2004 Fuel Cell Industry Survey

A Survey of 2003 Financial Results of Public Fuel Cell Companies*

PricewaterhouseCoopers

*connectedthinking

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FOCUS AREAS

Alkaline Fuel Cells (AFC) have been used in the US space program since the 1960's.

Direct Liquid Fuel Cells (DLFC) are primarily battery replacements for portable electronic devices.

Direct Methanol Fuel Cells (DMFC) are being developed for portable and micro applications such as laptop computers and mobile phones.

Fueling Infrastructure refers to developing components of the hydrogen supply chain, including the creation, storage and distribution of hydrogen.

Molten Carbonate Fuel Cells (MCFC) are best suited for larger stationary applications.

Proton Exchange Membrane Fuel Cells (PEMFC) are the leading fuel cell technology for use in transportation applications.

Solid Oxide Fuel Cells (SOFC) may be used in both utility and small-scale stationary power systems.

Scope

This survey presents financial information based on the annual reports of publicly traded fuel cell companies (PwC Fuel Cell List) for fiscal years ending in 2003. All figures are expressed in US dollars[1]. Companies were included in this survey if: (a) their primary goal is fuel cell production and/or system integration and/or related fueling infrastructure; and (b) they were a stand-alone public company as at December 31, 2003.

Companies Included in this Survey

Company	Country	Focus Area
Alternate Energy Corp.	US	Fueling Infrastructure
Astris Energi Inc.	Canada	AFC
Ballard Power Systems Inc.	Canada	PEMFC
Distributed Energy Systems Corp.	US	PEMFC
Dynetek Industries Ltd.	Canada	Fueling Infrastructure
Energy Visions Inc.	Canada	DMFC
Fuel Cell Technologies Corp.	Canada	SOFC
FuelCell Energy Inc.	US	MCFC
Hydrogenics Corp.	Canada	PEMFC
Manhattan Scientifics Inc.	US	DMFC
Medis Technologies Ltd.	US	DLFC
Millennium Cell Inc.	US	Fueling Infrastructure
Pacific Fuel Cell Corp.	US	PEMFC
Palcan Fuel Cells Ltd.	Canada	PEMFC
Plug Power Inc.	US	PEMFC
Quantum Fuel Systems Technologies Worldwide Inc.	US	Fueling Infrastructure
Snow Leopard Resources Inc.	Canada	PEMFC
Stuart Energy Systems Corp.	Canada	Fueling Infrastructure

It is estimated that public companies represent less than one third of the industry. Readers should note that considerable activity in this sector is conducted by private companies and operating divisions or subsidiaries of larger, diversified organizations, including MTI Micro Fuel Cells, Rolls Royce Fuel Cells and UTC Fuel Cells.

1. Financial data have been converted to US dollars using year end and year end average rates of exchange, where applicable. All companies have December 31 year ends except those listed below:

   Stuart Energy Systems Corp. – March 31
   Quantum Fuel Systems Technologies Worldwide Inc. – April 30
   Energy Visions Inc. – September 30
   FuelCell Energy Inc. – October 31

PRICEWATERHOUSECOOPERS

Introduction

Welcome to PricewaterhouseCoopers *2004 Fuel Cell Industry Survey*. Produced on an annual basis, the purpose of this survey is to provide the industry and the public with a perspective on the financial activities and trends in the sector as they develop.

This year, the scope of the survey was expanded in two respects; companies around the globe were included, as were employment statistics. Notably expanding the geographic scope had no effect on coverage as all publicly traded fuel cell companies continued to be based in North America.

This year, the PwC Fuel Cell list includes 18 companies. Four new companies were added: Alternate Energy, Manhattan Scientific, Millennium Cell and Pacific Fuel Cell. Global Thermoelectric and H Power were removed due to consolidation. Following its merger with Northern Power Systems, Proton Energy Systems is now listed under its new name, Distributed Energy Systems.

The aggregate financial results of the companies surveyed show the following key changes between 2002 and 2003:

- A 20% increase in revenues to $243 million.
- An 11% decrease in research and development (R&D) expenditures to $204 million.
- An 8% decrease in employment to 2,741.
- A 50% increase in market capitalization to $3.6 billion.

