Chapter 6. Policy Considerations for Combined Heat and Power

Policy Description and Objective

Summary

Several policy opportunities exist for states to support greater use of combined heat and power (CHP). CHP, also known as cogeneration, is the simultaneous production of electricity and heat from a single fuel source (EPA 2007, 2014b). CHP provides an alternative to purchasing electricity from the local utility and burning fuel in an onsite furnace or boiler to produce thermal energy (such as steam). An industrial, institutional, or commercial facility can instead use CHP to provide both electric and thermal energy services in one energy-efficient step by capturing and using surplus heat that would otherwise be wasted when generating electricity. Due to the increased system efficiency, the CHP system produces the same amount of energy while requiring less fuel; it also produces lower emissions overall than equivalent, separate heat and power systems.

Optimally designed CHP offers environmental and climate change benefits to states, communities, businesses, and institutions through increased energy efficiency and reduced fuel consumption. Other benefits include improved fuel efficiency, enhanced resiliency, and more reliable power and thermal energy supplies. These reliability and resiliency benefits bolster business competitiveness, the energy infrastructure, and energy security (EPA 2013b). These benefits are enhanced when a CHP system is used in a district energy system or a microgrid.[49]

Recognizing CHP market growth benefits and barriers, President Obama issued Executive Order 13624, "Accelerating Investment in Industrial Energy Efficiency," in August 2012 (White House 2012). The executive order called for the installation of 40 gigawatts (GW) of new, cost-effective industrial CHP nationwide by the end of 2020. It specifically recognizes the lack of a single solution to addressing market barriers and looks for support through a variety of approaches. These include encouraging private sector investment by setting goals and highlighting investment benefits, improving coordination at the federal level, encouraging federal agencies to partner with and support states, and identifying investment models beneficial to the multiple stakeholders involved.

Objective

States have implemented many policies to capture CHP's environmental, energy, economic, and reliability benefits. These policies are designed to maximize the savings and reductions from CHP in meeting states' goals on energy, environment, economics, resiliency, or reliability. In these policies, CHP is commonly characterized based on the CHP system's size, fuel used (renewable or fossil fuels), technology type (such as combustion turbine, reciprocating engine, and other commonly used technologies) and process (referred to as topping cycle or bottoming cycle processes), and other characteristics such as system efficiency or market sector. These policies generally offer CHP-specific incentives or incentivize CHP along with other similar technologies or fuel types. For example, in state renewable portfolio standards (RPSs), renewably fueled CHP typically qualifies as an eligible source. Very few state portfolio standards list CHP systems that use all fuel types as

[49] For more information on microgrids, see Section 7.5, "Maximizing Grid Investments to Achieve Energy Efficiency and Improve Renewable Energy Integration."

qualified eligible sources (EPA 2014e). Because CHP systems have such unique characteristics, CHP policies are considered more effective when they are CHP-specific rather than broadly applicable to a wide variety of energy resources (ACEEE 2014b). If the policy development process does not allow such specificity, it is helpful to have CHP and its attributes listed among the options for meeting the policy objectives. For example, an output-based regulation (OBR) for CHP can be useful, but it should also be specific enough to address thermal output. It would also be preferable to have an energy efficiency resource standard (EERS) and RPS explicitly include CHP with other technologies.

Benefits

By using fuel more efficiently to simultaneously produce electricity and thermal energy, CHP systems use less fuel than equivalent separate heat and power systems to produce the same amount of energy. Their increased efficiency offers environmental and economic benefits when compared with purchased electricity and onsite generated heat. States have found these benefits to be compelling in moving forward with CHP policies. Key CHP benefits include:

- *Efficiency benefits.* The average efficiency of central station fossil-fueled power plants in the United States is 33 percent and has remained virtually unchanged. This means that two-thirds of the fuel's energy is lost—vented as heat—at most U.S. power plants (EIA 2012). A CHP system's efficiency, depending on the prime mover, ranges from around 55 to 80 percent.[50] Because CHP is more efficient and often located closer to end-users, it requires less fuel than separate heat and power to produce a given energy output. Higher efficiency lowers operating costs and reduces emissions of all pollutants. An ACEEE analysis found that CHP systems of various sizes offer far lower levelized costs per megawatt-hour (MWh) than other non-CHP generation resources (ACEEE 2013). CHP's cost advantage also holds true when compared with smaller sized centralized systems. While a new 20 megawatt (MW) natural gas-powered combined cycle plant can yield power at a levelized cost of about 6.9 to 9.7 cents per kilowatt-hour (kWh), a new CHP plant can yield the same power at a levelized cost of about 6.0 cents per kWh (ACEEE 2013).

Measuring CHP Efficiency

The two most commonly used methodologies for determining CHP system efficiency are total system efficiency and effective electric efficiency. The calculation of total system efficiency compares what is produced (i.e., power and thermal output) with what is consumed (i.e., fuel). CHP systems with a relatively high net useful thermal output typically correspond to total system efficiencies that range from 55 to 80 percent.

Effective electric efficiency calculations allow for a direct comparison of CHP to conventional power generation system performance (e.g., electricity produced from centralized power plants, which is how the majority of electricity is produced in the United States). Effective electrical efficiencies for combustion turbine-based CHP systems range from 51 to 69 percent; reciprocating engine-based CHP systems range from 69 to 84 percent.

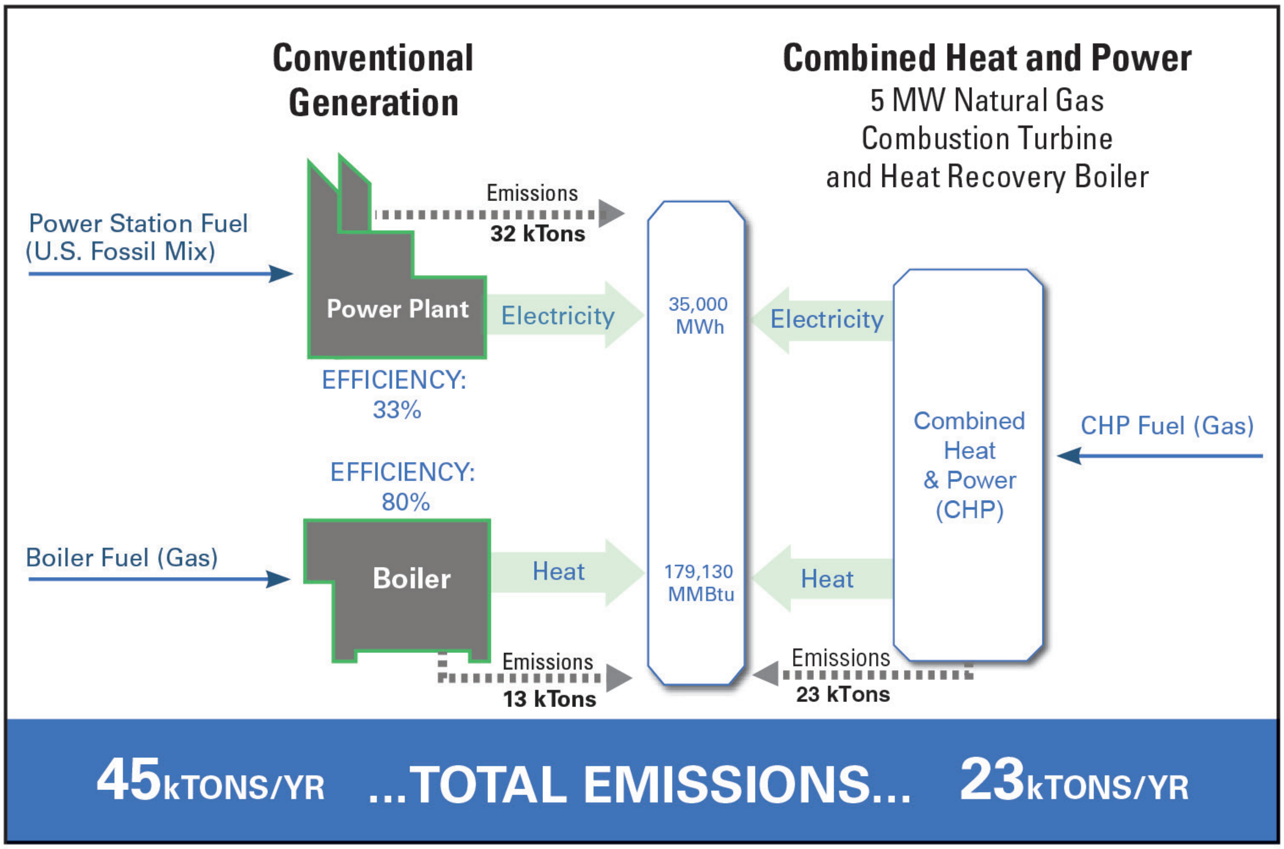
Both the total system and effective electric efficiencies are valid metrics for evaluating CHP system efficiency. They both consider all CHP system outputs and, when used properly, reflect CHP's inherent advantages. However, because each metric measures a different performance characteristic, using the two different metrics for a given CHP system produces different values. If the objective is to compare CHP system energy efficiency with the efficiency of a site's separate heat and power options, then the total system efficiency metric may be the right choice. If CHP electrical efficiency is needed to compare CHP with conventional electricity production (i.e., the grid), then the effective electric efficiency metric may be the right choice (EPA 2015a).

[50] The five most commonly installed CHP prime movers tend to offer the following standard ranges of achievable overall efficiency: steam turbine: around 80 percent, reciprocating engine: 77 to 80 percent, gas turbine: 66 to 71 percent, microturbine: 63 to 70 percent, and fuel cells: 55 to 80 percent (EPA 2014a).

- *Environmental benefits.* Because producing a given amount of electricity and thermal energy combusts less fuel, greenhouse gas (GHG) and criteria air pollutant emissions are reduced. Figure 6.1 shows the magnitude of a 5 MW natural gas-fired CHP system's reduced carbon dioxide (CO_2) emissions as compared with separate heat and power used to generate the same energy output.[51] A CHP system's efficiency and environmental benefits are optimal when the system is sized to meet thermal needs.

