



UTILITY INCENTIVES FOR COMBINED HEAT AND POWER

**U. S. Environmental Protection Agency
Combined Heat and Power Partnership**



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FOREWORD

The U.S. Environmental Protection Agency (EPA) established the Combined Heat and Power (CHP) Partnership as a voluntary program that seeks to reduce the environmental impact of power generation by promoting the use of CHP. CHP is an efficient, clean, and reliable approach to generating power and thermal energy from a single fuel source. CHP can increase operational efficiency and decrease energy costs, while reducing the emissions of greenhouse gases that contribute to global climate change. The CHP Partnership works closely with energy users, the CHP industry, state and local governments, and other stakeholders to support the development of new CHP projects and promote their energy, environmental, and economic benefits.

The CHP Partnership provides resources about CHP technologies, incentives, emissions profiles, and other information on its Web site at <www.epa.gov/chp>.

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ABOUT THIS REPORT

As part of its broader outreach and education efforts to expand knowledge of the benefits of and applications for combined heat and power (CHP), the U.S. Environmental Protection Agency, through its CHP Partnership (CHPP) has undertaken targeted efforts to increase CHP use in four market sectors: dry mill ethanol production, casinos/hotels, wastewater treatment facilities, and electric and gas utilities. The CHPP provides sector-specific information about the technical and economic benefits of CHP so that energy users and providers can consider implementing CHP.

This report describes the results of EPA's research and analysis into utility incentives for CHP. It provides information about utility-initiated policies, programs, and incentives for CHP systems, and is organized as follows:

- Descriptions of utility policies and programs launched by investor-owned and public gas and electric utilities.
- Discussion of utility actions resulting from state policies to promote CHP.
- Case studies of three successful CHP projects that resulted from utility-initiated programs to advance CHP.
- Tools and resources the CHPP has available to help utilities implement CHP projects.

To date, utility initiatives that encourage CHP deployment have taken many different forms. Of the 41 U.S. utility companies researched for this report, 18 provide some type of support for CHP that is not part of a state-mandated initiative; of these, four are gas-only utilities, two are electric and gas utilities, and 12 are electric-only utilities. Eight of the utilities are investor-owned, nine are publicly (municipal- or state-) owned, and one is a cooperative (consumer-owned). Direct financial incentives (i.e., grants or rebates) that are not the result of state policies are not commonly offered; however, at least one investor-owned gas utility (Southwest Gas) and two publicly owned electric utilities (City of Palo Alto Utilities and Sacramento Municipal Utility District) have developed or are developing such programs. Far more common are other types of activities that promote CHP development. Our research identified 16 types of utility actions/programs (shown in the list below) that support CHP development in ways other than offering direct financial incentives for CHP system installation:

- Program Funding (e.g., system benefits charge)
 - Financial Incentives
 - State Program Funding
- Request for Proposals (RFP) for Supply
- CHP Research and Development (R&D)/Demonstration Projects
- Outreach (e.g., CHP-specific Web page)
- Site/Feasibility Analyses
- Design and Engineering
- Construction and Installation
- Maintenance and Operation
- Project Management
- Ownership/Joint Ownership
- Performance Contracting
- Favorable Gas Rates
- Load Curtailment Payments
- Regulatory Process Advice
- Shared Savings Loans (waste heat recovery)
- Custom Rebates (waste heat recovery)

Table 1 provides a summary of the type of incentives offered by each utility contacted by the EPA. By and large, these types of utility-initiated incentives for CHP have resulted in the successful development of CHP projects; however, to date, these programs have led to the development of only a few projects in the utility territory they serve.

Utilities have also been involved to varying degrees in state-initiated programs to promote CHP. These state programs—typically funded by system benefits charges (SBCs) levied on customer bills—have resulted in hundreds of operational CHP projects and nearly 200 megawatts (MW) of supply. Utility actions in response to state policies and initiatives to promote CHP range from collecting mandated system benefits charges via customers’ gas and electric bills (e.g., in New York, Vermont), to assisting customers with accessing funding available from the state (e.g., in Connecticut, New Jersey), to administering state-initiated programs (e.g., in California, Minnesota).

Utilities also play a prominent role in the National Action Plan for Energy Efficiency¹ which has released a Vision for 2025. This Vision for 2025 establishes a goal of achieving all cost-effective energy efficiency by 2025, presents ten implementation goals for states, utilities, and other stakeholders to consider to achieve this goal; describes what 2025 might look like if the goal is achieved; and provides a means for measuring progress. Policies to remove barriers to combined heat and power was identified as an important policy step toward Goal 10, Advancing Advanced Technologies. Progress at the state-level on the supporting utility policies was measured on policies associated with interconnection rules; reviewing combined heat and power as part of the planning process and incorporating it where effective; and standby rates in place that value the costs and benefits of distributed generation. Reviewing this information in the Vision for 2025 may be instructive for utilities in addition to this report.

Table 1. Summary of Utilities That Offer Incentives, Policies, and Programs to Support CHP

Company/Utility	Type of Utility	Financial Incentives	State Program Funding	RFP for Supply	CHP R&D/ Demonstration	Outreach/ CHP Web page	Site /Feasibility	Design & Engineering	Construction & Installation	Maintenance & Operation	Project Management	Ownership/Joint Ownership	Performance Contracting	Favorable Gas Rates	Load Curtailment Payment	Regulatory Process Advice	Shared Savings Loans (WHR)	Custom Rebates (WHR)
<i>Utility-Initiated Actions</i>																		
Alliant Energy (IA, MN, WI)*	IOE, IOG					X	X	X	X	X	X	X					X	X
Austin Energy (TX)*	P					X	X											
Braintree Electric Light Department (MA)	P				X													
City of Palo Alto Utilities (CA)*	P	X					X											
Con Edison (NY)	IOE, IOG		X			X									X			
Great River Energy (MN, ND)*	C									X		X						
Groton Utilities (CT)	P					X		X	X							X		
Kansas City Power & Light (KS, MO)	IOE			X														
Long Island Power Authority (NY)	P			X	X													
Missouri Joint Municipal Electric Utility Commission (MO)	P									X		X						
Nebraska Public Power District (NE)*	P										X							
New Jersey Natural Gas (NJ)	IOG					X								X				
New York Power Authority (NY)	P				X				X		X	X						
PPL Corporation (multi-state)	IOE							X	X	X			X					
Sacramento Municipal Utility District (CA)*	P						X											
South Jersey Gas (NJ)	IOG					X				X	X							
Southwest Gas (AZ, CA, NV)	IOG	X				X	X											
The Gas Company (HI)*	IOG					X					X			X				
<i>State-Mandated Initiatives</i>																		
Cascade Natural Gas Corporation (OR)	IOG		X															
Central Hudson Gas and Electric (NY)	IOE, IOG		X															

Company/Utility	Type of Utility	Financial Incentives	State Program Funding	RFP for Supply	CHP R&D/ Demonstration	Outreach/ CHP Web page	Site /Feasibility	Design & Engineering	Construction & Installation	Maintenance & Operation	Project Management	Ownership/Joint Ownership	Performance Contracting	Favorable Gas Rates	Load Curtailment Payment	Regulatory Process Advice	Shared Savings Loans (WHR)	Custom Rebates (WHR)
Connecticut Light and Power (CT)	IOE		X			X												
Connecticut Natural Gas Corp / Southern Connecticut Gas (CT)*	IOG		X			X												
Consumers Energy (MI, WI)	IOE, IOG		X															
Detroit Edison (MI)	IOE, IOG		X															
Elizabethtown Gas (NJ)	IOG		X															
Entergy (VT)	IOE		X															
New York State Electric & Gas (NY)	IOE, IOG		X															
Niagara Mohawk (NY)	IOE		X															
Northwest Natural Gas (OR)	IOG		X															
Orange and Rockland Utilities (NY)	IOE		X															
Pacific Gas & Electric (CA)	IOE, IOG	X	X			X												
Pacific Power (OR)	IOE		X															
Portland General Electric (OR)	IOE		X															
Public Service Electric & Gas (NJ)	IOE, IOG		X															
Rochester Gas and Electric (NY)	IOE		X															
San Diego Gas & Electric (CA)	P	X	X			X												
Southern California Edison (CA)	IOE	X	X			X												
Southern California Gas (CA)*	IOG	X	X			X												
United Illuminating (CT)	IOE		X			X												
Xcel Energy (MN)	IOE, IOG	X	X															
Yankee Gas (CT)	IOG		X			X												

* = EPA CHPP Partner; C—Cooperative; IOE—Investor-Owned Electric; IOG—Investor-Owned Gas; P—Public; WHR—Waste Heat Recovery

UTILITY-INITIATED INCENTIVES, POLICIES, AND PROGRAMS FOR CHP

EPA examined utility-initiated policies, programs, and incentives for CHP for 41 U.S. utility companies. This examination shows that programs and policies to promote CHP have been adopted or developed by both investor-owned and public electric and gas utilities. These programs and policies include:

- Project management services.
- Design and engineering services.
- Installation and construction services.
- Maintenance and operation services.
- Creative ownership arrangements.

Presented below are brief case studies of utility-initiated actions and initiatives to promote CHP, presented by utility category—investor-owned gas utilities, investor-owned electric utilities, and publicly owned electric utilities. (Investor-owned utilities that sell both electric and gas are included with gas utilities.) Utilities that provide program funding as a result of state policies or that are involved in state-mandated incentive programs are discussed separately.

