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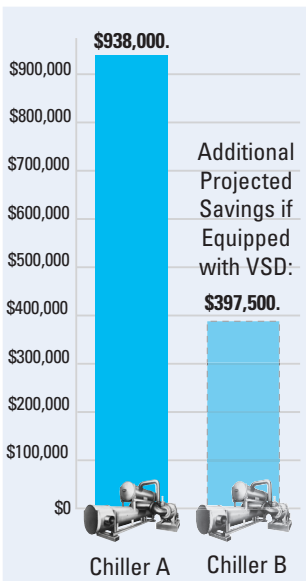
Case Study – Oklahoma State University

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Study of Chiller with Variable Speed Drive Confirms Substantial Savings

Energy Cost Savings with Variable Speed Drive



Project Objectives

For nearly four decades, Oklahoma State University has had a chiller equipment and plant expansion program commensurate with the growing needs of its campus community. Integral to this has been the purchase of five Carrier chillers — equipped with fixed-speed drives as well as Variable Speed Drives (VSD). As an efficient energy management strategy would contribute to improving the school's bottom line, OSU's engineers needed to accurately calculate and verify the energy savings between their chillers.

Solution

The OSU Utilities Department conducted an independent three-year benchmark study to compare the efficiency of two Carrier 4,200-ton chillers — one with a fixed speed drive, and the other equipped with a variable speed drive. Since the system had numerous optimization items, good operations practices and good maintenance, OSU was able to establish a baseline comparison with two Carrier 17DA 4,200-ton chillers operating in parallel. Their findings concluded that the Carrier chiller using the VSD saved the University nearly \$1 million in operating costs.

Dramatic energy savings were confirmed by a three-year independent study conducted by Oklahoma State University's Utilities Department which compared the operating costs of two identical Carrier 17DA chillers — one equipped with a Variable Speed Drive, one without.



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Case Study – Oklahoma State University *continued*

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Bill Burton
Utilities Manager
Oklahoma State University

Project Synopsis

Energy cost containment was one of the driving factors behind a recent 3-year benchmark study conducted by Oklahoma State University's Utilities department which compared the efficiency of two identical 4,200-ton chillers — one with a fixed speed drive, and the other with a Variable Speed Drive (VSD). Prior to the study, engineers from OSU had visited nearby University of Oklahoma to see the operation of the two VSDs installed on their chillers. What they saw firsthand was increased efficiency and lower operating costs. This research would prove invaluable in conducting the study for equipment serving OSU's sprawling 600 acre campus with 84 buildings and over 6.1 million sq.ft. of space served by the central chilled water system.

According to OSU's Utilities Manager, Bill Burton, the results of the study were remarkable. "This study confirmed my notion that a chiller with a VSD offers greater efficiency and lower operating costs under the operating conditions of the OSU Chilled Water Plant," said Burton. "The testing environment was perfect. There were no variables to skew the results." Specifically, using the VSD chiller over a three-year period saved the University nearly \$1 million. It was also determined that an additional \$400,000 could have been saved if the second chiller had a VSD as well.

Carrier's VSD strategy varies the compressor's speed, which proportionately affects power consumption at part load and dramatically increases efficiency. This increases the refrigeration cycle efficiency thereby decreasing the energy costs for cooling.

Richard Rauschuber, Service Engineer, Carrier Corporation, worked with OSU's Utilities personnel to make sure that all system elements were designed and operating at peak efficiency. Cooling towers are controlled to provide the coolest condenser water temperature to the chillers. The variable volume pumping operates in a range of 50% – 100% which is another energy savings component to the total optimized chiller operation and chilled water distribution system. "The use of the Variable Speed Primary in combination with the Variable Speed Drive is excellent", Burton stated. The chilled water system design is further enhanced by the use of a decoupled system piping design. Additionally, each chiller is equipped with a kWh and BTU meter so that personnel can view the chiller's operation in real time.

By partnering with OSU's Utilities personnel, the experts at Carrier were able to help achieve the goals of reducing energy costs and improving equipment operating conditions. "All utilities are critical to the University," said Burton. "The main mission of the Utilities Department is to support the campus community by producing properly regulated uninterrupted utilities efficiently."

Project Summary

Location: Stillwater, OK

Project Type: Applied/Retrofit

Building Age: Various; the oldest being 115 years with several more currently in the design stage

Building Type/Size: 84 separate buildings totalling more than 6.1 million sq.ft.

Building Usage: College Campus

Objectives: Confirmation of operational efficiencies and energy savings with VSD-equipped Carrier chillers

Major Design Drivers: Ongoing campus-wide program of energy cost containment

Design Considerations: Chiller plant upgrade for increased efficiency, reduced operational costs and chilled water generation to serve existing buildings and new construction

HVAC Equipment: Five Carrier chillers, including two 17DA 4200 ton chillers; one with a fixed speed drive and one with a Variable Speed Drive

Unique Features: 4160 volt VSD design for medium voltage application

Installation Date: 1986

For more information, contact your nearest Carrier Representative, call 1.800.CARRIER or visit our web site at www.commercial.carrier.com