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Innovation in the Energy Sector

Case Study of Fuel Cell Development in the UK 2003

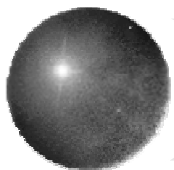
Roy Williamson

Key Business Technologies Directorate

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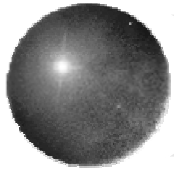
⊕ Coverage

- ⊕ The Drivers from a UK perspective
- ⊕ The UK Fuel Cell Industry
- ⊕ The Research Base and Activity
- ⊕ Public Research Support
- ⊕ Development Support
- ⊕ Private Support
- ⊕ IPR
- ⊕ Regional Activity
- ⊕ Collaboration
- ⊕ Conclusion

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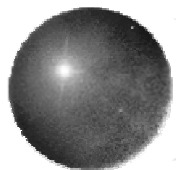
⊕ Drivers for Development in Fuel Cells

- ⊕ Low Carbon Economy Goals and rising pollutant levels
- ⊕ Energy Security issues, dependency and depletion of fossil fuels
- ⊕ The growing importance of renewable energy production
- ⊕ High Efficiency, Low pollution technology, amenable to existing fossil fuels as well as a hydrogen based economy

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⊕ Drivers for Development in Fuel Cells

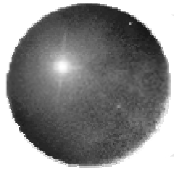
- ⊕ A market estimated to be worth \$25Billion by 2011 with significant growth anticipated there-after

	Application	2011 \$B	Longer term
Mobile	Propulsion	3	135
	APU	0.9	9.7
Stationary	DG/ CHP	6	
	Residential/ Small Scale CHP	3	
	Remote Power	2.5	
Portable	Battery/Genset etc Replacement	11	

E4 Tech Review of Fuel Cell Commercial Potential for DTI and The Carbon trust. Feb 2003

	Portable	Automotive	Residential	UPS	Utility
PEM	X	X	X	X	
DMFC	X	X			
SOFC			X	X	X





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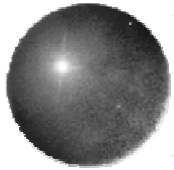
⊕ UK Industry –22 Companies Surveyed

- ❖ Johnson Matthey 30 years (Catalysts and Membranes)
- ❖ Rolls Royce 10 years (SOFC stack technology)
- ❖ Intelligent Energy 15 Years (PEM formed from Advanced Power Sources)
- ❖ + Morgan Fuel Cell, Advanced Ceramics, Microponents -over 10 years in component supply
 - Many new involvements (100+ companies and growing...)
 - R&D> Fuel Cell turnover
 - Johnson Matthey – dedicated MEA production facility – fully operational end2003

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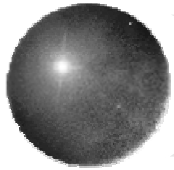
⊕ **UK Research Base** -12 Institutes Surveyed

- ⊕ Activity Across the board of technologies and issues

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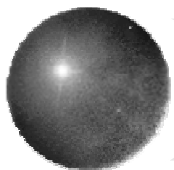
⊕ **UK Research Base** -12 Institutes Surveyed

⊕ Fuel Cells are still a specialisation in the education system

⊕ Post Graduate Research in Fuel Cells 2002-

Master Started	5
Master Running	3
Master Completed	5
PhD Started	18
PhD Running	24
PhD Completed	11

⊕ An issue for the future?



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⊕ Public Research Support

⊕ EPSRC

- £400 million a year in research at UK
- New and renewable energy generation technologies, (photovoltaics, fuel cells, wind power, wave power, biomass, hydrogen economy) £26million at May 2003
- SUPERGEN -a £2M consortium during 2004 specifically to investigate fuel cell technologies
- Research Council initiative on energy is being led by NERC in partnership with EPSRC and ESRC. This £28m programme will co-ordinate energy research across the UK and establish the UK Energy Research Centre

