing regulatory barriers.

Moreover, the FCH Representative Group can play an important role for the FCH JTI **strengthening the links between research and industry** (and so contributing to the realisation of the European Research Area).



Article 8: Scientific Committee

1. The Scientific Committee is an advisory body to the Governing Board. The Scientific Committee shall conduct its activities with the support of the Programme Office…

- A link between the Scientific Committee and the Research Grouping must be established. Research Grouping should have a natural way to contribute in the **definition of the scientific priorities of the annual and multi-annual Research Activities**.
- To assure the close relationship between the Scientific Committee and the Research Grouping, a Representative of the Research Grouping should be encouraged to participate in its meetings.
- Due to the FCH JTI is a partnership driven by European Industry, the role of the Scientific Committee and the Research Groping is of very important in order to prevent an inadequate funding and lack of scale to focus.

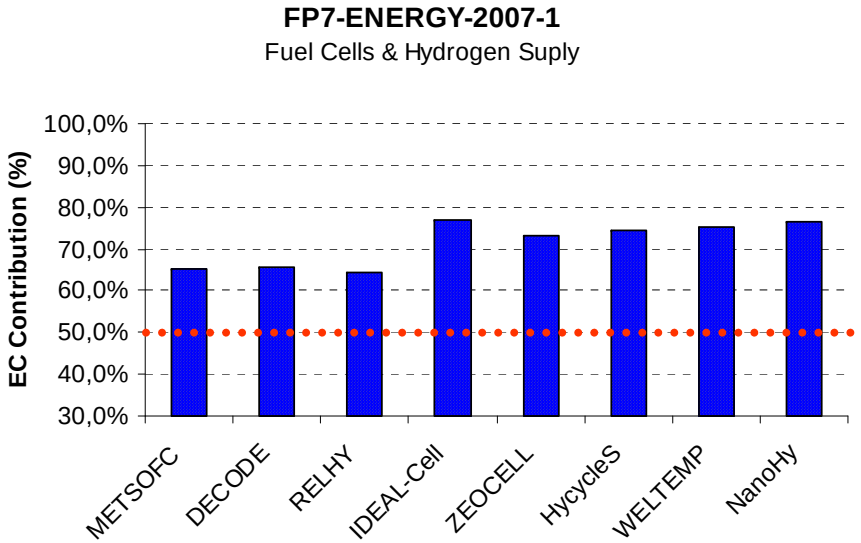
Article 12: Sources of financing (I)

3. The operational costs of the FCH Joint Undertaking shall be covered through the financial contribution of the Community, and through **in-kind contributions** *from the legal entities participating in the activities.* **The industry contribution shall at least match the Community's** *contribution. Other contributions to co-funding of activities will be considered as receipts in accordance with the rules of participation of the Seventh Framework Programme.*

7. The level of the in-kind contributions, calculated on a yearly basis, shall be assessed once a year. The methodology for evaluating contributions in kind shall be defined by the FCH joint undertaking in compliance with its financial rules and based on the Rules for Participation of the FP7.

- It has to be highlighted that **it is the Industrial Community, and not only the Industrial Groping**, the one which will cover the established **50% contribution to the operational cost** of the FCH JTI. This aspect is very important because it will be a heavy argument to eliminate some restrictions on participating in proposals set in Article 13.
- According to FP7 rules, **for R&D activities** Community financial contribution may reach 50% of the total cost, and in the case of SME and RTD performers it may reach 75%; and **for demonstration activities** may reach a maximum of 50% of the total eligible cost.

Article 12: Sources of financing (III)



From last 8 Hydrogen and Fuel Cell projects that will be funded under the Call FP7-2007-ENERGY-1. Average EC contribution to the projects is approximately **70%** of the total cost.

Therefore, sources of financing in order to fulfill with the minimum industry contribution established to the JTI operational costs must be clarified.

•Moreover, it would be recommended to explain not only its **contribution to the operational costs of the Industrial Community** but also the **upper funding limits for the Research Community.**

•One option that could be also considered is to **keep the upper funding limits of the research community** by sharing its costs between the EC and the Big Companies up to the target of 50% contribution of the Industrial Community.

Article 13: Participation in activities (I)

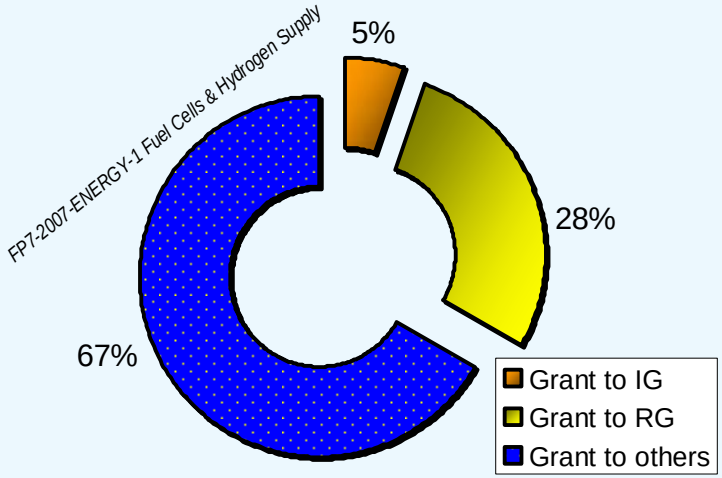
1. Participation in projects shall be open to legal entities and international organisations established in a MMSS, or any third country once the minimum conditions have been satisfied.

2. The minimum conditions to be fulfilled for projects funded by the FCH JU shall be the following:

(c) at least one legal entity must be a member of the IG or the RG.

3. The legal entities wishing to participate in a project shall form a consortium and appoint one of their members to act as its coordinator.

In general, the coordinator should come from the IG or, from the RG.



- In the call FP7-2007-ENERGY-1 call, 8 projects will be supported but only in 1 one them there are not IG or RG representatives (12%).
- If it is assumed that the most active and compromised organisations are members of the FCH JTI, **it is not necessary to establish special restrictions in order to encourage and favour their participation.**

Article 13: Participation in activities (II)

- To ensure proper **representation of smaller innovative companies and institutions** which, due to **resource and manpower limitations**, are unable themselves to participate fully in this initiative. The successful of the FCH JTI initiative pass through the participation of such organisations, that could be a key actors to generate the necessary breakthroughs and speed up the introduction of these disruptive technologies.
- For a competitive call, it would be recommended to delete this point 2.c ("*at least one legal entity must be a member of the IG or the RG* ") in order to avoid contradictions with basic public funding principles, especially the basic principle on the main text of the resolution where it is stated that: "The Community contribution to the FCH Joint Undertaking used to fund projects shall be allocated following open and competitive calls for proposals".
- It would be fully recommended to remove: "the coordinator should come from the Industry Grouping or for Research Grouping...". IG and RG members will participate actively in projects and their role within the consortium cannot be prefixed by empty rules. Coordinator shall be the appropriate for achieving a success project. (In the call FP7-2007-ENERGY-1 call, 4 projects are coordinated by members of the IG or RG (50%))

Article 15: Funding of activities

*3. The upper funding limits of the Community financial contribution in projects shall be aligned to the comply with those laid down by the Rules for Participation of the Seventh Framework Programme. In case lower levels of funding will be necessary to comply with the matching principles referred to in Article 12.3., **the decreases shall be fair and balanced proportionally** with the above mentioned upper funding limits of the rules of participation of the Seventh Framework Programme for all categories of participants in each individual project.*

- If EC financial contribution to the projects follows the Rules for Participation of the FP7, it will not be lower than 50% of the eligible cost of the project (always higher). In other words, Rules for Participation of the FP7, and Industrial Contributions to the project of 50% in kind, do not match with the objective of sharing investment between industry and CE.

- In this expected case of lower levels of funding of the Industrial Community, it would be recommended that the **extra cost were assumed by Big Companies**, keeping the upper funding limits of the 7 FP of the SMEs and RTD performers.

Conclusions

•The EC proposal fuel cells and hydrogen joint undertaking presents some lacks that could jeopardize the potential impact of the FCH JTI and could be easily overcame **following the Framework Programmes principles that have proven their validity**.

•Main aspects that should be revised are:

- •the **weak role of the MMSS** to be able to monitor and supervise the JTI through the mechanisms established in the Framework Programme, in aspects of utmost importance like the project approval for funding and the allocation of funds between the partners; organizations that should form the projects, etc;
- •the role of the research community to **contribute in the definition of the scientific priorities** and consequently in the Working Programs of the FCH JTI calls;
- •**restrictions** stated by current members of the FCH JTI related to the Participation in Activities.
- •In case of the industry contribution did not match the Community's one, the decrease of funding **should not be balanced proportionally** for all categories of participants but Big Companies should assume it, keeping the upper funding limits of the 7 FP for the SMEs and for the RTD organizations.