INVESTOR-OWNED GAS UTILITIES

Alliant Energy Corporation (CHPP Partner—Project Development; Financing; Rebates; Outreach) is a regulated, investor-owned utility providing electric and natural gas service to customers in Iowa, Wisconsin, and Minnesota. Alliant Energy's Distributed Generation (DG) team provides expert assistance to organizations interested in DG. The utility provides services such as project management and engineering for DG projects.

In Minnesota and Wisconsin, the company offers its business customers shared savings loans for energy efficiency projects, including waste heat recovery systems. Alliant's energy experts help customers identify, finance, and implement projects. Alliant pays for the initial cost of the system and works with suppliers to purchase and coordinate installation. The customer repays the utility each month over the contract term (usually five years) through its resulting energy savings.²

In Iowa, Alliant provides custom rebates for energy saving projects, including waste heat recovery systems for commercial, industrial, agricultural electric and gas customers.³ Incentives are paid after the project is completed, and in most cases are equal to 150 percent of the annual energy dollar savings. The program requires a minimum two-year payback after incentive.⁴

Alliant Energy maintains a DG Web site⁵ that explains how DG works and specifies capacity ranges from 1 kilowatt (kW) for residential customers to 15 MW for commercial and industrial customers. The Web site also describes various technologies used for DG, including wind, solar power, and CHP prime movers. Additionally, the site provides a contact hotline for more information. Some Alliant Energy DG projects include Albert Lea Wastewater Treatment Plant project (Minnesota); Sauk County Landfill project (Wisconsin); City of Sheboygan Wastewater Treatment Plant project (Wisconsin); and the City of Milwaukee backup generation project (Wisconsin).⁶ The City of Sheboygan Wastewater Treatment Plant Project is described as a case study on page 21 of this report.

ConEdison Company of New York (Demand-Side Management Incentive; Outreach) is a subsidiary of Consolidated Edison Inc. (ConEd), a large investor-owned energy company. ConEd provides electric service in New York City and most of Westchester County, New York, as well as natural gas service in the Boroughs of Manhattan, the Bronx, and parts of Queens, and in Westchester County. ConEd maintains a DG Web site that defines a DG facility as “up to 20 MW electric production facility for support of nearby load” and CHP DG as “a facility that produces heat as an energy product.” The Web site states that DG can use both renewable fuels (e.g., photovoltaic, wind, water, farm waste) and nonrenewable fuels (e.g., natural gas and fossil fuels for engines, turbines and fuel cells). ConEd permits its customers to operate a DG system and purchase natural gas or steam from the company if required for operation of DG.⁷

ConEd offers a demand-side management (DSM) incentive for DG/CHP customers who are willing to provide or curtail load during a power shortage or an emergency. Under the Installed Capacity Program (ICAP), customers capable of reducing at least 100 kW of load for at least four hours through onsite generation or load curtailment are paid either \$0.50 per kW-hour (kWh) or the real-time zonal location-based marginal price less the retail rate (whichever is higher) for voluntary load reductions. ICAP customers also receive a payment for load reduction based on a capacity rate. The capacity rate varies according to the capability period and location.⁸ For customers within the electrical boundaries of New York City, the payment rate is \$6.50 per kW. For customers within the electrical boundaries of Westchester County, the payment rate is \$2.67 per kW. The two payment rates are per kW of generator- or non-generator-based unforced capacity for each month of the customer’s contract during the capability period.⁹

New Jersey Natural Gas (Favorable Rates; Outreach) is a local gas distribution company that serves customers in New Jersey’s Monmouth, Ocean, Middlesex, and Morris counties. In 2006, the New Jersey Board of Public Utilities approved a request by New Jersey Natural Gas (NJNG) to implement a Conservation Incentive Program (CIP), a revenue decoupling program that would allow the utility to recover fixed costs and still provide and promote energy efficiency.¹⁰ NJNG provides a special pricing plan for commercial and residential customers who install DG. Under the special plans, a residential customer can save up to 40 percent on the delivery charges for natural gas and a commercial customer can save up to 50 percent on delivery charges. NJNG also provides guidance and support on DG equipment, manufacturers, distributors, and other resources. NJNG describes DG technologies fueled by natural gas on its Web site to include reciprocating engines, fuel cells, and microturbines. The NJNG Web site also includes examples of successful DG deployments, specifically highlighting a hotel and a college in New Jersey that have cut energy costs by installing cogeneration technologies (fuel cell) that

serve the electricity, hot water, and heating needs of the customers. The site also provides links to manufacturers of commercial and residential fuel cells, microturbines, and reciprocating engines.¹¹

South Jersey Gas (Incentive Program; Outreach) is a subsidiary of South Jersey Industries and provides natural gas to residential, commercial, and industrial customers in southern New Jersey.¹² South Jersey Gas was instrumental in the development of the New Jersey Clean Energy CHP incentive program in 2005.¹³ South Jersey Gas Company is supportive of CHP throughout its service district, and has worked with developers to initiate several projects. South Jersey Industries also promotes CHP through another subsidiary company, Marina Energy,¹⁴ an energy project developer that provides a full range of services to facilitate CHP.¹⁵ Marina Energy provides project management services during the design and construction phases of CHP projects, as well as operations and maintenance service once the projects are installed. Current projects for which Marina Energy is providing these services include Mannington Mills Cogeneration Facility¹⁶ and Johnson Matthey Cogeneration Facility.¹⁷

Southwest Gas (Incentive Program; Outreach) is an investor-owned gas utility that serves nearly 940,000 customers in Arizona, along with customers in Nevada and California. Southwest Gas's DG program is one of seven DSM programs included in their 2006 Arizona Program Plan, which was approved by the Arizona Corporation Commission (ACC) in late September 2007, and became operational in early 2008.¹⁸ Under this program, Southwest Gas provides incentives to customers installing onsite power generation, with a focus on CHP technologies. The program targets commercial and industrial customers and has an annual budget of \$400,000 (\$350,000 per year for incentives; \$50,000 for marketing, administration, and implementation). Southwest Gas Key Account Management engineers or contractors work with customers or customer consultants to determine the feasibility of a CHP project, and prepare economic studies and environmental assessments. A project must achieve an overall fuel efficiency of 60 percent or greater to earn utility incentives, which are payable up to a maximum of 50 percent of the installed cost of any project. The incentives are as follows:¹⁹

- \$400/kW for projects that attain fuel efficiencies from 60 to 64 percent.
- \$450/kW for projects that attain fuel efficiencies from 65 to 69 percent.
- \$500/kW for projects that attain fuel efficiencies of 70 percent and above.

In developing the program, Southwest Gas projected electricity and gas savings for 2007 to 2009 at 336,186,900 kWh and 22,063,200 therms based on funding two to three projects per year, up to a maximum of four projects. (Estimates were based on a 700 kW CHP engine.) Only engine-driven and turbine-driven CHP will initially be eligible for funding because the ACC staff made the determination that microturbines and fuel cells are supply-side, not demand-side resources, and are not cost-effective. If new technologies become available that provide natural gas DSM savings in a cost-effective manner, Southwest Gas is allowed to submit the programs utilizing these technologies for approval.

A customer seeking incentive payments will be required to submit a completed program application, 12 months of gas and electric utility bills, and a copy of the CHP project engineering

study signed and stamped by an Arizona registered professional engineer. The utility will not initially provide the customer with the entire incentive; instead, it will provide the first part of the incentive once the equipment is purchased following the submission of the project application and the engineering study. The utility will then verify the installation and operation of the equipment and energy savings prior to giving the remainder of the incentive to the customer.

The utility has appropriate forms and documents ready for customers as of early 2008.²⁰ There will be three application periods in a given year. The utility will review applications on a first-come, first-served basis, selecting qualified projects until all funding is used. Any funding not used in a given year will be carried over to the next year. The utility will seek additional funding from the ACC if the program is oversubscribed due to high levels of customer interest. The utility hopes to provide incentives for two to three projects per year, up to a maximum of four projects.

Southwest Gas educates customers about this program through their e-mail newsletter to targeted customers, called the Technology Information Center (TIC). For example, in October 2007, the feature story was about CHP applications. The TIC also provides customers with tools such as an “Ask an Expert” hotline and electronic research library. Southwest Gas engineers use the TIC to track customer interest in topics and programs. Targeted customers (e.g., energy representatives at government facilities) are also contacted directly by Southwest Gas personnel, receive direct mailings, and are invited to seminars or workshops.

Finally, Southwest Gas agreed to partner with the Intermountain CHP Application Center (ICHPC) to promote CHP regionally and to support any funding awarded by the U.S. Department of Energy (DOE). The utility co-hosted a meeting in Arizona with ICHPC to announce Southwest Gas’s DSM program to potential CHP candidates as well as other interested parties, including members of the ACC Staff.²¹

The Gas Company (CHPP Partner—Favorable Rates; Project Management) has been very interested in supporting and responding to CHP developers and expanding distributed energy markets in Hawaii. The Gas Company (TGC) offers favorable fixed gas and propane rates for CHP projects.²² TGC has also assembled project teams for CHP projects in the past, mostly in a project management capacity in which the teams coordinate with contractors, engineers, and others.²³ TGC is considering developing project support teams in the future that would assist with infrastructure upgrades, gas delivery, and other direct development efforts that might include building, owning, and operating CHP projects.²⁴ TGC also provides education and outreach activities for interested customers, businesses, policy makers, and other government representatives. TGC supplies gas and some infrastructure to eight operational projects and three projects in development. The list includes resorts, hospitals, military facilities, and retirement homes totaling 2.2 MW of operational CHP and 1.4 MW in development.

