

# NEXTHYLIGHTS

## Overview and Status Quo of the NextHyLights Project

Ulrich Büniger, Hubert Landinger – Ludwig-Bölkow-Systemtechnik GmbH

Erich Ramschak, Fabian Köhler – AVL List GmbH

Ben Madden, Roberto Zaetta – Element Energy Ltd.

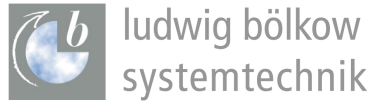
Ingo Bunzeck – Energy Research Centre of the Netherlands (ECN)

Fuel Cells & Hydrogen Joint Undertaking Stakeholders General Assembly  
Brussels/Belgium · 10 NOV 2010

**a project called for by the European Fuel Cells and Hydrogen Joint Undertaking (FCH JU) to assist the preparation of next large scale hydrogen and fuel cell electric vehicle demonstration projects in Europe**

# Project partners, structure & expected results

## NEXTHYLIGHTS



**BUCHER**

**DAIMLER**



**TOTAL**

**Passenger cars**



**City buses**



**Other vehicles**



International, national and regional  
H<sub>2</sub> & FCEV strategies

International industry strategies to commercialize  
vehicles and H<sub>2</sub> infrastructure

Demo projects and programs  
with focus on Europe

Status of technology development  
and techno-economic benchmarking

Regions & municipalities commitment

Cross-sectional infrastructure synergies

Environmental analysis and public acceptance

Business plan for roll-out strategy (buses)

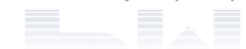


CENTRO  
RICERCH  
FIAT

**elementenergy**



Proton Power Systems plc Group



**Statoil**

**VATTENFALL**



- **Highest commitment**
  - Europe: FCH JU (MAIP), Germany (NIP, H2 Mobility), Scandinavia
  - internationally: U.S. / California
- **3 - 5 years lead time** expected to develop fast following committed regions
- **Grow-out from Germany** organically to neighbouring regions (Scandinavia, Benelux, UK, A, I)
- More regional dispersion is appreciated, but only with larger number of vehicles and as a consequence of **higher funding availability**
- **Scandinavia** offers specifically **good conditions** for transition period with
  - high tax exemptions for fuel cell vehicles (DK, N)
  - electricity tax exemptions for hydrogen from electrolysis (DK)
  - high funding levels for fuel cell vehicles (DK, N)
- The public-private activity **H2 Mobility** (D) is seen as relevant committed body and as blue print for other regions

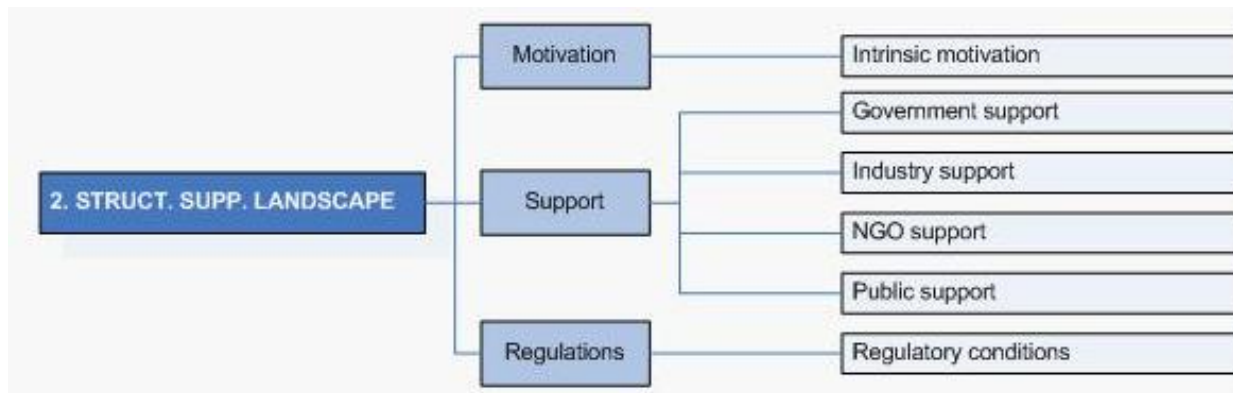


- New potential regions are considered
- How to assess 'new' regions' commitment?
- Tool approach
  - multiple eligibility categories & criteria
  - criteria are subdivided in indicators
  - indicator-scores can be evaluated by means of weighted summation (next slide)