EPSRC

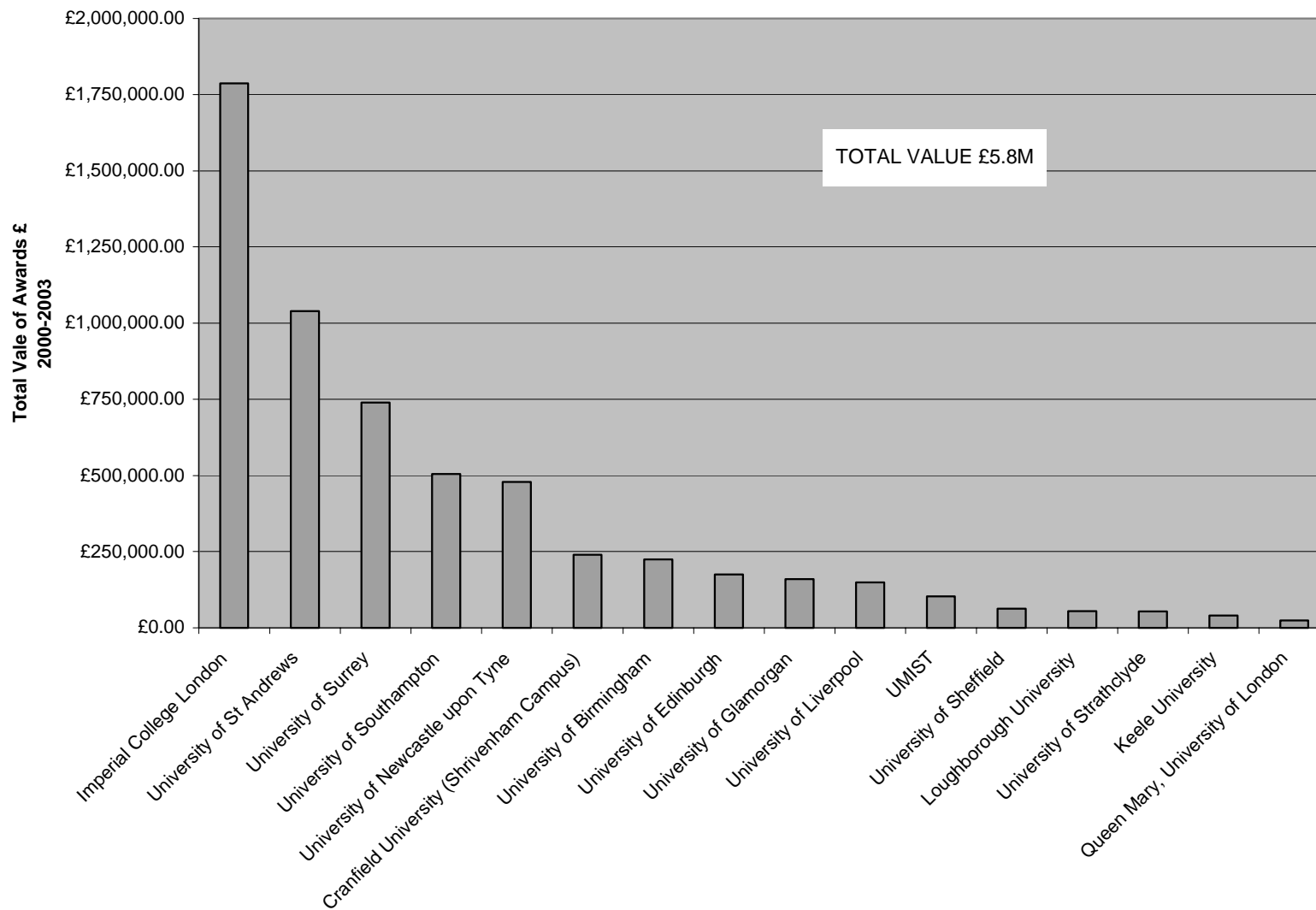
Engineering and Physical Sciences
Research Council

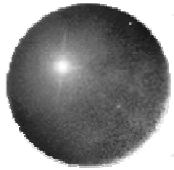
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**EPSRC Support Of Fuel Cell Projects With Research Establishments
Total of Grants Awarded 2000-2003**





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✦ Development Support

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▣ **DTI**

- 1992 **Advanced Fuel Cell Program** -150 projects, £92M, £13M
- Seed corn for **Fuel Cells UK**
 - **A Fuel Cell Vision for the UK**
 - **UK Capabilities Guide**
- International Missions and Reports
- Collaboration with EPSRC, Carbon Trust
- **Automotive Unit**
 - Low Carbon and Fuel Cell Research Centre –share of £15M for 2 CoE's
- **Fuel Cells Forum**



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FUEL CELLS FORUM

Powered by Global Watch
ONLINE

WELCOME TO THE UK FUEL CELLS FORUM



[Click here to find out what the Fuel Cells Forum is all about](#)

Developed to bring together the views of the UK's Industry, Academia, Venture Capitalists and Government Fuel Cells stakeholders

Existing Members Login here:

Username

Log In

Future Visits:

Automatically log me in

Are you interested in joining the UK Fuel Cell Forum ?

