



Fuel Cells and Hydrogen Joint Undertaking

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FCH JU Executive Director

Lampoldshausen, 15 September 2015



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

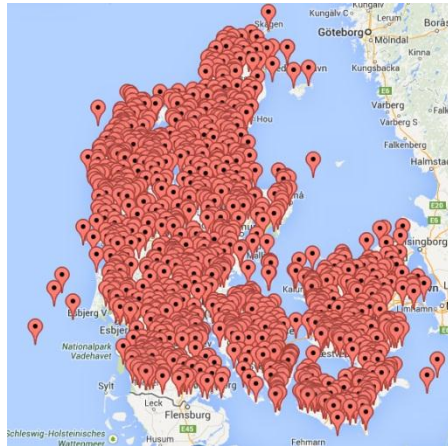
Energy Security

- Increase independence from unstable outside regions

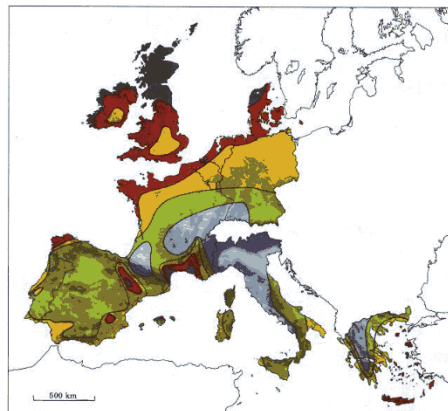
Competitiveness

- research excellence leading to industry innovation and growth

... increase of renewables

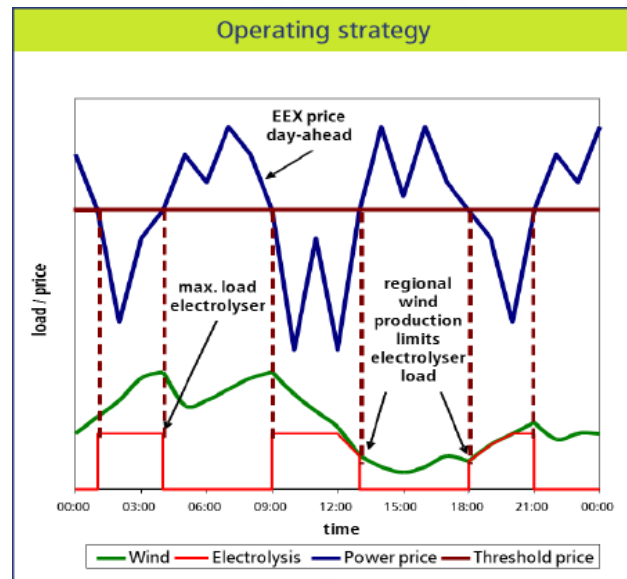


Wind turbines in Denmark



Wind resources ¹ at 50 metres above ground level for five different topographic conditions									
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	< 300	< 7.5	< 400

Hydrogen is an energy vector not an energy source

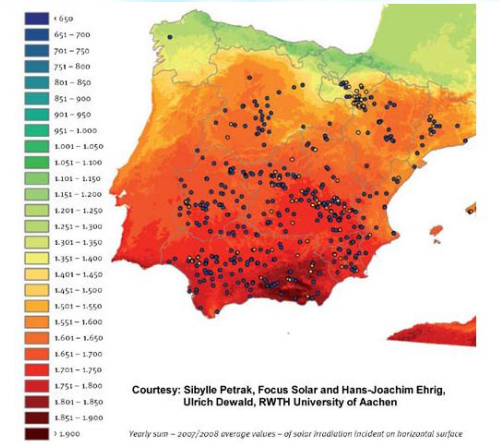


Water electrolysis

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

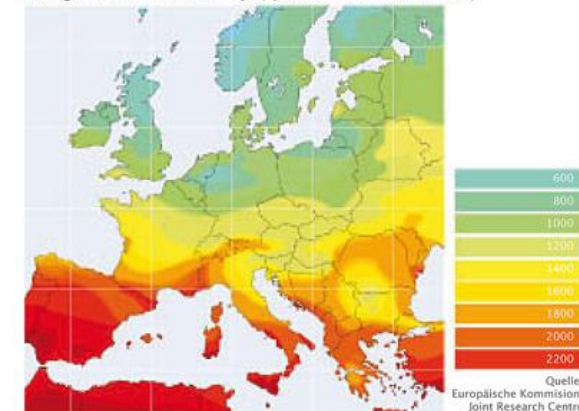
Hydrogen storage

- Underground storage
- Solid state storage



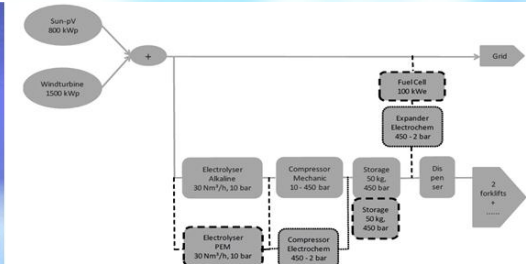
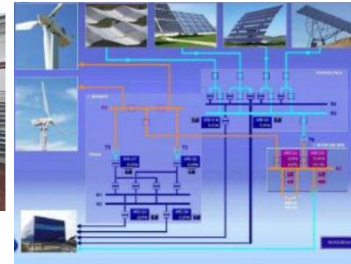
Photovoltaics in Spain

