breaking NEWS

Masonic Masterpiece

This is not your typical retrofit.

That's not meant to take anything away from projects that consist of the replacement of old rooftop units, or the change-out of a chiller.

It's just that this project represented a chance for McClure Company, Harrisburg, PA to really stretch its legs and show what Design/Build can accomplish. McClure's promotional materials tout three "T"s that make up the bedrock of the company: talent, tools, and technology. It took every ounce of all three to achieve success at the Masonic Homes of Eizabethtown, Elizabethtown, PA.

Just Your Average, Everyday 1,400 Acre Campus

The Masonic Homes of Elizabethtown is a non-profit continuing care facility located on 1,400 acres in Lancaster County, PA. The buildings on the site range from independent living condominiums, to assisted living apartments, to a fully staffed hospital. In operation since 1910, the Masonic Homes of Elizabethtown houses approximately 1,400 residents, cared for by 1,200 staff.

Other buildings on the campus include a 141,000 sq.ft. Grand Lodge Hall, a 33,600 sq.ft. Cultural Center, and an 8,300 sq.ft. chapel.

All of the campus buildings, whether originals from 1910 or built more recently, feature turn-of-the-century architecture, such as stone facades, large windows, slate roofs, and copper flashings.

Unfortunately for the Masonic Homes, the heating technology for the campus also hailed from early days of the 20th Century. The comfort heating, domestic water heating, laundry steam, and hospital process steam loads were served by a coal-fired, high pressure steam plant. The plant burned approximately 5,000 tons of coal annually to power three boilers that generated a total capacity of 1,050 boiler hp and 120 psi steam.

The high steam pressure was needed to serve dryers and rollers in the laundry. The pressure was
reduced to 50 psi for general campus distribution, and most of the

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HVAC and domestic water needs were served by heat exchangers that accepted further reduced pressure steam, at five to 15 psi.

When it was built, it made sense to locate the coal powerhouse close to rail lines. However, that location ended up being more than half a mile from most of the connected loads. The 50 psi steam was delivered through primary and redundant mains in an underground concrete tunnel system.

Although highly reliable in service, the steam system presented some obvious long-term concerns for the management of the Masonic Homes. These concerns included rising annual maintenance costs, high labor costs (seven full-time staff were needed to keep the plant operational 24/7), and high emissions.

Perhaps the most glaring concern was low net system efficiency, which was roughly 30%.

The leadership of the Masonic organization knew their facilities needed year-round heat. They were also aware of the potential feasibility of implementing a combined heat and power or cogeneration strategy, and were intrigued by Pennsylvania's recent adoption of electric deregulation.

The Masons eventually contacted Pennsylvania Power & Light (PPL) Energy Services to investigate solutions to their goal of modernizing their system. McClure Company, an integrated Design/Build contractor, is a wholly owned subsidiary of PPL.

The rest, as they say, is history.

The Scope of Work

After an extensive feasibility study, McClure's project team developed the following scope of work:

- Decommission the existing coal-fired, high pressure steam plant
- Construct a new, dual-fuel hot water plant centrally located to the connected loads
- Implement a combined heat and power strategy consisting of 300 kW of natural gas-fired microturbine generators
- Construct small, satellite heating plants where steam is needed for process requirements.

McClure's scope of work was accepted by the Masonic Homes' engineering and maintenance staffs for technical merit. The executive management and Board of Directors approved the project when the PPL team demonstrated that it would provide an 8.1% internal rate of return.

The project took more than three years to complete, with much of that time spent up front. McClure Co. conducted all the applicable energy models, and determined a guaranteed maximum price for the recommendations.

McClure served as the prime contractor and construction manager for the project. The 51-year-old company has 225 employees and projects total sales volume of $50 million in 2004. In addition to Design/Build services, the company also handles traditional mechanical plan-and-

spec projects, and has a mechanical services division.

At the Masonic Homes, McClure subcontracted the electrical work to a trusted partner, and, in a reversal of typical roles, hired a general contractor experienced with the Design/Build delivery system. In addition, McClure personnel commissioned the new systems. In short, it was true Design/Build on a grand scale.

“With more than 50% of the contract value being attributed to the mechanical systems, it was easy to justify the sensibility of having the mechanical contractor manage the entire construction process,” says McClure Co.’s Dan Kerr, P.E., director of Design/Build Services.

Design/Build Shines

The case is often made that Design/Build is the best delivery method for the customer. That was certainly the case at the Masonic Homes.

McClure Co. saved the Masonic Homes more than $700,000 through adaptive re-use of existing infrastructure. Tapping the under-utilized Grand Master’s garage as the new central plant saved more than $200,000 in construction costs. Adapting the existing primary and redundant steam supply lines to hot water supply and return duty saved an additional $500,000.