Are you willing to participate in debate in a secure environment about the future of fuel cell technology in the UK ?
Would you like to access fully up to date news, information and reports on fuel cell developments from around the world ?

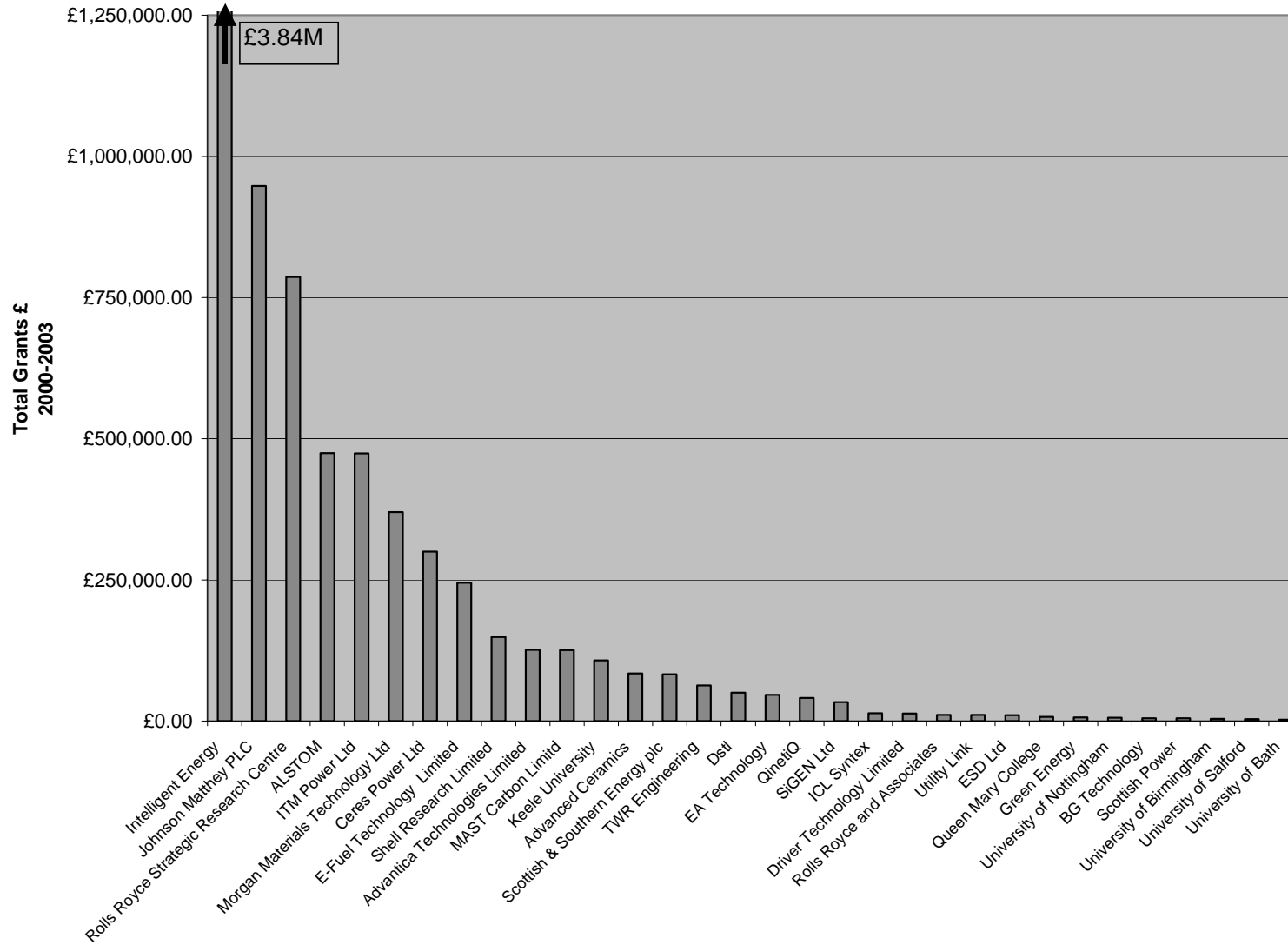
If so, then please email the site moderator [Gary Acres](mailto:gary.acres@pera.com) with your name and email address and he will reply by return.