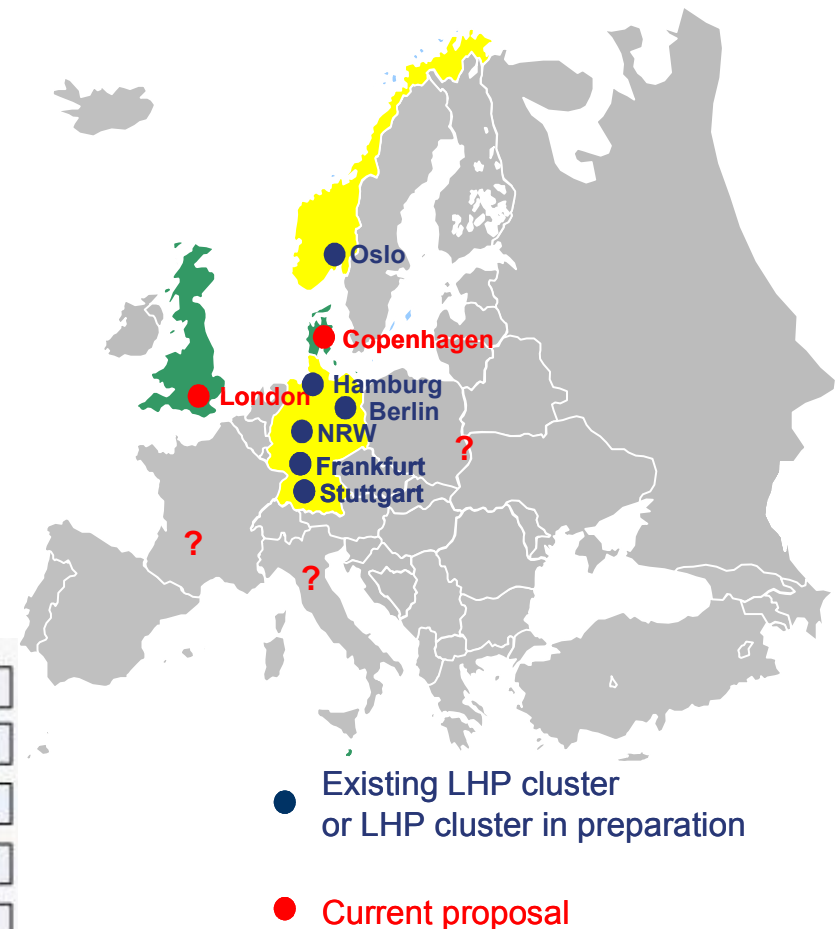
### Categories

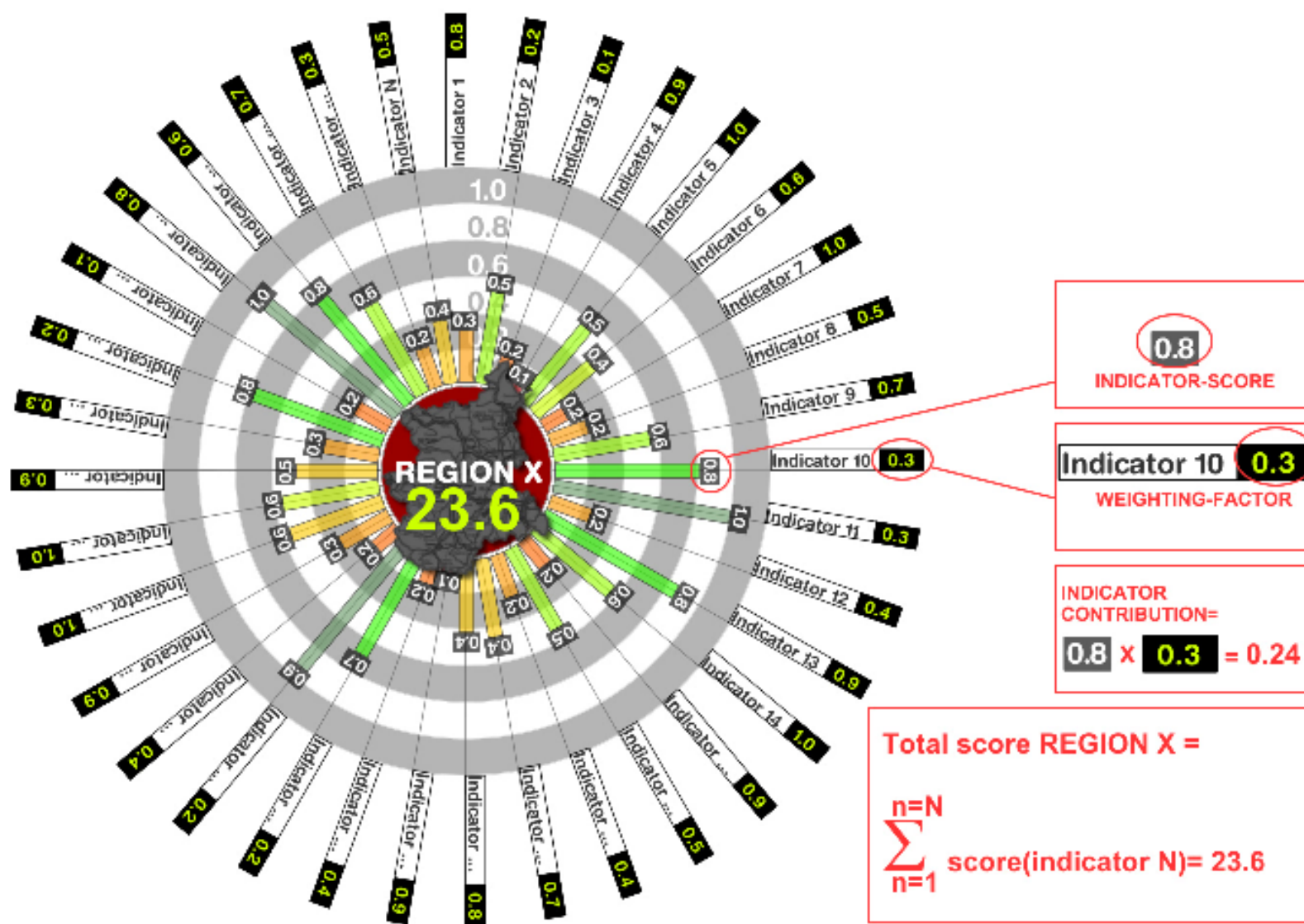
### Criteria

### Indicators



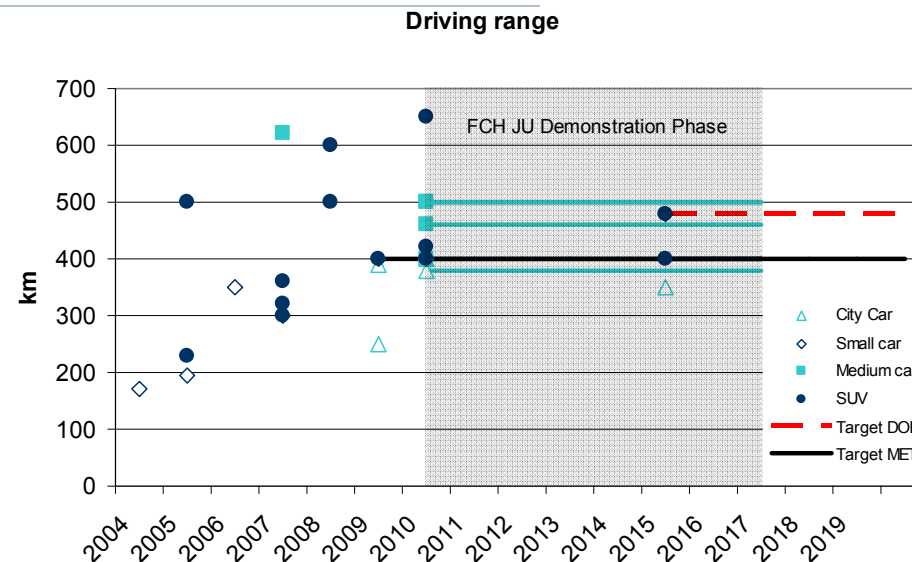
### Active passenger car demo sites





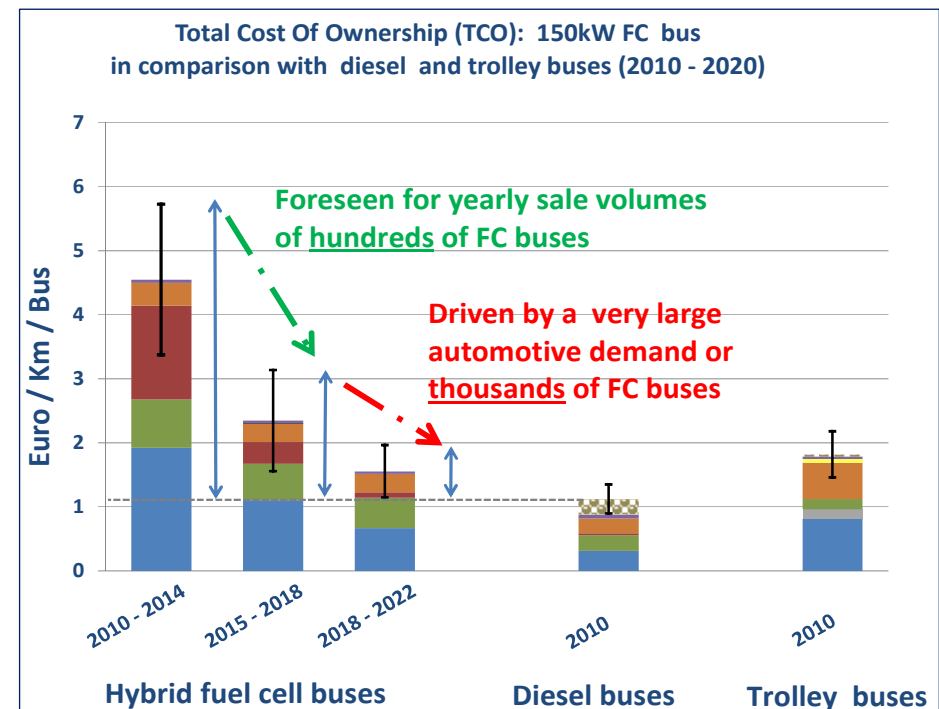
# Passenger cars – status quo

- Technical **learning** has been **tremendous** over the last 10 years
- Multiple OEMs believe to reach **technical goals by 2015 and cost goals by 2020**
- In principle industry has interest in **larger scale projects**
- **Next FCEV generations** will be rolled out after **2013**
- **OEMs will probably focus** on world regions with most stringent requirements to provide low emission vehicles. This may reduce vehicle availability for specific regions. OEMs go where
  - best conditions, i.e. funding levels for FCEV are provided
  - least bureaucracy to acquire public funds can be expected
- No technology breakthroughs but **continuous improvements** are expected
  - current generation: focus on technology readiness
  - next generation: focus on market readiness
- Mutual **agreement** of car & energy/retail industry on aligned roll-out of vehicles and hydrogen refuelling stations is **urgently needed**
- Policy framework not sufficiently attractive to stimulate **all** OEM's commitment to FCEVs



