COMBINED

HEAT AND POWER

ESC
Energy Solutions Center

Hospitals, schools, manufacturers find efficient power solutions in CHP

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Combined Heat and Power is a product of Energy Solutions Center, and is published in cooperation with PRISM Media Group. We offer our special thanks to the utilities and other businesses that sponsored this issue.

prism media

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COMBINED HEAT AND POWER is published by PRISM Media Group, 405 State Highway 121 Bypass, Suite A250, Lewisville, TX 75067. Visit www.prismmediagroup.com.

What power outage?

MicroCHP takes off in the residential sector.

BY DREW ROBB

Combined heat and power (CHP) has long been the province of commercial and industrial customers. But residential applications are gaining traction. This technology is known as micro CHP (mCHP). The basic concept is to install a natural gas-based small engine at the residential property to produce power heat, and sometimes cooling, too.

Take the case of a typical suburban home in Oakland County, Michigan: four bedrooms, 2.5 baths and about 2,900 square feet. Homeowner Tom Miller had the goal of reducing grid dependency while still leaving enough battery backup for a power outage. The initial plan was to install a 16-kilowatt (kW) photovoltaic (PV) solar system to satisfy the electric load of the house. However, the quote received for materials and installation came to $80,000.

With the assistance of Aisin World Corp. of America and the local utility, the project was reworked. A more feasible configuration turned out to be 2 kW of solar panels augmented by a forced air natural gas furnace and a hot water tank.

Aisin provided mCHP capable of generating up to 1.5 kW of power. This unit is fueled by an internal combustion engine running on natural gas. The thermal heat (up to 13,000 British thermal units) recovered from the engine's cooling is used to heat the domestic hot water tank as well as the 360-gallon hot tub.

Yoshi Sekihisa, senior manager for energy solutions at Aisin, said the adoption of mCHP cut the project costs in half while adding heat and power. Further, the property is now safeguarded against loss of power.

"The house has experienced many power outages in the neighborhood lasting up to two days but has managed to maintain electricity to critical appliances and a majority of the house," Miller said. "Since the install, utility bills — including natural gas and electricity — have dropped by 25%."

Sekihisa said that natural gas usage rose 26% due to the household power and heat configuration change. However, electricity usage dropped by 68%. That added up to total year-to-date (nine months) savings of $789.

Combining an mCHP system and solar

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PHOTO COURTESY OF TOM MILLER

Aisin World Corp. of America provided a micro combined heat and power unit to a residential unit in Michigan capable of generating up to 1.5 kilowatts of power.

Smarter Energy

DAL-TILE

Dal-Tile leads the industry in design, product innovation, and sustainable products. Their commitment in this area doesn't just target what they manufacture, but how. It's what led them to install a highly-reliable, highly efficient, ultra-low emission Capstone Green Energy power system at the company's plant in Dickson, Tennessee.

SCALABLE TO MATCH DEMAND
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INCREASED EFFICIENCY
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Green energy

Indoor agricultural facilities use CHP to save money and reduce carbon footprint.

BY TONYA MCMURRAY

With a technology-based approach to cultivating crops, controlled environmental agriculture (CEA) can create optimal growing conditions that result in faster and more reliable production. But that approach requires significant energy to meet the lighting, heating and cooling demands, making combined heat and power (CHP) solutions ideal for CEA facilities.

"Indoor agricultural facilities are ideal for gas engine-driven chillers and CHP because they have nearly constant loads 24 hours a day 365 days a year, with a sizable, simultaneous demand for heating and cooling," said Francis Boucher, energy efficiency program manager at National Grid PLC.

A SUSTAINABLE APPROACH

The energy efficiency of a CHP system was attractive to Wheatfield Gardens LLC because the greenhouse's investors are committed to an environmental social governance approach to CEA, said Paal Elfstrum, CEO of Wheatfield Gardens, a 550,000-square-foot indoor agricultural facility in western New York.

The greenhouse uses a 340-kilowatt natural gas engine manufactured by Professional Power Products Inc. along with two 650-horsepower natural gas fire tube boilers to provide redundant heat capacity.

The recovered heat from the engine provides heat for the greenhouse and drives an absorption chiller, while a carbon dioxide recovery system helps fertilize its plants, increasing production by up to 30%. The CHP system also allows the greenhouse to participate in demand response and real-time energy management strategies that maximize efficiency.

