



PRICEWATERHOUSECOOPERS 

2003 Fuel Cell Industry Survey

A Survey of 2002 Financial Results of North American Public Fuel Cell Companies



Scope

Welcome to the inaugural PricewaterhouseCoopers Fuel Cell Industry Survey. Produced on an annual basis, the purpose of these surveys is to provide the industry and the public with a perspective on the activities and trends in the sector as they develop. The 2003 edition focuses on North American public fuel cell companies.

The financial information presented in this survey has been obtained from the annual reports of 16 North American publicly traded fuel cell companies for fiscal years ending in 2002. All figures are expressed in US dollars¹. Companies were included 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 based in Canada or the US as at December 31, 2002.

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 for portable electronic devices.

Direct Methanol Fuel Cells (DMFC)

are being developed for portable and micro applications such as laptop computers and mobile phones.

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.

Companies Included in this Survey

Name	Country	Focus Area
Astris Energi Inc.	Canada	AFC
Ballard Power Systems Inc.	Canada	PEMFC
Dynetek Industries Ltd.	Canada	Fueling Infrastructure
Energy Visions Inc.	Canada	DMFC
FuelCell Energy Inc.	US	MCFC
Fuel Cell Technologies Corp.	Canada	SOFC
Global Thermoelectric Inc.	Canada	SOFC
Hydrogenics Corp.	Canada	PEMFC
H Power Corp.	US	PEMFC
Medis Technologies Ltd.	US	DLFC
Palcan Fuel Cell Company Ltd.	Canada	PEMFC
Plug Power Inc.	US	PEMFC
Proton Energy Systems Inc.	US	PEMFC
Snow Leopard Resources Inc.	Canada	PEMFC
Stuart Energy Systems Inc.	Canada	Fueling Infrastructure
Quantum Fuel Systems Technologies Worldwide Inc.	US	Fueling Infrastructure

Other public companies that conduct fuel cell related activities but do not make related financial information readily identifiable as separate operations within their annual reports were not included.

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
 H Power Corp. – May 31
 Energy Visions Inc. – Sept. 30
 FuelCell Energy – Oct. 31

Introduction

Financial information reported by North American publicly traded fuel cell companies provides valuable insight into an industry highly protective of intellectual property and competitive positioning. What emerges is the image of an industry operating at a loss. While revenues are increasing, they are as yet insufficient to fund the high cost of research and development. Sources of sustainable funding remain essential to bringing commercially viable fuel cell technologies to market.

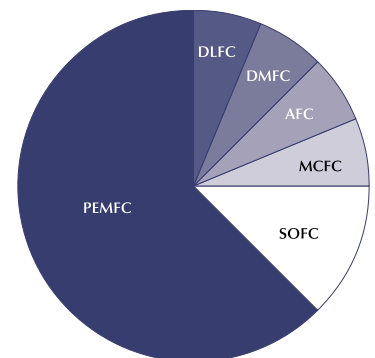
Industry Overview

Approximately one third of fuel cell companies in North America are publicly traded. The remainder are either private or an operating division of a diversified organization.

Public fuel cell companies can be separated into two primary areas of focus: fuel cell production and/or system integration, and fueling infrastructure. Furthermore, as fuel cell producers tend to focus on a specific technology, the companies can be categorized by the type of fuel cell they produce.

In North America, most public fuel cell companies are developing proton exchange membrane fuel cells (PEMFC) and related fueling infrastructure. This emphasis on PEMFC technology suggests that investor interest in the potentially huge transportation market has historically outweighed that for portable and stationary applications. However, with commercialization in the portable and stationary markets expected to precede commercialization in the transportation market, companies focused on PEMFC technology may remain dependent on financing for considerably longer than companies focused on other fuel cell technologies.

Focus Area of Fuel Cell Companies Included in Survey



Revenue and Income

REVENUE GENERATION

Across the companies surveyed, revenues increased 71%, from \$128 million in 2001 to \$219 million in 2002. Ballard Power Systems, FuelCell Energy and Quantum consistently ranked as the top three revenue producers accounting for 71% (\$156 million) of the total 2002 revenues and 67% (\$86 million) of the total 2001 revenues. Ballard continued to dominate the industry, reporting the largest 2002 revenue of \$91 million.

