

FUEL CELLS FOR SUPERMARKETS



Warren Leon and Alexei Ponomarov

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ABOUT THIS SERIES

This briefing paper is one of five papers on fuel cells and hydrogen technologies produced by Clean Energy States Alliance (CESA). These papers are part of a larger education and outreach initiative by CESA to inform and engage state policymakers about the benefits of fuel cells, their use in critical power applications, and model state policies to support them as well as information about hydrogen production and storage. The five briefing papers are:

- *Fuel Cell Technology: A Clean, Reliable Source of Stationary Power*
- *Stationary Fuel Cells and Critical Power Applications*
- *Advancing Stationary Fuel Cells through State Policies*
- *Hydrogen Production and Storage*
- *Fuel Cells for Supermarkets*

For further information on CESA's hydrogen and fuel cell activities, and to download the briefing papers, please visit www.cleanenergystates.org/projects/hydrogen-and-fuel-cells.

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Introduction

Supermarkets are turning out to be an important early market for stationary fuel cells. State clean energy agencies that are interested in helping to bring fuel cell technology into widespread use would be well-served by explicitly supporting fuel cells for supermarkets as a key market niche.

The Appeal of Fuel Cells for Supermarkets

In recent decades, supermarkets have grown larger and some have moved to 24-hour operation, 7 days a week. Stores have added large banks of freezers and refrigerated cases, as well as sections where prepared foods are cooked and kept warm. These changes have not only significantly increased the electrical, heating, and cooling loads of supermarkets, but have made them well-suited to take advantage of the electricity and heat provided by fuel cells.

Fuel cells provide a constant supply of electricity, which is just what these new supermarkets need. The heat produced by the fuel cells can be used for a variety of purposes, from heating water to running absorption chillers for cooling the stores. Using both outputs is key to the economics of a supermarket strategy for fuel cells, and also yields significant greenhouse gas emission reductions and other environmental benefits. The total efficiency of supermarkets' fuel cell systems can be quite high—often twice or more efficient as getting power from a central utility.

Because supermarket owners need to worry about the risk to the large inventory of cooled and frozen food during an interruption of power from the electric grid, they appreciate a fuel cell's ability to keep operating during a blackout. With a fuel cell, a supermarket can remain open at a time when the surrounding community is vulnerable and in need of supplies.

Recent trends in fuel cell financing have made them more business friendly. Manufacturers and system integrators increasingly offer lease arrangements that reduce the up-front cost of an installation. Longer initial warranties and the option of purchasing an extended warranty reduce the risk to the supermarket company.

Reasons for State Agencies to Target Supermarkets

Fuel cells clearly have appeal for supermarkets, but why might state agencies want to give special attention to supermarkets? Most importantly, to commercialize a

new technology, it makes sense to concentrate on a few niche markets where it can gain traction and become self-sustaining, rather than trying to spread the technology thinly over a small number of random installations in diverse settings.

The early installations among supermarket chains have created growing visibility for fuel cell technology within the industry. This is starting to stimulate other supermarket companies to want to learn about fuel cells and consider emulating the early adopters.

Beyond the essential starting point that fuel cells are a good match for the energy needs of supermarkets, there are other reasons why this is a promising niche:

- Supermarket chains own multiple stores. As in the cases of Price Chopper and Whole Foods Market described below, a company that climbs the steep learning curve for the first installation can then take what it has learned and apply it to additional installations in other stores. Each new installation becomes easier and better adapted to the specific needs of the company.
- Because of their many customers, supermarkets can educate large numbers of people about fuel cells through information panels and educational materials in those stores that have fuel cells.
- Supermarket chains can use fuel-cell-powered forklifts and other materials handling equipment at their distribution centers, as well as stationary fuel cells at their stores.

Grants and other incentives from state agencies have been essential to make the initial fuel cell installations possible. Such support will continue to be important in the coming years. Through it, states can help to advance a promising clean energy technology, while helping important local businesses.

