PROJECT UPDATE

December 2004

New York State Energy Research and Development Authority

Environmental Monitoring, Evaluation, and Protection Program

Quantifying the Environmental Benefits of Increased Deployment of Combined Heat and Power Technologies in NYS and the Impact of Proposed Emissions Standards for Small Distributed Generation

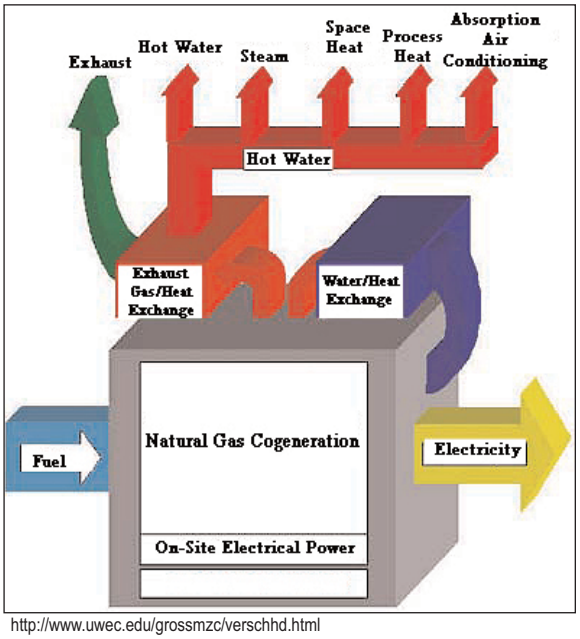
PROJECT FOCUS

The project will analyze how the widespread use of distributed generation (DG) systems operating in combined heat and power (CHP) applications throughout New York State (NYS) would affect emissions of criteria air pollutants and the wholesale electricity market.

The project team will analyze emissions for these pollutants: carbon monoxide (CO), nitrogen oxides (NO_x), sulfur oxides (SO_x), mercury (Hg), particulate matter (PM), volatile organic compounds (VOCs), and carbon dioxide (CO_2). Economic impacts on the electricity market will be gauged by wholesale market electricity prices.

CONTEXT

Distributed generation is defined as the use of various small-scale resources for generating power that are located close to the site where the power will be used. The DG systems are energy efficient and have the potential to improve air quality while lowering the costs of electricity for consumers. DG can also improve the reliability of transmission of power and its system of distribution. Combined heat and power technologies use a single fuel to produce both heat (steam) and electricity. While much of the heat produced with conventional electricity generation is wasted, with CHP systems that heat is recovered. DG/CHP technologies include fuel cells, reciprocating engines, microturbines, gas turbines, back-pressure steam turbines, and hybrid power systems. Lower costs are thus possible if energy efficient (low operating cost) DG/CHP systems can be collectively utilized to offset the operation of less efficient (high operating cost) central power plants.



http://www.uwec.edu/grossmzc/verschhd.html

The process of excess energy being caught and utilized.

The results of a NYSERDA-funded study reported in 2002 that DG/CHP installations could provide up to 2,400 and 6,000 megawatts of electric power (MWe) within New York State by 2010 and 2020, respectively. New York's peak electric power demand occurs during the summer months and is nearly 35,000 MWe. Because of the structure of New York's wholesale electric power market, if a sufficient number of DG/CHP systems are installed throughout New York State, it may not be necessary to draw on extra capacity from older, less efficient, more costly and polluting centralized power plants, as is currently the practice.

http://www.oswego.org/staff/ccarroll/diversity/industry.htm

Sithe cogeneration facility, Oswego, New York.

Principal Researcher

WALTER PUNTEL
Navigant Consulting, Inc

Project Participants

B. Hedman
Energy and Environmental Analysis, Inc.

F. Zalcman
Pace Energy Project

Project Location

Statewide

Credit: Navigant Consulting

A distributed generation - combined heat and power unit.

Contact Information

For more information on this project see:

http://www.nyserda.org/programs/environment/emep.asp

or contact Mark Torpey at:
mrt@nyserda.org

Keywords

- Air emissions
- Combined heat and power (CHP)
- Distributed generation (DG)
- Emission scenarios
- Market penetration
- Multi-Area Production Simulation software (MAPS)

PROJECT UPDATE

December 2004

http://www.maineenvironment.org/energy/earthjustice.htm
Emissions from industrial stacks.