Gross Revenues ² (\$ thousands)			
		2002	2001
Ballard Power Systems	Cda	\$ 90,937	\$36,204
FuelCell Energy	US	41,231	26,179
Quantum ³	US	23,403	23,358
Hydrogenics	Cda	15,840	7,418
Global Thermoelectric	Cda	14,207	9,918
Plug Power	US	11,818	5,742
Dynetek Industries	Cda	8,174	6,128
Stuart Energy Systems	Cda	5,052	6,255
Proton Energy Systems	US	4,714	2,968
H Power	US	2,576	3,643
Fuel Cell Technologies	Cda	709	443
Medis Technologies	US	192	–
Astris Energi	Cda	94	17
Energy Visions	Cda	50	141
Palcan Fuel Cells	Cda	–	–
Snow Leopard	Cda	–	–
Total		\$218,997	\$128,414

CUSTOMER BASE

Fuel cell companies are beginning to generate revenue from sales of products and contract engineering. Typically, research and development (R&D) services are provided to a small number of sophisticated customers. For example:

- Energy Vision's 2002 revenues were entirely earned from R&D and licensing fees from one company;
- 75% of FuelCell Energy's revenue came from one source — the US government.

- 80% of Quantum's 2002 revenues were received from General Motors and its affiliates.

These early customers play a major role in the commercialization strategy of fuel cell companies and are key to the short term direction and long term success of the industry.

Interestingly, Canadian public fuel cell companies reported revenue from customers in several countries including Canada, the United States, Japan, Germany and the UK. However, most of the US fuel cell companies did not report revenues from foreign countries.

For those that reported revenue categorized by products and services, product revenues accounted for 57% in 2002 and 65% in 2001.

PROFITABILITY

Despite an increase in revenue between 2001 and 2002, none of the companies included in this survey were profitable. The high costs of producing low volumes of product for a limited number of early-stage customers and a continued focus on R&D contributed to losses totalling \$405 million in 2002— a 35% increase from \$301 million in 2001.

Net Loss (\$ thousands)			
		2002	2001
Ballard Power Systems	Cda	\$(147,731)	\$(96,161)
FuelCell Energy	US	(48,840)	(15,438)
Quantum	US	(44,778)	(30,244)
Hydrogenics	Cda	(20,611)	(2,816)
Global Thermoelectric	Cda	(15,541)	(7,615)
Plug Power	US	(47,218)	(73,112)
Dynetek Industries	Cda	(3,141)	(747)
Stuart Energy Systems	Cda	(18,501)	(8,313)
Proton Energy Systems	US	(13,480)	(4,954)
H Power	US	(27,915)	(22,151)
Fuel Cell Technologies	Cda	(2,058)	(3,342)
Medis Technologies	US	(10,305)	(31,562)
Astris Energi	Cda	(420)	(384)
Energy Visions	Cda	(2,064)	(3,250)
Palcan Fuel Cells	Cda	(1,004)	(480)
Snow Leopard	Cda	(1,256)	(330)
Total		\$(404,863)	\$(300,899)

Company Financial Information (\$ thousands)