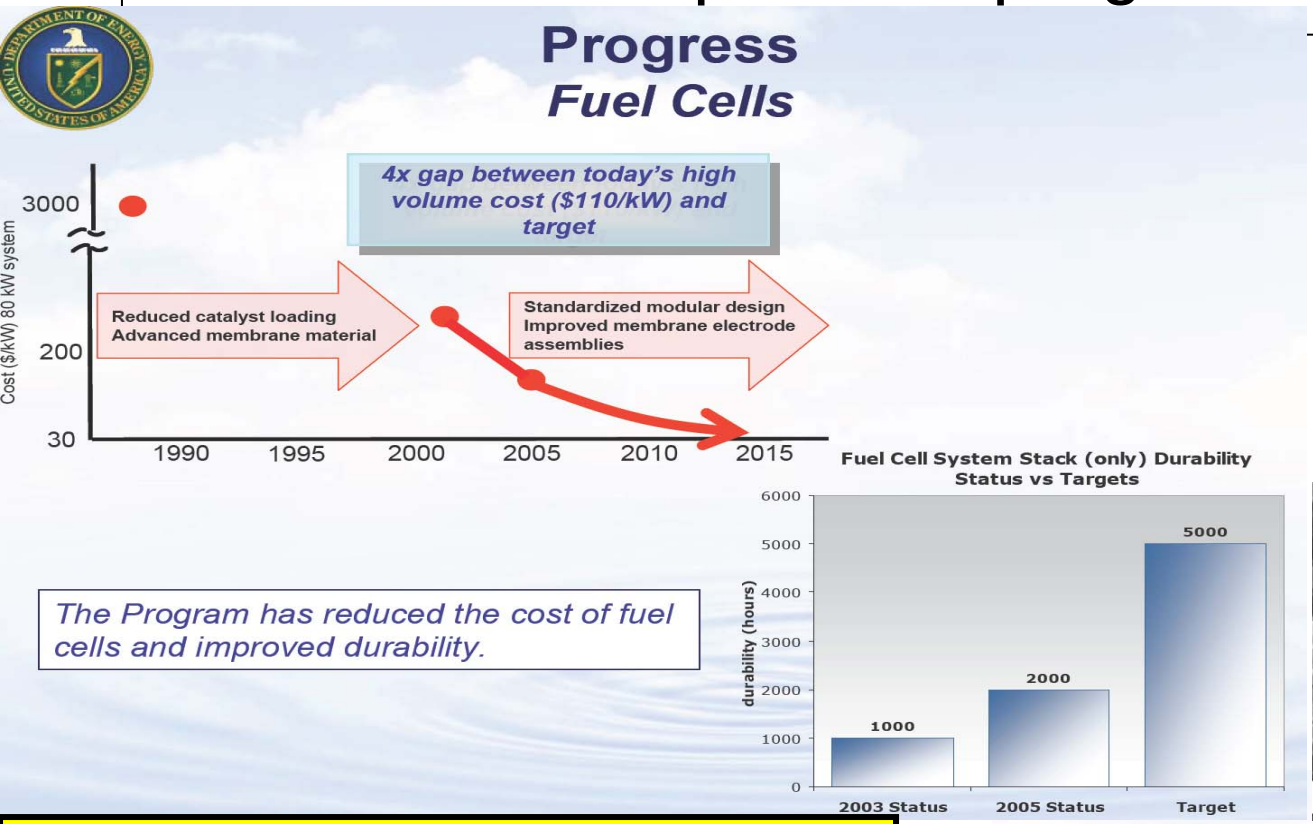
Briefing on Hydrogen and Fuel cells JU JTI

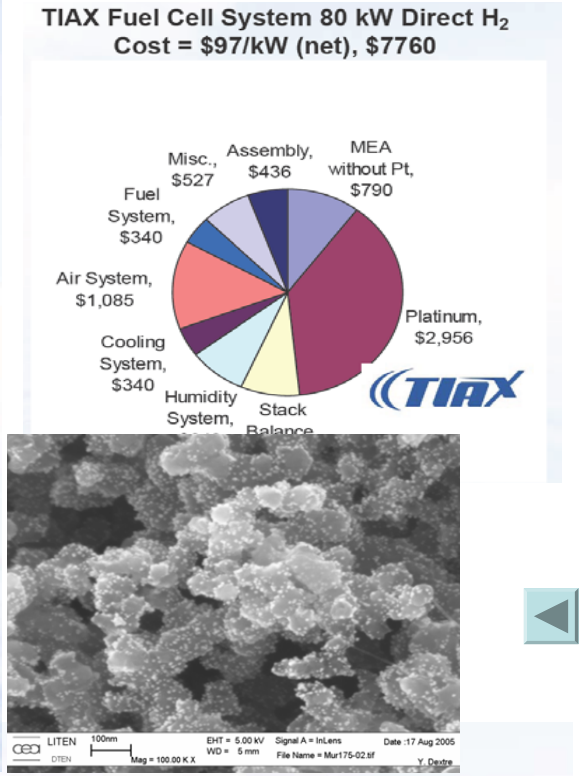
Paul Lucchese

CEA Programme director

IPHE Co Chair

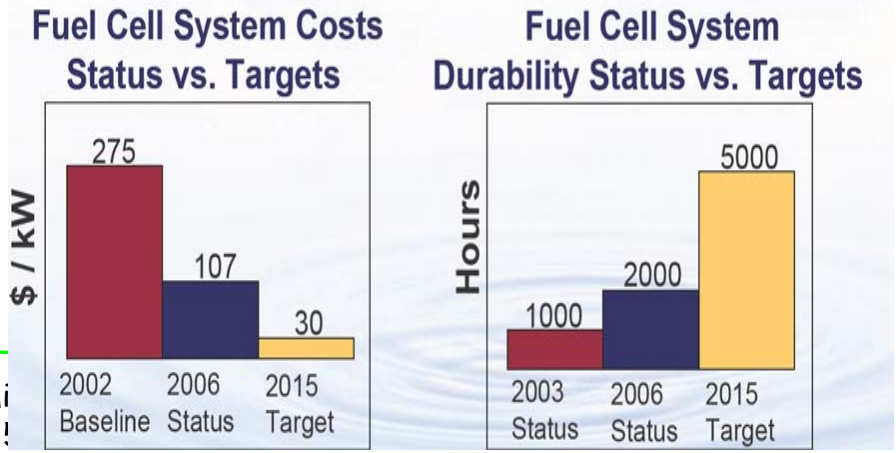
Impressive progresses





Since 2000:

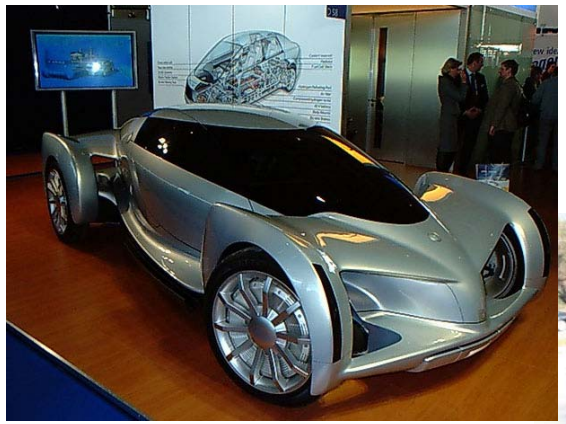
-Platinum content reduced by factor 10
-Dramatic decrease of bipolar costs
-Membranes thickness divided by 3
-Lifetime:
  -DOE: X2,5 à 3 (2000h)
  -Dupont: 5000h
-Cost divided by 5-10 10
-Cost Target reached: SOFC SECA: 400$/kW
- Storage capacity X 2 à 3:
  -350 bars and 700 bars



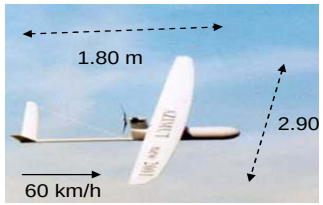
System integration during the last 12 years!

Necar 1 (1994)
PEMFC d50 kW (12 modules), H_2

- Rent a Honda 2008
  - $600/month, Southern California
- 780 km range (Toyota)
  - 2300 mile road trip, Alaska-California
- Vehicles fleet100(GM)
  - CA, NY, DC
  - 1000 vehicles by 2010-2012
- 3l/100 km estimated (Daimler)
- 300 km/h speed record zero émission



