State EE/RE Technical Forum
Call #6: Distributed Generation (DG) and Combined Heat and Power (CHP)
March 17, 2005, 2:00 – 3:30 PM EST

A. Background

Definitions & Applications

- ***Distributed generation*** (DG) is electricity generation that occurs at or near the point of use. Distributed generation includes many renewable energy options such as photovoltaic cells, wind turbines, biomass generation, and fuel cells. It also includes microturbines and small onsite diesel and gas generators. Solar thermal technologies and demand side management technologies, aimed at reduced energy consumption, are sometimes included in the slightly broader concept of distributed energy.

- ***Combined heat and power*** (CHP) is a distributed generation technology which generates electricity and heat from a single fuel combustion source. The heat may be used for process steam, heating, cooling, humidity control, and other residential, commercial, and industrial processes as well as for spinning a turbine to generate electricity. Using waste heat eliminates the need for fuel to perform the processes served by the recovered heat and avoids the emissions associated with burning that fuel. CHP is most likely to be economically viable in settings where there is a need for both electricity and thermal energy during much of the year. Energy-intensive industries like those in the chemical, refining, forest products, food, and pharmaceuticals sectors provide opportunities for CHP. Networks of buildings and large institutional facilities that require heating and cooling as well as electricity are also well suited to CHP. Smaller applications such as multi-unit residential buildings, hospitals, hotels, and casinos have also captured CHP's economic and environmental benefits. The range of economically beneficial applications for CHP has grown with recent developments in well-integrated modular CHP systems.

- ***Clean distributed generation*** (Clean DG) is a term used to describe renewable energy technologies and combined heat and power. It does not include those types of small generators that have emissions levels (pollutant per kWh) that are higher than an average power plant.

Regulatory Treatment of Distributed Generation

- Small-scale distributed power generators (those with a design heat input capacity of less than 10 mmBtu/hr) often fall below minimum levels for regulation under federal rules for emissions of air pollutants, but a variety of general state rules may apply to these small units.

- Several states have recently developed or are in the process of developing specific regulations for small-scale distributed electrical generation. Many of these regulations are oriented toward promoting the use of clean distributed generation. Model rules pertaining to distributed generation have been developed by the Regulatory Assistance Project (RAP) and by the Ozone Transport Commission (OTC).

Energy Supply and Environmental Benefits of Clean DG

- From an energy perspective, clean DG contributes to energy supply while increasing source diversity, delivery reliability, power quality, and efficiency. For example, the combined efficiency for an on-site electricity boiler and a separate heating source is typically about 49%, while that of a single-source CHP system can be 60 to 80%. These sources also can relieve congested transmission systems, make the grid less vulnerable to disruption, and help manage loads and peak demand.

- Clean DG options typically have lower emissions than centralized fossil fuel electricity generating units. Some options, such as wind turbines, photovoltaic (solar) cells, and hydrogen fuel cells, emit no pollutants.

Barriers to Clean DG

Potential users of distributed generation may face regulatory or economic barriers that hamper or preclude the installation of onsite generation. Carefully crafted regulations for distributed generators and emergency generators are needed to ensure access to the benefits of clean DG while avoiding any increase in emissions from certain small generators. Economic issues for clean DG include fairness in the financial relationship between utilities and distributed generators when demand for central utility generation is reduced and electricity is sold back into the grid. Other concerns include: interconnection standards, net metering, equipment certification and verification procedures.

- Historically, input-based air emission standards (e.g., lb/MMBtu) have failed to provide incentives that recognize the increased efficiency of clean DG, particularly CHP projects. CHP is disadvantaged under input based regulations because thermal energy benefits are not captured as useful output. Recently, EPA has begun to move towards output based standards (1b/MWh) as have many states. See, for example, February 2005 proposed New Source Performance Standards for combustion turbines. The EPA's recent guidelines on output-based regulations (see resources section below) may help air regulators to create regulations that recognize the benefits of CHP.

- Outreach is needed to build awareness of the opportunities for efficiency and savings made possible by CHP systems that use waste heat to cool, heat, control humidity, and power industrial processes.

- Small scale clean DG would benefit from consistent environmental regulation and permitting to reduce the transaction costs of project development. Many states have different exemption levels and regulatory/permitting requirements for these small sources. The model distributed generation regulations developed by the Regulatory Assistance Project, the OTC's Distributed Generation Initiative model permit

language, and similar guidance from other national and regional organizations may help states to develop consistent guidelines for utilities and small generators.

- Standardized interconnection technical standards are needed to provide DG generators and transmission system operators with reliable dispatch procedures and certified equipment for connections that enhance system reliability and efficiency as well as worker safety.

- Guidelines are needed for transmission grid access and two-way metering, with reasonable fees for interconnection and other distribution system costs as well as payment for clean DG electricity input. Standardized procedural aspects of interconnection (utility response time responsibilities, costs for fees, insurance responsibility, etc) are also important in reducing cost uncertainty for clean DG during project development. Agencies in de-regulated states are debating the merits of allowing distribution utility ownership of DG generation systems ("Disco-DG").

