



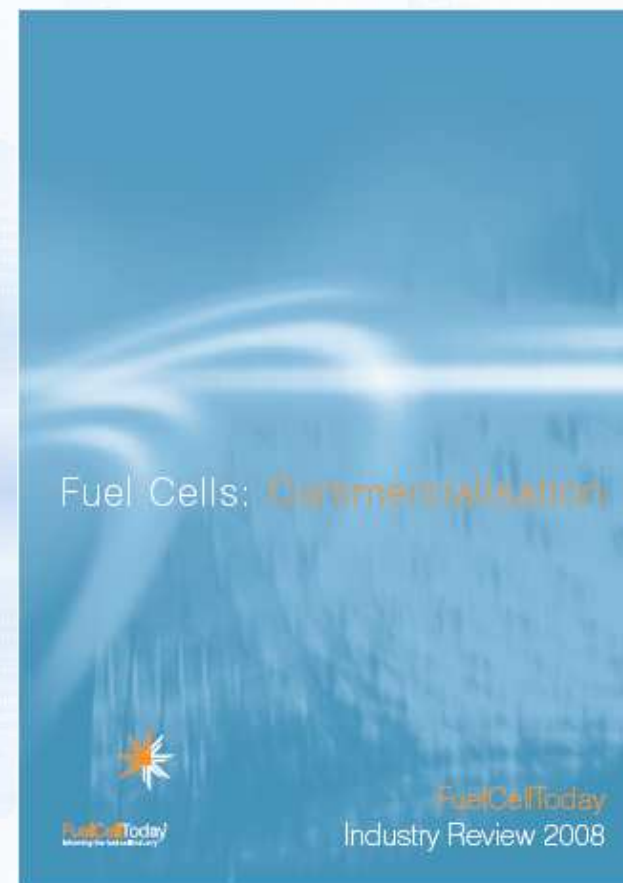
All Energy 2008

Fuel Cells: Commercialisation

Dr. Jonathan Butler

Dr. Kerry-Ann Adamson

Fuel Cell Today





Fuel Cell Today is the leading organisation for market based intelligence on the fuel cell industry. Covering key trends and developments in industry and government, Fuel Cell Today provides relevant, unbiased and objective information allowing decision makers to take advantage of the opportunities that our new industry offers.





- Funded by the UK government's Technology Strategy Board
- Operated by Fuel Cell Today, Fuel Cells UK and Foresight Vehicle under the stewardship of CENEX

- **The mission of the Fuel Cell Technology KTN...**

...is to provide an accessible and flexible platform for communication and cooperation between members of the UK specialist fuel cell community, as well as non-specialist and non-UK groups which will also play a vital role in bringing products to market.

Low Carbon and Fuel Cell Technology

Knowledge Transfer Network



Presentation Outline

1. Key Developments, 2007
2. Stationary
3. Transport
4. Portable
5. Summary



When is a Fuel Cell Commercial?

“A fuel cell is considered commercial if it is:

- Offered for sale to the public,
- Offered with a written warranty, supported by service capability,
- Meets approved industry standards or is certified by an established industry body”

Definition adopted from the US Fuel Cell Council



Key Developments, 2007

- Industry growth rate in units shipped 2006-2007 75%
- Direct government support topped £100 million in FY07
- Implementation of the ICAO ruling in the US to allow methanol cartridges in aircraft hand luggage
- Japanese government subsidy for residential fuel cells switched from the producer to the consumer
- Some early applications cost competitive with incumbent technologies
- Increased number of ISO, TÜV and UL certified products.





