INDUSTRY

Education

SCENARIO

This project was a two story addition to the Davis Street Facility on The University of Findlay campus

ARCHITECT, GENERAL CONTRACTOR & ENGINEER

RCM Architects, Inc.
Charles Construction Services, Inc.
Greensleeves LLC

SCHOOL PROFILE

Private institution with approximately 3,800 total enrollment. It is the largest private college in Northwest Ohio. The 78 acre campus is located in Findlay, Ohio and offers nearly 60 areas of undergraduate study.

SYSTEM BENEFITS*

- 57% energy cost reduction
- 35% maintenance cost reduction
- Simple payback of 1.5 years for the incremental cost
- Emission reductions of 51.5% per year
  - CO_2 (carbon dioxide) by 800+ tons
  - SO_2 (sulfur dioxide) by 12,000+ grams
  - NO_X (nitrogen oxide) by 3,000+
- 100% fresh air—no re-circulated air

*Based on 10 months of actual data
August 2012 - May 2013

Greensleeves LLC

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Rendering courtesy of RCM Architects, Inc.

Case Study
The University of Findlay

Davis Street Addition

The Greensleeves system was selected to be incorporated into the Davis Street Addition because of its anticipated energy cost reduction of over 50%. Actual results indicate a savings of 57%, compared to a conventional HVAC system with a gas boiler (built to ASHRAE 90.1.2007 standards), which is equivalent to approximately $59,600 savings per year, and an estimated maintenance savings of $7,500 per year. The simple payback based on the above analysis is less than 1.5 years.

"We are always concerned about energy costs; financially, 85% of the long term cost of a building is utilities," said Dan May, vice president of academic affairs. Martin Terry, vice president for business affairs, and Myreon Cobb, director of physical plant, set a challenge to achieve energy efficiency, a state of the art "clean tech" building and a high return on investment.

They chose to use the GeoModule™, an intelligent, hybrid geothermal control system. In addition to the GeoModule, the Energy Chassis consisting of circulating and geothermal heat pumps, thermal storage and radiant heating/cooling was utilized.

Greensleeves, in concert with the RCM Architects Project Team, completed multiple energy simulations looking at various components of the building (wall construction, windows, roof insulation, lighting, etc.) and provided feedback to the team on which areas would provide the most positive impact on overall energy use. Once the energy saving options were quantified, the initial cost for each option was analyzed to determine which strategies to implement to get the shortest payback for the greatest energy cost reduction.

This sustainable solution leverages existing equipment building and combines it with newer and more efficient technologies for the most effective results. The integrated advanced control package manages the temperature of the total system including the geothermal earth heat exchanger, to improve system efficiency.

HVAC SYSTEM DETAILS

- Central geothermal heap pump system (magnetic-bearing chiller) providing chilled and hot water
- Adaptive, predictive geothermal control system that anticipates desired loop temperatures and preconditions the loop seasonally and daily
- Hybrid wet/dry fluid cooler for geothermal heat exchanger (GHX) pre-conditioning
- Three GHXs that are managed to provide different fluid temperatures and direct sensible cooling via radiant cooling and active chilled beams
- Thirty 350 ft. deep bores configured with three headers piped separately to mechanical room with 10 loops on each
- Dedicated outside air system using dual energy recovery wheel technology feeding active chilled beams
- Thermally-massive radiant heating and cooling, that can use fluid directly from geothermal loops for cooling without engaging chiller operation
- Active chilled beams fed from geothermal loops or chilled water system as needed
- Active air quality monitoring system tracking volatile organic compounds, CO_2, particle counts, and wet bulb air
- Sophisticated fume hoods that sense both human movement and the presence of chemicals
- Sub-metered electrical use by HVAC system, lighting and receptacle loads

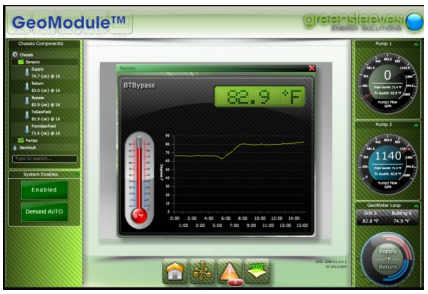
greensleeves ENERGY SOLUTIONS

The University of Findlay

Energy Efficiency Techniques Incorporated in the Greensleeves Patent Pending GeoModule™:

a. The Geothermal Heat Exchanger (GHX) is being used as an inexpensive thermal energy storage system by the GeoModule. This predictive energy control system uses computer technology to select the best time to use natural sources of thermal energy (seasonal and daily increases/decreases in environmental temperature) to replace fossil fuels for heating and cooling.

b. The GeoModule plans and executes action to utilize the cooling or heating of the GHX field when it is most cost-efficient to add or remove thermal energy. This allows the system to operate at times when operating the cooling equipment is least expensive.