- Car industry strategy follows **stepwise extension** of vehicle fleet in 'vehicle generations'
- For passenger cars **demo projects** remain **continuously relevant** until 2015 to better understand customer preferences and consumer behaviour. Available funds should be well balanced across the 3 remaining calls:
  - **2011/12: smaller projects** for then appropriate and prepared regions and/or special purpose cars (e.g. taxis, vans)
  - **2013: one or more large scale project(s)**
- Next demos must be **implemented in long-term strategy** i.e. refuelling stations must be part of future national / regional / municipal roll-out plans
- Clear **customer orientation** is needed in the next demo projects i.e. infrastructure build-up to start in clusters with multiple refuelling stations gradually growing along corridors & in refuelling capacity. Organic rollout to start from existing hubs
- **Standardized** refuelling **equipment**, vehicle interface and procedures important for economic and certification efficiency should be applied

- State-of-the-art hybrid fuel cell buses is one of few **viable zero tailpipe emission** options for urban transit. Even with hydrogen from natural gas considerable carbon savings over conventional diesel buses can be achieved
- **Key barrier to commercialisation** of the hybrid fuel cell bus technology is its high capital and ownership cost
- The analysis suggests that the **economic performance of hybrid FC buses will dramatically improve over time** but this will require:
  - a global deployment of 100's of fuel cell buses by ~ 2015
  - adoption of automotive stacks at large scale and/or **increase in global bus orders to 1,000's of fuel cell buses by 2020**



## Buses – recommendations for FCH JU's next calls **NEXTHYLIGHTS**

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- Before committing to new large bus deployments, next generation hybrid fuel cell buses have to prove outstanding **reliability** - this should be demonstrated by current wave of demonstration projects (Amsterdam, Cologne, Hamburg, CHIC, etc.)
- Assuming this is achieved, the next target is **cost reduction**. According to industry players the next step here is the deployment of buses in the low 100's by 2014/15
- It is suggested that FCH JU considers bus demonstration projects:
  - **Support large scale roll out of buses** (in 3 – 6 cities)  
  
Funding focus is a) clear pathway to significant bus cost reduction and b) achievement of several technical targets (procurement process based on competitive tenders and performance based contracts)
  - **Support smaller deployments explicitly favouring the entry of new competitors in the market** (e.g. 5 – 10 buses per player)

Competition would accelerate technology cost reduction

- **Motivation** for fuel cell drive trains is extended operating range (vs. batteries), zero emissions (vs. combustion engines) and potential for cost benefit
- About 36 different fuel cell demo projects in the sectors
  - **utility vehicles:** material handling (forklift, pallet truck, lift truck, tow tractor), tractor, sweeper machine, truck, ice cleaner, on-site transport
  - **bikes:** scooter, motorbike
  - **boats:** passenger boat, leisure boat/yacht, submarine
- **Forklift** is the **most present group** – 700 forklifts (growing to 1,000) in the U.S. and only 10 in Europe
- Most common hydrogen storage pressure is **35 MPa**.  
Some 20 MPa and 70 MPa systems
- Other vehicle applications need **on-site hydrogen refuelling**



