



UK H<sub>2</sub> Mobility

# **Developing a rollout strategy for hydrogen transport in the UK**

**Fuel Cells and Hydrogen Joint Undertaking (FCH JU)  
5<sup>th</sup> Stakeholders' General Assembly  
Paris – 12<sup>th</sup> October 2012**

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# Growing momentum at national levels, co-ordinating actions to enable hydrogen transport and overcome initial challenges

## Current state of initiatives



**Public-private coalition** of 17 companies evaluating a business case for a HRS refuelling station network and assessing options of forming a Joint Venture to inv



**Government** and **industry** partners currently building a coalition to evaluate the commercialisation of a refuelling station network and FCEV roll-out



**Fuel Cells and Hydrogen Joint Undertaking: European** study to evaluate alternative powertrains for urban **buses** with public authorities and industry



The **Danish Government** has announced a new Energy Plan 2020 that includes a **range of initiatives** for hydrogen infrastructure and FCEVs, amongst which are significant incentives



**Government** and **13 companies** announced program for **FCEV mass production** and **100 HRS** by 2015 **connecting** 4 metropolitan areas



**Government** announced program to finance and deploy **100,000 FCEV** and **170 HRS** by 2020



**Initiatives** in California and at the East Coast H<sub>2</sub> Highway; partially funded by Department of Energy

New "**Clean Fuels Outlet**" act in **California** requiring deployment of HRS



# UK H<sub>2</sub>Mobility: joint industry-government project to determine the potential for hydrogen and to develop a roll-out strategy

## Launch partners

- UK Government departments



- Car OEMs

DAIMLER



- Hydrogen providers/  
producers and utilities



- Technology providers



- Public-private partnerships



- Fuel retailers



## Companies interviewed in Phase 1A

- Fuel retailers



- Fleet operators and  
lease companies



Lex Autolease

- Valuation companies



- Grid operator



## Goal

- Evaluate the potential for **hydrogen as a transport fuel** and develop a **rollout strategy** that will contribute towards
  - Decarbonising surface transport
  - Creating new economic opportunities
  - Diversifying energy supply
  - Reducing local environmental impacts





# UK H<sub>2</sub>Mobility is following a stage-gated approach:

## Phase 1 concludes at the end of 2012

	Phase 1a: Role of hydrogen transport in the UK	Phase 1b: Hydrogen rollout strategy development	Phase 2: Business case development	Phase 3: Implementation plan
<b>Core activities</b>	Establish a robust evidence base for the role of H <sub>2</sub> in the UK market	Develop strategy for H <sub>2</sub> rollout in the UK and stress-test alternative scenarios to prove robustness of plans	Develop an agreed business case	Facilitate coordinated action to deliver the vision for hydrogen rollout
<b>Timeline</b>	Dec 2011-Mar 2012	Apr 2012-Dec 2012	Jan 2013-Aug 2013	Aug 2013-Dec 2013
<b>End products</b>	<ul style="list-style-type: none"><li>▪ A blueprint for hydrogen rollout in the UK, stress tested against key sensitivities</li><li>▪ Range of infrastructure and vehicle roll-out scenarios, including likely investments and revenues</li></ul>	<ul style="list-style-type: none"><li>▪ A detailed plan for structuring rollout of hydrogen vehicles and infrastructure in the UK</li><li>▪ Public report summarising activities of the consortium</li></ul>	<ul style="list-style-type: none"><li>▪ An agreed business case and implementation plan for rollout of hydrogen vehicles and refuelling infrastructure in the UK</li></ul>	<ul style="list-style-type: none"><li>▪ Commercial, synchronised deployment of fuel cell electric vehicles and hydrogen refuelling infrastructure in the UK</li></ul>
<b>Status</b>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

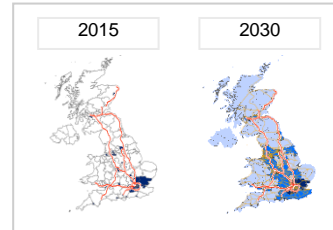


# UK H<sub>2</sub>Mobility: four 'work streams' producing evidence base

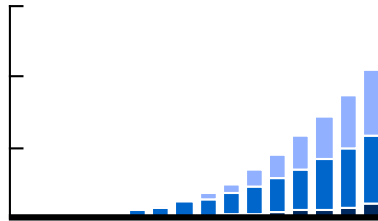
## 1 Market research : consumers and fleet managers



