

# Dennis Hayter - Intelligent Energy

## **Roundtable Meeting IPHE – Hydrogen and Fuel Cells Stakeholders Transport Applications**

17th November, 2011

Berlin

Germany



# Intelligent Energy

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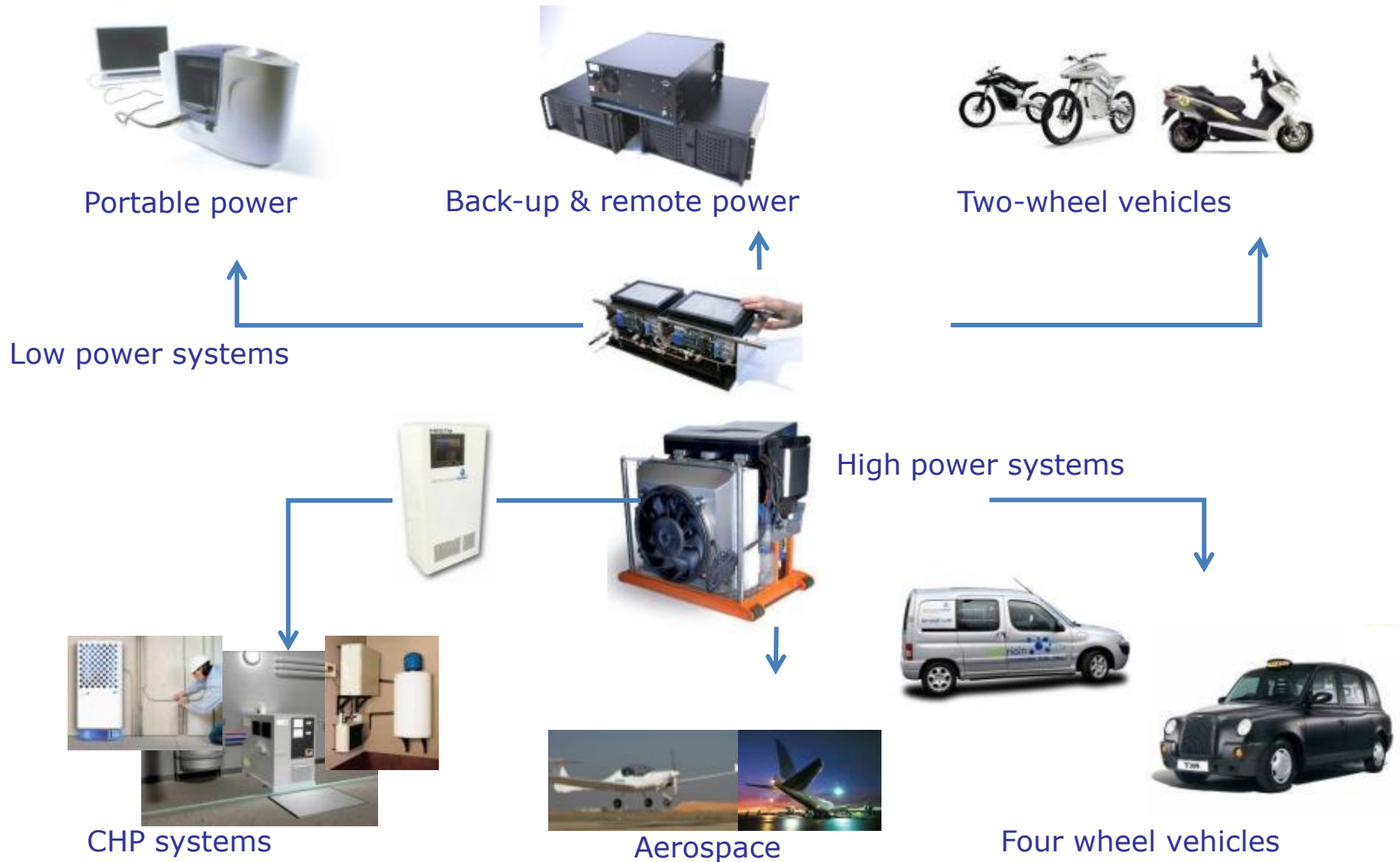
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# Intelligent Energy

- A clean power systems company with globally scalable business commercializing IE's proprietary fuel cell technologies with business partners
- Create bespoke power systems for OEMs and their global mass markets from our fuel cell 'clean engine' building blocks; our proprietary hydrogen fuel cells are versatile, robust, efficient, power-dense and designed from inception for low cost, high volume manufacturing
- Formed in 2001 but with over a 23 year history of fuel cell innovation incorporating Advance Power Sources group who created the first UK PEM fuel cells, built at Loughborough University, and a spin-out company in 1995
- Now with 200+ staff across the Group, and growing

