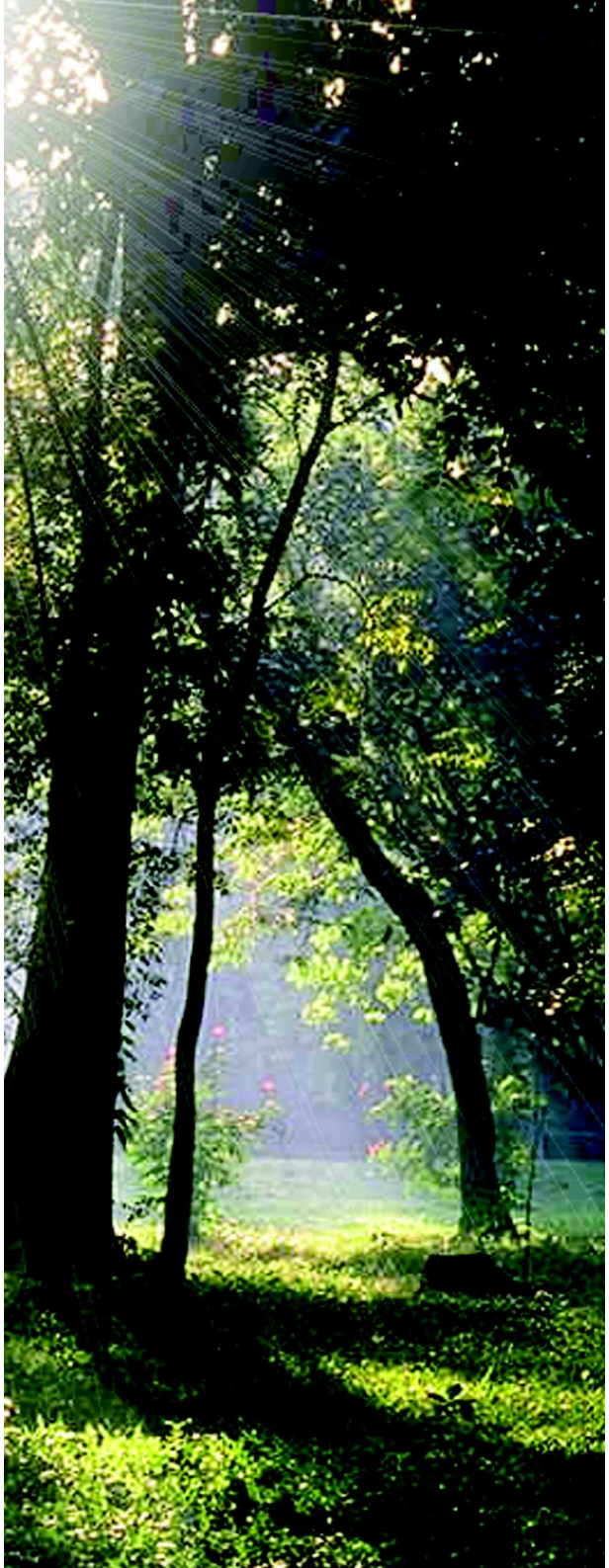

The UK Fuel Cell Industry:

A Capabilities Guide

2003

Initial funding from dti

Fuel Cells UK is managed by synnogy

fuel cells UK

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www.synnogy.co.uk & www.fuelcellsuk.org

The UK Fuel Cell Industry:

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List of Entries

Accentus plc
Adelan UK Ltd
AEA Technology plc
Air Products plc
Alternative Fuel Systems Ltd
AMEC plc
Aspen Technology

Baxi Group Ltd
BMT Defence Services Ltd
BOC
BP
Bronkhorst (UK) Ltd

Cambridge Consultants Ltd
Catal International Ltd
CD Adapco Group
CERAM Research
Ceres Power Ltd
Chell Instruments Ltd
Conduit Ventures Limited
Core Technology Ventures Limited
CPR Automation

Dart Sensors Ltd
Davis Pneumatic Systems Ltd
Drayton Beaumont Kilns Ltd
DT Assembly and Test Europe Ltd

E4tech (UK) Ltd
EA Technology Limited
ECOTEC Research and Consulting Ltd
Element Energy Ltd
Elsevier Advanced Technology
Eneco Ltd
Escovale Consultancy Services

Fluent Europe Ltd
Fuel Cells (Scotland) Ltd

Gencoa
Generics Group Ltd

Heatric
Hudson Shribman Scientific Recruitment
Hydrogen Solar Production Company Ltd

Inco Special Products
Ineos Chlor Ltd
Intelligent Energy Ltd
International Innovation Services Ltd
ITM Power Ltd

Johnson Matthey Fuel Cells

MEL Chemicals
Microponents Ltd
Microtherm International Ltd
Morgan Fuel Cell

Oxford Lasers Ltd

Parker Hannifin plc IPDE
Porvair Fuel Cell Technology
Powergen UK plc

QinetiQ Ltd

Ricardo UK Ltd
Rolls Royce Fuel Cell Systems Ltd

Scottish and Southern Energy plc
siGEN Ltd
South West Electrolysers
Stainless Metalcraft Ltd
Synnogy Ltd

Technology Interface
Turquoise International Limited

Unitec Ceramics Ltd

Voller Energy Ltd

Preface

Fuel cells are a technology that can:

- Contribute substantially to a global low carbon dioxide economy
- Improve urban air quality and the health of urban populations
- Form the basis of a 21st Century industrial sector that allows sustainable growth of the world economy
- Make an important contribution to energy security concerns by allowing a wider choice of fuels and hence enhance the prospects for international stability
- Provide essential intermediate and final components of any future hydrogen economy.

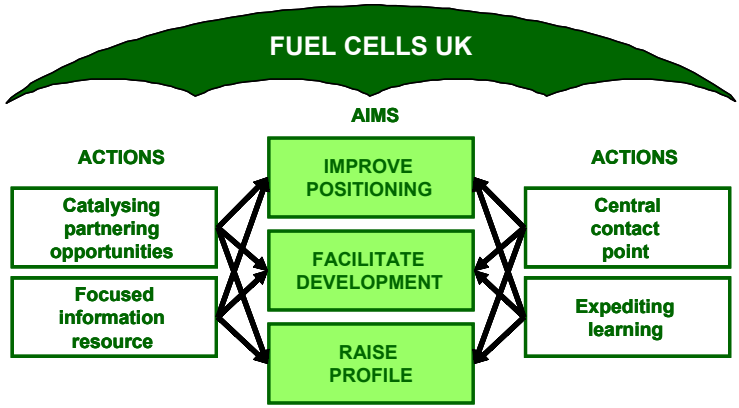
Fuel cell commercialisation is moving forward rapidly across the world, with some countries already establishing themselves as leading the way. The evolution from research activity to full scale production is generating opportunities for businesses along the full length of the supply chain. In the UK, against a backdrop of established players and research activities, recent months have seen the emergence of a number of small entrepreneurial companies and potential suppliers to the industry, all keen to establish a presence in the international market place.

This Guide has been developed by **fuel cells UK** to raise the profile of the UK fuel cell industry, and facilitate the establishment of mutually beneficial partnerships and collaborations. Information contained in this guide has been provided by the participating companies; inclusion is voluntary. The Guide is also available on the **fuel cells UK** website (www.fuelcellsuk.org). Regular updates will be made available online, with the aim of a hardcopy update in 2004 and beyond.

Introduction to fuel cells UK

fuel cells UK provides a focus for the UK fuel cell industry and works to foster its growth. Its role includes:

- Raising the profile of the industry both in the UK and overseas;
- Acting as a central liaison point for national and international contact;
- Catalyzing partnering opportunities between UK and overseas organizations;
- Improving the positioning of the UK fuel cell industry in the international arena; and
- Developing a pan-industry perspective on key issues.



fuel cells UK was launched in May 2003 with initial funding from the UK Department of Trade and Industry. In addition to the development of this Guide, other near term activities include:

- A Fuel Cell Vision for the UK: highlighting the benefits to the UK in taking a leading role in fuel cell development and deployment, and defining a pathway for the development of fuel cells in the UK; with input from over 150 UK fuel cell stakeholders (The Vision is available in hardcopy or online at www.fuelcellsuk.org.);

- Industry focused activities: building links to key organisations across the UK and beyond, brokering beneficial relationships and supporting the development of regional initiatives aimed at facilitating the development and deployment of fuel cells in the UK.

fuel cells UK is guided by a Steering Group which provides guidance on the short medium and long term evolution of **fuel cells UK**, with a particular emphasis on:

- Ensuring buy-in from key stakeholders and, thus, long term sustainability.
- Identifying appropriate routes for development which have the support of UK industry.

Over the next eighteen months, **fuel cells UK** will evolve into an industry funded membership organisation. For more information, visit the **fuel cells UK** website:

www.fuelcellsuk.org

The UK Fuel Cells Industry

Currently, over 100 UK companies are contributing to the creation of the global fuel cell industry. The knowledge and expertise of the UK industry spans the full length of the commercial value chain, from R&D to systems integration, and from finance to servicing. Many of these capabilities have been developed in partnership with companies and organisations from across the world.

The breadth of the UK Fuel Cell Industry's experience encompasses:

Low temperature fuel cell stacks and components: Here, the focus is on higher value stationary and portable applications. In the longer term, there is the potential to be engaged in high volume markets by exploiting knowledge and experience in scaling production processes.

High temperature fuel cell stacks and materials: Currently, UK companies are active at the short stack and subsystem level. For the longer term the industry expects to build on this materials research strength to provide competitive advantage through enhanced performance and lower costs.

Balance of Plant: Significant pockets of skills in component areas such as fuel processors, power conditioning mechanical balance of plant and hydrogen production and storage are important for all fuel cell applications. The UK's engineering capability has a long history of successful innovation creating tangible commercial advantage. The fuel cell industry is demanding such innovation along its supply chain and the UK is in a strong position to deliver.

The UK’s industrial strengths are complemented by a world-renowned science and technology base that is continuously delivering innovation into this dynamic industry.

Capabilities matrix

The matrix below summarises the entries included in this guide.

