POISED FOR PROFIT II:

INVENTORY OF FUEL CELL COMPANIES IN OREGON AND WASHINGTON

January, 2004

THE CENTER FOR SMART ENERGY

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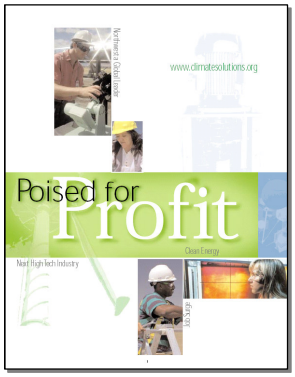
PREFACE

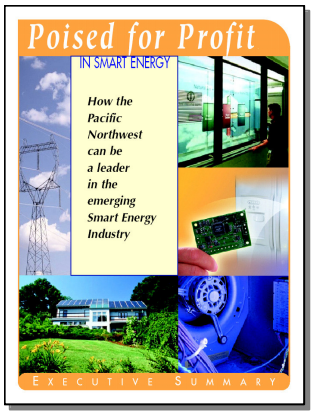
POISED FOR PROFIT: PROMOTING A NORTHWEST CLEAN ENERGY INDUSTRY



In 2001, eight economic development and energy agencies from Oregon, Washington, and British Columbia commissioned a study: *Poised for Profit: How Clean Energy Can Power the Next High-Tech Job Surge in the Northwest*. The resulting report revealed that the clean energy sector could be twice the size of the aircraft industry within 20 years. What's more, it could generate as many as 30,000 new jobs. That first report is available at www.climatesolutions.org.

A new partnership has come together to fund *Poised for Profit II,* follow-on research to support a world-class clean energy industry in the Northwest. Through the work of The Athena Institute, the project has produced a series of reports containing critical information for investors, entrepreneurs, and policymakers. These tools include:

- Research and analysis to pinpoint the largest and best opportunities
- Surveys of investor and utility plans
- Directories to research reports, related companies and helpful resources



The Athena Institute was asked to investigate near-term market opportunities in Oregon, Washington, and British Columbia for selected clean energy technologies. At the direction of the Steering Committee, we focused on opportunities that could see commercial success within five years, with emphasis on "cluster opportunities." The Milken Institute defines clusters as "agglomerations of interrelated industries that foster wealth creation in a region." (For example, Washington's King County is known for its aerospace and software clusters.)

This document is a directory of fuel cell-related companies in Oregon and Washington. It is a companion to the report *Prospects for the Fuel Cell Sector in the Pacific Northwest.*, which details the sector and its opportunities. The full report is available for download at www.centerforsmartenergy.com.

ABOUT THE PARTNERS

Poised for Profit II was jointly funded and guided by the following organizations and members of the Poised for Profit Steering Committee:

- **BC Hydro:** Bruce Sampson
- **Bonneville Power Administration**: Mike Hoffman and Kevin O'Sullivan
- **City of Portland:** Jeff Cogen and Curt Nichols

- **NW Energy Technology Collaborative:** Lee Cheatham and Jeff Morris
- **Oregon Institute of Technology:** Howard Thurston
- **Oregon Office of Energy:** Mark Kendall
- **Leading Edge British Columbia:** Anton Kuipers
- **Pacific Northwest National Laboratory:** Mike Lawrence
- **Portland Business Alliance:** Molly Moore
- **Portland Development Commission:** Ann Griffin
- **Portland General Electric:** Joe Barra
- **Seattle Office of Economic Development:** Ben Wolters
- **Washington Office of Trade and Economic Development:** Tony Usibelli and Tim Stearns

About Climate Solutions

The *Poised for Profit* initiative is managed by Climate Solutions, a public interest group that works to make the Pacific Northwest a global warming solutions leader. Since 1998, the group has targeted development of a Northwest clean energy cluster as a globally significant contribution the Pacific Northwest can make to reduce greenhouse emissions. Climate Solutions generates leading-edge information and knowledge on clean energy technology and the economic opportunities it presents. The organization issues reports, organizes conferences, and builds crosscutting alliances to further the goal of rapid energy transition.