> ***"Indoor agricultural facilities are ideal for gas engine-driven chillers and CHP because they have nearly constant loads 24 hours a day 365 days a year with a sizable, simultaneous demand for heating and cooling."***
>
> **— Francis Boucher, energy efficiency program manager, National Grid PLC**

"One of the biggest benefits has been the ability to avoid the cost and carbon footprint associated with purchasing tanker loads of liquid CO2," Elfstrum said. "We now emit less carbon to the

PHOTO COURTESY OF WHEATFIELD GARDENS LLC

Wheatfield Gardens' 550,000-square-foot indoor agricultural facility uses CHP to help meet its commitment to energy savings and environmental stewardship. A natural gas engine and two natural gas-fired tube boilers provide redundant heat capacity, deliver heat to the greenhouse and drive an absorption chiller. A carbon dioxide recovery system helps fertilize plants, increasing production with reduced carbon emissions.

atmosphere and fertilize our plants with CO2 at the same time."

Ken Lawton, senior technical energy consultant at National Fuel Gas Co., said on-site energy production contributes to the greenhouse's reliability, efficiency and cost savings.

"When power is purchased from the grid, there are efficiency losses due to transmission distance, downed wire reliability concerns and transmission costs associated with getting power to the end-user," he said. "Using CHP gives Wheatfield Gardens better lighting and heating control, more reliability and resiliency, while, at the same time, lowering their energy costs and carbon footprint."

A MECHANICAL OPTION

Sira Naturals, a 26,000-square-foot Milford, Massachusetts, indoor cannabis cultivation facility, opted for a mechanical CHP solution using two of Tecogen Inc.'s 300-ton Tecochill natural gas engine-driven chillers.

Similar to traditional electrical CHP systems, Tecogen's Tecochill system also uses a prime move — a natural-gas-fueled IC engine — to create shaft power to directly turn a refrigeration compressor, alleviating the electrical load typically associated with an electric motor-driven refrigeration compressor while capturing and reusing the waste heat for dehumidification in the facility.

By connecting a prime mover directly to the process, the system can maintain an overall efficiency of 80%, which is higher than the efficiency provided by a traditional trigeneration system offering combined cooling, heat and power via a waste-heat driven absorption chiller, said Stephen Lafaille, vice president of business development for Tecogen.

> ***"When power is purchased from the grid, there are efficiency losses due to transmission distance, downed wire reliability concerns and transmission costs associated with getting power to the end-user."***
>
> **— Paal Elfstrum, CEO, Wheatfield Gardens LLC**

"The mechanical CHP solution is a great choice for an indoor cultivation facility because they need cooling 24/7/365," he said. "Since the customer has to purchase a cooling system anyway, they can buy a cooling system that doubles as a CHP system, limiting their incremental capital expenditure. This offers a much less complex system and completely avoiding the interconnection process associated with electrical CHP systems that parallel to the grid."

The Sira Naturals CHP system removes heat generated by thousands of lights needed to grow the plants, and the recovered waste heat is used to dehumidify the air.

Sam Arthur, facilities manager for Sira Naturals, said the system has resulted in significant savings.

"Electric rates are extremely high in Massachusetts, so shifting about half of our input energy from expensive electricity to natural gas has dramatically reduced our utility costs," he said. "And the high efficiency of the combined heat and power process provides a substantial reduction in greenhouse gas emissions. This is a great way for us to produce a quality product while also being good stewards of the environment." **CHP**

PHOTO COURTESY OF TECHOGEN INC.

Sira Naturals chose Tecogen Inc.'s 300-ton Techochill natural gas engine-driven chillers to create a mechanical CHP solution to provide cooling, heat, and power for its 26,000-square-foot indoor cannabis cultivation facility. The mechanical CHP system boasts an overall efficiency of 80%.

For more information about combined heat and power (CHP), visit:

Tecogen Inc.: *tecogen.com*

Professional Power Products Inc: *psiengines.com*

Lessons learned

Schools cut costs with CHP.

BY MONICA STAVISH SKAGGS

More local schools are cutting costs and becoming environmentally proactive, using combined heat and power (CHP), or cogeneration, as an energy source to heat buildings, water and swimming pools and provide building cooling.

