



Fuel Cells and Hydrogen & Smart Specialization

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Fuel Cell & Hydrogen technologies can contribute to

Sustainability

- H₂ is a clean carrier of energy
- Transport and stationary applications, generate electricity and heat
- Storage of renewable energy sources
- Reduction of CO₂ emissions

EC targets	By 2020	By 2030 *
Increase of renewables	20 %	27 %
Increase of efficiency	20 %	27 %
Decrease of GHG	20 %	40 %

*European Council conclusions of 23/10/2014

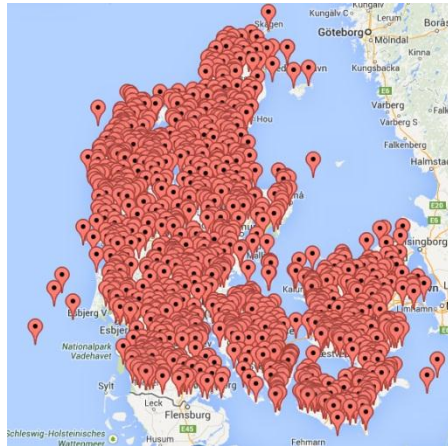
Energy Security

- Increase independence from unstable outside regions

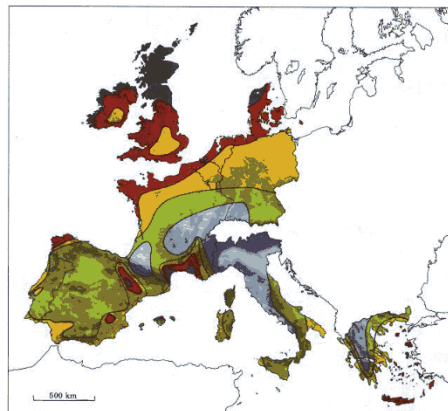
Competitiveness

- research excellence leading to industry innovation and growth

... increase of renewables

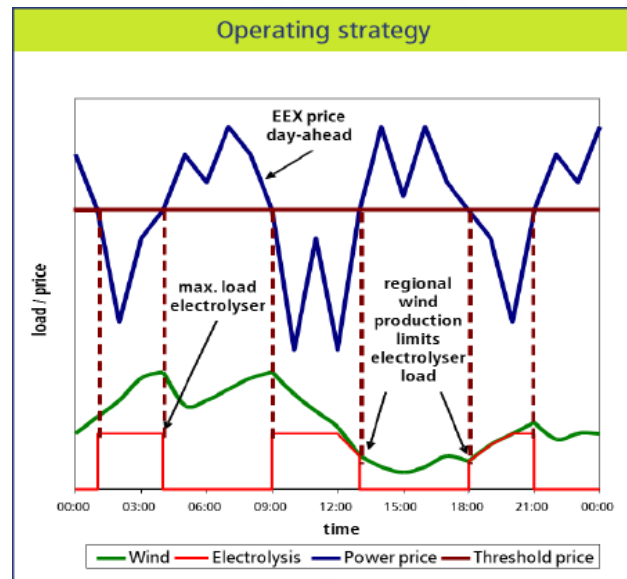


Wind turbines in Denmark



Sheltered terrain		Open plain		At a sea coast		Open sea		Hills and ridges ²	
ms ⁻¹	Wm ⁻²	ms ⁻¹	Wm ⁻²	ms ⁻¹	Wm ⁻²	ms ⁻¹	Wm ⁻²	ms ⁻¹	Wm ⁻²
> 6.0	> 200	> 7.5	> 500	> 8.5	> 700	> 9.0	> 800	> 10.5	> 1800
5.0-6.0	150-200	6.5-7.5	300-500	7.0-8.5	400-700	8.0-9.0	600-800	10.0-11.5	1200-1600
4.5-5.0	100-150	5.5-6.5	200-300	6.0-7.0	250-400	7.0-8.0	400-600	9.0-10.0	700-1000
3.5-4.5	50-100	4.5-5.5	100-200	5.0-6.0	150-250	6.0-7.0	200-400	7.0-8.5	400-700
< 3.5	< 50	< 4.5	< 100	< 5.0	< 150	< 6.0	< 200	< 7.0	< 400

