

Energy Solutions

for Commercial Buildings

Gassing up ... with Natural Gas

Natural gas makes economic and environmental sense over other fuels



Walmart is leading the way in driving on-site, fuel cell technology



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'EZ', affordable energy

Do-it-yourself audit tool allows multifamily property owners to identify energy savings.

By **Tonya McMurray**

Sunset Park Apartments, a 13-story, 238-unit senior housing property in Denver, Colorado, was a prime

candidate for energy retrofits.

Built in 1971, almost all of the housing complex's mechanical systems dated back to the original construction. So in November 2014, the facility's managers, Volunteers of America (VOA), turned to Stewards for Affordable Housing for the Future (SAHF) to evaluate Sunset Park's systems using the EZ Retrofit audit tool.

Developed by SAHF in June 2014, EZ Retrofit is a free, do-it-yourself, Excel-based audit tool that helps multifamily property owners and managers identify cost-effective energy and water efficiency upgrades. SAHF created the tool with contractors ICF International and Bright Power Inc. under a grant from the U.S. Department of Housing and Urban Development's Energy Innovation Fund.

The VOA team entered detailed data on the building's characteristics and systems into the EZ Retrofit tool. The team, using the EZ Retrofit tool, then assessed energy and water savings potential for the building based on a comparison with similar buildings. Based on the analysis, the EZ Retrofit tool identified significant retrofit needs for the building's heat and hot water systems. EZ Retrofit provided estimates of consumption, installation costs and payback periods as well as projected life cycle for each recommended improvement.

VOA worked with SAHF and the local nonprofit Energy Outreach Colorado to identify incentives that would support retrofits to boilers, refrigerators and light-



Volunteers of America used the EZ Retrofit audit tool to cut energy costs 22 percent over the past year.

ing for the Sunset Park Apartments. The new, high-efficiency boilers require less maintenance, thereby minimizing service interruptions and lowering operating costs. Savings from the boiler and lighting improvements allowed investments in other energy and water efficiency measures.

Upgrades have reduced energy use and operating costs while improving tenant comfort. The housing complex has seen a 20 percent energy reduction along with 22 percent cost savings over the past year.

Goodbye fees, hello EZ Retrofit

The EZ Retrofit tool grew out of SAHF's experience ordering audits to support mid-cycle, loan-financed retrofits for its members.

"In some cases, the cost of the audits proved to be a high portion of the overall project costs," said Ruchi Shah, energy program associate for SAHF. "The types of measures ultimately recommended by the expensive audits were typically those that seemed well-suited to simpler

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Case Study: Charter Foods takes tankless journey with Rinnai

Replacing traditional tank water heaters with Rinnai Tankless Wall-Hanging Rack Systems and Rinnai Tankless Water Heaters saves facility owners space, time, energy and labor costs.

As a company that owns and operates more than 100 Quick Serve restaurants across the country, Charter

Foods knows the importance of efficient service at great value.

Bob Jenkins, owner of Charter Foods, began Charter Foods' tankless journey with a visit to Rinnai's assembly facility at its headquarters in Peachtree City, Georgia. Together, Charter Foods and Rinnai Corp. addressed the company's needs for tank-

less units that will save space in its Taco Bell new construction and remodel projects where square footage is minimal. In response, Rinnai recommended its state-of-the-art, commercial Tankless Wall-Hanging Rack (TRW) systems, pre-assembled racks with multiple Rinnai Tankless Water Heaters. Charter Foods reaped the space-saving benefits of this complete and fully modular tankless solution, plus the added benefits from the TRW's easy installation, energy efficiency and lower utility costs.

THE RINNAI ADVANTAGE

- Endless supply of hot water
- Built-in redundancy – never experience downtime during peak business hours
- Ability to service without system shutdowns
- Save money – installation, maintenance and operational cost savings
- Save space – no tanks needed
- Green – lower carbon dioxide emissions

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PHOTO COURTESY OF RINNAI



Rinnai's tankless water heaters, with Tankless Wall-Hanging Rack System, provides Charter Foods' restaurants — including its Taco Bells — a nearly 40 percent reduction in gas consumption on each store's energy bill.

PHOTO COURTESY OF RINNAI



Rinnai's wall-hung tankless racks provided Charter Foods' restaurants with more and easier access for cleaning.

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Space savings and operational redundancy

A significant benefit of Rinnai's wall-hung tankless racks is space savings. Charter Foods' restaurants have sites with limited space. When the large traditional tanks were replaced with the Tankless Rack System™ wall hung models, it created an open space, and could even eliminate the need for a mechanical room where large storage tanks typically sit. As a result, the area now has easier access for cleaning.

"Having these tankless rack systems on the wall and off the floors allows the crews to keep the floors and corners cleaner and more organized," said Bob

Rave, new projects/facilities manager, Charter Foods. "It helps improve the culture of housekeeping within the team and restaurant where housekeeping and cleanliness is our top priority."