About The Athena Institute and The Center for Fuel cell

The Athena Institute is a research organization that helps executives and organizations find success in emerging markets. Its methodologies and insights have been implemented by many organizations, ranging from Fortune 1000 corporations to public policy agencies. **The Athena Center for Smart Energy** (www.centerforsmartenergy.com), the industry's guide to the value chain, is operated by The Athena Institute. The Center is dedicated to making North America the leader clean energy commercialization.

Acknowledgements

The Athena Institute would like to recognize the following companies and individuals for their contributions to the *Poised for Profit* initiative in general and this report in particular.

For catalyzing the project and providing oversight, we acknowledge Climate Solutions, with special recognition to Rhys Roth.

We also acknowledge and thank the dozens individuals who gave of their time for discussions with Athena analysts during the course of this study. For expert comments and research materials, we wish to thank:

- Peter Arias and Young Jin, Reed Global
- David Dusseau, Energy Hot Team, Portland Business Alliance
- Subhash Singhal, Pacific Northwest National Laboratory
- Wal Van Lierop, Chrysalix Energy

We are especially appreciative of the co-funders and members of the Steering Committee, who provided ongoing advice and assistance.

DISCLAIMER

HOW YOU CAN HELP KEEP THIS DIRECTORY CURRENT

Information in this directory comes from a variety of sources, and every effort was made to ensure accuracy. However, change is constant in this fast-paced, emerging market. If you have ideas, additions, changes or updates, please send them to FuelCells@theathenainstitute.com.

INTRODUCTION

This directory identifies companies active in the Fuel cell marketplace in Oregon and Washington. It is part of the *Poised for Profit II* research initiative and a companion to the report *Prospects for the Fuel Cell Sector in the Pacific Northwest.*

This directory includes contact information, a summary description, plus information on the activity and the product type, as defined below.

PRIMARY AND SECONDARY ACTIVITY

Companies were sorted into seven activities: 1) Component supplier, 2) consultancy, 3) design, engineering or other services, 4) distributor/reseller, 5) manufacturer/assembler, 6) research and development and 7) Other. Since many companies are active in several categories, we noted both a primary activity and a secondary activity.

Note: Some large companies are involved in dozens of different activities, only a few of which relate to fuel cells. In those cases, the Primary Activity field denotes the most important fuel cell-related activity. That activity is not necessarily the primary focus of the company as a whole, only the focus of its fuel cell efforts.

Component Suppliers

Companies in this category provide the "raw materials" that make up sub-systems and complete fuel cell systems. Some of them literally make materials (mostly advanced materials) that are formed into products. Others make sub-assemblies (such as battery systems or enclosures) that become part of a complete product. Most component suppliers market a wide range of materials for many different industries. Fuel cells are a relatively new and relatively small category and currently represent only a small fraction of their sales.

Building an eco-system of component suppliers is an important step towards a thriving fuel cell cluster, and to achieving its full economic benefits. Washington and Oregon are short on component suppliers. British Columbia has a better supply.

Consultancies

Companies in this category are typically smaller operations that offer advice and assistance with one phase. In addition to housing a few fuel cell specialists, the Pacific Northwest is also home to a large group of service providers such as law

firms, accounting firms, engineering firms, manufacturing firms, marketing firms, and others that serve many different high-tech industries.

Design, Engineering and Related Services

Design and Engineering service firms offer support to companies who are designing fuel cell products. They can be an import resource for a region by providing specialized talent that can be leveraged across many organizations. The region has few design and engineering firms specializing in fuel cells. It does, however, have several contract manufacturers experienced in high-tech, advanced materials. Many of them offer sophisticated design and engineering services in addition to their manufacture and assembly capabilities. In addition, most university and national labs are permitted by charter to offer design and engineering services to outside clients.