- Stand-by or back-up rates are charged by some utilities when all or a portion of the power they had previously sold to a customer is replaced by on-site production but the customer still sometimes needs power from the grid. These rates may serve as a deterrent to clean DG. Similarly, exit fees, low payment rates for input to the grid, and other elements in utilities' financial agreements with clean DG providers may slow the adoption of distributed generation in some areas.

State Level Programs for Clean DG

- New Hampshire, California, Texas, Connecticut, Massachusetts, and New York have output-based emissions regulations in place or under development for distributed generation projects.

- A model rule for emissions standards for distributed generators has been developed by the Regulatory Assistance Project (RAP).

- The National Association of Regulatory Utility Commissioners (NARUC) adopted the Model Interconnection Procedures and Agreement for Small Distributed Generation Resources (October, 2003), and the Federal Energy Regulatory Commission (FERC) has proposed standardized interconnection agreements and procedures for small generators.

- The public utility commissions of Delaware, District of Columbia, Maryland, New Jersey and Pennsylvania, along with the U.S. Department of Energy and PJM Interconnection have established the Mid-Atlantic Distributed Resource Initiative (MADRI) to develop regional policies and market-enabling activities to support distributed generation and demand response in the Mid-Atlantic region.

- Several states are developing or have already proposed distributed generation regulations (see Database of State Incentives for Renewable Energy (DSIRE) under the Resources section, below). The DSIRE database indicates that rules, regulations, and/or policies are in place for net metering in 39 states, interconnection standards have been developed in 38 states, and 34 states have access laws. In a few cases, utilities are responsible for these policies rather than state or local regulatory agencies.

B. Questions for Discussion

1) What are the primary policy drivers for promoting clean DG in your state (i.e. load response capability, transmission congestion management, national security, system reliability, and/or emission benefits)?

2) What incentives are available in your state for increased investment in clean DG?

3) What barriers limit investment in or the viability of clean DG? How have you attempted to address those barriers in your state?

4) What are the opportunities for energy and environmental agencies to work together on clean DG?

5) Has your state gathered any evidence about actual or estimated emissions impacts from different DG technologies?

6) Has your state attempted to quantify the actual or potential benefits of clean DG in terms of avoided fuel use (and associated emissions), increased reliability, and reduced transmission congestion? What additional technical assistance do you need to better capture the costs and benefits?

C. Resources

EPA's Combined Heat and Power Partnership
The Combined Heat and Power Partnership is a voluntary program that brings the CHP industry together with state and local governments, energy end-users and other stakeholders that are interested in using CHP as a way to reduce environmental impacts from electricity generation. http://www.epa.gov/chp/index.htm . This webpage includes links to several other EPA resources:

- Output-Based Regulations: A Handbook for Regulators
  This handbook is a tool for regulators who want to encourage energy efficiency and pollution prevention through output-based emissions regulations. The handbook explains how to develop an output-based emissions standard that estimates emissions on the basis of productive output rather than amount of fuel burned.

- Catalogue of CHP Technologies
  The Catalogue of CHP Technologies describes several CHP systems, including cost and performance characteristics of specific systems.

Regulatory Requirements Database for Small Electric Generators
The US DOE and Oak Ridge National Laboratory database of regulations for small generators offers state by state information about permit requirements, exit fees, standby rates, economic incentives, emissions regulations, siting regulations, and regulatory codes.
http://www.eea-inc.com/rrdb/DGRegProject/index.html

The Database of State Incentives for Renewable Energy (DSIRE)
This database offers a chart of state rules, regulations, and policies including public benefits funds, renewables portfolio standards, net metering, interconnection standards, extension analysis, generation disclosure, contractor licensing, equipment certification, solar/wind access laws, construction and design standards, and green power requirements. Buttons on the chart are linked to brief descriptions of the state policy.
http://www.dsireusa.org/summarytables/reg1.cfm?&CurrentPageID=7

DOE – EERE Distributed Energy Program website
This site has information and links to DOE's programs to support DG and CHP programs. The US DOE, Energy Efficiency and Renewable Energy, State Energy Program link leads to a DOE site with details about State Energy Office CHP projects.
http://www.eere.energy.gov/de/.

The DOE CHP Emissions Reduction Estimator
The CHP estimator provides estimates for CO_2, SO_2, and NO_x emissions for CHP options.
http://www.bchp.org/prof-emission-tool.html

California Energy Commission's Distributed Generation Program
This link leads to the California Distributed Energy Resources Guide, which contains information on distributed energy resources.
http://www.energy.ca.gov/distgen/

Model Regulations for the Output of Specified Air Emissions from Smaller Scale Electric Generation Resources
The Regulatory Assistance Project's 2002 draft model rule offers model regulations for certain air pollutants from small generating units.
http://www.raponline.org/ProjDocs/DREmsRul/Comments/EMAcomments.pdf