In addition, having two redundant tankless units in the store provides the restaurant owner peace of mind in the

event that one stops working because the second keeps the store operational while maintenance is performed.

Quick installation saves time and labor costs

The Rinnai Tankless Rack Systems shipped fully assembled with two tankless water heaters already connected to each other and arrived at Taco Bell locations ready for installation. The installers experienced less time on-site for the job, as placing a TRW with multiple units takes 40 percent less time than installing individual water heaters one unit at a time. The key is the TRW's specifically engineered and patent-pending wall hanging bracket that makes it easy for installers to place the system, reducing the labor needed on the installation. "We love how easy the rack systems install," Rave said.

Lower energy consumption = lower overhead

A nearly 40 percent reduction in gas consumption translated into big savings on each store's energy bills — a perk that any business owner can appreciate. Because tankless water heaters only heat water when it's needed; they don't consume energy during off hours, store closures and slow periods.

With Rinnai TRW02IN Tankless Rack Systems, each of the company's restaurants will experience the Rinnai tankless technology, featuring heat exchangers that provide hot water at the moment it's needed with 399K BTU maximum efficiency.

To date, Charter Foods has taken delivery of 30 rack systems and has installed four that are functioning perfectly. An additional 17 systems are planned to be installed in 2016. ▀

THE RINNAI ADVANTAGE FOR TANKLESS RACK SYSTEMS

- Endless supply of hot water delivered up to 9.8 GPM per unit
- Digital temperature displays provide error codes and other diagnostics for easy maintenance
- 96 percent thermal efficiency
- Commercial ENERGY STAR®-certified
- Indoor/outdoor, wall/floor mount installations
- Multiple venting options (PVC, Concentric)
- Available factory-direct preventive maintenance

WHEN COMMERCIAL CUSTOMERS NEED RELIABLE HOT WATER, RINNAI PRODUCTS KEEP IT COMING.



Rinnai Commercial Water Heating Solutions deliver performance and efficiency to suit even your most demanding commercial applications – from restaurants and hotels to multifamily residences, schools and more.

C199 Commercial Condensing Tankless Water Heater

The C199 Commercial Condensing Tankless Water Heater helps customers maintain business operations and peace of mind by supplying an endless supply of hot water. Commercial ENERGY STAR® certified C199 models feature a heat exchanger designed for the demands of a wide range of businesses, while delivering 199,000 BTU with 96% Thermal Efficiency. Protected with a 6-year warranty, the C199 also provides new venting options that streamline installations.

Demand Duo™ Commercial Hybrid System

Built with the C199, the Demand Duo™ Commercial Hybrid System provides hot water performance for peak needs, with a supply that goes the distance. Combining the on-demand, continuous delivery of the C199 Commercial Condensing Tankless Water Heater with an energy-efficient 119-gallon tank, the Demand Duo™ is perfect for emergency replacement.

Tankless Rack System and Tankless Wall-Hanging Rack

A complete and fully modular solution pre-assembled with multiple C199 Rinnai Tankless Water Heaters, the Tankless Rack System (TRS) and Tankless Wall-Hanging Rack (TRW) replace tank-style water heaters with one simple, energy efficient solution.

When demands are greatest, Rinnai delivers – with innovative products for your commercial customers and round-the-clock support for you.

For more information on Commercial Water Heating Solutions, Maintenance Services and a free sizing consultation by Rinnai Applications Engineers, call 866-383-0707 or visit rinnai.us/commercial.

Rinnai

Controlling the temperature

Natural gas systems rival ground source heat pumps for energy efficiency.

By *Tonya McMurray*

Heating and cooling account for 46 percent of all energy consumed in U.S. buildings, according

to the U.S. Department of Energy's Oak Ridge National Laboratory. So finding an economical, energy-efficient heating and cooling system can have a major impact on the bottom line for businesses and organizations.

Many environmentalists tout ground source heat pumps – sometimes called geothermal heat pumps – as an energy-efficient technology for heating and cooling systems. The International Ground Source Heat Pump Association (IGSHPA) estimates that ground source heat pumps can save 25 to 50 percent on energy costs, noting that both the Department of Energy (DOE) and the Environmental Protection Agency have endorsed the technology.

But ground source heat pumps are an expensive energy solution that don't necessarily provide the best energy cost savings, argues William Ryan, clinical associate professor and director of the master's energy engineering program at the University of Illinois at Chicago.

In fact, Ryan said, there is currently

little difference in the operating cost of ground source heat pumps and more conventional boilers and furnaces powered by natural gas.

Conventional boilers and furnaces burn fuel and pipe the resulting heat throughout the building. Ground source heat pumps, on the other hand, circulate liquid from below the ground and carry it into the building where it is heated and distributed to small heat pumps in each room of the building. In summer, the piping system can draw excess heat from the building to be absorbed back into the earth.