  Figure 6.1 illustrates the CO_2 emissions output from power and thermal energy generation for two systems: 1) a separate heat and power system with a fossil fuel-fired power plant (emissions based on the U.S. fossil mix) and a natural gas-fired boiler, and 2) a 5 MW combustion turbine CHP system powered by natural gas. The separate heat and power system emits a total of 45,000 tons of CO_2 per year (13 kilotons from the boiler and 32 kilotons from the power plant), while the more efficient CHP system emits 23,000 kilotons of CO_2 per year.

Figure 6.1: Conventional Generation vs. CHP: CO_2 Emissions



Source: EPA 2015b

- *Reliability benefits.* Reliability refers to the ability of power system components to deliver electricity to all points of consumption, in the quantity and quality demanded by the customer. Service interruptions and variations in power quality can happen at any time. Although most grid outages are brief, momentary occurrences that do not adversely impact anything other than the most sensitive operations, an average

[51] To analyze a facility's emission reductions, the EPA CHP Partnership's CHP Emissions Calculator can help compare the anticipated air emissions from a CHP system with those of a separate heat and power system.

facility can expect to experience an extended outage (lasting more than 5 minutes) every other year (EPA 2013a).

Rather than invest capital to install diesel backup generators that provide electricity only during an outage, a facility can design a CHP system that provides continuous electric and thermal energy to the site, resulting in annual operating cost savings. Onsite electricity generation yields increased reliability and power quality, reduced grid congestion, and avoided distribution losses.

To provide reliability benefits, the CHP system could be sized to meet the facility's base load thermal needs and to work in conjunction with the grid. The CHP operator can then decide to make or buy power from the grid based on forecasted prices or real-time price signals, system performance parameters, and optimized integrated resources such as solar electricity; thermal storage; or forms of demand response. Supplemental power purchased from the grid could provide the facility's peak power needs on a normal basis, as well as the entire facility's power when the CHP system is down for maintenance. However, the CHP system could also be configured to maintain critical facility loads in the event of an extended grid outage; in such a configuration, CHP has proven to be a reliable, alternative source of power and thermal energy (heating and cooling) during emergencies, and it has made energy infrastructure more resilient in the face of extreme weather events and other grid disruptions (EPA 2013b).

For certain types of customers, reliability is a critical business and operations issue rather than a mere inconvenience. These customers cannot afford to lose power or comfort conditions for more than a brief period without experiencing a significant loss of revenue, critical data/information, operations, or even life. Some particularly energy-sensitive customers include mission-critical computer systems, thermal-intensive industrial processing operations, high-tech manufacturing facilities, military operations, wastewater treatment facilities, research-intensive universities, museums and archives, and hospitals and other healthcare facilities.

Using CHP During Grid Outages

During Superstorm Sandy in 2012, there were several cases of malfunctioning emergency generators. The backup generator at NYU Langone Medical Center and fuel pumps for backup generators at Bellevue Hospital failed after the basements flooded (McNeal 2012; Ofri 2012). This forced the hospitals to evacuate patients to other medical centers with CHP systems or backup generators that remained operational during the storm. During the Northeast blackout in 2003, half of New York City's 58 hospitals suffered backup generator failures, and the lack of backup power allowed 145 million gallons of raw sewage to be released from a Manhattan pumping station (DOE 2013).

The New York State Energy Research and Development Authority (NYSERDA) analyzed CHP system operation at 24 sites that had received NYSERDA funding and were located in areas affected by Superstorm Sandy. Each site was grouped into one of the following four categories:

- *Category 1.* Site lost grid power. The CHP system was designed to operate during a grid outage and operated as expected.
- Category 2. Site lost grid power. The CHP system was designed to operate during a grid outage, but it failed to operate correctly.
- Category 3. Site never lost power. The CHP system was not put to the test.
- Category 4. Site lost grid power. However, the CHP system was an induction unit and was not designed to operate during a grid outage.

There were no sites identified under Category 2, and the sites in the other categories performed as expected.

*Email communication from Elizabeth Markham, NYSERDA Assistant Project Coordinator on January 14, 2013, to DOE-funded Northeast Clean Energy Application Center Staff, Timothy Banach and Tom Bourgeois.

- *Economic benefits.* CHP offers a variety of economic benefits for large energy users (EPA 2015c). These economic benefits include:
  - *Reduced energy costs.* The high efficiency of CHP technology results in energy savings when compared with conventional, separately purchased power and onsite thermal energy systems. To determine if

CHP is likely to offer a compelling return on investment at a particular site, the costs of the CHP system (capital, fuel, and operation and maintenance) can be compared with the costs of purchased power and thermal energy (hot water, steam, or chilled water) that would otherwise be needed for the site.

- *Offset capital costs.* Buildings can be connected to a CHP-based district energy system that provides district heating (steam or hot water) and district cooling services (chilled water) for space heating, domestic hot water, and air conditioning. Such services avoid onsite equipment and conserve valuable space in the building and rooftop for other revenue-generating uses.
- *Continuity of business.* Distributed generation (DG), also known as onsite generation, located closer to the end-user is inherently more reliable than power traveling long distances from remote power stations. CHP has been deployed in institutions because of the enhanced reliability that comes with proximity. The use of CHP configured for "islanding" enhances reliability and business continuity, which are key attributes for businesses and critical infrastructure to remain online in the event of a disaster or major power outage. The white paper, *Calculating Reliability Benefits*, explores the economic value of CHP as backup power (EPA 2013a).
- *Hedge against volatile electricity prices.* CHP provides a hedge against unstable electricity prices by allowing the end-user to supply its own power during periods when electricity prices are very high.

A CHP project's economic benefits depend on efficient design and operation to offset electric and capital costs, as well as policies established in the project's jurisdiction (EPA 2012). The value of these benefits will depend on the investor's needs and goals. A feasibility analysis to determine a project's technical and economic viability is typically performed in stages to reduce risk and minimize the costs and expenses of non-viable projects (EPA 2015c).

States with Policies

There are several policy options through which states can capture CHP benefits. Table 6.1 summarizes CHP-related policies, including incentives, which are currently in place in many states (EPA 2014c). They can be broadly classified under four categories: environmental, energy, financial, and utility. This section provides an overview of the four broad categories of state policies that factor into CHP's benefits. The American Council for an Energy-Efficient Economy (ACEEE) evaluates state policies that are critical for encouraging CHP in its annual State Energy Efficiency Scorecard report (2014b).

Table 6.1: State Policies Supportive of CHP

Policy/Incentive Types	Description
Bond	State or federal bonds can support CHP projects or activities (either specifically or where eligibility includes CHP). Bond programs help support CHP by establishing a means to borrow capital for CHP projects at a fixed and often lower interest rate. For example, under New Mexico's Energy Efficiency and Renewable Energy Bond Program, qualifying CHP systems at government facilities, schools, and universities may be eligible to receive up to $20 million in bonds backed by the state's Gross Receipts Tax. Further information is available in Chapter 3, "Funding and Financial Incentive Policies."
Commercial Property Assessed Clean Energy (PACE)	Commercial PACE programs allow building owners to receive financing for eligible energy-saving measures that can include CHP, repaid as property tax assessments over a period of years. For example, San Francisco has a commercial PACE program called GreenFinanceSF, which offers loans of up to 10 percent of the assessed value of a property to eligible CHP systems. Further information is available in Chapter 3.

Table 6.1: State Policies Supportive of CHP

Policy/Incentive Types	Description
Environmental Regulations	Federal and state environmental regulations can support CHP through specific inclusion or with output-based limits for thermal and electrical production. Environmental regulations can support CHP by recognizing CHP's efficiency benefits and account for them in meeting compliance obligations. For example, in Delaware, new and existing DG may be subject to emissions limits (lb/MWh) pursuant to state air quality Regulation No. 1144. Using the avoided emissions output-based approach, the rule allows a CHP system to account for its secondary thermal output when determining compliance with nitrogen oxides, carbon monoxide, and CO_2 emission limits.
Feed-in Tariff (FIT)	FITs specify per-kWh payments for electricity supplied to the grid by CHP or other DG. FITs typically offer a long-term contract to producers of energy-efficient and renewable generation based on the cost of each technology. The goal is to offer cost-based compensation to support CHP producers, providing price certainty and long-term contracts that help finance CHP investments. Under Governor Brown's Clean Energy Jobs Plan (2010), California initiated a FIT for CHP systems. Systems must be smaller than 20 MW, have an efficiency of at least 62 percent, and be placed in operation after January 1, 2008. Further information is available in Section 7.4, "Customer Rates and Data Access."
Grant	State or federal grants can support CHP projects or activities (either specifically or where eligibility includes CHP) by financing the development and purchase of CHP systems and equipment. Under Connecticut's Department of Energy and Environmental Protection, qualifying CHP projects are eligible for grants of $200/kW of nameplate capacity. Further information is available in Chapter 3.
Interconnection Standard	Interconnection processes and technical requirements govern how electric utilities will treat CHP and other DG systems that customers seek to connect to the electric grid. State public utility commission (PUC) interconnection rules typically address larger DG projects connecting to the distribution grid, whereas the Federal Energy Regulatory Commission (FERC) has jurisdiction over project interconnection at the transmission level. Transparent and uniform technical standards, procedures, and agreements established for all system sizes can reduce uncertainty and prevent time delays that CHP and distributed renewable energy can encounter when obtaining approval for electric grid connection. For example, Massachusetts' interconnection standards apply to all forms of DG, including CHP, served by the state's investor-owned utilities (IOUs). The standards follow a three-tiered approach with application fees varying based on the system's size. All system sizes are eligible to interconnect. Further information is available in Section 7.3, "Interconnection and Net Metering Standards."
Loan	State or federal loans can support CHP projects or activities (either specifically or where eligibility includes CHP) by financing the purchase of CHP systems and equipment, often at very low interest rates. In Connecticut, low-interest loans are available for qualifying CHP projects. Loans are available at a subsidized interest rate of 1 percent below the applicable rate or no more than the prime rate. Further information is available in Chapter 3.
Net Metering Policy	Net metering is a method of compensating customers for electricity that they generate onsite (e.g., using CHP) in excess of their own consumption—essentially giving them credit for the excess power they send back to the grid. Depending on individual state or utility rules, net excess generation (NEG) may be credited to the customer's account or carried over to a future billing period. Net metering policies are commonly implemented by state PUCs. Key criteria commonly addressed are system capacity limits, eligible system and customer types, treatment of NEG, and ownership of renewable energy certificates associated with customer generation. For example, in Washington State, qualifying CHP systems up to 100 kW are eligible for net metering. It is available on a first-come, first-served basis until the cumulative generating capacity of net metered systems reaches 0.50 percent of a utility's peak demand. Further information is available in Section 7.3.