CEA-PSA PEMFC Technology and Niches markets



Agricultar application

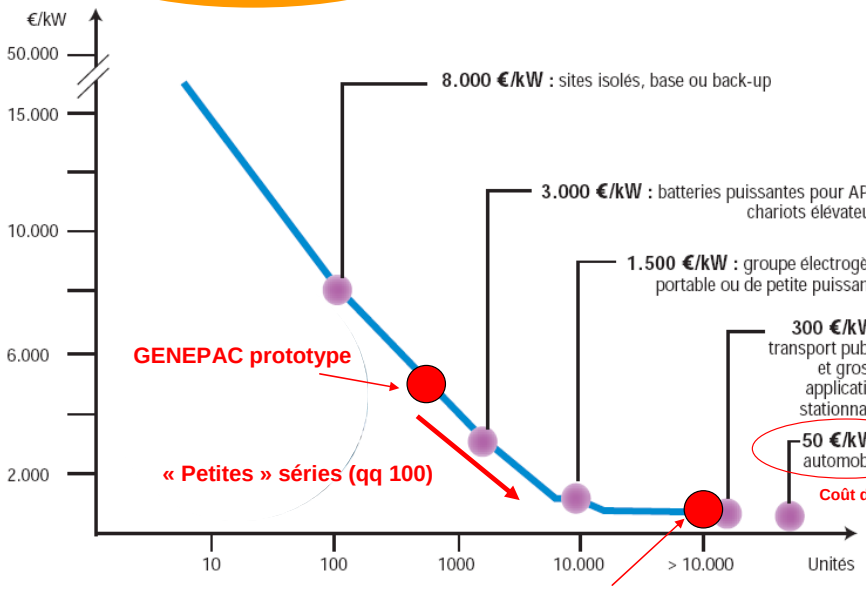
Leisure ships

Drone Military Applications aeronautcs

Back up supply

Stationnary Renewable coupling

Niches vehicles, leisure Heavy Transports lourds, Urban Transports



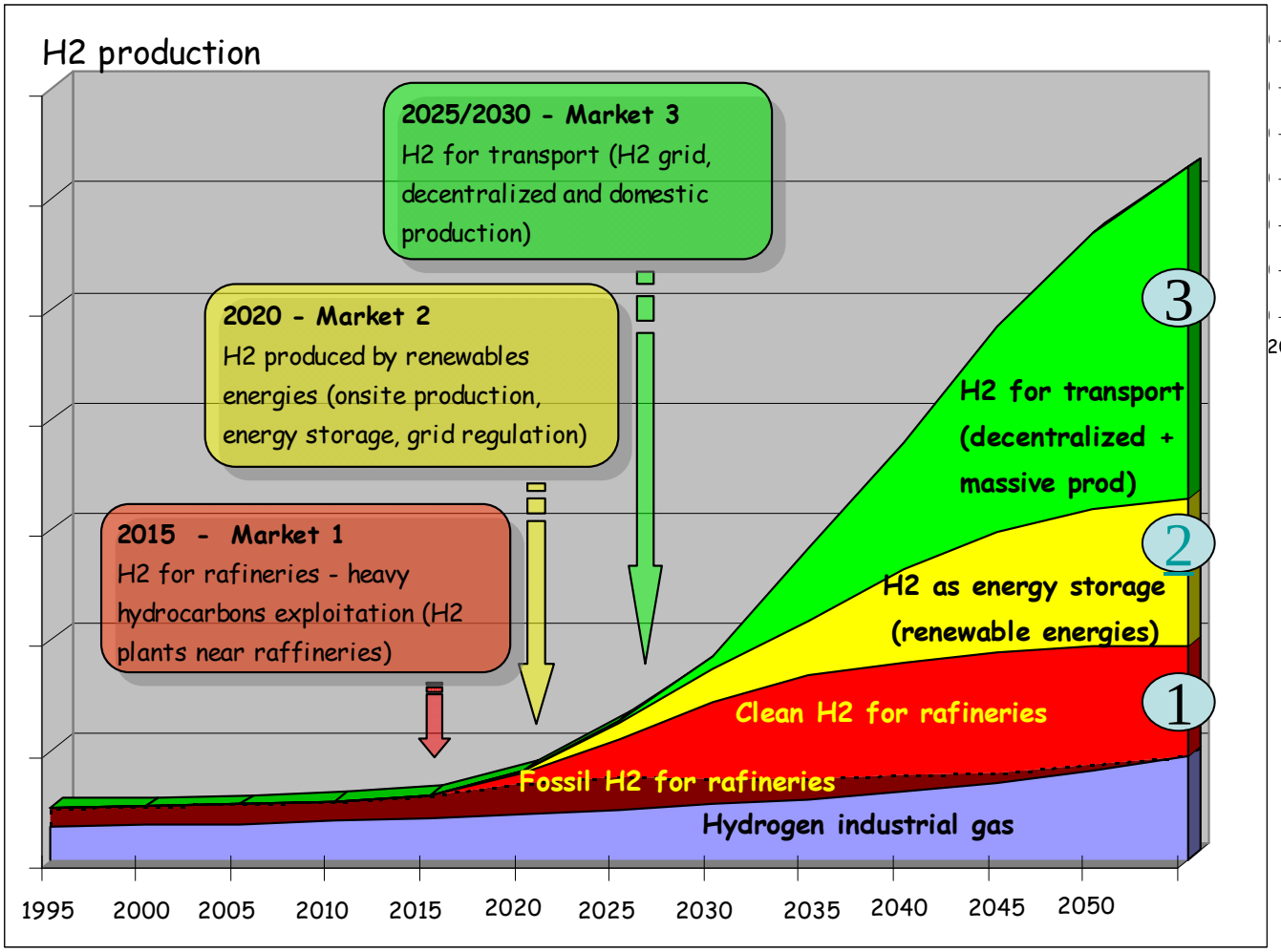
GENEPAC 80 kW
Worldwide state of the art
1,5 kW/l - 1.1 kW/Kg

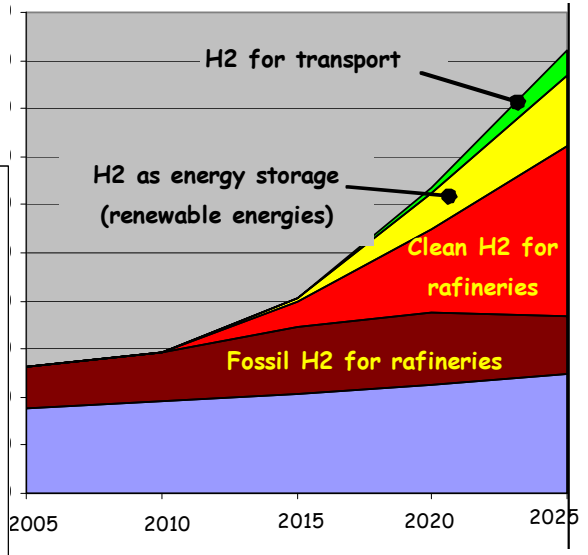
Committee
ssels, 5/03/06

/ Source : AFH2 / Photo : DR

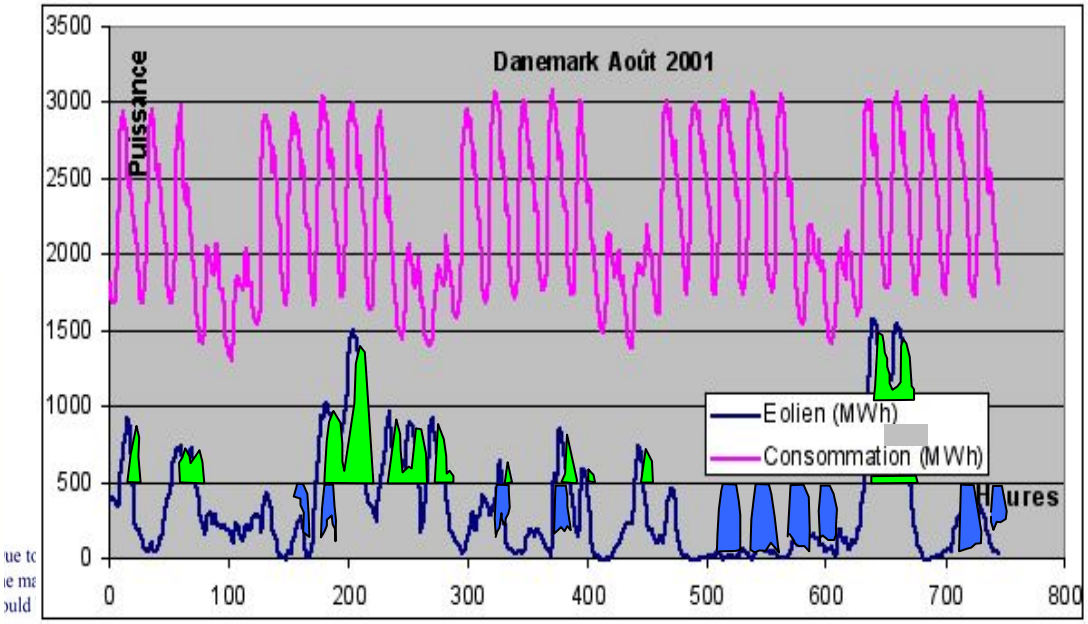
GENEPAC série 150 000 véhicules (évaluation PSA)

Hydrogen markets: Evolution

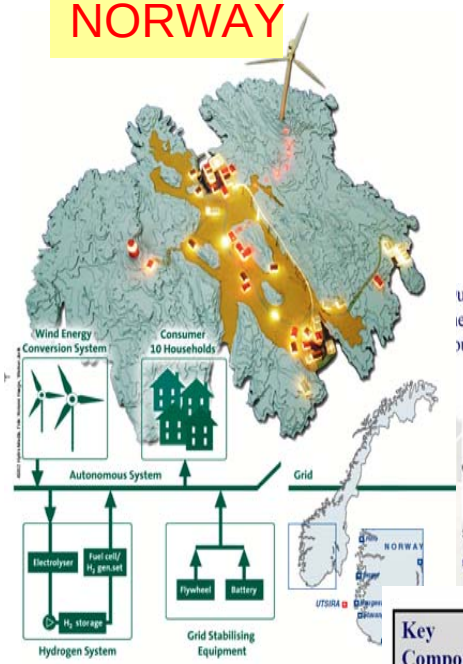




Increase potential and efficiency of Renewables with H2 and Fuel cells



NORWAY

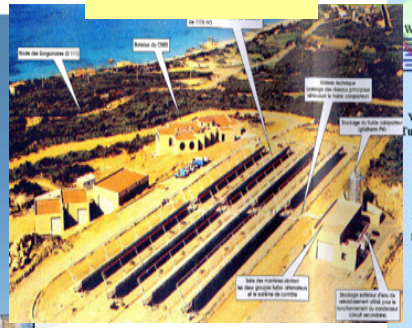


Greece

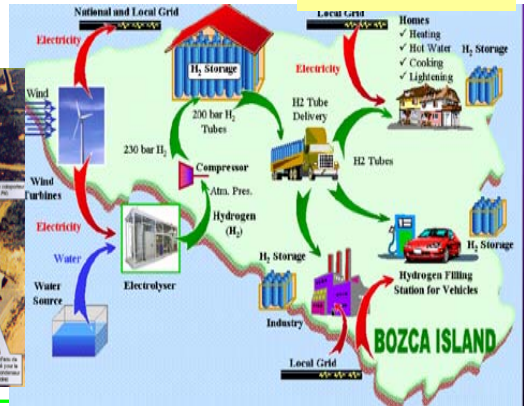
"H2ellenic Island"

CESI RICERCA has successfully tested an integrated system using a 3kW PEFC and a 6m3 metal hydride storage system

France Corsica



Turkey



Key Components	Key data
Start-up	October 2005
Wind Turbine	500 kW
Electrolyser	25 kW operating at 25 bar
Hydrogen storage	40 Nm^3 in MH tanks 100 Nm3 in bottles
1 stage H_2 compressor	at 220 bar
1 filling station	220 bar bottles