In 2003, revenues outstripped R&D expenditures for the first time in the PwC survey's three year history. While market capitalization increased significantly, the industry is still operating at a loss, investment in R&D remains high, and technical, marketing and financing challenges continue.

These challenges, notwithstanding, real progress is being made and the industry is looking forward to a more commercial environment for certain products within the next two to three years.

Industry Overview

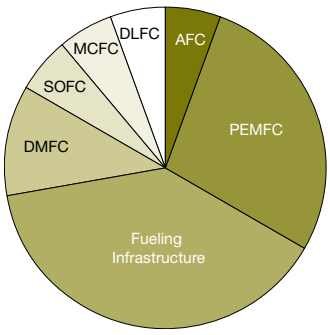
Financing fuel cell companies through public equity markets is more popular in North America than in other jurisdictions. Publicly traded fuel cell companies continue to represent about a third of the North American industry. However, as the number of private companies, subsidiaries and divisions of larger companies involved in the industry increases worldwide, the relative proportion of companies accessing capital this way is diminishing.

Of the companies included in the survey, those working on PEM fuel cells and fueling infrastructure continue to dominate. However, companies developing fuel cell technology for transportation and large stationary applications are, increasingly, looking to public markets to meet their long-term financing needs.

2003 saw a great deal of focus on the development of micro fuel cells. Consumers are demanding more and more functionality in portable electronic devices such as cell phones, laptop computers and cameras, driving up the power requirements. Most of the technology in this demand-led drive to commercialization is in the DMFC arena. Divisions of large multinational organizations, including NEC, Gillette and Toshiba, and a select number of smaller private partners are leading the way. Commercial products are already in the pipeline and, pending regulatory approval, are expected to hit markets in the next few years.

While only three public companies are active in this area—Manhattan Scientifics, Medis Technologies and Energy Visions—widespread adoption of fuel cell technology in portable markets will create a positive impact on investor perception, which will benefit the entire industry.

Focus Areas of the PwC Fuel Cell List



Company Financial Information
($ thousands)

		Gross Revenues[2]		R&D Expenditures[3]		Total Assets		Net Loss		Market Capitalization[4]		Net Cash Flow	
		2003	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003	2002
Ballard Power Systems	Canada	$119,566	$ 90,937	$103,863	$ 114,022	$ 834,835	$ 918,624	$(125,092)	$(148,417)	$1,398,163	$1,281,788	$ 40,856	$ 96,459
FuelCell Energy	USA	33,790	41,231	8,509	6,806	223,363	289,803	(67,414)	(48,840)	602,386	226,350	(61,495)	(154,375)
Hydrogenics	Canada	26,660	15,840	7,038	3,761	91,438	90,677	(22,091)	(20,611)	327,149	172,250	1,019	(644)
Quantum Fuel Systems	USA	23,639	23,403	14,255	32,657	50,952	28,159	(18,197)	(43,378)	47,175	n/a	11,362	173
Dynetek Industries	Canada	14,551	8,174	3,407	2,676	35,134	31,295	(3,488)	(3,141)	24,131	15,942	(6,712)	(8,014)
Plug Power	USA	12,502	11,818	40,070	40,289	160,589	108,683	(53,039)	(47,218)	528,168	228,977	61,427	(26,390)
Stuart Energy Systems	Canada	4,869	5,052	9,752	11,019	54,768	80,309	(21,981)	(18,501)	54,648	87,112	1,822	(1,226)
Distributed Energy Systems	USA	4,194	4,714	7,716	8,793	143,467	176,305	(16,768)	(13,480)	101,121	100,353	(12,140)	14,578
Fuel Cell Technologies	Canada	1,823	709	2,318	1,592	7,530	5,209	(2,019)	(2,058)	22,920	13,034	1,175	(418)
Millennium Cell	USA	467	719	1,020	1,515	10,985	14,166	(16,103)	(16,124)	81,618	69,376	(1,983)	1,638
Manhattan Scientifics	USA	300	156	286	865	1,225	1,646	(2,569)	(4,028)	11,181	8,077	(12)	(11)
Medis Technologies	USA	131	192	5,010	4,161	68,451	67,391	(9,837)	(10,305)	262,559	105,512	584	37
Palcan Fuel Cells	Canada	57	0	554	315	375	584	(1,326)	(1,004)	4,923	2,865	(180)	165
Astris Energi	Canada	48	115	0	0	337	429	(1,575)	(473)	10,577	10,469	67	154
Energy Visions	Canada	0	50	305	678	108	167	(1,201)	(2,064)	1,380	2,814	306	(482)
Snow Leopard Resources	Canada	0	0	1	115	295	56	(115)	(1,256)	3,061	4,615	226	22
Alternate Energy	USA	0	0	0	0	5,542	0	(3,699)	(2,110)	93,053	26,097	412	(6)
Pacific Fuel Cell	USA	0	0	0	0	23	121	(103)	(580)	25,376	1,903	(89)	101
Total		**$242,597**	**$203,110**	**$204,104**	**$ 229,264**	**$1,689,417**	**$1,813,624**	**$(366,617)**	**$(383,588)**	**$3,599,589**	**$2,357,534**	**$ 36,645**	**$ (78,239)**