INVESTOR-OWNED ELECTRIC UTILITIES

Kansas City Power & Light (Requests for Proposals) provides power to over 500,000 customers in Western Missouri and Eastern Kansas counties. Kansas City Power & Light (KCPL) issued an RFP in September 2007 for the supply of electric capacity and energy to meet future load growth. The RFP specified that to qualify as a capacity resource, proposals needed to meet the accreditation requirements of the Southwest Power Pool (SPP). Proposals that met these requirements were expected to include both traditional and nontraditional technologies. KCPL specifically sought proposals for:

- Generating facilities, including all forms of renewable generation.
- DG resources, including end-use or customer-based generation.

KCPL sought baseload, intermediate, peaking, and renewable energy facilities. In general, the company was seeking proposals with an annual generation capacity of 25 MW or more. However, proposals sourcing from renewable energy projects or DG were eligible outside of the 25 MW generation threshold. Responses to this RFP were due September 28, 2007. The company received several responses to review and will make recommendations to the Missouri Public Service Commission in October of 2008²⁵ based on its analysis of the proposals. The company received one or two CHP proposals in response to the RFP.²⁶

PPL Corporation (Project Development) is an investor-owned energy company headquartered in Allentown, Pennsylvania, that sells energy and delivers electricity to approximately 4 million customers in Pennsylvania and the United Kingdom. PPL Energy Services is a subsidiary of PPL Corporation that provides onsite thermal and electric energy solutions using DG and CHP technologies in the Northeast and Mid-Atlantic regions. The company provides capital and project development resources to businesses for developing and building CHP systems. PPL Energy Services helps design, install, and finance DG/CHP systems including fuel cells, turbines, microturbines, and reciprocating engines. They also operate and maintain DG/CHP systems to supply businesses with all of their electric and thermal needs. PPL Energy Services describes its CHP projects on its Web site.²⁷ These include the Sheraton Edison fuel cell project, the Sheraton Parsippany fuel cell project, the Ocean County College fuel cell project, the Allentown Wastewater Treatment project (microturbine), and the Bradford County Landfill project (engine). Their Web site also includes a contact form for DG solutions that has fields for providing general information about a business, reasons for installing a DG system, and operational information such as electric cost and energy consumption for the business. The Allentown Wastewater Treatment project and the Ocean County College fuel cell project are described as case studies at the end of this report.

PUBLICLY OWNED, MUNICIPAL, AND COOPERATIVE ELECTRIC UTILITIES

Austin Energy (CHPP Partner—Feasibility Assessment; Outreach) has a Web page dedicated to the promotion of CHP/onsite DG.²⁸ Austin Energy provides assistance to help customers determine their needs and provides an Energy Products team to evaluate the feasibility of various distributed generation technologies and CHP applications. Austin Energy does not

actively offer any incentives for CHP, nor have they been involved in undertaking any of these activities over the past few years. Austin Energy reports that they would be willing to do a preliminary site assessment and feasibility study for a customer facility. They have had limited interest within their service area but considerable interest outside their service area.²⁹

The utility has a conservation department that offers energy audits and will identify and recommend pursuing CHP if appropriate. Currently, Austin Energy's electric rates are such that without incentives to offset capital expenses, most site applications of DG/CHP are not economical. There are very few opportunities to provide large capacity heating in Austin Energy's service territory, so there is not much opportunity for CHP heating applications, which would be most readily cost effective. The utility has determined that the current spark spread is too narrow to justify investments in CHP cooling applications since absorption and steam-driven chillers are more costly and require more maintenance than electrically driven chillers. The utility has published tariffs and interconnection guidelines that enable customers to install onsite generation systems, and the utility embraces net metering.³⁰

Braintree Electric Light Department (Demonstration) is a public utility that supplies electricity, Internet, and cable services to the town of Braintree, Massachusetts. In the fall of 2005, Braintree Electric Light Department (BELD) launched a residential CHP pilot program. BELD advertised in the local newspaper for Braintree residents willing to have a micro-CHP system installed in their home. BELD and the manufacturer of the unit, Climate Energy of Medfield, Massachusetts, installed the systems in four homes and studied performance of the systems for a year. The unit burns natural gas to produce electricity which heats air used by the home furnace to heat the home. Surplus electricity from the unit is used to meet other household electricity needs (up to 1 kW) or fed into the local electrical grid. BELD saw the technology as important for its green power efforts³¹ and, in 2006, offered a special introductory program to its customers.³² BELD and Climate Energy expanded the program by offering Braintree homeowners the opportunity to purchase the Climate Energy Warm Air Micro-CHP System. BELD has installed these systems in three additional homes in its service territory. The units were installed by Keyspan Home Energy Services. BELD offered a \$2,000 rebate and the gas company matched it with another \$2,000 incentive, for a total net cost to the homeowners of \$8,000. The program now has a total of seven residential micro-CHP systems installed. The program is ongoing, and BELD is unsure how long it will continue to offer the incentives to customers.³³

City of Palo Alto Utilities (CHPP Partner—Incentive Program; Feasibility Assessment) is an electricity, natural gas, and water supply utility located in the San Francisco Bay area. The city of Palo Alto Utility (CPAU) began exploring options for increasing generation within its service territory in 2004. The utility examined the options of building and owning generation within the city and/or letting customers build DG systems using utility incentives, and then buying power from the customer. CPAU decided that the latter option was more suitable for its needs and requested that the Palo Alto City Council approve³⁴ an ultra-clean local DG incentive program, called "PLUG-In," and a new natural gas rate for electric generation service. The council approved the program on October 22, 2007, and it went into effect in January 2008.³⁵

Total PLUG-In program incentives will be available to support up to 20 MW of CHP, or \$5 million over 10 years. The program may be expanded in future years depending on utility need and demand among customers. The program incentive funds are to be collected through electric rates as part of customer commodity charges. Natural gas distribution rates for CHP customers will be determined based on cost of service assessments.³⁶

Eligible technologies under the PLUG-In program include CHP, fuel cells, waste heat recovery, and renewable resources. The program will operate using rebates and is based on the statewide Self-Generation Incentive Program (SGIP) operated by California's investor-owned utilities from 2001 to 2007. The program allows a maximum size of 10 MW per customer served for a single system. If small gas turbines or reciprocating engines are selected as the generating technologies, the base incentive is \$500/kW for the first MW and \$250/kW for the second MW resulting in a maximum base incentive of \$750,000. If microturbines are used, the incentive is \$700/kW for the first MW and \$250/kW for the second MW resulting in a maximum base incentive of \$900,000. *There is a bonus incentive of \$50/kW available for CHP systems that receive an ENERGY STAR[®] CHP Award.* (For more information about the ENERGY STAR CHP Award, visit <www.epa.gov/chp/public-recognition/index.html>.) If a CHP system reduces electric peak load due to waste heat driven cooling, it could qualify for additional incentives up to \$100/kW of peak demand reduction.

Great River Energy (CHPP Partner—Project Development) is a generation and transmission cooperative headquartered in Maple Grove, Minnesota. Great River Energy (GRE) provides wholesale electric service to 28 distribution cooperatives that serve approximately 600,000 members. Much of GRE's power is produced in North Dakota and delivered to Minnesota. GRE seeks to balance cost, reliability, and environmental performance from its power supply portfolio. Part of their approach involves capitalizing on CHP's efficiency and carbon reduction benefits by installing 450 MW of CHP in the coming years. GRE's approach will be to identify and partner with potential steam hosts who can benefit from co-location while helping to improve the efficiency of the overall energy system.³⁷ GRE has two coal-fired CHP projects with ethanol thermal hosts underway in North Dakota. One of these is an innovative new project with an existing malting plant and a proposed ethanol plant in Jamestown, and the other is an expansion/modification of an existing facility in Underwood. In both projects, CHP-produced electricity is delivered to the grid and sold to GRE's customers in Minnesota, while steam is sold to the co-located agricultural process facilities. GRE views CHP as part of an overall power supply strategy, which in the long run provides higher efficiencies and lower carbon intensity.³⁸

Groton Utilities (Design & Engineering; Permitting Support; Outreach) is a municipal utility that provides electricity, water, cable, and Internet services in Southeastern Connecticut. The utility offers expertise and advice to customers on the design and installation of onsite DG systems. Groton Utilities informs customers about state and federal incentives, permitting, and other regulatory processes. It also provides customers with expert design and engineering of distributed energy plants, including CHP systems. The utility advertises these services on its Web site and lists a specific contact within its organization for more information.³⁹