General View of wind-hydrogen installation

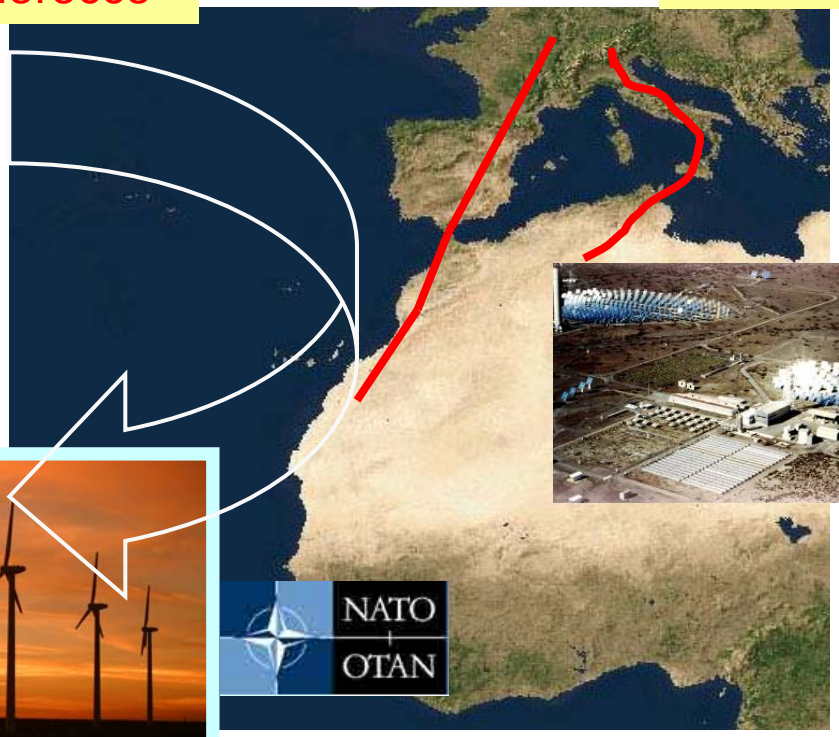
Three most impressive Renewable Potential in the World (Hundreds of GIGA Watt each at very low cost)

argentina

Producing massively Hydrogen with Renewables

Morocco

Algeria



Conclusions/recommendations
SRA, DS, IP

- Considering impressive progresses made last years, IP targets could be reach in 2015-2020;
- Some technologies (PEMFC, Hydrogen production, hydrogen storage for early markets) are mature enough to launch **early and niches markets for fuel cells**. Large demonstration phase (stationary and transport), large number of systems are needed as described in IP.
- Huge demand of Clean Hydrogen for industrial use in time frame 2010-2020 will accelerate innovative hydrogen production processes. This industrial market is an **"Early market for Clean Hydrogen"**
- Sustainable Hydrogen production for small quantities can start with renewables at local level: Islands, remote area
- BTH biomass to Hydrogen has to be coordinated with other biomass programme (BTL second generation): **Need of an Biomass European Road map**
- It is an unique occasion to create a big industrial stacks supplier supported by member states policy (public procurements…) **European Fuel cell stack supplier**
- **Large demos project could be a part of "World Hydrogen project"** recommended by IPHE
  - European leadership

Conclusions/recommendations
Gap IP vs JTI

- Although there is a huge gap between IP budget and JTI, **JTI must play a critical catalysing role in aligning** the various sources of public funding, Members States and regional, needed to achieve the Plan's goals. The European Parliament could propose and call for a great european Alliance.
- But the conditions are
  - **strong commitment of members states** and strong, long-term, public-private partnership on hydrogen and fuel; High Level group of national representative is now needed to link with JTI
  - Collaboration with national governments is also important in the development of a **common position on regulations, codes and standards.**

Conclusions/recommendations
Gap IP vs JTI Demonstration

- **Large demonstration projects** needs political support and strong regional commitments supported by :
  - **common public procurements** at European level (harmonized) and role of European Public Sector
  - **European Policy to internalise external costs** could help generate revenue flows Policy instruments to consider include zero emission zones,
    - capital subsidies and payments for carbon avoided
    - Create an European fund based on this principle to help significantly this large demonstration project European.
    - Fed for example by a tax on fossil fuel (Oil Companies profits) to fund Zero Emission Zone in Europe Shell+BP+Total: 50B€/year Tax 2%>> 1B€/yearX 10 years.
    - Investment Bank (EIB) could play a important role.

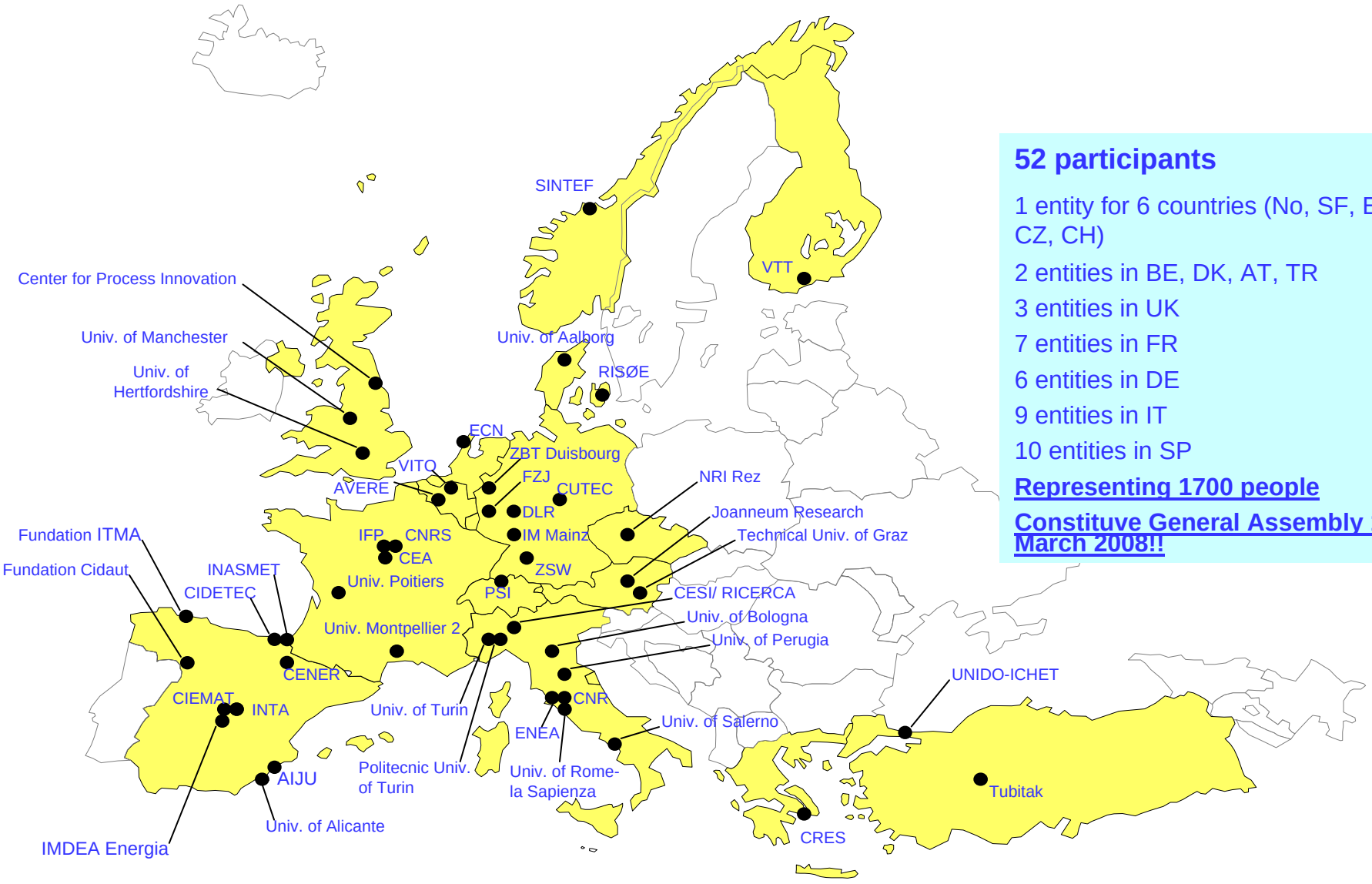
Conclusions/recommendations
Gap IP vs JTI Research

- **Research part** and training is rather low in JTI
- **Medium/Long-term research** leading to new ideas and concepts is key to overcoming these challenges
  - *must be long term funded.*
- Especially on research part, the **JTI should be proactive in working with national governments** to achieve central coordination of research budget.
  - *Most of research is funded through national budget and national call for proposal. It is crucial to call national programme, government and programme manager to launch joined and coherent call as soon as possible.*
- A **centralized strategy supported by a central validation and assessment exercise** is necessary.
  - *It could be done or coordinated through JTI office and management structure and Scientific Committee with the cooperation of the national programme agencies in charge of Hydrogen and fuel cells programme in Member States from which all can learn.*

JTI Governance

- **a central and catalyst role,** well balanced as today
- **link with members states and Regions** to be seriously reinforced
- **more representative group from Member States**
- a central coordination of strategy through supported by a central validation and assessment exercise.
- **Idea of a global scientific and technological evaluation of all H2&FC programmes**
  - including regional, national, JTI
  - to help to harmonization of road mapping and comparison of road maps in Europe at different level (regional, national, european).

Research grouping: a Success!



52 participants

1 entity for 6 countries (No, SF, EL, NL, CZ, CH)

2 entities in BE, DK, AT, TR

3 entities in UK

7 entities in FR

6 entities in DE

9 entities in IT

10 entities in SP

Representing 1700 people

Constituve General Assembly 17 March 2008!!

