MONMOUTH BATTLEFIELD STATE PARK, STATE OF NEW JERSEY

Renewable Energy from the Ground Up

PROJECT SNAPSHOT

PROJECT
Monmouth Battlefield State Park visitors center heating and cooling system

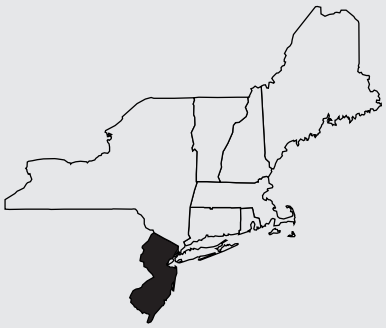
TECHNOLOGY
Geothermal heat pump system

CO_2 EMISSION REDUCTIONS
335,600 pounds a year

INVESTMENT AND SAVINGS
$210,000; lower utility costs of $75,000 over five years

LESSONS LEARNED
How to navigate the state treasury procurement system to evaluate contractors and vendors

FUNDING SOURCES
Eastern Heating and Cooling Council and the State of New Jersey



BACKGROUND

Heat pumps, which can tap into the earth's relatively balmy temperature 350 feet below the surface, provide an attractive source of low-impact energy. This fits well with Administrative Order 1998-09 on climate change, issued by New Jersey Department of Environmental Protection Commissioner Robert C. Shinn, Jr. in March 1998. The order presents New Jersey DEP's goal of reducing New Jersey's greenhouse gas emissions 3.5 percent below 1990 levels by the year 2005, and describes procedures for reaching this milestone. The state's strategy emphasizes "no regrets" actions undertaken on a voluntary basis – that is, activities that would make economic sense anyway. DEP has targeted the state's geothermal resources to play a major role in achieving this objective.

PROJECT DESCRIPTION

The visitors' center at the Monmouth Battlefield State Park hosts some 350,000 visitors each year. In spring, 2000, two underground fuel storage tanks were removed, and the center's industrial boiler was replaced with a geothermal heat pump system. Geothermal heating circulates water below the ground, where temperatures remain roughly 55 degrees Fahrenheit year round. Thus, a heat pump can provide both heating and cooling – by using the earth as a source of heat in winter, and a heat sink in summer.

Up to that point, the visitors' center had been heated and cooled by air-source heat pumps and electric resistance heat.[1] The system required some 8,500 gallons of #2 fuel oil and 700 gallons of propane each year. In addition to direct fuel use, it consumed about 166,000 kilowatt-hours (kWh) of electricity each year. The new system consists of 30 underground wells extending 350 feet below the ground. Within each well are pipes with water. Water pumped into the wells pass through a heat exchanger to cool the building in summer and heat it in winter.

The up-front costs of geothermal power are higher than an oil- or gas-fired system. However, the state faced the additional cost of having to replace the aging fuel storage tanks, if it wished to continue to use oil and propane at the Monmouth site. The estimated cost of replacing the storage tanks, along with associated environmental remediation, was just over $200,000. This increased the projected cost of maintaining the existing heating system to the point that the premium associated with installing geothermal technology was very small. In fact, geothermal's up-front costs were about $210,000, only $10,000 more. And its operating costs are considerably lower than those of the fossil-fueled system. As a result, the visitors' center began saving money virtually at once.

The design of the geothermal system was funded by a $10,000 grant from the Eastern Heating & Cooling Council, a nonprofit that distributes federal funding to geothermal developers. The Council's mission is to provide HVAC contractors and consumers with education, training, and awareness of EPA's Energy Star program, fostering the proper design and installation of high-efficiency heating and cooling systems. Construction costs of $200,000 were paid by the State of New Jersey. A number of New Jersey firms were involved in the project, including Geothermal Services, Inc, Concord Engineering Group, Inc., SBN Enterprises, Inc., and Voacolo Electric, Inc.

THE RESULTS

This installation will cut annual electricity use by 24 percent, or 40,000 kWhs, and eliminate the use of about 8,480 gallons of #2 fuel oil and 700 gallons of propane. As a result, CO_2 emissions will decline by 66 percent – 168 tons annually. This is equivalent to the CO_2 associated with removing 24 typical passenger cars from the road each year or avoiding the consumption of 307 barrels of oil annually. Finally, the project's electricity savings will cut annual emissions of NO_x and SO_2 by 133 and 401 pounds, respectively, based on average emission rates of the regional electricity grid.

Installation of the new system was announced on September 21, 2000, at which the state reinforced its commitment to greenhouse gas reduction and the use of efficient and renewable energy technologies. A poster display will be developed for the visitors' center illustrating key elements of the system, and describing its environmental benefits, particularly in addressing climate change.

LESSONS LEARNED

A key lesson about the state procurement process stands out in the mind of Michael Winka of the New Jersey DEP's Office of Innovative Technology and Market Development. Winka suggested that it would be helpful if the state treasury's product and service procurement process developed more effective ways to evaluate contractors and vendors who offer non-traditional products and services, like heat pumps. This would promote innovation. A second lesson is that traditional fossil-fuel-fired energy systems often impose significant costs that are not factored into initial cost estimates. When those costs later come to light, cleaner technologies appear far more competitive.

FUTURE COMMITMENTS

To date, New Jersey has performed geothermal heat pump feasibility and design studies at six state facilities, including Monmouth Battlefield State Park. Others include Batsto Village and Visitor Center at Wharton State Forest, Cheesquake State Park, Forest Education Resource Center in Jackson, Leeds Point Maintenance Yard, and Wharton Treatment Center. The DEP has asked for capital improvement funds in 2001 to install geothermal and other renewable energy technologies at the remaining state parks, with the above projects serving as the core of the effort.

CONTACTS

Michael Winka and Athena Sarafides
NJ DEP Tel. 609-984-5418
NJ State Web site:
www.state.nj.us/dep/dsr

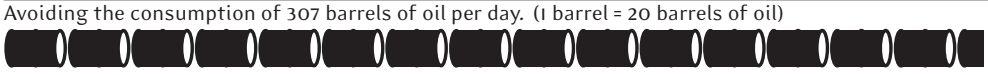
Eastern Heating and Cooling Council
web site: www.eh-cc.org/

[1] Air-source heat pumps draw on the ambient air rather than the earth's surface. A major limitation is that capacity and performance rapidly declines with outdoor temperatures. Although electric resistance heating converts nearly all the electricity into heat, most electricity is produced from oil, gas or coal generators that convert only about 30% of the fuel's energy into electricity, while polluting the air.

CLEAN AIR-COOL PLANET CASE STUDY RATING

This case study reduces CO_2 emissions equivalent to the following:

Avoiding the consumption of 307 barrels of oil per day. (1 barrel = 20 barrels of oil)



OR Taking 24 vehicles off the road per year. (1 car = 2 vehicles)

Assumptions: 1,093 lbs of CO_2 per barrel of oil. Vehicles are average passenger cars (approximately 20 lbs CO_2 per gallon of gasoline - 22.5 miles per gallon, averaging 16,000 miles per year)