Two northeastern U.S. high schools are among others benefiting from CHP. Ballston Spa High School in Ballston Spa, New York, cut its electric bill by one-third by adding cogeneration units. Seven Tecogen Inc. InVerde e+ units provide 875 kilowatts (kW) of CHP, along with 700 kW of standby power. The school uses the thermal output for space heating and domestic hot water (DHW) and to heat its pool.

At Naugatuck High School in Naugatuck, Connecticut, a cogeneration installation will provide 140 kW of electrical power and 820,000 British thermal units (Btus) of hot water to supply heat for the school's domestic needs and an Olympic-size indoor pool.

CHP is the simultaneous production of electrical and thermal energy from a single fuel source. This is a tremendous benefit to schools, which consistently need electricity and hot water.

When Ballston Spa opened its new high school in 1998, construction bids came in over budget. To save money and allow the project to move forward, the school district entered into a performance contract to replace a traditional heating plant with a CHP plant, said Edwin Martin, director of facilities with Ballston Spa Central School District.

"The initial plant configuration was 10 Tecogen 75 kW units, which were later upgraded to 12 units, producing 900 kW of power," he said. "Under a planned life-cycle replacement, the Tecogen 75s were replaced in 2020 with seven Tecogen InVerde e+ units."

Benefits include "reduced electrical purchases from the local electric utility and higher overall efficiency from the entire system – close to 83% combined electric and thermal efficiency based on the Higher Heating Value (HHV) of the fuel," said Jeff Glick, vice president of sales at Tecogen.

The system can also provide emergency backup power to school facilities, making them a safe location for local residents to gather in the event of a major power outage, he said.

The Ballston Spa High School complex has 2,500 students. The facility is 230,000-square-feet in size, with an attached 130,000-square-foot middle school. Water that cools the InVerde unit's engines and exhaust gas is used to provide heat for the buildings. This same hot water is also pumped to an absorption chiller to provide air conditioning to the high school. A hot water generator utilizes this heated wastewater to provide

PHOTO COURTESY OF TECOGEN INC.

Ballston Spa High School in Ballston Spa, New York, cut its electric bill by one-third by adding cogeneration units, including seven Tecogen Inc. InVerde e+ units.

PHOTO COURTESY OF YANMAR AMERICA CORP.

At Naugatuck High School in Naugatuck, Connecticut, a cogeneration installation will provide 140 kW of electrical power and 820,000 British thermal units of hot water to supply heat for the school's domestic needs and an Olympic-size indoor pool.

domestic hot water to both buildings.

The 240,000-gallon pool was initially heated and dehumidified by a standalone Dectron electric package unit, Martin said. The SAS Dectron Co. unit was replaced by a PEI fresh air unit, with cooling coils added to it, while the cogeneration module-produced hot water is used to heat pool water via heat exchangers.

Saving money on energy costs frees up more funding to meet the educational needs of students.

"Our electric bills are one-third of what they would be without our cogeneration units," Martin said. "Last year, we successfully obtained a grant from NYSERDA [New York State Energy Research and Development Authority] for an on-site energy manager, and we were able to document an additional 15% energy savings at the site through optimization of existing system controls."

As with other schools, the COVID-19 pandemic affected operations at Ballston Spa. In 2020, half of the district's students attended class in-person and half studied remotely. Decreased occupancy load savings were offset by maximizing fresh air in the buildings. Overall cost savings came from eliminating after-school programming and reducing the mechanical load required to support those activities, Martin said.

POOLING AROUND

Naugatuck High School has 1,230 students in grades nine through 12 and was built in 1959. The public approved an $81 million bond referendum in 2011 and the school underwent a complete interior and exterior renovation in 2014-2015. The school is upgrading its hot water system for the fall 2021 term. After a return-on-investment (ROI) analysis, school officials determined that a CHP system would be beneficial, said Michael Alfano, regional sales and service manager with Yanmar America Corp., CHP system manufacturer.

"Since the system makes hot water while making electricity, it efficiently uses the fuel energy to produce both electrical energy and heat energy," Alfano said. "It is about 87% efficient, compared to the electric grid, which is only about 33% efficient."

Controlled Air Inc., of nearby Branford, Connecticut, is installing four Yanmar CHP units at the school. Each unit has a natural gas engine that spins a generator that provides electricity with a byproduct of waste heat. The units use a technology similar to a power plant that uses natural gas to produce electricity.

"The system will provide 45% of the school's existing electrical consumption and 52% of its thermal consumption," said Melissa Fuller, strategic account executive with Eversource Energy. "One of the biggest energy consumers at the school is the pool. The waste heat from the CHP units will be used to help offset those costs."