JTI Governance and Research Grouping

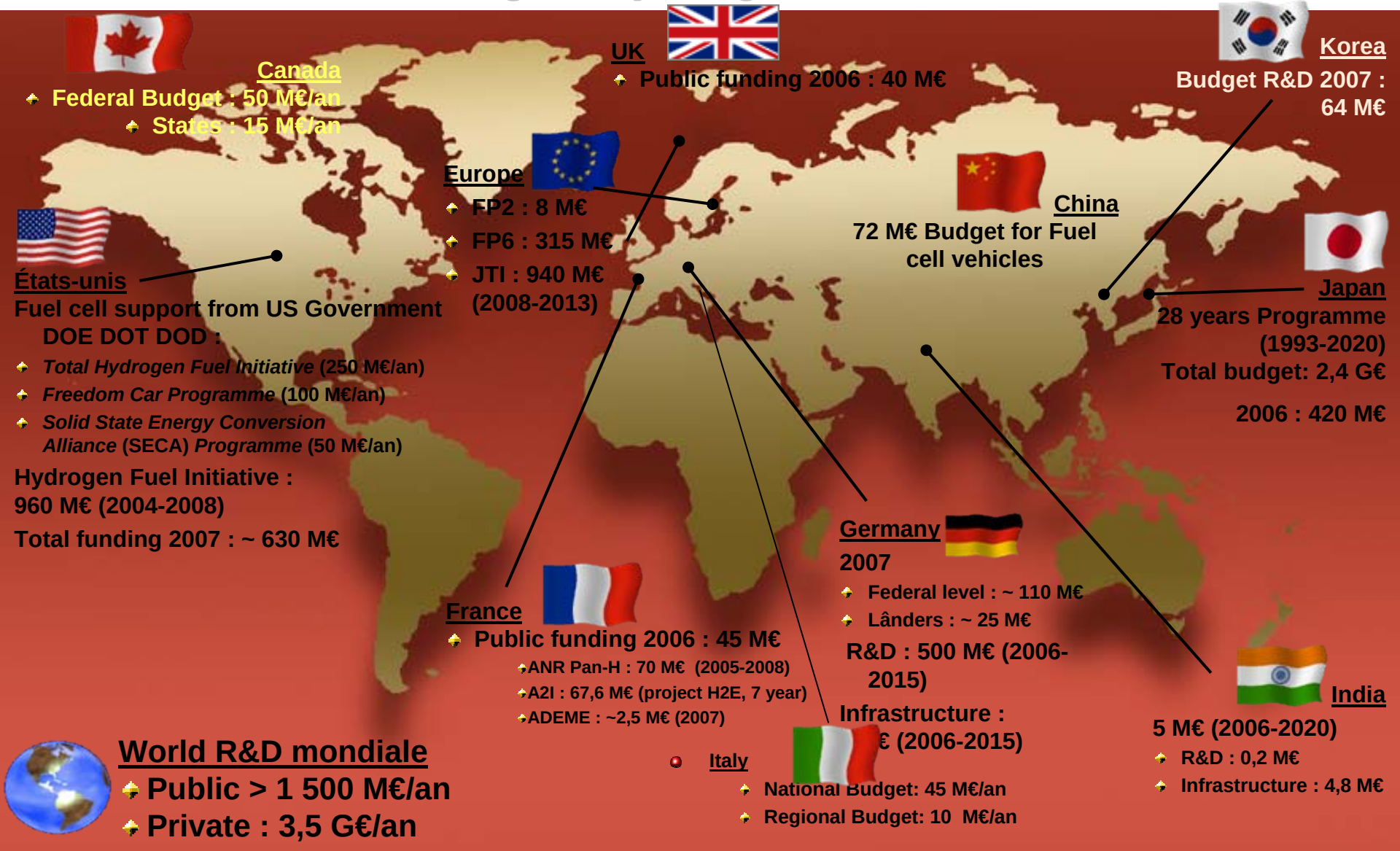
- the main objectives of Research Grouping, are:
  - providing expertise and advice to other stakeholders, e.g. industrial companies, the European Community and its Member States, including the European Hydrogen and Fuel Cell Technology Platform, about the results and needs of European research;
  - actively participating as a member in the creation and implementation of the joint undertaking for the JTI and in its decision process, in particular its highest decision making organ, or any other committees by electing from among its members representatives for such purpose and defining positions of the research community;
  - reaching a better gathering of the above-mentioned research community by mapping existing research competences, facilities and expertise and maintaining a respective knowledge base for its Members and third parties;
  - formulating joint views on existing and future needs on research infrastructures and programmes; special attention will be drawn to the interrelation and cooperation between upstream, basic and applied research, with the support of national and European programmes;
  - issuing any other coordinated positions of the research community and representation of the interests of its Members as research organisations and the research community in general towards third parties.Participate to the definition of the JTI Call for proposal;

- **Chair JTI Scientific committee**

- Work to alignment of national programme and definition of synergies between national programmes: complementarities
- Progressive structuration of European Research community
- Future european pioneer for more efficient and structured research organization in Europe R&D field, for example in preparation of EIT (European Institute of Technology)

International Partnership *for the* Hydrogen Economy

Public funding to Hydrogen and Fuel cells



Canada
- Federal Budget : 50 M€/an
- States : 15 M€/an

UK
- Public funding 2006 : 40 M€

Korea
Budget R&D 2007 : 64 M€

Europe
- FP2 : 8 M€
- FP6 : 315 M€
- JTI : 940 M€ (2008-2013)

China
72 M€ Budget for Fuel cell vehicles

États-unis
Fuel cell support from US Government
DOE DOT DOD :
- *Total Hydrogen Fuel Initiative* (250 M€/an)
- *Freedom Car Programme* (100 M€/an)
- *Solid State Energy Conversion Alliance* (SECA) *Programme* (50 M€/an)

Hydrogen Fuel Initiative : 960 M€ (2004-2008)

Total funding 2007 : ~ 630 M€

Japan
28 years Programme (1993-2020)
Total budget: 2,4 G€

2006 : 420 M€

Germany
2007
- Federal level : ~ 110 M€
- Lânders : ~ 25 M€

R&D : 500 M€ (2006-2015)

Infrastructure : € (2006-2015)

France
- Public funding 2006 : 45 M€
  - ANR Pan-H : 70 M€ (2005-2008)
  - A2I : 67,6 M€ (project H2E, 7 year)
  - ADEME : ~2,5 M€ (2007)

India
5 M€ (2006-2020)
- R&D : 0,2 M€
- Infrastructure : 4,8 M€

Italy
- National Budget: 45 M€/an
- Regional Budget: 10 M€/an

World R&D mondiale
- Public > 1 500 M€/an
- Private : 3,5 G€/an

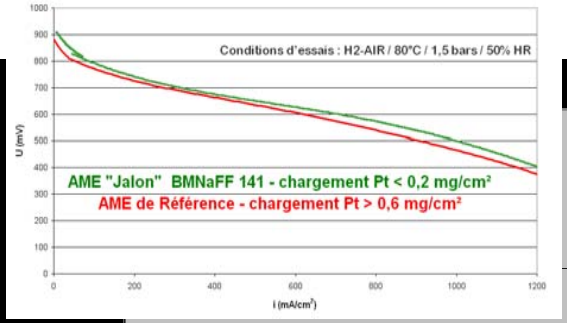
Back Up

Worldwide Islands Hydrogen Initiative

Islands – ideal polygons for demonstration of hydrogen energy technologies and entire hydrogen economy

- Supply and price of conventional energy
- Renewable energy sources
- Scale
- Energy autonomy
- Pristine environment
- Example of Iceland
- Other demonstration projects on islands
- Thousands of islands worldwide – thousands of opportunities

CEA Result in 2007
Platinum 1,2 g/kW to 0,4 g/kW



Breakthroughs
- Catalyst Pt alloys (Co, Cr,…)
- Non nobles Catalysts
- Nanotechnologies & Membranes: nanostructured & ultrathin
- Pur Oxygen pur (Pt reduction Pt et perf. increase)
- Hybrid power

0,1 g/kW

Zone de performances requises pour les premières applications automobiles

meilleurs industriels

env. 1 g/kW

GENEPAC

LITEN réf. 2007

Industry

Electrodes ELAT (standard)

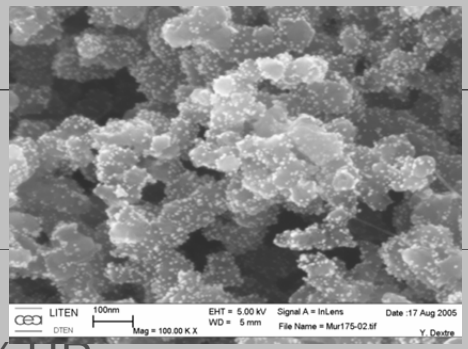
1,2 g/kW

Jalon 2008

Jalon 2007

< 0,4 g/kW !

LITEN résultat 2007



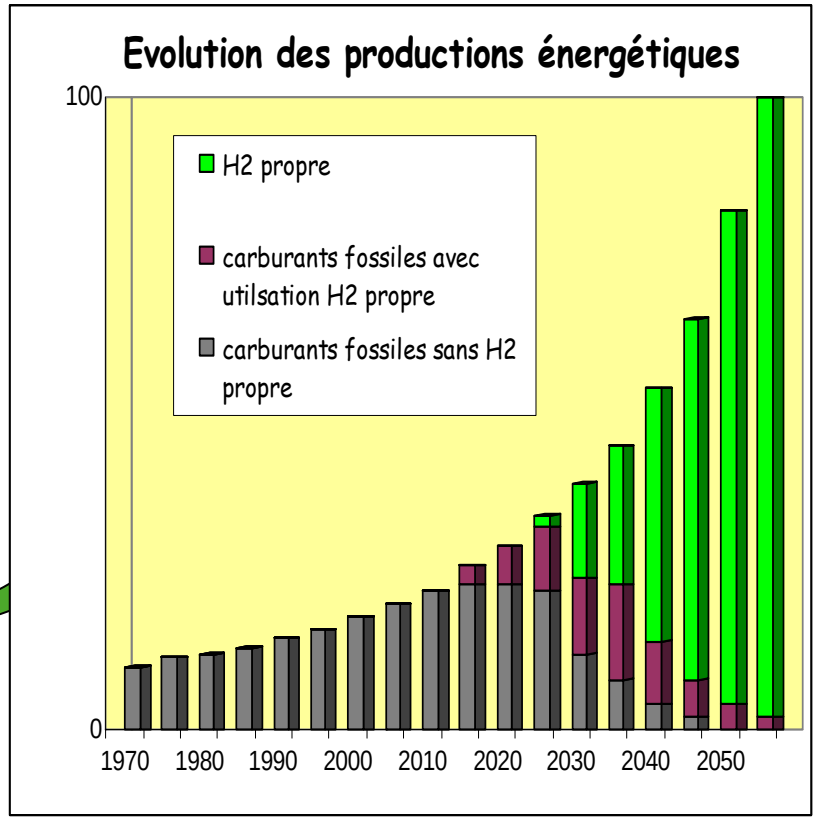
Conditions d'essais : H2-AIR / 80°C / 1,5 bars / 50% HR

