

**White Paper Summary of Interviews with Stationary  
Fuel Cell Manufacturers**

**August 2002**

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## Executive Summary

This survey summarizes the input received from manufacturers of stationary fuel cells for power generation regarding:

- Their recent activity (2001 – 2002) and future ability to manufacture, sell and install fuel cells in California over the next three years
- Product characteristics and costs (including warranty and service contract options)
- Customer / market targets
- Barriers to commercialization in California
- Impact of the California Stationary Fuel Cell Collaborative

The 2002 Survey of stationary fuel cell manufacturers reveals that, with adequate government incentives and structures in place, a potential exists to install 50 – 250 MW of fuel cells in California over the next three years. This range in potential installations represents 5 – 25 percent of the manufacturers's expected global sales volume.

## 2001 vs. 2002 Industry Survey

This White Paper Summary represents the 2<sup>nd</sup> annual survey of manufacturers. It differs from the 2001 survey in that the current survey *does NOT assume a bulk purchase order* and consequently the numbers reflect today's actual market prices and volumes in the absence of such an instrument.

The current survey also acknowledges the following:

- The California Power Authority purchase funding is today directed solely to a low-interest loan program.
- Market barriers (e.g., restrictive incentive conditions, exit and standby fees, and challenging interconnect rules), while being addressed by the Collaborative, are not fully resolved and continue to inhibit the market.

In addition, the 2002 Survey reviews the performance of the Collaborative over the past year and solicits suggestions for the upcoming year in order to create a favorable environment for the rapid installation of stationary fuel cells in California.

## 1 Overview

Major stationary fuel cell manufacturers (including Proton Exchange Membrane, Phosphoric Acid, Solid Oxide and Molten Carbonate Fuel Cell manufacturers) were interviewed on August 14<sup>th</sup> – 19<sup>th</sup>, 2002 to determine the current and projected manufacturing capabilities, sales volumes, and costing for the installation of stationary fuel cell power plants in the state of California over the past year and the next three years.

The purpose of the interviews was to compile information relative to the commercial availability of fuel cells for power generation over the next few years and identify the issues the state could take in order to create a more receptive environment for their installation.

Prior to conducting the survey, a standardized list of questions was established (see Attachment 1 and sent to each of the companies the day prior to the interviews. Representatives from Ballard Generation Systems, FuelCell Energy, H Power Corporation, Plug Power, Inc., Siemens-Westinghouse Power Corporation, and UTC Fuel Cells were interviewed by two representatives each from the California Air Resources Board and the National Fuel Cell Research Center. The same representatives conducted the 2001 Survey.

The information obtained from the interviews is presented in summary in this document. Detailed information for each manufacturer is, by agreement, held in confidence. The detailed data are compiled to produce an aggregate, generic perspective of the industry as a whole. It is this perspective that is summarized herein for public dissemination.

## **2 Results**

Each of the manufacturers presented their expectations of: (1) sales for the year ending June 2002; (2) their manufacturing capability and sales projections for the next three years; (3) their projected product portfolio, price expectations and warranty/service contract offering; and (4) the applications targeted for their products based on their business plans. The information compiled and presented herein reflects a range of fuel cell product sizes, fuel cell product types, expected efficiencies, expected life of the fuel cell stack and associated equipment, manufacturing strategies, and cost expectations.

The manufacturers also identified barriers to market entry and market facilitation, incentive strategies, as well as opinions on the performance of the Collaborative over the past year and suggestions for the role of the Collaborative in the coming year. These results are also summarized in this document.

### **2.1 2002 Volumes**

As stated above, the prospect of a bulk purchase order provided a foundation last year (2001) on which industry was asked to make estimates in terms of volumes and pricing. Due to changes in market conditions and available financial instruments, that assumption was not used in the current (2002) survey.