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

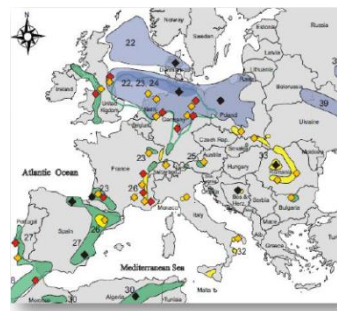
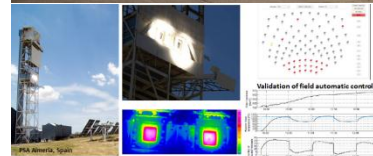


Quelle:
Europäische Kommission,
Joint Research Centre

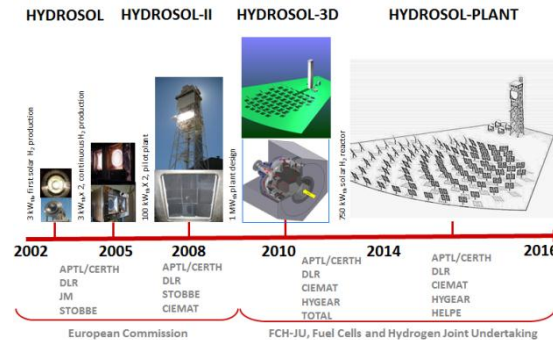
Hydrogen production and storage in FCH 1 JU