Long Island Power Authority (LIPA) (Demonstration Projects; RFP for Supply) is Long Island's primary electric service provider. Under LIPA's Clean Energy Initiative—a 10-year, \$355 million dollar commitment to promote clean new electric generation technologies and energy efficiency—LIPA supports CHP through its Clean Energy Research, Development and Demonstration (RD&D) Program. The program uses in-house expertise to promote clean energy RD&D projects and provides information and education to Long Island customers, encouraging them to team with LIPA on Clean Energy RD&D projects.⁴⁰ As part of this program, LIPA has recruited government, commercial, and industrial customers to demonstrate a number of 5 kW fuel cell CHP systems. LIPA commissioned the first 5 kW Plug Power CHP fuel cell in July 2002 at the Babylon Town Hall. Since then, LIPA has used other demonstration locations such as Hofstra University, East Hampton Town Hall, McDonald's, Farmingdale University, Nassau Community College, Southampton College, and the Wantagh Animal Shelter.⁴¹

In 2006 and 2007, LIPA issued RFPs for fuel cell and biomass CHP to help it meet its New York renewable portfolio standard obligations. In December 2006, LIPA issued an RFP for the construction and operation of a 5 MW fuel cell CHP project.⁴² In November 2007, LIPA issued an RFP for one and/or two blocks of energy from eligible renewable generating facilities interested in selling renewable energy or renewable energy certificates (RECs), including from biomass CHP.⁴³

Missouri Joint Municipal Electric Utility Commission (MJMEUC) (Project Development) is a statewide joint action agency that supplies power and capacity services to 56 municipal Missouri utilities. Missouri Joint Municipal Electric Utility Commission is interested in expanding its portfolio of supply resources to include partial ownership of large coal generation and high-efficiency natural gas-fueled CHP through the Missouri Public Utility Alliance (MPUA). MPUA is an umbrella organization representing three legal entities: the MJMEUC, the Missouri Association of Public Utilities (a trade association), and the Municipal Gas Commission of Missouri. High-efficiency natural gas-fueled CHP with a thermal host offers MPUA a 'win-win-win' effort, as it provides a cost-competitive power supply for MJMEUC, reduced steam costs for the thermal host, and additional baseload gas demand for the Missouri Municipal Gas Commission. In addition to these benefits, CHP directly supports a number of MPUA goals, including increasing the diversity of its supply portfolio, increasing local control of supply assets, promoting economic development for rural Missouri, and enhancing MPUA's commitment to the environment.⁴⁴

MJMEUC has joint ownership of a 14.4 MW Solar Titan gas turbine and an unfired heat recovery steam generator at an ethanol plant in Laddonia, Missouri, which began operation in September 2006. The plant uses approximately 5 MW of power and 100,000 pounds per hour (lb/hr) of steam with the remaining 9.4 MW of electricity sent to MJMEUC's grid. Natural gas costs for the CHP system are shared at a roughly 50/50 split between the utility and the ethanol plant. MPUA is looking for additional opportunities to expand the model used in Laddonia to other new ethanol and biodiesel plants. John Grotzinger, executive director of engineering and operations for MPUA, sees joint ventures like Laddonia and Macon as a way of getting "combined-cycle performance at simple-cycle prices," and as a way of adding efficient, competitive natural gas electricity generation to their system in capacity increments that match

their load growth (i.e., 15 to 20 MW rather than the 500 MW of a typical combined-cycle investment).⁴⁵

Nebraska Public Power District (CHPP Partner—Project Management) is Nebraska's largest electric utility, with a chartered territory including all or parts of 91 of Nebraska's 93 counties. Nebraska Public Power District (NPPD) believes CHP offers a competitive advantage for ethanol facilities and is particularly interested in encouraging customer-owned CHP at facilities throughout its service territory.⁴⁶

NPPD has evaluated the market potential for CHP at the 22 ethanol plants (more than 300 MW of power) that they serve. Their goal is to convince as many of these facilities as possible to install CHP. One step NPPD has taken to achieve this goal was the 2007 release of a brochure entitled *Transforming Waste Heat into Power: Turn Your Ethanol Plant from a Power Consumer to a Power Provider*,⁴⁷ which explains the business case for CHP at an ethanol facility. NPPD states that its experts will work with an ethanol facility during every stage of CHP development—from feasibility to design to ongoing operation. NPPD is proposing to buy all excess onsite generation produced at the ethanol plant through a power purchase agreement.

In June 2008, NPPD announced that it is considering a 1- to 100-MW fuel-neutral pilot cogeneration project that would be built at an existing Nebraska ethanol plant or at an industrial facility that is served electrically by NPPD or an NPPD wholesale utility partner. Under the pilot project, NPPD would finance, construct, own, operate, and maintain a topping turbine at the selected ethanol plant or industrial facility, but the facility would continue to own and operate the boiler unit. NPPD would also enter into a 15-year steam purchase and interconnection agreement with the selected facility. NPPD solicited inquiries for this program and interested facilities had until September 1, 2008, to complete an online questionnaire.⁴⁸

Additionally, NPPD is in the midst of developing a 2008 Integrated Resources Plan—its first since 2003—which will provide a strategic framework and plan for NPPD's future resource decisions. Among other things, NPPD's long-term (20-year) resource strategy will identify the preferred future mix of resources for the production of electricity in the service territory.⁴⁹ As NPPD has been developing its plan, it has examined five key issues and developed recommendations for implementation. One of these is CHP. (The other four are load forecast growth trends and volatility, climate change and greenhouse gas regulations, energy efficiency strategy, and renewable resource strategy). The plan should be released in 2008 and could contain additional programs or incentives for CHP.

New York Power Authority (Project Development) is the largest state-owned power organization in the United States and provides low-cost electricity in New York State. As part of the services it provides to New York customers, New York Power Authority (NYPA) develops innovative technologies for the generation and transmission of electricity.⁵⁰ NYPA conducts research on DG systems, participates in institutional research at the state and national level on DG systems, and provides its customers with efficient technical solutions related to these systems. NYPA has programs in place to promote and develop microturbine and fuel cell CHP systems.

In 2001, NYPA funded and installed a fuel cell power plant at the New York Aquarium in Coney Island, New York City. The fuel cell was developed by (UTC) Fuel Cells and is fueled by natural gas. The system supplies the aquarium with 200 kW of electricity (approximately 20 percent of the aquarium's daily requirements) and generates 700,000 British thermal units (Btu) of heat, which is used to preheat hot water for an aquarium boiler and support system tanks. The total cost for the project was \$1.1 million. NYPA provided \$800,000 in funding from its long-term energy services agreement with the city of New York, supplemented by funding from DOE and the Office of the Brooklyn Borough President.⁵¹

NYPA has installed two microturbine CHP systems—at Lewiston Wastewater Treatment Plant and NYPA's White Plains Office—that total 86 kW. In addition, a total of eight NYPA-funded and -installed fuel cells, powered by waste gas, were built at four wastewater treatment plants operated by the New York City Department of Environmental Protection in the Bronx, Brooklyn, and Staten Island. With these fuel cells installed, NYPA has 10 fuel cell projects operating throughout the state that will have a combined capacity of 2.4 MW. However, not all of these utilize CHP.⁵²

Currently, as part of its CHP Program, NYPA is working with the New York State Office of General Services and the State University of New York to install CHP systems at several of their facilities.⁵³ Two of these facilities are receiving some funding from the New York State Energy Research and Development Authority (NYSERDA): Bronx Zoo (720 kW fuel cell) and Suffolk State Office Building (700 kW fuel cell/reciprocating engine system). NYPA is also involved in advancing a municipal system in Auburn, New York (1.4 MW reciprocating engine for a waste heat sludge incinerator).

Sacramento Municipal Utility District (CHPP Partner—Feasibility Assessment), a municipal electric utility, is investigating the possibility of offering incentives for CHP in the future and is currently contemplating its options.⁵⁴ Sacramento Municipal Utility District (SMUD) is interested in greater CHP development to achieve peak-load reduction, reduction of greenhouse gases, and increased customer value. SMUD currently owns three industrial-scale cogeneration plants with large thermal host customers. SMUD has completed a market assessment to identify technical potential for additional CHP in their service territory. The likely market potential in SMUD is 380 MW with over 90 percent of the remaining potential residing in facilities less than 5 MW in size. Most of the opportunities are in the commercial sector and include hospitals, schools and colleges, medical office buildings, and high-density mixed use developments. When cooling is included, the technical potential more than doubles to 780 MW.⁵⁵ As a result of this assessment, SMUD has identified candidate projects in different customer classes and is now working with approximately 12 customers to identify load profiles and perform detailed investment-grade feasibility analyses. SMUD specifically wants to identify economically feasible CHP projects given current electric tariffs and gas rates.⁵⁶ It is attempting to identify opportunities favorable to both the customer and the utility.

In November 2007, SMUD began to consider the next steps for this effort. It is considering utility-only or joint ownership of CHP projects. SMUD is also considering developing a program to provide incentives for customer-owned projects. (SMUD customers who are Pacific Gas and Electric Company [PG&E] gas customers are eligible for California's

SGIP incentives if they own the CHP and if the SGIP program continues.) SMUD has been talking with contacts at NYSERDA about options and advice for their incentive program development.⁵⁷

UTILITY ACTIONS RESULTING FROM STATE POLICIES TO PROMOTE CHP

States can encourage CHP by implementing incentive programs in the form of grants, loans, rebates, or tax incentives. These measures do not necessarily require direct utility action or involvement. CHP system installations, however, can connect to the local utility, which may provide backup power to the local generator site or purchase excess power during periods of low onsite load. Some states have required that utilities create reasonable or favorable interconnection, net metering, and utility rates (e.g., standby charges, gas rates/charges) to recognize the many benefits that DG and CHP can provide. The CHPP maintains a Funding Database that provides up-to-date information about favorable regulations that remove unintended barriers to CHP (see <www.epa.gov/chp/funding/indx.html>).