While air temperatures can vary significantly depending on geography, the ground temperature remains relatively constant with temperatures six feet underground ranging from 45 degrees to 75 degrees Fahrenheit, according to California's Consumer Energy Center. This constant temperature allows the ground source heat pump to be more efficient than conventional air source electric heat pumps at generating building heat in colder climates.

That added efficiency proved particularly interesting in 2006 and 2007 when natural gas prices spiked and companies

began looking for more efficient heating alternatives, Ryan said.

But then, "another technology changed the picture," he said. "At the same time [natural gas prices rose], wholesale gas prices went up also, and that justified fracking."

Domestic supply

Hydraulic fracturing, or fracking, is a process in which water, sand and other chemicals are injected deep underground at high pressures to fracture rock formations. Fracking is one of the technologies that has dramatically expanded North American natural gas production, bringing more natural gas to market.

Because of these new technologies, along with the discovery of large shale gas reserves, natural gas prices have declined since 2007, and it is currently one of the cheapest fuel sources available.

More than 90 percent of all natural gas used in the United States is produced domestically, and much of what is imported into the U.S. comes from Canada. In fact, nearly all gas used domestically is produced in North America.

Because most natural gas is produced within North America, it creates a

GROUND SOURCE HEAT PUMPS VS. CONVENTIONAL, NATURAL GAS-POWERED BOILERS AND FURNACES: KEY TAKEAWAYS

- There is little difference in the operating costs of ground source heat pumps and more conventional boilers and furnaces powered by natural gas.
- Natural gas is efficient, reliable, and the long-range price is relatively stable.
- Many who tout the economic benefits of ground source heat pumps don't take into account the environmental impact of the electricity used to power them. When Environmental Protection Agency source energy and carbon emissions multipliers are factored into the equation, ground source heat pumps and natural gas boilers are in the same range for source energy use and greenhouse gas emissions.
- Initial installation costs for ground source heat pumps are high, and payback periods vary widely based on climate. In all but the coldest climates, the payback period is long with minimal annual operational savings in energy costs.
- The best option for future energy efficient elementary schools is a gas boiler and central chiller system.

reliable supply, which, in turn, contributes to stable pricing.

To make ground source heat pumps more competitive in the marketplace, many state and local governments have offered significant subsidies to offset the high, upfront cost of developing such systems.

Those subsidies are based on the premise that ground source heat pumps are a more environmentally friendly solution. IGSHPA and other proponents of ground source heat pumps note that the technology relies primarily on solar energy captured and stored in the ground, thus, minimizing environmental impact.

But Ryan said that rationale for subsidies “is based on questionable logic.” He notes many who tout the environmental benefit of ground source heat pumps don’t take into account the environmental impact of the electricity used to power them. And, since one-third of U.S. electricity is still generated using coal, there

can be a significant environmental impact from electricity generation.

“People think because there’s no on-site exhaust pipe, there is no environmental impact, but there’s an exhaust pipe elsewhere that shouldn’t be ignored,” Ryan said. When EPA source energy and carbon emission multipliers are factored into the equation, ground source heat pumps and natural gas boilers are in the same range for source energy use and greenhouse gas emissions.

Back to school

Ground source heat pumps have been marketed extensively to schools, which may not significantly benefit from the technology, Ryan said.

Ryan and Marek Czachorski, founder of MC Scientific Group Inc., conducted a study that modeled energy use in a typical elementary school building with different heating and cooling systems. The researchers compared energy efficiency

and overall cost across 16 different U.S. weather zones.