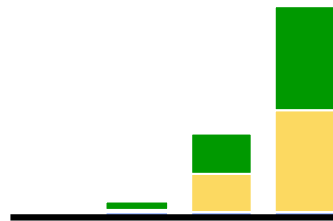
## 2 HRS rollout scenarios



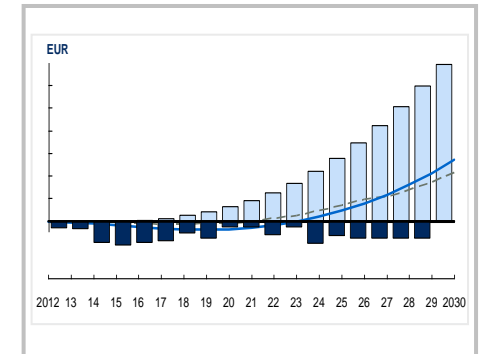
## 3 FCEV ramp-up scenarios



## 4 H<sub>2</sub> production and distribution road map



## Cross-industry, evidence-based perspective





# Selected achievements of UK H<sub>2</sub> Mobility to date

## Achievements

### Market research on consumers and fleet managers

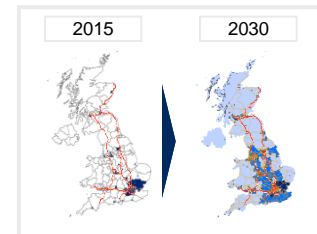
## Selected end products

- Application of **qualitative and quantitative market research** to understand customer attitudes on hydrogen, FCEV and HRS infrastructure
- Quantification of customers' **willingness-to-pay** for hydrogen and FCEV and **segmentation** of customers



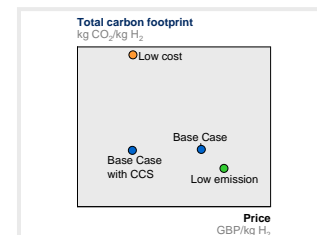
### Rollout scenarios for H<sub>2</sub> station network and FCEVs

- Development of **H<sub>2</sub> station rollout** and network requirements (e.g., density, sizes, location)
- Development of **FCEV roll-out** scenarios and **forecasts** with car OEMs (e.g. number of FCEV in different passenger car and LCV<sup>1</sup> segments)



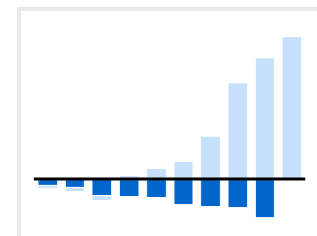
### H<sub>2</sub> production and supply roadmap

- Assessment of **H<sub>2</sub> production technologies** on cost and CO<sub>2</sub> emissions, e.g. SMR<sup>2</sup> vs. water electrolysis
- Definition of H<sub>2</sub> **production and supply mixes** focusing on CO<sub>2</sub> abatement and economic efficiency
- Analysis of **wider benefits of water electrolysis** to energy system



### Initial rollout scenario

- Description of an initial **cross-industry perspective**
- Financial assessment** of rollout scenario including NPV, investment required, payback time
- Evaluation of **additional levers to improve scenario**
- Investigation of **barriers, market failures and intervention options**



<sup>1</sup> Light Commercial Vehicles

<sup>2</sup> Steam methane Reforming



# A staged HRS rollout strategy will enable the UK to achieve nationwide coverage in 3 phases

## Rollout approach

**Classification of regions** and motorways in 3 tiers based on scoring of population, traffic etc.

- **Tier 1 covered by 2020**

Focus on **major population centres**, enable long distance **travel between Tier 1 regions- covered by 2020**