Eversource is New England's largest energy provider, serving 3.6 million electric and natural gas customers in Connecticut, Massachusetts and New Hampshire.

The efficiency of a cogeneration system means that "while electricity is being generated, the waste heat will save the boilers from having to run as

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"Our electric bills are one-third of what they would be without our cogeneration units … We were able to document an additional 15% energy savings at the site through optimization of existing system controls."

— Edwin Martin, director, facilities, Ballston Spa Central School District

CHP 2.0

Manufacturers harness latest CHP technology to upgrade and expand existing systems.

BY DREW ROBB

Using natural gas-fueled turbines for combined heat and power (CHP) applications has become something of a no-brainer for many industrial facilities. As well as the ability to continue operations during grid disturbances, these facilities can produce cheaper power and utilize the waste heat for facility and process heating.

"Producing power, heat and cooling close to where it is used gives greater control over the energy supply, gaining the dual benefits of security and independence," said Anders Stuxberg, power plant process integration specialist at Siemens Energy AG.

That's why existing users are expanding their CHP plants and upgrading to larger and more modern gas turbines that harness the latest CHP technology.

Tate & Lyle PLC, for example, gained CHP experience on a project completed five years ago at its corn milling facility in Loudon, Tennessee. That site has two Siemens Energy SGT-700 gas turbines and two heat recovery steam generators (HRSG) provided by Rentech Boiler Systems Inc.

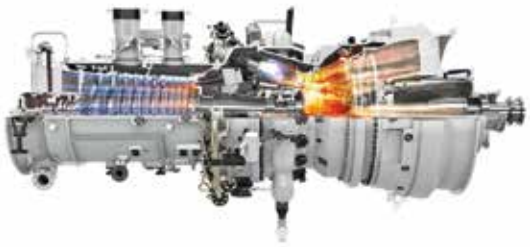

PHOTO COURTESY OF SIEMENS ENERGY AG

Two Siemens Energy SGT-700 gas turbines replaced aging coal boilers at Tate & Lyle PLC's Lafayette South plant in Indiana.

The return on investment and environmental benefits demonstrated by switching from coal boilers to natural gas-based CHP at the Loudon site motivated company officials to upgrade another plant. At its Lafayette South food ingredient processing plant in Lafayette, Indiana, Tate & Lyle replaced its aging coal boiler with a similar configuration as Loudon: two combustion turbines and two HRSGs. The gains reported by the plant manager include power resiliency, greater process efficiency and a reduction of carbon emissions by more than 30% while substantially reducing energy costs and cutting water usage by 5%.

"We take our responsibility to the environment very seriously and are committed to doing more to care for the planet, including lowering our greenhouse gas emissions by using cleaner energy," said Travis Montoya, Lafayette South plant manager for Tate & Lyle.

This is all part of ambitious targets for 2030 set by the company to deliver:

- a 30% reduction in CO2 emissions
- beneficially use all its waste
- a 15% drop in water use
- elimination of coal from operations

Getting rid of the coal boilers at Loudon and Lafayette is a major step in the latter goals.

"The Lafayette South Plant project not only helps meet our sustainability goals in reducing greenhouse gas emissions and water use, but it's also a project that saves us money as a company, so it was really a win-win for us," said Nick Waibel, global energy lead for Tate & Lyle. "Eliminating coal and going into a clean-burning fuel is the right next step for our plant."

"Producing power, heat and cooling close to where it is used gives greater control over the energy supply, gaining the dual benefits of security and independence."

— Anders Stuxberg, power plant process integration specialist, Siemens Energy AG

TIME FOR AN UPGRADE

CHP is so popular that even those who have been proponents for decades want to expand their CHP resources.

Take, for example, the case of a Bristol Myers Squibb Co. research and development facility in Wallingford, Connecticut.

Back in 1998, the facility installed a 4.7-megawatt gas turbine from Solar Turbines Inc., a HRSG, backup boilers, chillers and generators for emergency

power and demand response. Fueled by natural gas, the CHP plant boasted 72% efficiency. As well as providing consistent power for decades, it also produces process and building heating and cooling. The initial investment in the state-of-the-art plant had a payback time of fewer than five years.