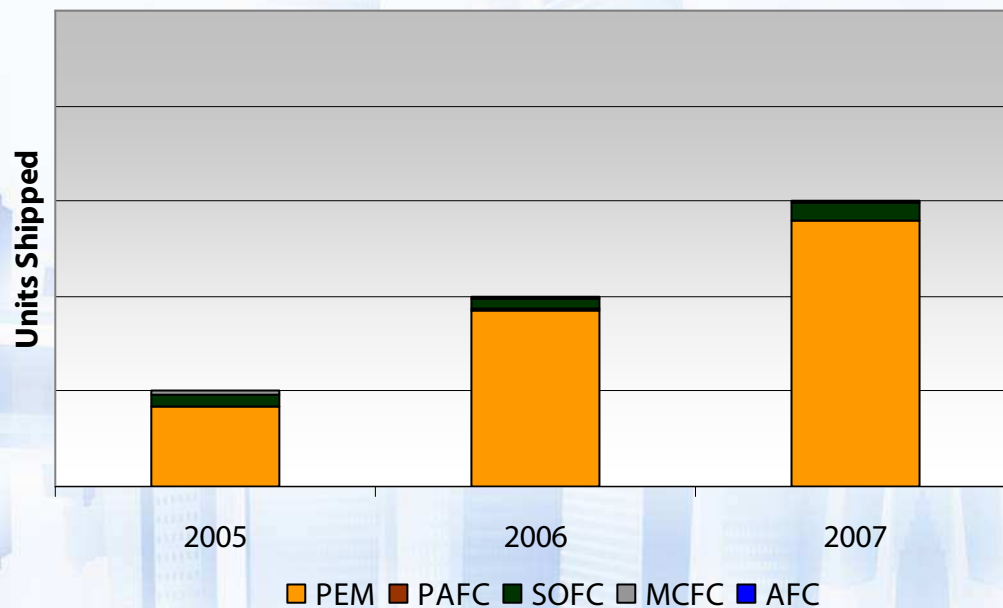
Stationary

Any permanently fixed fuel cell





Stationary Development 2005 – 2007



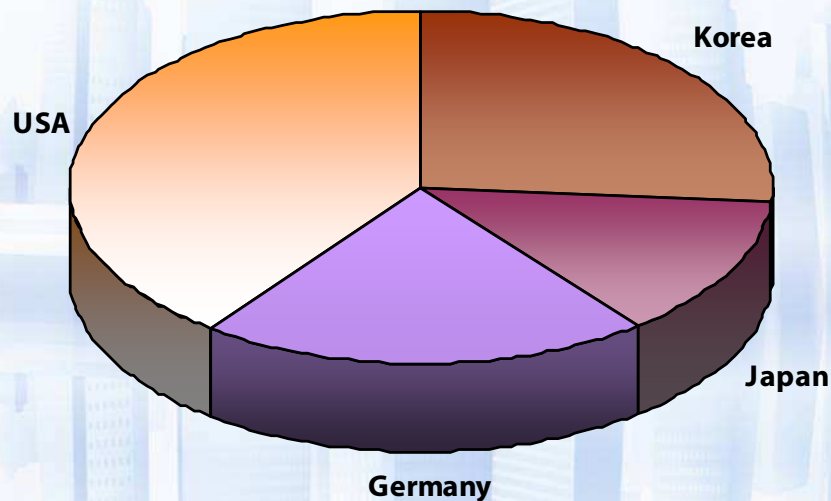
AGR 125%

Key Points:

- Global market, some 30+ countries now with operating stationary fuel cells
- UPS systems increasing rapidly in terms of distribution and sales
- At present commercial companies in NA concentrating on UPS whilst in Japan with focus on residential markets
- In 2007 units under 10 kW (PEM, SOFC and AFC) contributed under 5 MW of power whilst units over 10 kW (MCFC and PAFC) contributed approximately 8 MW



Stationary Funding FY07



- South Korea - Around £10 million for MCFC power plant development and a further £5 million for residential fuel cells
- Japan - Very clear funding structure with stationary receiving £24 million (£2 million more than transport)
- USA - £30 million available from the SECA programme for SOFC development. Parallel military SOFC programme adds approximately a further £2.5 million to this
- *(Other money is available in countries such as the UK with integrated funding streams)*



Policy and Legislation

Japan

- Large Residential Fuel Cell Programme most proactive in the world
 - Clear long term technical targets outlined in 2005 with subsidies for production available to 2007. Funding switching from producer to consumer in 2008

