NJHEPS Energy Case Studies

Richard Stockton College:
Faculty and Staff United for Energy Progress

Project:
Academics and Facilities work together on energy at The Richard Stockton College of New Jersey.

Technology:
Geothermal technologies, photovoltaics, and phosphoric acid fuel cells.

CO_2 Emission Reductions:
3600 tons annually.[1]

Investment:
$550,000

Annual Savings:
$275,0002

Lessons Learned:

- Always explore opportunities when outmoded equipment needs to be replaced.
- Uniting the talents of administrators, students, professors and facilities staff can produce quality education, effective energy management, and diverse funding for energy projects.
- Projects that result from this collaboration provide multiple benefits: student training, rigorous data that benefit all energy consumers, enhanced prestige for the institution, and an effective demonstration model with skilled, committed disseminators of lessons learned -- in addition to energy savings and reduced emissions.

- Conducting energy-related research at your institution can provide a host of benefits: educationally-useful student research, a conduit to cutting-edge energy research to inform your institutional planning, and skilled fundraising help for energy projects.

- Investing time and energy in ensuring that energy researchers and facilities staff communicate and work well together will provide untold benefits: in staff trust, in ensuring that energy plans are informed by staff's real-world experience, and in synergies that enhance knowledge, cost savings, funding and energy progress.

Funding Sources:
University bonds; NJ Department of Environmental Protection funds; Department of Energy funds (both equipment and research); utility demand-side management grant; Board of Public Utilities rebates.

Introduction
At most colleges, physics professors and facilities staff communicate only about the usual concerns of comfort and safety. At The Richard Stockton College of New Jersey, however, research interests and sound facility management work hand-in-hand to benefit budgets, train students, and advance knowledge about new energy technologies.

Project Description
The Richard Stockton College of New Jersey is a public four-year comprehensive college in Pomona, NJ with 5300 full-time equivalent students. The College has a long-standing commitment to advance students' understanding of math, physics, biology and environmental studies through the study of energy. Campus buildings often have served as energy study and test sites. In the mid-1980's, Dr. Stiles and colleagues received research funds to accurately measure energy leaks in buildings, and the studies performed by Dr. Stiles' students on Stockton's academic buildings served as the basis for successful funding of energy retrofit projects: insulation, motion detectors, and energy-efficient lighting, Thus, from the mid-1980's, academic work was closely connected to improving Stockton's energy performance, and Stockton facilities personnel saw clear benefits from working with professors and students.

A 1986 project sought funding to replace the existing heaters in student housing with geothermal heat pump units (already in use in nearby residences and small businesses), and Stockton produced an engineering study that demonstrated a clear and well-documented case for geothermal technology at the College. While this project was not funded, it introduced Marvin Witmer, Stockton's Director of Facilities Planning and Construction, to geothermal technology and its benefits.

In the early 1990's, two developments provided an opening for pursuing further energy progress at

Stockton: aging, inefficient rooftop heating and cooling units desperately needed replacement, and a new Vice President of Administration and Finance, Dr. Charles Tantillo, was very interested in cost-saving measures -- and proved very willing to invest in proven projects with reasonable payback periods and long-term potential for improving Stockton's bottom line. Using data already gathered for the earlier feasibility study, Dr. Stiles and Mr. Witmer made the case for installing a massive geothermal system in lieu of replacing the failing rooftop units.

$3.5 million would have been required to replace the aged heating and cooling units with comparable technology -- money that the state of New Jersey did not have available. Replacing the units over the course of several years (the only conceivable means) would increase the project cost to $5 million (as each phase required engineering expenditures). The total geothermal project cost was $5.1 million -- arguably, a negligible incremental cost. Moreover, both the newness of the project (it's scale and its industrial application) and the demonstrated benefits of geothermal technology made it eligible for support from a variety of sources, further reducing the out-of-pocket costs for Stockton.

The anticipated reduction in Stockton's energy usage enabled Stockton's utility company, mandated by the state to support demand-side management measures, to provide $1.1 million to support the project (a cost-effective alternative to building additional generators). New Jersey's Department of Environmental Protection, moreover, also supported the project, out of a fund designed to support state projects that reduced energy-related emissions. The small incremental cost of this project thus became instead a series of benefits for the college, as the geothermal project provided:

- A much-needed parking lot addition with upgraded lighting
- Additional new Arts and Sciences building GHP system added to existing well field (cost avoidance for this project)
- Added HVAC capacity to service Stockton's new Library (cost avoidance for this project)
- Yearly incremental energy savings compared to a traditional replacement of $125,000 per year (the savings are expected to escalate over time and to last decades into the future, as geothermal technology is extremely long-lasting and reliable)
- An energy management system which also saves money by enabling load-shedding and reducing unneeded energy use
- An opportunity for students to perform Department of Energy-funded work to study the performance of the system, which performed within expected parameters and delivered its promised energy savings (a 25% reduction in electricity and a 70% reduction in natural gas usage). Over 40 students have engaged in biology, chemistry, physics, and engineering studies of Stockton's geothermal system
- International recognition and renown. Stockton became an internationally-known and visited site,

and the Geothermal Project became a public relations showcase. Stockton subsequently received funding from the Department of Energy's Energy $mart Schools program to educate school districts about geothermal systems, resulting in numerous geothermal systems installed in New Jersey and North Carolina schools. Scores of architects and engineers, moreover, also have been educated about geothermal technology from Stockton programs.

The school's growing reputation as a successful, effective site to test and disseminate new technology contributed to its success in securing funding from the Department of Energy for a phosphoric-acid fuel cell, which provides additional yearly savings for energy and hot water of $115,000. Stockton's Arts and Science building also hosts an 18 kW photovoltaic system, providing about $3,000 of electricity annually.

The Results

Stockton's implementation of energy-efficient and renewable technology has resulted in a nearly 16% reduction in Stockton's emissions from electricity and natural gas – in spite of a 25% increase in Stockton's campus size. Stockton saves more than a quarter million dollars each year in avoided energy costs, and society benefits each year from approximately 2300 tons fewer emissions. Moreover, the emissions-reducing measures put in place at Stockton have resulted in more than 3600 tons of avoided emissions— Stockton would be producing more emissions, given its growth, but for the energy steps taken since 1990.

Future Commitments

Stockton is again seeking to make the College the site of new technology: the first US aquifer thermal exchange storage system (ATESS). This technology, used in Canada, Asia and Europe, also uses the Earth's thermal properties to heat and cool buildings, but with much greater efficiencies than a geothermal heat-pump system. Scientific organizations and energy-efficiency funders will be asked to support the development of this system, the rigorous study of its operations, and the dissemination of lessons learned. Staff geothermal experience and its history of growing staff skills with new technology make Stockton an attractive and promising test site for ATESS in the US. Again, students stand to gain market-useful skills in a new and promising technology. Campus expansion again provides a timely opportunity, as new buildings are mandating additional campus heating and cooling. Stockton is also seeking support for a large-scale wind turbine project (over 1 MW). As in other Stockton energy projects, research and cost savings will be combined as the interactions of migratory and resident birds with the wind turbine will be rigorously studied.

Contacts:

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Additional resource:

New Jersey College Continues To Benefit From Pioneering Geothermal System, http://www.trane.com/commercial/library/stockton.asp.

Notes:

[1]Based on PJM figures of .0005919 tons/kwh.

[2]Includes incremental savings for the geothermal heat pump system, as compared to a more conventional retrofit. Stockton also benefits from $100,000 in yearly energy savings from more "standard" energy improvement efforts in insulation and lighting retrofits.