The rest of this briefing paper describes a few of the early uses of fuel cells at supermarkets. In addition to these examples, other supermarket companies have used fuel cells, including Central Grocers, H.E. Butt Grocery Company, Safeway, Star Market, Stop & Shop, and Wal-Mart.

Albertsons Implements a Model Installation

A 50,000 square-foot Albertsons supermarket that opened in San Diego, California in 2010 is being powered by a PureCell 400-kilowatt fuel cell system from UTC Power. The



system was leased from UTC, reducing Albertsons' up-front costs and risks.

The fuel cell provides about 90% of the electricity that the store needs. Albertsons is also using almost all of the heat produced by the system for heating and cooling. In the case of a power outage, the fuel cell can generate enough energy on-site to power the building. Because of the use of the heat, the total efficiency of the system is about 60% (nearly twice as high as relying on the electric grid) and the store's annual carbon footprint is reduced by 478 metric tons of CO₂. In addition, the PureCell system is designed to operate in water-balance, saving millions of gallons of water annually when compared to traditional power generation.

Pete Pearson, Director of Sustainability and National Accounts for SuperValu, Albertsons' parent company, explains that the company weighed its energy options as part of the planning process for the new store. "At the very beginning of the project, we thought of implementing a system that would provide clean energy for our facility. We considered solar installations but a fuel cell seemed to be the perfect solution. We wanted to help the environment, reduce our carbon footprint, and gain operational efficiency. We performed a thorough engineering and financial analysis before proceeding with implementation. And now the system is in place and is working just fine and as expected."

Federal and state financial incentives were necessary to make the project financially feasible. Especially important was a grant from California's Self-Generation Incentive Program through San Diego Gas & Electric.

Albertsons also needed to learn about and give special attention to the interconnection process, especially because of the company's desire for the fuel cell to be available as

independent power during a electric grid power outage. "Particularities of the interconnection with the grid in San Diego area were unknown to us," comments Pearson. "But we communicated with San Diego Gas & Electric; they provided us with the requirements to safely disconnect from the grid."

As advice for other companies that may want to consider installing a fuel cell, Pearson points out that "you have to have adequate gas and electrical connections that could run in parallel with the fuel cell. Furthermore, fuel cells are not 'one size fits all'. You have to work closely with the vendor and the utility company and, of course, get the financial piece settled first." Because a fuel cell is still a relatively new technology, the company "has to make sure there is proper service and support provided from the vendor's side. We negotiated a clause with UTC to assure that we have availability of parts and service contractors in case of malfunction of the fuel cell. UTC Power has a remote control system which can track the operation of the fuel cell and dispatch service technicians within 24 hours to repair it."

It has been important to Albertsons to let shoppers know that the store is powered by the fuel cell. The store therefore features abundant signage about it and the company will highlight the fuel cell in the store's upcoming one-year anniversary celebration.

Price Chopper: One Fuel Cell Leads to Another

Price Chopper's experience shows how an initial successful fuel cell installation can lead to additional installations. The supermarket chain, which is based in Schenectady, New York and has 128 stores in six Northeast states, started by installing a fuel cell in its Colonie, New York store. It then moved on to install a fuel cell in its Glenville, New York location, and more recently installed a third system in Middletown, Connecticut.

Price Chopper started to investigate fuel cell projects because of concerns about the instability in electricity prices and the price spikes of 2007. Grants from the state of New York through the New York State Energy Research and Development Authority (NYSERDA) were essential to achieving an appropriate return on investment for the Colonie and Glenville projects. With grants of roughly \$800,000 for each project, the price of each fuel cell went down to between \$1 million and \$1.5 million. Significantly, Price Chopper's management projects a five-year payback period. "Without the grants, the projects would not have been approved," notes Benny Smith, Vice President of Facilities at Price Chopper.