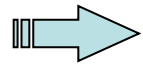


# Core technology development working with OEMs



# Commercialisation through partnerships

- Accelerate and de-risk our customer's product development and go-to-market plans
- Blue Chip customers with understood & scalable commercialization route
- Business model: from licensing to equity participations



**Scalability, cost reduction  
and manufacturing  
risks mitigated**

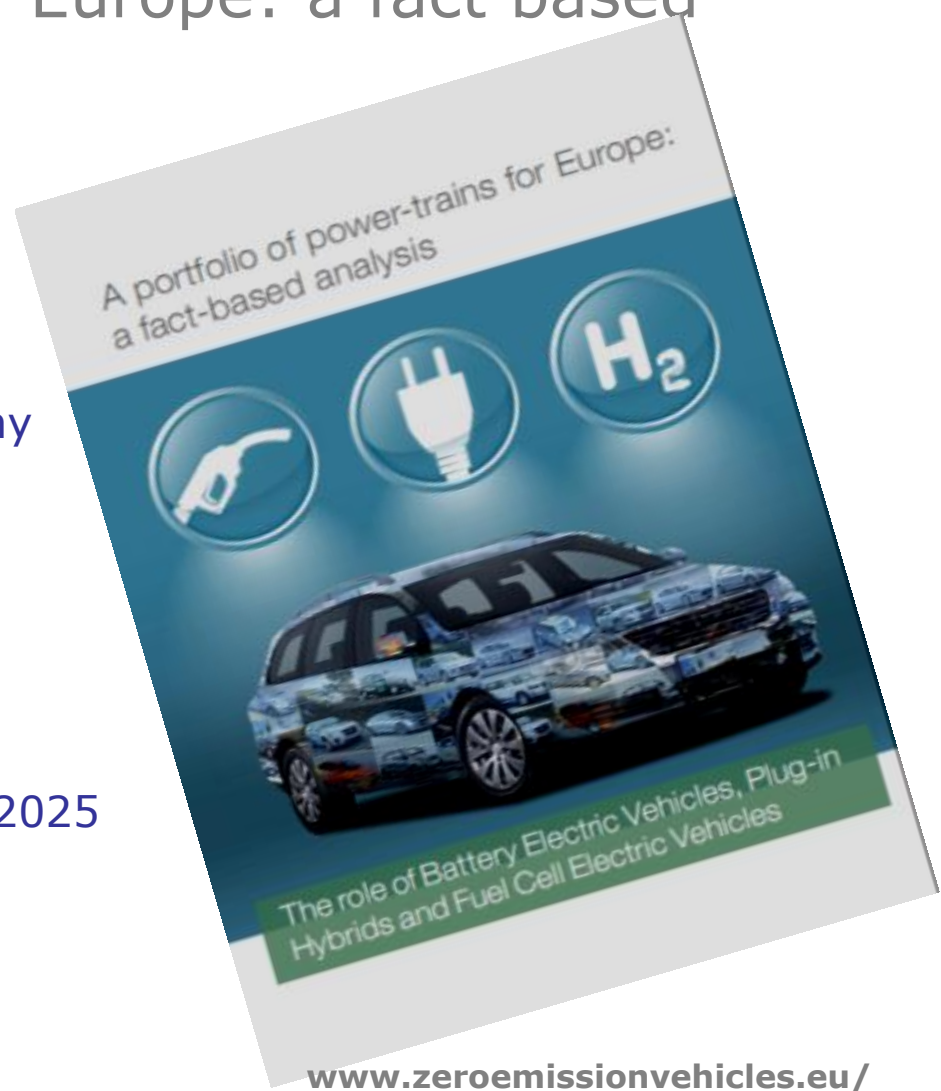


*Select examples...*

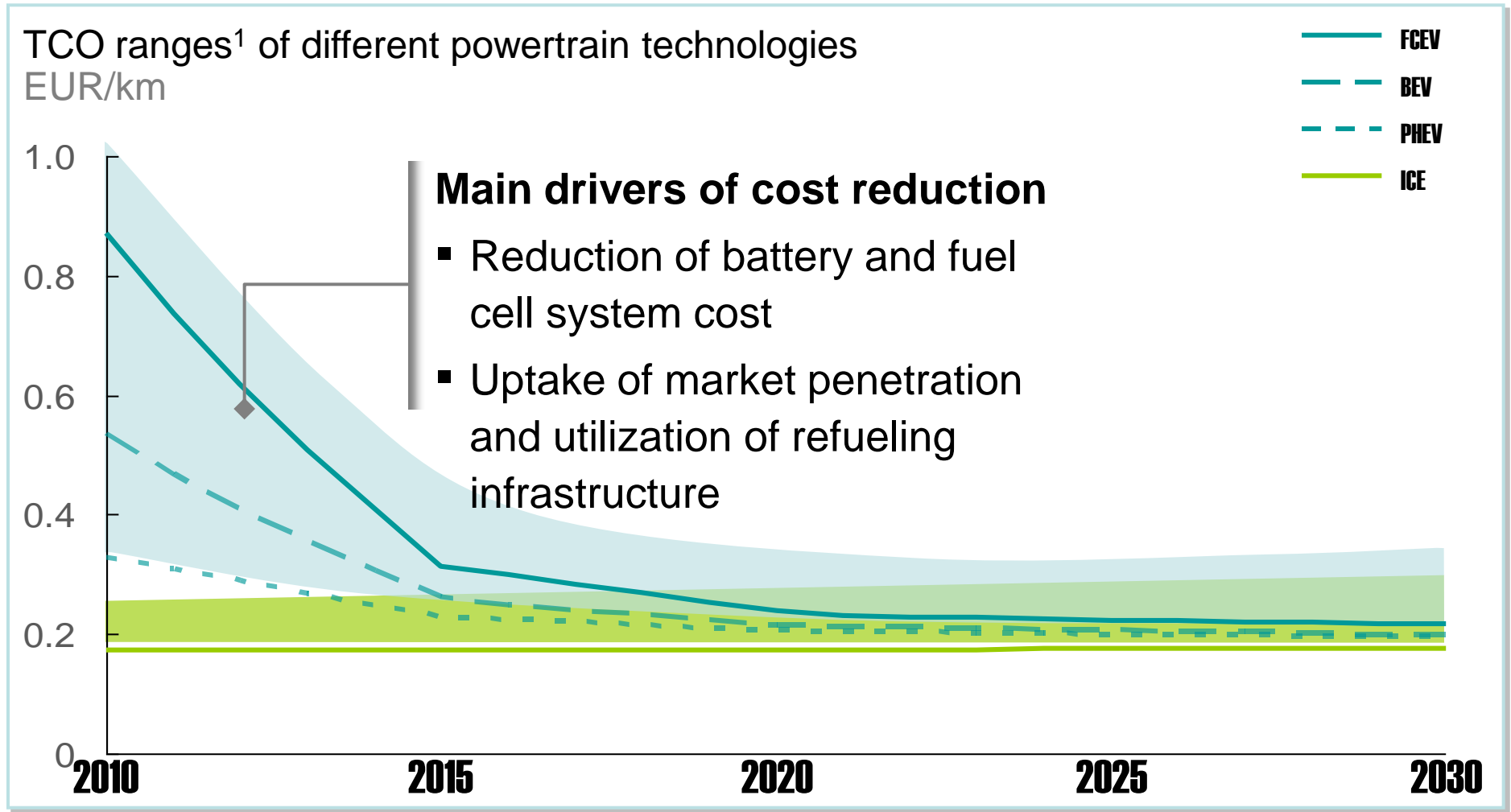


# " A Portfolio of Power-trains for Europe: a fact based analysis

- 30 global companies, 10,000 proprietary and confidential data points
- Independent analysis by McKinsey & Company
- **Conclusions include**
- FCEVs ready for commercialisation,
  - 90% cost reduction by 2020,
  - Cost competitive with ICE vehicles around 2025
- Hydrogen infrastructure affordable
- Hydrogen can be produced cost effectively



# Alternative powertrain TCO will converge with ICE after 2020 – also re-confirmed in UK LCVP study results (Element Energy)



<sup>1</sup> Ranges based on data variance and sensitivities (fossil fuel prices varied by +/- 50 %; learning rates varied by +/- 50 %), all taxes excluded



# EU FP6/7 Programmes and FCH JU impacts

## Fuel Cell Vehicle System Component Development: EU Project HySYS (FP6)



Fuel cell vehicle (validator)



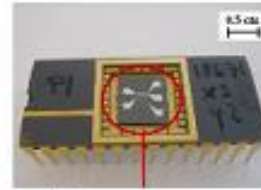
Electrical turbo charger



Integrated air sensor



Humidifier



Hydrogen sensor



Hydrogen metering device

**Coordinator:** Daimler AG  
**Total budget:** 22.7 M€  
**EC-Funding:** 11.2 M€  
**Partners:** 28 (6 OEMs, 13 Suppliers, 4 Institutes, 5 Universities)  
**Countries:** 8 EC Member States and Switzerland  
**Duration:** 01.12.2005 – 30.11.2010