											Fuel cells				
Company Name	Control systems	Hybrid engines	Hydrogen production	System integration	Fuel / fuel systems	Fuel storage	Services	Materials / components	Test / sensor equipment	Venture capital / other funding	AFC	DMFC	MCFC	SOFC	PEMFC
Accentus plc			X	X		X									
Adelan UK Ltd			X	X	X		X	X	X					X	
AEA Technology plc	X			X	X	X					X	X	X	X	X
Air Products plc	X		X	X	X	X	X	X		X					
Alternative Fuel Systems Ltd	X			X		X	X	X			X				X
AMEC plc	X			X			X								
Aspen Technology					X		X				X	X	X	X	X
Baxi Group Ltd				X											X
BMT Defence Services Ltd	X			X	X		X	X							X
BOC			X	X	X	X	X			X					
BP			X				X								
Bronkhorst (UK) Ltd	X							X	X						
Cambridge Consultants Ltd							X								
Catal International Ltd	X		X	X	X		X	X	X						
CD Adapco Group							X								X
CERAM Research			X			X		X	X					X	
Ceres Power Ltd														X	
Chell Instruments Ltd	X			X			X		X						
Conduit Ventures Limited										X					
Core Technology Ventures Limited										X					
CPR Automation				X			X								
Dart Sensors Ltd							X	X				X			X
Davis Pneumatic Systems Ltd	X														
Drayton Beaumont Kilns Ltd	X						X								
DT Assembly and Test Europe Ltd							X	X	X		X	X	X	X	X
E4tech (UK) Ltd							X				X	X	X	X	X
EA Technology Limited	X	X		X		X	X		X	X	X			X	X
ECOTEC Research and Consulting Ltd							X								
Element Energy Ltd							X				X		X	X	X
Elsevier Advanced Technology							X								
Eneco Ltd	X	X		X			X	X	X		X				
Escovale Consultancy Services							X								
Fluent Europe Ltd							X				X	X	X	X	X
Fuel Cells (Scotland) Ltd	X				X				X					X	
Gencoa								X							
Generics Group Ltd							X				X	X	X	X	X

												Fuel cells				
Company Name	Control systems	Hybrid engines	Hydrogen production	System integration	Fuel / fuel systems	Fuel storage	Services	Materials / components	Test / sensor equipment	Venture capital / other funding	AFC	DMFC	MCFC	SOFC	PEMFC
Heatric			X				X	X							
Hudson Shribman Scientific Recruitment							X								
Hydrogen Solar Production Company Ltd			X												
Inco Special Products								X					X	X	X
Ineos Chlor Ltd			X					X			X	X	X	X	X
Intelligent Energy Ltd				X	X			X	X						X
International Innovation Services Ltd							X			X					
ITM Power Ltd			X					X				X			X
Johnson Matthey Fuel Cells					X			X		X		X			X
MEL Chemicals								X						X	X
Microponents Ltd								X			X	X		X	X
Microtherm International Ltd								X			X		X	X	X
Morgan Fuel Cell								X				X	X	X	X
Oxford Lasers Ltd							X	X							
Parker Hannifin plc IPDE	X			X	X			X							
Porvair Fuel Cell Technology					X			X							
Powergen UK plc				X			X								
QinetiQ Ltd	X	X	X	X		X						X			X
Ricardo UK Ltd	X	X		X	X		X	X	X						
Rolls Royce Fuel Cell Systems Ltd		X		X			X							X	
Scottish and Southern Energy plc							X			X					
siGEN Ltd				X			X					X			X
South West Electrolysers			X				X								
Stainless Metalcraft Ltd						X		X			X	X	X	X	X
Synnogy Ltd							X				X	X	X	X	X
Technology Interface								X			X	X			X
Turquoise International Limited										X					
Unitec Ceramics Ltd								X						X	
Voller Energy Ltd				X	X	X	X								X

accentus

Accentus plc

Building 551 Harwell IBC, Didcot, Oxfordshire OX11 0QJ

Website: www.accentus.co.uk

Description:

Accentus plc, a wholly-owned subsidiary of AEA Technology, is a leading international generator, developer and exploiter of Intellectual Property.

Accentus is developing compact mini-channel reformers, low temperature plasma reformers for diesel, as well as novel hydrogen storage technology.

Products:
Small-scale steam methane reformers.

Notable achievements to date:

- Development of a steam methane reformer unit, 4 kWe equivalent output at less than 1 litre volume.
- Successful execution of 3-year development program.
- Looking to exploit process intensified SMR technology to hydrogen production and for fuel cell applications.

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Adelan UK Ltd

Birmingham University Research Park, 97 Vincent Drive, Birmingham B15 2SQ

Website: www.adelan.co.uk

Description:

Adelan focuses on the registration and incubation of solid oxide fuel cell (SOFC) intellectual property (IP) developed in the course of academic and commercial R&D efforts. Adelan aims to develop strategic client partnerships to mass-produce proprietary technology through license agreements. Typically Adelan does not sell IP, and only licenses IP. Adelan is a Director-owned "spin out" company strongly linked to formulation engineering research at Birmingham University. Started in 1996 with a UK Department of Trade and Industry (DTI) SMART award, Adelan is under the scientific guidance of Professor Kevin Kendall FRS; SOFC system design and SOFC fuels processing are Adelan's key strengths.

Adelan's principal novel contribution to the SOFC industry is a micro-tubular fuel cell from which modular full-scale units can be built according to power requirements. Adelan's expertise in micro-tubular SOFC technology has formed the basis for product development projects with a range of international clients. The company engages strategic partners to participate in these projects, which are based on single patent licensing agreements. Current projects aim to develop APU systems for road and air vehicles. Past projects include the development of a portable power unit and a domestic-scale CHP system. Future projects will develop a unique micro-SOFC system design and a new hydrogen generation method. Opportunities to co-develop and invest in three in-house patents currently exist. Interested parties should contact Professor Kevin Kendall or Dr Michaela Kendall with well-developed proposals.

Products:
14 years experience in optimising formulation, extrusion and assembly of micro-tubular SOFCs provides Adelan a demonstrable market advantage. Demonstration cells and cell assemblies are regularly produced in the Adelan laboratories at Birmingham University, UK. Prototype systems designed around in-house patents continue to be produced for clients.

Notable achievements to date:
- Commercial experience in patent licensing and product development with strategic partners (6 patents registered by Kendall et al. since 1994; 2 sold to Acumentrics, 1 transferred to US, and the latest 3 patents are owned in-house).
- State-of-the-art R&D facilities in Birmingham, UK and manufacturing partners in Europe
- Training (including MSc and PhD) FC personnel, now through Birmingham University

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AEA Technology plc

Harwell, Didcot, Oxfordshire, OX11 0QJ

Website: www.aeat.com

Description:

AEA Technology is involved in the development of a number of key technologies that are required in fuel cell systems. This includes fuel reforming, fuel processing and conditioning, fuel storage, balance of plant technologies including CHP, power electronics and control, and interconnection of stationery fuel cells to the electricity network. The work undertaken spans both SOFC and PEM fuel cells. AEA Technology also acts as a systems integrator, working with companies that have developed fuel cell stacks to design/develop/build complete systems and run demonstration projects.

Products:
A range of products and services related to the key technologies involved in fuel cell systems (see achievements below).

Notable achievements to date:
- Kinectrics Inc in Canada (a wholly owned subsidiary of the AEA Technology Group) is working with Siemens to develop, build, commission the world's largest pre-commercial SOFC.
- Kinectrics Inc also has teams with expertise in a range of components in fuel cell systems, including fuel processing, hydrogen storage, and balance of plant including CHP, and connection to the power grid.
- Accentus plc (a wholly owned subsidiary of the AEA Technology Group) has been developing non-thermal plasma and catalytic reformers for converting various fuels to hydrogen for use in fuel cell systems.
- Accentus plc has also undertaken studies of the technologies being developed on a worldwide basis for application within the hydrogen economy

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Email: Ralph.watts@aeat.co.uk

Air Products plc

Hersham Place, Molesey Road, Walton-on-Thames, Surrey KT12 4RZ

Website: www.airproducts.com/h2energy

Description:

Air Products – the world's largest supplier of merchant hydrogen – is taking an active leadership role in the emerging field of hydrogen energy.

Air Products is working with public, private and governmental bodies to develop and promote hydrogen in fuel cell and other energy applications. During the past 10 years the company has been a leader in the design, construction and installation of numerous hydrogen fuel stations for demonstration projects for buses, cars and trucks in Europe and North America.

Since the early 1990s, Air Products hydrogen safety engineering teams have participated in various safety hazard reviews including hydrogen, fuel cell powered vehicles and refuelling stations. In addition the company's experts are actively participating on committees for the development of codes and standards for hydrogen technologies.

Products:
Air Products works to supply hydrogen and the surrounding infrastructure required for fuel cell applications. The company has expertise in the production, distribution, purification and storage of hydrogen.

Notable achievements to date:
Built over 20 hydrogen fuelling stations worldwide including:

- Las Vegas Hydrogen Energy Station – onsite hydrogen production with a fuel cell power plant and vehicle fuelling capability
- Howaldtswerke-Deutsche Werft AG (HDW) – supply of a hydrogen fuelling station for fuel cell powered submarines

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Alternative Fuel Systems Ltd

Spring Copse Business Park, Slinfold, West Sussex RH13 0SZ

Website: www.afs.uk.com

Description:

AFS is actively involved in the development of Alkaline Fuel Cell stacks and systems in the 2-10kW range. Initial projects are for stationary power applications in the telecoms and UPS market.

New technology for the manufacture of low cost, reliable and recyclable fuel cell stacks, without the use of noble metals is available to AFS and cells are currently on test. Integration of reformers and regenerative CO2 scrubbers is underway

Products:

- 2 kW demonstration systems, both manual and automatic are in use in various countries.
- 10kW CHP demonstration system on test, to be installed in a UK housing project in the 3rd quarter of 2003
- 10kW Telecoms system under design

Notable achievements to date:

- Over 15 concept proving prototypes delivered (using ZeTek power stacks).
- 'Smart' award for the development of the current system.
- Fuel Cell controller (microprocessor) to be patented.

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AMEC plc

410 Birchwood Boulevard, Birchwood, Warrington WA3 7WD

Website: www.amec.com

Description:

AMEC plc is an international engineering services company providing design, project, delivery and maintenance support to clients in the oil and gas, transportation, industrial and infrastructure sectors. The company generates revenues in excess of £5.5 billion per annum and works at local, national and international levels, employing 50,000 staff throughout the UK, continental Europe, North America and some 40 countries worldwide.

Products:
AMEC aims to provide its clients with the most appropriate technology to safely deliver the best value. As a fuel cell user, and as engineers to clients, AMEC recognises that there is still much to learn and do to fulfil the promise of fuel cells.

Notable achievements to date:

- First major UK engineering firm to recognise and support the role of fuel cells in its energy strategy.
- First purchaser of a fuel cell for a UPS (Uninterruptible Power Supply) application in the UK.
- Working with BOC plc on the safe installation of a safe hydrogen supply for a PEM fuel cell.
- Working with a local authority in the promotion of a community hydrogen infrastructure.

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Email: renewables@amec.com

Aspen Technology

Titan House, Castle Park, Cambridge CB3 0AX

Website: www.aspentech.com/

Description:

AspenTech's Fuel Cell Engineering Solution (FCES), is one of the world's leading fuel cell modeling systems. It accelerates the design and refinement of fuel cell systems. In addition to providing steady state, dynamic, and property capabilities, the solution is open and flexible, enabling customers to model a wide variety of different fuel cells and integrated fuel cell systems for diverse applications.

AspenTech's customers have experienced a substantial cycle time reduction in Fuel Cell development! The key to customers' successes has been the rapid system-wide integration of fuel cell components. AspenTech has validated this system-wide approach through 10 years of helping customers accelerate development and deployment of fuel cell technologies. Over 1,200 leading process companies already rely on AspenTech's 20 years of process industry experience to increase revenues, reduce costs and improve capital efficiency. Customers include leading automobile manufacturers, leading developers of stationary fuel cell systems, established fuel cell providers, reformer technology developers, leading hydrogen producers, and the world's largest suppliers of power plant systems.

Products:
AspenTech supplies an integrated, state of the art Simulation, Design and optimisation software tools and services for rapid fuel cells development.

Notable achievements to date:
- 7 out of 10 automobile manufacturers use AspenTech's Fuel cell solutions.
- 8 out of 10 power producers/developers use AspenTech's solution.
- Several major Fuel cell developers and manufacturers use AspenTech's solution.
- Leading edge flowsheeting technology to simulate the tightly integrated fuel cell system including heat integration between the exothermic oxidizers and the endothermic reformer, water recycle, and hydrogen recovery and recycle.