## 2.2 Production Capabilities and Sales Potential of the Stationary Fuel Cell Industry

In the 2001 survey, the stationary fuel cell community was generally understood to have one commercial product (a 200 kW PAFC unit) manufactured by UTC Fuel Cells. In the past year, the market dynamic has substantially changed. Today, a number of companies are offering products for sale and, with them, warranties and service contracts.

While some manufacturers are cautious to increase manufacturing capacity without firm orders for products, others have added and continue to add capacity in an aggressive production strategy with confidence that orders will follow.

Depending on the manufacturer, the anticipated manufacturing capability ranges from 0.5 MW/yr to 50 MW/yr in 2002, to 1 MW/yr to 400 MW/yr by 2005 (see Figure 1). The manufacturers, particularly in their projections for years 2004 and 2005 have closely matched production volumes to sales volumes.

Sales projections (MW) for years 2003 – 2005 are weighted heavily by the larger systems (>100 kW), with a substantial increase in volume during the 2004 time frame (see Figure 1).

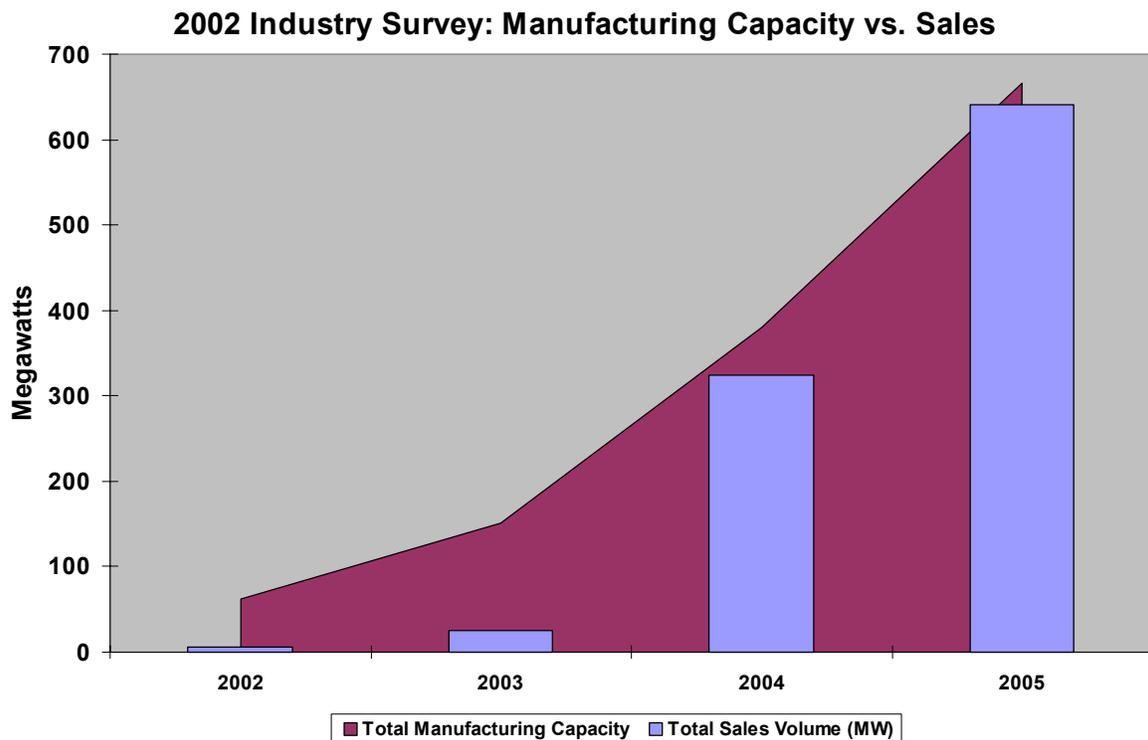


Figure 1

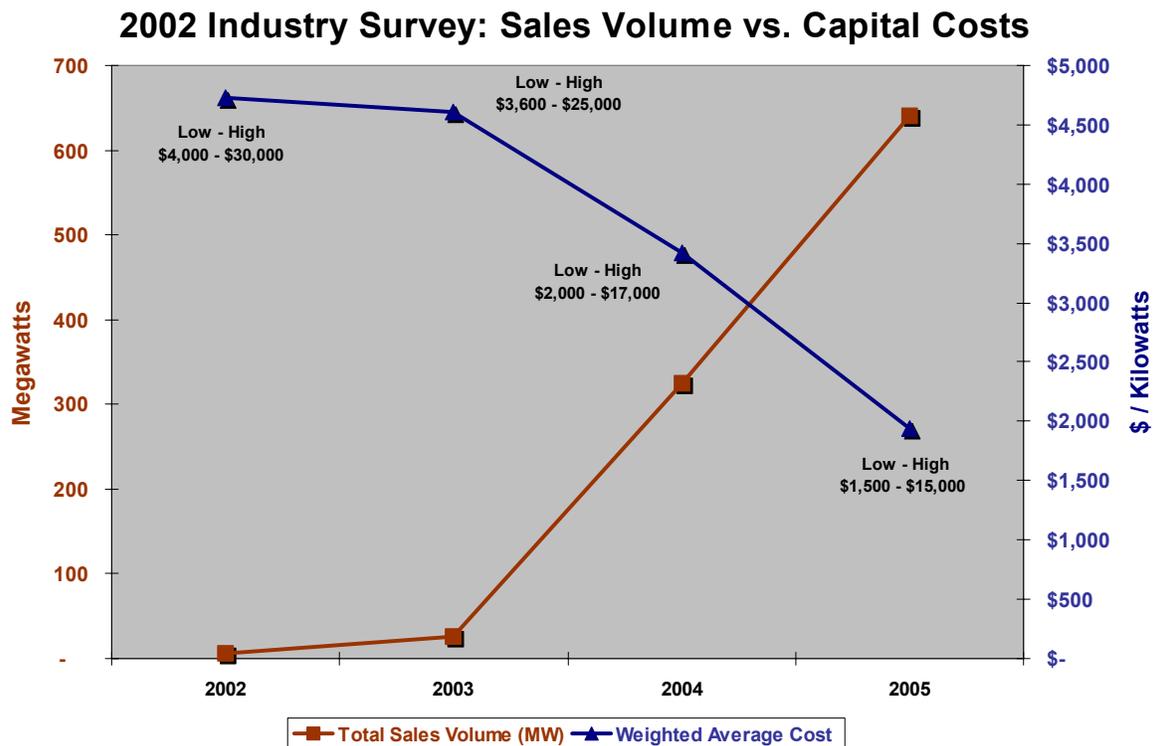