With increasing pressures to reduce greenhouse gases and expand in-state energy resource development without increasing state budgets, many states have sought to encourage clean energy through the use of utility-focused policy measures such as energy portfolio standards (EPSs) and SBCs. These types of policies require some level of compliance or cooperation by utilities subject to public utility commission oversight and regulation (generally larger investor-owned utilities).

As of July 2008, 32 states plus the District of Columbia have either mandatory or voluntary EPSs in place. These policies have varying eligibility requirements. Twelve states—Colorado, Connecticut, Hawaii, Massachusetts, Nevada, North Carolina, North Dakota, Ohio, Pennsylvania, South Dakota, Utah, and Washington—include CHP and/or waste heat recovery as an eligible resource, and Arizona explicitly includes renewable-fueled CHP systems (see Table 2 on page 19). Only five of these states, however, credit CHP in typical new gas-fired installations as eligible technologies (Connecticut, Hawaii, Pennsylvania, North Carolina, and Washington).

To date, little data is available about the success of EPS in promoting CHP installations. Washington and North Carolina enacted their EPS in 2006 and 2007, respectively. Washington has not yet completed rule development to implement the EPS, while North Carolina's EPS rules were enacted in February of 2008.⁵⁸ The first compliance year for Hawaii's CHP provisions is not until 2010, so no data are available about the number of CHP installations resulting from the EPS. In Pennsylvania, utilities have met their first compliance year obligations (June 1, 2006–May 31, 2007) largely through the purchase of renewable energy credits;⁵⁹ however, differentiated data showing the proportion of CHP projects included in those eligible projects are not yet available. In Connecticut, the Class III obligation begins at 1 percent of total output by 2007 and increases to 4 percent by 2010. Utilities that fail to meet their EPS obligations are required to make a payment to the Connecticut Department of Public Utility Control (DPUC). These payments are in turn used to help fund the Connecticut Clean Energy Fund (CCEF). The CCEF is also funded primarily through a combined Public Benefits Charge (PBC).^{60,61} The PBC-funded incentive programs have been very successful in promoting CHP development—250 MW of CHP have been approved for grants since 2005.

Public benefit funds (PBFs) are funded by SBCs or negotiated utility payments⁶² and are a more direct effort by states to encourage the installation of CHP. Eight states (see Table 3 on page 20) have created PBF incentive programs that award grants and funding to CHP projects:

- California—Self-Generation Incentive Program (SGIP).
- Connecticut—Incentive Program for Customer-Side Distributed Resources.
- Michigan—Low-Income and Energy Efficiency Fund.
- Minnesota—Xcel Energy’s Renewable Development Fund.
- New Jersey—Clean Energy Program CHP Program.
- New York—NYSERDA Program Opportunities.
- Oregon—Oregon Energy Trust’s Business Energy Solutions Program.⁶³
- Vermont—Clean Energy Development Fund.⁶⁴

Three basic types of utility responses to state PBF programs exist:

- Utilities administering programs directly.
- Utilities assisting customers in accessing funds from state-run incentive programs.
- Utilities collecting funds on behalf of the state with little other involvement.

The state PBF incentive programs that support CHP are classified according to each type of response below. The Appendix provides details about each state’s program(s).

STATE-MANDATED INCENTIVE PROGRAM ADMINISTERED BY THE UTILITY

California’s SGIP is administered by the state’s investor-owned electric and gas utilities (PG&E, San Diego Gas & Electric, Southern California Gas, and Southern California Edison) that are responsible for collecting funds, marketing the availability of funds, soliciting applications, evaluating applications, and awarding funding. The program has been highly successful in promoting CHP project development since 2001. More than 325 CHP projects totaling nearly 150 MW have been installed.⁶⁵ Under the current program, eligible technologies include only wind turbines and renewable and nonrenewable fuel cells, including nonrenewable fuel cell CHP systems.⁶⁶

Xcel Energy’s Renewable Development Fund (Minnesota) is administered by Xcel Energy through an RFP solicitation process run by the utility. The state is not involved. Because the focus of the fund is on renewable energy, only biomass CHP is eligible. In 2005, one biomass CHP research and development project (for an ethanol facility) received funding. Numerous

other biomass and ethanol-related projects have received funding, so there is the potential for biomass CHP to be included in the future.⁶⁷

STATE INCENTIVE PROGRAMS ADMINISTERED BY A STATE AGENCY; UTILITIES ASSIST CUSTOMERS IN ACCESSING FUNDING

Connecticut's Customer-side Distributed Resources Program is an incentive program run by the Connecticut Department of Public Utility Control (DPUC).⁶⁸ Connecticut's utilities have no part in soliciting or evaluating applications, but the electric and gas utilities (Connecticut Light and Power, United Illuminating, Connecticut Natural Gas Corp/Southern Connecticut Gas, and Yankee Gas) have helped increase customer awareness of the incentives by advertising their availability on their Web sites and by providing a contact within their organizations who can provide more information. As of September 2008, the Connecticut DPUC program had approved funding for 67 CHP projects in the state (an additional four are pending), with a capacity potential of 223.1 MW (~221.3 MW approved; ~1.8 MW pending).

New Jersey's Clean Energy CHP Program was created in 2005 through a joint effort of the state's gas utilities, utility commission, and environmental agency.⁶⁹ The state's gas utilities (Elizabethtown Gas, New Jersey Natural Gas, Public Service Electric & Gas, and South Jersey Gas) provided logistical/administrative support during the program's first funding round. The utility commission (through the Clean Energy Program) posted the funding solicitation, and Rutgers Center for Advanced Energy Research evaluated the applications. The gas utilities promoted the availability of funds through their Web sites, customer meetings, publications, and staff efforts. In 2006, administration of the program reverted entirely to the utility commission, and the gas utilities have slowed their promotion of the program, although some information can still be found on the gas utilities' Web sites. The program has received applications for funding in three rounds, and as of November 2007, eight projects were operational, representing more than 10.5 MW.

STATE INCENTIVE PROGRAMS ADMINISTERED BY A STATE AGENCY WITH LIMITED UTILITY INVOLVEMENT

Michigan's Low-Income and Energy Efficiency Fund is administered by the Michigan Public Service Commission.⁷⁰ Detroit Edison and Consumers Energy, Michigan's largest utilities, both contribute to the fund and recover costs through customer charges but have no other involvement in the fund's administration. Approximately \$387.5 million has been awarded over the course of 17 rounds of funding since 2002. Of the 142 contracts awarded, only 20 of these (totaling \$18.2 million in funding) have been for projects that are not earmarked for low-income energy efficiency. Two of these were CHP projects (in 2002).⁷¹ It is not clear if future funding rounds will be restricted to low-income only or will include more broadly eligible technology grants.

New York's NYSERDA Program Opportunities are administered by a state agency with limited involvement with the state's utilities. To support New York's PBF program, the state's

six investor-owned utilities (Central Hudson Gas and Electric, Consolidated Edison, New York State Electric & Gas, Niagara Mohawk, Orange and Rockland Utilities, and Rochester Gas and Electric) collect SBC funds from customers through a surcharge on customer bills. Each utility remits the funds to NYSERDA, which then solicits and evaluates proposals and provides grants following successful implementation. NYSERDA has provided funding to 51 projects that are now operational (totaling 26.5 MW capacity) and has approved funding for 57 additional projects in development (totaling more than 160 MW of capacity).⁷²

Energy Trust of Oregon, Inc. is a nonprofit, quasi-public agency that receives SBC monies from the state's largest electric and gas utilities (Pacific Power, Portland General Electric, Northwest Natural Gas, and Cascade Natural Gas Corporation) to conduct its programs.⁷³ Utility involvement is limited to collecting the customer charges and reverting them to the Energy Trust of Oregon (as authorized by the Oregon PUC). Seventeen percent of funds are used to provide incentives to renewable energy projects including CHP. Five CHP projects have received funding from the Energy Trust—four biomass CHP and one natural gas CHP. One of the projects is in operation (395-kW biogas-fueled engine), two are under construction (totaling 3.2 MW of biomass CHP), and two more have recently been approved for funding (one of which is a 15 MW biomass CHP project).⁷⁴

Vermont's Clean Energy Development Fund was established in 2005 and is administered by the Vermont Department of Public Service (DPS) to promote renewable energy and CHP. Vermont's DPS receives between \$4 million and \$7 million per year from the state's largest utility (Entergy) as part of a negotiated permit to allow Entergy to operate a nuclear energy facility in Vermont through 2012. The utility has no role in the execution of the program. During the first round of funding in late 2006, the DPS proposed that \$50,000 be used to support the installation of a CHP facility in the state.⁷⁵ In 2007, the DPS received 34 proposals for project funding in four categories: pre-project financial assistance, small-scale systems, large-scale systems, and special demonstration projects. Seventeen projects were awarded a total of \$2 million, and four of those projects included CHP. Two of the CHP projects were for biomass CHP pre-project financial assistance and the remaining two CHP projects were for small-scale systems.⁷⁶