AspenTech has more than 1200 process industry customers, 600 university customers in 55 countries.

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BAXI GROUP LTD

European Fuel Cell gmbh, a subsidiary of the Baxi Group Ltd

Pentagon House, Sir Frank Whittle Road, Derby DE21 4XA

Website: www.baxi.com and www.europeanfuelcell.de

Description:

European Fuel Cell is a systems integrator.

Products:
Currently developing beta PEM fuel cell CHP system.

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Ian Stares, Baxi Group
Email: ian.stares@baxi.com

BMT Defence Services Ltd

Maritime House, 210 Lower Bristol Road, Bath BA2 3DQ

Website: www.bmtdsl.co.uk

Description:

BMT DSL is a leading independent engineering and management consultancy specialising in whole-warship design and support services including naval architecture, marine and systems engineering, safety, environmental and risk engineering.

Products:
The company's services encompass engineering and management consultancy in the maritime defence field, ranging from minor studies through to the design and procurement definition of a complete warship. Professional expertise includes naval architecture, marine engineering, combat system engineering, risk, safety and environmental assessments and management services.

Notable achievements to date:
- Detailed feasibility study into replacement of submarine main battery by regenerative fuel cells.
- Feasibility assessment of diesel reformer / PEM fuel cell based harbour generator for warships.
- Team members of NATO Industrial Advisory Group investigating warship technologies, including fuel cells.

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BOC

The Priestley Centre, The Surrey Research Park, Guildford Surrey GU2 7XY.

Website: www.boc.com

Description:

The BOC Group, the worldwide gases, vacuum technologies and distribution company, serves more than two million customers in more than 50 countries. It employs some 46,000 people and had annual sales of over £4 billion in 2002.

BOC has a dynamic program of initiatives in the evolving hydrogen energy market. This includes investments in Chrysalix and QuestAir, participation in a number of bus trials in the UK and Australia, alliances with several fuel cell system companies and engagement with influential industry groups. It also participates in collaborative development programme, and internal R&D programmes for innovative catalytic partial oxidation technology and novel approaches to small-scale hydrogen production.

Products:
BOC supplies hydrogen and safe engineering services to customers around the world.
For hydrogen users there are three main supply options. The option chosen by a customer depends on the amount required or the distance from a production facility:

- Road deliveries in tankers and cylinders; generally less than 200 Nm3/h
- Small onsite production; between 200 Nm3/h and 400 Nm3/h
- Deliveries by pipeline

Notable achievements to date:
- BOC supplies approximately 7.5M Nm3 of hydrogen to its customers each day.
- BOC operate a direct and indirect equity investment programme for the emerging hydrogen economy
- BOC's knowledge of hydrogen safety is extensive and globally the company helps to create many of the standards
- BOC is engineering a number of demonstration projects around the world, most notable is the CUTE bus trial in London and Perth

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BP

Chertsey Road, Sunbury-on-Thames, Middlesex TW16 7LN

Website: www.bpenergy.com/news/publications.html

Description:

BP has a vast amount of experience in manufacturing, distributing and retailing fuels and has a commitment to developing cleaner energies for its customers. The company currently produces hydrogen in large scale at its refineries and sees potential for hydrogen to be an important energy source for the future. To this end, BP is focused on hydrogen manufacture, distribution and retailing.

BP is working to achieve technical and economic breakthroughs in these areas through practical demonstration projects with partners in the auto and technology industry and government. There are currently only a small number of hydrogen-refuelling stations worldwide, which are used to test and demonstrate pre-commercial hydrogen vehicles. BP is a partner in the California Fuel Cell Partnership site and has a hydrogen-refuelling site at the Munich airport in Germany. The company will build several refuelling sites in time for the arrival of additional pre-commercial hydrogen vehicle testing (in the US, Europe and Singapore). The first of these sites has already been completed in Barcelona, Spain.

To address social and regulatory issues associated with hydrogen, BP is working with customers and permitting authorities to test acceptability of site layouts, and is a key member on a variety of standards and regulations committees.

Notable achievements to date:

- Public hydrogen refuelling station at Munich airport in Germany.
- Member of the California Fuel Cell Partnership.
- Provider of hydrogen infrastructure to 3 of the 9 cities (and a partner in 2 other cities) in the Clean Urban Transport for Europe (CUTE) hydrogen bus project.
- Hydrogen refuelling station recently commissioned in Barcelona, Spain.
- Announced future hydrogen refuelling stations in Perth (Australia), Singapore and Los Angeles.

Contact: **Michael Jones**
Hydrogen General Manager
Email: jonesMID@bp.com

Bronkhorst (UK) Limited

Cathrine House, London Road, Sawston, Cambridge CB2 45XE

Website: www.bronkhorst.com

Description:

For many years Bronkhorst High Tech has been at the forefront of world-wide developments in gas and liquid control within the fuel cell sector. The vital component to this success is Bronkhorst's collaborative approach to product design and development is characterised by close dialogue with customers, which ensures a solution tailor made to their specific requirements. Continuous growth over the last 20 years has resulted in multiple manufacturing facilities spanning three continents, sales and service centres in over 30 countries and additional sales agents in a dozen more. The company is approved to ISO9001 and ISO14001, and currently employs over 200 people. The commitment to advanced customer focused research into new techniques continues, with over 70 staff involved in R & D.

Products:

- Analog and digital communications (Including DeviceNet and Profibus DP)
- Thermal Mass Flow Meters and Controllers for gas applications (Flow ranges from 0.02 ml/min to 11,000 m3/hour air, pressure rating from vacuum to 700 bar).
- Thermal Mass Flow Meters and Controllers for liquid applications (Flow ranges from 500 nanolitres/min to 20 Kg/hour water equivalent, pressure rating from vacuum to 400 bar).
- Coriolis Mass Flow Meters and Controllers for Gases and Liquids (Flow ranges from 20 g/hour to 600 kg/hour, pressure rating to 300 bar).
- Electronic Pressure Controllers (Ranges from "WC to 700 bar)
- Direct Liquid Source Evaporators for Controlled Evaporation and Mixing (Generally used for humidification. Far superior performance to traditional bubbler systems).
- Mechanical Pressure Regulators
- Cylinder gas regulators and accessories, line regulators for "WC to 690 bar.

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Cambridge Consultants Ltd

Science Park, Milton Road, Cambridge CB4 0DW

Website: www.CambridgeConsultants.com

Description:

Cambridge Consultants Limited (CCL) designs and develops innovative new products, processes and systems, and offers world-class technology consulting expertise. CCL enables clients to turn business opportunities into commercial successes, whether launching first-to-market products, or expanding existing markets through the introduction of new technologies.

Backed by teams dedicated to the automotive, defence and energy markets, Cambridge Consultants offers consulting skills in fuel cell technology, backed by the development capabilities to help clients realise their commercial objectives.

Products:

- Leading edge sensor and control technology.
- Technology and market assessment.
- Design and development.

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Catal International Ltd

Cooper Buildings, Arundel Street, Sheffield S1 2NS

Website:

Description:

Catal is a developer and manufacturer of catalysts and equipment for the production of hydrogen for fuel cell applications. Processes include steam and carbon dioxide reforming and oxidative reforming. Catal undertakes collaborative projects with customers and is focused on the development of process catalysts and hardware for the fuel cell industries.

Products:

- High performance catalysts for steam/carbon dioxide reforming and partial oxidation, Shift and CO oxidation systems.
- Miniature and compact steam reforming process hardware

Notable achievements to date:

- Experts in Steam Reforming and hydrogen processes
- Significant development and engineering facilities
- 15 years expertise in hydrogen processes and hardware construction
- Manufacturing and pilot plant facilities in Sheffield.
- Development of compact catalytic process and catalyst commercialisation

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CD adapco Group

200 Shepherds Bush Road, London W6 7NY

Website: www.cd-adapco.com/apps/STAR-CDfcell.htm

Description:

The growing interest in fuel cell technology and the use of Proton Exchange Membrane Fuel Cells (PEMFC) as a means of developing cleaner and more efficient electric power units for automotive and stationary applications, has led to the CD adapco Group's development of CFD (Computational Fluid Dynamics) products to assist fuel cell designers in optimising their designs and fuel cell performance. To this end, the Group's Engineering Services team in New York has been involved in an extensive program of collaborative research and development with the University of South Carolina (USC), striving to provide the industry with the best CFD analysis solutions in this area.

Products:
The CD adapco Group's CFD tools along with USC subroutines, allow for improved understanding of the physical phenomena that take place inside the fuel cell. PEMFC systems can be simulated and analysed using the CD adapco Group's pre-processing tool (es-fuelcell) for setting up and building the models, and the CFD solver STAR-CD and USC's electrochemistry subroutines can be used for calculating the solution. Calculated values include current density, overpotential, water management and temperature distribution.

Notable achievements to date:
- Substantial R+D programs with USC since 2000 in PEM fuel cells.
- Simulation of a commercial sized fuel cell (6 million cells).
- Substantial validation work with experimental data.
- Trimmed cell technology allows modelling of complex flowfield designs.

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CERAM Research

Queens Rd, Penkhull, Stoke on Trent ST4 7LQ

Website: www.ceram.com

Description:

CERAM is an international research and technology organisation with over 50 years experience in working for clients involved in ceramics and materials processing, manufacture of components and the use of ceramic products. CERAM's involvement in fuel cells has focused on SOFC and has encompassed modelling and design, materials development, component manufacture, testing, and evaluation.

CERAM works closely with clients and academic partners either in one to one, or collaborative projects to solve specific problems. The company has contributed to several projects in the UK Advanced Fuel Cells, and the EU funded Joule programmes both as collaborators and as project leaders. CERAM has made several novel contributions in the SOFC field through the work of internally sponsored Teaching Company Associates and through its Post Graduate Training Partnership with Keele University. CERAM is also involved in hydrogen generation and storage projects.

Products:
Research and development projects addressing various aspects of SOFCs and related technologies.

Notable achievements to date:
- Carried out and been involved in several research and development projects in UK, Europe, and USA, including leading a major Joule project on Intermediate Temperature SOFC.
- Developed novel electrode materials and application techniques.
- Led an outward expert mission to Japan on SOFC on behalf of DTI.
- Applied novel ceramic manufacturing techniques to fabricate both planar and tubular SOFC components.
- Modelled the performance of manufacturing routes and developed factory layouts for SOFC manufacture.

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Ceres Power Ltd

Unit 18, Denvale Trade Park, Haslett Avenue East, Crawley, West Sussex RH10 1SS

Website: www.cerespower.com

Description:

Ceres Power is focused on becoming the world's preferred supplier of quality, solid oxide fuel cell (SOFC) technology.

Customer demands in the distributed power market for robust, durable, efficient, reliable, rapid start-up and low cost units producing usable heat have been challenging targets in the fuel cell world. At Ceres Power these issues have been taken on-board, and through development of a unique, metal-supported intermediate temperature SOFC technology operating at 500-600ºC, Ceres Power is set up to deliver 1-25 kWe power units for the following applications:

- Remote power
- Auxiliary Power Units
- Micro-CHP
- UPS

Ceres Power is capable of delivering added value to its customers businesses via a forward thinking, world eminent team operating in a dedicated development facility. The simple technology can be tailored to multiple fuel, market and end-user needs, and it has a low cost production ability that is not globally limited.