Project Status

- Initiated 2003
- Project ongoing

New York Energy $mart℠
PUBLIC SERVICE COMMISSION — NYSERDA

Since 1975, the New York State Energy Research and Development Authority (NYSERDA) has developed and implemented innovative products and processes to enhance the State's energy efficiency, economic growth, and environmental protection. One of NYSERDA's key efforts, the Environmental Monitoring, Evaluation Protection (EMEP) Program, supports energy-related environmental research. The EMEP Program is funded by a System Benefits Charge (SBC) collected by the State's investor-owned utilities. NYSERDA administers the SBC program under an agreement with the Public Service Commission.

METHODOLOGY

This project defines four emissions scenarios based on different regulatory models. Each scenario includes four "data points" - 2005, 2010, 2015, and 2020 - with the interim results to be determined through interpolation.

- **Baseline scenario:** Impact of the NYS Department of Environmental Conservation (DEC) standard, assuming that the initial limits on emission rates remain constant throughout the analysis period (i.e., until 2020).
- **Moderate phase-in scenario:** Effects of reducing the DG/CHP emission rate limits throughout the analysis period in discrete steps every five years. These effects would be consistent with periodic technology review requirements that reflect the implementation of cost-effective advances in pollution control for these systems. This scenario is a "moderate" phase-in since emission rate reductions will be implemented only if the pollution control technology is cost effective.
- **Stringent phase-in:** Effects of implementing a "technology-forcing" DG/CHP emission reduction strategy. Emission rates will be reduced every five years regardless of cost-effectiveness and will establish aggressive environmental performance targets throughout the analysis period.
- **Oversizing DG/CHP:** The impact of installing oversized DG/CHP systems for future growth. The extra DG/CHP capacity might be used to support electric system operating reserve requirements. This scenario will show how oversizing the typical CHP project, as compared with the baseline, could affect CHP market penetration and composition and the resulting air-quality benefits.

Credit: NYSERDA
The 450-kW installed backpressure steam turbine produces no additional emissions and reduces electrical costs by $89,000 annually.

The project team will develop **cost, emission, and performance profiles** for a variety of DG/CHP technologies that will be used in the market penetration analysis. These profiles will help identify technologies that could meet the conditions set by the four scenarios and determine their costs. Estimates of emissions performance will include the following pollutant categories: CO, NO_x, SO_x, Hg, PM, VOCs, and CO_2.

DG/CHP market penetration estimates will be developed for the scenarios using modeling tools. The fact that certain CHP technologies will better meet the needs of some applications and/or size categories than others will be reflected in the relative economics of the technologies. As the technology performance and costs are changed to reflect the requirements of the different scenarios, the relative costs of the competing systems will change, affecting overall market penetration and the technology mix involved. Therefore, potential emissions benefits and financial savings will vary among scenarios.

Computer simulations of each scenario using a highly detailed model (GE-MAPS Multi-Area Production Simulation software) that simulates electricity production will capture the hourly dynamics of electric power markets. The results of these simulations will be analyzed, with the research team quantifying the environmental and economic impacts of the different DG/CHP market penetration scenarios in New York State. The scenarios will be compared in terms of projected changes in total ambient emissions of key pollutants and economic impacts (i.e., wholesale electricity price changes).

PROJECT IMPLICATIONS

This project's analyses of the implementation of DG/CHP technologies in four potential regulatory scenarios will make an important contribution to our understanding of the environmental and economic costs and benefits of the widespread deployment of these technologies. Certain technologies might not meet the strict emissions standards or might only do so at a significant cost. The effects on CHP system economics arising from these additional costs or the narrowing of technology choices will ultimately affect technology deployment within the various scenarios and thus CHP penetration into the market. Two of these scenarios should shed light on the optimum "phased in" emission rate limit that could result in improved air quality if the widespread use of DG/CHP resources is encouraged. The hypothesis is that if emission standards are too stringent and effectively limit DG/CHP market penetration, air quality could be adversely affected over time as a consequence.