

GRINNELL COLLEGE

ALEX NEUMANN
MECHANICAL ENGINEERING, IOWA STATE UNIVERSITY



COMPANY BACKGROUND



GRINNELL

Grinnell College is a private college located in Grinnell, Iowa. The college serves approximately 1,500 undergraduate students and employs about 200 faculty members. There are more than 60 buildings on campus, including classrooms, offices, athletic facilities, and dorms. Many buildings were built in the last ten years and many others have been renovated. Most buildings use heat provided by a central boiler plant, and air conditioning provided by a central chiller plant.

PROJECT BACKGROUND

The intern focused on three main projects: Expansion and renovation of the chiller plant, including installation of reheat chillers; renovation of the air handling units (AHUs) in Norris Hall dormitory; and the installation of motion sensors in the Alumni Recitation Hall (ARH).

INCENTIVES TO CHANGE

There would be many benefits to renovating the chiller plant. Reheat chillers recover heat that is normally dissipated into the atmosphere and use the heat to provide energy for domestic hot water. This process would not only decrease the overall cost of daily energy use at the campus, but would also decrease the emissions of the heating, ventilation and air conditioning (HVAC) systems. Improving the efficiency of the AHUs in Norris Hall would also significantly decrease the daily costs of HVAC. Finally, installing motion sensors in ARH would dramatically save HVAC costs. All three projects would decrease thermal and pollutant emissions.

RESULTS

Renovation of Chiller Plant: The intern evaluated two options for upgrading the chillers. The first was to replace three outdated, but still operational, chillers. An analysis of this project concluded that this would not be economically

feasible at this time. The intern also analyzed the option of installing reheat chillers. These chillers not only provide chilled water for air conditioning; they also provide hot water for any necessary load. The result would be that the summer heating load would decrease to the point where the 250 horsepower boiler is powerful enough to handle the load. Even taking into account a slight increase in electric consumption, this project would save the college more than \$24,000 per year.

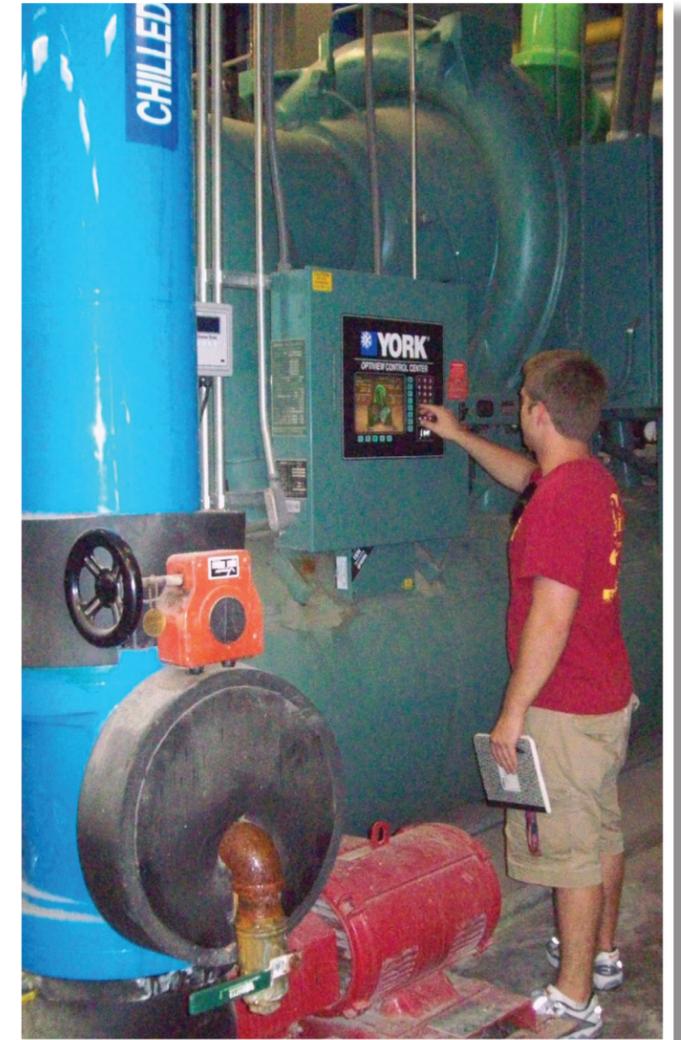


Air Handling Units in Norris Hall: There are two AHUs in Norris Hall. One is operational, but uses outdated technology; the other is an archaic machine that needs to be replaced for economic, environmental, and sanitation reasons. The solution would be to install a variable frequency drive (VFD) control on the newer unit, replace the old unit, and install a heat recovery wheel in the relief vent. All of these projects would assist in decreasing the demand on utilities, and would consequently decrease the emission of pollutants into the atmosphere.

Motion Sensors in Alumni Recitation Hall: Installing motion sensors on the variable air volume (VAV) boxes throughout the ARH building would greatly decrease the heating and cooling demands in the winter and summer. This decrease in demand would provide significant savings in utility costs from the boiler plant and chiller plant, and the project would pay for itself in less than one school year. The college could expect similar results if it were to install motion sensors throughout other buildings on campus.

CONVENTIONAL AIR POLLUTANTS AND GREEN HOUSE GASES DIVERTED IN STANDARD TONS

Total for all sectors					
CO ₂	SO ₂	CH ₄	N ₂ O	CFC	PM-10
39.41	0.11	65.06	0.17	0.50	0.01



PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
RENOVATION OF THE CHILLER PLANT	\$24,400	78,210 THERMS	RECOMMENDED
AIR HANDLING UNITS IN NORRIS HALL	\$6,060	3,555 THERMS	RECOMMENDED
MOTION SENSORS IN ARH	\$12,400	15,111 THERMS	RECOMMENDED