USA

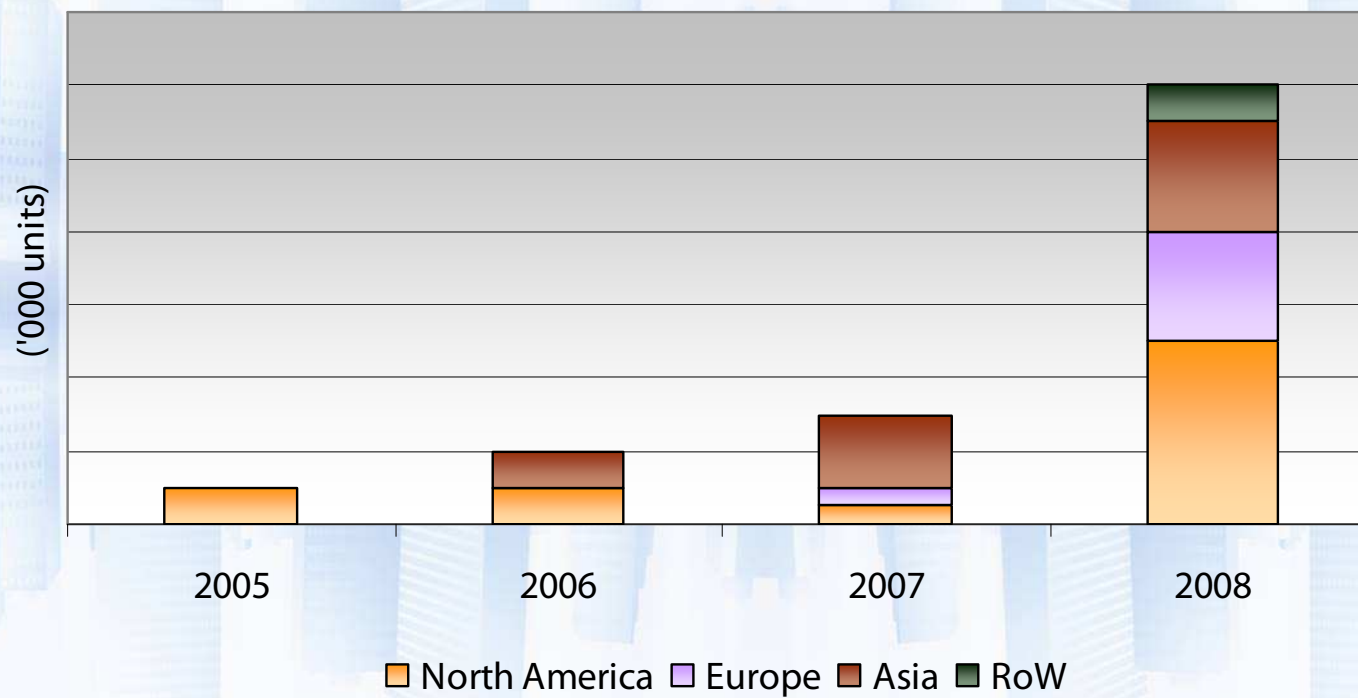
- Federal level policies aimed at fundamental R&D (primarily transport). Work at State level critical with for example interconnection standards being developed at this level

Europe

- The new Joint Technology Initiative outlines a number of long term goals for stationary fuel cells (Routemap of adoption not yet published)
- Nordic states proactive with development of cross border policy including stationary (and transport fuel cell) adoption



Stationary Outlook - Fuel Cell Units by Shipment and Region





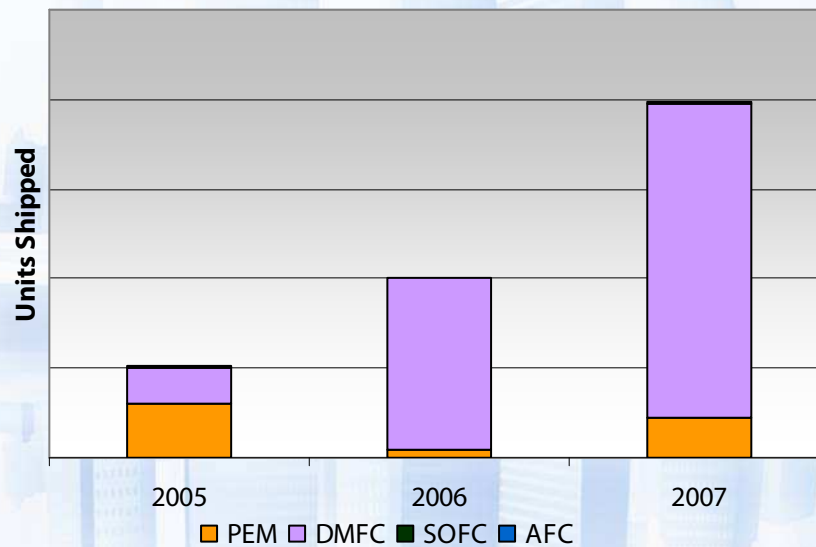
Transport

Any unit that is included in a vehicle whether for direct propulsion or on-board power.