Hydrogen is an energy vector not an energy source

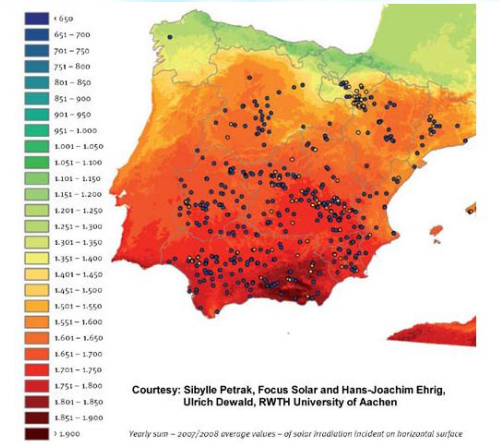


Water electrolysis

- High power (MW-GW)
- Coupling with intermittent energy sources

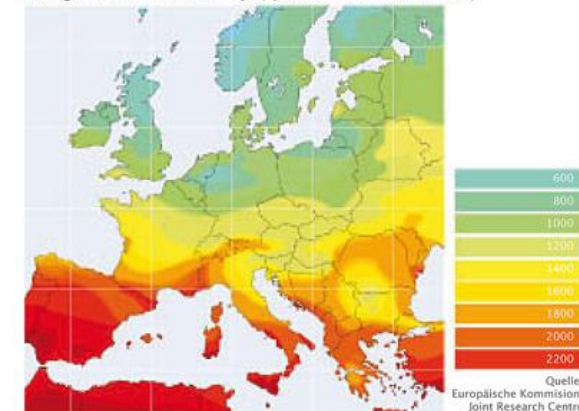
Hydrogen storage

- Underground storage
- Solid state storage



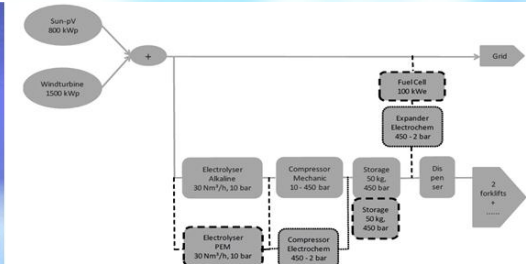
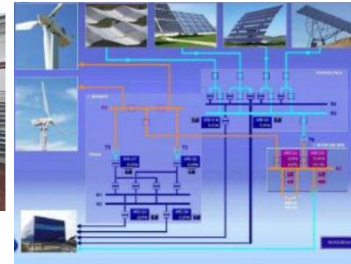
Photovoltaics in Spain

The Potential of Photovoltaic in Europe
Average annual value of sun rays (optimal PV-Module in kW/m²)

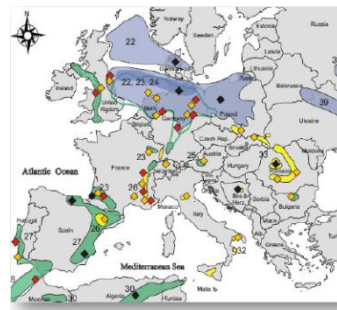
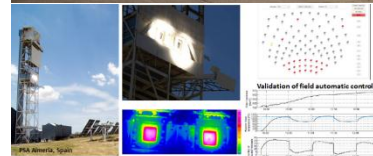


Quelle:
Europäische Kommission,
Joint Research Centre

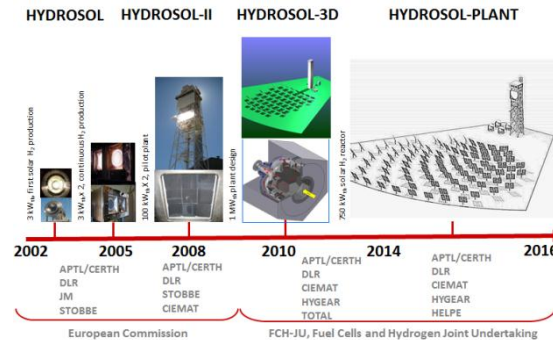
Hydrogen production and storage in FCH 1 JU



- Demonstration of high power electrolyzers coupled to renewable energy sources
- Demonstration of integrated systems
- Demonstration of hydrogen production through concentrated solar energy
- Hydrogen Underground storage