TOTAL : une stratégie d'accompagnement de l'offre énergétique pour le transport

Carburants fossiles

H_2

H_2



1. Optimisation des ressources fossiles par l'hydrogène propre
2. Remplacement progressif des carburants fossiles par l'hydrogène vecteur énergétique

Le paradoxe de l'hydrogène

L'hydrogène est l'élément le plus abondant de la planète …
… pourtant il n'existe pratiquement pas à l'état pur dans la nature

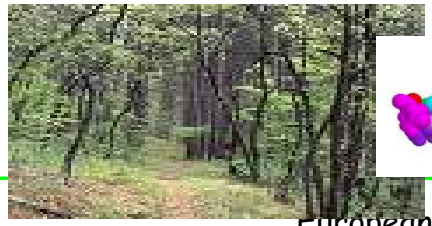
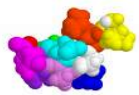
l'hydrogène est d'ailleurs l'ancêtre de tous les autres éléments.

PRÉSENT PARTOUT… MAIS DISPONIBLE NULLE PART

L'hydrogène est extrêmement abondant sur notre planète.. Mais bien qu'il soit l'élément le plus abondant de la planète, l'hydrogène n'existe pratiquement pas dans la nature à l'état pur.





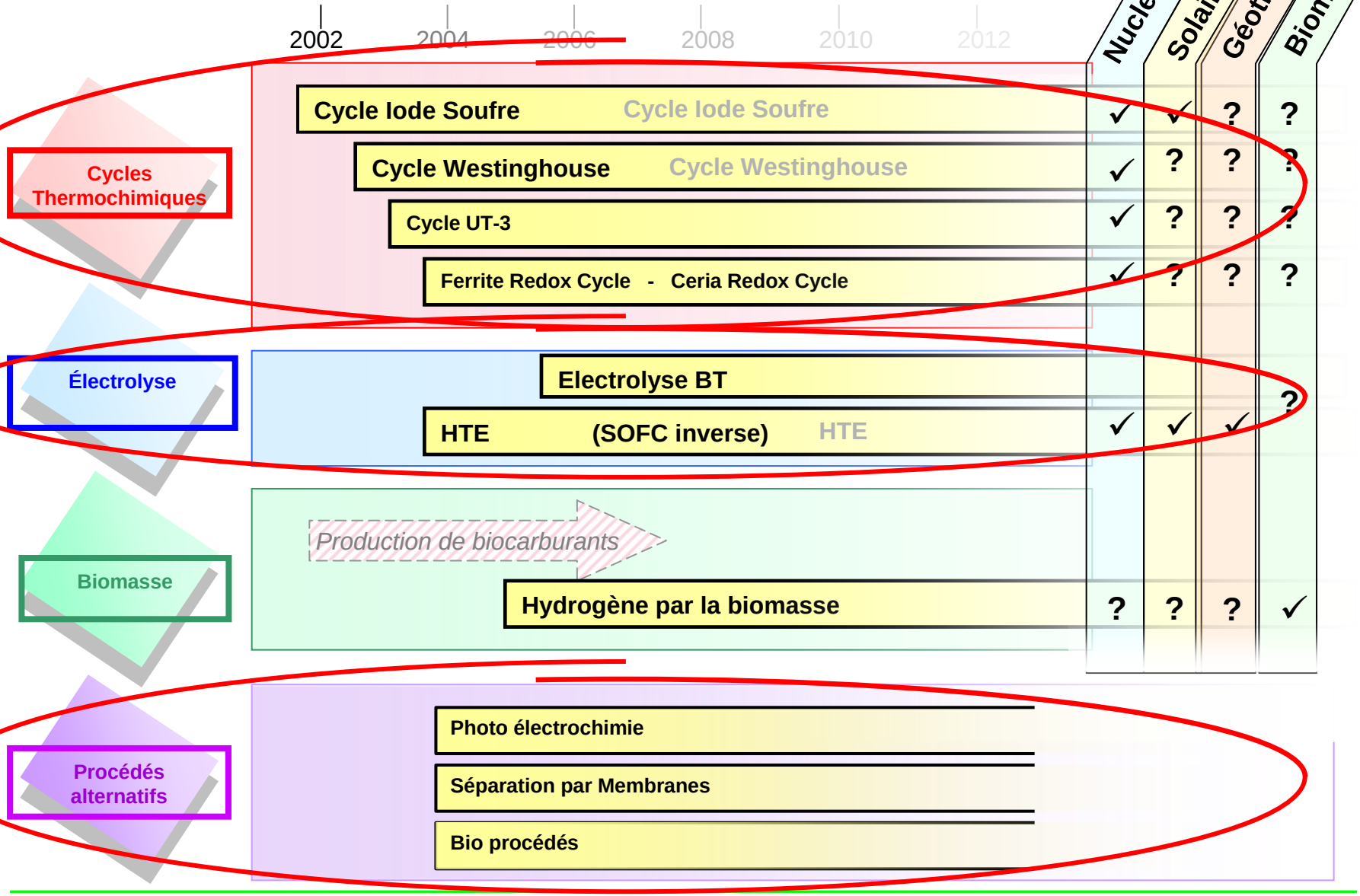


Chaque molécule d'**eau** (H_2O) est le fruit de la combinaison entre un atome d'oxygène et deux atomes d'hydrogène. Or, l'eau couvre 70 % du globe terrestre.

On trouve également de l'hydrogène dans les **hydrocarbures** qui, comme leur nom l'indique, sont issus de la combinaison d'atomes de carbone et d'hydrogène

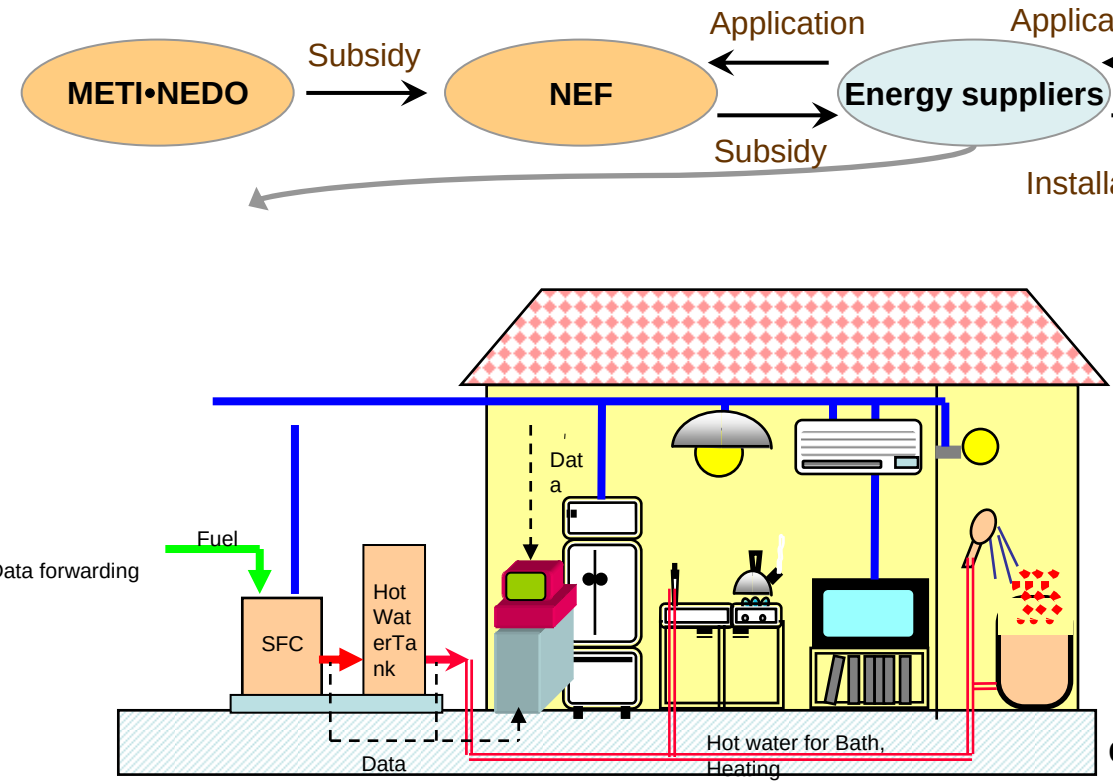
Enfin, tout organisme vivant, animal ou végétal, est composé d'hydrogène : la **biomasse** est donc une autre source potentielle d'hydrogène.