Transport Development 2005 – 2007



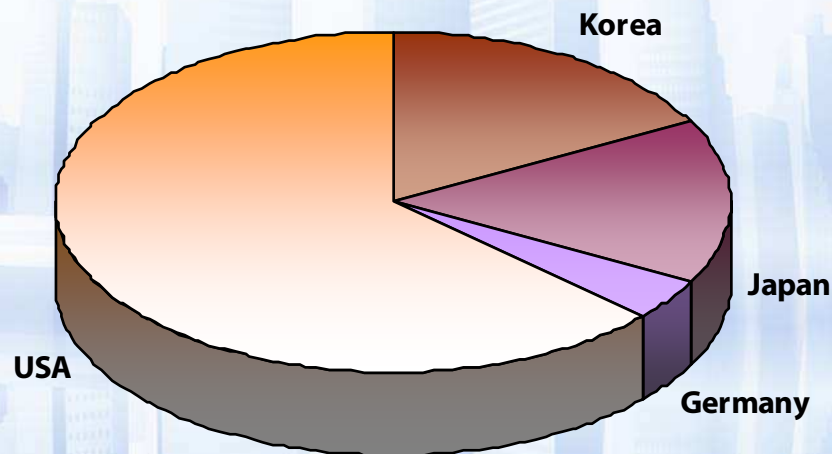
AGR 150%

Key Points:

- Niche markets fastest growing, especially APU deployment in the leisure industry (campervans and boats)
- Very large spread of vehicles being developed with programmes being in the low tens of units
- Number of highly successful and ongoing bus demonstration programmes
- 2007 saw jump in interest in fuel cells for materials handling vehicles



Transport Funding FY07



- USA - money channelled through the FreedomCar programme of ~ £88 million (similar level request in FY08) specifically for FCV development
- Japan – money also specifically for FCV development , £22 million FY07
- Germany – using funding for electrolyte types rather than vehicle types, i.e. PEM and DMFC for transport



Policy and Legislation

Policy and legislation driving fuel cells into the market in some regions, e.g. Shanghai with the prohibition of petrol driven motorbikes and the creation of “low emission harbours”

Japan

- Currently a basket of next-generation vehicle fuels being considered, including batteries, biofuels and hydrogen fuel cells
- Soft infrastructure such as codes and standards for transport being developed