This 1 million-square-foot facility operates around the clock and must maintain tight control over temperature, humidity and ventilation. After more than two decades of successful operation, and the need for facility expansion, Bristol Myers Squibb officials realized it was time for an upgrade.

"This was an opportunity to upgrade to a larger, improved CHP system to provide more steam and power to meet growing requirements at the facility," said Dang Le, head of power generation marketing at Solar Turbines Inc.

As part of the project, Bristol Myers Squibb added a 5.7-megawatt Taurus 60 gas turbine from Solar Turbines running on natural gas. It provided more power as well as steam needed by manufacturing processes. In addition, it raised resiliency and helped the company realize sustainability goals.

"The new natural gas-based CHP system is efficient in providing both electrical and thermal energy and operates at a reduced emission footprint," Le said. "It eliminates about 10,000 metric tons of CO2 per year." **CHP**

For more information about combined heat and power (CHP), visit:

Rentech Boiler Systems Inc.: *rentechboilers.com*

Siemens Energy AG: *siemens-energy.com*

Solar Turbines Inc: *solarturbines.com*

Tecogen Inc.: *tecogen.com*

Yanmar America Corp.: *yanmar.com*

Lessons learned

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often, also saving fuel," Alfano said. "It will reduce the energy spend of the school significantly."

The CHP project is an important component of the Borough of Naugatuck's decision to become a sustainable community, said Adam Burkitt, managing partner with Advanced Energy Efficiencies LLC, which oversees the project for the borough.

"The system will provide 45% of the school's existing electrical consumption and 52% of its thermal consumption. One of the biggest energy consumers at the school is the pool. The waste heat from the CHP units will be used to help offset those costs."

— Melissa Fuller, strategic account executive, Eversource Energy

PHOTO COURTESY OF YANMAR AMERICA CORP.

At Naugatuck High School, a cogeneration installation will provide 140 kilowatts of electrical power and 820,000 British thermal units of hot water to supply heat.

"The natural efficiencies of CHP over the grid and conventional boiler combination will significantly reduce overall utility cost to the school with a projected ROI of approximately four years and an emission reduction equal to the removal of 103 passenger vehicles or 72 homes," Burkitt said. **CHP**

For more information about combined heat and power (CHP), visit:

Siemens Energy AG: *siemens.com*

Rentech Boiler Systems Inc.: *rentechboilers.com*

Solar Turbines Inc.: *solarturbines.com*

Yanmar America Corp.: *yanmar.com*

A healthy power source

CHP gives hospitals a resilient energy source for mission-critical operations.

BY TONYA MCMURRAY

For hospitals, power outages — even brief ones — can disrupt critical life support systems. And, because they operate around the clock, hospitals have extensive needs for both power and hot water.

More than 200 hospitals in the United States have turned to combined heat and power (CHP) to meet their needs for reliable and cost-effective energy, according to the U.S. Environmental Protection Agency.

"Hospitals make excellent applications for CHP because they are 'energy hogs' that have both high thermal and electrical loads that occur simultaneously, which allows the CHP system to recover the maximum amount of waste heat and utilize it for heating, domestic hot water, cooling and steam for sterilization," said Justin Rathke, founder and president and of Vergent Power Solutions Inc., a Capstone Green Energy Corp. turbine distributor. "This increase in energy efficiency provides valuable cost savings, freeing up the hospital's financial resources for health care-related investments."

PHOTO COURTESY OF DRYDEN REGIONAL HEALTHCARE CENTRE

Dryden Regional Healthcare Centre turned to CHP to reduce its rapidly increasing electricity costs. Four natural gas-fueled Capstone C65 microturbines provide electricity and supply the building's heat, leading to cost savings of at least $150,000 per year.

"About two years after start-up, the cost savings have been on track with the $150,000 to $250,000 savings projected per year."

— Austin Madussi, director, facilities, Dryden Regional Healthcare Centre

Because electricity is produced onsite from the CHP system rather than transmitted across the grid, it provides more reliable energy, said Michael Alfano, sales application engineer at Yanmar America Corp.

"CHP gives you resiliency against any issues that might occur because you're producing electric at your facility," he said. "You don't have to worry about lines going down in a storm or other disruptions. It provides very controlled power, so the electricity produced is more stable than you get from the electric utility. That's important for sophisticated equipment that hospitals rely on."

CHP systems using natural gas offer hospitals an attractive value proposi-

"CHP is a stable and reliable source of power and hot water, steam and chilling. It is an uninterruptable fuel source with simple operation that offers a reduced carbon footprint, high overall efficiencies and lower cost versus local utilities."