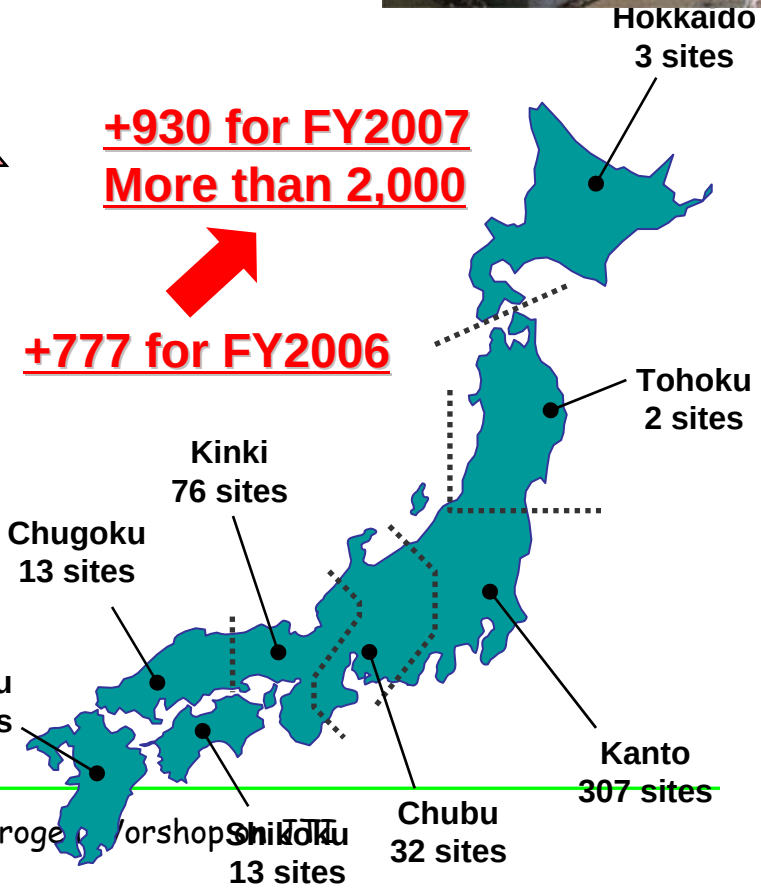
Production d'hydrogène : R&D sur les principales filières



Large-Scale Stationary Fuel Cell Demonstration Project

Provide feedback on various demonstration data, for research and development
Step up to mass production and inspection of learning curve
Price target: 1.2 million yen/system (in 2008)





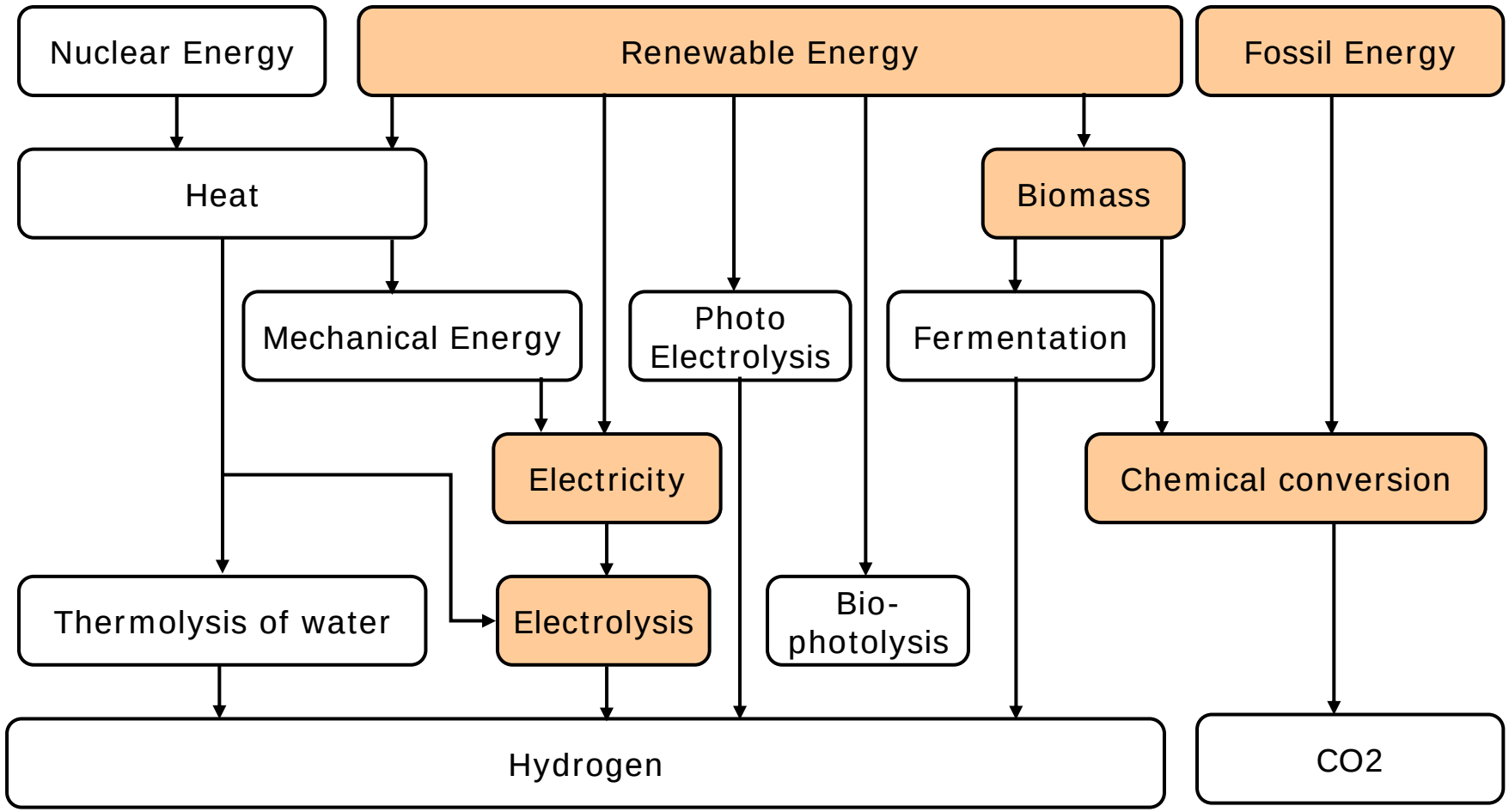
Presentation to ITRE Committee

Brussels, March 5th 2008

Agenda

- Hydrogen technologies
- Adequacy of the preparatory documents
- Adequacy of the JU means & objectives
- Recommendations / governance

Hydrogen production pathways



Note: Hydrogen fulfills a crucial role as storage for renewable energy
Source: Hydrogen production pathways, Adapted and expanded from John A. Turner, Science 285, 687 (1999)

Hydrogen production technologies most technically mature for early commercialisation

	Demo	Early commercial	Commercial	Application	Comments
CCS + (gasification/ reforming)	2011	+/-2015	+/- 2020	• Shell Pernis (NL), RCI R'dam (NL), RWE Cologne (G)	• Capture cost with gasification is much lower, than for reforming
Coal gasification with biomass cofeeding			2007	• Nuon, Buggenum plant (NL)	• Buggenum coal gasification power plant can use up to 30% of biomass as feedstock
Bio-gasification	+/- 2008	+/- 2014	+/- 2018	• Freiburg	• Beta plant being constructed; syngas supplied to Fisher-Trops reactor (15 KT/yr Bio-fuels ~ 4 KT/yr Hydrogen)
Bio-gas reforming (small scale)	2006	+/-2013	+/-2018	• Hynor (Norway)	• Biomethane as feedstock (land fills, Agriculture) • Gas impurity bad for catalyst, Discontinuous process issue
Electrolysis large scale, using renewable electricity			2008	• No example	• Large scale electrolysis is used for production of Chloric, only appropriate when renewable electricity is abundant
Electrolysis small scale, using renewable electricity	2003	+/- 2010	+/- 2016	• Statoilhydro Hamburg, Reykjavik	• Reliability of the electrolyser (lye)

Note: it was assumed that hydrogen technologies are hydrogen production technologies. As a back up, a slide will be prepared on hydrogen transport and filling technologies as well

Agenda

- Hydrogen technologies
- Adequacy of the preparatory documents
- Adequacy of the JU means & objectives
- Recommendations / governance

Assess the adequacy of the preparatory documents for market breakthrough

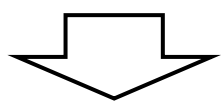
- Develop all elements of the future value chain synchronized
  - Hydrogen production methods
  - Hydrogen infrastructure development
  - Fuel Cell applications
  - Cross cutting actions:
    - Socio Economic analysis
    - Codes & Standards
    - Education
- Put hydrogen and fuel cell in the right context
  - Hydrogen production from grey, to clean and finally to green
  - Hydrogen as a key energy vector across applications
  - Fuel cells as a highly efficient conversion technology to allow for change
- Articulate a clear vision: Hydrogen and fuel cells as a part of the 3rd industrial revolution

Agenda

- Hydrogen technologies
- Adequacy of the preparatory documents
- Adequacy of the JU means & objectives
- Recommendations / governance