Distributors/Resellers

Distributors, dealers, and manufacturer's representatives will ultimately play a key role in the fuel cell sector. Distributors buy goods in large quantities and resell them but to retailers, contractors and others who then resell to the end user. Dealers stock and sell items for sale to the end user (typically high-end merchandise that requires some special expertise). Manufacturer's representatives are independent salespeople. Rather than working for a single company, they represent products from a range of companies. A few of the companies listed below are "incidental" distributors. They typically provide energy management services and sell related products as a sideline and a convenience for clients.

The distribution channel can act as a hidden roadblock to an emerging cluster. It's one thing to create a new product. It's another to make it widely available to tens of thousands of companies throughout the world. That's where the distribution channel can either help or hinder. For instance, manufacturer's representatives typically have long-standing, multi-year relationships with their clients, acting as consultants as part of their sales function. Their recommendations carry significant weight.

Oregon and Washington have few companies in this category at this early stage of the fuel cell industry.

Manufacturers/Assemblers

Companies in this category make fuel cell components, fuel cell stacks, or entire fuel cell systems. Washington and Oregon have only two companies that manufacture complete systems, but they do have several contract manufacturers with the capacity to produce fuel cells.

Research and Development

Organizations in this category focus on scientific progress in the various components and processes that make up a fuel cell. British Columbia is home to one of the world's largest concentrations of fuel cell research. Oregon and Washington also house several important research efforts.

PRIMARY AND SECONDARY PRODUCT TYPE

This directory also notes eight different product types: 1) Balance of plant, 2) components, 3) fuel cell stacks, 4) complete systems 5) hydrogen infrastructure, 6) power electronics, 7) services, and 8) test equipment.

Balance of Plant

A complete fuel cell system includes several components in addition to the fuel cell itself. These components are known collectively as balance of plant. They may include a fuel processor or fuel reformer, fuel storage, power conditioning (such as inverters and voltage controls), motors, compressors, blowers and fans, valves and piping, even conventional batteries complementary to the fuel cell stack.

Complete Systems

A complete fuel cell system contains all the pieces to create a functioning, standalone product. Very few fuel cell manufacturers make all of the components. Most of them specialize in one aspect or another -- modular stacks, or fuel reforming -- and then bring together the remaining pieces through partnerships with other companies.

Components

Components are the raw materials that go into the various parts of a fuel cell system. They may be materials (ceramics, metals) or electronics or sub-assemblies.

Fuel Cell Stacks

A single fuel cell generates very little power. However, like batteries, individual fuel cells can be combined into stacks of virtually unlimited size. These stacks can then be integrated with the *balance of plant* (see above) to create a complete fuel cell system.

Hydrogen Infrastructure

Most fuel cells run on hydrogen, which can be obtained through a variety of methods. Companies in the hydrogen infrastructure category deal with the creation, transport, storage, and dispensing of hydrogen.

Power Electronics

Although some people include power electronics as part of the *balance of plant* (see above), we have chosen to include it separately. Power electronics refers to the use of digital technology for the control and conversion of electrical power. The IEEE Power Electronics Society has a more formal definition: "the effective use of electronic components, the application of circuit theory and design techniques, and the development of analytical tools toward efficient electronic conversion, control, and conditioning of electric power."

Power electronics invert, convert, control, condition, and safeguard the electricity produced by a fuel cell. For instance, fuel cells produce DC power, which must be converted to AC for use by most motors and appliances. The Northwest has a number of experienced power electronics companies, but only a few of them have turned any significant energy towards adapting their products for the fuel cell industry.

Services

Companies in this category perform design, engineering, testing, marketing, and similar functions in behalf of fuel cell companies.

Test Equipment

Testing the many different aspects of a complete fuel cell system requires sophisticated, specialized equipment.

ALPHABETICAL DIRECTORY

4HYDROGEN.COM

Michael Schutte, Founder

PO Box 95617

Seattle, WA 98145

www.4hydrogen.com

Company Type:	■ Consultancy	**Product Categories:**	■ Services

Attempting to raise awareness of the potential of hydrogen by broadcasting pro-hydrogen Public Service Announcements (PSAs) across Canada and the United States.