The Colonie project was the first field-connected installation of UTC Power's new 400-kilowatt PureCell system. Price Chopper is leasing the fuel cell, which was installed in June 2009. It generates up to 70% of the store's



The fuel cell at an Albertsons supermarket in San Diego.



Price Chopper's first fuel cell installation in Colonie, New York.

required energy during the summer and the entire amount of electricity needed during the winter. The system also captures the heat produced by the fuel cell, which is used for hot water, refrigeration, air conditioning, snow melting, and floor heating.

A key benefit of the fuel cell is that it provides the store with an uninterrupted power supply. In case of a grid failure, the supermarket will continue to operate at full capacity independently of the electric grid.

Price Chopper is convinced that fuel cells are a perfect match for supermarkets. As Smith points out, "Supermarkets are a great facility to apply fuel cell technology because we are operating 24-7 year-round. It's not like an office building where you go home at five o'clock and the lights go off."

Wegmans Switches Forklifts

Supermarket chains' distribution centers run 24 hours a day, 7 days a week. In these large indoor spaces, battery-powered forklifts are usually used for materials handling, because they do not produce any emissions. But battery-powered systems also have disadvantages and fuel cell technology has recently been proving itself to be a sound, practical alternative.

For one thing, battery charging, with up to three battery changes a day, can disrupt work flow, whereas fuel cell refueling proceeds quickly. In addition, fuel cells ensure constant power delivery and performance. As Jennifer Gangi of Fuel Cells 2000 notes, they avoid "the reduction in voltage output that occurs as batteries discharge and the numerous interruptions in current input and output electric forklifts experience due to the frequent starting and stopping during use."¹

In March 2010, Wegmans, a supermarket company with stores in six eastern states, purchased nine hydrogen-powered forklifts for its Retail Service Center at Highridge Business Park in Pottsville, Pennsylvania. The forklifts were manufactured by Plug Power, one of several suppliers of fuel-cell materials-handling equipment. A \$1 million grant from the Pennsylvania Energy Development Authority helped make the project possible.

The employees at Wegmans were not only trained on how to operate the new forklifts, but were also educated about hydrogen and fuel cells, as well as the financial and environmental reasons for adopting the new technology.

"The new equipment with the fuel cells was a huge hit," said David J. Allar, the Maintenance Manager at the Wegmans Center. "Employees are highly satisfied with

¹ Jennifer Gangi, "Fuel Cell-Powered Forklifts: Raising the Bar," Industrial Utility Vehicle & Mobile Equipment Magazine (May-June 2008). Available at http://www.iuvmag.com/articles/2008_05-05.html



the new forklifts. They don't need to wait for the battery to be charged or changed any more. Operators can refill the fuel cells with hydrogen at their convenience. Refueling takes several minutes and lasts for about two shifts." With the use of the fuel cells, Wegmans was able to avoid the addition of 60 lead-acid batteries, changing equipment, and more staff to maintain and change the batteries. Moreover, Wegmans determined that implementing forklifts with fuel cells in just the produce area of the Retail Service Center reduced the company's carbon emissions by an amount equivalent to removing 134 cars from the road.

Another important benefit of the hydrogen-powered forklifts is that, once installed, they do not require any special charging space. Rooms that were previously used to recharge the lead-acid batteries can now be used as additional space for product storage. According to Allar, just gaining this extra space was a large enough financial advantage to the company to almost pay for the fuel cells.



One of the fuel-cell-powered forklifts being used at the Wegmans Retail Service Center.

"The fuel cells have performed far beyond our expectations," concludes Allar. "There was nothing that interrupted our operations in the least and the employees' reception of the new technology was incredible."

It is unsurprising that Wegmans has added to its fuel cell fleet and currently has 37 forklifts in operation. The company is now looking to expand its use of fuel cells to yard tractors and refrigerated trailers at the Retail Service Center.