Table 6.1: State Policies Supportive of CHP

Policy/Incentive Types	Description
Portfolio Standard	Portfolio standards are state regulations that require utilities to obtain a certain amount of the electricity they sell from specified sources and/or achieve specified reductions in electricity consumption. Some of these standards specifically include CHP (i.e., fossil-fueled CHP, waste heat to power, or where renewable CHP is specifically deemed eligible). Portfolio standards can help improve a CHP project's economics by rewarding eligible projects with a credit for helping to meet state targets, typically as $/MWh payments. Under Massachusetts' Alternative Energy Portfolio Standard (AEPS), CHP systems are eligible to receive credits of around $20/MWh of electrical energy output. In 2009 and 2010, about 99 percent of AEPS compliance was met through CHP projects. Further information is available in Section 4.1, "Energy Efficiency Resource Standards," and Chapter 5, "Renewable Portfolio Standards."
Production Incentive	Production incentives are payments typically made by state agencies on a per-kWh basis to operators of CHP and other DG. These incentives can help to support CHP development. Under Baltimore Gas & Electric's Smart Energy Savers Program, qualifying CHP projects are eligible to receive production, installation, and design incentives of up to $2 million. The incentive program expires on December 31, 2016. All eligible projects must be operational by that date. Further information is available in Chapter 3.
Public Benefits Fund (PBF)	PBFs are resource pools typically funded by a charge included on customers' utility bills. States generally use these funds to support energy efficiency and renewable energy, including the development of CHP. New York State has a system benefits charge (SBC) in place, which is included as a bill surcharge for customers of IOUs. Administered by NYSERDA, the SBC supports funding for eligible CHP projects and has an annual budget of $15 million. Further information is available in Section 4.2, "Energy Efficiency Programs."
Rebate	State, federal, or utility rebates can support CHP projects or activities, either specifically or where eligibility includes CHP. California's Self-Generation Incentive Program offers rebates and performance-based incentives to eligible CHP projects. The program has a maximum incentive of $5 million with a 40 percent minimum customer investment. Information on system type, financing, and operational status is available in quarterly reports available to the public on the California Public Utilities Commission website. Further information is available in Section 4.2.
State or Local Climate Change Plan	A climate change action plan lays out a strategy, including specific policy recommendations, that a state or local government will use to address climate change and reduce GHG emissions. Certain climate change action plans include specific policy or financial measures to support CHP, including zoning preferences and resiliency objectives. As an example, North Carolina's Climate Action Plan proposed a policy recommendation to encourage development of CHP systems less than 10 MW through a combination of utility incentives, information provisions, review of net metering policies, streamlining of interconnection requirements, providing low-interest loans, and/or tax credits for potential hosts/owners/developers of these systems. The goal of the recommendation is to implement 25 to 33 percent of North Carolina's CHP potential by 2020.
State Energy Plan	A well-constructed state energy plan is the outcome of a planning process among state stakeholders to move toward meeting future energy needs based on agreed goals, objectives, and criteria. It assesses current and future energy supply and demand, examines existing energy policies, and identifies emerging energy challenges and opportunities. Certain state energy plans recommend CHP to achieve the agreed-upon goals, objectives, and criteria laid out in the plans. In New Jersey's 2011 Master Energy Plan, Governor Christie set a goal to develop 1,500 MW of new DG and CHP projects over the next decade.
Energy Regulation and Policy	Federal and state energy regulations and policies, including federal and state laws, executive orders, and FERC orders, can account for the role of CHP. For example, in August 2012, President Obama issued Executive Order 13624 calling for the development of new CHP systems. The order set a target of developing 40 GW of new industrial CHP by the end of 2020.

Table 6.1: State Policies Supportive of CHP

Policy/Incentive Types	Description
State Utility Rate Policy	State PUCs can develop rate policies for utilities that account for CHP and other DG. Designs differ based on whether the utilities are in a restructured market (for more information about market structure, see the introduction to Chapter 7). In some states, municipally and cooperatively owned utilities have different rate structures. State utility rates exist for different customer classes. Design criteria that account for CHP can include a reduction or exemption from standby rates and/or exit fees, the application of daily or monthly as-used demand charges, the option to buy backup power at market prices, and guidelines for dispute-resolution processes. State utility rates take several forms and can include riders such as standby and related rates, exit fees, buyback rates, gas rates, and decoupling mechanisms. For example, under California's Departing Load Charge Exemption policy, qualifying CHP systems are exempt from paying exit fees. Further information is available in Section 7.4.
Tax	State or federal tax credits or favorable tax treatment can support CHP projects or activities, either specifically or where eligibility includes CHP. For example, CHP systems that meet a minimum efficiency of 60 percent are eligible for a 10 percent Federal Investment Tax Credit for the first 15 MW of capacity. The credit expires on December 31, 2016. Further information is available in Chapter 3.
Utility Rate	Utility rate structures can include discounts for CHP. For example, in New Jersey, commercial and residential customers that install DG systems can save up to 50 and 40 percent, respectively, on their gas delivery charges.

Source: EPA 2014c

Environmental Policies

Regional, state, and local policy actions that account for CHP's environmental benefits are primarily output-based emissions regulations, climate change action plans, and streamlined permitting programs.

Output-Based Emissions Regulations

States have found that OBRs can be effective tools for promoting CHP by relating emissions to the productive output of the energy-consuming process. The goal of OBR is to encourage the use of fuel conversion efficiency (FCE) as an air pollution control measure.

OBR define emissions limits based on the amount of pollution produced per unit of useful output, accounting for the unit's efficiency (e.g., pounds of sulfur dioxide per MWh of electricity). In contrast, input-based regulations are based on the amount of fuel burned and do not reflect a unit's efficiency. Electricity generation technologies, including CHP, have traditionally been subject to input-based emissions regulations. OBR can be used to credit all of the useful energy generated. CHP systems fare well under this approach when it credits both the thermal and electric energy they produce. OBR have been developed for state, regional, and federal rules. As of December 2014, 19 states have adopted some form of OBR (EPA 2014d). Massachusetts has adopted such an approach for a suite of air pollution regulations that include conventional emissions limits, emissions limits on small DG, allowance trading, allowance set-asides, and an emissions performance standard.

Climate Change Plans

A climate change action plan lays out a strategy, including specific policy recommendations a state would use to address climate change and reduce its GHG emissions. There are currently 19 state climate change plans that recommend implementing CHP (EPA 2014c). For example, Minnesota's Climate Change Advisory Group issued its final report in April 2008 with recommendations to the governor for reducing Minnesota's GHG emissions. Chapter 3 of the Minnesota Climate Mitigation Action Plan details recommendations for the residential, commercial, and industrial sectors and recommends CHP as one way to reduce Minnesota's GHG emissions and improve energy efficiency. The state has estimated that 50 percent of CHP's technical potential in Minnesota can be met if these recommendations are implemented (MPCA 2013).

Streamlined Permitting Programs

When installing a CHP system, a facility must obtain permits from local authorities to set up the system, connect it to the local grid, and operate it in compliance with local and state regulations. To ensure compliance with air quality standards, a facility—in consultation with the state or local permitting agency—reviews air permitting requirements and then obtains a permit before the system is installed and operated. CHP stakeholders have found the process for obtaining air permits to be time and resource intensive and a potential impediment to CHP projects (EPA 2014e). In the past decade, and particularly in the past few years, several states—including Connecticut, New Jersey, and Texas—have introduced streamlined permitting procedures for certain types of CHP units to simplify and speed up the permitting process.

Energy Policies

States have factored CHP into state energy plans, energy codes, and portfolio standards. CHP can also be considered in state energy sustainability plans when accounting for resiliency measures independently or as part of a suite of modern grid investments.

Energy Plans

As of late 2011, 38 states and Washington, D.C., had a state energy plan. Of these plans, 22 reference CHP (EPA 2014c). Some state energy plans consider CHP in the context of renewable energy resources, while others group CHP with energy efficiency resources. Highlights from the plans that mention CHP include offering financial incentives, encouraging CHP to spur economic development within the manufacturing sector, suggesting that energy portfolio standards be revised to include CHP, and suggesting that streamlined CHP permitting be implemented to encourage energy efficiency in industrial sites. For example, the 2008 Intelligent Energy Choices for Kentucky's Future identifies CHP as one method for meeting the goals under Strategy 1, "Improve the Energy Efficiency of Kentucky's Homes, Buildings, Industries, and Transportation Fleet."

The 2012 Washington State Energy Strategy was the state's first detailed strategy since 1993. The strategy focuses on energy and transportation, the largest energy-using sector in the state (WA Commerce 2012). It also addresses building energy use and distributed energy resources, including CHP. Chapter 5 cites three key reasons for including distributed energy and CHP in the strategy: timeliness (Washington has established incentives and policy mandates that encourage the development of both renewable and distributed energy systems), responsiveness (citizens and businesses are asking their state and utilities to help them develop distributed energy systems), and the potential contribution to the state's energy future (citing the example of California with its goal to develop 12,000 MW of distributed renewable energy facilities by 2020). The near-term recommendations to advance distributed renewable energy, including CHP, touch upon interconnection, net metering, and permitting. Longer term recommendations involve distributed renewable energy-compliant purchase power agreements, potential changes to Initiative 937 (the Energy Independence Act), and rationalizing state distributed renewable energy incentives.