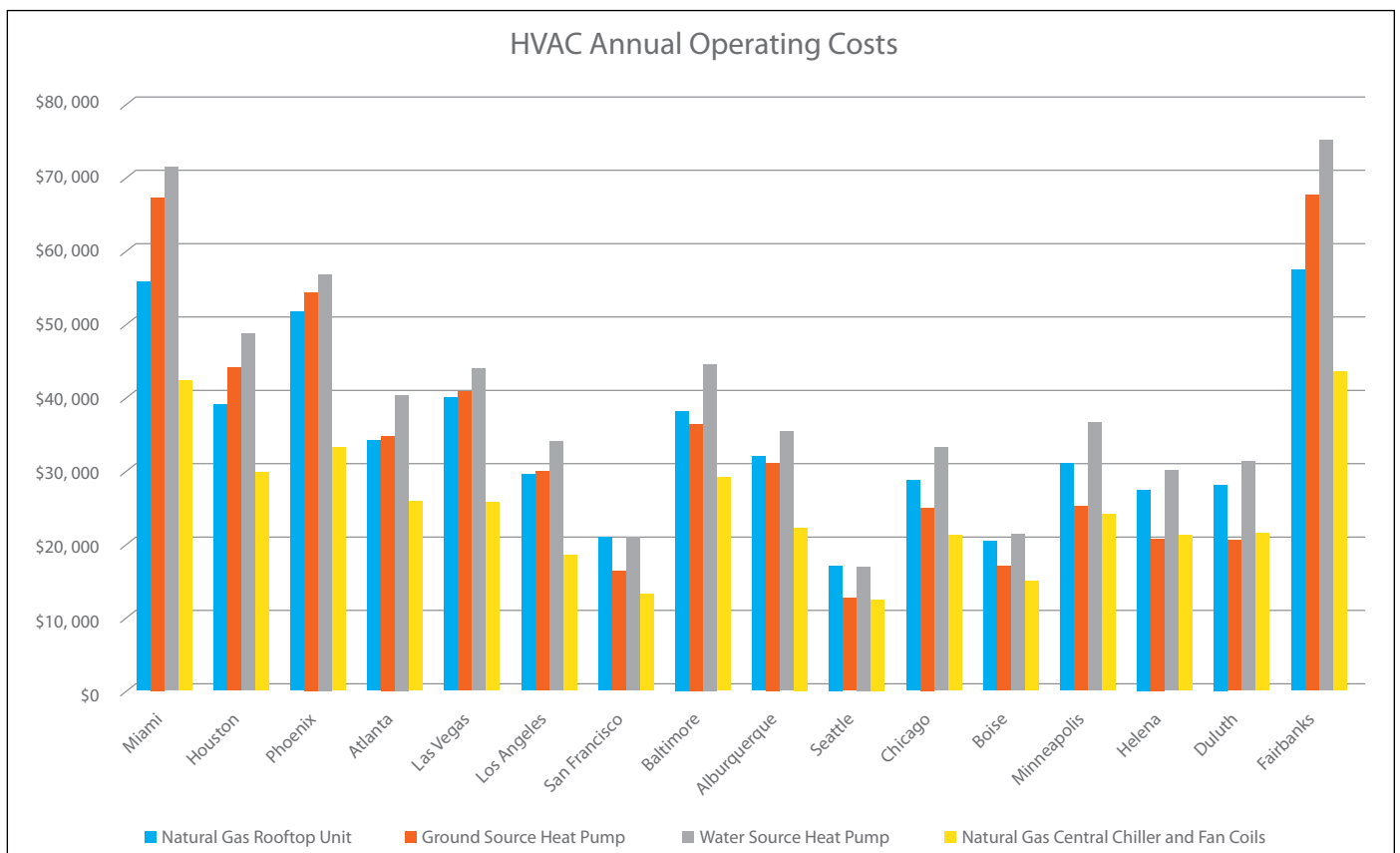
The study compared rooftop units, a ground source heat pump system, a water source heat pump system, and a central heating and cooling system with fan coil units. Both the rooftop units and the central heating and cooling system were fueled with natural gas. (See chart).

Initial installation costs for ground source heat pumps are high, and the study found that the payback period varied widely based on climate. However, in all but the coldest climates, the payback period was long, with minimal annual operational savings in energy costs.

The study was completed two years ago, and its results are more valid today, Ryan said.

“The only change between now and then is that natural gas has gotten less expensive, so the payback periods are even longer,” he said. “If electricity had

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SOURCE: THE ECONOMICS OF DIFFERING HEATING AND COOLING SYSTEMS IN ELEMENTARY SCHOOL BUILDINGS

Ground Source Heat Pumps vs. Natural Gas-fueled Boilers and Furnaces

Gassing up . . . with CNG

The industry is tapping a variety of options to ramp up refueling infrastructure.

By Drew Robb

Natural gas has been used successfully as a transportation fuel around the world for decades. Due to its increasingly favorable economic and environmental benefits, natural gas continues to gain traction in the United States. With compressed natural gas (CNG) offering a lower price per gallon than gasoline and diesel gallon equivalent (DGE) across the country, it's no surprise that more and more fleets are turning to CNG – and employing several options to build infrastructure.

“Natural gas prices are staying low, and its appeal as a fuel for ground vehicles is increasing,” said Sam Abuelsamid, a research analyst at Navigant Research. “As fuel economy and greenhouse gas emissions standards become increasingly stringent in world markets, particularly for medium and heavy duty vehicles, natural gas is becoming an attractive alternative to diesel.”

This is leading to the establishment of a coast-to-coast CNG refueling infrastructure. According to Navigant, the total number of natural gas refueling

stations globally is expected to grow from 23,001 in 2015 to about 39,300 by 2026. In the U.S., Navigant said there are currently about 1,643 CNG stations, and it is projecting about 1,941 CNG stations by 2026, a combined annual growth rate of 1.7 percent.

