

Messiah College Drastically Reduces Energy Costs Through Natural Gas and a Combined Cooling, Heat and Power System

By **Brad Markley** and **Mark A. Fennell**

Messiah College, nestled on a 471-acre picturesque campus in Grantham, is a private Christian college of the Liberal and Applied Arts and Sciences that continually strives for advancement, especially when it comes to serving their 3,000 plus students. For the past decade, Messiah has wanted to bring natural gas to its campus, eliminating the use of propane and the associated maintenance and supply challenges. Because of the seasonality of fuel consumption it had not been cost-effective to have the natural gas pipeline extended to the campus.

UGI Performance Solutions, a division of UGI HVAC Enterprises, Inc., worked extensively with Messiah College to evaluate and develop a Combined Cooling, Heating and Power project that would bolster the College's gas usage and level out monthly usage to make a natural gas pipeline for Messiah College a reality. The goal of the project—to dramatically lower the College's energy costs while increasing energy reliability on its campus. To that end, the team worked with UGI Utilities, the largest natural gas utility in Pennsylvania, to find a cost effective way to bring natural gas to the campus.

The \$7.5 million project consists of the construction of the natural gas pipeline (by UGI Utilities), installation of the CCHP system, electrical distribution to connect to the Sollenberger Sports Center and the Eisenhower Campus Center, and hot water and chilled water piping to connect to both of



these buildings and the Frey Hall heating and cooling system. The Frey Hall loop serves hot water to Frey Hall, Jordan Science Center and Kline Hall; and chilled water to these three buildings, the Chapel and Library. The CCHP system will include a Capstone C1000 Microturbine Generator System (five 200kW turbine units), a 288 ton absorption chiller, an exhaust gas to hot water heat exchanger and all required ancillary equipment. Together it will provide 1,000 KW of power, up to 1.75 MMBTU per hour of hot water and 288 tons of chilled water. The electricity will be provided directly to the Sollenberger Sports Center and the Eisenhower Campus Center, with any excess power being delivered to PPL under the standard net metering rules. This allows the C1000 to operate at full load when the grid is available and offset additional power purchases for

the College without having to create multiple delivery locations.

While this construction project is an investment for Messiah College, it will reap immediate benefits. "At the end of one full year of operating, we conservatively project an \$800,000 savings," said Kathie Shafer, vice president of operations. "The six and a half year pay back and long-term savings this project provides impacts our ability to manage the growing cost of higher education."



The UGI project will give the College the ability to redirect the savings to accomplish major improvements on campus. According to Bradley Markley, director of facility services at Messiah College, "If we did not work with UGI to get natural gas and the combined cooling, heating and power project on campus, most likely we would not have considered other projects. We now refer to three projects—CCHP, the Sports Center Renovation/Gym Expansion and the Dining Hall Addition—as our Student Enhancement Projects. These projects will provide an enhanced environment for our students to not only learn, but also enjoy their free time."

Bob Stoyko, vice president of marketing and consumer relations for UGI Utilities, raved about the project. "We're very pleased to be a part of this project for two reasons. First, the 10,000

feet of pipe we're installing to connect Messiah to our natural gas distribution system will help the College achieve a more efficient and cost-effective energy system. At the same time, the project enables us to make improvements to the West Shore distribution system that will increase capacity in the surrounding community."

"As a higher educational facility, it is our responsibility to concern ourselves with the triple bottom line," says David Walker, Messiah College's vice president for Finance and Planning. The Triple Bottom Line evaluates actions or projects by evaluating three measures of performance: social, environmental and financial. "Taking on the UGI project has helped us address all of them. It will affordably allow the College to advance timeframes of student enhancement projects that will in turn increase the quality of their experience on campus without having to burden them financially."

Back in May of 2014, UGIPS first met with Messiah College and explained the concept of CHP and how it may be an economical method to bring natural gas to the campus. Messiah College provided utility data, hours of operations, data on their existing heating and cooling system and a list of the needs of various campus facilities. UGIPS returned a Preliminary Analysis showing potential

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Energy Savings in Action

With Messiah College's



Brad Markley
director of
facilities



Kathie Shafer
vice president
of operations



David Walker
vice president
of finance

What was your experience going through the process of designing the new CCHP project?

Markley—"The cost analysis that UGIPS did early on is still something we have a lot of confidence in as we move forward. The detailed financial and engineering aspect from UGIPS to design a functional system that has been customized to meet our needs has been really impressive."

Walker—"Our experience was top notch. UGI was very patient with us and we learned a lot along the way. It was a process that could have been very cumbersome and tense, however, UGI helped facilitate a process that at the end of the day was very useful. It's nice to be able to participate in a process of where all our key considerations were taken into account. Ultimately, the milestone-based process, the evaluation, and the due-diligence are what led us to ask our Board to approve the project."

Shafer—"Part of me is still amazed that almost 12 months from the day of our first meeting we will be putting our first set of pipes in the ground."

