Fuel cells and hydrogen
the importance of public-private partnerships

Why a public-private partnership?

Only a strong public-private partnership can help overcome the lack of economic incentives preventing individual players from moving into markets in which a new technology requires initial high level of investments while offering only very little (to initially negative) returns.

The first European public-private partnership created in 2007, the Fuel Cells and Hydrogen Joint Undertaking (FCH JU), supports the research, development and demonstration toward commercial introduction through annual and competitive calls for proposals.

NEW-IG is the sole industry partner of the European Commission and the research community (N.ERGHY) within the partnership. The joint approach (50% funding from industry and research and 50% from the European Commission) and close interaction of public and private players is essential for alignment and joint progress to market deployment.

155 projects	**1266** participants
7 studies	**545** Beneficiaries**
22 EU Member States represented*	**>260** hydrogen cars **>74** hydrogen buses
>20 hydrogen refuelling stations installed	**1,200** stationary fuel cells installed
>400 materials handling vehicles	**10** MW decentralised power production

* in the FCH JU through the States Representatives Group (advisory body) benefited from funding
** 192 Industries (35%), 154 SMEs (28%), 149 Research Organizations (27%), 20 High Education Institutions (4%), 30 Others (6%)

Breakthroughs to date

(2008-2013) (Investment of close to €1billion)

Car range **improved 100%** (from 250 km to 500km)	PEM electrolyser performance **increased by 30%**	Cumulative distance travelled in car demonstrations (km) **>5,000,000km**	Bus fuel cell vehicle cost **improved by 40%**
Bus fuel cell system cost **improved by 29%**	Bus fuel cell system lifetime **improved by 350%**	Bus fuel cell consumption (kgH2/100km) **improved by 55%**	Cumulative distance travelled in bus demonstrations (km) **>2,000,000km**
Stationary FC cost **reduced by 60%**	Electrical efficiency of stationary fuel cells **improved up to 60%**	**99.4% reliability** of stationary fuel cells achieved	**5 year** lifespan of fuel cell stacks achieved

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Objectives until 2020

Renewed in 2014 with a 45% increased budget commitment totalling €1.3 billion until 2020, the second phase of this public-private partnership will work toward bringing to the point of market readiness a portfolio of cost-efficient solutions for energy and transport. Specifically, it will:

Improve performance
specifically efficiency and durability of the different fuel cells; energy efficiency of the production of hydrogen from water electrolysis and renewable sources whilst reducing operational and capital costs.

Reduce costs
mainly of fuel cells used in transport applications whilst increasing their lifetime.

Demonstrate on a large scale
the readiness of the technology to enter the market in the fields of transport (cars, buses and refuelling infrastructure) and energy (hydrogen production and distribution, energy storage and stationary power generation).

Reduce the use of 'critical raw materials'.

Priorities and deliverables of the Fuel Cell and Hydrogen Joint Undertaking (FCH 2 JU) under Horizon 2020

Transport

Main priorities:

Road transport will be the main priority because it offers the greatest potential for addressing EU climate change and energy security objectives and is critical for European competitiveness.

In addition to passenger vehicles, the focus will initially be on captive fleets (buses, trucks, vans etc.) along with the specific refuelling infrastructure for these applications.

Applications for maritime, rail and aviation and other off-road applications require additional research efforts for Auxiliary Power Units (APUs) and possibly propulsion applications.

Main deliverables:

Reduce cost and improve efficiencies and performance.

Fuel cell electric vehicles (FCEVs) and Hydrogen Refuelling Stations (HRS) developed using the new generation technologies and demonstrated, for both passenger and commercial vehicles.

Participation in standards development and definitions necessary for market deployment.

Energy

Main priorities:

Hydrogen production for energy storage and grid balancing from renewable electricity will be a main priority – including large 'green' hydrogen production, storage and re-electrification systems. The initial focus will be on the role hydrogen can play in the integration of renewable energy sources in the grid.

Hydrogen production with a low carbon footprint from other resources will be a topic of focus – whereby different hydrogen pathways will be developed and if appropriate demonstrated.

Fuel cell systems for Combined Heating and Cooling (CHP) and Power only – covering the technical developments necessary to reduce costs, increase lifetime and improve performance is imperative to the Energy Pillar.