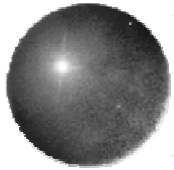
For general comments about this portal contact : fuelcellsforum@pera.com

For further information on fuel cells in the UK, visit our sponsor partner sites



DTI Support Of Fuel Cell Development Totals 2000-2003





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⊕ Development Support

⊕ The Carbon Trust

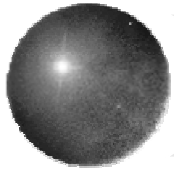


- Low Carbon Innovation Programme, with a budget of £75M over 3 years and investing in low carbon technologies,
- looking to support demonstration projects in fuel cells, seeking to determine and investigate the societal issues and benefits of fuel cells in operation, such as where they will be installed, who will install and maintain them, and public opinion and behaviour.

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⊕ Development Support



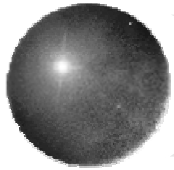
⊗ The Low Carbon Vehicle Partnership

- -Encourage industries and other stakeholders to become engaged in the move to low carbon vehicles and fuels;
- -Provide a forum in which different groups of stakeholders can work together in overcoming the market barriers to the take up of new low carbon vehicles and fuels;
- -Provide a forum for Government industry and other partners to liaise on upcoming policy developments and regulatory issues;
- -Provide Government with independent advice on the progress and effectiveness of Government programmes Low

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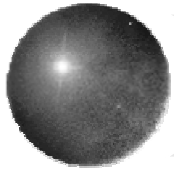
⊕ Private Support

- ⊗ Funds being established
- ⊗ Lack of awareness and demonstrators
- ⊗ Fuel cell components first to perform with current activity
- ⊗ Creation of the Vision and new activity are confidence builders



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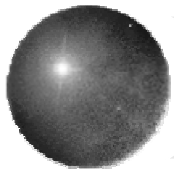
⊕ **IPR**

- ⊕ Highly Important for all sizes of companies
- ⊕ Becoming recognised by higher education
- ⊕ Concern over infringement between application and granted

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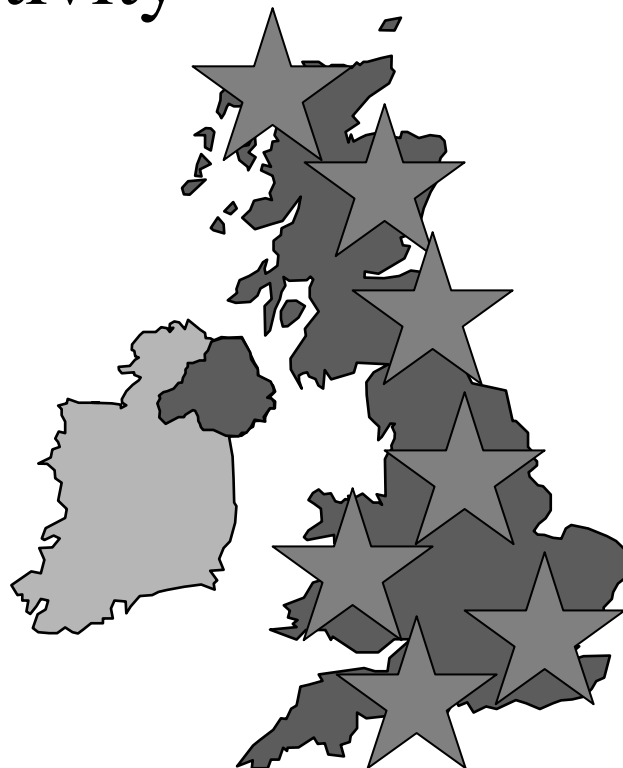
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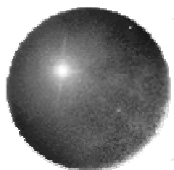
⊕ **Regional Activity**



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Regional Activity

Scottish Enterprise

2000 Scottish Fuel Cell Consortium -9 companies, 3 universities, £300,000 over the past 3 years -fuel cell powered sports car, with plans to develop a fuel cell van.