Operated and maintained by Environmental Media Northwest a non-profit organization that produces Public Service Announcements (PSAs)on a variety of subjects, ranging from endangered species to alternative energy.

AFS TRINITY POWER CORP.

PO Box 449

Medina, WA 98039

Phone: 425-454-1818

www.afstrinity.com

Company Type:	■ R&D ■ Manufacturer/assembler	**Product Categories:**	■ Power electronics

Manufacturer of smart flywheels for power quality and power management applications. Future applications may include peak shaving for utilities and stored power for fuel cell vehicles.

R&D conducted at Livermore Laboratory, CA.

AIR PRODUCTS AND CHEMICALS, INC.

1500 39th Ave SE
Puyallup, WA 98374
Phone: 253-845-4000
www.airproducts.com

Company Type:	▪ Distributor/reseller ▪ Component supplier	**Product Categories:**	▪ Hydrogen/fuel processing, transport, storage

World's largest supplier of commercial hydrogen. Very active in fuel cell research projects and demonstration refueling activites. Headquarters are in Allentown, PA, with offices in most states and major countries. In addition to the Puyallup location listed here, Air Products has four locations in the vicinity of Portland, OR.

ALLIANCE TECH, INC

Brian Foster, Founder

18892 Angeline Ave
Suquamish, WA 98392
Phone: 360-981-0773

Company Type:	▪ Consultancy	**Product Categories:**	▪ Services

Consultancy dedicated to the fuel cell industry. Helps manage projects from requirements to regulatory approval.

Customers include: Ballard Power Systems, Daimler/Chrylser, Ford, Cellex Power, George Town University,

ALUMINA MICRO

Steve Booth, Co-Founder and President

1971 Midway Lane, Suite J
Bellingham, WA 98226
Fax: 360-734-8212
www.aluminamicro.com

Company Type:	■ Component supplier ■ R&D	**Product Categories:**	■ Balance of plant (plumbing, heat exchanger, etc.)

Designs, develops, and markets intelligent fluid control microsystems. The company's proprietary multi-layer silicon chip microvalve, called MicroSTAQ, is a constructed using silicon wafer fabrication. This silicon valve offers advantages of size, cost, manufacturability, and flexibility over traditional valve actuation technologies such as diaphragms, bellows, and electric solenoids. The company's initial product is its Fluid Control Microsystem (IFCM) for use in automotive fluidic systems. It also has potential applications for the control of fluids in fuel cell systems.

AVISTA LABS

Mike Davis, CEO

15913 E Euclid Ave
Spokane, WA 99216
Phone: 509-228-6500
Fax: 509-228-6510
www.avistalabs.com

Company Type:	■ Manufacturer/assembler ■ R&D	**Product Categories:**	■ Complete systems ■ Fuel cell stacks

Make of PEM fuel cell systems in the 50W-5kW range, principally for premium power markets. Features a modular design that permits cartridges to be "hot-swapped" without taking the stack apart. Currently sells three products, all fuelled by industrial grade hydrogen. Units can also be connected in series for higher power outputs.

Avista Labs is currently begin spun off from parent company Avista Corp. In July 2003 it announced that it had secured $7.5M in its first round of independent financing.

BOEING COMPANY

David Daggett, Technology Leader, Energy & Emissions

PO Box 3707 M/C 02-TR

Seattle, WA 98124

Phone: 425-266-4306

www.boeing.com

Company Type:	▪ R&D ▪ Design, engineering or other services	**Product Categories:**	▪ Complete systems

Has extensive experience in fuel cells for space and terrestrial applications. Currently studying fuel cells for unmanned electric planes and as auxiliary power units on commercial planes. Much of the work on the former will be conducted in Europe with partners. However, the Commercial Airlines group is studying fuel cells to replace aircraft auxiliary power units. That effort is headquartered in Seattle. Also working on technology to generate hydrogen called BOSH2 --Boeing One Step Hydrogen generator.