Portfolio Standards

States use portfolio standards to increase the adoption of energy efficiency, renewable energy generation, and other clean energy technologies such as CHP. There are three main types of portfolio standards (EPA 2015d):

- *Renewable portfolio standard (RPS) or clean energy standard (CES).* An RPS typically requires electric utilities and other retail electric providers to supply a specified minimum percentage (or absolute amount) of customer load with eligible sources of renewable electricity. Some states have broader CESs that encompass more than just renewable energy. These portfolio standards are designed to increase the contribution of renewable energy and clean energy to the electric supply mix. These standards support the growth of renewable energy sources such as wind, solar, hydro, geothermal, and biomass, as well as clean energy technologies such as CHP. Some states maintain a broad RPS definition under which renewably fueled CHP systems qualify; other states explicitly include CHP, regardless of the fuel source.
- *Energy efficiency resource standard (EERS).* EERSs are designed to meet energy savings goals through energy efficiency. They are intended to encourage more efficient generation and transmission by electric and gas utilities. They are usually focused on end-use energy savings, but some include other efficiency measures such as CHP, or other high-efficiency systems or distribution system improvements.
- *Alternative energy portfolio standard (AEPS).* AEPSs are hybrid standards that allow energy efficiency to qualify within an RPS or a CES. This is done by setting targets for a certain percentage of a supplier's capacity (MW) or generation (MWh) to come from sources such as CHP. In the Massachusetts Green Communities Act of 2008, CHP was a qualified technology, with both power and thermal outputs measured for compliance.

As of February 2015, 25 states specifically name CHP and/or waste heat to power (WHP) as eligible under their RPS, EERS, or AEPS program guidelines (EPA 2015d). These states include Arizona, Colorado, Connecticut, Delaware, Hawaii, Illinois, Indiana, Louisiana, Maine, Massachusetts, Michigan, Minnesota, Nevada, New Hampshire, New York, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Dakota, Utah, Vermont, and Washington. More information on portfolio standards is available in Section 4.1, "Energy Efficiency Resource Standards," and Chapter 5, "Renewable Portfolio Standards."

Energy Reliability Policies

As disruptions in the energy supply pose a serious risk to local governments, especially at critical facilities such as wastewater treatment plants, hospitals, emergency shelters, and schools, states have observed that CHP systems can be designed to disconnect from the grid. Disconnection enables them to operate in "island mode" if grid-supplied electricity is lost during extreme weather or other circumstances and provides increased reliability for these critical facilities. States have also found that using CHP to generate electricity on site avoids the need to rely on non-CHP backup generators and can even improve the overall reliability of the electricity grid by reducing peak load and blackout risks.

Some state and local governments have developed, or are in the process of developing, policies to include CHP and other forms of clean DG in critical infrastructure planning. This ensures the energy security and reliability of emergency facilities. For example, the damage caused by hurricanes along the Texas and Louisiana Gulf Coasts acted as a catalyst to propel the adoption of critical infrastructure policies in Texas and Louisiana (LAHR 2012; TSL 2013a, 2013b). Both of these states have adopted laws requiring state agencies to evaluate installing CHP in new buildings or during major retrofits of existing buildings.

The Maryland EmPOWER Energy Efficiency Act of 2008 set a target reduction of 15 percent below 2007 peak demand and electricity consumption levels by 2015. Baltimore Gas & Electric, Pepco, and Delmarva Power have developed performance-based incentive programs for CHP as a way of meeting the EmPOWER Act's 2015 targets. To qualify for these utility incentive programs, CHP systems had to meet a minimum efficiency of 65 percent. The programs provided eligible CHP systems with a production incentive of $0.07 per kWh for the first

18 months of the system's operation. The program expired in February 2015. Under the program, Baltimore Gas & Electric approved 16 CHP system applications in 2012, with potential annual savings of 102,000 MWh.

Financial Policies

CHP projects are primarily funded through the following financing options (EPA 2012): company earnings or internal cash flow, debt financing, equity financing, lease financing, bonds (for public entities), project or third-party financing, and build-own-operate options such as some energy savings performance contracts (ESPCs). Given the diverse nature of the CHP market, multiple financing options may be desirable to meet the needs of CHP system owners and host facility operators. These financing options include, but are not limited to, commercial banks, energy service companies (ESCOs), third-party ownership, and utility cost recovery. States offer grants, low-interest loans and loan guarantee programs, bonds, rebates, public benefits funds, and production incentives to support CHP deployment. Some states use an emerging approach called commercial property assessed clean energy programs. These programs allow building owners to receive full financing for eligible energy saving measures such as CHP; they are repaid on their property tax assessments, with some having long repayment periods. CHP projects have been financed using all of these approaches.

Spark Spread

A primary consideration for a CHP system's financial feasibility is the spark spread, or the relative difference between the price of fuel for the CHP system to produce power and heat on site and the price of electricity the customer would have purchased from the utility. A company would consider investing in a CHP project if the value of the future stream of cost savings is greater than the upfront equipment investment.

A CHP project's actual cost varies depending on a number of characteristics, including who develops the project (i.e., the local government or a private developer as part of a turnkey arrangement), system capacity, availability and type of fuel, prime mover, and overall system configuration. CHP systems can cost between $670 and $6,500 per kilowatt of installed capacity (EPA 2014a). In addition to system purchase and installation costs, a CHP project will incur other associated costs for conducting preliminary feasibility studies and obtaining permits, and for operation and maintenance. Preliminary feasibility studies, for example, can range from $10,000 to $100,000, and operations and maintenance costs can range from $0.005 to $0.015 per kWh (EPA 2012).

As an example, the New Jersey Board of Public Utilities (NJBPU) offers incentives for CHP and fuel cell systems, which represent a combination of New Jersey Clean Energy Program (NJCEP) and utility incentives. Utilities offer incentives for CHP and fuel cells of up to $1 million, and NJCEP will provide an incentive that meets the combined incentive, up to a maximum of $2 million. Another example is the Vermont Commercial Energy Loan Program, one of four loan programs under the Vermont Sustainable Energy Loan Fund, created in 2013 (VEDA 2015). The maximum loan amount is $2 million. Loan terms and amortization schedules are determined on a case-by-case basis up to 20 years. Interest rates are variable, but may be fixed in some circumstances. Loans may not fund more than 40 percent of a project's total cost. More information on CHP project funding and incentives can be found in Chapter 3, "Funding and Financial Incentive Policies."

Utility Policies

Through state public utility commissions (PUCs), some state utility policies have considered how CHP and other DG technology can be better integrated to provide environmental and economic benefits to customers. These policies include interconnection and net metering standards, standby rates, resource planning and procurement processes such as Integrated Resource Planning (IRP), and excess power sales. CHP systems will often reduce the overall annual volume of purchased electricity, which may affect cost recovery under conventional rate design for utilities. However, CHP systems also produce system benefits by reducing peak demands during periods of high use that strain grid resources. CHP systems can be a highly cost-effective option for reducing grid congestion or improving locational marginal pricing by deploying these smaller generating units closer to load centers.

When viable, states have seen CHP hosts either reduce purchased electricity from the grid or leave the grid entirely by self-generating. This outcome affects regulators and utilities because a significant loss of customers, either leaving the grid or staying in with a reduced share, shifts costs to other customers, thereby requiring these remaining customers to carry the costs of the departing CHP user. States have observed that the challenge for all affected parties is to identify the most equitable arrangement that encourages CHP adoption while ensuring there is no inequitable transfer of costs. When a CHP system exports excess electricity, states or independent system operators have to consider additional issues such as different contractual arrangements, time-of-use rates, and payments for capacity or grid support services. Today, regulators and commissions are evaluating a wide range of conditions to more fully account for the grid benefits provided by CHP and not just the potential impact that self-generators will shift cost recovery or distribution expenses to other customer classes. Some states are adopting "decoupling" policies to address the regulatory objective of increasing DG deployment for resiliency or sustainability goals while recognizing the need for continued investment in traditional grid assets.

Interconnection and Net Metering Standards

Typically, PUCs define the standards for interconnection to the distribution grid, while the Federal Energy Regulatory Commission (FERC) establishes standards for transmission-level interconnection. Technical requirements governing how onsite generators connect to the grid serve an important function, ensuring that the safety and reliability of the electric grid is protected; however, non-standardized interconnection requirements and uncertainty in the timing and cost of the application process have long been a barrier to more widespread adoption of customer-sited generation (SEE Action 2013). As of April 2015, 45 states and Washington, D.C., have adopted some form of interconnection standards or guidelines (DSIRE 2015).

Effective interconnection requirements for CHP projects with no electricity exports include streamlined application timelines and procedures, simplified contracts, appropriate cost-based application fees, well-defined dispute resolution procedures, and the ability to connect to both radial and network grids (SEE Action 2013). More information can be found in Section 7.3, "Interconnection and Net Metering Standards." Examples of some interconnection procedures that have accounted for CHP include the following:

- The Illinois Commerce Commission (ICC) established standard interconnection requirements for DG systems, including CHP. Both fossil-fueled and renewably fueled CHP systems are eligible for standardized interconnection. For DG systems up to 10 MW, the rules set four levels of review for interconnection requests. The ICC adopted IEEE 1547 as the technical standard of evaluation and systems are considered to be lab-certified if the components have been evaluated as compliant with UL 1741 and the 2008 National Electric Code according to the testing protocols of IEEE 1547. The rules also specify the technical screens that may be applied to applications at each level of review as well as time limits for different stages of the evaluation process. Facilities >1 MW must carry liability insurance with coverage of at least $2 million per occurrence and $4 million in aggregate. All systems are required to have an external disconnect switch directly accessible to the utility. The rules also specify a procedure for dispute resolution. For DG systems (including CHP) >10 MW, an interconnection feasibility study and a system impact study will be required. A standard interconnection agreement form is available from the utility, and fees and insurance requirements will be determined on a case-by-case basis.
- Oregon has three categories of interconnection standards that apply to both fossil-fueled and renewably fueled CHP systems: one for net metered systems, one for non-net metered small facilities, and one for

non-net metered large facilities. There are two separate interconnection standards for net metered systems in Oregon: one for the state's two IOUs, Pacific Gas and Electric (PG&E) and PacifiCorp, and another for municipally owned utilities, cooperatively owned utilities, and People's Utility Districts (another form of publicly owned utility under Oregon state law).