- 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

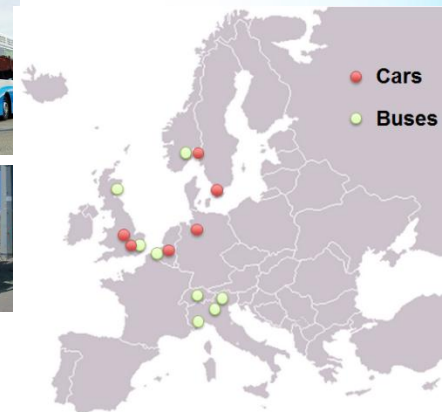


HyFIVE



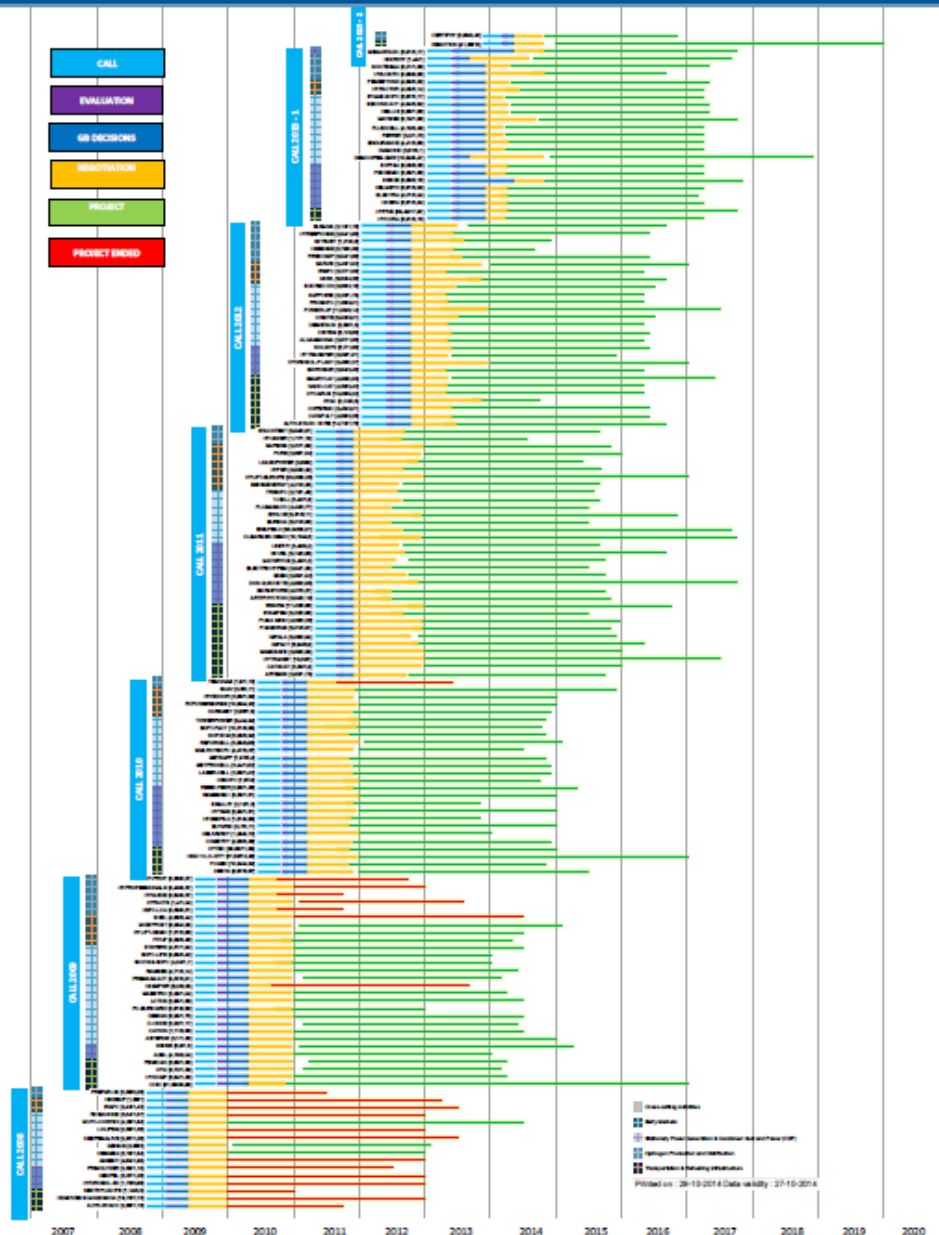
HyTransit

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

EU member state participation in the FCH JU



- 22 Member States represented
- Missing:
 - Ireland
 - Latvia
 - Slovakia
 - Malta
 - Cyprus
 - Luxemburg

Non EU MS beneficiaries:

