Energy

Geothermal Energy System

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Summary: Many colleges and universities face severe budgetary challenges as they strive to operate, update, and replace aging, inefficient buildings. Enrollment is rising along with energy costs and student demand for energy-intensive amenities like air conditioning, high-speed Internet connections, and voice mail. Eastern Connecticut State University (ECSU) has found a way to reduce operating costs and improve the campus environment by making energy-efficient building improvements. By renovating an existing building, ECSU has provided air conditioning to the residents and reduced energy and natural resource consumption at the same time. Recently, ECSU renovated a 30 year old, nine story residential hall that was originally heated with traditional electric resistance baseboard. During the planning stages of this project, it was decided that the electrical heat would be replaced with a more efficient system and that air conditioning would be integrated into the building. When the renovation was completed, the electric resistance heat was removed and replaced with a two-pipe fan coil system with the heating and cooling water generated in the geothermal heat pump system.

Eastern Connecticut State University

Campus Profile

Eastern Connecticut State University
Willimantic, CT
Full Time UG Students: 3,574
Total Students: 5,337
Faculty: 650
# of Buildings:
GSF of all Buildings: 1,267,000 sq ft

Project Goals

- Replace existing heating system, since it was at the end of its useful life.
- Introduce Air Conditioning for the residence.
- Reduce the heating energy cost in this building.
- Generate energy for this building by using natural renewable resources.
- Reduce Greenhouse gas emissions.

More "Energy" projects at ECSU….

- Installed "Vending Misers" on all vending machines
- We have a few solar powered pole lights
- Replaced all electric ballast with an electronic ballast
- Installed motion sensors in classrooms and offices
- Heating and Cooling of buildings is programmed to turn back at off peak hours.
- Both of the main heating plants are dual fuel, Natural Gas and #2 Oil

Description

As fuel prices skyrocket all over the country, the benefits of renewable energy could provide cheaper energy to many colleges and universities. Access to cost-efficient, environmentally friendly utility services at these institutions is beginning to change. As our nation struggles to find a workable balance between people and nature, colleges and universities continue to demonstrate positive and practical solutions to the energy debate through conservation and efficiency. ECSU is turning their attention to recycling, sustainable development, use of renewable energy, and to increasing energy efficiency. Recent decades have seen the introduction and rapid growth in the use of geothermal heat pumps to heat and cool buildings, and to heat water. Energy efficiency, environmental benefits, economic operation and maintenance and effectiveness in heating and cooling are among the reasons for the popularity of these systems with consumers.

The High Rise Apartments, a 72,000 square foot, nine story residential hall, which houses approximately 224 students was originally heated via a traditional electric resistance baseboard system installed when the building was constructed more than 30 years ago. Additionally, the domestic hot water was heated by electrical water heaters located in each of the apartments. This building was not previously air-conditioned.

Prior to Starting the Project

Due to the complexity of this type of project, there are several key points that needed to be considered.

- Constant communication/coordination between the contractor, agency, engineer, and regulatory agencies.
- Meetings with the regulatory agencies to determine what permits are necessary for this project.
- Determine if there is adequate space for piping to couple the heat pump system with the ground and acceptable ground characteristics.
- Determination of whether or not there is an adequate water supply for this type of project. (In calendar year 2002, ECSU diverted 21,750,063 gallons of water.) Open loop systems require a plentiful supply of high quality well or groundwater and a good place for water disposal after the heat has been used.
- Determine the quality of the water being discharged since there are considerable sampling requirements.
- Determine incentives available from Connecticut Light and Power Company for efficiency improvement

Financial Info

Initial Costs:
$706,000

Funding Sources:
CHEFA
Connecticut Light & Power Incentive

Savings, Etc.
The average electrical utility bill, including the heating cost for this building from 1995-2000 was $82,000/year. In calendar year 2002, after installation of the geothermal system, the average electrical utility cost, including the heating **AND** cooling of the building was $72,000.

Steps Taken

1. Prior to the renovation, there were several meetings held with the Dept. of Public Health and Connecticut Department of Environmental Protection to determine what regulatory requirements would apply.
2. Due to the complexity of the permits an Environmental Engineer was hired to prepare the necessary permits.
3. Test wells were drilled to determine if there was adequate water to supply the geothermal system. This project utilized three 800-foot wells.
4. The water that is being discharged has to be tested for both chemical analysis and aquatic toxicity. Results of these tests may affect the type of permit needed.
5. A survey of the surrounding area (1000-foot radius from the well site) was documented to ensure that there were no private drinking wells that could be influenced by the withdrawal of these wells.
6. Diverting this water to the Willimantic River will improve the rivers ecosystem.

Tools Used – Software, Equipment, etc.

The geothermal well pumps (including variable speed drive for reduced energy consumption under part load conditions), the geothermal heat pumps, and the entire building HVAC system is monitored, controlled, and reported by a building automation system. Additionally, CL&P has 15-minute meter reads on the electric use of this building available to the University off the WEB.

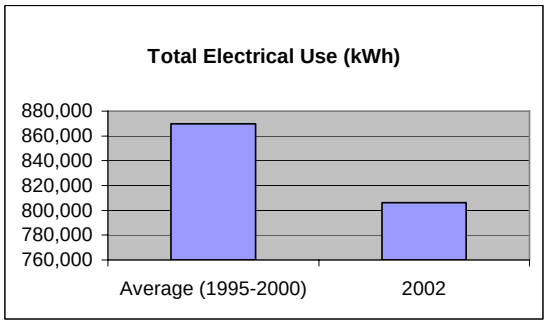
Personnel/Departments Involved in the Effort

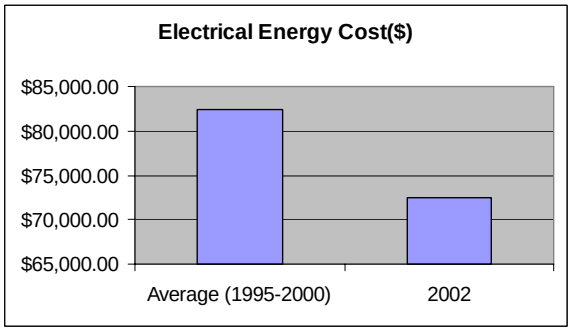
Facilities	20 employees
Environmental Health and Safety	1 employee
Department of Public Works	5 employees
Connecticut State University Systems Office	5 employees
Housing Staff	3 employees
Engineers	3 employees

Performance and Benefits

The most notable benefit of converting from traditional electrical resistance baseboard heat to the geothermal system was the utilization of less electricity to both heat and cool a nine-story building. The average electrical utility bill that included heating this building from 1995-2000 was $82,000. The first calendar year that the geothermal heat pump system was operational the total electrical utility bill including the heating **AND** cooling of the building was $72,000.

The High Rise renovation was completed for occupancy in Fall 2001. The renovation of the Residence Hall allowed for a new state-of-the-art geothermal system, replacement of electric heat and the added benefit of air-conditioning. In addition, a computer lab, as well as a refurbished laundry room was added to the renovation. The project basically completely upgrades the building.





Lessons Learned:

- Need to be flexible in the well design.
- Must be proactive regarding the permit process and start early.
- System should be commissioned to maximize efficiency and minimize maintenance.

For Further Information And Or Resources:

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