McClure Co. also modeled the heating and domestic hot water usage for the campus, and sized the microturbines to produce only enough heat output to satisfy the continuous summer thermal load. This corresponded to a little less than 10% of the peak load. This not only ensured that the turbines would provide useful heat at all times, it also avoided the “stranded costs” charged by the local utility if the campus produced more than 10% of its own electrical requirement.

McClure’s association with PPL also benefited the Masonic Homes. In Elizabethtown, electric rates are relatively low, and natural gas rates are volatile. To counter possible negative impacts on the project’s economic projections, PPL offered the Masonic Homes a 16-month price lock and an additional 50 cents/MMBtu risk hedge on natural gas pricing.

Goals Met, Expectations Exceeded

Following commissioning and operating experience in central Pennsylvania’s four-seasons climate, it’s apparent that McClure’s design intent and performance goals at the Masonic Homes of Elizabethtown have been met.

The central heating plant provides reliable heat to all of the campus’ ancillary mechanical rooms, and the satellite steam generating plants also perform in accordance with their design intent.

The central plant now employs a single operator for a single shift, five days per week. An integrated energy monitoring, management, and control system allows for real-time monitoring of the system from remote locations.

Plant emissions have been reduced by more than 90%, enabling the Masonic Homes to shed its Title V status with the Pennsylvania Department of Environmental Protection. This has reduced the facility’s regulatory controls and costs.

The microturbines, despite some early stumbles, have helped the project exceed the rate of return originally projected in the feasibility studies. “We had a particularly harsh winter, and the microturbines didn’t take much of a liking to horizontal sleet and snow,” Kerr notes. “However, with the help of the manufacturer, all the bugs were eventually worked out.”

Finally, net operating efficiency of the system has increased to more than 60%.

“When it comes to this project, the microturbines get the most attention,“ Kerr says. “Everybody wants to talk about that, because it’s new technology. But I don’t think the microturbines should overshadow what a difficult construction project this was. We kept the whole campus operational while we decommissioned an existing steam plant and simultaneously commissioned a new hot water plant. That was quite a feat, and I’m pretty well convinced that it couldn’t have been done except by an integrated Design/Build contractor.”

A Perfect Score

Is this an example of the best that the Design/Build process can offer? One of the judges brought in by Contracting Business to review this year’s entries awarded McClure 100 out of 100 possible points, in categories such as design quality, economic impact, unique problems resolved, and commissioning. “This was a highly qualified firm providing an excellent long-term vision for its clients,” he said.

Joseph E. Murphy, CEO of the Masonic Homes of Elizabethtown, has similar praise for McClure.

“This was a fairly cutting-edge project, and we knew that on a project like this everything wasn’t going to go perfectly,” Murphy says. “So while I was impressed with McClure’s design, and with the quality of their work, what really made this project stand out was the follow-up. For example, we were very pleased with the way they handled some initial problems with the turbines.

“Dan and his group did an excellent job for us. We’ve been seeing the results, and it’s been very positive for our organization,” Murphy adds.

Congratulations to McClure Co. for putting its talent, tools, and technology to work for its clients, and, in the process, putting a new star in the Design/Build sky.

Winner at a Glance

Category B* - *Retrofit/Renovation more than $500,000

Company: McClure Company, Harrisburg, PA

Project Name/Location: Masonic Homes of Elizabethtown, Elizabethtown, PA

Total Cost: $3,600,000

Key Customer Contact: Joseph E. Murphy, CEO, Masonic Homes of Elizabethtown

Nomination Submitted By: Daniel P. Kerr, P.E., director of Design/Build Services, McClure Company

The Project Team:

- Joseph E. Murphy, CEO, and Jeffrey J. Gromis, facilities engineer, Masonic Homes of Elizabethtown
- Daniel P. Kerr, P.E., director of Design/Build Services; Dean E. Badorf, project manager; Matt Tressler, mechanical designer; and Jason J. Richards, P.E., C.E.M., account manager, McClure Company
- Jeffrey Sterner, P.E., senior vice president and general manager, High Construction (general contractor)
- William N. Luddy, P.E., president, IETC (electrical contactor)

Products Key To Success:

- 3 Bryan hot water boilers, model RW1260-W-FDGO
- 5 Capstone microturbine generators, model C60
- 2 Unifin heat recovery heat exchangers, model MG4
- 1 Unifin heat recovery heat exchanger, model MG2
- 3 Aurora boiler pumps, model 413
- 2 Aurora distribution pumps, model HSC
- 1 Highland fuel oil tank, model S2
- 1 BFS fuel oil duplex pump, model BFS 2HJ-1L
- 1 Century boiler sequencing panel, model CC-600
- 1 Trane Building Automation System
- 7 Tranter hot water heat exchangers, model UFX
- 7 Reco domestic hot water storage heaters, model TMH
- 1 Hurst steam generator, model 4VT-100
- 2 Burnham steam boilers, model 5P-100