SHOWCASE PROJECT: GENERAL ELECTRIC: HVAC ENTHALPY CONTROLS UPGRADE

SOLUTION OVERVIEW

GE Gas Power Systems owns a 1.5 million square foot gas turbine manufacturing facility in Greenville, South Carolina. In 2013, the company initiated a project to upgrade the location's 100 rooftop heating, ventilation, and air conditioning (HVAC) units. The units were 15 to 25 years old and provided a total capacity of approximately 6000 refrigeration tons, equivalent to 72 million British thermal units (BTU). Rather than replace the units, GE planned to upgrade them with modern enthalpy controls, which were estimated to save energy at a much lower cost.

Enthalpy controls, also referred to as "economizers" or "free cooling," can rarely be found in older facilities. They check to see if both the outside temperature (sensible heat) and the outside humidity (latent heat) are low enough to be used for indoor cooling. If the indoor thermostat calls for cooling and the outside air enthalpy (total heat) is low enough, the economizer brings in the cooler and less humid air instead of operating a compressor, allowing for greater energy savings.

SECTOR TYPE

Industrial

LOCATION

South Carolina

PROJECT SIZE

1,500,000 Square Feet

FINANCIAL OVERVIEW

$835,960

SOLUTIONS

After conducting a proof of concept on two units, GE projected that installing modern enthalpy controls would reduce rooftop energy consumption by 50% per year, bringing it down from approximately 35,000 MWh to 17,000 MWh with annual dollar savings of roughly $1 million. Capital investment and installation consisted of a one-time expense of less than a $1 million, covering HVAC controls, variable damper controls, new non-slip fan belts, filter sensors, and power meters. Simply installing new HVAC units could have cost between $5 million and $10 million. Funds were allocated in late 2013 and the facility's HVAC rooftop controls were upgraded by June 2014. A second proof of concept project was conducted after half of the controls and power sub-meters were

installed. The outcome of the study modified projected energy use from 17,000 MWh to 15,500 MWh, exceeding the initial study's estimated savings.

Summary of energy efficiency measures:

- Installing modern enthalpy controls on all 100 rooftop HVAC units
- Implementing power sub-meters

The enthalpy controls are programmed to automatically use outside air for partial cooling if the outside air is at least 5 degrees cooler than the inside recirculated air. This reduces the need for mechanical cooling.

The power sub-meters enable GE to not only track total reduction, but also track usage by physical location or business component. When the company sees an area suddenly rise in usage, it can then target efforts to improve efficiency.

OTHER BENEFITS

The enthalpy controls provide for greater comfort for the facility's employees at lower cost to GE. The facilities team maintains the manufacturing floor temperature comfort level between 70°F and 75°F. GE determined this ideal temperature range by looking at years of studies on the various heat loads generated at each work space and the most effective installation of HVAC units to maintain each space. As the company has 1.5 million square feet of conditioned manufacturing space, balancing cost and comfort has long been a challenge.

With enthalpy controls, GE now has excess capacity on compressors so it can respond quicker to temperature changes. Bringing in outside air to cool the building is most effective in the spring and fall. There are also energy efficiency gains because before the controls' installation, manufacturing equipment would have required cooling all year long due to latent heat.

The "annual plant electricity use" bar chart in the first tab below shows 2013 and 2014 annual plant electricity index numbers. Those numbers are calculated using the following formulas: Baseline Electricity Use Index (2013) = (Baseline Electricity Consumption)/(Baseline Electricity Consumption) Actual Electricity Use Index (2014) = (Baseline Electricity Consumption – Expected Electricity Savings)/ (Baseline Electricity Consumption)

Annual Energy Use

Annual Energy Cost

Energy Savings

Cost Savings

100 roof-mounted HVAC units, each the size of a small RV

GE's upgraded HVAC units

HVAC controls are constantly monitored on the facility network