2. Revenues reported are total revenue as stated in the companies' financial statements and do not include investment or other income.
3. R&D expenditures are net and exclude costs of R&D contracts.
4. Based on common shares outstanding and share prices at company's year end.

Revenue and Income

REVENUE GENERATION

Revenue across the industry continues to build on that reported in last year's survey. Of the companies surveyed, gross revenues increased by 20%, to $243 million from $203 million in 2002. The top two revenue producers were once again Ballard Power Systems and FuelCell Energy, accounting for 63% of total 2003 revenues in the survey.

Ballard Power Systems continued to dominate the industry reporting $120 million in revenue, a 31% increase over last year.

Fuel Cell Technologies, which is focused on stationary applications, and Manhattan Scientifics, a micro fuel cell producer, reported the largest revenue increases over last year, at 157% and 92% respectively.

Palcan reported its first revenue in 2003, reflecting a change from sales of developmental products to research and educational customers to sales of prototypes to manufacturing customers.

Energy Visions' 2002 revenues were wholly related to the company's joint R&D agreement with Ilion Technology. With the termination of this agreement, 2003 revenues fell to zero.

CUSTOMER BASE

While continuing to rely heavily on its traditional OEM and niche market base, recent activity suggests the industry is now reaching a broader customer base and developing new relationships, either directly or through distribution arrangements and sales channels.

- Energy Visions purchased Pure Energy to facilitate access to US and European markets and the development of fuel cells for OEMs producing products such as cordless phones, emergency lighting and motorized toys.
- FuelCell Energy received more than 75% of its revenue in 2002 from sales to the US Government. In 2003 this dropped to 52% as they added two major new customers to their portfolio—MTU in Europe and Marubeni in Japan.
- Ballard reported 250 unit sales of its Nexa product to 20 countries.
- While Quantum continues to count General Motors as its major customer, it has since 2001, initiated 30 customer programs with other large corporations.
- Plug Power began commercial shipment of its GenCoreTM5T to customers in the telecommunications industry in the US, UK and Japan.
- Hydrogenics announced the commercialization of its 10kW power module, HyPM10, for early adopters in telecom, industrial, aerospace, military and light mobility markets.
- Hydrogenics launched the next generation of Greenlight Power Technologies' FCATS PEM fuel cell test station.
- Dynetek received a $1.0 million order for 800 compressed natural gas cylinders from strategic partner JFE Container Company Ltd. for distribution to Japanese car and bus manufacturers.

PROFITABILITY

Consistent with last year, none of the companies surveyed were profitable. However, the total net loss decreased slightly from $384 million in 2002 to $367 million in 2003.

We don't expect to see profitability in the majority of these companies in the short to medium term, although early profitability appears to be most likely in companies focused on fueling infrastructure such as Quantum, Stuart Energy and Dynetek.