Public: access without hassles

Take American Natural Gas LLC (ANG), a company that designs, builds and operates CNG stations in Arkansas, Indiana, Kentucky, New York, Pennsylvania, Tennessee and Vermont.

PHOTO COURTESY OF TRYIT CORP.



Tryit Corp., an Anheuser-Busch distributor, hosts its own compressed natural gas (CNG) stations.

PHOTO COURTESY OF NATIONAL FUEL

More and more fleets of commercial vehicles are converting from gasoline to CNG.



Drew West, founder and CEO of ANG, said his company typically seeks out an anchor tenant for a public CNG station. ANG then searches for the best location for a public station, whether at a major junction, near a large grouping of fleet-based businesses or on the customer's property.

"Customers want a good price per gallon for CNG and don't want to deal with the construction, permitting, taxation, insurance and supply hassles of establishing and operating a station," West said.

West estimated savings of about 75 cents to \$2 per gallon compared to diesel, depending on the state.

"CNG is the fuel of the future," he said. "Look to partner with companies that understand the mechanics of establishing and running a station."

On-site station: going it alone

Don't tell that to Barry Carr. The director of business development at Landi Renzo USA and head of Clean Communities of Central New York (CCCNY), an organization that works with organizations to reduce petroleum use in transportation, is a firm advocate of building your own station.

"The biggest advantage is that you have complete control when developing your own site," Carr said.

As a rule of thumb, he said, at a minimum, a fleet user would want to be using at least 5,000 gallons monthly for a refueling station to make sense.

An example of this in western New York is Trypt Corp., an Anheuser-Busch Cos. Inc. distributor that hosts its own station. To make the economics work, it is open to other fleets, both public and private, as a means of boosting revenue. Incentives and taxpayer funding are also available. Public stations, said Carr, have the advantage of being able to access taxpayer funding, which is sometimes a pre-requisite to building a station.

Consortium: sharing the profits

Yet another alternative to building a public/private CNG station involves a group of businesses forming a consortium. The City of Lemoore in California's San Joaquin Valley, for example, partnered with four school districts and a local business to construct a public CNG fueling station. The initial driver of the project was local cheese processor Leprino Foods Co. When Leprino expanded one of its plants, it fell afoul of pollution restrictions due to increased milk truck traffic. The company approached the City of Lemoore and four school districts also got involved. Leprino put up a large amount of the funds and one of the school districts provided the land. The city secured a grant for the remaining funding.

The station is a combination of time-fill for partnership vehicles and fast-fill for public vehicles. Between the city and districts, almost 12,000 gallons equivalent of CNG were dispensed within six months of opening, with another 3,500 gallons to other users of the station. The station partner organizations are more than happy with the economics of CNG. They are paying on average about \$2.00 per gallon equivalent including the cost of the gas, electricity, monthly maintenance, and contributions to a maintenance set-aside fund. This compares well

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Opening day at a new CNG station in New Jersey



PHOTO COURTESY OF NEW JERSEY NATURAL GAS

PHOTO COURTESY OF TRYIT CORP.

To make the economics work, Tryit stations are open to other fleets, both public and private, as a means of boosting revenue.



PHOTO COURTESY OF NEW JERSEY NATURAL GAS



Refueling at a CNG station is much the same as putting gas in a car.

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to the average cost of diesel of \$4.09 per gallon for the same time period. This added up to more than \$25,000 in savings in the first six months of operation.

Nexus Natural Gas LLC in Tonawanda, New York, is another example of a successful consortium. A time-fill station costs about \$300,000, and a small fast-fill station is about \$500,000, said Chris Guard, president of waste hauling company Guard Contracting and president of the Nexus consortium.

"These economics make it impossible for a company with less than 15 trucks to recover their investment in a reasonable timeframe," Guard said.

His solution was to reach out locally to form a consortium of seven businesses: Triad Recycling and Energy, Guard Contracting Corp., Speed Global Services, Niagara Metals, The Pariso Companies, O&K Truck Repairs and Swift River Associates. A location was found that was easily accessible to all members so their combined 150 trucks could benefit from low-cost CNG. Nexus also partnered

with Clean Communities of Western New York, Cobey Energy and National Fuel, while securing a grant from the New York Power Authority (NYPA) to help fund construction. In addition, the project received funding from National Fuel's NGV Pilot Program, which provides a one-time cost buydown of a CNG refueling station facility installation and/or purchase of natural gas vehicles.

"We equally share the costs and the profits," Guard said. "We have a set price that the partner companies pay per gallon, which is below market price. The trucking companies that are part of the consortium committed to consume enough gas so we could reach the breakeven point within two years."

He said that CNG prices per gallon are more than \$.50 a gallon cheaper than diesel in New York. But that is not the only advantage. He cited lower emissions, the business advantage of using cleaner fuel and quieter trucks, and the lack of price volatility that natural gas offers.