USA

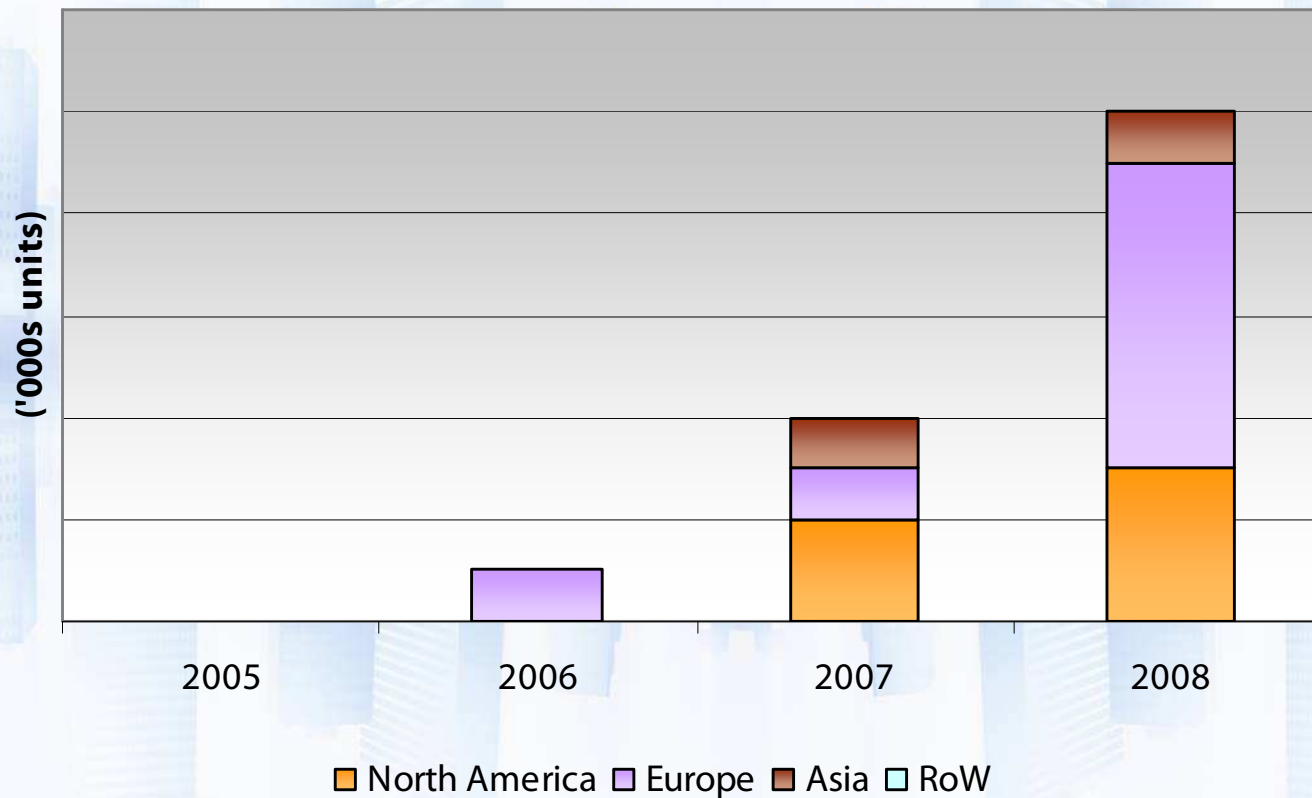
- Replacement Fuel Goal and US Energy Act 2007 key policy developments in 2007 at Federal level.
- State level, again, is highly proactive.

Europe

- ‘Type Approval’ system for hydrogen vehicles is under development, in parallel with the JTI



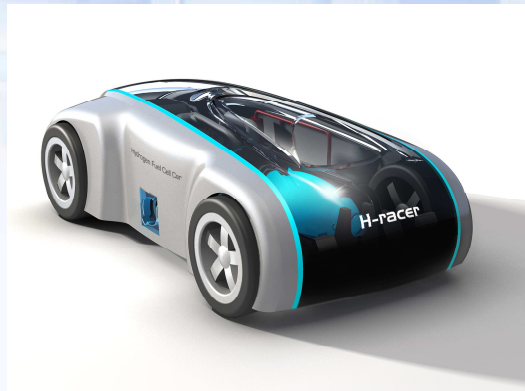
Transport Outlook - Fuel Cell Units by Shipment and Region