CH, NO, IL, TR, IS, RS, CN, RU US

Industry led Public Private Partnership



**Industry Grouping
NEW-IG**
80 members

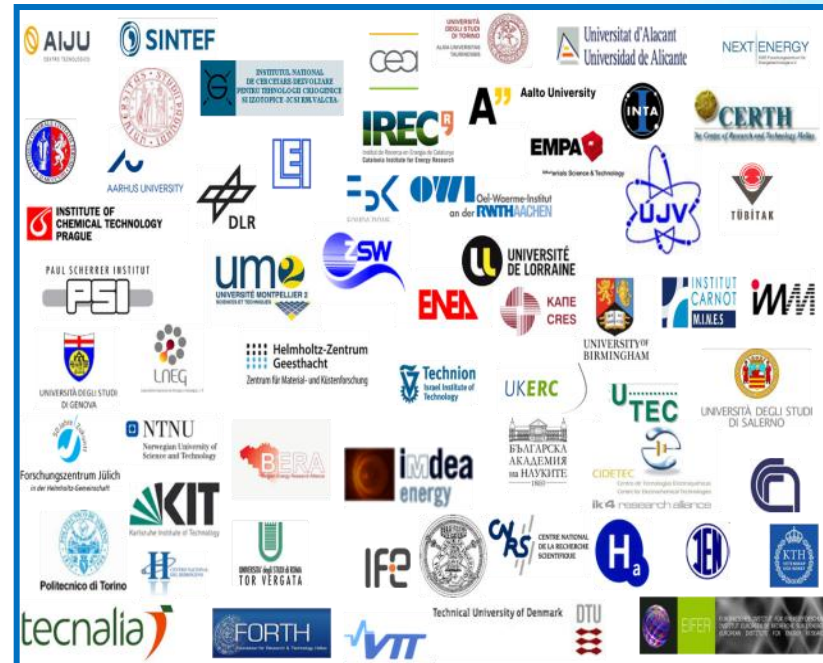


European Union
represented by the
European Commission

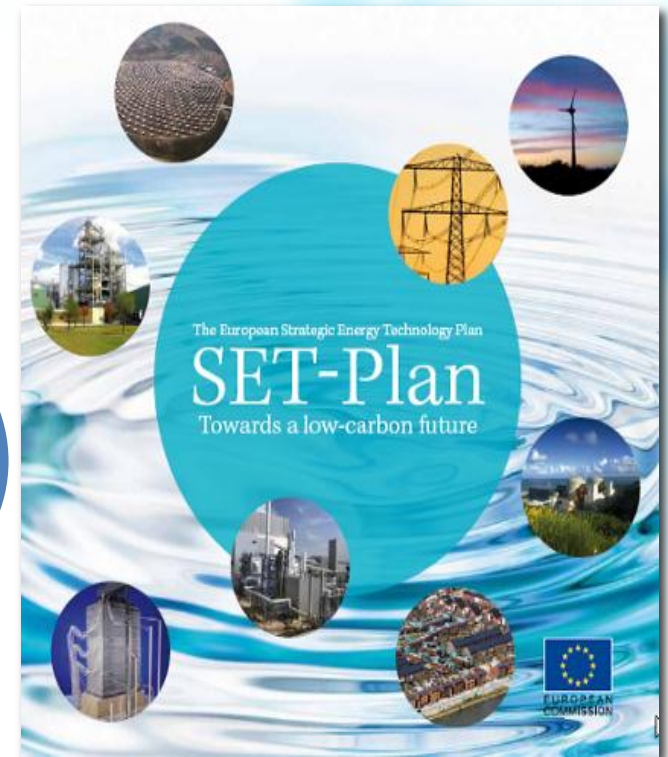
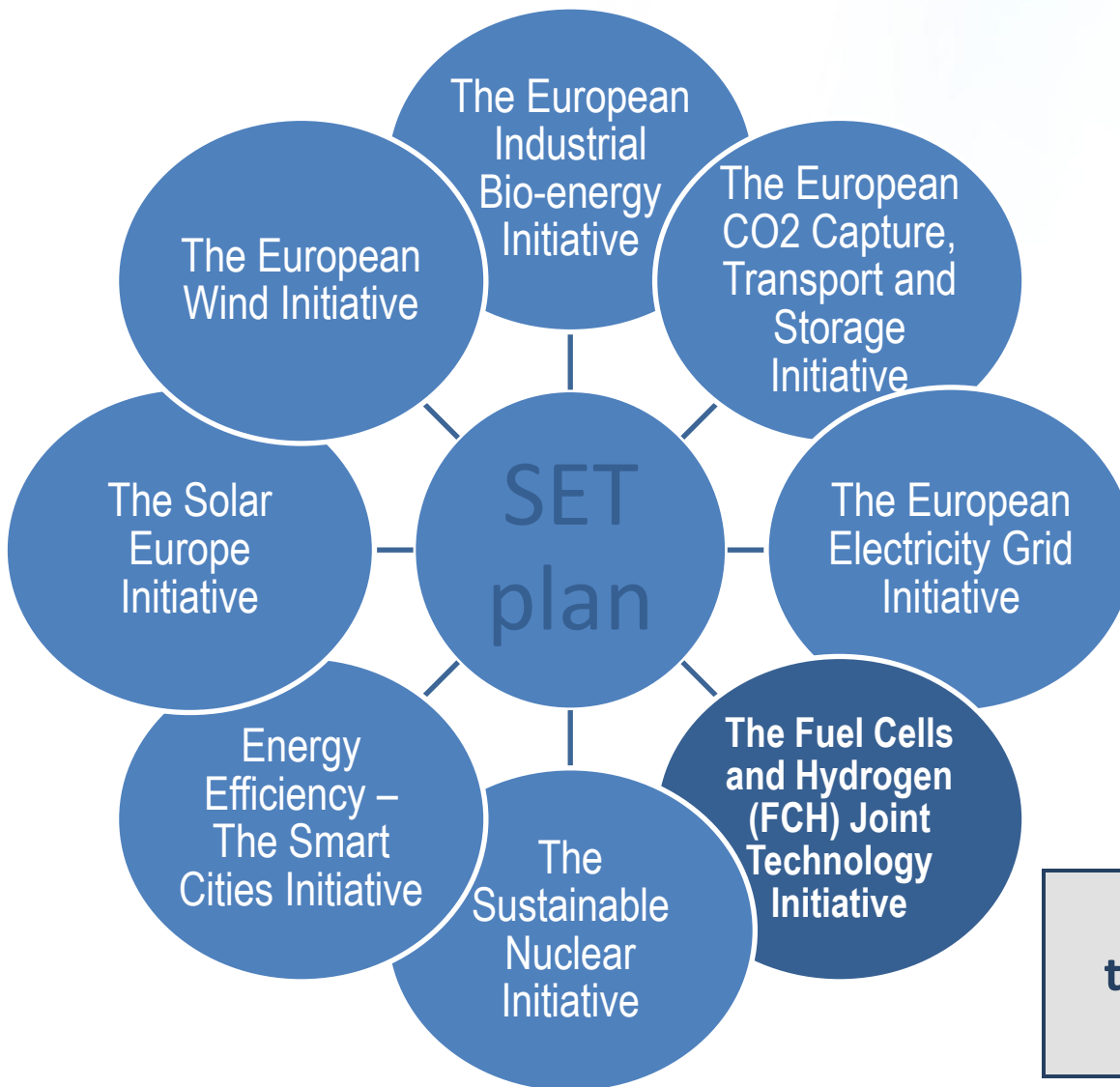


research on fuel cells & hydrogen

**Research Grouping
N.ERGHY**
59 members



The FCH JU in the SET plan



Fuel cells technology is a key technology for Europe towards the 20-20-20 goal by 2020