		Gross Revenues		R&D Expenditures ⁴		Total Assets		Net Loss		Market Capitalization ⁵		Net Cash Flow	
		2002	2001	2002	2001	2002	2001	2002	2001	2002	2001	2002	2001
Ballard Power Systems	Cda	\$ 90,937	\$ 36,204	\$ 113,736	\$ 77,197	\$ 917,803	\$ 959,319	\$(147,731)	\$(96,161)	\$ 1,282,226	\$ 3,103,360	\$ 96,459	\$(40,325)
FuelCell Energy	US	41,231	26,179	6,806	3,108	289,803	334,020	(48,840)	(15,438)	226,350	609,551	(154,375)	182,116
Quantum	US	23,403	23,358	32,657	26,687	57,163	32,815	(44,778)	(30,244)	n/a	n/a	173	3
Hydrogenics	Cda	15,840	7,418	3,761	2,337	90,677	107,633	(20,611)	(2,816)	173,211	353,492	(644)	(80)
Global Thermoelectric	Cda	14,207	9,918	14,850	9,744	77,588	92,196	(15,541)	(7,615)	44,009	132,023	(34,476)	50,885
Plug Power	US	11,818	5,742	40,289	60,600	108,683	151,374	(47,218)	(73,112)	228,977	439,822	(26,390)	(4,864)
Dynetek Industries	Cda	8,174	6,128	2,676	1,449	31,295	33,603	(3,141)	(747)	16,580	31,580	(7,399)	(4,602)
Stuart Energy Systems	Cda	5,052	6,255	11,019	8,864	85,746	102,111	(18,501)	(8,313)	87,168	90,130	(1,226)	(10,846)
Proton Energy Systems	US	4,714	2,968	8,793	6,500	176,502	181,868	(13,480)	(4,954)	100,353	274,135	14,578	477
H Power	US	2,576	3,643	18,905	13,466	73,752	105,350	(27,915)	(22,151)	363,709	3,538,714	(7,723)	38,129
Fuel Cell Technologies	Cda	709	443	1,592	2,505	5,209	4,954	(2,058)	(3,342)	13,034	14,468	(418)	1,274
Medis Technologies	US	192	–	4,161	4,251	66,894	69,894	(10,305)	(31,562)	105,511	128,866	37	3,114
Astris Energi	Cda	94	17	–	–	421	112	(420)	(384)	10,719	3,068	154	(3)
Energy Visions	Cda	50	141	678	856	167	1,377	(2,064)	(3,250)	2,814	6,031	(482)	461
Palcan Fuel Cells	Cda	–	–	315	240	584	145	(1,004)	(480)	2,838	38,875	165	6
Snow Leopard	Cda	–	–	115	134	56	981	(1,256)	(330)	4,597	7,036	22	(22)
Total		\$ 218,997	\$ 128,414	\$ 260,353	\$ 217,938	\$ 1,982,343	\$ 2,177,752	\$(404,863)	\$(300,899)	\$ 2,662,096	\$ 8,771,151	\$(121,545)	\$ 215,723

2. Revenues reported are total revenue as stated in the companies' financial statements and do not include investment or other income.

3. Based on pro forma statements at April 30, 2002.

4. R&D expenditures are net and exclude costs of R&D contracts.

5. Based on common shares outstanding and share prices at company's year end.

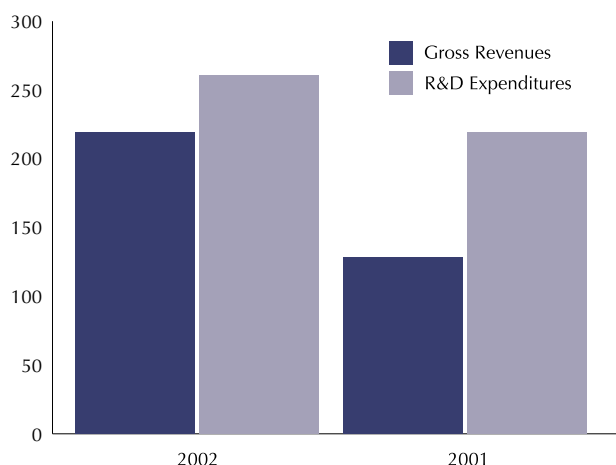
Innovation

Fuel cell companies are currently in the R&D business and, not surprisingly, R&D expenses account for a major proportion of their operational costs. Overall, R&D spending increased by \$42 million or 19% between 2001 and 2002.