"We know that the price of natural gas will stay stable for years to come," Guard said. ▸

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gotten cheaper, then it might make more economic sense, but that hasn't happened."

Chris McGill, vice president of industry analysis and standards for the American Gas Association, said changes in price and marketing conditions have made natural gas a more viable alternative for many businesses, and that is not expected to change over the next few years.

"In the next 10 years, we have enough gas for any plausible demand scenario," McGill said. "And that's taking into account increased demand, even including trans-

portation. Given the current supply and the technology we have, a \$4 to \$6 gas price in the short- to mid-term is reasonable."

One benefit often touted for ground source heat pumps is the ability to heat one room while simultaneously cooling another. However, Ryan said, schools seldom need this. In schools, most rooms have exterior exposure, so heating and cooling needs are typically consistent throughout the building.

The study concludes that, in general, the best option for future energy efficient elementary schools is a gas boiler and

central chiller system.

Building managers should carefully evaluate options when looking at heating and cooling systems, Ryan noted. He recommends closely examining claims of price or energy savings to see if they really add up when accounting for initial installation fees, energy costs and maintenance.

"It's important to look at true economic viability," he said. "There are many ways to get high efficiency heating and cooling with more straightforward operating costs [than ground source heat pumps]." ▶

(continued from page 2)

savings calculations and not those that require more advanced engineering."

The high cost of the audits was a significant barrier for many property owners and managers. The EZ Retrofit tool allows property owners and managers to perform the analysis on their own without huge fees.

"EZ Retrofit was designed particularly for small to medium-sized multifamily prop-

erties that are a little too big for programs or services focused on single-family homes and a little too small for programs or services that focus on larger multifamily and commercial properties," Shah said.

During its initial rollout period, the tool was used by 39 properties to evaluate 4,645 units and led to the retrofit of 1,802 units, Shah said.

To download the EZ Retrofit tool, go to <http://www.sahfnet.org/ezretrofit.html>. ▶

EZ RETROFIT: KEY TAKEAWAYS

EZ Retrofit is a free, do-it-yourself audit tool that gives multifamily property owners and managers an easy way to identify cost-effective energy and water efficiency upgrades that can help:

- Reduce energy and water consumption and costs
- Improve indoor air quality and tenant comfort
- Attract and retain tenants
- Increase property efficiency
- Reduce maintenance and extend equipment life



PHOTO COURTESY OF STEWARDS FOR AFFORDABLE HOUSING FOR THE FUTURE

EZ Retrofit takes a whole-building approach to energy and water efficiency.

The power of fuel cells

Walmart is leading the way in driving on-site, fuel cell technology strategy.

By Drew Robb

What do companies like Walmart, eBay, Home Depot and IKEA have in common? They have all

adopted fuel cells to power their facilities, slash electricity bills, increase resiliency and reduce their carbon footprint.

“Fuel cell technology provides on-site, 24x7 power that is reliable, clean and cost effective,” said Asim Hussain, vice president of marketing and customer experience, Bloom Energy, a provider of fuel cell systems.

Fuel cells are devices that generate electricity through an electro-chemical reaction. The process is efficient, virtually silent, and generates little in the way of pollution. In commercial buildings, fuel cells are used to provide primary power as well as backup power. There are various types of fuel cells, though the one in use in the majority of U.S. commercial buildings is the solid oxide fuel cell (SOFC) fueled by natural gas.

“Fuel cell customers are saving money on fuel and labor costs, lowering emis-

sions, and yielding substantial energy savings through increased efficiency and reliability,” said Morry Markowitz, president of the Fuel Cell and Hydrogen Energy Association (FCHEA). “Many have now become repeat customers, purchasing additional, and in many cases, larger fuel cell systems for their facilities.”

Investing in fuel cells

The fuel cell industry worldwide grew to \$2.2 billion for 2014, up from \$1.3 billion the previous year, according to

PHOTO COURTESY OF BLOOM ENERGY



Wal-mart Stores Inc. has been in the forefront of fuel cell implementation for many years. It installed its first fuel cell, a Bloom Energy server, at its Lancaster, California, store in 2009.

FCHEA. More than 50,000 fuel cells were shipped over the course of the year, totaling 180 megawatts (MW). Currently in the U.S., there are more than 232 MW of fuel cells in operation. There are almost 100 MW planned, but not yet installed – including a 63 MW power park in Beacon Falls, Connecticut, according to the FCHEA.

While the bulk of these systems are small units for backup power at telecom and residential sites, the big news is adoption of the technology in large businesses. FCHEA reports that almost 10 percent of Fortune 500 companies now use fuel cells. Of the top 100 on the Fortune list, 25 percent utilize fuel cells.

This activity, said Markowitz, indicates that more U.S. businesses than ever are investing in fuel cells.