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

FCH JU Project Activities

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

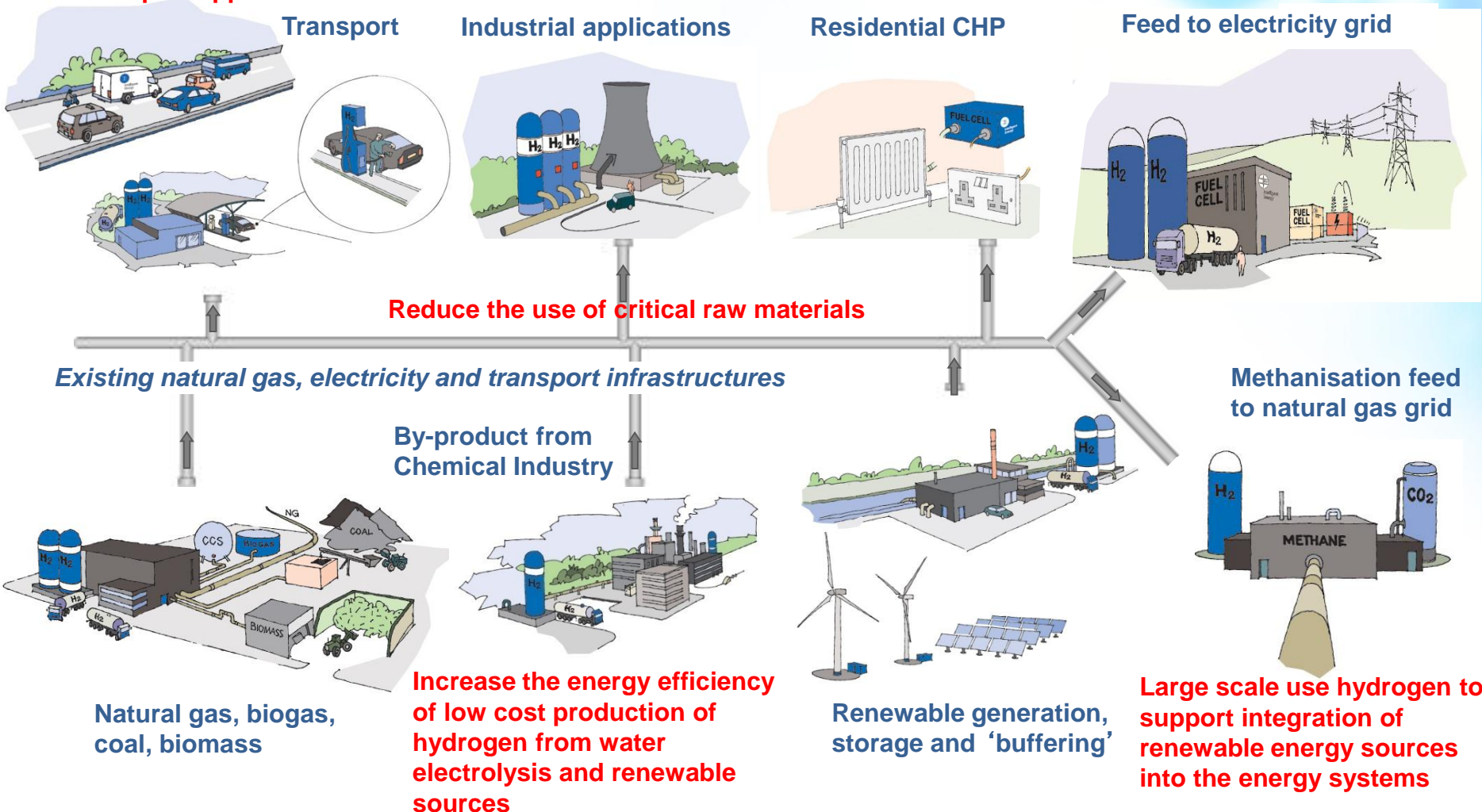
Methanisation feed to natural gas grid

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'