Products:
Ceres Power processes readily available raw materials to form SOFC cells, arrays and stacks that can be added to application specific products. In-house modelling, research, processing, building, development and testing allows for client specification testing to be undertaken, and systems design work allows for early product design development to occur.

Notable achievements to date:
- World's only commercial provider of metal supported SOFCs operating at 550ºC
- Rapid thermal cycling, mechanically robust design with fast start-up capability
- Attracting international commercial and industrial interest for potential partnerships
- Strong team of development staff based in a purpose built facility beside London Gatwick airport with excellent links to the world's markets

Contact: **Dr Peter Bance**
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Chell Instruments Limited

Folgate House, Folgate Road,North Walsham, Norfolk NR28 0AJ

Website: www.chell.co.uk

Description:

Chell Instruments Ltd offer gas flow, pressure and vacuum instrumentation, but more than that the company is involved in the technical application of such equipment. Chell has the capability to tailor standard equipment if needed, or develop new products for very specific applications. Everything offered is backed up with service and support right here in the UK, and the company's UKAS Accredited calibration laboratory can deal with most makes of gas flow, vacuum and pressure instrumentation.

Products:

- Gas Mass Flow Controllers to 10,000slpm and Meters up to 15,000slpm.
- Gas Flow Calibration Standards.
- Gas Purifiers and Dryers (prevents membrane damage!)
- Gas Pressure Control Systems.
- Gas Panels and Systems Integration.
- R & D (specific to gas flow and pressure control techniques).
- Service / Repair / Calibration of Flow, Vacuum and Pressure Instrumentation.

Notable achievements to date:

- ISO17025 Calibration Laboratory (UKAS accredited).
- European Service Centre for Teledyne Hastings Instruments.

Contact:

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Conduit Ventures Limited

20-21 Took's Court, Cursitor Street, London EC4A 1LB

Website: www.conduit-ventures.com

Description:

Conduit Ventures Limited is the first European based venture capital company which focuses purely upon fuel cells and related hydrogen technologies.

Notable achievements to date:

- Four cornerstone investors; Shell Hydrogen of Amsterdam, Mitsubishi Corporation of Tokyo, Danfoss A/S of Nordborg, Denmark, and Johnson Matthey plc of London.
- First investment in Cellex Power Products Inc., Canada.
- Over 90 credible deals reviewed to date.
- Aim for US$100 million in the Fund.
- Investment team highly experienced in both venture capital and the fuel cell industry.

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Core Technology Ventures LLP

Queens House, 1 Leicester Place, London WC2H 7BP

Website: www.coretecventures.com/

Description:

Core Technology Ventures (CTV) is a venture capital fund dedicated to the early stage fuel cell industry in Europe. With offices in the UK and Germany the fund will invest in companies developing technologies that will accelerate the commercialisation of fuel cells.

The CTV team has 40 years' experience of venture capital investment and investment banking, dealing with the problems and pressures that small businesses face and managing their path to exit. In addition, the CTV team has in-depth knowledge of the technology, the competitive landscape and markets.

CTV has established a network of relationships covering industry, research institutes, universities and government throughout the European fuel industry and has formed an Advisory Group comprising clean energy experts to advise on the unfolding industry structure, technological developments and European and member governments' policy.

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CPR Automation Ltd

Apollo, Lichfield Road Industrial Estate, Tamworth, Staffs B79 7XH

Website: www.cprautomation.com

Description:

CPR Automation Ltd provides flexible production automation solutions to meet customers' specific requirements. CPR Automation fills the gaps between standard items of production equipment, either literally or metaphorically.

Literally, CPR can provide the hardware and software to link standard machines with robots and conveyors. More importantly, the company will design and develop special machines and produce complete systems for many assembly, process and test applications.

With forty years experience of providing production solutions to a broad spectrum of customers, the company can adapt and adopt to create the machine or system that is right for purpose:

- with the right blend of bespoke and standard equipment to satisfy the task with maximum reliability and maintainability.
- offering the right level of technology to produce quality products at reasonable capital costs.
- coupled with the right level of product and process traceability.
- and the right degree of future-proofing to meet foreseen expansion of production or of product variants.

Working in close partnership with customers, the company makes the most of joint talents. CPR Automation Ltd's expertise and experience of production automation and processes complements customers' knowledge of their products and process idiosyncrasies.

Products:
Special purpose production machines, robot cells, complete turnkey systems.

Notable achievements to date:

- Patented the world's leading spring disentangler.
- Continue to be at the leading edge of automating new processes, such as transition laser welding.
- Retain the ability to offer the most appropriate production solutions.

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Dart Sensors Ltd

Dart Marine Park, Totnes, Devon TQ9 5AL

Website: www.dart-sensors.com

Description:

Electrocatalysis, the engine of the fuel cell, is one of Dart Sensors' core strengths. Dart is a major manufacturer of fuel cell sensors for breath alcohol measurement. Dart's products are used worldwide: about half of British drink-drive prosecutions depend on them. The sensors' high performance is due to a proprietary method of preparing high activity platinum electrocatalysts.

Dart Sensors brings over 30 years relevant experience to the re-emerging power fuel cell sector. The company has modified its catalyst production method to produce supported versions suitable for use in fuel cell cathodes and anodes, and are adapting an ethanol sensor to operate as a methanol sensor for fuel control in DMFCs.

Dart Sensors reprocesses all platinum from its spent and reject sensors and manufacturing residues back into catalyst.

Products:
Of relevance to the fuel cell industry: electrocatalysts both supported and unsupported. New products under development include a fritless screen-printable platinum ink, and a methanol sensor. Platinum recovery service. See website for latest details.

Notable achievements to date:
- Experience in electrocatalysis and fuel cell technology dates back to 1969.
- Continuous development of platinum electrocatalyst since 1986.
- Almost 100,000 evidential quality, ethanol fuel cell sensors made since 1991.
- Suppliers of electrocatalyst to manufacturers of electrochemical toxic gas sensors.
- Accreditation to ISO 9001:2000, and holders of DTI "SMART" development award.

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Davis Pneumatic systems Ltd

Plympton, Devon PL7 4BQ

Website: www.Davispneumatic.co.uk

Description:

Davis Pneumatic is a manufacturer of specialist pneumatic / fluidic products, including low-power consumption solenoid control components.

Products:
Low power consumption and spring-applied control valve solutions.

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Drayton Beaumont Kilns Ltd

Newstead Trading Estate, Plantation Road, Trentham, Stoke On Trent, Staffs ST4 8HX

Website: www.beaumontkilns.co.uk

Description:

Designers and manufacturers of thermal units.

Products:
Kilns, driers, furnaces, test and production equipment.

Notable achievements to date:
- Supplied a kiln and drier to Foseco group.
- Designed and built kilns for aerospace market.
- Carpenter Certech and Ross ceramics (Rolls Royce) are customers.

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Sales Director
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DT Assembly & Test Europe Ltd

Tingewick Road, Buckingham MK18 1EF

Website: www.dtindustries.com

Description:

DT is committed to supporting the Fuel Cell industry by providing automation and assembly systems. The company offers customised solutions ranging from market entry to high volume Assembly and Verification In Process systems.

Its aim is to provide modular solutions with the ability to grow with the demand of client's products, ensuring that the investment is relevant to the stage of business and product development.

The European Fuel Cell team comprises engineers and technicians across mechanical, controls, standards, marketing, manufacturing and customer support disciplines. The team also calls upon DT Industries' extensive experience in providing Automation, Assembly, and Test solutions across a broad range of manufacturing industries and applications.

Products:
Structure and Support for: FMEA, Design for Assembly / Test, Value engineering, Value Stream Mapping, Cause & Effect Analysis. Production & VIP Equipment from DT Industries' range of automation & packaging solutions: Research and Low Volume to High Volume Quality Production systems. Automation of individual processes or complete assembly of Fuel Cells/ Stacks.

Notable achievements to date:
- Manufacturing and support facilities in UK, Germany and USA.
- ISO accredited, all European equipment is designed, built and certified to all relevant European and CE standards.
- 200 employees in Europe, 2000 employees world wide.
- Over 70 years experience in component testing.
- Suppliers of automation & test systems to the world's major automotive, medical and high volume production companies.

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E4tech (UK) Ltd

46 Prince's Gardens, London SW7 2PE

Website: www.e4tech.com

Description:

E4tech is a strategic consultancy in the field of energy and the environment, with a main emphasis on fuel cells, hydrogen energy, biomass, distributed generation and sustainable buildings. E4tech's goal is to enable solutions that are technologically, economically and environmentally sound.

Products:
E4tech's work typically involves drawing business and policy level conclusions based upon a sound understanding of energy technologies and the issues that drive them. Clients include global multinationals, regional, national and international government organisations, venture capital firms, NGOs and inventor-led startups.

Notable achievements to date:

- 10 years involvement in the fuel cell sector.
- Study for The Carbon Trust and DTI on the status and potential of the fuel cell industry in the UK, published February 2003.
- Analysis of potential for stationary fuel cells in developing country settings for UNEP/UNDP, 2001.
- Review of innovation systems in new and renewable energy technology for DTI, summer 2003.
- Participation in variety of EU projects assessing prospects for fuel cells and hydrogen energy in remote and island locations.

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EA Technology Limited

Capenhurst Technology Park, Capenhurst, Chester CH1 6ES

Website: www.eatechnology.com

Description:

EA Technology is one of the UK's leading energy technology services companies. Independently owned, by its management and employees, it has particular expertise in fuel cell systems and their applications, combined heat and power (CHP), renewable energy technologies, energy storage and their overall interaction within the wider context of distributed generation (DG).

Products:
EA Technology has long standing interests in the development, applications and markets for fuel cell systems. It conducts various technology, applications and market assessments on behalf of its international client base.

Notable achievements to date:
- Detailed assessment of market potential for PEMFC and SOFC systems.
- Assessment of fuel cell competing technologies.
- Assessment of fuel cell niche market applications.
- Assessment of prospects for UK component supplies.
- Various specific client confidential technology and market assessment studies.

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ECOTEC Research and Consulting Ltd

Priestley House, 28 - 34 Albert Street, Birmingham B4 7UD

Website: www.ecotec.com

Description:

ECOTEC Research and Consulting is an international consultancy and research company. It has a staff of about 160 drawn from a wide range of disciplines including economists, environmental scientists, planners and social scientists. The company's four key business areas lie in environment, economic development, social policy and communications. Its expertise lies in identifying and quantifying the economic and social benefits and implications of new technologies and helping both private and public sector clients maximise these gains. ECOTEC is active at the European, national and regional level.

ECOTEC has an active interest in fuel cell and hydrogen economy projects. The company is particularly interested in the potential social and economic impacts that the sector can bring.

Notable achievements to date:
Recently completed projects of relevance include

- For Advantage West Midlands (the regional development agency for the West Midlands): A study to identify potential hydrogen economy projects in the region. The report considered the regional skill base and potential hydrogen economy / fuel cell markets and suggested a number of projects designed to match regional abilities to potential markets. Outline feasibility reports were completed for each project (with Whitby Bird and Partners).

- For the Hong Kong legislature: A review of the potential for new and renewable energy take-up in Hong Kong. This study included analysis of the potential for fuel cell use in buildings - focussing on UPS applications.