Table 2. States with CHP or Waste Heat as Eligible Resources within Their Energy Portfolio Standard

State	Technology Eligible	Enacted	First Compliance Period (for CHP portion)	Results
Arizona	Renewably Fueled CHP	2006	By 12/31/07	Not yet available—first compliance period has not ended
Colorado	Waste Heat	2004	By 12/31/07	Not yet available—first compliance period has not ended
Connecticut	CHP	1998 (amended in 2003, 2005, 2006)	By 1/1/07	Utilities are expected to meet the Class III standard; details to be released in 2008
Hawaii	CHP	2004 (amended 2006)	By 12/31/10	Not yet available—first compliance period has not ended
Massachusetts	CHP	1997	Annual reporting required beginning January 1, 2009	Alternative Energy Portfolio Standard (AEPS) takes effect January 1, 2009
Nevada	Waste Heat	1997	By 12/31/05	Utilities met their RE obligations; EE includes waste heat CHP only
North Carolina	CHP	2007	By 1/1/10	Not yet available—first compliance period has not ended
North Dakota	Waste Heat	2007	By 1/1/15	Not yet available—first (voluntary) compliance period has not ended
Ohio	CHP	2008	Annual benchmarks for the alternative energy standard not yet developed	Alternative Energy Resource Standard takes effect January 1, 2009
Pennsylvania	CHP	2004 (amended 2007)	6/1/06–5/31/07	All utilities met Tier II obligations in 2007; amount of CHP not yet differentiated ^a
South Dakota	Waste Heat for Electricity Generation	2008	12/1/08	Voluntary objectives—annual reporting begins December 1, 2008
Utah	CHP	2008	2025	Voluntary objectives—first progress report required January 1, 2010
Washington	CHP	2006	By 1/1/12	Not yet available—first compliance period has not ended

Source: DSIRE Database of State Incentives for Renewables and Efficiency. www.dsireusa.org. Accessed August 20, 2008. EPA CHPP paper, Energy Portfolio Standards and the Promotion of CHP. www.epa.gov/chp/documents/eps_and_promotion.pdf

^a Phone conversation with Calvin Birge, Pennsylvania Public Utilities Commission, December 3, 2007.

Table 3. States with Public Benefit Funds that Support CHP

	California	Connecticut	Michigan	Minnesota	New Jersey	New York	Oregon	Vermont
Program Name	Self-Generation Incentive Program (SGIP) ^a	Customer-Side Distributed Resources Program	Low-Income and Energy Efficiency (LIEE) Fund	Xcel Energy Renewable Development Fund (RDF)	NJ Clean Energy Program (NJCEP)	NYSERDA Program Opportunities	Energy Trust of Oregon	Clean Energy Development Fund (CEDF)
Year Established	2001	2005	2002	1999	2005 ^d	1996	2002	2005
Number CHP Projects Approved for Funding	430	60	2	1	43	57	5	4
MW Potential of CHP Projects Approved for Funding	214	253	>0.025 ^b	N/A ^b	>20	160	18.6	0.010
Number CHP Projects Installed	330	Information Not Yet Available	2	1	8	51	1	0
MW Capacity of CHP Project Installed	150	Information Not Yet Available	>0.025 ^c	N/A ^b	10.5	26.5	.395	N/A

N/A = Not applicable.

^a Under the current SGIP, eligible technologies include only wind turbines and renewable and nonrenewable fuel cells, including nonrenewable fuel cell CHP systems.

^b One of the two projects funded was 25 kW; the size of the second project is not available.

^c The only project funded to date was a demonstration project.

^d The SBC/PBF has been in place since 1999, the CHP incentive program has been in place since 2005.

CASE STUDIES OF UTILITIES PROMOTING CHP

The case studies discussed in this section highlight the variety of approaches taken by utilities to incentivize the development and installation of CHP projects. These approaches include:

- Participation in unique business and financial arrangements.
- Provision of key funding for the projects.
- Special pricing plans for delivery of natural gas.
- Design, construction, installation of CHP equipment.
- Assumption of performance risks through performance contracts.

CITY OF SHEBOYGAN, WISCONSIN, WASTEWATER TREATMENT PLANT PROJECT

In 2004–2005, the city of Sheboygan Wastewater Treatment Plant recognized that it had nearly 50,000 cubic feet of methane available from the operation of its digesters and began exploring ways to use the gas. However, the city was hesitant about self-installing microturbines. Alliant Energy, the local electric and gas utility, presented the city with another solution. Alliant offered to install 10 microturbines in a CHP configuration, fueled by the wastewater treatment plant's biogas. Alliant had a number of the turbines available and was looking for viable sites that could provide fuel at no cost. The project also helps Alliant satisfy the state's renewable requirement by selling the electricity generated from the project to the city.

Alliant financed \$1 million of the \$1.2 million cost for the plant, with the city paying the \$200,000 balance. Under the development agreement with the city, Alliant owns the microturbines and will maintain them for six years. At the end of the six year period, the city has an option to buy the turbines for \$100,000. It is unclear whether the city will exercise the option, as maintenance costs are high and Alliant will likely still be interested in generating clean energy to satisfy the state's renewable energy requirement.⁷⁷

Alliant Energy installed and began operating the equipment—10 30 kW Capstone microturbines, two Cain heat exchangers, and Unison gas conditioning equipment—in February 2006. The CHP system generates about 2 million kWh of electricity annually and 6 trillion Btu of thermal energy per year. The heat is used by Sheboygan to maintain proper temperature in their digesters. The electricity is sold by Alliant to the city at 4.2 cents per kWh. The city's total annual electricity bill is close to \$380,000, including \$145,000 in demand charges. Alliant refunds approximately \$30,000 to the city for the demand charge portion of the energy produced by the microturbines.

The new CHP system saves the city about \$30,000 per year in electrical savings and \$50,000 per year in heat savings—for total energy savings of about \$80,000 per year. The city

also receives about \$6,000 of additional revenues per year from the sale of the green attributes (RECs) associated with the electricity produced by the microturbines. The payback period for the city on the project is less than 2.5 years. If the city chooses to purchase the microturbines in 2012, its savings will climb to \$180,000—\$60,000 in heat energy savings and \$120,000 in offset electricity costs that the city will not have to pay Alliant. Dale Doer, plant superintendent at the Sheboygan Wastewater Treatment Plant, states, “This has been a very good project for the city. We had a valuable experience with Alliant and are looking to install four to eight more turbines at the plant in the future.”⁷⁸

ALLENTOWN, PENNSYLVANIA, WASTEWATER TREATMENT PROJECT

The Allentown wastewater treatment plant serves a population of approximately 195,000 people in 14 townships and boroughs plus the city of Allentown. The plant’s biogas is collected from two primary digesters and one secondary digester. PPL Spectrum, a subsidiary of PPL Corporation, worked with the city of Allentown, Pennsylvania, to successfully install a 390-kW wastewater treatment biogas CHP project at the facility in 2004.

PPL installed 13 30-kW biogas-powered Capstone microturbines at the plant. The turbines use 42 million cubic feet of waste methane gas each year to produce electricity and hot water for the city’s use at the plant and in the digesters. The thermally baseloaded system meets close to 96 percent of the facility’s thermal requirements and roughly 10 percent of its electrical demand.⁷⁹

PPL and the city of Allentown financed the project through a performance contracting model. Under the performance contract, PPL assumed all performance risks related to the equipment and guaranteed the savings from the project. The capital investment was provided by a 10-year municipal lease with a bond-comparable interest rate. The city makes payments toward the lease from the reduction in utility costs guaranteed by PPL Spectrum. The reduction in utility costs has resulted in annual savings of nearly \$85,000 per year for the city, which is slightly less than initially projected.

OCEAN COUNTY COLLEGE FUEL CELL PROJECT

NJNG and PPL Energy Services partnered with Ocean County College (OCC) in Toms River, New Jersey, to install a 250-kW natural gas fuel cell CHP system in late 2003. The fuel cell CHP system uses natural gas delivered by NJNG to generate electricity and heat for the central power and heating system for a number of campus buildings. The system serves about 90 percent of power needs for two OCC buildings and provides 20 percent of the heating needed for seven buildings.

NJNG offers a special pricing plan to OCC for the project, which saves the college approximately \$0.28 per therm for the delivery of natural gas used by the fuel cell.⁸⁰ (NJNG was at the forefront of offering lower gas delivery charges, even before the New Jersey Board of Public Utilities asked for lower gas transportation rates by utilities.⁸¹) The college saves nearly

\$60,000 in annual energy costs by purchasing gas at the reduced rate, generating electricity on site, and recovering waste heat from the fuel cell. In addition, the college realizes operating cost savings, maintenance cost savings, and has seen an increase in boiler life of 30 percent. (Previously, the college needed to run three boilers continuously, whereas now only one runs at a time and the other two are used as spare boilers.)

The total cost of the project was \$1.5 million. A portion of the initial capital cost of the project (\$100,000) was provided by the New Jersey Board of Public Utilities through funding available from the New Jersey Clean Energy Program; a federal grant provided \$700,000 toward the project; and OCC paid for the remaining project costs.⁸²

TOOLS, SERVICES, AND RESOURCES FOR UTILITIES

A number of tools, services, and resources are available from the CHPP to help utilities support and/or implement CHP projects in their service territories. More information about all of these offerings is available on the CHPP Web site at <www.epa.gov/chp>.