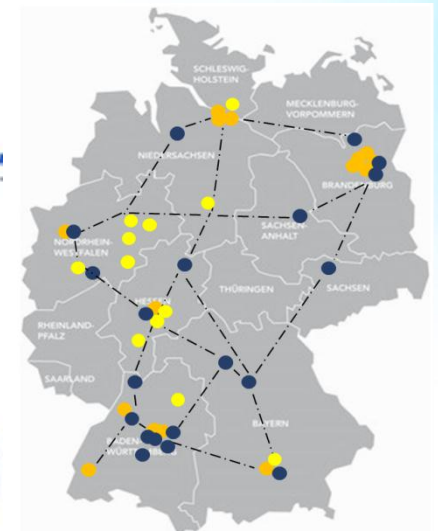
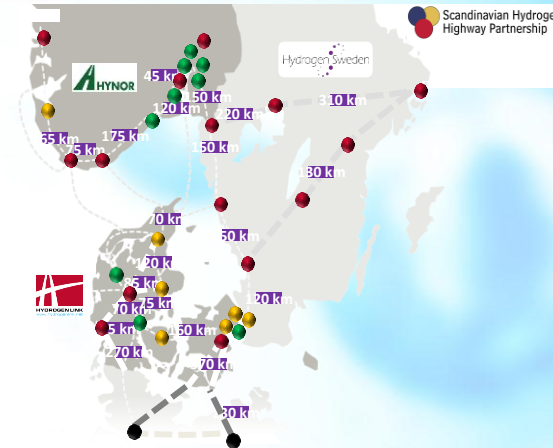
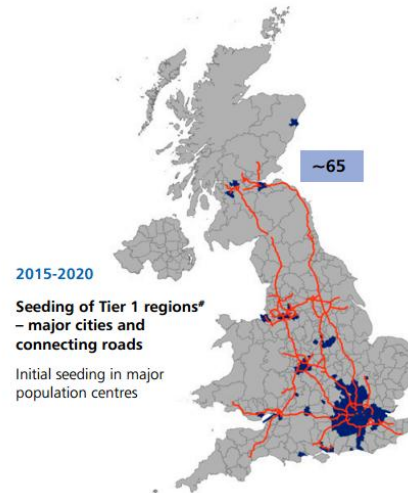
Large scale use hydrogen to support integration of renewable energy sources into the energy systems



FCH cars and HRS

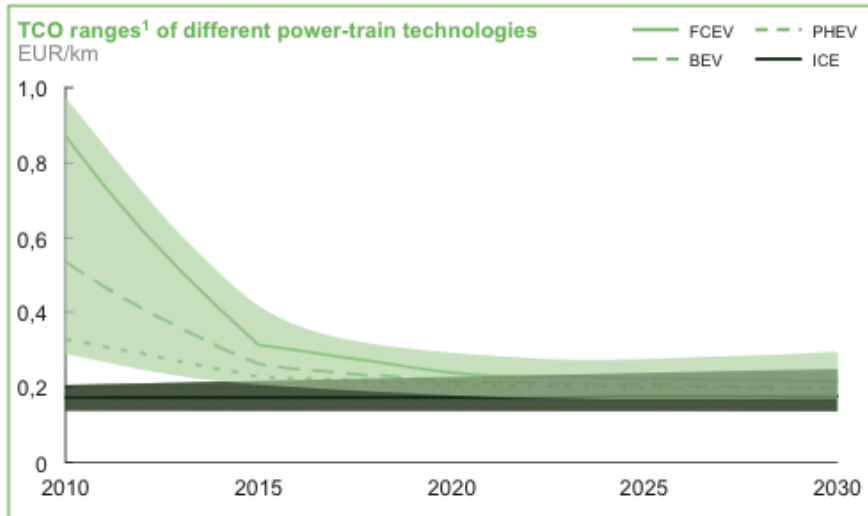
Advanced FCEV and HRS programs

- **France** – a large private consortium has agreed a strategy based on a transition from captive fleets to nationwide infrastructure for FCEVs.
- **Germany** –
 - 50 H2 stations by end of 2015 under the Clean Energy Partnership. Government and industry invest jointly over 40 M€.
 - the H2Mobility project has already signed a “term sheet” linking six industrial players to deploy 100 stations by 2017 and 400 by 2023 for 350 M€.
- **Scandinavia** – An initial network provides coverage for FCEVs, which can be purchased at equivalent ownership cost.
- **UK** – a consortium with significant Government presence has agreed a strategy based on seeding a national network of 65 stations by 2020. 7.5M£ have been committed by the Government for 15 HRS by 2015.



Similar initiatives are starting or running in other countries: **Austria , Belgium, Finland, Netherlands** (plan to be published before the end of 2014), **Switzerland**.

FCH cars and HRS



EU HRS infrastructure by 2020

- 250¹ units at 1M€/unit & 0,1M€/Y

FCEV in EU by 2020

- 100.000 cars at 50.000 €/car
- Current price : 65.000 € – 100.000 €

¹ Numbers are indicative and based on public statements from each initiative

possible FCH JU funding for EU HRS infrastructure :

- 75 HRS at 70 % + 2 year opex : 60 M€
- remaining 175 HRS by CEP, CEF, national governments (ref CPT)

possible FCH JU funding for FCEV :

- estimated 2000 cars at 70 % with max (FCEV at 500 €/kW and FCEV RE² at 2000 €/kW) : 60 M€
- remaining 98.000 FCEV ?