Whole Foods Thinks Holistically

Whole Foods is serious about "whole energy" as well. The company takes a systematic, holistic approach that seeks to reduce energy use at all stages in a store's life-cycle, from store design and construction through engineering, procurement, relationships with suppliers, and maintenance. As part of the search for the best energy solutions, the company has experimented with fuel cells and installed them in four stores in California, Connecticut, and Massachusetts.

In San Jose, California, a UTC 400-kilowatt PureCell system installed in 2010 is generating more than 90% of the store's needs. The heat produced by the fuel cell is being used for heating and cooling, as well as for refrigeration of the produce in the store. Because the system takes advantage of both the electricity and heat generated by the fuel cell, it is approximately 60 percent efficient. Whole Foods Market estimates that the installation reduces its carbon footprint by 370 metric tons of carbon dioxide each year. The California Energy Commission provided valuable support to make the installation possible.

Two stores in Connecticut have been equipped with UTC Power fuel cells. In Fairfield, another 400 kilowatt UTC Power fuel cell has been installed. The project received a grant of \$731,291 from the Connecticut Clean Energy Fund as part of that agency's On-Site Renewable Distributed Generation Program.

A 46,000-sq-foot-store in Glastonbury, Connecticut was Whole Foods Market's first fuel cell installation in 2008 and the first supermarket in the world to get most of its energy from a fuel cell. Like the other three installations, this one is configured to operate independently of the electric grid if necessary. A 200-kilowatt UTC Power fuel cell is able to provide enough energy for the store to operate without interruption in case of a grid failure. The system provides half of the store's electricity needs and all of the required hot water.

A fuel cell has also been put in place in Dedham, Massachusetts with help from a grant from the Massachusetts Renewable Energy Trust. The 400-kilowatt fuel cell generates most of the electricity for the store. "With the combined power generated from our fuel cell and solar panels, the Dedham store is essentially able to generate



The fuel cell at Whole Foods Market's store in Fairfield, Connecticut.

almost 100 percent of its power needs onsite with clean energy resources," observes Kathy Loftus, Global Leader of Sustainable Engineering, Maintenance and Energy for Whole Foods Market. The clean energy systems help the company reduce its carbon footprint by 764 metric tons of CO₂ per year.

Whole Foods Market has also started to use fuel-cell-powered forklifts. Sixty-one forklifts are in operation at a distribution center in Landover, Maryland. Although the company had been aware of the labor-saving virtues of fuel-cell-powered forklifts, the equipment was not

affordable until Genco Supply Chain Solutions received a \$6.1 million award from the US Department of Energy through the American Recovery and Reinvestment Act. Now, by introducing the new forklifts, Whole Foods has reduced the 4,000 hours in labor time that it took annually to recharge the batteries of the previous forklifts to only 250 hours.

But the company is not stopping there. As Loftus notes, "Whole Foods also hopes to retrofit one or two sites with 100-kilowatt, solid-oxide fuel cells from Bloom Energy of Sunnyvale, California, in the near future."



Clean Energy States Alliance (CESA) is a national nonprofit coalition of state clean energy funds and programs working together to develop and promote clean energy technologies and markets. CESA provides information sharing, technical assistance services and a collaborative network for its members by coordinating multi-state efforts, leveraging funding for projects and research, and assisting members with program development and evaluation.

Many states across the U.S. have established public benefit funds to support the deployment and commercialization of clean energy technologies. More than twenty states are actively participating in CESA membership activities. Through these clean energy funds, states are investing hundreds of millions of public dollars each year to stimulate the technology innovation process, moving wind, solar, biomass, and hydrogen technologies out of the laboratory and toward wider use and application in business, residential, agricultural, community and industrial settings. State clean energy funds are pioneering new investment models and demonstrating leadership to create practical clean energy solutions for the 21st century.

www.cleanenergystates.org



Clean Energy States Alliance

50 State Street, Suite 1
Montpelier, VT 05602
Phone 802.223.2554
Fax 802.223.4967
Email cesa@cleanegroup.org
Web www.cleanenergystates.org

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