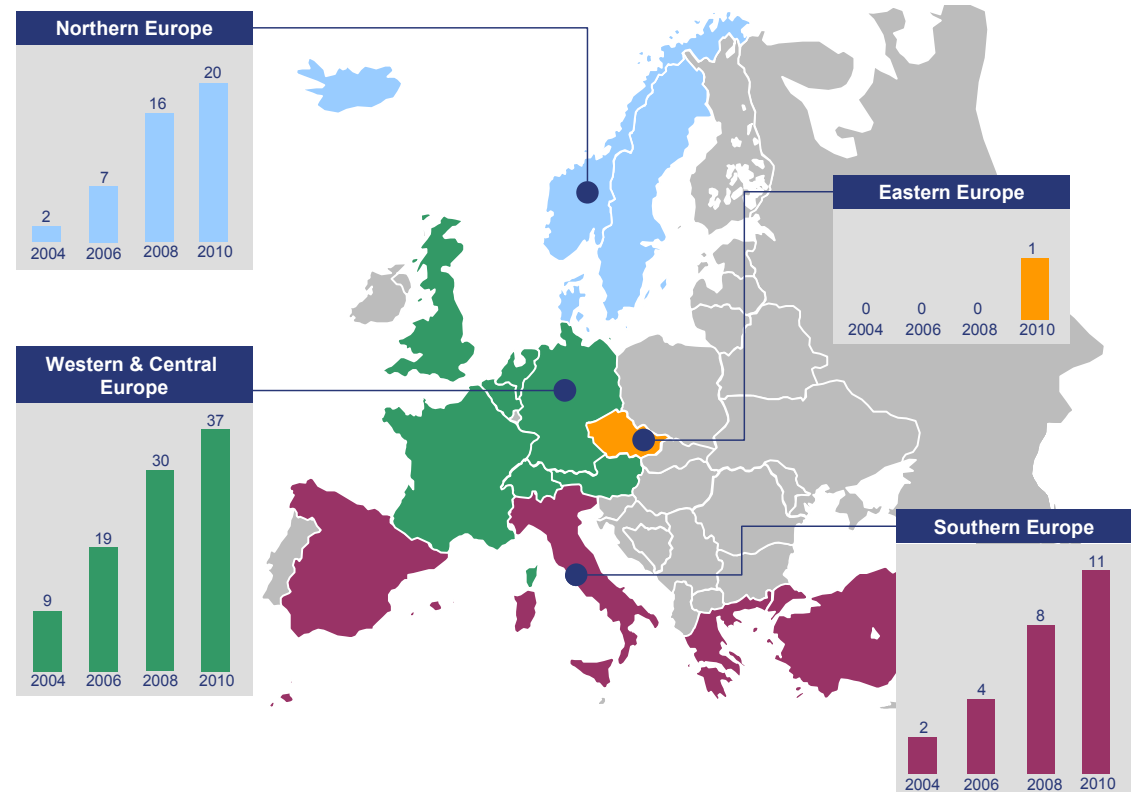


### Forklift trucks

- High capacity application of **>10 vehicles preferable** in three shift operation: reduces operating costs per hour (allocation of investment costs)
- **Substitution of Diesel ICEs**
  - provides emission and energy savings
  - cost benefit due to lower energy costs
  - indoor operation strengthens advantages of fuel cell forklifts
  - fuel cell forklifts should be applied to higher load segment >2.5t
- **Utilisation of existing hydrogen supply** at e.g. chemical or iron metal industry (for production processes)
- **4 year demonstration periods** for gathering sufficient data to prove lifetime, reliability and cost predictions



- **Technical synergies between car & bus refuelling** are obvious, but **no utilisation synergies** are expected as refuelling stations for captive fleets are different from public refuelling stations
- **Renewable hydrogen** is seen as one but not most important target in early transition across all vehicle segments. Yet, individual and visible pro-active industry strategies are welcomed by vehicle manufacturers



# H<sub>2</sub> refuelling station synergies – recommendations **NEXTHYLIGHTS**

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- Next demo projects should be **built on** results of **existing activities** (CEP, CHIC, H2mS, HyCHAIN, HyFLEET:CUTE, HyNOR, ZERO REGIO, ...)
- Focus should be on **market preparation** for commercial launch in 3 – 5 years
- **Synergies** between vehicle segments
  - in principle **utilisation of synergies aspired**; implementation to be checked case by case; might be difficult e.g. causing limitations regarding site selection
  - **mobile refuelers** may serve as back-up for several refuelling stations across vehicle segments
- **Expectations** from next demo projects
  - contribute to ease regulations, codes & standards requirements and permitting procedures
  - further improve metering of hydrogen dispensed
  - focus on customer expectations
- **Hydrogen supply routes**
  - make them lean, reliable and efficient; move away from demo project concepts
  - key criteria: hydrogen purity and cost
- Establish **database for refuelling station safety records** to document technology's safety

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