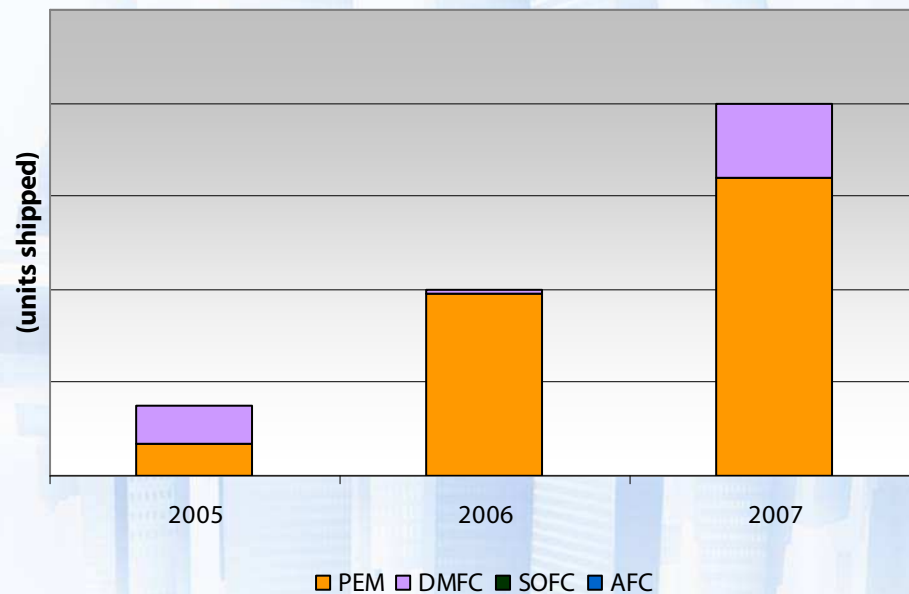
Portable

Any fuel cell that is designed to provide power to portable objects





Portable Development 2005 – 2007

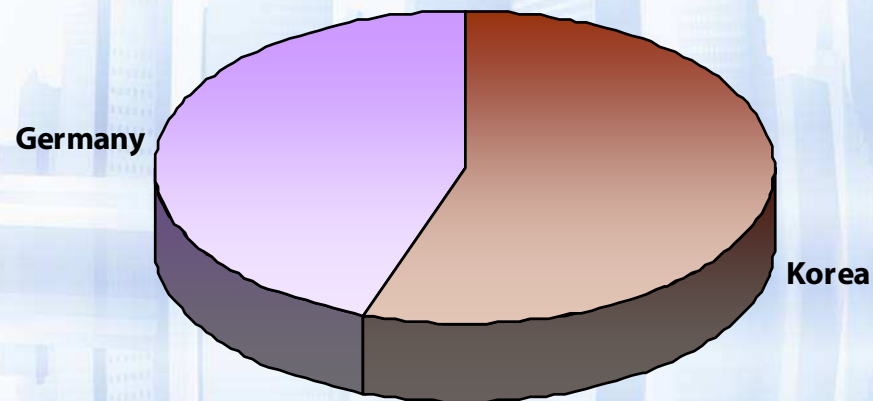


Key Points:

- First market to support volume shipments
- 2005 saw fairly equal split between DMFC and PEM, 2006 flipped to PEM though this dominance started to be challenged in 2007
- Non-military development in Asia by large multinationals whilst conversely in SME development in NA is supported military work