— Aaron Tasin, vice president, product support operations and sales, Northeast – Western Energy Systems

tion, said David Swenson, manager of industrial services at Intermountain-Gas Co., which serves about 350,000 in southern Idaho.

"Natural gas is both energy efficient and very price competitive," he said. "We have some of the least expensive power in the entire country in this area and, even so, CHP is cost-effective when compared with the cost of power."

A MORE SUSTAINABLE SOLUTION

Cost was the primary reason Dryden Regional Healthcare Centre (DRHC), a rural Ontario, Canada, hospital, turned to CHP. The hospital's electric bills increased nearly 44% between 2012 and 2017, and provincial changes in pricing and rebates were projected to add another 31% increase in November 2020.

"The main reason we undertook this project was the cost savings," said Austin Madussi, director of facilities for DRHC. "As the services we provided, and their associated power requirements, grew and the cost of electricity increased, the financial burden became unsustainable."

In 2019, DHRC installed four natural gas-fueled Capstone C65 microturbines to provide electricity and supply the building's heat by repurposing exhaust produced by the microturbines.

"About two years after startup, the cost savings have been on track with the $150,000 to $250,000 savings projected per year," Madussi said. "During the winter months, we have been able to reclaim an average of 1.5 million British thermal units per hour, which has been a great supplement to our heating demand. In the summer months, the CHP system has satisfied all of our heating needs."

David Sertic, senior adviser of commercial industrial energy conversation for Enbridge Inc., said DRHC's results prove the value CHP offers to hospitals.

"CHP is a good fit for facilities requiring power and heat year-round, and hospitals fit that bill," he said. "CHP installations enable hospitals to 'peak shave' their electricity purchasing, supplementing with CHP power."

A CLEAN ENERGY SOLUTION

When Inspira Health built its new in Mullica Hill, New Jersey, it turned to CHP to create a cost-effective, reliable and clean energy solution.

Inspira Medical Center Mullica Hill installed an INNIO Jenbacher engine providing 1,141 kilowatts of capacity to work in conjunction with a three-acre

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PHOTO COURTESY OF ANORTHEAST – WESTERN ENERGY SYSTEMS

Inspira Medical Center Mullica Hill uses a INNIO Jenbacher CHP engine in conjunction with a three-acre solar field to provide electricity for the hospital. Excess heat generated by the CHP system provides the hospital's hot water. Not only does the system result in significant cost and energy savings, but it ensures the hospital never runs out of electricity. If power goes out, the system operates in island mode to provide all of the hospital's electricity.

Abundant energy

CHP provides reliable and economical power for manufacturing facilities.

BY TONYA MCMURRAY

With equipment and machines running almost nonstop, manufacturing facilities need an abundant amount of power, and they need to be able to rely on the stability of their electricity supply to avoid costly shutdowns.

Combined heat and power (CHP) offers a reliable, affordable and energy efficient solution that can generate both electric power and thermal energy from a single fuel source.

"In this era of public safety power shut-offs, resiliency and reliability are of extreme importance," said Rosie Magana, clean energy innovations, distributed energy resource manager for Southern California Gas Co. "CHP provides resiliency with the added benefit of operating cost savings. With proper waste heat recovery and utilization, CHP systems running on renewable natural gas offer a greenhouse gas reduction."

CONVERTING WASTE TO ENERGY

For Anaergia Inc., a world leader in converting waste materials into renewable energy, water and fertilizer, CHP seemed a natural choice when in 2020 it built its Rialto Bioenergy plant in Rialto, California. Rialto Bioenergy is North America's largest food waste diversion and energy recovery facility.

"The Rialto Bioenergy project harnesses Anaergia's advanced anaerobic digestion technology in combination with 2G Energy's avus CHP system to extract and generate energy from organic material," said Uday Purani, a regional sales manager for 2G Energy Inc. "CHP provides the Rialto Bioenergy facility with a stable power supply while reducing energy costs, decreasing environmental impact and increasing energy reliability."

Anaergia's anaerobic digestion technology decomposes organic food waste, producing methane gas. Rialto Bioenergy uses a reciprocating engine with two avus 1500-kilowatt systems and two avus 800-kilowatt systems to drive its generator and produce electricity. Residual heat created during the process is recaptured and used to heat its digesters and provide heat for the bio solid dryer system.