## 2.3 Capital Costs

The capital cost of fuel cell systems differs quite dramatically from the survey last year, as the “bulk purchase order” was not a premise for consideration. Consequently, the capital costs (\$/ kW) presented in this survey more closely reflect manufacturer’s actual costs and the market environment / tolerance in the absence of a bulk purchase agreement.

In 2002, prices range from \$4,000 - \$30,000 / kW, however, the weighted average cost is \$4,722 / kW. Stated another way, the bulk of the sales volume is in the \$4,500 range with a small volume at higher and lower levels.

Generally, the higher capital cost (\$30,000/kW) are attributable to product in the very early stages of commercialization, and the lower capital cost (\$4,000/kW) is associated with product that is proactively engaged in commercial deployment.

By 2004 – 2005, the majority of the manufacturers predict a significant reduction in capital costs, typically associated with an expectation of increased sales (see Figure 2).



Note: Weighted average cost =  $\frac{\text{Sum (Individual Company's MW sales volumes} \times \text{Individual Company's Projected Capital Cost)}}{\text{Total Sales MW Volume}}$

**Figure 2**

## **2.4 Warranties / Service Contracts**

It is common (although there are exceptions) that companies offer today a full one-year warranty on the system as part of their base purchase price. In one case this includes the potential replacement of the stack based on a performance guarantee.