Gross Revenues
($ thousands)

		2003	2002
Ballard Power Systems	Canada	$ 119,566	$ 90,937
FuelCell Energy	USA	33,790	41,231
Hydrogenics	Canada	26,660	15,840
Quantum Fuel Systems	USA	23,639	23,403
Dynetek Industries	Canada	14,551	8,174
Plug Power	USA	12,502	11,818
Stuart Energy Systems	Canada	4,869	5,052
Distributed Energy Systems	USA	4,194	4,714
Fuel Cell Technologies	Canada	1,823	709
Millennium Cell	USA	467	719
Manhattan Scientifics	USA	300	156
Medis Technologies	USA	131	192
Palcan Fuel Cells	Canada	57	0
Astris Energi	Canada	48	115
Energy Visions	Canada	0	50
Snow Leopard Resources	Canada	0	0
Alternate Energy	USA	0	0
Pacific Fuel Cell	USA	0	0
Total		**$ 242,597**	**$ 203,110**

Net Loss
($ thousands)

		2003	2002
Ballard Power Systems	Canada	$ (125,092)	$ (148,417)
FuelCell Energy	USA	(67,414)	(48,840)
Hydrogenics	Canada	(22,091)	(20,611)
Quantum Fuel Systems	USA	(18,197)	(43,378)
Dynetek Industries	Canada	(3,488)	(3,141)
Plug Power	USA	(53,039)	(47,218)
Stuart Energy Systems	Canada	(21,981)	(18,501)
Distributed Energy Systems	USA	(16,768)	(13,480)
Fuel Cell Technologies	Canada	(2,019)	(2,058)
Millennium Cell	USA	(16,103)	(16,124)
Manhattan Scientifics	USA	(2,569)	(4,028)
Medis Technologies	USA	(9,837)	(10,305)
Palcan Fuel Cells	Canada	(1,326)	(1,004)
Astris Energi	Canada	(1,575)	(473)
Energy Visions	Canada	(1,201)	(2,064)
Snow Leopard Resources	Canada	(115)	(1,256)
Alternate Energy	USA	(3,699)	(2,110)
Pacific Fuel Cell	USA	(103)	(580)
Total		**$ (366,617)**	**$ (383,588)**

Innovation

RESEARCH AND DEVELOPMENT

For the companies surveyed, R&D expenditures declined to $204 million in 2003—a decrease of 11% from $229 million in 2002.

Most of this decrease occurred at Ballard and Quantum. In both cases the reductions in R&D expenditures were a result of cost reduction programs and, in the case of Ballard, restructuring activities.

Research and Development Expenditures
($ thousands)

	2003	2002
Ballard Power Systems	$103,863	$114,022
FuelCell Energy	8,509	6,806
Hydrogenics	7,038	3,761
Quantum Fuel Systems	14,255	32,657
Dynetek Industries	3,407	2,676
Plug Power	40,070	40,289
Stuart Energy Systems	9,752	11,019
Distributed Energy Systems	7,716	8,793
Fuel Cell Technologies	2,318	1,592
Millennium Cell	1,020	1,515
Manhattan Scientifics	286	865
Medis Technologies	5,010	4,161
Palcan Fuel Cells	554	315
Astris Energi	0	0
Energy Visions	305	678
Snow Leopard Resources	1	115
Alternate Energy	0	0
Pacific Fuel Cell	0	0
Total	**$204,104**	**$229,264**

Consistent with last year's survey, R&D declined as a percentage of revenue. While in both 2001 and 2002 R&D exceeded revenue, 2003 marked the first year revenues exceeded R&D expenditures. This, in combination with other factors, is an indicator of the gradual strengthening of commercialization efforts of public fuel cell companies.