Current study



- Local high-level cost analyses
- Mobilisation of interested locations
- Preparation joint procurement



- Engineering of H₂ refueling infrastructure

2014-2015



- Detailed cost analyses



- Grant application for demo project



- EU roadmap/discussion on regulation

2016



- Execution of demo projects

Scale effects
Incentives
Regulation

- Local, national and EU funding schemes for demos



- Regulations framework to support roll-out

2017-2020

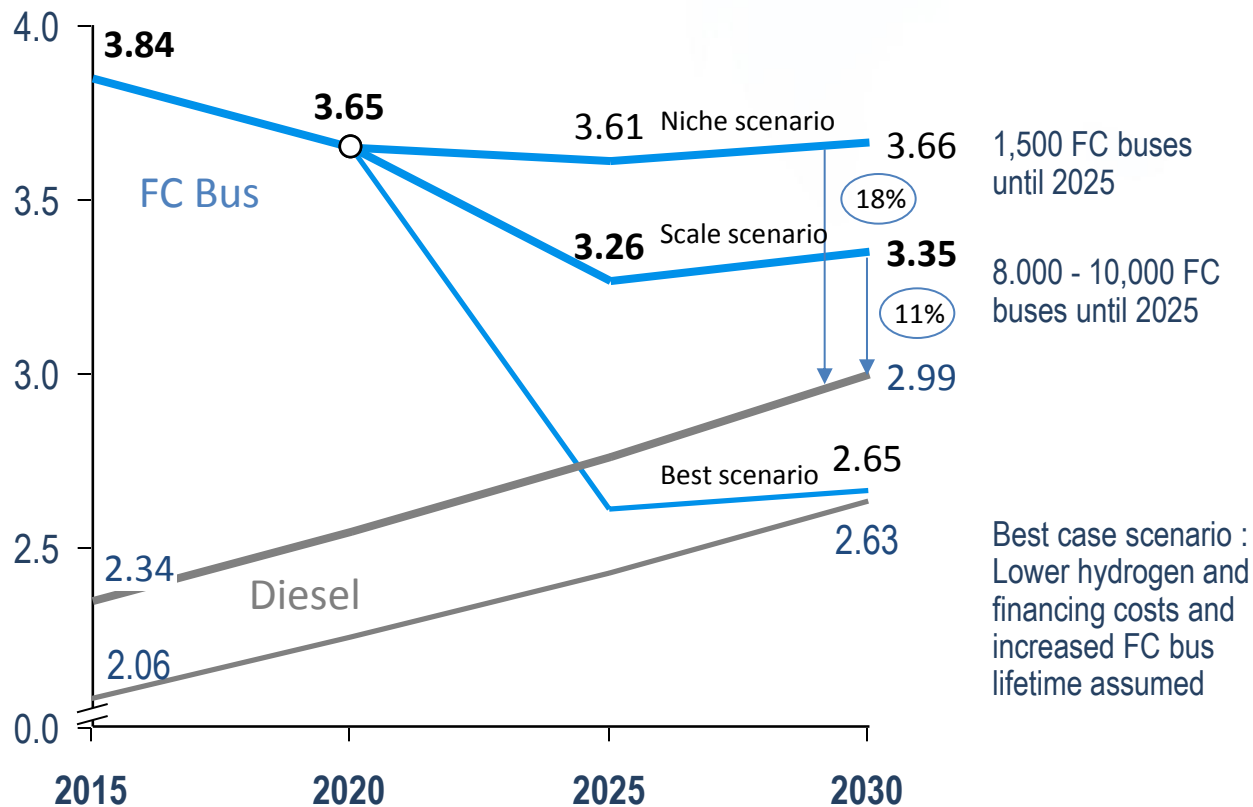
VISION –
FC electric buses commercially viable
and rolled-out in Europe



2020 onwards

FC bus deployment costs analysis indicates financing gap/cost premium

Total Servicing Cost development scenarios (EUR/km)