What results does Messiah College expect as the result of bringing natural gas and CCHP on the campus?

Walker—"Our Board characterized the natural gas and CCHP project as an 'absolute no-brainer.' When you factor in the broader benefits of this project, you have to look at our ability to redirect and redistribute the savings to make two additional campus projects happen that are going to cost approximately \$30 million. For us to look at raising money bundled with financing with municipal bonds or borrowing, and looking at the incremental difference in debt service, we can more than pay for the change in our debt service by the savings this project alone generates."

Shafer—"We conservatively project \$800,000 in savings after the first year. The savings will grow after that. Environmentally, this project will provide annual emission reductions equivalent to 1,354 passenger vehicles taken off the road; the consumption of over 723,000 gallons of gasoline avoided annually; and the import of nearly 15,000 barrels of oil avoided annually. This project will reduce our campus carbon footprint about 25 percent. Our students are passionate about leaving the world a better place than it is today. We signed the Presidents' Climate Commitment and this allows us to have a pretty drastic impact on that."

What advice would you give to other colleges considering CHP?

Shafer—"Make sure you have a good team that is willing to learn and be open to new ideas. Brad has made this successful because he wants to learn about it and supports making it happen. There was a point where we could have said, 'this is great on paper, but we're not doing it.' Instead, our team went in the right direction and now we have a plan in place for making the project a reality. I think that CHP projects are worthy of a conversation for every college."

Walker—"I don't think it is optional for other institutions. They have to think about this type of project because it is the responsible thing to do, on the part of our students and the broader community. I think all higher education institutions in Pennsylvania and beyond really need to pay attention to what we did and evaluate the process, because there will be a lot of additional pressure from the trustees and governing bodies knowing others can do it." ♦

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technical solutions and related economics. This analysis showed that not only would CCHP provide a load profile and gas consumption level to economically bring natural gas to the campus, it would triple the savings the College had originally estimated it would save by just switching from propane to natural gas.

According to Gary Fechter, general manager of UGI Performance Solutions, "UGIPS models a client's energy usage and then uses available prime-mover and thermal utilization technologies to find the best economic fit for each site. We perform 100 percent of the conceptual design to include detailed technical and financial modeling. By utilizing a design-build model and by self-performing the installation with our mechanical [Berkshire Mechanical] and electrical [Denny's Electric] divisions, UGI HVAC Enterprises streamlines the installation and removes a level of mark-up. This helps to keep project costs down and makes the IRR more attractive."

The College was excited about moving forward, but this project would impact the schedules and cost of the Dining Hall Renovation and Gym Expansion projects that were currently in progress. As a result, Kathie Shafer had the UGIPS team present the CCHP concept to a group of College stakeholders. This included the Board President, Department Heads and existing design teams of Spillman Farmer Architects, Wohlsen Construction, Derck & Edson and Gannett Fleming Engineers—companies that would end up having a part in making the centrally located CCHP building a reality. When reminiscing about these early meetings, vice president of Finance David Walker commented, "It caught our attention when UGIPS was able to put together a more than reasonable perspective financially for the college, addressing the issues of finance and those that extend beyond the operating budget that really touch our students in terms of affordability. This was one of those rare opportunities that we had to look at a very sensible ROI-type project that makes sense for us both financially and environmentally. It's a win-win on many fronts."

To become comfortable with the technology, UGIPS and the Messiah team visited several local CHP sites to learn first-hand from system owners about their experiences and the different CHP technologies. Markley

remarked, “I never worked through a CHP project before. I started with the thought of having a stand-alone emergency generator for the campus center that would provide redundant power in the event of a power failure. So 98 to 99 percent of the time, the generator would sit idle and only function when the power goes off. As we learned more about CHP, we saw the ability to have a system that was always functional at providing cooling, heating and power while enhancing our crisis management plan for the campus center.”

There was significant time invested in working together, but it paid off. “When I took this to the President and then to the Board, I shared why this was a non-negotiable project,” Shafer recalled. “First, the projected savings is huge. Managing college budgets and keeping tuition down is a major challenge these days. This return is at a rate that’s much better than our endowment; that has a significant impact long term on when the college needs to raise tuition. This brings our costs down while providing quality spaces to our students. That’s critical. Second, because part of my role is risk/crisis management of this campus,

the fact that we can generate power in a power outage and have a place of refuge for students is huge. People expect it. It’s impossible for a campus to keep all their facilities up and running, but being able to have a place where we can operate when we have a power outage and have students be safe, warm and secure is really important to me.”

The team is completing the detailed design and is in the process of releasing certain portions of the construction out to bid. The internal modifications to the Jordan Science Center mechanical room, the Eisenhower Campus Center’s hot water system and the Sollenberger Sports Center’s chilled water system will be completed this summer. The distribution systems and the new CCHP building are scheduled to be complete by Thanksgiving, and the full CCHP system will begin testing in first quarter of 2016. The system will be fully operational by May 2016. ♦

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