CRYOFUEL SYSTEMS

14815 Chain Lake Road, Suite D

Monroe, WA 98272

Phone: 360-794-3755

Fax: 360-794-4636

www.cryofuelsystems.com

Company Type:	▪ Manufacturer/assembler ▪ R&D	**Product Categories:**	▪ Hydrogen/fuel processing, transport, storage

Designs, manufactures, and markets advanced fuel gas processing systems. Exploring the potential for adapting its natural gas vehicle (NGV) refueling systems to fuel cells. Would extend its technology to liquefy hydrogen for fuel cell vehicle refueling stations.

ENERGY INTERNATIONAL

Samuel Bernstein, President

127 Bellevue Way SE
Bellevue, WA 98004
Phone: 425-453-9595
Fax: 425-455-0981
www.energyint.com

Company Type:	■ Consultancy ■ R&D	**Product Categories:**	■ Services ■ Test equipment

Consultancy in strategic planning, technology transfer, market assessments, and software development. The firm does considerable work evaluating distributed generation technologies and alternative vehicles, including fuel cells.

Subsidiary of Gastec N.V.

GENESIS FUELTECH INC.

Phillip Piffer, President

4922 East Union Avenue
Spokane, WA 99212
Phone: 509-534-5787
Fax: 509-534-5790
www.genesisfueltech.com

Company Type:	■ Manufacturer/assembler ■ Component supplier	**Product Categories:**	■ Hydrogen/fuel processing, transport, storage

Designs and builds reformers that produce hydrogen for fuel cells from alcohol. Currently focused on methanol reformers. Makes a smaller, 200W unit for portable and stationary applications and a larger 500W unit for OEM applications (where other companies make the Genesis reformer part of their products). Has also designed a 1.5Kw model that will generates 20 liters of hydrogen per minute. Increasingly active in demonstrations of potential for military applications.

H2FUEL

Serge Randhava, President

411 North Business Center Drive
Mt Prospect, IL 60056
Phone: 847-297-2265

Company Type:	■ R&D ■ Design, engineering or other services	**Product Categories:**	■ Hydrogen/fuel processing, transport, storage

Although based in Illinois, H2fuel is 70% owned by Spokane-based Avista Labs and conducts some of its activities in that city. The company develops hydrogen extraction and purification processes for fuel cells. Its membrane-based technology eliminates carbon dioxide and carbon monoxide from fuels such as natural gas and propane, allowing production of nearly pure hydrogen.

Joint venture between Avista Labs and Unitel Technologies of Mt Prospect, IL.

IDATECH, LLC

Claude H. Duss, President and CEO

63160 Britta Street
Bend, OR 97701
Phone: 541-383-3390
Fax: 541-383-3439
www.idatech.com

Company Type:	■ Manufacturer/assembler ■ R&D	**Product Categories:**	■ Hydrogen/fuel processing, transport, storage ■ Complete systems

Develops fuel processing modules and fuel cell systems for stationary and portable electric power. Its compact, efficient, patented fuel processor converts methanol into hydrogen. The company also integrates its own fuel processor into complete systems using fuel cell components and stacks produced by others.

Awarded a $9.6M development program by the U.S. Department of Energy for the development of a 50-kW fuel cell system suitable for grid-independent energy for large facilities. Has a long-term strategic alliance with Tokyo Boeki, which represents the company's interests in Asia.

INNOVATEK

Patricia M. Irving, Ph.D, President

350 Hills Street, Suite 104

Richland, WA 99352

Phone: 509-375-1093

Fax: 509-375-5183

www.tekkie.com

Company Type:	■ R&D ■ Design, engineering or other services	**Product Categories:**	■ Hydrogen/fuel processing, transport, storage

Creates and develops technologies for environmental safety and sustainable power. The Company is located in the Applied Processes Engineering Laboratory (APEL)near Pacific Northwest National Laboratory in Richland, WA. The company's InnovaGen fuel processing system uses advanced technology to provide clean hydrogen for fuel cells. The system uses standard gasoline or diesel to generate hydrogen for on-site electrical power production.

