GRINNELL COLLEGE

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GRINNELL

COMPANY BACKGROUND

Grinnell College is a private liberal arts college located in Grinnell, Iowa. Approximately 1,600 students from all states and about 50 countries are enrolled at Grinnell College, and the college employs approximately 600 faculty and staff. The campus covers 120 acres with 64 buildings and a 365-acre environmental research area. Since its founding in 1846, the college has pursued its mission to educate its students "for the different professions and for the honorable discharge of the duties of life."

PROJECT BACKGROUND

The Pollution Prevention intern at Grinnell College worked on two main projects: boiler retrofits and rainwater harvesting. The boiler plant consumes over 90 percent of the natural gas used by the college and presents opportunities for changes that will save money and reduce emissions. The intern also examined rainwater harvesting as a possible water supply for the chiller plant cooling towers.

INCENTIVES TO CHANGE

Grinnell College is very dedicated to environmental stewardship. Two buildings on campus are LEED Silver Certified and the Environmental Education Center at the Conrad Environmental Research Area is LEED Gold Certified. The president of the college recently signed the American College and University Presidents Climate Commitment. This signifies Grinnell College's commitment to reduce emissions as the college works towards climate neutrality. The college has also formed a committee that is writing a comprehensive sustainability plan for the campus.

RESULTS

Boiler Economizers: The boiler plant at Grinnell College consists of three 500 hp and two 600 hp fire-tube boilers. The plant provides steam throughout campus for heating, dehumidification, and domestic hot water use. Economizers use the heat from the exhaust stack to pre-heat the boiler feedwater, reducing the amount of natural gas needed for combustion. Adding economizers to all five boilers would reduce the college's total natural gas consumption by 5.7 percent and save $57,132 annually. The emissions reductions would help the college as it works towards climate neutrality.

Variable Frequency Drives for Blowers: Variable frequency drives (VFD) control the speed of the motor to match the required load under varying conditions. The savings potential associated with VFDs is greatest when the load on the motor is less than the maximum continuous rating for long time periods and when the burner must operate at low- or mid-fire. These conditions are common for the boiler plant at the college. Adding VFDs would reduce the facility's electricity consumption by 117,000 kWh each year.

Rainwater Harvesting: Grinnell receives an average of 36.59 inches of precipitation each year. Rainwater collection from the chiller plant and Noyce Science Center roofs could provide 1,480,250 gallons of water for chiller plant make-up water annually. However, with an initial cost of over $100,000 and annual savings of $9,770, the project is not recommended at this time.

Solar Water Heating System: In 2011, a solar water heating system was installed on the EcoHouse, a project house owned by Grinnell College. The system was added as a testing opportunity for the students who lived in the EcoHouse, so payback was not calculated before purchasing the system. Since its installation, the system has collected 380.94 therms, resulting in a payback of 26 years. More research is needed to determine if solar water heating systems would be feasible for other housing on campus.

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN STANDARD TONS

Total for all sectors					
CO_2	SO_2	CH_4	N_2O	CFC	PM_{10}
230.28	0.61	89.66	0.22	1.71	0.02

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
BOILER ECONOMIZERS	$57,132	90,686 THERMS	RECOMMENDED
VARIABLE FREQUENCY DRIVES FOR BLOWERS	$7,804	117,000 KWH	RECOMMENDED
RAINWATER HARVESTING	$9,770	1,480,250 GALLONS	NOT FEASIBLE AT THIS TIME
SOLAR WATER HEATING SYSTEM	$348	344 THERMS	MORE RESEARCH NEEDED