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Element Energy Ltd

Janus House, 50 St. Andrews Street, Cambridge CB2 3AH

Website: **TBC by October 2003**

Description:

A hydrogen and fuel cell integration company, Element Energy provides strategic advice and engineering design consultancy services. Specialist areas include the integration of hydrogen and energy storage technologies with renewable and intermittent energy sources, low/zero emission transportation (including hydrogen) and the integration of fuel cells and hydrogen technologies within the built environment. The company's work in the built environment provides them with a unique understanding of client needs and real-world demand side requirements. Element continues to be very successful in instigating projects and acquiring funding for new and emerging technology demonstrations. Detailed analytical and design skills are complimented with an understanding of the financial dimensions of the sector. While most of Element's work is UK based, the company is EU focused and is currently engaged on projects in Sweden, the Republic of Ireland and in the developing world.

Element Energy Ltd was founded in 2003, to build upon and expand over 20 man-years work on renewables, hydrogen and fuel cells undertaken at Whitby Bird and Partners (a major UK engineering firm). The company has access to the resource and design experience of a major engineering firm.

Products
Element Energy's strengths originate from its broad knowledge of the energy industry, allowing the company to identify market opportunities for emerging technologies. Complimenting its core engineering and consultancy work, Element is involved in a number of joint venture product developments, integrating hydrogen technologies into complete systems and developing control systems.

Notable achievements to date:
- Expanding clients list including: City Councils, Regional Development Agencies, major industrial companies, retail companies, SME development companies, universities, government R&D projects and electrical utilities.
- Obtained over £5.7 m of state funding for RES and hydrogen initiatives in the UK and overseas.
- USHER project – fully funded and designed solar hydrogen bus project in Cambridge and Gotland (Sweden). Obtained funding, managed the technical side of the project and carried out the scheme design work.
- Advantage West Midlands "Hydrogen Economy" – strategy to stimulate hydrogen and fuel cell activity in the region (with ECOTEC Research and Consulting Limited).
- 'Feasibility study for a UK domestic SOFC micro-CHP unit', with Adelan.

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Elsevier Advanced Technology

PO Box 150, Kidlington, Oxford OX5 1AS

Website: www.grovefuelcell.com and www.elsevier.com/vj/fuelcell

Description:

Elsevier has a portfolio of major research and industrial information products, including some of the leading conferences, research journals and industrial publications covering fuel cells and related technologies.

Products:
Elsevier Advanced Technology organises the Grove Fuel Cell Symposium and the Fuel Cells Science & Technology conference series, and publishes the monthly *Fuel Cells Bulletin* technology/business newsletter and *Refocus* renewable energy magazine. Elsevier also publishes leading research journals in fuel cells and related fields, including the flagship *Journal of Power Sources* (and the related Fuel Cell Virtual Journal), *Solid State Ionics*, *Electrochimica Acta* etc.

Notable achievements to date:
- The Grove Fuel Cell Symposium (held in London in alternate years) is one of the world's leading conferences on fuel cell commercialisation, and for September 2003 has expanded to include a major exhibition and demonstration areas.
- The Fuel Cells Science & Technology Conference – held in non-Grove years, with the first in Amsterdam in 2002 – is now established as a major European research meeting. The 2004 conference will be held in Munich.
- The Fuel Cells Bulletin is the leading international technology/business newsletter covering fuel cells and related technologies, offering news, features, events, and extensive patent and research coverage.
- The new, monthly Fuel Cell Virtual Journal is available exclusively in electronic format, and lists selected articles with a fuel cell component recently published in a diverse range of Elsevier journals.

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Eneco Ltd

Unit 6, Spring Copse Business Park, Slinfold, West Sussex RH13 0SZ

Website: www.eneco.co.uk

Description:

Designers and manufacturers of alkaline fuel cells and ultra low emission electric hybrid fleet based inner city vehicles.

Products:
Eneco offers a full range of fuel cell systems of 0.5 to 50kW output, including a 0.4 kW output educational unit, a 9kW standby power generator and systems suitable for commercial vehicle installation. In addition: generic fuel cell controller, generic fuel cell voltage monitoring unit and battery charging management system**.**

Current electric hybrid vehicles include a 3.5 tonne van and a 26-seater bus with iterations of 7.5 tonne van expected in 2003 and 12 and 20 tonne trailer tractor units planned for 2004. (Ultra low emission performance / vastly reduced fuel consumption).

Notable achievements to date:
- Proven suitability of Alkaline Fuel Cell (AFC) for inner city vehicle application.
- Built 8 AFC powered vehicles.
- Designing own ultra low cost AFC system.
- Planning UK's first AFC manufacturing plant.
- Designed and built: 0.4 kW educational unit – 3 sold, 6 kW automotive system, 9 kW stand by generator- fully automated – remotely controlled.
- Designed and developed first European fuel cell educational course – starts Sept 2003 – College of Northwest London.
- Electric Hybrid Vehicles: designed and built a 3.5 tonne delivery van and two 26-seater buses.

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EscoVale Consultancy Services

Nutley Dean Business Park, Norwood Hill, Surrey RH6 0HR

Website: www.escovale.com

Description:

EscoVale has undertaken consultancy assignments relating to fuel cells for more than 25 years. During this time, it has delivered more than 1,000 reports to hundreds of clients from six continents. Topics covered include

- all the main FC technologies
- key materials, components and sub-systems
- stationary power, transportation and portable applications.

With a fuel cell track record that includes a multi-$M aggregate project value, EscoVale is one of the most experienced consultancies working in this sector. This fuel cell activity is supported by extensive work on other emerging and established energy technologies.

Products:

- **"Fuel Cells: The Sourcebook"** the reference report on companies involved in the fuel cell industry worldwide.
- **"Fuel Cells: Applications and Opportunities"** EscoVale's management study evaluating commercial prospects over the period to 2025.
- **"Fuel Cells: Technologies and Competitors"**, examining the present and future technical status of FCs compared to other contenders.

Notable achievements to date:

- clients for fuel cell projects from 55 countries.
- more than 50 FC consultancy assignments, tailored to the needs of specific clients.
- over 200 fuel cell management reports delivered to six continents.
- a leading FC reference report, used by more than 1,000 organizations worldwide.

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Fluent Europe Ltd

Sheffield Business Park, Europa Link, Sheffield S9 1XU

Website: www.fluent.com

Description:

Fluent, the world's leading Computational Fluid Dynamics (CFD) software company, offers a full set of state-of-the-art cell modelling tools developed to predict and optimise fuel cell performance. Used during the design process, these new models will decrease turnaround time considerably.

Detailed models for Solid Oxide Fuel Cells (SOFC) and Polymer Electrolyte Membrane Fuel Cells (PEMFC) have been developed that are fully coupled with Fluent CFD software.

These modules allow the user to:

- Model fluid flow, heat transfer and mass transfer in porous media (anode and cathode)
- Simulate electrochemical reactions
- Predict the distribution of current and potential field in porous media and solid conducting regions

Fluent's electrochemical model predicts the local current density and local voltage distribution at the electrolyte and the electric potential field model allows users to reliably calculate the current and voltage in all the conducting solid and porous regions. In addition, the membrane water transport model describes net water flow across the membrane due to electro-osmotic drag and molecular diffusion of water.

Products:
Computational Fluid Dynamics Software, Consultancy & Training

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Fuel Cells (Scotland) Ltd

295 Carnethie Street, Rosewell, Midlothian EH24 9DT

Website: www.fuelcells-scotland.com

Description:

A small company developing highly innovative Solid Oxide Fuel Cell Stacks. Patented technology will create a major "cost down" breakthrough that will make SOFC Fuel Cells highly competitive in the near to medium term. First scale model of the fully operational stack will be unveiled at the Grove Exhibition in London on 24th September, 2003.

Products:
Seal-less Planar Solid Oxide Fuel Cell Stacks

Notable achievements to date:
- 3000 hr laboratory trials with no degradation.
- High power density, approx 1mW per cubic metre.
- Design can bypass faulty cells.
- CHP heat exchangers offer high efficiency energy use.
- Multi-fuel capability.
- Theoretical cost ratio of around £300 per kW.
- Internal gas reforming integral to design.

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Gencoa

4 Wavertree Boulevard South. Wavertree Technology Park, Liverpool L7 9PF

Website: www.gencoa.com

Description:

Gencoa is a high technology based company specialising in thin film technology and surface modification. The technology is based upon PVD (physical vapour deposition) and plasma CVD (chemical vapour deposition). These techniques and the related Gencoa products allow the creation of thin film layers (usually 0.05 – 10 microns) on organic or inorganic substrates.

Products:
Gencoa manufactures a range of magnetron sputter cathodes and plasma sources for a variety of thin film and plasma polymerisation processes. Process development of PVD and polymer layer systems.

Notable achievements to date:
2002 start of development for a low cost plasma deposited membrane system for fuel cells.

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Generics Group Ltd

Harston Mill, Harston, Cambridge, CB2 5GG

Website: www.GenericsGroup.com/fuelcell

Description:

The Generics Group (Generics) is a leading integrated technology and business consulting and development organisation, with an international reputation for successfully commercialising emerging science and technology in a wide range of industries. Generics' specialist Fuel Cell Team has been providing independent technical and business services to clients throughout the global fuel cell value chain since the mid-1980s.

Generics employs more than 150 high-calibre technology professionals with expertise in energy, engineering, materials, telecommunications, life sciences, business innovation and electronics. Facilities, including state-of-the-art laboratories, are located in Europe in Cambridge, Frankfurt, Zurich and Stockholm; and in Boston and Baltimore in the USA.

In the areas of electrochemical science, hydrogen generation, components, materials, fuel cell systems and end-applications, the company's range of activities for clients has included:

- Board-level support in technology and business strategy, venturing, partnering etc.
- Identification and qualification of new business opportunities.
- Product and manufacturing process innovation, development and cost engineering.
- Design, specification and modelling of fuel cell components and sub-systems.
- Technology due diligence and market & competitor analysis.
- IP evaluation and commercial exploitation.
- Systems procurement and testing at the company's Stockholm test laboratory.

Additionally, the compact mixed-reactant (CMR) fuel cell was invented at Generics. Through the use of highly selective electrocatalysts, CMR potentially offers an order of magnitude increase in stack power density and decrease in stack cost. Development is focused in the area of portable direct methanol fuel cells, although potentially it can be applied to any fuel cell chemistry.

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Heatric

46 Holton Road, Holton Heath, Poole, Dorset BH16 6LT

Website: www.heatric.com

Description:

Heatric is expert in providing compact solutions to the process industry and is dedicated to the development and manufacture of compact components for balance of plant applications for fuel cell systems.

Further to the company's experience in the manufacture of Printed Circuit Heat Exchangers (PCHEs), Heatric is seeking to provide similar solutions for chemical reactions, using its Printed Circuit Reactors (PCRs) concept. Heatric's innovative compact steam reformer has been proven to produce hydrogen-rich gas for a fuel cell system. In the coming months, Heatric envisions the manufacture of larger scale reformers.

Recently, PCHEs have also been used as the enabling technology for very demanding heat transfer applications in both automobile and stationary fuel cell systems. Working closely with customers, Heatric aims to tailor the best compact solutions for each individual fuel cell system.