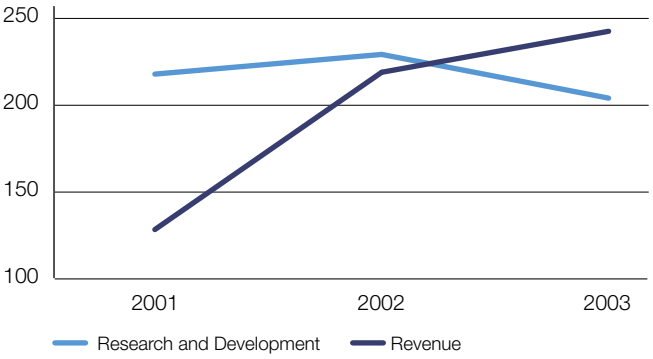
DEMONSTRATION PROJECTS

Demonstrations of fuel cell products in various environments are on the increase. These projects are essential, not only in building customer relationships and in demonstrating capability and safety, but also in enabling the development of know-how and technological change. Many companies in our survey reported examples of demonstration projects. Here are just a few:

- In Ontario, Hydrogenics led a number of companies in establishing the Hydrogen Village Project.
- In British Columbia, the Hydrogen Highway Project represents a collaboration involving companies and governments. It is being developed in conjunction with the 2010 Winter Olympics.

- The North American Industry Coalition announced the National Fuel Cell Bus Technology Initiative, a six-year, $150-million effort to address fuel cell and hydrogen vehicle technology commercialization challenges.
- FuelCell Energy installed a Direct FuelCell power plant for Starwood Hotels & Resorts Worldwide, Inc., one of the world's largest hotel and leisure companies.
- Ballard and partner/customer DaimlerChrysler delivered 30 zero-emission Mercedes-Benz Citaro Buses to cities throughout Europe as part of a two-year field trial program.
- The United States announced a $1.2 billion "Freedom Fuel" initiative to develop commercially viable hydrogen powered fuel cells.
- Stuart Energy demonstrated the world's first intelligent electrolytic Hydrogen Energy Station.

Revenues versus Research and Development Expenditures[5]
($ millions)



5. 2001 data from: *2003 Fuel Cell Industry Survey: PricewaterhouseCoopers*

CONSOLIDATION IN THE INDUSTRY

In 2003, we saw more evidence that the trend towards consolidation continues. Deals have tended to remain within the same technology field as companies strive to rationalize R&D and administrative expenses and consolidate financial, technological and intellectual property resources. We are also seeing improved access to capital and expanded strategic relationships with distributors, suppliers and government agencies.

Examples of merger and acquisition activities in 2003 included:

- Hydrogenics acquired Greenlight Power Technologies (January 2003).
- Stuart Energy acquired Vandenborre Technologies (February 2003).
- Plug Power acquired H Power (March 2003).
- Energy Visions acquired Pure Energy (October 2003).
- FuelCell Energy acquired Global Thermoelectric (November 2003).
- Proton Energy Systems merged with Northern Power Systems to form Distributed Energy Systems (December 2003).

STRATEGIC ALLIANCES

Strategic alliances remain prominent in the industry and are considered necessary to share knowledge, resources, capital and market access. Examples having taken place during this survey year include:

- Stuart Energy and Dynetek signed an agreement relating to the supply of Dynetek's stationary hydrogen storage systems for Stuart Energy's Hydrogen Energy Station product line.
- Palcan signed a joint venture agreement with Shanghai Mingliang Plastic Co. Ltd. to establish a commercial manufacturing facility in Shanghai to produce PEM fuel cell stacks for the global fuel cell marketplace.
- Palcan also signed a marketing agreement with Nagase Corporation Ltd. for the promotion, marketing and sales of Palcan's products in Japan.
- Toshiba and Plug Power announced a joint marketing agreement to explore the application of fuel cells in uninterruptible power systems.
- FuelCell Energy signed an MOU with Enbridge to develop a distribution agreement for its Direct FuelCell products in Canada.
- Astris announced a Letter of Intent with Alternate Energy Corp. to produce and sell complete stationary electric power systems for residential and business markets.
- Shell Hydrogen signed a development, marketing and sales agency agreement with Vandenborre Technologies N.V. to conduct market analysis of the potential of Vandenborre Technologies' home hydrogen refueling.

Employment

New to this year's survey are employment figures, a key indicator used by the industry to measure growth.

In 2003, increased focus on near-term growth and sustained profitability led to merger and acquisition activity. The subsequent rationalization of resources resulted in an 8% reduction in employment amongst publicly traded fuel cell companies.