Hydrogen storage, handling and distribution – to allow storage of hydrogen at central production plant and distribution to the customer base should be seen as a top priority for Energy.

Main deliverables:

Electrolysers at variable scales developed and demonstrated for use in renewable energy integration systems, and injection of hydrogen into the grid.

On-site hydrogen production systems using renewable fuels for decentralised hydrogen production; biological reactors with larger volumetric density & scale.

Fuel cell systems for CHP and power only applications that incorporate new technologies.

Hydrogen storage (large scale) and distribution systems developed and demonstrated.

Fuel cells and hydrogen benefits for Europe

Top 2015 technology by World Economic Forum

Recognised by the Word Economic Forum in Davos as one of the top 2015 emerging technologies,[1] fuel cells and hydrogen are amongst the most promising low carbon solutions. They have been rightfully identified by the European Commission as key to Europe's effort to decarbonise its energy sector and increase energy efficiency.[2]

In essence, they can serve as a bridge to the recognised needs to:

- Store domestic renewables at a virtually unlimited scale, boost their share in the mix and increase Europe's energy independence.
- Decarbonise transport through the deployment of zero-emission fuel cell electric vehicles powered by hydrogen.
- Reduce primary energy consumption as well as emissions of greenhouse gases, pollutants and particulates for heating and decentralized power production.[3]

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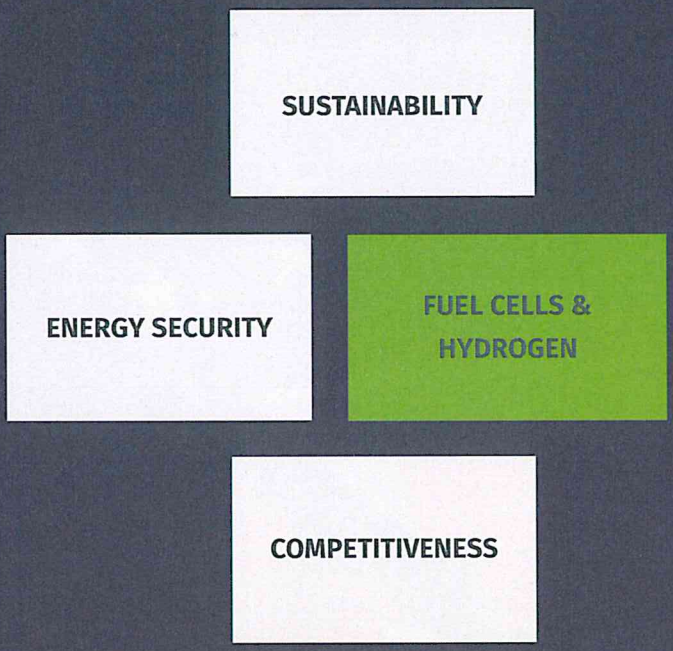
A triple win for Europe

Fuel cells and hydrogen constitute a triple "win" for Europe because they simultaneously enhance energy security, improve environmental sustainability, and boost economic competitiveness

Be it for the production of heat and electricity for buildings, as an electrical power source for vehicles or energy storage enabler, fuel cells and hydrogen can help address the most pressing European challenges and priorities.



Sustainability

Solutions

A radical reduction in harmful emissions can be achieved through the deployment of zero emission vehicles and the use of fuel cells for decentralized power production and heating of buildings.

Proof point

CO2 could be cut by between 64 per cent and 97 per cent in 2050

Energy security

Solutions

As hydrogen can be produced from a range of primary energy sources, its availability is almost limitless, thus allowing Europe to enjoy energy security and independence.

Proof point

Cut fuel consumption would deliver between €58 and €83 billion a year in fuel savings for the EU economy by 2030

Competitiveness

Solutions

Hydrogen is an extremely flexible energy carrier that can be used in all fields of the industry, with markets worth billions of euros across numerous applications.