Research and Development Expenditures (\$ thousands)			
		2002	2001
Ballard Power Systems	Cda	\$113,736	\$ 77,197
FuelCell Energy	US	6,806	3,108
Quantum	US	32,657	26,687
Hydrogenics	Cda	3,761	2,337
Global Thermoelectric	Cda	14,850	9,744
Plug Power	US	40,289	60,600
Dynetek Industries	Cda	2,676	1,449
Stuart Energy Systems	Cda	11,019	8,864
Proton Energy Systems	US	8,793	6,500
H Power	US	18,905	13,466
Fuel Cell Technologies	Cda	1,592	2,505
Medis Technologies	US	4,161	4,251
Astris Energi	Cda	–	–
Energy Visions	Cda	678	856
Palcan Fuel Cells	Cda	315	240
Snow Leopard	Cda	115	134
Total		\$260,353	\$217,938

For most companies R&D spending outweighed revenue. However, the declining ratio of R&D to revenue — from 170% in 2001 to 119% in 2002 — may suggest an industry-wide move towards commercialization.

Comparison of R&D Expenditure to Revenue
(\$ millions)



Strategic Alliances

Developing and demonstrating new technology, tailoring that technology to meet specific application requirements, reducing production costs, expanding manufacturing capability and establishing a distribution network are just a few of the challenges facing the fuel cell industry.

Collaboration within industry, through partnerships, alliances and other strategic relationships, allows fuel cell companies to leverage their complementary strengths—aiding in product development and extending geographic reach and customer base. Examples of such relationships include:

- Ballard Generation Systems, Tokyo Gas and EBARA Ballard signed a three year agreement to commercialize residential power units (Jan. 2002);
- Fuel Cell Technologies (FCT) entered into an agreement with Border States Electric Supply to promote and distribute FCT products in 15 of the United States (Feb. 2002);
- FuelCell Energy and Caterpillar announced plans to develop and sell fuel cell power generation products (April 2002);
- Hydrogenics and Dow Corning agreed to joint commercialization of a fuel cell manufacturing process (Aug. 2002).

Consolidation

A trend towards growth by consolidation is emerging in the industry as fuel cell companies become more vertically integrated. As companies drive towards commercialization, acquisitions are consistent with the continued focus on specific technologies. For example:

- Hydrogenics acquired EnKAT GmbH (April 2002);
- Ballard acquired 100% ownership of Ballard Generation Systems (Dec. 2002).

Shareholder Value

Across the companies surveyed, share prices tended to decline between 2001 and 2002. This is not surprising given the general state of capital markets in that same period.

Overall, the market capitalization of these companies fell by 70%. This compares with the following declines in stock market indices: S&P /TSX Composite Index down 14%; Dow Jones Industrial Average down 17%; the S&P 500 down 23%; and the NASDAQ Composite Index down 32%. Only one company, Astris Energi, went against this trend.

Market Capitalization (\$ thousands)				
		2002	2001	% Change
Ballard Power Systems	Cda	\$ 1,282,226	\$ 3,103,360	-59
FuelCell Energy	US	226,350	609,551	-63
Quantum ⁶	US	n/a	n/a	n/a
Hydrogenics	Cda	173,211	353,492	-51
Global Thermoelectric	Cda	44,009	132,023	-67
Plug Power	US	228,977	439,822	-48
Dynetek Industries	Cda	16,580	31,580	-47
Stuart Energy Systems	Cda	87,168	90,130	-3
Proton Energy Systems	US	100,353	274,135	-63
H Power	US	363,709	3,538,714	-90
Fuel Cell Technologies	Cda	13,034	14,468	-10
Medis Technologies	US	105,511	128,866	-18
Astris Energi	Cda	10,719	3,068	+249
Energy Visions	Cda	2,814	6,031	-53
Palcan Fuel Cells	Cda	2,838	38,875	-93
Snow Leopard	Cda	4,597	7,036	-35
Total North America		\$ 2,662,098	\$ 8,771,152	

Another interesting perspective is provided by the ratio of market capitalization to revenues; i.e. what \$1 of revenue means in terms of market capitalization. The broad range of results between 2001 and 2002 suggests that other factors, in addition to revenue, impact market capitalization.

