H2ME/H2ME2 – the largest EU funded hydrogen infrastructure and vehicle demonstration

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What to talk about?

1. H2ME project general overview
2. Different coalition strategies
3. Snapshots of project status
4. Emerging conclusions
H2ME brings together high level partners in these initiatives in a European approach

This project has received funding from the **Fuel Cells and Hydrogen 2 Joint Undertaking** under grant agreement No 671438 and No 700350. This Joint Undertaking receives support from the **European Union**’s Horizon 2020 research and innovation programme, the New European Research Grouping on Fuel Cells and Hydrogen (“N.ERGHy”) and **Hydrogen Europe**.
H2ME – a major pan-European effort to support commercialisation - part of a much larger vehicle and HRS rollout in Europe

H2ME 1
29 stations
>300 cars and vans
€70m total cost
€32m funding
Started June 2015

H2ME 2
20 stations
>1100 cars, vans and trucks
€100m total cost
€35m funding
Started May 2016

- >45 refuelling stations
- >1400 cars, and vans
- €170m total cost
- €67m funding
- > 40 organisations
A major European activity!
H2ME initiative (2015 – 2022)

Project overview

**Fuel cell vehicles:**
- 500 OEM* FCEVs
- 900 fuel cell RE-EV vans

**New hydrogen refuelling stations:**
- 20 - 700bar HRS in Germany
- 11 - 350bar and 700bar HRS in France
- 11 - 700bar HRS in Scandinavia
- 6 – 350bar and 700bar HRS in the UK
- 1 - 700bar HRS in NL

**Hydrogen rollout areas:**
- Scandinavia, Germany, France, UK, The Netherlands

**Observer coalitions:**
- Belgium, Luxembourg, and Italy

**Industry observer partners:**
- Audi, BMW, Nissan, Renault, Renault Trucks, AGA, OMV

*OEM refers to original equipment manufacturer.
Vehicles deployed under H2ME initiative

Deployment of partner models

- **Daimler B-Class F-CELL**
  - 700 bar hydrogen tank
  - 40 already deployed

- **Daimler GLC F-CELL**
  - 700 bar hydrogen tank
  - 150 being deployed

- **Toyota Mirai**
  - 700 bar hydrogen tank
  - 100 being deployed

- **Honda Clarity Fuel Cell**
  - 700 bar hydrogen tank
  - 10 already deployed

- **Renault Kangoo ZE-H2**
  - 5kW fuel cell module with 350-bar
  - >900 being deployed

- **Symbio RE Maxity**
  - 350 bar hydrogen tank
  - 3 being deployed

Other vehicles procured

300 other vehicles will be procured by project partners e.g. in Paris and in Hamburg
# Hydrogen Mobility Europe deployment timeline

**Deployment phase**
*All vehicles in operation*

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<td><strong>Daimler FCEVs</strong></td>
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<td><strong>B-Class F-Cell from 2015Q2</strong>&lt;br&gt;40 in operation in the project</td>
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<td><strong>GLC F-Cell from 2018Q3</strong>&lt;br&gt;150 in operation</td>
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<td><strong>Honda FCEVs</strong></td>
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<td><strong>Honda Clarity from 2017Q1</strong>&lt;br&gt;10 in operation in the project</td>
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<td><strong>Toyota FCEVs</strong></td>
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<td><strong>Toyota Mirai from 2017Q3</strong>&lt;br&gt;100 in operation in the project</td>
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<td><strong>Procurement of other FCEVs</strong></td>
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<td><strong>FC range-extended electric vans</strong></td>
<td><strong>Renault Kangoo ZE-H2 from 2015Q3</strong>&lt;br&gt;900+ in operation</td>
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<td><strong>FC range-extended electric trucks</strong></td>
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<td><strong>HRS</strong></td>
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<tr>
<td><strong>Significant HRS and Vehicle deployment outside H2ME projects</strong></td>
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- **Daimler FCEVs**: B-Class F-Cell from 2015Q2, GLC F-Cell from 2018Q3
- **Honda FCEVs**: Clarity from 2017Q1
- **Toyota FCEVs**: Mirai from 2017Q3
- **Procurement of other FCEVs**: Other vehicle types procured and deployed from 2017Q2
- **FC range-extended electric vans**: Kangoo ZE-H2 from 2015Q3
- **FC range-extended electric trucks**: 
- **HRS**: Various numbers from 2015Q2 to 2018Q3
- **Significant HRS and Vehicle deployment outside H2ME projects**: Various numbers from 2015Q2 to 2018Q3
Deployment & National refuelling infrastructure introduction strategies – H2ME & broader context

