



University of Central Florida

5.5 MW CHP System with District Energy

Project Overview

The University of Central Florida (UCF), located in Orlando, is the nation's second-largest university with 210 degree programs to choose from and approximately 61,000 students enrolled. The main campus stretches 1,415 acres, has 180 buildings totaling 9 million gross square feet. The built space includes on-campus housing of 11 communities for 12,000 students. The university employs 11,074 people and has an operating budget of approximately \$1.5 billion.



Quick Facts

LOCATION: Orlando, FL
MARKET SECTOR: University
FUEL: Natural Gas
GENERATING CAPACITY: 5.5 MW
IN OPERATION SINCE: 2012
EQUIPMENT: Mitsubishi 18KU30GSI
 992 ton Thermax absorption chiller
USE OF ELECTRIC ENERGY: On-site
USE OF THERMAL ENERGY: Cooling
INSTALLED COSTS: \$12 million
ESTIMATED ANNUAL SAVINGS: \$2.1 million
SIMPLE PAYBACK: ~6 years
ENVIRONMENTAL BENEFITS: 96% reduction in NOx, 60% reduction of VOCs, 50% reduction of CO2 ~ 3,000 tons/year
EFFICIENCY: 78%

In 2012 UCF started the operation of a 5.5 MW natural gas fueled CHP system that supplies one third of the campus' total electricity demand. The plant is powered by a Mitsubishi reciprocating engine and features a 992 ton Thermax absorption chiller that uses the waste heat recovered from the engine's exhaust and water jacket to produce chilled water.

Reasons for Installing Combined Heat & Power

For 15 years UCF placed extra focus on energy efficiency, renewable energy, energy storage, and conservation projects. In 2007 UCF started a revolving energy program for the sole purpose of funding these projects. UCF used to have a district hot water loop that was abandoned years ago. Being in Florida they still have a significant cooling load. They decided therefore to explore the option of a base loaded CHP central energy plant that covers approximately one third of their electricity load and part of their cooling load. The project's main goals included cost avoidance, a 5-year payback, clean and affordable fuel, reduced emissions, and resiliency.

"Our primary goal for the CHP project was cost reduction. The reduction of emissions was an ancillary benefit of the project. Within the first 2 years of operation, we were very pleased that the savings averaged more than \$2M per year. We are on track to pay back the \$12M startup cost within the first six years of operation."

David Norvell, Assistant VP for Sustainability Initiatives, UCF

Equipment , Configuration & Operation

Equipment

- Mitsubishi 18KU30GSI – 18V, 720 RPM
- 992 ton Thermax absorption chiller



Operation

Natural gas fuels a 5.5 MW reciprocating engine. The 18KU30GSI Mitsubishi is an 18 cylinder, 720 RPM lean burn spark ignition engine. Due to the low speed, the engine life exceeds 160,000 hours. For the UCF operating schedule, this means that the engine should operate for 20 years without requiring major overhaul. The waste heat streams from both the engine's cooling jacket and exhaust are fed to a 992 ton Thermax absorption chiller which is used to supplement the existing chilled water district system. Under optimal circumstances, the CHP plant has the capability to generate 52 million kWh per year.

In the first quarter of 2014, the CHP system yielded energy savings of \$753,000 and when the year closed a total of \$2.1M in energy savings was reported.

Lessons Learned

- Interconnection Arrangement: Including a microgrid with islanding capability increases resiliency; which UCF plans to include in their next CHP project.
- Design/ Construction Cost Control: Using different companies in different parts of the world can be challenging. Limit risks by ensuring sufficiently detailed cost estimates.
- Maintainability: Make sure replacement parts and qualified maintenance personnel are easily available domestically, since a lot of this type of equipment is not produced domestically anymore. UCF took this into account when purchasing equipment and completing their risk analysis.
- Availability and Reliability: Understand the utility's standby charge potential impact that is necessary for reliability purposes. Planned and unplanned maintenance schedules should be well accounted for in economic analyses. UCF included these in the financial model and was able to analyze the impact they have on payback.
- Use of Waste Heat: In future plans, UCF plans to be more aggressive in the utilization of waste heat, and look at other possibilities besides cooling to further improve the CHP plant's efficiency.



For More Information

U.S. DOE SOUTHEAST CHP TECHNICAL ASSISTANCE PARTNERSHIP

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