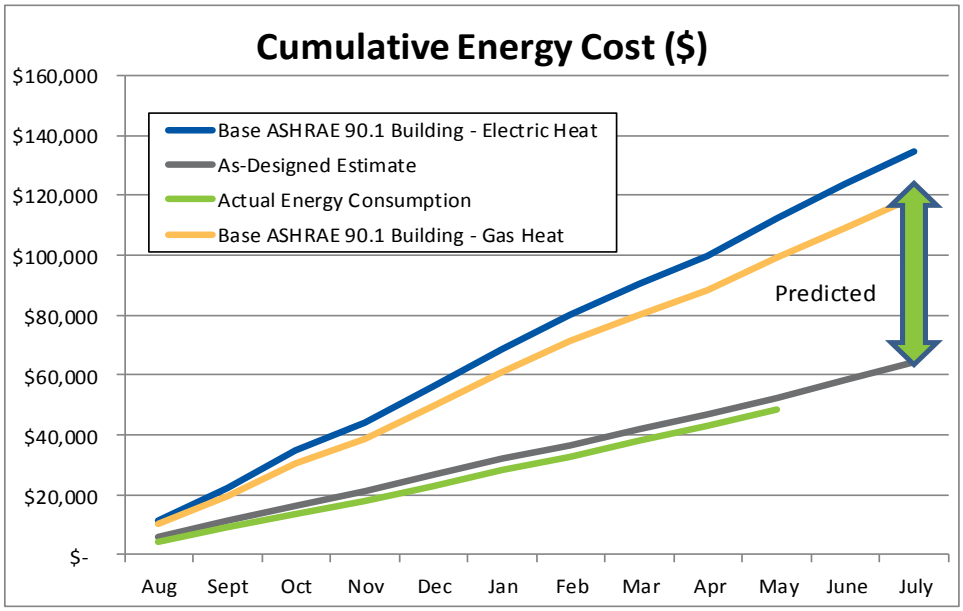
c. The predictive control software "plans" when to operate the system to use the least possible energy at the lowest possible cost.

d. The GHX predictive control system manages the system to operate with the maximum possible efficiency.

e. The central geothermal energy plant recycles energy by simultaneously making hot (95°F) and chilled (45°F) water for heating and cooling. When the loads are unbalanced, the control system determines whether to dump heat into the GHX for later use or rejection or directly to the fluid cooler if that process consumes less energy.

f. Environmental and operating conditions like humidity or time of day utility rates affect the economics of system operations. The GeoModule has the ability to implement computerized energy efficient strategies that consider these factors. New strategies are constantly being added to this system.

Using some of its energy efficiency strategies, the Greensleeves system EER (Energy Efficiency Ratio) can approach 150-200 BTUs per watt (EER) versus a typical chiller EER of 15 to 20.



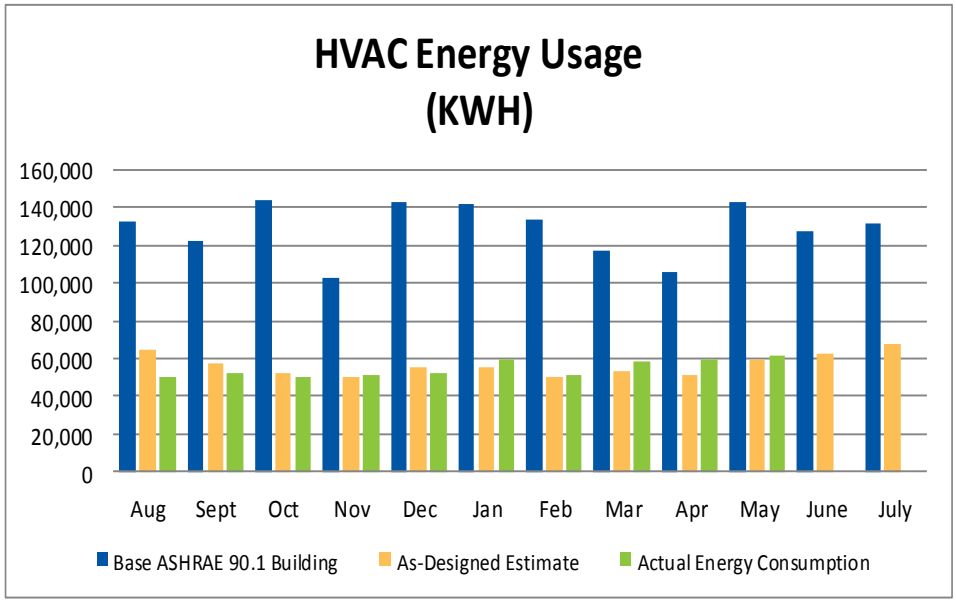
The University of Findlay

Recycle energy:

a. Use of the geothermal system as an energy "router" allows waste energy from the cooling system to be reused by the system when heat is needed.

Innovations:

a. The control system uses anticipatory predictive algorithms for the geothermal heat exchanger to minimize energy use, in lieu of traditional "real-time" controls that trigger a fluid cooler operation when the GHX temperature reaches a set-point.
b. The control system measures and "learns" the actual building load imposed on the GHX and adjusts the algorithms in relation to this intelligent, self-learning model.
c. The energy plant, consisting of the magnetic-bearing chiller, pumps, variable speed drives and controls, was factory-assembled at an ISO-9001 facility and shipped to the site in portions for site assembly. This significantly reduced construction and commissioning time, as well as risk related to varying on-site conditions and quality control.



Operation and Maintenance:

A direct digital control system monitors and controls all aspects of the HVAC system and provides valuable performance tracking for the maintenance staff.

Cost Effectiveness:

The cost premium for the installed system was $2.50 per square foot versus a conventional HVAC system with a the simple payback of less than 1.5 years.

greensleeves ENERGY SOLUTIONS

ADDITION

The addition primarily houses the biology program and related forensic science laboratories.

The $11 million construction project was completed in June, 2012

PHYSICAL DETAILS

- **42,000 sq. ft. addition**
- **19 science laboratories**
- **112-seat lecture hall**
- **1 computer lab**
- **15 facility offices**
- **1 conference room**
- **1 student lounge**