RUTGERS UNIVERSITY

A Captive Audience for Super-efficient Generation

PROJECT SNAPSHOT

PROJECT
Cogeneration plant on a university campus

TECHNOLOGY
Gas turbines, duct burners and water heaters with heat-recovery systems

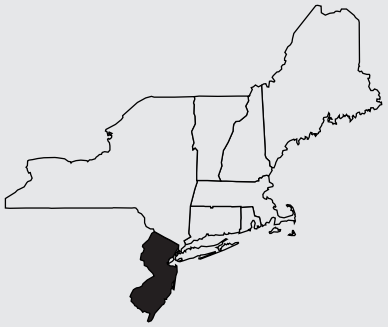
CO_2 EMISSION REDUCTIONS
70,000 tons a year
Reductions

INVESTMENT
$25 million

ANNUAL SAVINGS
$1-2 million

LESSONS LEARNED
- Long-term thinking needed to assess project economics and plan its development.
- Success can be attained using mainstream approaches - e.g., known manufacturers and technologies.

FUNDING SOURCES
University bonds



INTRODUCTION

Efficiency is a concept that relates energy input to useful output. Power plants, for example, tend to be 35-45 percent efficient. That is, they waste a lot of electricity. But the latest gas turbine technology is breaking the mold. This is particularly true of gas cogeneration systems – turbines that burn natural gas to generate electricity. They also capture and use the resulting waste heat, both to produce more electricity and to harness a steady source of steam. The steam in turn may warm buildings and their occupants, or run machinery. The current crop of cogeneration plants is managing to achieve efficiencies of up to 75 percent. That means less expensive power and lower greenhouse gas emissions.

PROJECT DESCRIPTION

Rutgers University recently added three high-efficiency gas turbines to the existing central heating plant at its Busch campus in New Brunswick/Piscataway, New Jersey, along with a trio of duct burners and heat-recovery water heaters. The primary fuel for the new 13.5-megawatt (MW) facility is natural gas, with low-sulfur diesel as back up. It went into operation in December 1995.

The plant's electrical output supplies about 90 percent of the winter electricity needs of the Busch and Livingston campuses – two of four campuses located at the University's New Brunswick site. In addition, it produces high-temperature hot water for heating, localized steam generation and absorption cooling.

The entire congeneration project cost $25 million. The university provided seed money for a feasibility study, with university bonds funding project development and construction. The facility is operated by the school's Utilities Department. Previously, all of its electricity was purchased from New Jersey's largest utility, Public Service Electric & Gas Co. The university also has instituted a $5 million demand side management program that has installed energy-efficient lighting and variable speed motor drives. The new plant recently received the Combined Heat and Power Certificate of Recognition from the U.S. EPA's EnergyStar Program, which encourages energy efficiency and pollution reduction. As Rutgers Director of Utilities Paul Meierdierck explains, this award recognizes cogeneration facilities that demonstrate especially cost-effective expansion of their energy service capabilities while minimizing emissions.

THE RESULTS

The results show why Rutgers won an award from EPA. The plant's 13,500 kWh/yr output nearly eliminates the need to buy higher-cost electricity from the grid to meet the winter needs of the two New Brunswick campuses. That means annual savings of $1-2 million. Excluding the cost of money, the university estimates that the plant will pay for itself in about five years,[1] only a short way into its 20-to-25-year useful life. The university's new demand-side management program saves another $1 million a year. After repayment of capital and interest, savings that the plant generates accrue to a special account, the Energy Conservation Saving Fund, that supports energy efficiency projects like hot water line upgrades and better computer controls for the campus energy management system.

The Busch cogeneration plant also has cut emissions dramatically. Two factors account for this. First, because the plant is so efficient and natural gas so clean, each unit of electricity it generates brings with it far less pollution than electricity purchased from the power grid. Second, the plant's capacity to provide useful thermal energy rendered unnecessary the construction of a separate heating plant that would have polluted more. EPA estimates that the Rutgers facility reduces yearly CO_2 emissions by roughly 70,000 tons. NO_x reductions are about 100 tons a year, and SO_2, 240 tons. This is the equivalent of decreasing annual oil consumption by some 128,100 barrels, or taking more than 9,800 typical passenger cars off the road.

LESSONS LEARNED

Rutgers' Meierdierck stresses that the decision to construct the cogeneration system was not made lightly. The university spent a good deal of time trying to obtain reliable estimates of its current and future energy demands, and correlating them to projected fuel and electricity prices. For an investment this large, it had to be confident about the project's anticipated economics. But, as it turned out, a high confidence level was instrumental in maintaining support through a long and tedious permitting process.

Cogeneration's strong track record elsewhere helped build the case that Rutgers ought to step up to the plate too. But, Meierdierck noted, the university took advantage of the lessons learned by other institutions that have embraced the technology. And, to limit uncertainty, it relied upon known technologies and manufacturers.

FUTURE COMMITMENTS

The University plans to install 1,000 tons of additional chilling capacity in the next year, increasing the new power plant's efficiency from 75 percent to 90 percent. There also is talk of adding turbines to provide electricity to other campuses, although that is likely to await the results of electricity industry deregulation, as it plays out over the next several years.

INSTITUTIONAL PROFILE

From its roots as a colonial college and land-grant institution, Rutgers University of New Jersey has developed into one of America's leading public research institutions. The University is located on three regional campuses: New Brunswick/ Piscataway, Camden and Newark. Total student enrollment is 48,000, 13,500 of them graduate students. Rutgers employs 2,600 faculty, 98 percent of whom hold the top degree in their field.

CONTACTS

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This case study has drawn information from these Rutgers Web Sites:
http://facilities.rutgers.edu/utilities/
www.rci.rutgers.edu/~jonflrty/cogeneration.htm

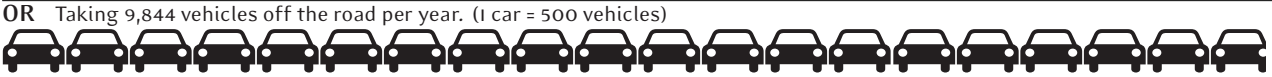
[1]This is calculated by comparing the capital and operating costs of the plant with the costs the university otherwise would have borne to supply its energy needs – that is, continuing to purchase power from the grid, and building a new heating plant.

CLEAN AIR-COOL PLANET CASE STUDY RATING

This case study reduces CO_2 emissions equivalent to the following:

Avoiding the consumption of 351 barrels of oil per day. (1 barrel = 20 barrels of oil)

OR Taking 9,844 vehicles off the road per year. (1 car = 500 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)