Products:
Heatric manufactures compact components for balance of plant fuel cell systems. The company's expertise to date includes the manufacture of Printed Circuit Heat Exchangers (PCHEs) and Printed Circuit Reactors (PCRs).

Notable achievements to date:
- Successful demonstration of 5kWe steam methane reformer.
- Alliance with IMM-Mainz in demonstrating mass production of micro-devices.
- 20 years of manufacturing compact, high integrity components.
- Modelling heat transfer, hydraulic and mass transfer in microchannels.
- Substantial fuel cell related R&D programs.

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Proposals Manager
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Hudson Shribman Scientific Recruitment

Vernon House, Sicilian Avenue, London WC1A 2QS

Website: www.hudson-shribman.co.uk

Description:

Established in 1996, Hudson Shribman Scientific Recruitment is a specialist scientific recruitment consultancy handling a range of opportunities for scientists of all disciplines across the UK. The company has a particular interest in the area of renewables, and has worked with a wide range of clients in sourcing scientists for various Fuel Cell projects. The company offers a free, confidential service to all job seekers, and would welcome the opportunity to discuss current opportunities and client's future career plans.

Notable achievements to date:
Successful collaborations with a number of blue-chip and start-up organisations seeking to recruit Fuel Cell specialists.

Contact: **Adam Isle**
Manager
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Hydrogen Solar Production Company Ltd

Surrey Technology Centre, 40 Occam Road, The Surrey Research Park, Guildford, Surrey GU2 5YS

Website: www.hydrogensolar.com

Description:

Hydrogen Solar is building a portfolio of hydrogen technologies and Intellectual Property aimed at the new hydrogen economy. Currently the lead technology is the Tandem Cell, which converts light and water directly into hydrogen fuel and for which Hydrogen Solar owns the world-wide exclusive rights. The company also owns rights to biological processes for generating hydrogen, and are actively seeking to acquire compatible technologies in hydrogen generation and storage.

Tandem Cell
The Tandem Cell is made up of two photo-catalytic cells in series: the front cell absorbs the high-energy ultraviolet and blue light in sunlight, using nano-crystalline thin films to generate electron-hole pairs. The longer wave-length light in the green to red region passes through the front cell and is absorbed in a Grätzel Cell producing electrical potential under nearly all light conditions. The two cells are connected electrically and together split the water in the electrolyte into hydrogen and oxygen. The Cell is fabricated from widely-available and cheap materials, and the hydrogen will be usable directly in fuel cells.

The key to the tandem cell is the performance of the thin-film coatings in reacting to the photons of the incident light, and state-of-the-art conversion efficiency approaches 7% at laboratory scale. Hydrogen Solar has successfully transferred the technology to industrial laboratories, and is developing industrialised production methods.

The Tandem Cells will be built into arrays and the company is now actively seeking demonstrator projects, primarily in the areas of vehicle fuelling and building services.

Hydrogen from biomass
Hydrogen Solar also has intellectual property in biological hydrogen production, both from liquid food-processing wastes using solar energy and a specially-identified catalyst, and from solid food-production processes using fermentation.

Contact: **Dr David Auty**
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Inco Special Products

Clydach Refinery, Clydach, Swansea, SA6 5QR

Website: www.incosp.com

Description:

Inco Special Products is a business unit of Inco Limited, the world's leading nickel company. Inco Special Products produces a range of fine, very pure, nickel powders and nickel oxides and nickel foam products that can be used for a variety of roles in Fuel Cells. Inco Special Products have production facilities in Europe, Canada and the USA for these products and work closely with customers (leading producers of Fuel Cells world-wide), developing tailored products for individual needs.

Products:

- Inco Type 255 filamentary nickel powder, for sintered electrodes for MCFC
- Novamet H.P. Green Nickel Oxides, for SOFC
- Incofoam, high purity pure nickel foam, for electrodes, gas diffusion, spacers in several FC systems.

Notable achievements to date:

- Development of powder products for MCFC electrodes with leading MCFC producers.
- Development of special foam products for several FC systems made by unique proprietary CVD technology.
- Development of special high purity green nickel oxides for SOFC.
- On-going substantial R&D programs to support development of FC products.

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INEOS Chlor Ltd

Runcorn Site HQ, PO Box 9, South Parade, Runcorn, Cheshire, WA7 4JE

Website: www.pemcoat.com

Description:

INEOS Chlor is a leading supplier and developer of coated metal plate systems for fuel cell and electrolyser technologies, branded as PEMcoat™. Using manufacturing facilities in the UK, INEOS Chlor supplies coated metal plates to customers world-wide.

INEOS Chlor prides itself on its customer service and enjoys a close working relationship with its customers to develop products that add significant value to customer operations.

Notable achievements to date:

- Significant IP portfolio in coatings for metal bipolar plates.
- Active in UK and European research activities.
- Established manufacturing plants with experienced teams.
- Proven supply chain.

Contact: **Dr David Hodgson**
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Intelligent Energy Ltd

42 Brook Street, Mayfair, London W1K 5DB

Website: www.intelligent-energy.com

Description:

Intelligent Energy is an intellectual property-led energy solutions company at the forefront in developing a unique portfolio of fuel cell and related new energy technologies to produce clean, quality electricity. Intelligent Energy's technology is the result of over 200 man years of research and the company also holds a worldwide license to exploit fuel cell–related know-how developed at Loughborough University over a 15-year period. The company is working with corporate partners globally to apply the unique combination of technical skills and commercial know-how to distributed power generation as well as motive and portable power delivery. Intelligent Energy is committed to delivering the next generation of energy solutions: to provide Energy for life™.

Products:
Intelligent Energy offers the following via licensing agreements and corporate partnerships:

- Energy solutions comprising ambient and pressurised fuel cell systems for generation and
- motive power applications, ranging from 10W to 50kW.
- Systems integration expertise across remote power, genset, propulsion, portable and CHP platforms.
- Leading-edge micro channel reformer technology.
- Advanced fuel cell test and analysis equipment.

Notable achievements to date:

- Fuel cell stack power density in excess of 2.5 kW/L achieved.
- Partnership with Boeing to develop the first fuel cell powered aircraft for manned flight.
- Accepted into US Department of Defense's Foreign Comparative Test program. This program provides direct route to procurement for non-US companies with world-class technology of interest to US armed forces.
- 50 employees in Europe and US.
- Funding of £20m secured via two private placements.
- Acquisition of Element One Enterprises which comprises a team of leading US fuels processing experts.

Contact: **Judith Agar**
Director, Marketing and Communications
Email: judith.agar@intelligent-energy.com

International Innovation Services Limited and LIFE-IC

Unit D2, Sheffield Technology Park, 60 Shirland Lane, Sheffield S9 3SP

Website: **TBC**

Description:

International Innovation Services Limited (IIS) is currently spearheading the development of LIFE-IC - a new business and knowledge-clustering initiative focused on the development of new energy based ventures regionally, nationally and internationally. In addition to a client portfolio of over 30 energy related companies including a number of fuel cell technology ventures, LIFE-IC has also put in place a dynamic infrastructure that will enable the project to effectively meet the needs of its clients. This will include a 30,000ft^2 incubator on 40 acres of development land. The incubation process, developed as part of this process, will be uniquely focused on the requirements of innovative new energy businesses across a range of disciplines. This will be supported in the medium term with other mechanisms including the development of technician training for fuel cell technicians with appropriate learning agencies.

IIS works with a wide range of key stakeholders within the area of fuel cells to enable this technology to become a commercial reality. A comprehensive network of expertise has been assembled from across the world including universities, small & large companies and public bodies with expertise ranging from basic science to manufacture and marketing. LIFE-IC is aiming to become the national resource centre for the development of new energy technologies, linking up all parts of the supply chain from concept to marketplace. Support for fuel cell technology clients is wide ranging. Seed funding is available in the form of grants and loans to enable relevant projects to develop.

Services:

Specialist innovation support for small business and start-ups
Financial support, advice and grant assistance
Business planning

Under development:

Purpose built incubation facilities for new energy technologies
Fuel cell technician training

Notable achievements to date:

- An active cluster of over 30 firms assembled on a new energy theme.
- Active client bank of over 2,000 organisations.
- Demonstrated track record since 1985 of business development, technology transfer and innovation with over 500 companies with a survival rate of over 90%.

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LIFE-IC
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ITM Power Ltd

Villa Farm, Jack Haws Lane, Barnack, Stamford PE9 3DY

Website: www.itm-power.com

Description:

ITM Power Ltd is developing low cost electro-chemical cells suitable for mass production based upon a patented new range of solid polymer electrolytes (SPEs) and novel production methods ("one-shot"). The range will cover fuel cells, electrolysers and solar photo-voltaic products, produced as composite membrane electrode assemblies (cMEAs) or "one-shot" composite stacks (cSTACKs). ITM has over 30 years polymer expertise which is focused on cost efficient solutions for products in the future energy sector.

ITM is collaborating with a number of major UK, EU and US corporations to optimise its technology for market driven solutions. ITM has received funding from investment funds, investment banks and the private equity sector. Additional research funding has come from the DTI New & Renewable Energy Programme to develop low cost alcohol powered fuel cells.

Notable achievements to date:

- Patents for materials and processes.
- Consistent achievement of technical goals on plan and within budget.
- Team building.
- Development facilities in Sheffield.
- Early stage industry collaborations.
- DTI recognition.

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Johnson Matthey Fuel Cells

Lydiard Fields, Great Western Way, Swindon SN5 8AT

Website: www.matthey.com/environment/fuelcell/index.html

Description:

Johnson Matthey Fuel Cells is dedicated to the development and manufacture of catalysts for all fuel cell types, membrane electrode assemblies (MEAs) for PEM and DMFC fuel cells, fuel processor sub systems, and other catalysed components for hydrogen supply to any fuel cell system.

Johnson Matthey Fuel Cells works closely with customers and suppliers, to develop the products its customers need. JM continues to invest in R&D and has established many development programs with customers and suppliers, aimed at tailoring products to specific applications, designs and operating conditions, to achieve the best possible performance.

In addition Johnson Matthey (together with Shell Hydrogen and Mitsubishi) has founded Conduit, a venture capital company focused on fuel cell opportunities. JM also supports fuel cell today.com, the world's leading fuel cell portal.

Products:
Johnson Matthey Fuel Cells supplies all the key catalytic stages in a fuel cell power train including fuel cell catalysts, MEAs, fuel reforming, shift, CO cleanup and afterburner catalysts.

Notable achievements to date:
- Substantial R+D programs since 1992 in PEM fuel cells
- Major development facilities in UK, USA and Japan
- Manufacturing plants in the UK and USA
- In 2002 employed more than 150 people worldwide.
- A strategic business of Johnson Matthey PLC

Contact: **Dr Jonathan Frost**
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MEL Chemicals

P.O. Box 6, Swinton, Manchester M27 8LS

Website: www.zrchem.com

Description:

MEL Chemicals produces a wide range of zirconium oxides and chemicals designed for the fuel cell industry. The products are manufactured in QS9000 approved facilities in the UK and the USA. The company's portfolio includes cost effective fully and partially stabilized yttria/zirconia powders for the production of anodes and electrolytes in SOFC systems. A new range of zirconium based products has been developed for use as raw materials in water-gas-shift catalyst systems.