- **Risk sharing JV** - Widespread deployment of 100 HRS by 2019 and further expansion in line with development of vehicle numbers to provide a national network and allow OEM vehicle introduction.

- Deployment based on *expected sales of OEM vehicles (facilitated by tax regime).* Aiming at a network of stations by 2020 across the SHHP countries to allow transnational driving within the region.

- **Deployment in 3 stages** - clustered phase (2015-2020), accelerated ramp-up (2020-2025) and established market (2025-2030) characterised by a progressive introduction.

- **Initial strategy based on 350bar RE-EVs in captive fleet** linking H₂ supply and vehicles, which de-risks early hydrogen infrastructure investments across the country before OEM vehicles arrive.


### National Strategy

- **HRS network**
  - 20 x 700 bar HRS in Germany
  - 10 x 700 bar HRS in Scandinavia
  - 6 x 350/700 bar HRS in the UK
  - 10 x 350/700 bar HRS in France
  - 1 x 700 bar HRS in the Netherlands

### Vehicles

- 400 FCEVs across Scandinavia, Germany, France, the UK and the Netherlands
- >1,000 RE-EV vans and trucks in France, Germany, Norway and the UK
German strategy

Widespread deployment of **100 HRS by 2019 (700bar)** and further expansion in line with development of vehicle numbers **to provide confidence by delivering a dense national network** in parallel to the large-scale introduction of OEM vehicles.

An increasing focus is now being placed on **‘demand-led’ deployments of stations** where vehicle demand is secured in advance of site selection.

The German government provides **grants for station installation** and incentives covering up to 40% of the cost premium, and **tax exemptions for FCEVs**.

In 2018 the Federal Ministry of Transport, Building and Digital Infrastructure (BMVI) released a call for bids with a total of up to **15 million euros of funding available for FCEVs and HRS**.

UK strategy

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<th>HRS network rollout from 2016 to 2023</th>
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<td><strong>1) Initial cluster in the South East</strong></td>
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<td>- Network in and around London</td>
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<td>- Stations sited near main roads</td>
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<td>- ~ 20 stations provide initial coverage</td>
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<td><strong>2) Create new HRS clusters</strong></td>
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<td>- New HRS clusters (min. 2 stations) in large urban areas with a H2 strategy and willing early adopters</td>
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<td>- Sited near main roads and also major national motorways</td>
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<td><strong>3) Secure basic national driving</strong></td>
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<td>- A basic national coverage along the major North-South and East-West motorways</td>
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<td>- Located near to urban centres to seed add. uptake</td>
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- Originally, no specific linkage between vehicle and HRS deployment was planned but *letters of intent are increasingly being sought in advance of HRS deployments* to guarantee H₂ demand.
- The UK government provides *grants for both HRS installation and purchase/lease of FCEVs for fleets.*
- The Office for Low Emission Vehicles (OLEV) has created a *£23 million fund* to accelerate the uptake of FCEVs and HRS (2018).
French strategy

- **National network started using lower-cost 350bar HRS** to support local captive fleets with limited dual-pressure (700 & 350bar) HRS deployed. There is now an *increasing focus on dual-pressure stations* to ensure future-proofing for passenger cars.

- **Strategy based on captive fleet applications** which allows hydrogen stations to be deployed at the same time as a vehicle fleet, thereby securing demand and de-risking early HRS investments. *Letters of intent are obtained prior to HRS investment decisions*, thereby confirming demand and HRS utilisation.