Electricity Resource Planning and Procurement Processes

Most states require utilities to engage in a form of electricity resource planning to substantiate that the utility's plans for meeting demand for electricity services are in the public interest. Planning processes vary greatly across states, but they generally fall into four categories: IRP, power plant investment preapprovals through Certificates of Public Convenience and Necessity, default service (also referred to as Standard Offer Service), and long-term procurement planning. These planning processes can consider a variety of energy resources, including supply-side (e.g., traditional and renewable energy sources) and demand-side (e.g., energy efficiency) options. Connecticut, a restructured state, has general statutes that require CHP to be included in the state's energy and capacity resource assessment as well as utilities' procurement plans. In California, utilities must prepare a DG forecast as part of their long-term procurement plans. DG, of which CHP is a subset, must also be considered as an alternative to distribution system upgrades by California's IOUs. Connecticut, Georgia, Iowa, Indiana, Kentucky, Massachusetts, Minnesota, Nebraska, Nevada, Oregon, Utah, and Washington also call out CHP as an option in IRP. Section 7.1, "Electricity Resource Planning and Procurement," provides more information about these and other planning approaches.

Utility Rates

Customers with onsite generation typically require a different set of services, which includes continuing electricity service for the portion of usage that is not provided by the onsite generator, as well as service for periods of scheduled or unscheduled outages. "Partial requirements" is another name for standby or backup service: the set of retail electric products that customers with onsite, non-emergency generation typically desire. This service could be a tariff that replaces the standard full requirements tariff or an additional tariff that applies on top of the standard tariff for certain special types of service. Many of the utilities that provide these services distinguish three types of partial requirements service in their tariffs: supplemental, backup, and maintenance. Some differentiate only between standby and supplemental (EPA 2009).

A review of selected rate tariffs suggests that the better rate designs share common and central characteristics: they are designed to give customers a strong incentive to use electric service most efficiently, to minimize the costs they impose on the system, and to avoid charges when service is not taken (EPA 2009). This means that they reward customers for maintaining and operating their onsite generation. To encourage customer-generators to use electric service most efficiently and minimize the costs they impose on the electric system, standby rates that incorporate some or all of the following features would be helpful (SEE Action 2013):

- Establish as-used demand charges (daily or monthly) for backup power and shared transmission and distribution facilities.
- Reflect CHP customers' load diversity in charges for shared delivery facilities.
- Provide an opportunity to purchase economic replacement power.
- Allow customer-generators the option to buy all of their backup power at market prices.
- Allow the customer to provide the utility with a load reduction plan.
- Offer a self-supply option for reserves.

More information can also be found in Sections 7.2, "Policies That Sustain Utility Financial Health," and 7.4, "Customer Rates and Data Access." Examples of some utility rates that account for CHP either through departing load charges, exit fees, or standby charges are:

- On April 3, 2003, the California Public Utilities Commission (CPUC) issued Decision 03-04-030, outlining a mechanism for granting a range of DG customer exemptions from paying power surcharges known as "exit fees" or "cost responsibility surcharges." A customer with departing load generally refers to utility customers that leave the utility system in part or entirely to self-generate electricity. CPUC tasked the California Energy Commission (CEC) to determine exemptions from exit fee requirements. The following systems are exempt from the exit fee rules:
  - Systems <1 MW that are net metered and/or eligible for CPUC or CEC incentives for being clean and super clean are fully exempt from any surcharge, including solar, wind, and fuel cells.
  - Ultra clean and low-emission systems (defined as generation technologies that produce zero emissions or emissions that meet or exceed 2007 California Air Resources Board [CARB] emission limits) >1 MW that meet Senate Bill 1038 requirements to comply with CARB 2007 air emission standards will pay 100 percent of the bond charge, but no future Department of Water Resources (DWR) charges or utility under-collection surcharges.

  All other customers will pay all components of the surcharge except the DWR ongoing power charges. When the combined total of installed generation reaches 3,000 MW (1,500 MW for renewables), any additional customer generation installed will pay all surcharges.
- States and utilities have provided further direction on customer generation. For example, PG&E defines customer generation as "cogeneration, renewable technologies or any other type of generation that is dedicated wholly or in part to serve all of a portion of a specific customer's load or relies on non-PG&E or dedicated PG&E distribution wires rather than PG&E's utility grid. Reductions in load are classified as customer generation departing load only to the extent that such load is subsequently served with electricity from a source other than PG&E" (PG&E 2015). In January 2012, New Jersey Governor Chris Christie signed NJSA 48:2-21.37, the "Standby Charge Law" concerning the burden of standby charges on DG customers. The law requires the NJBPU to conduct a study to determine the effects of DG, including CHP, on energy supply and demand. The study will also determine whether DG, including CHP, contributed to any cost savings for electric distribution companies. Under the law, the NJBPU must establish criteria for fixing rates associated with the study assessment and require public utilities to file tariff rates according to the new criteria. The NJBPU must also ensure equity between DG customers and other customers.
- In April 2014, the Minnesota Department of Commerce published an analysis of standby rates' policy impacts on CHP opportunities in the state (MDC 2014). The analysis examined how existing rates affect the market acceptance of CHP projects today and presented recommendations that could help reduce the barriers that these factors impose on CHP development in Minnesota. Though the standby suggestions for each utility are somewhat unique, there were certain recurring themes:
  - *Standby rates should be transparent, concise, and easy to understand.* Potential CHP customers should be able to accurately predict future standby charges to assess their financial impacts on CHP feasibility.
  - *Standby usage fees for both demand and energy should reflect time-of-use cost drivers.* Time-of-use energy rates send clear price signals about the utility's cost to generate needed energy. This information can further incentivize the use of off-peak standby services.
  - *The forced outage rate should be used to calculate a customer's reservation charge.* Including a customer's forced outage rate directly incentivizes standby customers to limit their use of backup

service. This approach further links standby use to the price paid to reserve such service, creating a strong price signal for customers to run most efficiently. This approach also involves removing the grace period.

- *Standby demand usage fees should only apply during on-peak hours and be charged on a daily basis.* This rate design would encourage DG customers to shift their use of standby service to off-peak periods when the marginal cost to provide service is generally much lower. It would also allow customers to save money by reducing the duration of outages.
- *Grace periods exempting demand usage fees should be removed where they exist*. Exempting an arbitrary number of hours against demand usage charges sends inaccurate price signals about the cost to provide this service. The monthly reservation cost provides grace period charges for 964 hours of usage regardless of whether a customer needs that level of service. Standby demand usage should be priced as used on a daily and preferably on-peak basis. This method directly ties the standby customer to the costs associated with providing standby service and allows customers to avoid monthly reservation charges by increasing reliability.

These themes are also seen in a 2014 study that outlines best practice recommendations and breaks these practices into three categories: allocation of utility costs, judgments based on statistical methods, and value of customer choice and incentives (RAP 2014). The financial effects of these modifications largely depend on customer-specific metrics, including CHP capacity, operating hours, voltage classification, etc.; the suggested modifications would likely increase each utility's avoided rate (MDC 2014).

Excess Power Sales and Net Metering

Sizing the CHP system to the thermal load in facilities with large thermal needs, such as industrial facilities in the chemical, paper, refining, food processing, and metals manufacturing sectors, can result in more electricity generated than can be used on site. Excess power sales may provide a revenue stream for a CHP project, possibly enabling the project to go forward, and can help achieve state energy goals. For these sales to take place, the CHP system will need to evaluate different contractual arrangements, time-of-use rates, and payments for capacity or grid support services. Several types of programs can provide for excess power sales from CHP systems: programs based on state implementation of the federal Public Utility Regulatory Policies Act (PURPA), net metering, and non-competitive power purchase agreements; feed-in tariffs and variations; and competitive procurement processes (SEE Action 2013). More information can also be found in Section 7.4, "Customer Rates and Data Access."

ACEEE's review of state CHP policies found that sound net metering regulations allowed owners of small DG systems to get credit for excess electricity that they produced on site, gave credit to states that offered at least wholesale net metering to all customer classes, and specifically offered credit to natural gas-fired CHP systems (ACEEE 2014b).

Examples of approaches that encourage CHP include the following:

- The Maine Public Utilities Commission's net metering policy is available to both fossil-fueled and renewably fueled CHP that meets certain efficiency and size requirements. April 2009 legislation (LD 336) amended net metering rules to include high-efficiency micro-CHP systems as eligible. Net metering had been available in Maine from 1987 to 1998 for qualified CHP and from 1987 until April 30, 2009, for other small power production facilities up to 100 kW. Micro-CHP with an electric generating capacity rating of 1 kW to 30 kW must achieve a combined electric and thermal efficiency of at least 80 percent or greater to qualify. In addition, micro-CHP 31 kW to 660 kW must achieve a combined efficiency of 65 percent or greater to qualify.

- All of Maine's electric utilities—IOUs and publicly owned utilities (e.g., municipally owned and cooperatively owned utilities)—must offer net metering to micro-CHP. IOUs are required to offer net metering to shared ownership customers, while publicly owned utilities can offer it. Shared ownership allows for community net metering, where several people invest in an eligible system and are therefore allowed to benefit. IOUs are required to offer net metering to eligible facilities up to 660 kW. Publicly owned utilities are required to offer net metering to customers up to 100 kW and are authorized (although subject to the utility's discretion) to offer net metering to eligible facilities up to 660 kW.
- Net excess generation (NEG) is credited to the following month for up to 12 months; after the end of an annualized period, all NEG is granted to the utility with no compensation for the customer. At its own expense, a utility may install additional meters to record purchases and sales separately. There is no limit on the aggregate amount of energy generated by net metered customers. However, a utility must notify the PUC if the cumulative capacity of net metered facilities reaches 1 percent of the utility's peak demand.