GENERAL CHP EDUCATION AND OUTREACH RESOURCES

The CHPP conducts education and outreach about CHP and its benefits to industry partners and energy end users. Many of these resources can provide utilities with valuable knowledge about CHP, its benefits, and potential applications. Some of the key education and outreach resources include:

- **CHP Catalog of Technologies.** This catalog provides an overview of how CHP systems work and the key concepts of efficiency and power-to-heat ratios. It also provides information about the cost and performance characteristics of five commercially available CHP prime movers. <www.epa.gov/chp/basic/catalog.html>
- **Biomass CHP Catalog of Technologies.** This catalog provides resource owners, facility managers, developers, policymakers, and other interested parties with a detailed technology characterization of biomass CHP systems. The report reviews the technical and economic characterization of biomass resources, biomass preparation, energy conversion technologies, power production systems, and complete integrated systems. <www.epa.gov/chp/basic/catalog.html>
- **CHP Project Development Handbook.** This handbook describes the CHP project development process and offers hints and strategies for successfully developing CHP projects, which can be especially beneficial to utilities because CHP projects might be new to utilities in many cases. <www.epa.gov/chp/project-development/index.html>
- **CHP Funding Database.** CHP and biomass/biogas funding opportunities are offered by various entities throughout the country, many at the state and federal level. These opportunities take a variety of forms, including financial incentives, such as grants, tax incentives, low-interest loans, favorable partial load rates (e.g., standby rates), and tradable allowances, as well as favorable regulatory treatment that removes unintended barriers to CHP, such as standard interconnection requirements, net metering, and output-based regulations. The Funding Database lists these and other incentives that might be applicable to a CHP project. This resource can be beneficial to utilities by presenting the financial incentives available to a utility for a CHP project, as well as to see the types of incentives and favorable regulatory treatment that utilities can consider offering in their service territories. <www.epa.gov/chp/funding/funding.html>
- **Strategic Market Resources.** The CHPP has targeted some of its analysis and outreach efforts to increase awareness and adoption of CHP in four strategic market

sectors: dry mill ethanol production, hotels and casinos, municipal wastewater treatment facilities, and utilities. The Partnership's work in these sectors includes evaluating the technical fit for CHP within each market sector; conducting market-specific research and analysis of economic opportunities; performing outreach to sector stakeholders, including energy users, sector associations, and relevant state and federal agencies; and providing project assistance to promote the installation of CHP in the sector. Because CHP in all of these sectors has strong technical and economic viability, utilities may want to consider working within these sectors to increase CHP capacity in their service territories. <www.epa.gov/chp/markets/index.html>

STATE POLICY RESOURCES

Recognizing the numerous benefits CHP provides, an increasing number of states are interested in policies to promote increased investment in CHP. The Partnership works with federal and state policymakers and utilities to help identify and evaluate best practice policies and programs to support the increased use of clean DG, such as CHP. Policy opportunities include:

- Developing standardized interconnection rules.
- Designing standby rates that suitably recognize DG and CHP benefits while appropriately compensating the utility for its provided services.
- Developing incentive programs for CHP using public benefit funds.
- Including CHP/waste heat recovery in renewable portfolio standards and energy efficiency portfolio standards.
- Establishing output-based emissions regulations and incorporating other efficiency measures into state implementation plans.

The CHPP can work with utilities and state regulators to improve the policy and regulatory environment for CHP. For more information and to access the CHPP's state policy resources, please visit the State Policy Resources Web site at <www.epa.gov/chp/state-policy/index.html>.

TECHNICAL ASSISTANCE FOR CANDIDATE SITES

The CHPP provides information, tools and technical assistance to utility partners who are considering implementing CHP projects. The Partnership can help:

- Identify opportunities for cost-effective CHP.
- Assess goals, drivers, and potential barriers for a project.
- Direct energy users to existing tools and resources.

- Determine next steps for project technical assistance.

If there is a compelling technical and business case for CHP at a particular site, a goal will be to identify the information necessary to advance to the next stage of project development. This may include quantifying the technical and economic potential at a site, estimating the environmental impacts and providing letters of support for beneficial projects, or providing information on a variety of technical or policy issues that will be important when considering, planning, or building your CHP system.

Types of technical assistance offered by the CHPP include:

- **Spark Spread Screening for CHP Candidate Sites.** Based on minimal site information, the CHPP team can provide a preliminary spark spread screening of CHP economic viability for a single site or multiple end-use sites. The screening includes assumptions about typical CHP system performance characteristics, fuel prices, and credit for displaced thermal energy to estimate the operating cost of onsite power generation at each site. The difference between the cost of purchased power and the cost to produce power on site indicates whether CHP will provide energy savings.
- **Level 1 Feasibility Analysis.** If a site is determined to have good economic and technical potential for CHP, the CHPP team can conduct a Level 1 Feasibility Analysis to help utility partners determine how compelling the opportunity is. The CHPP team evaluates several CHP technologies or system options and develops budgetary pricing and economic analyses for each option to determine a simple payback timeframe. In addition, the CHPP can conduct sensitivity analyses to help quantify the benefits of available grants or incentives, the additional costs and benefits associated with using the CHP system to provide backup power in utility outages, or the impacts of future utility rate increases or decreases.
- **Third-Party Review of Feasibility/Design Analyses.** The CHPP team can provide third-party reviews of CHP system feasibility and/or design analyses. A review will include an evaluation of critical assumptions, approaches to CHP equipment selection and sizing, and project economics.
- **Technology/Vendor List.** The Partnership team can furnish a list of technology suppliers and project developers with relevant expertise in the CHP technology being considered. The list is not a vendor recommendation; it will merely identify suppliers and vendors with experience in similar installations, noting which businesses are CHP partners.
- **Incentive/Policy Analysis.** The Partnership team can provide a review of specific national and state incentives and policies that could affect a prospective CHP installation at a given location. The policy analysis will identify national and state incentives that might apply to the installation. The review also outlines critical policies or regulations that could affect the economic viability of the project.

- **Energy and Emissions Savings Calculations.** The CHPP team has developed the CHP Emissions Calculator, an easy-to-use online tool that can be used to quantify the energy and emissions (carbon dioxide, sulfur dioxide, and nitrogen oxides) savings from using CHP technology. The CHP Emissions Calculator compares the energy use and emissions reductions of a CHP system with the energy and emissions from separate heat and power generation. The CHPP team is available to help a candidate or operating site run the tool and will send a letter to the site owner outlining the results upon request. Across the United States, utilities are under pressure to decrease carbon emissions. The CHP Emissions Calculator is a valuable tool for assessing the potential emissions reductions associated with a utility CHP project.
<www.epa.gov/chp/basic/calculator.html>

To access the technical assistance resources offered by the CHPP, please visit the “Technical Assistance for Candidate Sites” Web page at <www.epa.gov/chp/partnership/tech_assistance.html>, or contact the CHPP helpline at <chp@epa.gov> or 703-373-8108.

PUBLIC RECOGNITION

EPA awards the ENERGY STAR CHP Award to leaders who increase the nation’s electric generation efficiency through the development of highly efficient CHP projects. The ENERGY STAR CHP Award recognizes projects that reduce emissions and use at least 5 percent less fuel than state-of-the-art separate heat and power generation. When a system qualifies for an award, EPA:

- Sends a letter to the recipients acknowledging their achievement.
- Develops an announcement describing the system's energy and environmental excellence. The announcement is posted on the CHPP Web site.
- Presents the framed award to the recipient at an event attended by their peers.

Earning an EPA ENERGY STAR CHP Award is a great way for utilities to receive recognition for their commitment to improving the environment. To learn more about the ENERGY STAR CHP Award and how to apply, please visit the CHPP Web site at <www.epa.gov/chp/public-recognition/awards.html>.