The JTI would help to overcome the following short comings

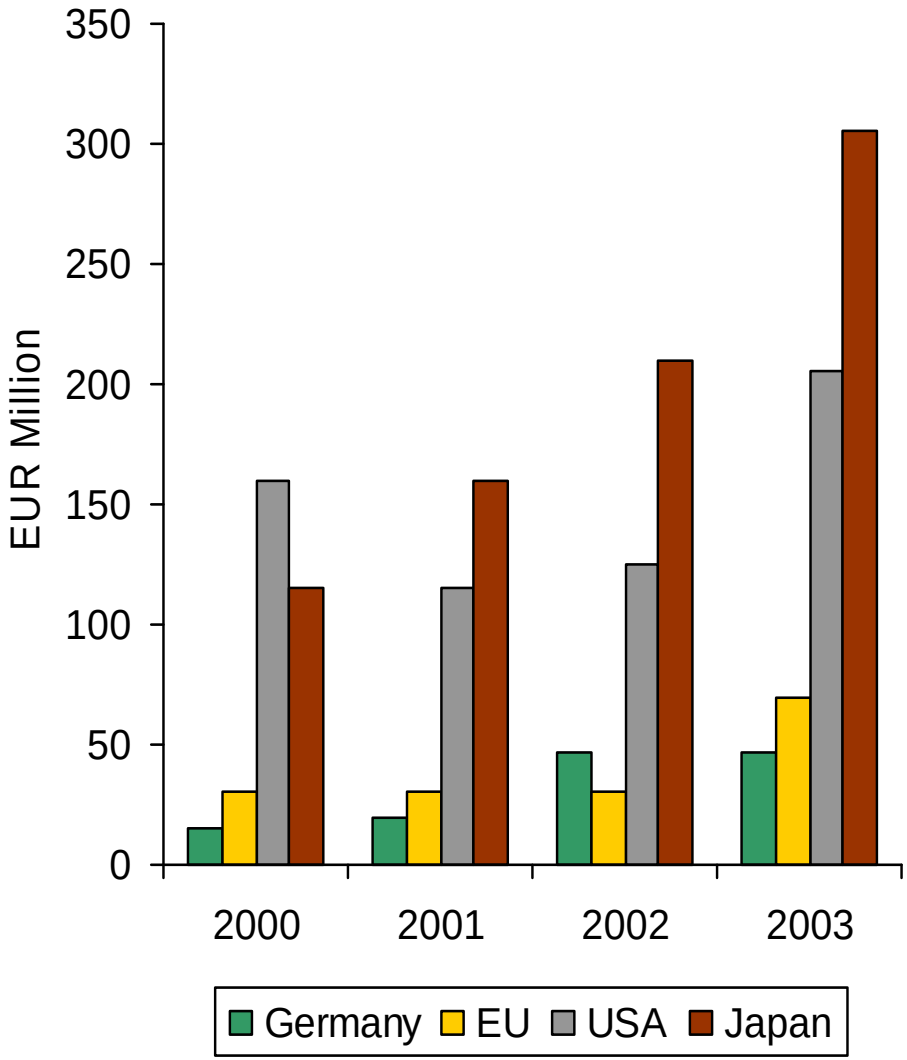
- The lack of commitment by the public sector beyond the annual calls –
  - a JTI with committed funds and a five/six year plan would help over come this
- The lack of funding cohesion between industry, regions, MS and Europe – although there are considerable funds available for fuel cell and hydrogen technologies the co-ordination of these has been limited in the past
  - a JTI with agreed objectives and multi-annual plan would help provide a future focus for pan-European efforts
- The lack of vision for the technologies beyond the industry and committed supporters
  - a JTI would provide the political commitment by the EU as well as lead the necessary public education and awareness activities required over the next few years
- Lack of collaboration and joint road map between industry and research vs joint program objectives and agreed actions
- Lack of critical mass and substance due to fragmentation in many areas vs focussed and collaborative program activities



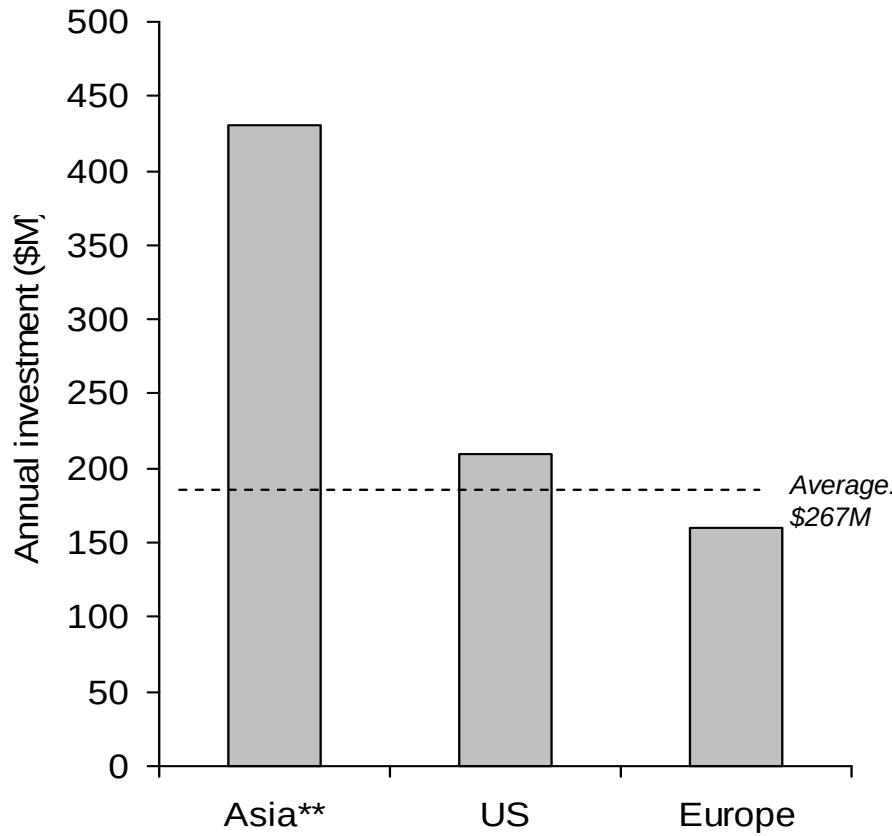
Support RTD in a coordinated manner to overcome market failure

Assess the adequacy of the proposed means...

Government spending Fuel Cells 2000 - 2003



Annual Fuel Cell Investment Level by Region

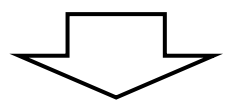


**Other Powertrain research spend on future generation technologies of traditional engines and transmissions, alternative fuel engines*
***Asia without China*

Source: Booz Allen analysis, interviews with Daimler Chrysler, Ford, GM, BMW, Honda, Toyota, Hyundai, VW, Nissan

How much funding does the JTI need?

- Original Implementation Plan calls for +/- EUR 7 Billion (pubic and private), but also over a 10 year period
- Current JTI budget +/- EUR 900 Million (pubic and private)
- JTI needs to coordinate the EU program with Member States and Regions in order to gather more funds

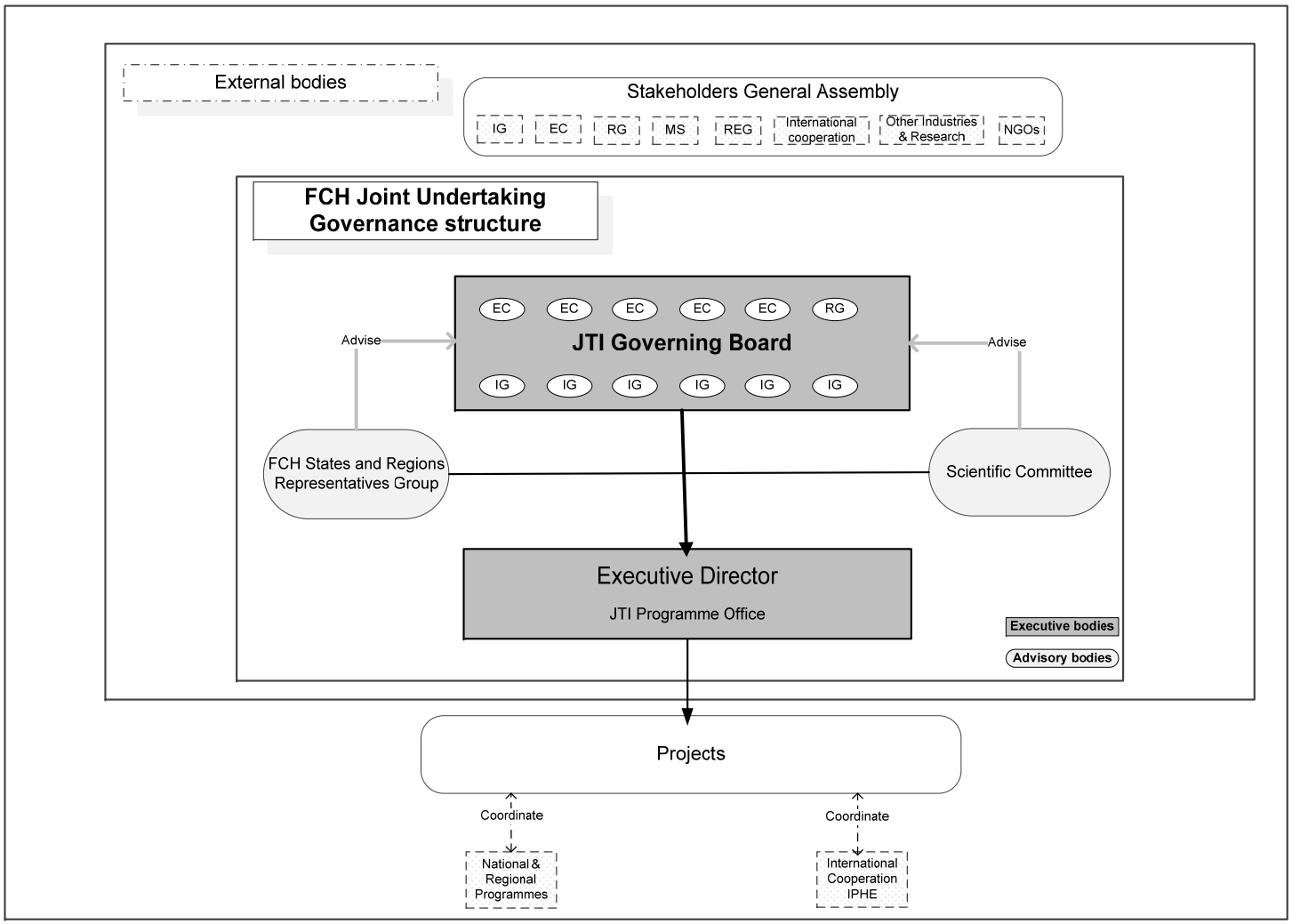


Focus will be needed to achieve major quantitative goals instead of widespread distribution of funds

Agenda

- Hydrogen technologies
- Adequacy of the preparatory documents
- Adequacy of the JU means & objectives
- Recommendations / governance

Recommendations /governance structure



PROPOSAL

- Structure of Scientific Committee
- Structure and name of FCH Member State Group
- Term of the EC officers
- Composition of the Scientific committee
- Preparatory actions vs Interim Structure
- The role of peer reviews