"The CHP systems have the ability to use either biogas from digesters or natural gas," said Jeremy Metts, managing director for Anaergia. "Our normal mode of operation will be to use natural gas to run the CHPs, send the biogas to the biogas upgrading system and inject biomethane into the Southern California Gas Co. pipeline."

Because the installation is new, Anaergia has not yet calculated yearly energy or cost savings, but the company is confident the savings will be significant, Metts said.

"The CHP system will provide power to the facility at a better rate than we can buy from Southern California Edison," he said. "We expect to have significant energy savings once the plant is at full capacity as we are using both the power and heat from the CHPs."

PHOTO COURTESY OF ANAERGIA INC.

Rialto Bioenergy, North America's largest food waste diversion and energy recovery facility, combines 2G Energy's avus CHP system with parent company Anaergia's advanced anaerobic digestion technology to extract and generate energy from organic material. The CHP system provides stable power, lower energy costs, and increased energy reliability.

"CHP provides resiliency with the added benefit of operating cost savings. With proper waste heat recovery and utilization, CHP systems running on renewable natural gas offer a greenhouse gas reduction."

— Rosie Magana, clean energy innovations, distributed energy resource manager, Southern California Gas Co.

A SOUND ECONOMIC INVESTMENT

Cost and energy savings were key reasons one of UGI Utilities Inc.'s customers chose CHP for its manufacturing plant.

"The facility has significant coincident thermal and electrical loads, making it a good candidate for CHP," said Becky Eshbach, director of marketing programs and strategy at UGI Utilities Inc.

UGI's commercial and industrial customer team met with its customer's representatives to help plan for the implementation its CHP system. The utility also helped its customer secure $25,000 in rebates to make the project more affordable.

The 1.43-megawatt system from INNIO Jenbacher was installed in 2019 and provides electricity for the plant. The recovered heat is used for hot water and steam in the manufacturing process.

CHP systems are both a good economic investment for companies and a good public policy choice, Eshbach said.

"CHP can enhance our energy security by reducing our national energy requirements, and it diversifies our energy supply by enabling further integration of domestically produced and renewable fuels," she said. "CHP also advances our climate change and environmental goals by reducing emissions of carbon dioxide and other pollutants. It improves business competitiveness by increasing energy efficiency and managing costs, and it helps businesses weather energy price volatility and supply disruptions." **CHP**

For more information about combined heat and power (CHP), visit:

2G Energy Inc.: *2g-energy.com*

INNIO Jenbacher: *innio.com*

What power outage?

(continued from page 2)

power proved to be a wise choice on many fronts, not just economics. After all, sunlight is at a premium in the Northern United States in winter. The home only produced 37-kilowatt hours (kWh) of solar power in January and February of 2021. In March, that jumped to 892.1 kWh. For part of the year, then, CHP is needed to compensate for the lack of solar resources. At other times of the year, however, excess solar power can be used to charge batteries during the day to provide about 25% of the power needed at night, further reducing power and fuel needs.

"MicroCHP provides year-round efficient power generation and an overall system cost reduction," Sekihisa said.

"MicroCHP provides year-round efficient power generation and an overall system cost reduction."

— Yoshi Sekihisa, senior manager, energy solutions, Aisin World Corp.

HOME INNOVATION

MicroCHP projects may be in the early adoption phase. But their numbers are steadily rising.

James Leidel, principal technical consultant at DTE Gas, said his utility is installing an mCHP system in Rochester Hills, Michigan. This "hybrid house" includes a 1.5-kW Aisin mCHP unit, an instantaneous hot water heater, a new 60-gallon water tank and a 12-kWh battery module with an uninterruptible power panel. Solar PV will be added later. Installation should be completed this fall.

"MicroCHP can significantly lower the carbon footprint of a home," Leidel said. "Combining microCHP and solar is an ideal solution as you gain thermal energy as well as baseload power to supplement the intermittent solar."

Another innovative mCHP project is a 1.5-kW ceramic fuel cell unit from Solid Power Inc. installed in a home in Long Island, New York.

"This project met several key objectives, including demonstration of several high-efficiency fuel cell mCHP systems, provisioned with the ability to toggle off-grid for critical circuit resiliency," said Christopher Cavanagh, PE, future of heat principle program manager for utility National Grid PLC.

