OPTERRA
ENERGY SERVICES

Eastern Michigan University

2012
AWARD WINNER

The Opportunity

In the spring of 2009, Eastern Michigan University (EMU) identified two key goals they wanted to meet during the renovation of four campus residence halls and two dining halls: make the spaces more efficient to operate and more comfortable for students and faculty. With the help of OpTerra Energy Services, EMU was able to achieve their goals during the implementation of a design-build project. With OpTerra as their trusted partner through every step of this program, EMU was able to make essential facility upgrades that resulted in reducing energy costs by several million dollars over the life of the program.

After completing comprehensive facility upgrades during the successful first phase of work, EMU partnered again with OpTerra in the fall of 2016 to improve the performance, reliability and efficiency of its Central Heating Plant. The University needed to replace a 64-year-old boiler and a 28-year-old cogeneration system located inside the Central Heating Plant, both which were nearing the end of their useful lives.

The Partnership

Starting in 2009, OpTerra installed new boilers to replace a failing system that was wasting thousands of gallons of heated water every year. OpTerra converted four residence halls from a steam system to a hot water system and put thermostats in each room for optimum heat control and comfort of students.

The cogeneration modernizations in development will provide greater power reliability for the community. The new turbine and corresponding Heat Recovery Steam Generator are capable of producing up to 7.8 MW of power and 90 MMBtu of steam, respectively. This production is a significant improvement compared to the output of the old system, which topped out at 4.5 MW and 56 MMBtu. Such a large increase in generation capacity from that of the current cogeneration system will be an advantage for both the University and community. In the event of a major utility outage, EMU will be in a position to be a safe-haven for the surrounding community.

The upgrades inside of the Central Heating Plant represent a unique learning opportunity for students attending EMU's College of Technology. OpTerra's education team is working with University faculty to roll out an internship program which will utilize the cogeneration technology as a real-world learning opportunity. Over the course of

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Program Highlights

- Expected to save $2.8MM annually from upcoming cogeneration modernizations
- Renovated cogeneration facility is expected to create up to 50 local jobs and increase local spending by roughly $4.3MM
- Developing an eight-week internship program to give students direct, real-world access to cogeneration technology while shadowing OpTerra engineers and construction managers

The Technical Scope

Phase I - Comprehensive Facility Upgrades:

- Replacement boilers
- Building envelope improvements
- Air handling improvements, providing what is needed to heat/cool the space
- Improved energy management systems
- Replacement of 727 windows with new energy efficient windows
- Improved water pressure and hot water storage
- Thermostat controls
- Industrial kitchen appliance upgrades

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Phase II - Cogeneration Facility Modernizations, In Development

- Solar Taurus 70 Natural Gas-Fired Turbine (7.8 MW)
- 90 MMBtu Heat Recovery Steam Generator
- Exhaust by-pass duct
- Natural gas compressor station equipped with redundant compressors
- New switch gear & control center
- Black start generator

the eight-week internship program, two to four students per cycle are given the chance to shadow engineers and construction managers on the project site to gain practical knowledge through direct, hands-on experience. Faculty and students look forward to the launch of this internship opportunity aligning with the beginning of cogeneration modernizations in 2017.

The Impact

Recognizing the achievement of energy savings at a higher education institution, EMU was awarded the Energy Services Coalition's Annual Energy Efficiency Project Award in 2012. Following project implementation, EMU was also named one of the top green colleges in the country by the Princeton Review, and has continued to pioneer environmental change over the past seven years, becoming a model for other colleges and universities across the nation.

With the forthcoming cogeneration modernizations, EMU can anticipate further positive impact campus-wide, including:

Boosting Efficiency and Savings

- Upgrades at the Central Heating Plant will increase campus efficiency from 68% to 83%, resulting in savings of roughly $2.8MM per year

Being More Resilient

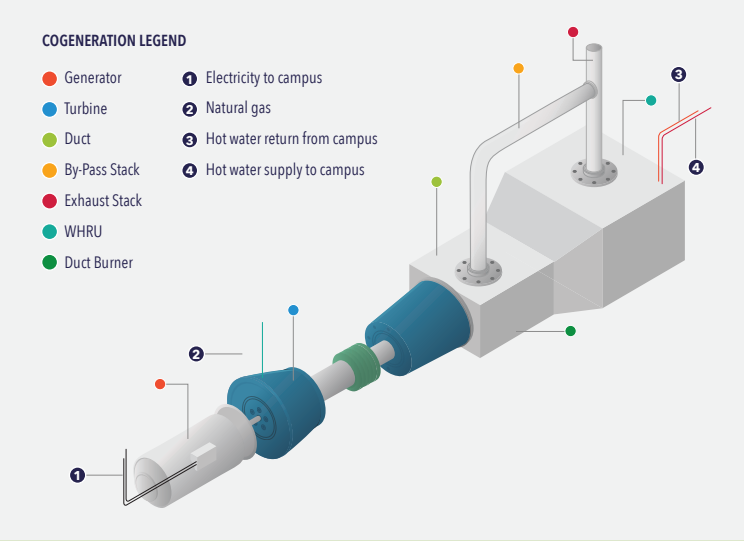
- The renovated cogeneration system is capable of producing up to 7.8 MW of power and 90 MMBtu of steam, meaning EMU will be generating 98% of the campus heat requirements and 93% of campus electrical requirements.

Reducing Carbon Footprint

- Offsets annual CO_2 emissions by 48,791 metric tons per year, equivalent to removing more than 10,300 passenger vehicles from the road

Cogeneration at EMU: How it Works

The cogeneration system at EMU uses natural gas to power the turbine, which generates electricity and heat from the exhaust air stream, thus producing electric and thermal energy from a single source of fuel.



1. The exhaust air stream, at approximately 950° F, is channeled into a Heat Recovery Steam Generator (HRSG).
2. The steam is then sent out to campus via the steam distribution system.
3. When the University's thermal load exceeds the recoverable energy from the exhaust, a supplemental duct burner in the HRSG provides additional thermal capacity at 90% + efficiency.
4. The cogeneration system operates utilizing an electric import control strategy. The system allows for an electric import set point, which is adjustable to ensure power is always flowing into campus as required by the utility.