OTHER EPA RESOURCES

In addition to the tools, services, and resources offered by the CHPP, the following resources developed by EPA that can help utilities better understand and develop CHP projects:

- **Aligning Utility Incentives with Investment in Energy Efficiency Report.** In support of the National Action Plan for Energy Efficiency (Action Plan), the report on Aligning Utility Incentives with Energy Efficiency Investment describes the financial effects on a utility resulting from its expenditures on energy efficiency programs, how those effects could constitute barriers to more aggressive and sustained utility investment in energy efficiency, and how adoption of various policy mechanisms can reduce or eliminate these barriers. The report also provides a number of examples of such mechanisms drawn from the experience of utilities and states.
www.epa.gov/cleanenergy/documents/incentives.pdf (report);
www.epa.gov/eeactionplan (Action Plan).
- **EPA Clean Energy Resources Database.** This searchable database describes key resources and documents relevant to the Action Plan, the Clean Energy-Environment Guide to Action, and State Clean Energy Program Activities. It addresses the following issues: Evaluation, Measurement and Verification; Energy Efficiency Potential Studies; Cost Effectiveness; Program Design and Implementation; Dynamic Rates; Resource Planning; Cost Recovery and Incentives; Codes and Standards; Emissions Trading; State Management Best Practices; Air Quality; Clean Energy Supply; Local Government; and Portfolio Standards.
http://cfpub.epa.gov/ceird/index.cfm?fuseaction=napee.search_js (database);
www.epa.gov/cleanenergy/energy-programs/napee/index.html (Action Plan)
- **Clean Energy-Environment Guide to Action.** Across the country, states are using clean energy policies to help meet their expanding energy demand in a clean, low-cost, reliable manner. In addition, a growing number of states are interested in learning about successful clean energy strategies and their economic and environmental benefits. The Guide to Action describes 16 clean energy policies, details the best practices and attributes of effective state programs, and provides resources for more information.
<www.epa.gov/cleanenergy/documents/gta/guide_action_full.pdf>

APPENDIX—STATE PUBLIC BENEFIT FUND (PBF) PROGRAMS

CALIFORNIA SELF-GENERATION INCENTIVE PROGRAM

In California, the state's four investor-owned utilities (PG&E, Southern California Edison, Southern California Gas Company, and San Diego Gas and Electric) have been required to provide incentives to CHP systems under the state's SGIP since 2001. The SGIP is funded through an SBC and provides credits of \$0.80 per watt to eligible projects in each utility's service territory, up to a capacity of 5 MW. The SGIP program has provided partial funding for 402 projects between 2001 and 2007.⁸³

On September 20, 2007, the California Public Utilities Commission (CPUC) approved a new system of incentives and penalties to encourage IOU spending on energy efficiency efforts. The CPUC believes the "new program provides incentives of sufficient level to ensure that utility investors and managers view energy efficiency as a core part of the utility's regulated operations that can generate meaningful earnings for its shareholders."⁸⁴ The CPUC plan allows the investor-owned utilities to collect 9 percent of the net benefits (resource savings minus total portfolio costs) once they reach their 85 percent savings goals. The earnings rate increases to 12 percent if the utilities achieve 100 percent of the goal. If the utilities met their performance threshold of 85 percent for the 2006–2008 program cycle, rate payers would have saved approximately \$1.9 billion in net benefits. Under the new system, investor-owned utility shareholders would have received \$175 million of those net benefits, thereby encouraging their investment in more energy efficiency efforts, including CHP. Although CHP is not specified as an eligible technology under the new incentive system, it is included as one of the energy efficiency performance options that the utilities can use to achieve their savings targets. The utilities have not yet begun submitting program filings related to this new incentive system.

CONNECTICUT DEPARTMENT OF PUBLIC UTILITY CONTROL INCENTIVE PROGRAM FOR CUSTOMER-SIDE DISTRIBUTED RESOURCES

In July 2005, Connecticut passed its Act Concerning Energy Independence, which established a number of measures to encourage CHP. These measures included:

- Base Load Distributed Generation grants of \$450/kW.
- Additional grants of \$50/kW for generation projects located in Southwest Connecticut that begin operation prior to April 30, 2008.
- Lower backup charges for customers in the event that they need to take power from the electric company if their own system is not operational.
- Reduced natural gas rates for customer-side generation projects that use natural gas. Gas distribution charges will be waived.

The incentives are being evaluated and distributed by the Connecticut DPUC through individual docket filings. As of August 2007, the Connecticut DPUC program had approved funding for 60 CHP projects in the state (46 approved; 14 pending), with a MW potential of 252.8 MW (~235.8 MW approved; ~16.9 MW pending).

MICHIGAN LOW-INCOME AND ENERGY EFFICIENCY FUND

Michigan's Low-Income and Energy Efficiency Fund (LIEEF) is administered by the Michigan Public Service Commission (PSC) and has invested approximately \$295 million in providing energy assistance to low-income customers and promoting energy efficiency among all customers in the state. The LIEEF is funded through: 1) a PSC-established surcharge on Detroit Edison's distribution rates, and 2) a rate-case settlement with Consumers Energy whereby Consumers Energy makes contributions to the fund from its electricity and natural gas businesses. The two utilities recover these costs through charges to their customers. Total funding for the LIEEF is approximately \$84 million per year, with a target of 75 percent of the funds awarded for energy efficiency projects and energy assistance for low-income residents, and 25 percent for energy efficiency projects to benefit all customers in Michigan.^{85,86}

XCEL ENERGY RENEWABLE DEVELOPMENT FUND (MINNESOTA)

The Xcel Energy Renewable Development Fund (RDF) provides ratepayer-sourced funding in the form of grants awarded through an RFP mechanism. "The overall purpose (mission) of the RDF is to increase the market penetration of renewable energy resources at reasonable costs in the Xcel Energy service territory; promote the startup, expansion, and attraction of renewable energy projects and companies in the Xcel Energy service territory; and stimulate research and development into renewable technologies that support this mission."⁸⁷ The grants are distributed between energy production projects (maximum of \$2 million per project) and research and development projects (\$1 million maximum per project).⁸⁸ CHP is included as an eligible technology to receive funding from the RDF in the Xcel Minnesota service territory.⁸⁹ For all eligible technologies, a total of 19 projects received funding in 2001 under the RDF, and 29 projects were awarded grants in 2005. Only one project that was awarded funding under the RDF was clearly identified as incorporating CHP ("Generating Electricity with Biomass Fuels at Ethanol Plants R&D Biomass," 2005).⁹⁰

NEW JERSEY CLEAN ENERGY PROGRAM CHP PROGRAM

The CHP Program in New Jersey is part of a suite of energy efficiency programs offered to the commercial and industrial market sector. The CHP program provides financial incentives for CHP installations to enhance energy efficiency through onsite power generation with recovery and productive use of waste heat, thus reducing demand on the electric power grid. The goals and objectives of the CHP program are to reduce overall system peak demand, encourage the use of emerging technologies, use energy more efficiently and reduce emissions, and use DG to provide reliability solutions for New Jersey. To qualify, the customer's facility must be

located in New Jersey, and the customer must purchase energy from the utility grid. Any portion of a customer's load that is committed to an interruptible or peak load reduction program is not eligible for incentives. However, these customers can seek incentives for generation capacity to cover their uncommitted load. Currently, customers interested in participating in the CHP program must submit proposals during an annual RFP process. Proposals are received, evaluated for compliance with program requirements, and ranked accordingly. Incentives are awarded based on rank and available funding. Incentives vary based on CHP technology type, project size and total project cost. Incentives are based on dollars per watt and any single project could be eligible for up to \$1 million.

The program has seen three rounds of funding between 2005 and 2007, with the last round of applications received in November 2007 and projected to be evaluated through Q1 2008. For 2007, the CHP budget is \$6.5 million and 20 applications were received. More than 10.5 MW of CHP that received incentive payments was installed and operational as of November 2007.⁹¹

NEW YORK STATE ENERGY RESEARCH AND DEVELOPMENT AUTHORITY (NYSERDA)

NYSERDA provides numerous grants for CHP projects (e.g., Residential Energy Affordability Program (REAP)—Custom Measures; Enhanced Commercial and Industrial Performance Program; Distributed Generation as Combined Heat and Power Program) with PBF funding collected through the state's SBC and a System Wide Program in the Consolidated Edison service territory.⁹²

ENERGY TRUST OF OREGON, INC.

As a result of Oregon's electric-utility restructuring legislation (1999) and subsequent (RPS) legislation, Pacific Power and Portland General Electric are required to collect a 3 percent public-purpose charge from their customers to support renewable energy and energy efficiency projects through 2025. Additionally, NW Natural Gas collects a 1.25 percent charge from its customers, and Cascade Natural Gas collects a 1.5 percent charge from its customers. Eighty percent of these funds go to Energy Trust of Oregon, which is authorized by the Oregon Public Utility Commission (OPUC) to administer renewable energy and energy efficiency programs. Sixty-seven percent of allocated funds provide financial incentives for renewable energy projects, including biomass CHP. Sixteen percent of the funds collected fund energy efficiency programs for low-income housing and school energy conservation programs. Seventeen percent of the allocated funds provide incentives for improvement projects for residences, commercial buildings, and manufacturing processes, including CHP promotion.⁹³

VERMONT CLEAN ENERGY DEVELOPMENT FUND

Vermont's Clean Energy Development Fund (CEDF) was established in 2005 and is administered by the Vermont Department of Public Service (DPS). The purpose of the CEDF is

to promote “the increased use of renewably produced electrical, thermal energy, and combined heat and power technologies in the state; the growth of the renewable energy-provider and combined heat and power industries in the state; the creation of additional employment opportunities and other economic development benefits in the state through the increased use of renewable energy and combined heat and power technologies; [and] the stimulation of increased public and private sector investment in renewable energy and combined heat and power related enterprises, institutions, and projects in the state.”⁹⁴ The CEDF provides grants, loans, equity investments, and direct incentive payments to subsidize clean energy projects, and will receive annual payments of between \$4 million and \$7 million through 2012 from Entergy.⁹⁵ During the first round of funding (prior to December 2006), Vermont DPS proposed that \$50,000 be used to support the installation of a CHP facility in the state.⁹⁶ In 2007, the Vermont DPS received 34 proposals for project funding from the CEDF. Seventeen projects were ultimately awarded a total of \$2 million, and four of those projects include CHP.⁹⁷ To qualify for funding, CHP projects must have a system efficiency of at least 65 percent, and installations must meet Vermont's air-quality standards.⁹⁸

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