Trials of a locally developed fuel cell powered bus on local routes are planned for 2003/2004.

SOFCRoll, by St Andrews University, siGEN.

Highlands and Islands Enterprise - Islay -world's first hydrogen-powered island, wave power and stored for use in fuel cells.

Part funding the Scottish Hydrogen Fuel Cell Association (SHFCA)

Highlands and Islands Enterprise

Islay, hydrogen from wave power which will then be stored and used for vehicles and power generation.

Shetland island of Unst - hydrogen from wind power.

One Northeast,

Tees Valley Hydrogen Project -existing hydrogen production and distribution infrastructure

System has a capacity of over 100 000tc of hydrogen, modern hydrogen plants, underground storage caverns 1000tc.

50 years experience with hydrogen and associated materials

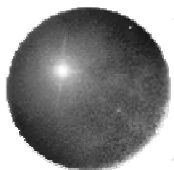
Traffic signs and remote lighting, - plans for transport and residential CHP

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Regional Activity

The North West Development Agency (NWDA)

Renewables North West was established in 2002, Proposals for a UK Energy Research Centre and a dedicated, regional North West Centre for Energy with fuel cell content

East Midlands Development Agency (emda)

Keen to assist in the commercialisation of fuel cell technologies, both in large stationary SOFC and mobile/automotive PEM application. Formation of energy parks, location of premises and identifying suitable future projects such as distributed generation and sustainable villages.

The Welsh Development Agency (WDA)

Hydrogen Valley Project 2001. Develop hydrogen production, storage and distribution, fuel cells, electric vehicles, batteries, internal combustion of hydrogen.

Yorkshire Forward

looking to establish an Energy Technology Incubator centre -Fuel Cells, Photovoltaics, Biomass and Energy Storage.

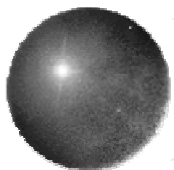
South East of England Development Agency (SEEDA)

14% of power generation from renewables by 2026, 1600MW. Woking, producing 250KW to an independent electricity grid, plus heat to a local swimming pool.

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Regional Activity

Advantage West Midlands (AWM)

Proposal for national fuel cell centre and the development of international partnerships to advance work on fuel cell technology

Bid to Centre of Excellence in Low Carbon Vehicle partnership and having focus on fuel cells for automotive application report recommended a series of projects to demonstrate the use of fuel cells in remote power, stationary (buildings) and transport applications.

The Greater London Authority (GLA)

April 2002 the London Hydrogen Partnership

- Produce and implement the London Hydrogen Action Plan, now in it's second draft form
- Establish and maintain dialogue among all sectors/actors relevant to the hydrogen economy
- Disseminate relevant materials
- Provide a platform for funding bids and initiation of projects
- 3x CUTE Buses 2003

South West Regional Development Agency (SWRDA)

Established two region organisations, with an interest in hydrogen technologies and fuel cell development. These are RegenSW, the Regional Renewable Energy Agency for the South West and SWRDA's Environmental Technology Sector Group - SW EnviroTech. More specifically support for a

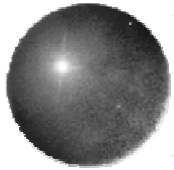
Hydrogen Economy 'Active Network

plans are already in place for a hydrogen bus service powered by hydrogen generated from wind energy and coordinated by the Gaia Energy Trust.

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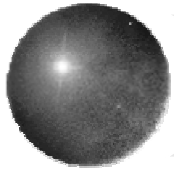
Collaboration

-  Businesses working with Universities
-  Global –USA, Germany, Europe, China, Australia
-  Clusters forming pro-rata with activity and expertise though collaboration widespread
-  Cooperation and Partnership are a foundation to such a global potential and disruptive technology






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Conclusion

-  **Nascent Industry –New and Established Companies**
 - Fuel Cells UK
 - Fuel Cell Vision for the UK
-  **Strong research base in all aspects of the technology**
-  **Private Support tentative**
-  **Growing Regional and National Interest**
 - Fuel Cells Forum
-  **Cooperation and partnership has a big role to play FC, H2**