DC/DC converter



Electric motor



Li-Ion battery

Vehicle Data	
Vehicle Type	Mercedes-Benz Sprinter
Fuel Cell System	PEM, 80 kW
Engine	IPT Engine Output (Continuous/ Peak) 70kW / 100kW (136hp) Max. Torque: 290 Nm
Fuel	Compressed Hydrogen (70 MPa / 10,000 psi)
Range	> 300 km
Top Speed	130 km/h
Battery	Li-Ion, Output: 40 kW ; Capacity 6.8 Ah, 1.9 kWh

Achievements	
Component	Result
Electrical Turbo Charger	Low weight, small size, low noise, high efficiency, high dynamics,
Integrated Air sensor	Automotive sensor combining pressure, temperature and mass flow
Humidification	Lab scale hollow fibre humidifier for air humidification
Hydrogen Sensors	First prototype sensors of a promising new hydrogen sensing principle
Hydrogen Supply	Automotive hydrogen metering device with high maturity for mass production
Power Electronics	Automotive inverters and DC/DC Converters with high efficiency
Electrical Motors	High efficient and dynamic e-motors for electric drive trains
Battery	High power Li-Ion Batteries

# Commercial roll-out readiness

## Common Commitment for Commercialization of Fuel Cell Vehicles until 2015

Letter of Understanding signed in Sept. 2009 for commercialization of fuel cell vehicles until 2015

- The Letter of Understanding was signed by all relevant automotive manufacturers, which are engaged in the development of fuel cell technology.
- From 2015 onwards a quite significant number of fuel cell vehicles could be commercialized. This number is aimed at a few hundred thousand vehicles over life cycle on a worldwide basis.
- In order to ensure a successful market introduction of fuel cell vehicles, this market has to be aligned with the build-up of the necessary hydrogen infrastructure by 2015.
- The network should be built-up from metropolitan areas via corridors into area-wide coverage.

DAIMLER



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## Signing of Memorandum of Understanding "H2 Mobility Initiative" on September 10th, 2009 in Berlin

Signed by 7 key stakeholders and the NOW the Memorandum of Understanding "H2 Mobility" defines joint build up of hydrogen fueling infrastructure in Germany.



## Press Release

### H2 Mobility Initiative: German Hydrogen Infrastructure in Place by 2015

Berlin, September 23, 2009 - A comprehensive nationwide infrastructure for hydrogen refuelling will be in place in Germany by 2015. This is the declaration of the landmark agreement signed

## 13 Japanese Companies Eye Smooth Domestic Launch of FCVs -Development of Hydrogen Supply Infrastructure Key-

Toyota Motor Corporation (TMC), Nissan Motor Company, Ltd., Honda Motor Company, Ltd., JX Nippon Oil & Energy Corporation, Idemitsu Kosan Company, Ltd., Showa Shell Osaka Gas Company, Ltd., Cosmo Oil Company, Ltd., Iwatani Corporation, Sekiyu K.K., Taiyo Nippon Sanso Corporation, Tokyo Gas Company, Ltd., and Toho Gas Company, Ltd. jointly announce the following details regarding the launch of mass-produced fuel-cell vehicles (FCVs)—one of a number of potential next-generation vehicles—in the Japanese market in 2015 and the development of the hydrogen supply infrastructure necessary for the successful adoption of the vehicles.

Toyota Motor Corporation  
Nissan Motor Co., Ltd.  
Honda Motor Co., Ltd.  
JX Energy Corporation  
Idemitsu Kosan Co., Ltd.  
Iwatani Corporation  
Osaka Gas Co., Ltd.  
Cosmo Oil Co., Ltd.  
Saibu Gas Co., Ltd.  
Sekiyu K.K.  
Nippon Sanso Corporation  
Tokyo Gas Co., Ltd.  
Toho Gas Co., Ltd.



# Certification – a step toward commercial roll-out

## Whole Vehicle Type Approval (WVTA)

- IE – Suzuki joint development
- First time for any fuel cell vehicle
- Intelligent Energy fuel cell based powertrain
- Certified safe for use on public roads
- Approved for production and sale in Europe

*"Our aim is to make eco-friendly fuel cell scooters increasingly common in Europe"*

**Mr O. Suzuki, Chairman and CEO  
Suzuki Motor Corporation - March 2011**



# Wider vehicle mix

Overall Length	4580mm
Overall Width	2036mm (including mirrors)
Overall Height	1834 mm
Weight	2180kg
Motor	3-phase brushless permanent magnet (100kW)
Fuel Cell	PEMFC (Intelligent Energy)
Fuel Storage	Pressurised Hydrogen Tank (35 MPa)
Battery	Li-Polymer Battery, 14kWh
Range	250 miles / 402 km
Top Speed	95 mph



# Media attention



Unveiling at City Hall  
June 2010



Michelin Challenge  
Brandenburg Gate – May 2011



London debut  
March 2011

Since June 2010 media coverage has reached an estimated audience of over  
**700,000,000**

# Clean power anywhere

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