“Fuel cells help our customers reduce energy cost, supply continuous power during utility outages and achieve their environmental sustainability goals,” said Todd Gordon, manager of commercial and industrial accounts at South Jersey Gas. “Large commercial operations and national chains are leading the way.”

Walmart thinks big

South Jersey Gas worked closely with fuel cell manufacturer Bloom Energy on five fuel cell projects for Wal-mart Stores Inc. Gordon said equipment is installed in all five stores; three are operational. Totalling 1.85 MW of capacity, three stores have 200 kilowatt (kW) systems and two have 250 kW fuel cells.

“Due to the large developers promoting fuel cells, and strong interest from national companies (coupled with state incentives), we are seeing a sharp rise in demand for fuel cell technology,” Gordon said. “This technology is helping Walmart reduce its reliance on utility power.”

Walmart has been in the forefront of fuel cell implementation for many years. It installed its first fuel cell, a Bloom Energy server, at its Lancaster, California, store in 2009. It has expanded this to 42 California stores, two more in Connecticut and additional units with South Jersey

Gas. Most are powered by biogas, with the rest using natural gas.

As the world’s largest retailer, energy is one of Walmart’s biggest expenses. It has been steadily adding on-site power in the form of almost 300 solar and scores of fuel cell projects to decrease reliance on grid-based power and achieve greater sustainability. Its stores in New Haven and Waterford, Connecticut, for example, use Bloom Energy fuel cells to provide 40 percent to 60 percent of its electricity requirements. Further, these fuel cells act as backup power in the case of a grid failure.

“It’s a clean technology, probably the most attractive of all the renewable technology we’ve installed,” said David Ozment, senior director of energy at Walmart. “We believe it’s the right thing to do and the best way to leverage our size and scale to drive positive change.”

Follow the leader

But Walmart is not the only company eagerly pursuing a fuel cell approach to onsite power. eBay Inc. used 6 MW fuel cells to power its South Jordan, Utah, data center. When the company began planning this new facility, it questioned the deployment of traditional backup generators and battery-based Uninterrupted Power Supply (UPS) systems, as they are used less than 1 percent of the year. Instead, the online retailer harnessed fuel cells.

“More than just cutting costs and increasing performance, we’ve gained both the economic and ecological benefits,” said Dave Nelson, eBay’s vice president of global foundation services.

The Home Depot Inc., too, installed fuel cells in 81 stores across the country, totaling 870,522 pounds of carbon dioxide removed per year per store, a 30 percent reduction. These Bloom Energy units use natural gas to generate electricity without combustion. In addition, the company reports a drop of 315 million kW used in store operations for the year, a 17 percent reduction, with fuel cells being one of several technologies

contributing to this.

Home furnishing company IKEA is another advocate of this technology. Its retail store in Emeryville, California, has a 300 kW biogas fuel cell system, as well as solar panels on the roof. Combined, these systems generate most of the store’s energy requirements onsite. The fuel cell system alone produces almost 2.5 million kWh of electricity per year. IKEA’s goal is to be independent of the electric grid by 2020.

“This fuel cell system will greatly reduce our carbon footprint and the store’s reliance on the power grid,” said Pat Choa, IKEA’s Emeryville store manager. ▶

FUEL CELL BOOM

In 2015 alone, the leading fuel cell suppliers reported robust orders and installations in the United States.

Doosan Fuel Cell America Inc.:

- Amgraph Packaging (Baltic, Connecticut), 800 kW
- California State University (San Marcos, California), 880 kW
- CTransit (Hamden, Connecticut), 400 kW
- Norco College (Norco, California), 400 kW

FuelCell Energy Inc.:

- Alameda County (Dublin, California), 1.4 MW
- Riverside Wastewater Quality Control Plant (Riverside, California), 1.4 MW
- Pepperidge Farm (Bloomfield, Connecticut), 1.4 MW
- Town of Woodbridge (Woodbridge, Connecticut), 2.2 MW
- University of Bridgeport (Bridgeport, Connecticut), 2.2 MW

Bloom Energy:

- CenturyLink (Irvine, California), 500 kW
- Comcast (Berlin, Connecticut), 400 kW
- Equinix (San Jose, California), 1 MW
- IKEA (Emeryville, California), 300 kW
- Johnson & Johnson Advanced Sterilization Products (Irvine, California), 500 kW
- Staples Center (Los Angeles, California), 500 kW
- Stop & Shop (Mount Vernon, New York), 250 kW



A smart choice

Natural gas is a ‘game-changer’ at Delaware Technical Community College.

By **Tonya McMurray**

Delaware Technical Community College’s (DTCC) facility manager remembers just a few years

ago when soot from the college’s oil-based heating and cooling systems covered the roof of the campus’ day care center.

“But you don’t see that any longer,” said Scott Iseman, DTCC’s chief facility manager and energy director. “Now, it’s clean, and we have state-of-the-art equipment for even our very youngest students.”