Awarded a $780,000 contract from the U.S. Army for the development of a fuel processor. The device will generate hydrogen for a fuel cell to provide a portable power for the individual soldier for extended missions.

KYOCERA INDUSTRIAL CERAMICS CORP.

5713 East Fourth Plain Blvd

Vancouver, WA 98661

Phone: 360-696-8950

Fax: 360-696-9804

www.kyocera.com/kicc/industrial/

Company Type:	■ Component supplier ■ Manufacturer/assembler	**Product Categories:**	■ Components ■ Complete systems

Kyocera Industrial Ceramics Corporation is headquartered in Vancouver, WA with four manufacturing plants and 12 sales offices throughout the United States. The company manufactures advanced ceramic components. It also markets LCDs, thermal printheads, fiber optic components, and industrial lenses. In February 2003, the company announced the development of a 1Kw solid oxide fuel cell, with the goal of reaching commercial markets in 2005.

A wholly-owned subsidiary of Kyocera International, Inc. of San Diego, the North American holding company for Kyocera Corporation

LOGAN INDUSTRIES

Harold Alexander, President and CEO

3808 N Sullivan Road, Bldg 5
Spokane, WA 99216
Phone: 509-462-7400
Fax: 509-344-0739
www.loganind.com

Company Type:	■ Manufacturer/assembler ■ Design, engineering or other services	**Product Categories:**	■ Fuel cell stacks ■ Balance of plant (plumbing, heat exchanger, etc.)

Performs assembly, testing, and supply chain management for makers of electronics and fuel cells.

Has worked for Avista Labs assembling and testing its fuel cells and managing relationships with subcontractors.

MARKETECH INTERNATIONAL, INC.

4750 Magnolia Street
Port Townsend, WA 98368
Phone: 360-379-6707
Fax: 360-379-6907
www.mkt-intl.com

Company Type:	■ Distributor/reseller ■ Component supplier	**Product Categories:**	■ Components

Distributor of advanced materials and components, including electro-chemical materials used in fuel cells.

MBI GRAPHITE

Marvin Brashem, President

14023 NE 8th Street
Bellevue, WA 98007
Phone: 425-641-1566
Fax: 425-641-1583
www.mbigraphite.com

Company Type:	▪ Distributor/reseller ▪ Component supplier	**Product Categories:**	▪ Components

Leading distributor of graphite electrodes, cathode blocks, and related materials that are used inthe construction of certain fuel cell stacks.

A division of M Brashem Inc.

NEAH POWER SYSTEMS, INC.

David Dorheim, President and CEO

22122 20th Avenue Southeast, Suite 161
Bothell, WA 98021
Phone: 425-424-3324
Fax: 425-483-8454
www.neahpower.com

Company Type:	▪ Manufacturer/assembler	**Product Categories:**	▪ Complete systems ▪ Fuel cell stacks

Neah Power develops micro fuel cells for portable electronic devices. The company bases its products on a patent-pending silicon design that differs substantially from the base materials used for most Proton Exchange Membrane (PEM) fuel cells.

Neah Power was founded in 1999 by Leroy Ohlsen, a graduate of the University of Washington. He used University labs and facilities to perfect some of his early research. Today research is conducted at the headquarters in Bothell and in Finland.

Recipient in September 2003 of a $2M grant from the Advanced Technology Program (ATP) of the National Institute of Standards and Technology (NIST). The award will help fund a two-year, $6.5M cost-shared program to further the development of Neah Power's silicon-based micro fuel cell. Partnered in October 2003 with Montecito Group, a consulting firm specializing in new military technologies, to pursue research and product opportunities within the U.S. Department of Defense.

Neah Power Systems is a privately-held company. Primary investors include Frazier Technology Ventures, Alta Partners, and Intel Capital.