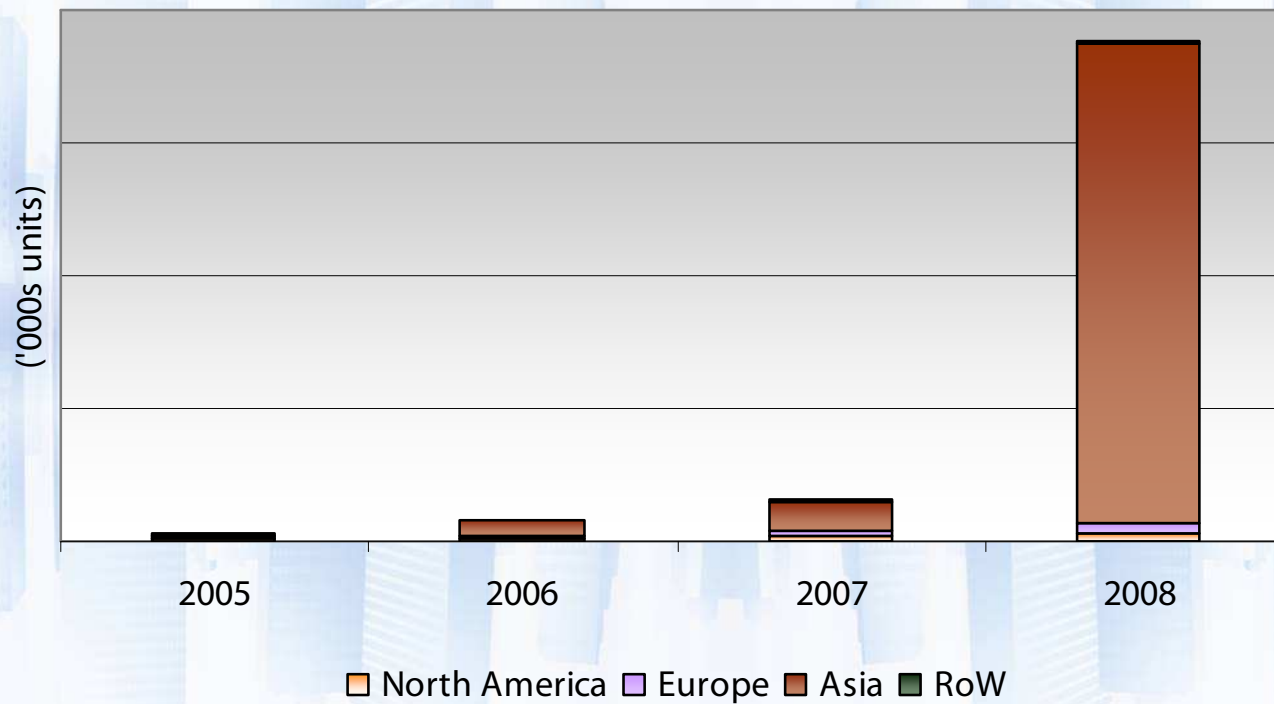
Portable Funding FY07



- USA – portable funding comes from the military, not shown in the graph, and adds approximately £11 million to this figure. Over 90% of this funding is for field of combat developments
- S. Korea – is working in collaboration with Samsung on portable developments.
- Germany – some £4 million was available for development of PEM portable systems.



Portable Outlook - Fuel Cell Units by Shipment and Region





Summary

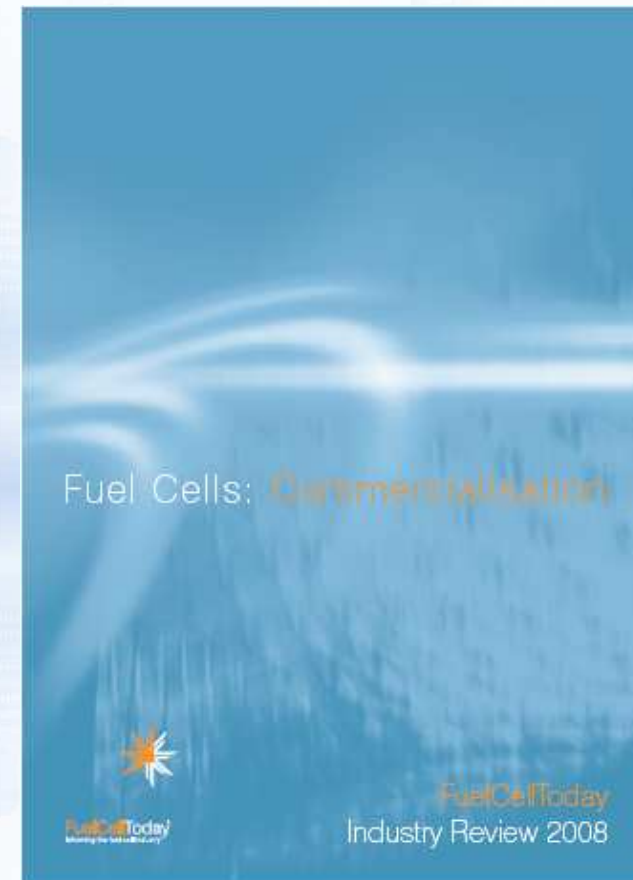
- We believe that the start of full commercialisation of fuel cell technology started in 2007
- A number of applications are *cost competitive*
- A number of products hold international *certification*
- A growing number of products are available in the open market place

Auxiliary power units, uninterruptible power supply systems, combined heat and power units, power plants, toys, submarines, and materials handling vehicles are all proving that fuel cells are no longer just about hype but are now, increasingly, a market reality.



Fuel Cell Today Industry Review 2008

Fuel Cells: Commercialisation





Thank You

Kerry-Ann: kerry-annadamson@fuelcelltoday.com

Mike: mikehugh@fuelcelltoday.com

Jonathan: jonathanbutler@fuelcelltoday.com

Nicholas: nicholashuleatt-james@fuelcelltoday.com

Ben: bentodd@fuelcelltoday.com