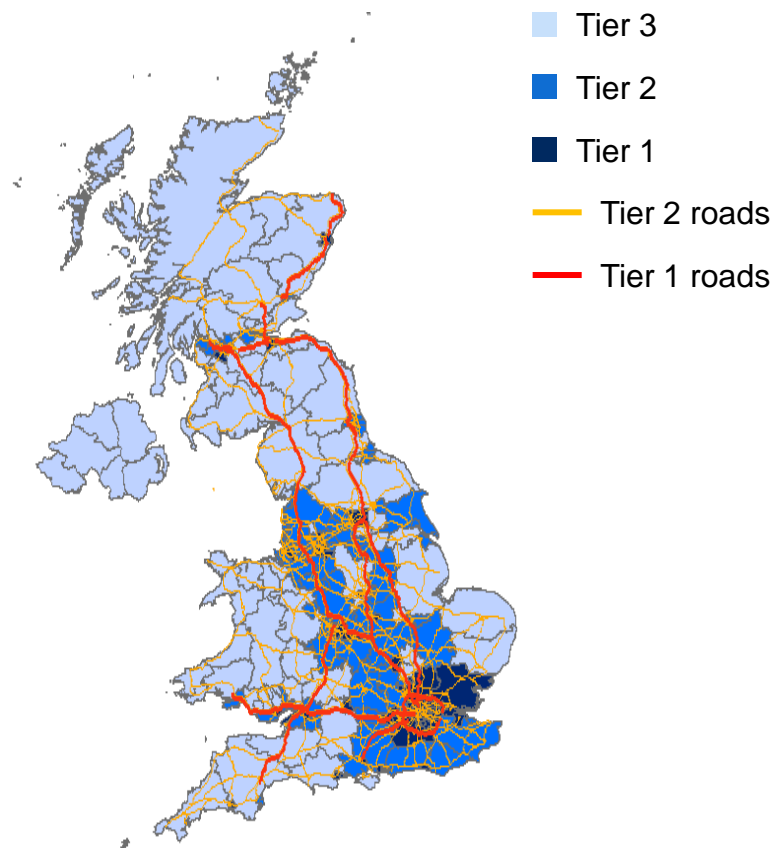
- **Tier 2 by 2025**

Extend close-to-home refuelling to **70%** of the population, **full coverage** of major road network

- **Tier 3 by 2030**

Extend close-to-home refuelling to the **whole of the UK**, including less populated regions

## Expected HRS network





# Key focus: linking HRS deployment with initial vehicle sales to minimise risk of low utilisation while meeting customer needs

## Aim

- Ensure that enough stations are available in early years to meet needs of early adopters
- Link the subsequent rollout of hydrogen refuelling stations (HRS) to the deployment of FCEVs over time

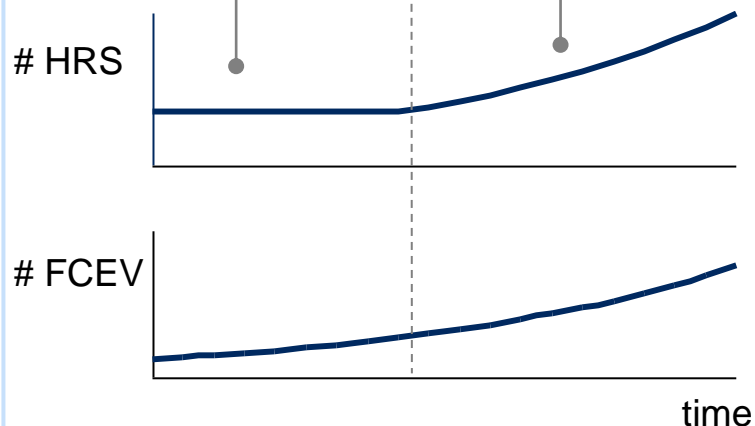
## Concept

### Initial seeding of HRS

- Fixed number of HRS deployed
- No further HRS built until FCEV parc reaches agreed threshold

### Mass-market rollout

- HRS deployed to match vehicle sales
- FCEV to HRS ratio set to ensure profitability of infrastructure



## Advantages

- Approach minimises risk of low station utilisation – further expansion of HRS conditional on FCEV sales growing
- Provides customers with confidence that infrastructure will grow
- Provides confidence to OEMs that new customers will be unlocked as coverage increases





# Roll-out of hydrogen for transport will provide opportunities across the entire value chain while decarbonising transportation

## Overview of potential benefits of hydrogen transport in the UK

### Hydrogen providers



- Assist in **creation of multi-billion GBP hydrogen market** for transportation
- Use **assets and capacities** to expand into new business application
- Enter new business field by providing **refuelling technology**

### Utilities



- Benefit from **additional demand** for electricity (e.g. for water electrolysis) and for **renewable energy sources**
- Take advantage of **benefits** of hydrogen to **wider energy system**, e.g. load balancing, creation of strategic demand

### Technology providers



- Participate in and shape **establishment of industry standards**, e.g. for refuelling technologies and protocols
- Create additional and accelerated demand for own technology by helping to **fast-track establishment of hydrogen market**

### Investors



- Secure **return** through early involvement in **first financing rounds**
- **Interact with industry players and government** to develop options for financing aspects of the roll-out strategy