NORTHERN TECHNOLOGIES INC.

23123 E Mission Ave
Liberty Lake, WA 99019
Phone: 509-927-0401
Fax: 509-927-0435
www.northern-tech.com

Company Type:	■ Manufacturer/assembler ■ Design, engineering or other services	**Product Categories:**	■ Balance of plant (plumbing, heat exchanger, etc.) ■ Power electronics

Provides backup power for broadcast, cable, government, medical, transportation, corrections, and cellular facilities. Now beginning to experiment with the inclusion of fuel cells into backup solutions, and to do contract design and manufacturing for fuel cell makers. Expertise includes understanding of power electronics, transformers, battery backups, and other components that are often part of commercial fuel cell products.

Division of Emerson Network Power.

NU ELEMENT, INC.

Karen Fleckner; President and CEO

2323 N 30th Street, Suite 100
Tacoma, WA 98403
Phone: 253-573-1780
www.nuelement.com

Company Type:	■ Manufacturer/assembler ■ Design, engineering or other services	**Product Categories:**	■ Complete systems ■ Hydrogen/fuel processing, transport, storage

Develops modular PEM fuel cells for the residential and small business auxiliary power market. Also develops fuel processing technology that has received some interest from military and aerospace organizations.

PACIFIC AEROSPACE & ELECTRONICS, INC.

Don Wright, CEO

430 Olds Station Road
Wenatchee, WA 98801
Phone: 509-667-9600
Fax: 590-667-9696
www.pcth.com

Company Type:	■ Manufacturer/assembler ■ Design, engineering or other services	**Product Categories:**	■ Balance of plant (plumbing, heat exchanger, etc.) ■ Components

Manufacturing company specializing in metal and ceramic components. Special expertise in technically demanding interconnect systems and machined components. Approximately 850 customers worldwide. Customers include fuel cell makers, aerospace, defense, electronics, medical, telecommunications, energy and transportation companies.

PACIFIC NORTHWEST NATIONAL LABORATORY (PNNL)

Len Peters, Director

902 Battelle Boulevard
Richland, WA 99352
Phone: 888-375-7665
www.pnl.gov

Company Type:	■ R&D ■ Design, engineering or other services	**Product Categories:**	■ Fuel cell stacks ■ Components

One of nine U.S. Department of Energy (DOE) multiprogram national laboratories. Works on a variety of national issues, including the development of clean, efficient and reliable energy sources. Conducts substantial research in fuel cells and fuel reforming.

Coordinates and provides technical leadership for the DOE's Solid State Energy Conversion Alliance (SECA). This collaborative effort by industry, academia and research organizations aims to commercialize an SOFC power generation system within the next 10 years.

Collaborates with NASA's Glenn Research Center on investigations into key components for SOFCs.

Manages the Fuel Cells Web site for the Department of Energy's Hydrogen, Fuel Cells and Infrastructure Technologies.

PERMAGAS, INC.

Joe Sternola, President

2317 N Machias Rd
Lake Stevens, WA 98258
Phone: 800-481-8808
Fax: 425-334-9018
www.permagas.com

Company Type:	■ Component supplier	**Product Categories:**	■ Hydrogen/fuel processing, transport, storage

Distributor of propane to industrial, commercial, and residential customers in Alaska, Washington, Idaho, and British Columbia. Also contributing to developing hydrogen fuel quality specifications and supplying propane for the fuel cell reforming and testing projects.

PROTARUS LLC

Anthony Dickman, President

PO Box 7409
Bend, OR 97708
Phone: 541-390-5131
www.protarus.com

Company Type:	▪ R&D ▪ Manufacturer/assembler	**Product Categories:**	▪ Fuel cell stacks ▪ Complete systems

An early-stage startup with the goal of commercializing proton-exchange membrane (PEM) fuel cells for stationary and portable applications. The company is currently seeking both financing and sales and marketing executives. Its R&D focus emphasizes manufacturability, cost reduction and product reliability. Its sales strategy is to find high-value niche markets for early entry. Its financing strategy is to acquire basic funding through research grants for fuel processing and fuel cell components.