Source: KBB



Storage potential in salt formations



Storage potential in depleted gas fields and Aquifers



Source: DEEP Underground Engineering GmbH



Stationary FC applications in FCH 1 JU

- Demonstration of > 1000 residential micro-CHP units in 12 Member States (system efficiency > 95%)
- Demonstration of 3 industrial CHP projects >1,5 MW
- Demonstration of > 37 back-up power systems



ene.field★

SOFT-PACT

FCpoweredRBS

fitup



Transport in FCH 1 JU

- Demonstration of > 260 hydrogen cars
- Installation of > 20 hydrogen refueling stations
- Demonstration of > 74 hydrogen buses
- Demonstration of > 400 hydrogen materials handling vehicles
- Demonstration of auxiliary power units for trucks, planes and maritime applications

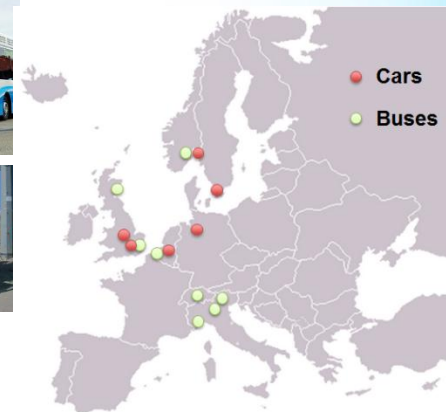


HyFIVE



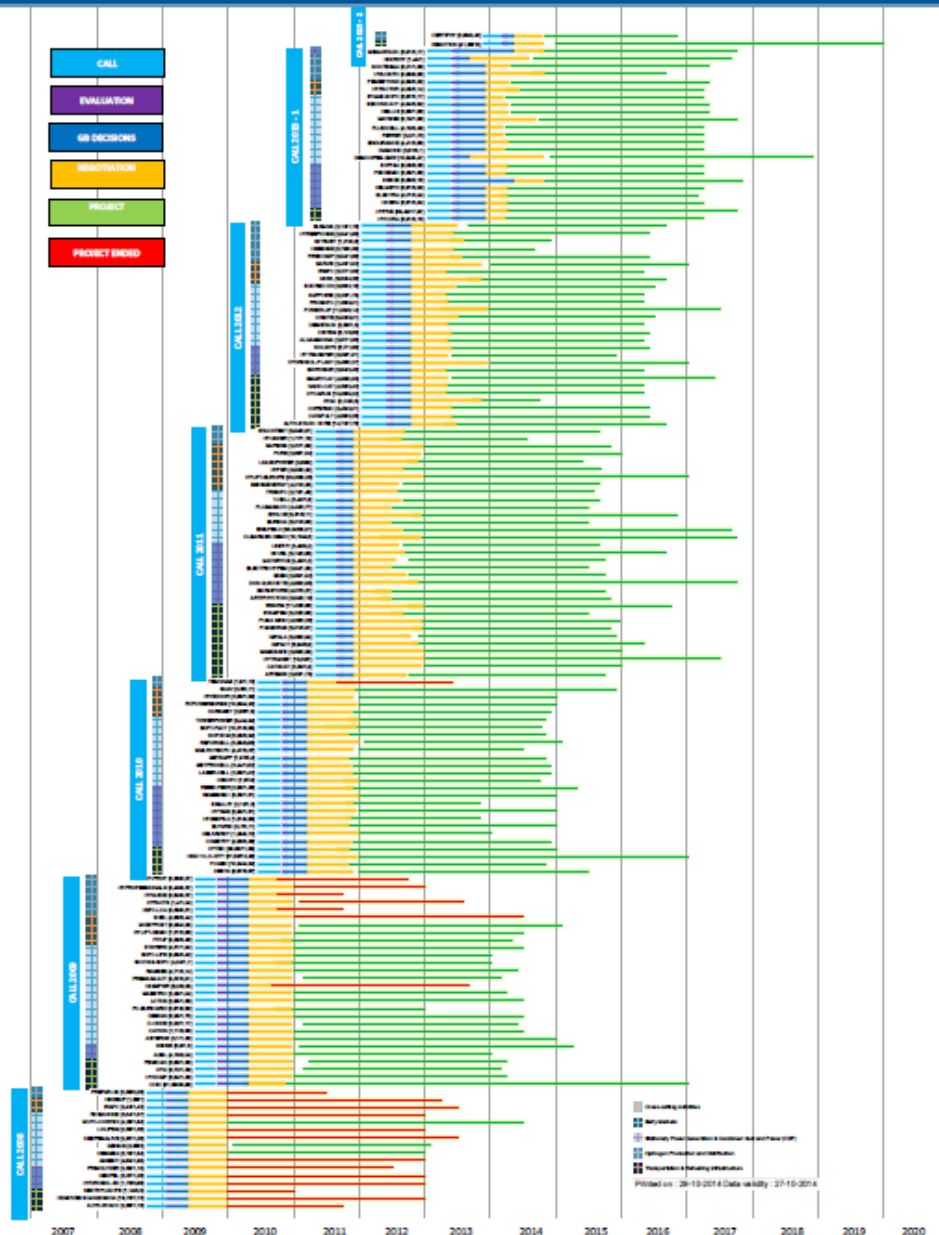
HyTransit

3EMotion



SAPIENS

purew



- 155 R&D D projects financed
- over 7 calls for proposal
- covering 5 application area's
- total value of 900 M €
- with 545 participants of which
 - 192 industries (35%)
 - 154 SMEs (28%)
 - 149 research organisations (27%)
 - 20 higher education (4%)
 - 30 other (6%)
- international cooperation outside EC
- **Mature European FCH community :**
 - Strong, visible and coherent
 - Consensus strategy (MAIP/AIP)
 - Pre-competitive collaboration

Industry led Public Private Partnership



**Industry Grouping
NEW-IG**
80 members



European Union
represented by the
European Commission



research on fuel cells & hydrogen

**Research Grouping
N.ERGHY**
59 members



1. Budget (EC contribution) :