Ratio of Market Capitalization at Year End to Revenue for the Year			
		2002	2001
Ballard Power Systems	Cda	14	86
FuelCell Energy	US	5	23
Quantum	US	n/a	n/a
Hydrogenics	Cda	11	48
Global Thermoelectric	Cda	3	13
Plug Power	US	19	77
Dynetek Industries	Cda	2	5
Stuart Energy Systems	Cda	17	14
Proton Energy Systems	US	21	92
H Power	US	141	971
Fuel Cell Technologies	Cda	18	33
Medis Technologies	US	550	n/a
Astris Energi	Cda	115	180
Energy Visions Inc.	Cda	56	43
Palcan Fuel Cells	Cda	n/a	n/a
Snow Leopard	Cda	n/a	n/a

6. Quantum has a year end of April 30, but was not a public company until July 23, 2003.

CASH FLOW

Cash flows for the companies surveyed were negative in 2002 compared to positive in 2001. A major factor in this change was the significant decline in cash flow from financing — from \$612 million in 2001 to \$159 million in 2002 — accompanied by an increase in the negative cash flow from operations — from \$200 million in 2001 to \$338 million in 2002. This is not sustainable in the long term. For 2002, the average cash burn rate (cash plus short term investments over operating cash flows) for these companies was 3.5 years. For six of the companies surveyed it was less than one year.

Cash Flow (\$ thousands)		
	2002	2001
Cash Flow from Operations	\$ (337,562)	\$ (199,990)
Cash Flow from Investing	\$ 57,330	\$ (196,192)
Cash Flow from Financing	\$ 158,687	\$ 611,905
Total Cash Flow	\$ (121,545)	\$ 215,723

SOURCES OF CAPITAL

In 2002 the money raised from the issuance of common shares for these companies dramatically decreased.

Fuel cell companies will require additional financing if they are to grow and move toward product commercialization. Most companies in the group went through their last round of financing by public offering in 2000-2001.

On their own, public capital markets may be insufficient to fund the sustained level of R&D spending required to achieve full-scale commercialization of fuel cell technology.

Private equity placements also featured prominently in the industry and are a major source of funding for these companies. In addition, some companies (Ballard and Plug Power) continue to receive funding from industry partners such as the top tier auto-makers (DaimlerChrysler, Ford, GM) which already own stakes in these organizations.

To date, there are relatively small amounts of long-term debt held by any company in the group.

During 2002, public companies and their private counterparts benefited from government programs and incentives promoting the development and commercialization of fuel cell technology. We expect this to continue.



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Looking Forward

Looking at the financial information available from public North American fuel cell companies for 2002 provides some interesting observations about the industry. We see a dramatic fall in their market capitalization and a paucity of financings consistent with capital market trends in general. More specific to the fuel cell sector, we see rapidly rising revenues and a continued focus on the development of intellectual property through high levels of research and development expenditures.

It is important, however, to note that the significant and positive trends that are beginning to shape the industry have yet to be reflected in the financial results. Over the next few years we expect to see the impact of:

- A strong commitment by governments in the key economies of Canada, Germany, Japan, the UK and USA to further the development of fuel cells;
- Continued participation in the sector by large multinational enterprises, either through strategic alliances, direct investment or joint development efforts;
- Consolidation of enterprises such as Hydrogenics acquiring Greenlight Power Technologies;
- Increased activity from specialist financiers such as Chrysalix and Conduit Ventures;
- An increased number of demonstration projects and fuel cell installations providing potential customers with awareness of fuel cells' capabilities across a wide spectrum of applications.

We also anticipate that the fuel cell industry will be positively impacted by the growing demand for alternative energy in general. This demand is driven by:

- Concern for energy security;
- Concern over climate change and air quality;
- Concern for backup power and system reliability;
- The potential for developing nations to "leapfrog" conventional technologies and move straight to newer technologies such as fuel cells.

While the immediate impact of these factors is uncertain, we expect these drivers to increase demand for fuel cells. Further, improved product performance and cost reduction will add to the competitiveness of fuel cells in the future. Whatever happens in the short term, we expect the development of fuel cell products and their markets to expand vigorously in the medium and longer term.

We hope that you find the 2003 Fuel Cell Industry Survey to be a valuable resource. PricewaterhouseCoopers supports the global fuel cell industry and welcomes thoughts and comments on our perspectives. If you have any comments, or would like to have your company included in the 2004 Global Fuel Cell Industry Survey, please contact one of our industry specialists.

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