All three founders are former employees of IdaTech, which is also located in Bend, OR.

TORAY COMPOSITES (AMERICA), INC.

Moriyuki Onishi, President

19002 50th Avenue East
Tacoma, WA 98446
Phone: 253-846-3090
www.torayusa.com

Company Type:	▪ Component supplier	**Product Categories:**	▪ Components

North American distributor for Toray TGP-H carbon fiber paper, used as gas diffusion media in fuel cell applications.

Subsidiary of Toray Industries (OTC: TRYIY), a Japanese firm that manufactures a wide variety of materials and components through more than 200 subsidiaries and affiliates.

UNIVERSITY OF WASHINGTON

Box 352600 University of Washington
Seattle, WA 98195
Phone: 206-543-2100
http: //depts.washington.edu/fuelcell/

Company Type:	▪ R&D ▪ Design, engineering or other services	**Product Categories:**	▪ Fuel cell stacks ▪ Test equipment

Hosts an undergraduate fuel cell research team conducting research into in bipolar plates, catalyst printing, test stand design, and fuel cell use in transport applications. Interested in both PEM and SO fuel cells.

Works closely with the DOE's SECA program, which aims to commercialize SOFCs.

VIRTUAL TECHNOLOGIES, LTD.

Mike Whitefoot, President

3815 S Union Road
Spokane, WA 99206
Phone: 509-244-3252
Fax: 509-921-0618
www.virtualtechnologiesltd.com

Company Type:	▪ Manufacturer/assembler ▪ Design, engineering or other services	**Product Categories:**	▪ Power electronics

Designer and manufacturer of alternative energy power products, battery chargers, DC-to-DC converters, custom inverters, custom power supplies, solar powered telemetry and communications equipment, as well as industrial control solutions. It also offers consulting, design, custom engineering, product development, project development services and research.

WAH CHANG

Lynn D. Davis, President

PO Box 460
Albany, OR 97321
Phone: 541-926-4211
Fax: 541-967-6990
www.alleghenytechnologies.com/wahchang

Company Type:	■ Component supplier	**Product Categories:**	■ Hydrogen/fuel processing, transport, storage ■ Components

One of the world's largest manufacturers of specialty metals and chemicals. Most are used in chemical and mineral processing, aerospace, medical, research and consumer products. A few of their metals and chemicals are used in energy production. For instance, the company's Palladium/Copper Membrane Modules are used to separate and purify hydrogen from mixed gas streams.

Subsidiary of Allegheny Technologies, one of the world's largest and most diversified producers of specialty materials.

APPENDIX A: ABOUT THE ANALYSTS

PS Reilly is a noted expert, researcher, and advisor on commercial success in emerging markets. Her insights and predictions are regularly featured in articles, columns, and keynotes. Most recently she was Vice President of Emerging Markets for Ziff Davis Media, where she provided strategic advice to leading technology companies, including IBM, Peoplesoft, and many others. She has designed and led numerous large-scale research projects, from analysis of a single market, to investigating the economic impact of regional policy and infrastructure changes.

Jesse Berst is an internationally known technology and business analyst. He has authored or co-authored more than a dozen books on technology topics, written hundreds of articles for leading publications and keynoted dozens of business events in the U.S. and abroad. He combines two decades of professional experience in emerging markets with a personal interest in environmental and energy issues. He has served on the Department of Energy National Grid Vision Planning Committee and is the Chairman of the Advisory Committee for Pacific Northwest National Laboratory's Energy Sciences and Technology Directorate.

Jeff Canin brings 20 years of experience in the financial services sector. As a stock analyst with Hambrecht & Quist, Montgomery Securities and Salomon Brothers in San Francisco, he provided in-depth high tech research coverage to institutional investors in North America and Europe. Since 1995, he has worked as a venture capitalist and consultant to emerging growth companies in the information technology and distributed energy fields.

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