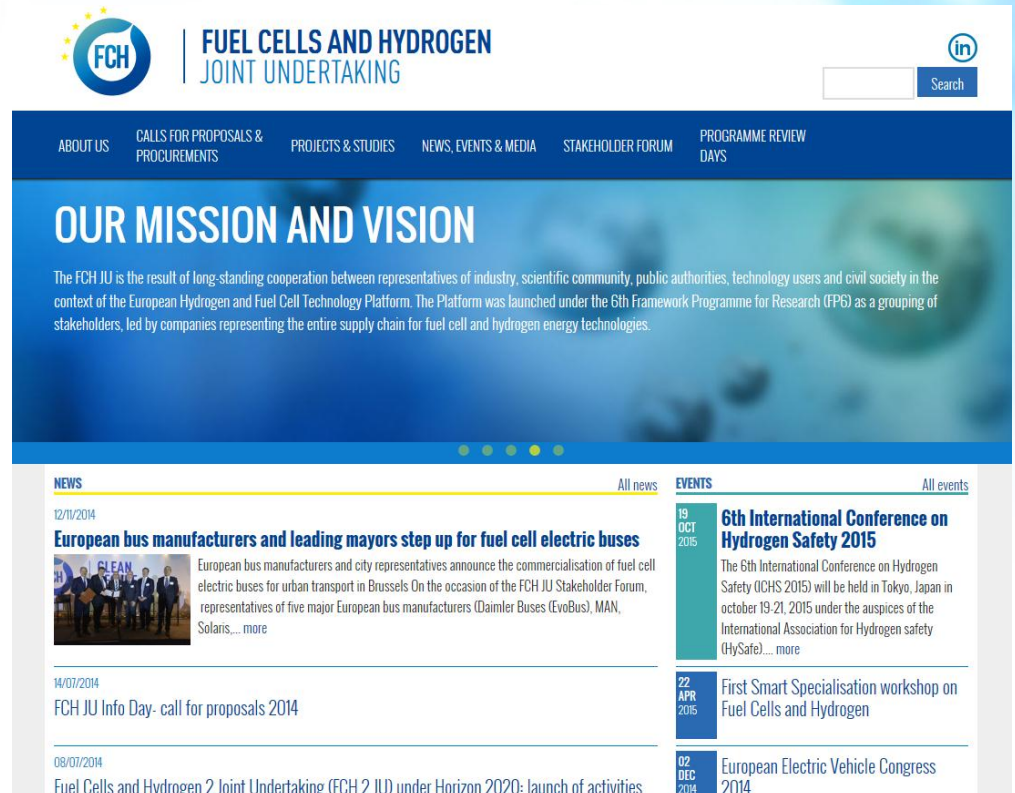


- > Deploying more buses earlier will support scale effects and cost reduction
- > More locations as first-movers need to be mobilized
- > TSC gap to the diesel bus expected to decrease to 11%, but can remain higher
- > Synergies with fuel cell passenger car industry offer further significant cost reduction potential (not depicted here)

Thank you for your attention !

Further info :

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



The screenshot shows the homepage of the Fuel Cells and Hydrogen Joint Undertaking (FCH JU). The header features the FCH logo and the text 'FUEL CELLS AND HYDROGEN JOINT UNDERTAKING'. A navigation bar includes links for 'ABOUT US', 'CALLS FOR PROPOSALS & PROCUREMENTS', 'PROJECTS & STUDIES', 'NEWS, EVENTS & MEDIA', 'STAKEHOLDER FORUM', and 'PROGRAMME REVIEW DAYS'. The main section is titled 'OUR MISSION AND VISION' and contains a paragraph about the FCH JU's role in the European Hydrogen and Fuel Cell Technology Platform. Below this, there are sections for 'NEWS' and 'EVENTS'. The 'NEWS' section lists three items: 'European bus manufacturers and leading mayors step up for fuel cell electric buses' (dated 12/11/2014), 'FCH JU Info Day- call for proposals 2014' (dated 14/07/2014), and 'Fuel Cells and Hydrogen 2 Joint Undertaking (FCH 2 JU) under Horizon 2020- launch of activities' (dated 08/07/2014). The 'EVENTS' section lists two items: '6th International Conference on Hydrogen Safety 2015' (dated 19 OCT 2015) and 'First Smart Specialisation workshop on Fuel Cells and Hydrogen' (dated 22 APR 2015). A third event, 'European Electric Vehicle Congress 2014' (dated 02 DEC 2014), is partially visible at the bottom.

FCH JU | FUEL CELLS AND HYDROGEN JOINT UNDERTAKING

ABOUT US | CALLS FOR PROPOSALS & PROCUREMENTS | PROJECTS & STUDIES | NEWS, EVENTS & MEDIA | STAKEHOLDER FORUM | PROGRAMME REVIEW DAYS

OUR MISSION AND VISION

The FCH JU is the result of long-standing cooperation between representatives of industry, scientific community, public authorities, technology users and civil society in the context of the European Hydrogen and Fuel Cell Technology Platform. The Platform was launched under the 6th Framework Programme for Research (FP6) as a grouping of stakeholders, led by companies representing the entire supply chain for fuel cell and hydrogen energy technologies.

NEWS

12/11/2014
European bus manufacturers and leading mayors step up for fuel cell electric buses
European bus manufacturers and city representatives announce the commercialisation of fuel cell electric buses for urban transport in Brussels On the occasion of the FCH JU Stakeholder Forum, representatives of five major European bus manufacturers (Daimler Buses (EvoBus), MAN, Solaris,... more

14/07/2014
FCH JU Info Day- call for proposals 2014

08/07/2014
Fuel Cells and Hydrogen 2 Joint Undertaking (FCH 2 JU) under Horizon 2020- launch of activities

EVENTS

19 OCT 2015
6th International Conference on Hydrogen Safety 2015
The 6th International Conference on Hydrogen Safety (ICHS 2015) will be held in Tokyo, Japan in October 19-21, 2015 under the auspices of the International Association for Hydrogen safety (HySafe).... more

22 APR 2015
First Smart Specialisation workshop on Fuel Cells and Hydrogen

02 DEC 2014
European Electric Vehicle Congress 2014