- In 2004, the PUC of Oregon began a thorough investigation into rates, terms, and conditions for PURPA qualifying facilities (Oregon PUC 2007). The PUC also adopted complementary procedures for interconnection and dispute resolution. Its goal was "to encourage the economically efficient development of these [qualifying facilities], while protecting ratepayers by ensuring that utilities pay rates equal to that which they would have incurred in lieu of purchasing [qualifying facility] power." Results to date suggest their approach achieves the policy's intent (SEE Action 2013).
  - Oregon's avoided cost rates recognize the difference in qualifying facility value when a utility is resource-sufficient versus when it is resource-deficient. When the utility does not need large-scale thermal or renewable resources, as may be the case in the early years of the qualifying facility contract, avoided cost rates are based on projected monthly on- and off-peak electricity market prices at the appropriate trading hubs. Conversely, when the utility is resource-deficient, rates are based on the projected cost of a new combined cycle combustion turbine, with its cost and timing vetted in the utility's IRP process. Further, while qualifying facilities may choose fixed avoided cost rates for the first 15 years of the contract, during the last 5 years, the fuel price component of the rates are based on monthly natural gas price indexes. Qualifying facilities also may choose these market-based options for the entire contract term.
  - The regulations that the PUC of Oregon adopted for small and large qualifying facilities uphold the PURPA principle by which utilities may not be required to pay more than avoided costs for qualifying facilities. The PUC's guidance on contract provisions related to creditworthiness, security, default, and insurance also protect ratepayers. Under the state RPS, electric utilities must acquire such resources, and the renewable avoided cost rates are based on the cost of the next large scale renewable resource identified in the utility's IRP (SEE Action 2013).
- In Vermont, fossil-fueled and renewably fueled CHP systems are eligible for net metering. Net metering legislation, which includes provisions for CHP, was enacted for the first time in Vermont in 1998 and has been amended several times, most recently by House Bill (HB) 702 of 2014. HB 702 now allows any electric customer in Vermont to net meter after obtaining a Certificate of Public Good from the Vermont Public Service Board. The bill establishes a process to revise the state's net metering program by January 1, 2017.

The Department of Public Service was charged with preparing a report by October 1, 2014, that evaluates the current state of net metering in Vermont.

- A net metering system meets the size definition provided in the rules; operates in parallel with the electric distribution system's facilities; is intended primarily to offset the customer's own electricity requirements; is located on the customer's premises or, in the case of a group net metering system, on the premises of a customer who is a member of the group; and employs a renewable energy resource or is a qualified micro-CHP system. Net metering is generally available to systems up to 500 kilowatts (kW) in capacity that generate electricity using eligible renewable energy resources, including CHP systems that use biomass. CHP systems that use a non-renewable fuel are allowed to net meter, but are limited to small CHP systems up to 20 kW.
- Net metering is available on a first-come, first-served basis until the cumulative capacity of net metered systems equals 5 percent of a utility's peak demand during 1996 or the most recent full calendar year, whichever is greater. Renewable energy facilities established on military property for onsite military consumption may net meter for systems up to 2.2 MW. NEG is carried forward as a kWh credit to the next month. Any NEG not used within 12 months will be granted to the utility. Net metering is also available under a time-of-use metering arrangement. All renewable energy certificates associated with the electricity produced by the system remain with the customer.

Designing Effective CHP Policies

States have found that the general steps for designing an effective CHP policy are:

- *Assess whether CHP can play a role in achieving state policy objectives.* States have found CHP systems can be attractive to policy-makers and industries because these applications are inherently energy-efficient and produce energy at the point of generation where it is needed. As CHP does not fit neatly into one category based on technology, fuel type, and benefits, states consider a variety of policy options to incorporate CHP benefits. Recent efforts in Alabama, Arkansas, Illinois, Iowa, and Tennessee—where the National Governors Association (NGA) Policy Academy meetings were convened—provided insights into identifying effective policies, taking different approaches based on state stakeholder engagement (NGA 2014).
- *Assess whether there has been increased CHP market development.* Where increased market deployment already exists, it would be helpful to understand the factors that have contributed to its growth and understand its contribution to the state's CHP potential.
- *Assess the state economic potential for CHP.* Where available, a state CHP potential analysis is a valuable tool to asses which sectors have immediate and long-term opportunities. There have been several recent studies that point to the national CHP economic potential and aggregate the state potential in the process (DOE and EPA 2012; McKinsey 2009). The potential varies by state based on the available energy-intensive industries, spark spread (or the difference between grid-purchased electricity and electricity generated at a site with CHP), and existing CHP-favorable policies.
- *Assess the barriers to realizing CHP's potential*. While developing CHP country profiles, the International Energy Agency (IEA) discovered many barriers in the United States that prevent CHP from reaching its full potential (IEA 2008). IEA also determined that targeted policy measures are needed to remove these obstacles and achieve CHP benefits. Common barriers include:
    - Significant upfront financial investments required.

- Economic and market issues related to the difficulty in securing fair value prices (i.e., net metering rates) for CHP electricity that is exported to the grid.
- Regulatory issues related to inconsistent interconnection procedures and backup charges (i.e., standby rates).
- A lack of knowledge about CHP, its benefits, and savings. When CHP's role is not clearly tied to the state economy, public funds expended to promote it may result in inefficient CHP installation or systems that do not have adequate thermal or electric loads, thereby acting as a deterrent to more appropriate CHP applications.
- Regulatory challenges in integrating emission benefits due to CHP's status as combined technologies that include heat and power.

New York's position as a strong CHP market has been a consistent, evolving process strengthened by soundly understanding state market barriers, engaging with CHP stakeholders to better understand their challenges and opportunities, and translating the knowledge gained into policy actions or program efforts among state stakeholders.

- *Assess CHP's contribution to achieving key policy objectives.* Policy analysis helps to provide a better understanding of CHP's role in meeting policy objectives and lays out the process in which these opportunities can be realized. In states where a direct linkage has been shown to a CHP-related policy and project development, CHP's benefits have continued to play a role in state energy and environmental plans, such as those seen in New York, Massachusetts, and Connecticut. States have found that careful planning to relate CHP potential to the appropriate policy drivers can result in win-win situations for states and CHP system owners.

Participants

A variety of participants can play important roles in mobilizing resources and ensuring effective implementation for CHP projects, including:

- *State energy and environmental departments.* Dialogue and engagement between these two agencies can help achieve a better understanding of the environmental benefits provided by a supply-side energy efficiency resource like CHP and can enhance the realization of CHP's potential. These state departments can provide information and technical assistance in planning and permitting CHP systems and also provide financial incentives. For example, under its system benefits charge (SBC) program for the 2012–2016 period, the State of New York has set aside an annual average $15 million budget to reduce barriers and costs and increase market penetration of CHP in New York for both smaller (1.3 MW or less) and larger systems that can provide on-peak demand reduction during summer (NYSERDA 2014).
- *State PUCs.* PUCs help assess utility policies, such as standby rates and portfolio standards, and ensure customers are treated fairly under these policies. State governments can work with state PUCs to obtain information on connecting CHP systems to the electricity grid and to learn about funding opportunities available for CHP projects. Some state PUCs administer programs that offer clean energy options for a targeted customer base or provide financial incentives for DG projects, including CHP.
- *Private developers.* In many states, private developers work with end-use facilities to implement CHP systems. They factor federal, state, and local incentives into successfully developing projects.

- *Manufacturers.* Manufacturers actively ensure that CHP systems are installed and operated in an optimal fashion. In a successfully implemented CHP system, manufacturers are typically part of a partnership between the developer and the consulting firm engaged in project development.
- *Engineering and architectural firms and consultants*. Firms with engineering and architectural expertise play an important role in developing CHP by providing critical knowledge to an end-user who may see the potential but does not possess the requisite expertise to evaluate the CHP opportunity.
- *Private financiers and private equity firms.* As the interest in CHP has increased, private financiers and equity firms have seen the value of financing CHP systems that offer a reliable return on investment, such as systems installed in the commercial and institutional sectors.
- *ESCOs.* ESCOs provide technical expertise on energy efficiency projects and often offer performance contracts, which typically include a guarantee that savings will occur, and that payments for these services will not exceed the monetary value of the savings generated. For example, local governments can contract with ESCOs to purchase and install CHP systems and to obtain operations and maintenance services.
- *Utilities*. Each utility has its own interconnection and net metering rules, which include rules on the rates and charges that apply to CHP. They vary widely by state and utility. Information on state interconnection and net metering rules, which determine whether and how a utility allows customers to connect to the grid, can be accessed through the EPA CHP Partnership (CHPP) website (http://epa.gov/chp/policies/database.html). Utilities offer financial incentives for CHP projects through energy conservation programs and have played a role in the increase of CHP.
- *State code enforcement officials and planning departments.* State governments can work with their code enforcement officials and planning departments to update codes (Virginia DEQ 2004). Some local governments, such as Boston, Massachusetts, and Epping, New Hampshire, have modified zoning ordinances to provide permitting incentives for CHP projects. Planning departments can also be responsible for developing local energy plans that include CHP-specific goals and activities.
- *Nonprofit organizations.* State governments can work with nonprofit organizations to obtain technical or financial assistance for implementing CHP-related activities.