The option for a customer to purchase a service contract is also typical, generally extending to 5 years. Stack replacement is sometimes included, as part of the service contract but is not typical. Of those companies who offer a service contract, the average cost per year is approximately \$200/kW.

Generally speaking, the warranty and service contract strategy is today less ambiguous on larger (>100 kW) systems.

## **2.5 Key Customers**

All participants in the survey have a notable focus and clearer characterization of target customers compared to last year. One commonality among the customer segmentation is an enhanced focus on high reliability and / or Combined Heat and Power (CHP) applications. While there are a couple of exceptions, base-load operation is a typical operating characteristic.

As to be expected, early market targets are comprised of early adopter customers such as government agencies and the state, local and federal levels as well as utilities and energy service companies (ESCOs) who are investing in order to understand, prepare for and utilize the technology.

Specific base-load markets that were identified include hospitals, universities, prisons, hotels, food and beverage industries and wastewater treatment plants using anaerobic digester gas. In these markets, manufacturers are targeting high heat recovery opportunities, high reliability distributed generation systems, as well as applications where a need for energy security exists.

Specific markets for smaller applications included premium power applications, rural and remote applications, residential power applications, backup power for telecommunication systems and cell towers and other premium power applications where the current cost of the systems is not a primary issue when compared, for example, to the loss of critical equipment and data.

## **2.6 California Plans**

Regarding sales volume, industry reaffirmed the importance that California could represent to this market. They estimated that California could capture less than 1 *and up to* 5 percent of sales between 2001 – 2003 with potential volume growing significantly after that – representing 20 – 50 percent.

No company expressed near-term plans for establishing manufacturing capability in California. However, several manufacturers have a presence in California through sales offices as well as through agreements and alliances with installers, service contractors and system integrators. There was interest in California-based assembly provided that a sufficient customer base evolves. For example, manufacturers indicated a desire to stage systems and provide balance of equipment at the project sites.

## **2.7 Barriers to Commercialization in California**

### **2.7.1 Incentives and Demonstration Funds**

Clearly, the number one barrier companies identified are the current high capital cost of fuel cell systems in the face of a lack of available funds to mitigate that situation (e.g. incentives, demonstration funds).

Various government agencies have incentive programs to mitigate the early high cost environment. However, particularly in California, it is still difficult to access those incentives, although that is recently changing. Consequently, one of the most significant actions recommended to the Collaborative was to facilitate the accessibility and applicability of incentive programs for fuel cell installations.

In regards to commercial funds, there was disappointment expressed at the status of fuel cell funds from the California Power Authority, although some felt low rate loans could be helpful to some of their customers. Several respondents stressed the importance of state-sponsored demonstrations and of state government agency commercial purchases to support the evolution of the California fuel cell market.

Several concerns were expressed with current incentive programs in California. For example, one manufacturer cited limitations of the current California Public Utilities Commission Self Generation Incentive Program. This manufacturer felt that the program tends to disadvantage cleaner power generation technologies by making less clean technologies even more affordable as they experience fewer barriers when seeking incentives.

Strong encouragement was voiced for the strengthening and focusing of demonstration programs with encouragement to the Collaborative to achieve success in this area including coordination amongst agencies. Demonstrations that focused on reliability, CHP, and Base Load performance were cited as particularly important examples.

Manufacturers cited several incentive programs in other states that appear to create a favorable atmosphere as well as have advantages for manufacturers. These programs include the New Jersey incentive program. Other progressive state programs cited were Michigan, New York, Connecticut, Massachusetts and Texas.

### **2.7.2 Standby fees / Exit Fees**

Respondents also pointed out the significant repercussions of excessive standby fees and exit fees, particularly in these early years. In particular, manufacturers cited the uncertainty in rates due to utility charges, such as standby fees and exit fees that have the potential to discourage and even eliminate distributed power generation in general. These fees are significant in terms of making the economics unfavorable for all distributed generation projects. Encouraging utilities to adopt standardized interconnection standards and reduce standby and exit fees was stressed.

