

Residential/Public Facility

## Masonic Village

Several years ago, officials at Masonic Village at Elizabethtown, Pennsylvania, weary of the campus' 90-year-old, inefficient coal-fired steam system – and the high emissions associated with burning coal – knew it was time to move to a next-generation technology for their heating and electric needs – combined heat and power (CHP).

Masonic Village is a sprawling continuing-care retirement community, children's home, and community-service organization that opened in 1910. Today, the 1,400-acre complex serves more than 1,700 residents cared for by 1,300 staff.

For decades, the complex's old coal plant burned in excess of 5,000 tons of coal each year to produce heat for laundry and space heating.

### Low Emission, High Efficiency Capstone MicroTurbines® Installed

Eager for a change and after conducting deep research, Masonic Village in 2002 installed five C60 low-emission Capstone microturbines that produce a combined 300kW of electricity. The microturbines are designed specifically for CHP applications. For five years, the natural-gas microturbines supplied existing base-load hot water needs, and simultaneously created electric power for the campus. The reliable, clean-and-green turbines drastically lowered emissions and improved energy efficiency.

In the meantime, at its California headquarters, Capstone's product-development team continuously worked to enhance the microturbine and developed an integrated heat-recovery module (known today as the C65 ICHP), which generates 65kW of electricity and ejects 408,000 BTUs an hour.



## At a glance

### Location

Elizabethtown, Pennsylvania, USA

### Commissioned

- 2002 – five Capstone C60 microturbines
- 2007 – all microturbines upgraded to C65 ICHP units
- 2011 – added sixth Capstone C65 microturbine

### Fuel

Natural gas

### Technologies

- Six Capstone C65 ICHP microturbines used in a CHP application.
- Capstone-designed integrated Heat Recovery Modules on each microturbine.
- Remote monitoring allows real-time remote monitoring, alarming, and trouble shooting of the power plant via the Internet.

### Results

- 2015 – system array has exceeded 550,000 hours of energy production.
- The six Capstone ICHP microturbines produce 390kW, which is 90kW more than the original Capstone installation.
- Each C65 ICHP produces 408,000 BTUs an hour.
- 47% increase in net heat recovered.
- Overall system efficiency of approximately 83%.
- Capstone Heat Recovery Modules are on top of each microturbine, meaning the entire system takes up much less space than the earlier installation.

### **Quick Upgrade in 2007**

Masonic Village officials, delighted with the performance of the original natural-gas C60s, agreed in late 2007 to upgrade the CHP microturbines to C65 ICHP microturbines. Working with local Capstone distributor E-Finity Distributed Generation, the retrofit increased the onsite power plant's thermal- and electrical-energy efficiency virtually overnight.

In addition to the five C65 ICHP microturbines, E-Finity and Capstone also installed the Capstone-designed integrated Heat Recovery Modules on each microturbine as well as the Capstone Service Network that allows real-time remote monitoring, alarming, and troubleshooting of the power plant via the Internet.

During cold, rainy weather in December 2007, three employees from Capstone and E-Finity upgraded the five microturbines in less than 48 hours. In fact, the retrofit was so efficient that the array of microturbines was only down for a total of eight hours.

### **More Efficient Microturbine Array**

The new system produces 325kW, which is 25kW more than the original Capstone installation. Masonic Village has seen a 47 percent increase in net heat recovered, and an overall system efficiency of approximately 83 percent.

The original Capstone installation placed third-party heat exchangers beside each turbine. After the upgrade, the Capstone Heat Recovery Modules sit on top of each microturbine, meaning the entire system takes up much less space.

"The upgraded system at Masonic Village nearly doubles the thermal energy output of the microturbines and has increased the electricity produced," said Jeff Beiter, Managing Partner, E-Finity Distributed Generation. "There's less equipment than the original footprint, so the space impact is minimal. The return on investment is quick on a project of this caliber because of the increased system efficiency."

The 2007 upgrade also included a five-year Capstone Factory Protection Plan, with a second complete overhaul scheduled after the next 40,000 hours of operation, projected to occur in 2012. E-Finity officials indicate the array of microturbines will not need another major overhaul after that until 2017.

When compared to the original coal-fired plant Masonic Village used for more than 90 years, the Capstone installation emissions are so low, the plant is the equivalent of removing 642 cars off the road or planting 1,000 acres of forest. ■

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*— Jeff Beiter, Managing Partner,  
E-Finity Distributed Generation*



*Capstone microturbines generate electricity and heating at Masonic Village, a 1,400-acre complex serving more than 1,700 residents since 1910.*