budget : 665 M €

administration : 19 M €

7 calls : 2014 – 2020

+ IG additional activities

2. Funding rates :

	Direct cost	Indirect cost flat rate of direct cost
R&I	100 %	25 %
I	70 %	17,5 %

4. Objectives (transport & energy)

- reduce the (production) cost
- increasing the lifetime
- increase the efficiency
- demonstrate (large scale) hydrogen as RES integration and energy storage medium
- reduce ‘Critical raw materials’

3. Funding distribution :

	Research and Innovation	Innovation	Total
Transport	94 (± 5)	213 (± 10)	307
Energy	94 (± 5)	213 (± 10)	307
Cross-Cutting			32 (5%)
Total (in M€)	192 (29%)	426 (66%)	646

5. Objectives

Within the mandate¹ of the FCH JU, recital 24 calls for :

“Horizon 2020 should contribute to the closing of the research and innovation divide within the Union by promoting synergies with the European Structural and Investment Funds (ESIF). Therefore the Fuel Cells and Hydrogen 2 Joint Undertaking should seek to develop close interactions with the ESIF, which can specifically help to strengthen local, regional and national research and innovation capabilities in the area of the Fuel Cells and Hydrogen 2 Joint Undertaking and underpin smart specialisation efforts.”

¹ COUNCIL REGULATION (EU) No 559/201 of 6 May 2014 establishing the Fuel Cells and Hydrogen 2 Joint Undertaking

Workshop discussion subjects

(non exhaustive)

Reduction of production costs of long lifetime FC systems to be used in local transport applications

Increase of the electrical efficiency and durability of low cost FCs used for power production