Products:
MEL Chemicals' product range includes zirconium chemicals, zirconium oxide and hydroxide, yttria doped zirconium oxide, ceria doped zirconium oxide and other rare earth doped zirconium oxides and hydroxides. MEL Chemicals is willing to discuss specific requirements with individual customers.

Notable achievements to date:
- Manufacturing Facilities in the UK and USA
- New yttria/zirconia plant with capacity set aside for growing SOFC sales
- Leading supplier of raw materials for catalyst and SOFC electrolyte and anode applications
- Substantial R+D programmes
- QS 9000 approval

Contact: **Russell Heathcote**
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Microponents Ltd

P.O.Box 162, 30 Curzon St, Birmingham B4 7XD

Website: www.microponents.com

Description:

Supplier of Fuel Cell Components
Metallic components for Stacks:- PEM, Solid Oxide, direct methanol, Alkaline
Components for heat exchanges, reformers, electrolysers

- interconnects
- current collectors
- bipolar plates
- anodes and cathodes
- flow fields

Manufacturing:-

- Prototype to volume
- Photo Etching, Electroforming, Stamping
- R&D to mass production

Coatings available

Notable achievements to date:
Components supplied and on test with

- major automotive manufacturers and developers
- major DMFC manufacturers and developers
- major solid oxide manufacturers and developers
- major hydrogen reforming and renewable hydrogen manufacturers and developers

Manufactured components for the fuel cell industry for the last 10 years

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Microtherm International Ltd

1 Arrowe Brook Road, Upton, Wirral CH49 1SX

Website: www.microtherm.uk.com

Description:

Microtherm International Limited is the leading supplier of high performance microporous insulation to fuel cell manufacturers for high temperature applications, particularly MCFCs, SOFCs, and for reformers and balance of plant. Microtherm has been the market leader in microporous insulation for more than 30 years, meeting high temperature insulation requirements where space, weight, and heat loss are critical. The thermal insulation properties of Microtherm insulation exceed those of still air. The preferred Microtherm strategy is one of design involvement and support to enable customers to take full advantage of the expertise within its Materials Research Group. Microtherm International welcomes development partnerships with customers and can provide support for engineering and thermal design to optimise thermal solutions.

Products:
Microtherm is a silica based insulation that can withstand continuous operation at temperatures up to 1000 °C. A specialised version, Microtherm Super A, is also available for even higher temperatures and for applications where possible contamination of the catalyst could present a problem. Microtherm can be supplied as glass cloth covered panel, block, and flexible glass cloth covered quilt, all in various sizes. Microtherm can also supply custom made CNC machined parts, moulded pipe sections in standard sizes, bend kits, and thin sheets. High temperature coatings can be applied.

Notable achievements to date:
- Microtherm currently has active projects with almost all of the major fuel cell manufacturers throughout Europe, the USA, Asia, and Australia.
- Most of the operating high temperature fuel cell applications around the world incorporate Microtherm insulation to increase overall system efficiency.

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Morgan Fuelcell

Tebay Road, Bromborough, Wirral CH62 3PH

Website: www.morganfuelcell.com

Description:

Morgan Fuelcell is part of Morgan Crucible plc, a specialist materials engineering company supplying carbon, ceramic and magnetic materials to the global market.

Morgan Fuelcell develop and manufacture a wide range of carbon bi-polar plate materials and has been a provider of these materials to the fuel cell industry for 20 years. Morgan has also developed high performance flow field designs, Biomimetic™ flow fields which provide enhanced performance to PEM based systems.

From its Ceramics Division, Morgan also provides ceramic materials for use in SOFC stacks and also fibre insulating materials for thermal management in MCFC and SOFC systems.

Morgan Fuelcells' current focus is on developing solutions to reduce the cost and complexity of fuel cell systems. Areas of research include elimination of seals and high temperature membranes for PEM systems.

Products:
Graphite and graphite composite bi-polar plates.
Fibre insulating materials for thermal management
Dense and porous ceramics for SOFC stack components
Thick and thin film ceramic processes for electrolyte deposition.

Notable achievements to date:
- 1984 - First supply of carbon bi-polar plates
- 1985 - Supply of SOFC components
- 2001 - Morgan Fuelcell formed
- 2002 - Biomimetic™ flow fields patented
- 2003 - Development of 9 layer MEA for PEM

Contact: **Brendan Bilton**
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Oxford Lasers Ltd

Unit 8, Moorbrook Park, Didcot, Oxon, OX11 7HP

Website: www.oxfordlasers.com

Description:

Oxford Lasers specialises in Laser Micromachining of a variety of features from holes and slots through to hole arrays and complex shapes. These features are on the scale from microns to millimetres, with tolerances of +/- 1 micron. Materials include Metals, Ceramics, Polymers, Glass and many others.

Recently Oxford Lasers has been undertaking developments with other companies (names protected by NDA) on electrolyte supports in Solid Oxide Fuel Cells, where precise arrays of small holes and slots are crucial to the functioning and efficiency of these Fuel Cells.

Products:
Visible and UV Laser Systems
Subcontract /Research and Development labs are available for laser micro-machining.

Notable achievements:
Production of large area, precise small hole (10-50micron) arrays in a fast, efficient manner, quicker than 5 minutes.

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Industrial Sales Engineer
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Parker Hannifin plc

Instrumentation Products Division Europe (IPDE), Riverside Road, Barnstaple, Devon EX31 1NP

Website: www.parker.com/ipd

Description:

IPDE is one operating division and the European Headquarters of the Instrumentation Group of Parker Hannifin Corporation employing 45,000 people worldwide. At this location Parker employs 280 people and has responsibility for the supply of the complete Instrumentation product range into Europe, Russia & Middle East markets.

IPDE are currently a component supplier to the Fuel Cell market, however sub-system build opportunities are actively being pursued.

Parker Hannifin Corp in the USA has set up a small business unit to service the Fuel Cell market.

Products:
At this location Parker designs and manufactures a range of Instrumentation Valves, Manifolds and Fittings specifically for the control of gases & liquids.

Parker Hannifin corp. also offers: Seals, Filters, Valves specifically for the Fuel Cell market.

Notable achievements to date:
- Relationships with key Fuel Cell companies
- Standard products that meet industry requirements
- Products used on both vehicles & in static applications
- developing new products to meet specific industry needs

Contact: **Graham Johnson**
Business Development Manager
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Porvair Fuel Cell Technology

Estuary Road, King's Lynn, Norfolk PE34 4JX

Website: www.porvairfuelcells.com and www.porvair.com

Description:

Porvair Fuel Cell Technology designs, manufactures and supplies advanced materials and components used in the fuel cell industry, fuel reformation technology and allied applications.

Porvair applies its expertise in microporosity to provide solutions to problems encountered by fuel cell developers in heat exchange, catalyst substrate emissions and moisture control applications.

Products:
Materials and components include carbon/carbon bi-polar plates, ceramic foam, microporous ceramic, metal foam (Metpore) and microporous metal (Micromass)

Stack components include metal foam gas diffusion material as well as carbon/carbon composite materials for bipolar plates. Metal and ceramic foam and microporous materials are used in heat and moisture management as well as fuel reformation.

Notable achievements to date:
- Substantial R&D program since 2000
- Awarded US DOE development grant for bipolar plates
- Certified ISO9001, QS9000 & ISO14001
- Members of USFCC and Fuel Cell Europe

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Powergen UK plc

Power Technology Centre, Ratcliffe-on-Soar, Nottingham NG11 0EE

Website: www.powergenplc.com and www.powertech.co.uk

Description:

Powergen is a vertically integrated Anglo-American energy services business, which is a part of E.ON AG, the world's largest investor owned utility, and is one of the UK's best-known names in electricity and gas.

Powergen produce electricity from its portfolio of world-class gas and coal fired power stations, and its renewable energy businesses. Powergen sell electricity, gas and related services to residential, and business customers and trade electricity, gas and oil in UK markets. Through East Midlands Electricity, Powergen runs the electricity distribution network for the East Midlands, over 67,000 km of overhead lines and underground cables, to 2.1 million homes and businesses. Powergen are a market leader in providing combined heat and power plant to industrial clients.

Within its centre of engineering and technical expertise, Power Technology, Powergen has developed the capability to model a range of fuel cell technologies. This capability has been used to assess impact on existing and advanced generation cycles. Powergen undertakes regular reviews of fuel cell technologies, and is currently participating in an EC funded FuelSave project to develop a small scale hybrid heating and cooling system utilising a fuel cell and a novel form of heat pump.

Powergen continues to search for new technology to add value to its business. In June 2003 the company announced the launch of a new home energy system, based on Stirling engine technology, which represents the world's first large-scale commercial sales of a domestic appliance providing combined heat and power.

Notable achievements to date:

- Participation in BRITE-EURAM Novel Compact Steam Reformer Project
- Development of models for MCFC, PAFC,SOFC, and steam reformer
- Assessment of gas turbine and fuel cell hybrid cycles
- Participation in EC FuelSave project to develop small scale hybrid fuel cell/heat pump CHP system
- Launched first commercial large scale home energy CHP system

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QinetiQ Ltd

Cody Technology Park, Ively Road, Farnborough GU14 0LX

Website: www.QinetiQ.com

Description:

QinetiQ conducts research and development of fuel cell power solutions including fuel cells, hydrogen storage and generation, hybrid-electric drive systems and integration and associated technologies. Together with licensee customers, QinetiQ is developing the technology for practical applications.

Products:

- Portable PEM fuel cells
- Annular PEM fuel cells
- Portable fuel cell-based battery charger
- Integrated 25W fuel cell power supply
- Portable hydrogen generator
- Conformable composite gas cylinders
- Hybrid electric drive model/simulation

Contact: **Ian Whiting**
Business Development Manager
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Ricardo UK Ltd

Bridge Works, Shoreham By Sea, West Sussex BN43 5FG

Website: www.ricardo.com

Description:

Automotive consultancy with expertise in all aspects of powertrain design and development, including:

- Advanced Gasoline and Diesel combustion systems
- Transmission and driveline engineering for conventional, hybrid and fuel cell vehicles
- Thermal systems engineering for vehicle cooling and cabin comfort
- Vehicle sound quality, noise and vibration
- Hybrid vehicles and vehicle energy management
- Fuel cell systems integration
- Control systems and electronics
- Prototype vehicle design and build
- Vehicle design to manufacturers' process

Engineering centres located in the UK, US and Germany.

Notable achievements to date:

- I-MoGen mild hybrid demonstrator vehicle
- Control systems for OEM hybrid and fuel cell demonstrator vehicles
- Simulation models for hybrid and fuel cell powertrains
- Technology Roadmaps for government and OEM organisations

Contact: **Dave Greenwood**
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Rolls-Royce Fuel Cell Systems Ltd

PO Box 31, Derby DE24 8BJ

Website: www.Rolls-Royce.com

Description:

Rolls-Royce Fuel Cell Systems (RRFCS) is positioning to design, manufacture, test and deliver fuel cell systems of one, five and ten megawatts for stationary power generation applications. The systems will be based on its low-cost, patent-protected solid oxide fuel cell ("SOFC") technology in combination with specialist turbomachinery, resulting in an SOFC 'hybrid'. The SOFC hybrid will be compact, highly efficient, cost competitive and generate negligible emissions.