Proof point

Europe could improve its growth prospects and create 500,000 to 1.1 million net additional jobs in 2030 through auto sector innovation

Data based on the report "Fuelling Europe's Future" by Cambridge Econometrics (CE), in collaboration with Ricardo-AEA (2013). It considers the economic impact of a series of forward looking scenarios that encompass alternative visions of Europe's future vehicle fleet.[4]

[1] Top 10 emerging technologies of 2015, Meta Council on Emerging Technologies, World Economic Forum (2015): http://tinyurl.com/n6u5flz
[2] Strategic Energy Technology Plan (SET Plan): https://setis.ec.europa.eu/about-setis/set-plan-governance
[3] Advancing Europe's energy systems: Stationary fuel cells in distributed generation: A study for the Fuel Cells and Hydrogen Joint Undertaking, Roland Berger, FCH JU, 2015 http://www.fch.europa.eu/sites/default/files/FCHJU_FuelCellDistributedGenerationCommercialization_0.pdf
[4] http://www.camecon.com/EnergyEnvironment/EnergyEnvironmentEurope/FuellingEuropesFuture.aspx

Fuel cells and hydrogen
the sector today

Growing European industry

The fuel cell and hydrogen sector is developing quickly thanks to global leaders such as Siemens, Air Liquide, Daimler and also a dynamic landscape of innovative SMEs.

With more than 85 member companies established in 18 European countries (doubled over the last couple of years), the New Energy World Industry Grouping (NEW-IG) (www.new-ig.eu) is the leading industry association working to accelerate the market deployment of fuel cells and hydrogen technologies at the European level.

NEW-IG MEMBERS

Dynamism and innovation

According to industry data, the sector has experienced considerable growth since 2008, the year when the first European public-private partnership for fuel cells and hydrogen was launched.

10%
average increase of annual turnover

16%
annual increase in patents granted in the EU to European companies
(compared to an average of 1.5% for all European industries)

8%
average increase of R&D expenditures

6%
growth in jobs per year while average EU job market has contracted

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Closer than you think

From a technology point of view, fuel cells and hydrogen have achieved remarkable progress and are closer, mature and more ready than one may think:

hydrogen
is already produced in large quantities for industrial applications.

5,000+
forklift fleets powered by fuel cells and hydrogen are being used in warehouses of corporates such as La Poste in France or Wal-Mart and Coca-Cola in the US today.

+100,000
stationary systems are being used around the world by companies like Bouygues Telecom, Toshiba or Apple.

500+
electric vehicles powered by hydrogen are already operating in Europe, mainly in Germany, Scandinavia, the UK, the Netherlands and France. The operation of fuel cell buses for public transport has already started in London, Hamburg, Cologne, Milan, Oslo and other cities.

50+
hydrogen stations will be built in Germany by the end of 2015. By 2023, Germany will have around 400 hydrogen refuelling stations, becoming the first country with basic hydrogen refuelling station network.

Globally competitive

To be globally competitive, Europe needs to build on innovation to transform its economy and maintain and create new jobs. According to Ricardo-AEA and the economic modelling by Cambridge Econometrics,[2] innovation in the auto sector could create between 500,000 and 1.1 million new jobs in Europe by 2030. Beyond Europe, other regions of the world such as Japan and California are investing in the technology and moving fast.

300
fuel cell electric vehicles and 22 hydrogen stations have already been implemented on California's roads.

2040
The Government of Japan has recently launched a "hydrogen society strategy" aiming at establishing a "hydrogen society" by 2040.[3]

+100,000
residential fuel cells installed in Japan, with a set goal of installing them in 5.3 million homes by 2030, about 10 percent of all households

telecoms
Global tech/IT and telecom companies in countries like the US or India have entered into partnerships. with a number of fuel cell manufacturers aiming to increase deployment of fuel cells for telecommunications backup and grid stabilization.

korea
Korean government launched an industrial complex in Gwangju to help Korea emerge as a global leader of fuel-cell vehicle production.

[1] Trends in investments, jobs and turnover in the Fuel cells and Hydrogen sector (Fuel Cells and Hydrogen Joint Undertaking, 2013): http://www.fch-ju.eu/sites/default/files/Investment%20jobs%20%26%20turnover%20in%20FCH%20Sector.pdf
[2] Fuelling Europe's Future: How auto innovation leads to EU jobs, Cambridge Econometrics (2013) http://www.camecon.com/EnergyEnvironment/EnergyEnvironmentEurope/FuellingEuropesFuture.aspx
[3] Strategic Road Map for Hydrogen and Fuel Cells, Japan's Ministry of Economy, Trade and Industry (METI) (2014) http://www.meti.go.jp/english/press/2014/0624_04.html