Transport

Industrial applications

Residential CHP

Feed to electricity grid

Reduce the use of critical raw materials

Existing natural gas, electricity and transport infrastructures

By-product from Chemical Industry

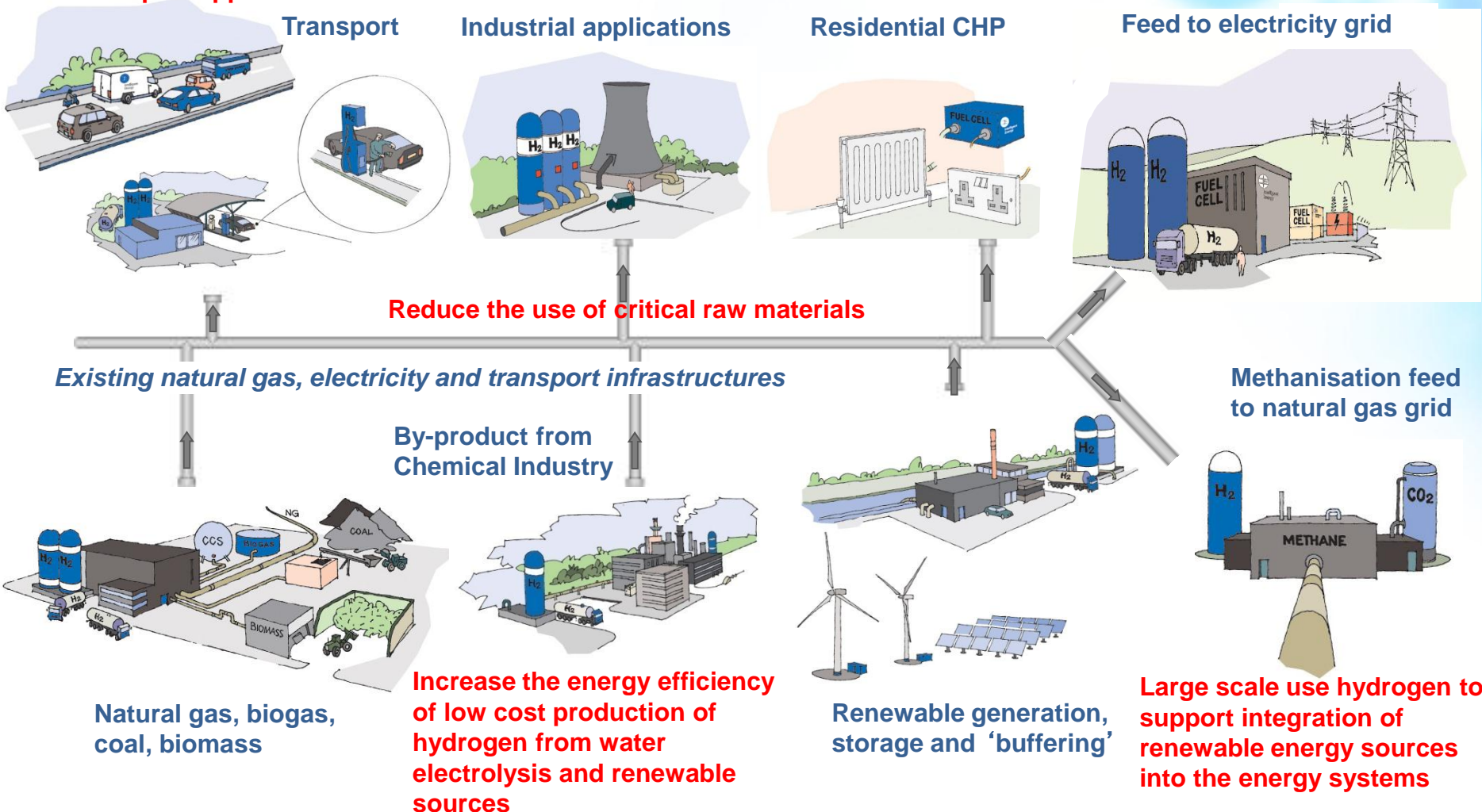
Methanisation feed to natural gas grid

Natural gas, biogas, coal, biomass

Increase the energy efficiency of low cost production of hydrogen from water electrolysis and renewable sources

Renewable generation, storage and 'buffering'

Large scale use hydrogen to support integration of renewable energy sources into the energy systems



Objectives for the workshop

First : To exchange experiences between European regions and industry to find (new) synergies in the deployment of Fuel Cells and Hydrogen (FCH) technologies and to identify related technical, operational and financial obstacles and to describe pathways to overcome these obstacles.

→ Unlock ESIF for FCH R&D and deployment.

Second : Planning of next steps :

Bilateral or multi regional activities, with (local) industry and research, addressing regional challenges by using regional opportunities and resources.

Thank you for your attention !

Further info :

- FCH JU : <http://www.fch.europa.eu>
- NEW-IG : <http://www.new-ig.eu>
- N.ERGHY : <http://www.nerghy.eu>