Interaction with Federal Programs

There are several federal programs through which a state can look to incentivize and deploy CHP. These programs include the following:

- *EPA's CHPP.* The EPA CHPP seeks to reduce the environmental impact of power generation by promoting the use of CHP. The CHPP works closely with energy users, the CHP industry, state and local governments, and other clean energy stakeholders to facilitate the development of new projects and to promote their environmental and economic benefits.
- *U.S. Department of Energy (DOE) CHP Deployment Program.* The DOE CHP Deployment Program provides stakeholders with the resources necessary to identify CHP market opportunities and support implementation of CHP systems in industrial, federal, commercial, institutional, and other applications. A key component of the Program is the regional CHP Technical Assistance Partnerships (TAPs), which promote and help transform the market for CHP, WHP, and district energy nationwide. CHP TAPs offer key services, including technical assistance, education and outreach, and market opportunity analyses.
- *DOE State Energy Program (SEP).* DOE SEP provides funding and technical assistance to state and territory energy offices to help them advance their clean energy economy while contributing to national energy

goals. SEP also provides leadership to maximize the benefits of energy efficiency and renewable energy in each state through communications and outreach activities and technology deployment, and by providing access to new partnerships and resources. In 2013, eight states received SEP funds totaling more than $750,000 for CHP-related efforts.

- *EPA Climate Showcase Communities (CSC).* EPA's CSC Program helps local governments and tribal nations pilot innovative, cost-effective, and replicable community-based GHG reduction projects, which include CHP. Fifty communities received CSC funding, including a few CHP applications, and EPA is leveraging the lessons from these projects to help others implement their own actions through peer exchange, training, and technical support.
- *Federal EPA regulations that call out CHP's inclusion*. These inclusions could be called out directly or through the use of OBR for CHP units in New Source Performance Standards and other regulations. For example, the Clean Air Interstate Rule for ozone and fine particulate matter and the Clean Air Mercury Rule allow states to determine the method for allocating allowances. EPA model rules include examples of output-based allocation, including methods to include CHP units.

Interaction with State Policies

As CHP deployment often depends on local policies, favorable state policies play a critical role in its increased use. State CHP policies can be related to environmental, energy, financial, or utility goals, as described in detail in this chapter.

Implementation and Evaluation

Administering Body

The state, local, or tribal environmental agency and energy office are typically responsible for developing and implementing CHP-related policies.

Roles and Responsibilities of Implementing Organization

The following are responsibilities of the state, local, or tribal environmental agency and state energy office:

- Identify and evaluate opportunities for considering CHP-related policies.
- Gather information, develop goals, and develop CHP-related policies and regulations.
- Publicize and implement the CHP-related policy.
- Evaluate the value of the policy in encouraging efficiency, CHP, and emission reductions.

Best Practices: Implementing CHP Policies

The best practices identified below will help states effectively implement their CHP policies. These recommendations are based on the experiences of states that have implemented CHP policies and regulations to encourage CHP.

- Start with internal education to ensure that state energy and environmental regulators understand the benefits, principles, and mechanisms under which the CHP policy will be designed. Ensure that regulators understand why this change is good for state energy and environmental goals.
- Coordinate with other state agencies that can lend support. State energy research and development offices, as well as economic development offices, can provide valuable information on CHP's energy and economic benefits. Their perspective on the importance of energy efficiency and pollution prevention can help formulate policy.
- Apply the policies' principles to new regulations, as appropriate.
- Publicize the new rules and train personnel internally and externally.

Evaluation/Oversight

States evaluate their programs periodically to determine whether their regulations and policies are structured to encourage CHP in line with their objectives. This evaluation helps identify new opportunities for using a CHP policy to encourage energy efficiency and reduce emissions through effective regulatory and program design.

Regulatory programs are routinely reviewed and revised, and occasionally new programs are mandated by state or federal legislation. For example, states are developing revised State Implementation Plans to achieve larger emission reductions and address problems of ozone, fine particulates, and regional haze. States can use this opportunity to evaluate the benefits of energy efficiency in attaining and maintaining air quality goals. Another example is New York's SBC program, established by the state Public Service Commission (PSC) and administered through NYSERDA, which reviews the performance data from systems receiving incentives.

State Examples

Iowa

Iowa was one of four states chosen from around the country to work with the NGA to improve industrial use of CHP and enhance economic development. Iowa's CHP Policy Academy began in October 2012 and continued through April 2013. The NGA supported this interagency effort with technical assistance and expertise, workshop training, in-state visits, and grant funding of $12,000. Iowa has a very diverse manufacturing base, which creates both challenges and opportunities for CHP. The scope of Iowa's CHP Policy Academy was to address CHP across a broad range of industries in order to better define the opportunities, barriers, and types of policies that would facilitate progress in Iowa. In addition, more information about the current status of the existing stock of Iowa CHP was gathered to help utilities and policy-makers assess potential age-related impacts on Iowa's electrical supply/demand balance. This effort aimed to identify potential obstacles to cost-effective, large-scale CHP and to ascertain the best means of bypassing hurdles and facilitating CHP improvements and economic competitiveness in Iowa.

Iowa has several incentives in place that support CHP deployment, as well as others under development. The DOE Midwest Technical Assistance Program has developed a baseline analysis report for the CHP market in Iowa (DOE 2005). It assesses the prevailing environment for CHP systems from the regulatory, private market, and technology perspectives within Iowa. This information may be used to develop educational and market transformation programs.

The Alternate Energy Revolving Loan Program (AERLP) is administered by the Iowa Energy Center and funded by the state's IOUs. The AERLP provides loan funds to individuals and organizations that seek to build commercial, industrial, residential, or utility renewable energy production facilities in Iowa. The Iowa Economic Development Authority, in partnership with the Iowa Area Development Group, is offering low interest loans for energy efficiency improvements, renewable energy projects, energy management, and implementation plans. Loans will have terms of up to 10 years and range from $50,000 to $500,000 with a 1 percent or higher interest rate.

Under the Energy Replacement Generation Tax Exemption, the State of Iowa provides a 100 percent exemption for self-generators and landfill gas systems. This tax is imposed in lieu of a property tax on generation facilities. Facilities with onsite self-generators must wholly own or lease the facility in question and produce electricity solely for their own consumption, except for inadvertent unscheduled deliveries to their electric utility. However, facilities that do not consume all energy on site are not required to pay the replacement tax on energy that is used to operate the facility.

The State of Iowa offers a production tax credit of $0.015 per kWh for energy generated by eligible renewable energy facilities. In addition, Iowa offers $4.50 per million British thermal units of biogas used to generate either electricity or heat for commercial purposes, or $1.44 per thousand cubic feet of hydrogen fuel generated and sold by an eligible renewable energy facility. These credits may be applied toward the state's personal income tax, business tax, financial institutions tax, or sales and use tax. They last for a 10-year period.

In the 2008 *Iowa Climate Change Advisory Council Final Report*, policy recommendation CRE-11 ("Distributed Generation/Co-Generation") includes investment in small-scale DG through incentives or subsidies and the prevention of barriers to both utility and customer investment. It also seeks to ensure access to the grid under uniform technical and contractual terms for interconnection, so that owners know parallel interconnection requirements in advance, and manufacturers can design standard packages to meet technical requirements. The goal of CRE-11 was to deploy 7,500 MWh per year of new distributed renewable generation by 2010, continued each year thereafter; CHP using renewable fuels would be eligible. Policy recommendation CRE-12, "Combined Heat and Power," suggests promoting CHP across Iowa by providing incentives for CHP development. Suggested incentives include tax credits, grants, zoning provisions, and offset credits for avoided emissions. Policy recommendation CRE-13, "Pricing Strategies to Promote Renewable Energy and/or CHP," suggests creating pricing and metering strategies that encourage customers to implement CHP and renewable energy, resulting in overall GHG emissions reductions. This recommendation aimed to achieve a 10 percent shift to renewable energy and/or CHP as a percentage of retail sales.

Iowa has interconnection standards for systems including both fossil-fueled and renewably fueled CHP for rate-regulated utilities (MidAmerican Energy, Interstate Power and Light, and Linn County Rural Electric Cooperative). The standards apply to DG facilities, including CHP, <10 MW that are not subject to the interconnection requirements of FERC; the Midwest Independent Transmission System Operator, Inc.; or the Mid-Continent Area Power Pool. Although standard interconnection rules only apply to systems <10 MW, the rules state that larger facility interconnection should take place using the Level 4 review process as a starting point. The Iowa Economic Development Authority's Energy Office is collaborating with the Iowa Department of Natural Resources to streamline the CHP permitting process to further assess the application of CHP technology in Iowa. Iowa will explore the market potential for CHP in the commercial and institutional sectors, sponsor CHP educational events, and create a guide that will serve as a resource directory for future CHP projects.

Websites:

http://www.iowaenergycenter.org/alternate-energy-revolving-loan-program-aerlp
http://www.iadg.com/services/financial-assistance/iadg-energy-bank.aspx
http://www.iowaeconomicdevelopment.com/Energy/CHP
http://www.iowa.gov/tax/index.html
http://www.iowadnr.gov/Environment/ClimateChange/ClimateChangeAdvisoryCo.aspx
http://www.legis.iowa.gov/DOCS/ACO/IAC/LINC/1-23-2013.Rule.199.15.10.pdf

Kentucky

Kentucky is using a multi-pronged policy approach to advance CHP. It has factored in CHP as part of its efforts to meet the state energy plan's GHG emissions reduction target. It has established financial incentives under its Incentives for Energy Independence Act as well as energy efficiency loans for state government agencies. It also has interconnection standards in place that take CHP into consideration.

CHP's role as an energy efficiency measure has also been considered. It will support the governor's strategy to offset 18 percent of the state's projected 2025 energy demand through efficiency. A 2-year initiative aims to identify policies and programs that will create a better environment for economical usage of CHP.

Governor Steve Beshear announced Kentucky's first comprehensive energy plan, Intelligent Energy Choices for Kentucky's Future, in November 2008 with the ultimate goal of reducing GHG emissions levels to 20 percent below 1990 levels by 2025. As part of this goal, at least 18 percent of the state's projected 2025 energy demand will be offset through efficiency. Governor Beshear plans to have 25 percent of Kentucky's energy needs met through energy efficiency, conservation, and the use of renewable resources. One way Kentucky is increasing energy efficiency is by promoting CHP use through a public/private partnership.