Despite a 15% reduction in staff, Ballard remained the largest employer in the industry, accounting for 40% (1,099 people) of the total employees of the companies surveyed. FuelCell Energy was again the second largest employer with 372 employees in 2003, down from 425 employees in 2002.

Nearly 40% of the companies surveyed had over 100 employees.

The largest staff increase was reported by Stuart Energy, which grew almost 20% to 186 employees following its acquisition of Belgium-based Vandenborre Technologies. Since then, Stuart Energy has outlined an integration plan to reduce costs and accelerate commercialization.

US-based FuelCell Energy reported a 12% decrease in employees prior to its purchase of Global Thermoelectric in November 2003.

Distributed Energy Systems also reported a decrease in employees following the merger of Proton and Northern Power Systems.

Employment

	2003	2002
Ballard Power Systems	1,099	1,300
FuelCell Energy	372	425
Hydrogenics	250	235
Quantum Fuel Systems Technologies Worldwide	134	156
Dynetek Industries	88	79
Plug Power	343	348
Stuart Energy Systems	186	156
Distributed Energy Systems	115	135
Fuel Cell Technologies	26	28
Millennium Cell	31	40
Manhattan Scientifics	2	2
Medis Technologies	58	45
Palcan Fuel Cells	20	n/a
Astris Energi	n/a	8
Energy Visions	6	6
Snow Leopard Resources[6]	0	n/a
Alternate Energy[7]	8	4
Pacific Fuel Cell	3	2
Total	**2,741**	**2,969**

6. All staff were terminated effective June 19, 2003.
7. 2002 figures shown were anticipated employees following corporate restructuring.

Shareholder Value

CASH FLOW

Total cash flow for the companies surveyed was $37 million in 2003 compared to a negative $78 million in 2002.

Cash flow from operations was negative again for 2003 at $222 million, an improvement over negative $311 million in 2002. For the second year in a row, cash flow from investing increased from $67 million in 2002 to $186 million in 2003, while cash flow from financing dropped to $73 million in 2003 from $166 million in 2002—also continuing a trend from 2001.

Cash Flow
($ thousands)

	2003	2002
Cash Flow from Operations	$ (222,127)	$ (310,616)
Cash Flow from Investing	$ 186,207	$ 66,903
Cash Flow from Financing	$ 72,565	$ 165,474
Total Cash Flow	**$ 36,645**	**$ (78,239)**

MARKET CAPITALIZATION

The industry showed marked signs of returning investor confidence in 2003, reporting a total increase in market capitalization of 50% to $3.6 billion—outperforming the S&P/TSX Composite Index (24%), the Dow Jones Industrial Average (25%) and the S&P 500 (26%).

- In its first year as a public company, Quantum raised a total of $60 million from two public equity offerings.
- Proton paid $27.5 million to Northern Power Systems' security holders—approximately two-thirds in cash and the balance in Proton common stock.

The companies surveyed also outperformed the WilderHill Clean Energy Index. Comprised of publicly-traded companies whose businesses stand to benefit from societal transition to cleaner energy and conservation, this index, which includes some of the companies included in this survey, ended 2003 at a 47% increase.

Market Capitalization
($ thousands)

		2003	2002
Ballard Power Systems	Canada	$ 1,398,163	$ 1,281,788
FuelCell Energy	USA	602,386	226,350
Hydrogenics	Canada	327,149	172,250
Quantum Fuel Systems	USA	47,175	n/a
Dynetek Industries	Canada	24,131	15,942
Plug Power	USA	528,168	228,977
Stuart Energy Systems	Canada	54,648	87,112
Distributed Energy Systems	USA	101,121	100,353
Fuel Cell Technologies	Canada	22,920	13,034
Millennium Cell	USA	81,618	69,376
Manhattan Scientifics	USA	11,181	8,077
Medis Technologies	USA	262,559	105,512
Palcan Fuel Cells	Canada	4,923	2,865
Astris Energi	Canada	10,577	10,469
Energy Visions	Canada	1,380	2,814
Snow Leopard Resources	Canada	3,061	4,615
Alternate Energy	USA	93,053	26,097
Pacific Fuel Cell	USA	25,376	1,903
Total		**$ 3,599,589**	**$ 2,357,534**