Respondents also noted the conflicting message the California Public Utilities Commission (and the utilities serving as its agents) is sending to the marketplace. On one hand, the CPUC has been very supportive through their Self Generation Incentive Program (providing fuel cell incentive funds of \$2,500 - \$4,500 / kW) and on the other hand, was considering Exit Fees, or Cost Responsibility Surcharge as it is now known, that would dis-incentive such purchases.

### **2.7.3 Bureaucracy**

Concern was expressed that where funds were available for demonstration programs, buy downs or incentives, the administrative hurdles for securing the funds in a timely manner can be prohibitive.

In regards to the ease of commercializing stationary fuel cells in California, most respondents compared current programs and policies to those in New York, Connecticut, and New Jersey as well as Michigan and Texas.

## **2.8 Collaborative Report Card: 2001 - 2002**

While there were many suggestions for how to enhance the commercial environment in California, the Collaborative and its agency supporters were acknowledged for a number of efforts including raising the level of awareness of stationary fuel cells, particularly in California. Disappointment was particularly directed to the outcome of the RFB process. However, it was noted that the RFB from the California Power Authority acted to force industry to take a look at some critical issues such as warranties and service contracts, as well as distribution and servicing plans, that have been beneficial beyond their activities in California. The Collaborative was commended for its role in encouraging and drafting the RRB, and working to assure that the process was as effective as possible.

The point was also made that the Collaborative and the California Power Authority have become credible authorities to the industry and that organizations outside of industry are looking to them as such. This includes financial institutions and the

stock market. While this can be beneficial to the development of the industry, it also can have negative repercussions such as raising expectations that were not realized.

All in all, while concern was expressed as to the pace of development of the Collaborative, there is an appreciation of the complicated nature of the situation, the formidable progress made by the Collaborative, and high expectations for the coming year. The Collaborative was credited for substantially increasing awareness throughout the nation for fuel cell technology and the fragility of the early market, facilitating DGS initiatives, supporting the CPA process, and addressing proactively incentive restrictions. The Strategic Plan for the Collaborative, developed in recent months and currently undergoing review in final draft form, was supported as an effective and necessary instrument to achieve the mission established for the organization.

## **2.9 Conclusions**

Manufacturers have a positive outlook for the commercialization of fuel cells over the next three to five years. This outlook is based on anticipated improvements to their systems, projected reductions in system costs as well as the presence of adequate government programs including incentives. Overall, the manufacturers surveyed identified the potential to install 50 – 250 MW of fuel cells in California over the next three years. This figure represents 5 – 25 percent of their expected global sales volume. Specifically, the following conclusions can be reached:

1. California is an important market to manufacturers and there is a commitment to continuing to work with the Collaborative to further the commercialization of stationary fuel cells in California;
2. Of the manufacturers surveyed, the projected world-wide sales volume of stationary fuel cells will substantially increase over the next three years with anticipated sales exceeding 600 MW by the year 2005;
3. If projected sales volumes are achieved, the projected capital costs of these systems are expected to substantially decrease to as low as \$1,500 per kilowatt by the year 2005. Larger capital costs continue for manufacturers of smaller systems, particularly in premium power applications;
4. All participants in the survey had a notable focus and clearer characterization of target customers compared to last year with an enhanced emphasis on high reliability and/or Combined Heat and Power (CHP) applications;
5. While several market barriers have been removed, specific barriers to market entry and market facilitation continue to exist in California;
6. Incentive programs will assist in the commercialization of stationary fuel cells in California, but some programs are difficult to access and excessive standby fees and exit fees discourage the installation of clean distributed generation;

7. Manufacturers cited several incentive programs in other states that appear to create a favorable atmosphere as well as have advantages for manufacturers;
8. Based on market projections there is a potential for future California-based assembly such as staging systems and the purchase and installation of balance of plant equipment; and
9. The Collaborative and its agency supporters were acknowledged for a number of efforts including raising the level of awareness of stationary fuel cells, particularly in California.