Products:
1MW to 10 MW integrated SOFC hybrid systems for stationary power generation applications

Notable achievements to date:
RRFCS has fifteen years of development experience and is a prominent SOFC programme in the European Commission framework funding initiatives, currently leading three of four high temperature fuel cell programmes. It is successfully applying Rolls-Royce advanced technologies to reduce fuel cell costs, including:

- materials application in high temperature environments,
- managing airflow in pressurised systems,
- specialised microturbines,
- system integration expertise, and
- power generation application expertise - controls, packaging, maintenance regimes, system interfaces, market knowledge.

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Scottish and Southern Energy plc

Inveralmond House, 200 Dunkeld Road, Perth PH1 3AQ

Website: www.scottish-southern.co.uk

Description:

Scottish and Southern Energy plc (SSE), a FTSE-100 company, formed in 1998 from the merger of Scottish Hydro-Electric plc and Southern Electric plc, is one of the largest energy companies in the UK. The company employs 9000 people in the UK and its core activities include the generation, transmission, distribution and supply of electricity to circa 5 million energy customers throughout the UK. Other activities include the operation of a telecoms network, supply of gas, retail shops and utility and specialist contracting.

SSE has an ownership interest in over 7GW of generation plant assets comprising gas-fired, hydro, pumped storage and wind power stations plus some island generation. Approximately 1.4GW is conventional and pumped storage hydro power plant. SSE has recently commissioned a 13MW windfarm at Tangy in Argyll and Bute. SSE is the UK's leading generator and supplier of renewable energy. Typically, 8% of SSE's total supply is from renewable sources, some 40% of the UK total. The company has announced a £450m programme for new renewables. £250m will be used to refurbish the existing hydro power stations and £200m will be invested in new renewable projects, mainly wind generation.

In the field of fuel cells the company has been involved in:-

- ETSU report F/03/00235/00/00, “Assessment of the Implementation Issues for Fuel Cells in Domestic and Small Scale Stationary Power Generation and CHP Applications”, 2002.
- ETSU report F/02/00166/REP "Solid Polymer Fuel Cell Stationary Power Generation Design Studies", 2000.
- ETSU report F/03/00157/REP “Commercial Evaluation of Phosphoric Acid Fuel Cell Systems", 1999.
- participating in numerous energy industry consultation processes on fuel cells

Products:
Generation, transmission, distribution and supply of electricity to industrial, commercial and domestic customers; energy trading; gas marketing; electrical and utility contracting and telecommunications.

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Market Development, Energy Supply.
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siGEN Ltd

Mill of Craibstone, Bucksburn, Aberdeen, AB21 9TB

Website: www.sigen.co.uk

Description:

SiGEN offers systems engineering and design, system build, installation and commissioning of fuel cell based power systems. SiGEN does not manufacture any fuel cell generator and has access to a variety of systems from differing suppliers and technologies. SiGEN specialises in the practical applications of fuel cells and offers the following:

- Analysis of the technical requirements
- Selection of the optimal fuel cell system from those really available, with consideration of the load characteristics and duty cycle, system location and refuelling strategy
- System and housing design, site-specific build and installation, training, service and after sales support
- HAZOP analysis and development of operational procedures for FC systems implementation and operation

SiGEN can offer solutions in the range of 100W to 5kW solutions; both PEM and DMFC. SiGen also has a close interest in H2/O2, Metal Air and SOFC systems.

Notable achievements to date:

- Secured first round funding in March 2003 to become the first commercially active fuel cell company in Scotland
- Designed, built and delivered the first commercial fuel cell truly-online-UPS to AMEC, with technical support from AMEC, BOC and Avista. The siGEN FC-UPS 1kW is available for sale
- SiGEN, with technical support from BOC, the title Sponsor, delivered and ran the first fuel cell powered car in the UK Shell eco marathon event. SiGEN has made the vehicle power train for this vehicle, siGEN FC-PT 1200, available to other car builders throughout Europe.
- Attracted funding support from UK DTI to test and characterise the siGEN FC-UPS 1kW
- Secured funding support to apply a fuel cell electric vehicle range extender to the G-Wiz from the Scottish Clean Energy Development Scheme for a client in Aberdeen
- Agreed distribution rights with Avista, Heliocentris and Voller, supply agreement with Ballard

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South West Electrolysers

Bowdah house, Week St. Mary, Holsworthy, Devon, EX22 6XD

Website: www.sweh2.com

Description:

The aim of South West Electrolysers is to provide off the shelf "plug and play" solutions for electrolytic hydrogen generation, initially in the range of 2.5nm^3/hr to 12.5nm^3/hr, specifically designed to meet the demand for hydrogen as a energy carrier.

South West Electrolysers is particularly interested in the generation of hydrogen from renewable electricity, as this opens up the possibility of a transportable, sustainable fuel stock for all our future energy needs.

As a spin off from the core electrolyser development work South West Electrolysers has grant, partner and match funding identification experience plus a range of project development and management skills to assist hydrogen related projects get up and running.

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Stainless Metalcraft Ltd

Chatteris Engineering Works, Chatteris, Cambs PE16 6SA

Website: www.metalcraft.co.uk

Description:

Metalcraft is a part of the Ferraris group of companies and is a leading producer of fabricated and machined components for industries worldwide. The company has links to the medical, research, process and environmental industries and the long standing history as suppliers to these markets has led the company to attain unrivalled expertise in the joint development of containment systems.

Metalcraft has a history of joint development success stories where engineers attend customers design review and production meetings on a regular basis. The company's expertise in product development from design, prototyping and into production can reduce what is sometimes a lengthy and difficult process into a manageable affair with a greater chance of success.

Metalcraft will, if required, set up dedicated facilities with the latest manufacturing equipment to enable the most cost effective solutions to be offered to customers.

Notable achievements to date:

- Containment specialists for demanding situations
- Track record of successful joint developments
- Holders of internationally recognised approvals
- Major UK based manufacturing facilities
- A strategic business of the Ferraris group of companies.

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Synnogy Ltd

1 Aldwincle Road, Thorpe Waterville, Northants. NN14 3ED

Website: www.synnogy.co.uk

Description:

Synnogy is dedicated to helping a wide variety of organisations optimise their strategic decision making around new technology and, in particular, fuel cell commercialisation. The Synnogy team has an extensive track record in the delivery of successful collaborative consortia in fuel cells and other energy technologies. Participants benefit from a rich and accelerated learning experience that dramatically improves their understanding of issues arising from innovative science and technology. This enhances their response to emerging opportunities and challenges, and aids both their strategic planning and the realisation of those plans.

As an independent organisation, Synnogy acts as an 'honest broker' in facilitating understanding of the complexities and sensitivities of the commercialisation process.

Notable achievements to date:

- The Synnogy team has worked with over 100 organisations worldwide including: technology developers, materials & component manufacturers, government bodies, investment community, fuel & energy companies, utilities, engineers and more.
- Synnogy is the co-ordinator of Fuel Cells UK (www.fuelcellsuk.org).
- The Synnogy team has co-ordinated four Fuel Cell missions to the US and Canada, helping UK companies to extend their networks and build new business.

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Technology Interface

2 Barn Way, Cirencester, GL7 2NA

Website: www.technology-interface.co.uk

Description:

Technology Interface undertakes a variety of technology access and reporting assignments, including several relevant to fuel cell technology.

Through a joint venture with Rondol Technology Ltd, Technology Interface has prepared highly conductive polymer composites that show similar performance to graphite in short term tests.

Products:
Low cost highly conductive polymer composites using readily available materials. A very high volume manufacturing route has been planned.

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TURQUOISE

Turquoise International Limited

2 Lambeth Hill, London EC4V 4GG

Website: www.turquoiseassociates.com

Description:

Turquoise is a corporate finance advisory firm based in the City of London. The fuel cell sector is a specialist area for Turquoise, whose staff have been involved with many of the third-party private-sector investments in UK fuel cells in recent years. Turquoise is authorised and regulated by the Financial Services Authority (FSA).

Products:
- Investment appraisals and valuations
- Fundraisings
- Acquisitions and disposals
- Transaction support

Notable achievements to date:
Members of the Turquoise fuel cell team have worked on a variety of fuel cell and energy projects. This includes acting as:
- lead advisers on the first £8.2m private placement by Intelligent Energy (including acquisition capital for takeover of APS)
- lead advisers on Anglo Platinum's acquisition of 17.5% of Johnson Matthey Fuel Cells
- consultants on Intelligent Energy's second £11m private placement

Turquoise is also an active supporter and sponsor of fuel cell initiatives including:
- sponsorship of the Grove Symposium 2003
- sponsorship of the Grove statue at the Woking fuel cell park

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Unitec Ceramics Ltd

Doxey Road, Stafford. Staffordshire ST16 1DZ

Website: www.ucm-group.com

Description:

Unitec Ceramics Ltd is a subsidiary of the international, U.K.-based electro-fused minerals company UCM Group plc. Unitec Ceramics has been manufacturing zirconia for over thirty years and in the last twenty years has developed a range of fine-sized, stabilised-zirconia powders for application in the manufacture of structural and functional advanced ceramics. Today, Unitec Ceramics is widely recognised as a key manufacturer of specialised yttria-stabilised zirconia powders for use in SOFC units. Unitec Ceramics' powders are suitable for incorporation into SOFC anodes, electrolytes and cathode systems.

Unitec Ceramics' powders are particularly suited to the most commonly used SOFC fabrication processes such as tape casting and screen-printing. Continuing technical development is aimed both at developing new powder formulations and at optimising existing powders in order to make them easier to fabricate and consistent in their properties. Unitec Ceramics is well aware of the challenges faced by all companies associated with the SOFC market but believes that it is well positioned to continue to be a key player when SOFC manufacture assumes full commercial scale.

Unitec Ceramics is working in close collaboration with a large number of clients and research institutions to optimise the powder properties, both structural and functional, for specific designs and fabrication processes. Typical SOFC applications include stationary, automotive, portable and micro- designs of SOFCs.

Notable achievements to date:

- Involvement in SOFC development since 1990
- Zirconia powder of choice of a number of SOFC developers for both Anode and Electrolyte applications
- Development of a fine zirconia powder for cathode addition
- Significant investment in increased manufacturing capacity in anticipation of demand growth.
- Ability/willingness to develop specialised materials for SOFC systems
- Queens Award for Innovation 2001

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Voller Energy Limited

Grove House, Groveley Way, Romsey, Hants, SO51 9AX

Website: www.voller-energy.com

Description:

Voller Energy is a manufacturer of portable fuel cell systems for industrial and military use. The product range includes portable battery rechargers and mobile generators based on hydrogen powered Proton Exchange Membrane (PEM) fuel cell technology. Voller Energy is also developing a range of integrated fuel cells for the next generation of portable electronic equipment such as mobile phones, laptop computers and power tools that will provide continuous power without the user needing to recharge their battery. Founded in 2002, the company is privately held and is located in UK and in China. Distributors supply Voller Energy products in Germany, Italy and the United States.

Products:
Portable battery rechargers and mobile generators :

- VE1000 – 1kW transportable fuel cell with 4x230v AC and 12v DC sockets
- VE100 – 100 watt hand portable fuel cell with 230v AC and 12v DC socket
- Both VE1000 and VE100 can be used with internal metal hydride canisters or compressed hydrogen. Voller Energy also has a development program for an integrated micro-PEM fuel cell designed to replace the rechargeable batteries in portable electronic equipment such as mobile phones, laptop computers and power tools.

Notable Achievements to date:
Registered NATO supplier

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