Working with Intellicochoice Energy LLC, DTCC installed the NextAire™ natural gas heat pump to provide both cooling and heating for the 16,000-square-foot daycare facility. Iseman said the college was the first in Delaware to use a natural gas heat pump for a day care facility.

He said the technology was a good fit for the day care because it offered clean energy at an affordable cost. Combined with radiant floor heating, the natural gas heat pump provides a consistent, comfortable temperature during both heating and cooling seasons.

In addition, Iseman said, the system is extremely quiet, so there is no impact on the activities at the center, which provides care for 120 children ranging in age from 2 months to 5 years.

While most people think of natural gas as a heating fuel, the same qualities that make it efficient for heating also make it a winning choice for cooling systems. Natural gas cooling systems offer lower operating costs, reduced demand charges, improved air quality and a quick payback on equipment pur-

chases. And, natural gas costs are often “off peak” during the summer cooling season, precisely the time electricity rates are reaching their peak, further reducing cooling costs with systems fueled by natural gas.

Campus conversion

The DTCC day care facility conversion is the latest example of the college’s switch to natural gas for its facilities. When natural gas became widely available in the Georgetown, Delaware, area, where the Owens DTCC campus is located, many of the college’s oil boilers were approaching the end of their life spans, said Bill Beauch, Energy and HVAC (heating, ventilating and air conditioning) instructor.

After researching options, Beauch and his team found that shifting to natural gas would have significant benefits for the college. In addition, the team planned and installed new natural gas equipment in-house, giving them resources for a wide-scale conversion.

“We found out if we did the work ourselves, we could use the money we had set aside for three boilers and do the whole campus,” Beauch said. The conversion paid off in one year because of fuel savings and improved energy efficiency. “We went from 68 percent efficiency to 90 percent efficiency, so we got [nearly] a 30 percent increase in fuel efficiency with a cheaper fuel.”

The Owens DTCC campus is able to partner with the other three DTCC campuses throughout the state to purchase natural gas in larger quantities, which brings the cost down even more. Beauch estimates that the switch to natural gas

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The Owens campus of Delaware Technical Community College (DTCC) uses its natural gas-based systems as a lab for students in its HVAC program. David LaFazia, far right, discusses the energy and cost savings of the school’s natural gas systems with students (from left) Jocelyn Gabriel, Anthony Rousak III and Aliaksandr Miafodzyeu.

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In addition to the cost savings, the natural gas is a more environmentally friendly fuel source for the college. Replacing oil and electricity with natural gas can achieve significant reductions in carbon emissions. Natural gas emits about half as much carbon dioxide as coal and 33 percent less than oil, according to the Environmental Protection Agency. Plus, the Energy Information Administration reports that natural gas also does not have significant emissions of nitrogen oxides and sulfur dioxide.

A campus-wide lab

DTCC’s state-of-the-art equipment not only helps run the college’s heating and cooling systems, but it also serves as a lab for the HVAC and energy management programs.

“We use the whole campus as a lab,” said David LaFazia, chairman, energy technologies department at DTCC’s Owens campus. “It helps students see the type of energy conservation measures they could put in place in residential and commercial buildings.”

The 30-year-old HVAC program is highly respected in the state and draws many students working in the industry who want to broaden their skill set, LaFazia said. And exposure to natural gas systems is an important part of helping

students broaden their skills.

The Center for Climate and Energy Solutions reports that natural gas accounts for more than 25 percent of U.S. energy consumption. The U.S. Census Bureau reported that in the last census, more than 54 percent of new family homes used natural gas for heating.

Iseman added: “More and more employers are looking for technicians who are able to work with natural gas.” The DTCC Owens campus gives students a chance to work directly with the technology, which gives them an edge in seeking employment in the area’s HVAC industry.

Energy management

Many students in the HVAC program take courses in the college’s five-year-old energy management curriculum, which also uses the campus natural gas installations as a lab to help students understand the systemic impact of the fuel used in HVAC systems across an organization.

“Energy management is about how it affects the whole building rather than just the HVAC system,” Beauch said. “An HVAC technician just focused on servicing the unit doesn’t think about what it affects. With an energy management approach, you look at air quality, comfort, energy use, and making sure the customer doesn’t see spikes in costs during peak seasons. It’s a larger scale.”

And it’s that view that has made natural gas such an ideal solution for the DTCC Owens campus.

“We’ve literally gotten rid of every propane tank on the campus and converted over to natural gas,” Iseman said. “We use natural gas for everything except vehicles at this point.”

Beauch added, “Natural gas has been a real game-changer around here. And the students get to see that in action.”



LaFazia, right, discusses how HVAC equipment fits into an overall energy management system with students (from left) Craig Edick and Miafodzyeu.

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