- The French government has announced *100 million euros in funding* for the development of the hydrogen sector from 2019.

Source: Element Energy  1 – Based on consultation of OEM partners in H₂M France
Scandinavian strategy

Strategy based on introduction of 700bar OEM FCEVs to create a **first network across Scandinavia.**

Vehicle deployment is supported by **generous national tax regimes and other support mechanisms** (free public parking, etc.).

There are both **government grants and tax exemptions for vehicles and HRS.**

It has been assumed that low taxes would be a sufficient trigger for FCEV breakthrough but **vehicle costs and the popularity of BEVs (and limited availability of FCEVs) have proved to be barriers.**
Dutch strategy

Strategy based on **gradual deployment of HRS and vehicles clustering around major cities** (e.g. the Hague).

Vehicle and infrastructure deployment is supported by **generous national tax regimes and other support mechanisms** (free public parking, access to bus lanes etc.).

Planned deployment of **4 public HRS by 2018 and 20 in 2020**.
Deployment to date (September 2018) H2ME initiative

15 HRS and 360 vehicles have been deployed to date:
- 170 Renault Kangoo vans
- 40 B Class F-CELL
- 80 Toyota Mirai
- 10 Honda Clarity
- 60 vehicles procured by project partners

3 HRS operational in the UK (6) including 2 with on-site electrolysis

3 HRS operational (11) in France including 1 with on-site electrolysis

6 HRS operational in Scandinavia (11) including 3 with on-site electrolysis

3 HRS operational (20) in Germany

7 HRS planned for the Paris region within H2ME

*Numbers in brackets () denote the total number of HRS planned for deployment under the H2ME initiative

**Significant HRS and Vehicle deployment is taking place outside of the H2ME initiative
Project Snapshot (vehicles)

To date, 360 vehicles have been delivered to end-users

Operating profiles
The vehicles in the project are being demonstrated across a wide range of use cases including:

- Private usage
- Fleet operation e.g. taxis, car leasing companies, fire service
- Business operations for delivery van drivers

Project vehicles have recorded over 1,770,000 km driven since the first FCEVs were deployed in Germany in 2015
Project Snapshot (HRS)

To date 15 HRS are in operation

- **Project HRS have dispensed over 15 300 kg of hydrogen** since the first station was opened in Denmark in 2015.
- The Orly (Paris) HRS alone has dispensed 8 250kg of H₂ since its opening in Q3 2017.
- **Average refuelling time of vehicles is 170 seconds.** This has also been demonstrated in other projects to date (e.g. Hytec) and confirms that refuelling time of FCEVs is comparable to that of conventional petrol and diesel vehicles.
- The availability of stations in the H2ME project has so far been high - **average station availability is over 95%** at the majority of sites in the project, and 4 HRS currently exceed the target of 98% availability for the stations in the project.
Emerging conclusions

- We see the unequivocal importance of renewable hydrogen to achieving **significant WTW emission savings** over conventional and electric vehicles.

- Analysis suggests that **hydrogen infrastructure scales better** than competing zero emission technologies, both in terms of infrastructure costs and logistics.

- Lessons learnt in Germany have **cut rollout time of HRS** from 24 to 16 months with an end target of 12.

- In certain applications and operational needs, **FCEVs provide the only viable zero-emissions mobility solution.**
A swiss army knife for meeting energy and climate policies

Accommodate increases in renewable energy production

Electrolysis as a grid balancing tool

H2 makes energy transition feasible

FCEVs have significantly lower GHG emissions compared to ICE

H2 contributes to meeting CO2 reduction targets
All of the above supports project messages

- Clear indication of the environmental benefit of hydrogen cars and fuel cell technology
- Hydrogen is a solution today for fleets and private customers
- Help shape the European debate on hydrogen mobility
- Demonstrating the readiness of hydrogen for commercial operation
Thank you for your attention!

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