Natural Grid worked closely with Aris Energy Solutions LLC, a New York-based renewable energy company introducing the U.S. market to Solid Power BlueGen fuel cell technology, which is well established in Europe with thousands of installations. **CHP**

For more information about combined heat and power (CHP), visit:

Aisin World Corp. of America: *aisinworld.com*

Solid Power BlueGen: *solidpower.com*

More reliable natural gas

Lima Company finds savings with micro combined heat and power.

BY MONICA STAVISH SKAGGS

Taking a two-prong approach to promote the use of combined heat and power (CHP) in the United States, Lima Company has installed a micro combined heat and power (mCHP) system to operate its 37,000-square-foot headquarters in Philadelphia, Pennsylvania. The system also serves as a fully operational CHP Training and Education Center.

To ensure a successful project, Lima Company designed the system around a micro 35-kilowatt CHP system and worked closely with the local gas company, Philadelphia Gas Works (PGW). The system includes the CHP unit, a gas-fired water heater, two 100-gallon hot water storage tanks, a 10-ton absorption chiller and a fully integrated building control system.

The CHP system enables the facility to generate electricity on-site and then captures the heat that would otherwise be wasted to provide steam or hot water. This recovered heat can be used for space heating, cooling, industrial processes and domestic hot water.

During summer, thermal energy from the CHP primarily powers the absorption chiller. In the winter, recovered heat is used for hydronic and radiant heating and domestic hot water. By installing this mCHP system, the company expects to reduce its incremental cost of an aggregate unit of energy by 47.6%.

"Lima Company built the training center to educate and train facility owners, engineers, developers and everyone interested in progressive energy solutions," said Bob Adams, vice president of sales and marketing at Lima Company. "These energy solutions include CHP, solar, battery storage and building controls."

LOCAL UTILITIES AND PROJECT INCENTIVES

Incentives are important to energy projects and must be included in the decision-making process, said Jason Kaplan, vice president, energy services at Lima Company. "Close partnerships with all of the stakeholders, including local utilities, are helpful in creating a great and successful project."

Clients also benefit from a Technology and Economic Development (TED) monetary incentive provided by PGW.

"Philadelphia Gas Works' TED rate increases access and incentivizes CHP installations," said Florian Teme, vice president of marketing at PGW. "PGW supports the use of CHP and mCHP through incentives and is eager to help drive the switch from congested, aging power grids to more reliable natural gas." CHP

A healthy power source

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solar field to provide electricity for the hospital. The excess heat generated by the CHP system provides the hospital's hot water.

"By using the otherwise wasted heat, the overall efficiency of the system is extremely high," said Aaron Tasin, vice president of product support operations and sales at Northeast – Western Energy Systems, which provided the Jenbacher systems for the hospital. "The emissions are greatly reduced by using a selective catalytic reduction emissions system."

Resiliency is another benefit of the system, said Brandon Bardowsky, vice president of facilities, design and construction for Inspira Health.

"We're set up to run in island mode, so if the power goes out, it can provide 100% of our electricity needs," he said.

New Jersey's Clean Energy Rebate program provided the hospital $1.5 million in rebates, which paid for about one-third of the project, Bardowsky said. Since its installation in 2020, the system has provided significant cost and energy savings.

"It's reduced our electric cost by 40% on average, and we're projected to save half-a-million dollars a year," he said.

Tasin said the Inspira Medical Center Mullica Hill installation is an example of the benefits CHP can provide.

"CHP is a stable and reliable source of power and hot water, steam and chilling," he said. "It is an uninterruptable fuel source with simple operation that offers a reduced carbon footprint, high overall efficiencies and lower cost versus local utilities." CHP

For more information about combined heat and power (CHP), visit:

Capstone Green Energy Corp.: *capstonegreenenergy.com*

INNIO Jenbacher: *innio.com*

Yanmar America Corp: *yanmar.com*

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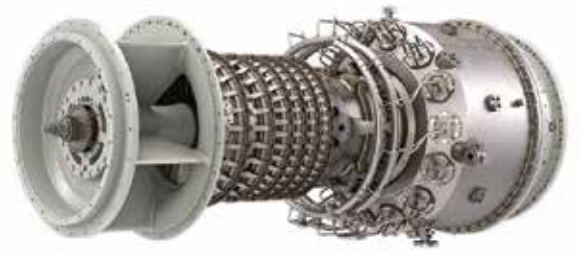

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