Ratio of Market Capitalization at Year End to Revenue for the Year

		2003	2002
Ballard Power Systems	Canada	12	14
FuelCell Energy	USA	18	5
Hydrogenics	Canada	12	11
Quantum Fuel Systems	USA	2	–
Dynetek Industries	Canada	2	2
Plug Power	USA	42	19
Stuart Energy Systems	Canada	11	17
Distributed Energy Systems	USA	24	21
Fuel Cell Technologies	Canada	13	18
Millennium Cell	USA	175	96
Manhattan Scientifics	USA	37	52
Medis Technologies	USA	2,004	550
Palcan Fuel Cells	Canada	86	–
Astris Energi	Canada	220	91
Energy Visions	Canada	–	56
Snow Leopard Resources	Canada	–	–
Alternate Energy	USA	–	–
Pacific Fuel Cell	USA	–	–

Fuel Cell Prospects Not All That They Seem

The public, industry analysts and the media are sometimes skeptical about the future of the fuel cell industry. On the surface, the industry is not a picture of health. The financing climate continues to be difficult for fuel cell companies and the sector as a whole still faces many challenges. It has not yet produced a commercially viable company or product that by traditional measures—such as earnings—is successful. Timelines for technical development are not clear and an explanation of the latest progress has not been clearly articulated.

But it is important to look below the surface to see what is happening in the fuel cell sector. In doing so, we see significant developments not evident in the current financial results, that bring more positive news.

Fuel cell commercialization will most likely first appear in portable applications, such as battery replacements for cell phones, laptop computers, and cameras—products largely driven by consumer demand. Through our involvement in the fuel cell sector, PricewaterhouseCoopers (PwC) has seen a substantial rise in the attention given to the portable application market over the last two years. Fuel cell power suppliers are offering consumers a real option to operate these increasingly power hungry devices.

Companies such as Medis Technologies, MTI Micro Fuel Cells and Toshiba are each advancing plans to bring commercial micro fuel cell products to market in the near term. The portable device markets are huge and will allow the general public to use fuel cells in an everyday environment. Bringing fuel cells directly to the public will go a long way towards overcoming many of the issues which have dampened enthusiasm for this technology's promise.

Second round commercialization will come in stationary applications, such as institutional electrical generators. Ironically, the transportation sector, where fuel cells have earned the broadest groundswell of acceptance, will need a much longer time to reach its commercialization horizon. Major challenges that will take time to overcome include cost, compared to the internal combustion engine, and establishing hydrogen fueling infrastructure.

Various environmental and economic factors continue to drive the need to develop fuel cells, including the price of oil, energy security, climate change, and air quality. China and India's growing energy demands, the many conflicts in the oil producing regions around the world, and the desire of governments in developing countries to protect their citizens from the polluting effects of rapid industrial development are just some of the issues playing an increasingly important role in the fuel cell sector's evolution.

We are seeing continued investment in fuel cells by large, well-funded multi-nationals on all continents, with government support being strong in Canada, the United States, Japan and a number of European Union countries. With this private and public support, new companies continue to make progress with solutions that will improve the effectiveness of existing technologies, the cost of fuel cells and their ability to compete with incumbent technologies.

Financial results do not tell the story of the progress being made. This survey has examined the world's publicly-traded fuel cell companies and reveals that, financially, the industry is still experiencing mixed results. Revenues are up by 20% from the previous year and for the first time in the three-year history of PwC's annual survey, total 2003 gross revenues are greater than R&D expenditures. Total cash flows from operations are still negative, and losses abound.

Despite the red ink, however, we see the next two years as critical in the sector's future as fuel cells for portable applications are introduced to consumer markets and stationary producers find more early adopters.

Bringing new energy to world markets

PricewaterhouseCoopers understands and supports the fuel cell industry, in Canada and around the world. Its Alternative Energy Network of professional staff, drawn from 120,000 people in 139 countries, has a firm grasp of the issues facing companies as the industry evolves towards commercialization.

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