The Incentives for Energy Independence Act was passed in August 2007 and established incentives for companies that build or renovate facilities 1 MW or greater, which use renewable energy to produce electricity for sale. Biomass resources, including CHP, are among the acceptable renewable energy sources. For companies that work on renewable energy facilities, incentives may include the following:

- A tax credit that allows approved facilities to receive a credit up to 100 percent of Kentucky income tax and the limited liability tax for projects that construct, retrofit, or upgrade facilities that generate power from renewable resources.
- A sales tax incentive of up to 100 percent of the Kentucky sales on materials, machinery, and equipment used to construct, retrofit, or upgrade an eligible project.
- As a condition of employment, approved companies may also require that employees whose jobs were created as a result of the associated project agree to pay a wage assessment of up to 4 percent of their gross wages. Employees will be allowed a Kentucky income tax credit equal to the assessment withheld from their wages.
- Advanced disbursement of post-construction incentives.

The maximum recovery for a single project from all incentives, including the income and liability entity tax credit, sales tax refund, and the wage assessment, may not exceed 50 percent of the capital investment.

Through the Green Bank of Kentucky, state agencies may be eligible for three separate energy loan products, depending on the proposed energy efficiency improvements. Renewable energy technologies, including CHP, are eligible for funding under this program as long as the payback period is 15 years or less. Initial funding for the Green Bank of Kentucky was provided by the American Recovery and Reinvestment Act through the Kentucky SEP. The eSELF Revolving Loan is a loan for energy efficiency projects costing between $50,000 and $225,000 that will result in at least a 20 percent energy reduction. The state agency will directly manage improvement projects funded under this loan. The Hybrid Revolving Loan is for energy efficiency projects costing between $50,000 and $600,000. An energy audit or engineering analysis is required, as well as a design and development package. The state agency is responsible for procuring materials and service. The cost of the audit/engineering analysis may be rolled into the loan. The ESPC revolving loan is for comprehensive energy efficiency projects costing more than $600,000 that use an ESPC or ESCO. A detailed industrial energy audit and cost-benefit analysis are required. The cost of the audit/engineering analysis may be rolled into the loan.

The Kentucky PSC has established interconnection standards that apply to renewable CHP. The standards apply to all retail electric suppliers in the state, excluding Tennessee Valley Authority utilities. Kentucky's interconnection standards apply only to certain renewables (photovoltaic [PV], wind, biomass, biogas, and small hydro) <30kW.

Kentucky has a two-tiered interconnection process for eligible systems:

- *Level 1.* Level 1 applies to inverter-based systems <30 kW that are certified to the UL 1741 and comply with IEEE 1547. Systems cannot require the utility to make modifications to its system in order to be interconnected. Utilities must notify the customer within 20 business days whether the interconnection application has been approved or denied. No application fees or other related fees apply.
- *Level 2.* Level 2 applies to systems that are not inverter-based, systems that use equipment not certified as meeting UL 1741, or systems that fail to meet the other technical requirements outlined for Level 1 applications. The utility has 30 business days to process a Level 2 application. Utilities may require customers to submit an application fee of up to $100 for processing and inspection purposes. If the utility determines that an impact study is needed, the customer is responsible for costs up to $1,000 for the initial impact study.

Utilities may choose to require an external disconnect switch. In addition, customers must maintain general liability insurance coverage (e.g., a standard homeowner's or commercial policy) for their systems. The guidelines also cover procedures for dispute resolution.

In March 2014, a public/private partnership was announced to promote high-efficiency CHP technologies as a means of reducing energy costs and carbon emissions, and as a way to spur new economic growth in Kentucky's industrial and manufacturing sectors. It includes the Kentucky Energy and Environment Cabinet, the Kentucky Pollution Prevention Center at the University of Louisville, and the Kentucky Association of Manufacturers. The partnership will promote the environmental and economic benefits of CHP through education and outreach with the support of the CHP TAP, a voluntary program established by DOE to facilitate and promote CHP technology. The public/private partnership will promote CHP in two phases. The first focuses on education and outreach presented through a series of work group meetings, as well as the development of a policy and implementation plan. The second phase consists of a feasibility study and strategies to increase Kentucky's CHP capacity.

Websites:
http://energy.ky.gov/Programs/Pages/chp.aspx
http://energy.ky.gov/Programs/Documents/Kentucky%20public%20private%20partnership%20to%20advance%20industrial%20energy%20efficiency.pdf
http://migration.kentucky.gov/Newsroom/governor/20081120energy.htm
http://energy.ky.gov/resources/Pages/EnergyPlan.aspx
http://finance.ky.gov/initiatives/greenbank/Pages/default.aspx
http://www.thinkkentucky.com/kyedc/kybizince.aspx
http://www.psc.ky.gov/agencies/psc/Industry/Electric/Final%20Net%20Metering-Interconnection%20Guidelines%201-8-09.pdf

New York

Over the past decade, New York has consistently implemented CHP policies to encourage and support CHP's role in meeting the state's energy, environmental, and reliability goals. New York has promoted CHP expansion through a combination of funding incentives, utility policies and rates, an RPS, and a comprehensive state energy plan. New York's SBC, which supports funding for CHP, was created in 1996 by the New York State PSC, and is currently administered by NYSERDA. The SBC supports energy efficiency, education, outreach, research and development, and low-income energy assistance. It is a surcharge on the bills of customers of New York's six IOUs.

The CHP program's objective in the 2012–2016 SBC plan is to "reduce barriers and costs and increase market penetration of CHP in New York." To achieve this goal, NYSERDA will: 1) implement a pilot program to promote pre-engineered, modular-based CHP systems and break down barriers to broader CHP use in various markets, and 2) provide performance-based payments for custom CHP systems that benefit summer peak demand periods. The SBC plan's budget for these initiatives is $15 million annually.

NYSERDA offers the CHP Acceleration Program to increase market penetration in the commercial and institutional sectors where New York has seen the most opportunities to use CHP and the CHP Performance Program. The CHP Performance Program currently provides incentives for CHP systems with an aggregate nameplate capacity greater than 1.3 MW that provide summer on-peak demand reduction. These incentives are performance-based and correspond to the summer-peak demand reduction (kW), energy generation (kWh), and FCE achieved by the CHP system on an annual basis over a 2-year measurement and verification period.

While the CHP Performance Program covers all of New York State, the CHP Acceleration Program applies to installation sites that pay the SBC surcharge on their electric bill or are located within New York City or Westchester County. The CHP system must also be fueled by natural gas that is subject to the SBC surcharge on gas bills.

The CHP Acceleration Program provides incentives for the installation of prequalified and conditionally qualified CHP systems by approved CHP system vendors in the size range of 50 kW to 1.3 MW. Incentive funds are allocated on a site-by-site, first-come, first-served basis in the order that applications are received until December 30, 2016, or until all funds are committed. An application is not considered received until it has been deemed full and complete by NYSERDA. The maximum incentive per project, including bonuses, is $1.5 million.

The New York State PSC adopted uniform interconnection standards that apply to CHP in 1999. The Standard Interconnection Requirements (SIR) have been amended several times, most recently in February 2014. The SIR applies to New York's six investor-owned, local electric utilities: Central Hudson Gas and Electric, Consolidated Edison (ConEd), New York State Electric and Gas, Niagara Mohawk, Orange and Rockland Utilities, and Rochester Gas and Electric. It includes two sets of interconnection and application procedures: an expedited process and a basic process. Under the expedited process, as amended in 2013, systems up to 50 kW are eligible for a simplified or expedited six-step process. Systems up to 300 kW may be eligible for this provided that the inverter-based system is UL 1741-certified and tested. Systems proposed for installation in underground network areas may need to submit additional information and may be subject to a longer review process. Systems up to 50 kW are not charged an application fee. Applicants must use the basic 11-step interconnection process for all systems greater than 50 kW and up to 2 MW, and for systems greater than 50 kW and up to 300 kW that have not been UL 1741-certified and tested.

New York's original net metering law, enacted in 1997 for PV systems, has been modified several times to include farm-based biogas systems up to 1 MW (A.B. 7987) and residential CHP systems up to 10 kW (A.B. 2442). Another modification (A.B. 7765) extends net metering to fuel cell systems of up to 1.5 MW for non-residential customers. New York's net metering rules apply to all IOUs in the state. Publicly owned utilities are not required to offer net metering; however, the Long Island Power Authority offers net metering using terms similar to the state law.

Most NEG is credited to the customer's next bill at the utility's retail rate. However, micro-CHP and fuel cell NEG is credited at the utility's avoided cost rate. In June 2011, New York enacted legislation (A.B. 6270) allowing eligible farm-based and non-residential customer-generators to engage in "remote" net metering. The law permits eligible customer-generators to designate net metering credits from equipment located on property that they own or lease to any other meter that is both located on property they own or lease and is within the same utility territory and load zone as the net metered facility.

New York customers using natural gas for DG, including CHP, may qualify for discounted natural gas delivery rates. In April 2003, the PSC issued procedures for developing gas-delivery rates that the local gas distribution companies would exclusively apply to gas-fired DG units. Gas for CHP must be separately metered and meet certain load factor requirements (NYSPSC 2014).

New York's RPS includes some renewably fueled CHP as an eligible resource. There are two tiers used to meet the RPS:

- *Main tier.* Eligible resources include methane digesters and other forms of biomass, liquid biofuels, fuel cells, hydroelectric power, PV, ocean power, tidal power, and wind power. NYSERDA can procure main tier resources through auction, requests for proposals, or standard offer contracts. While the main tier seeks to foster the development of additional renewable resources in New York, existing renewable energy facilities will also be eligible if they began operation on or after January 1, 2003.
- *Customer-sited tier*. Eligible resources include fuel cells, PV, solar hot water, wind turbines, digester gas-fueled CHP systems, and methane digesters. Customer-sited tier systems are generally limited to the size of the load at the customer's meter.

The RPS applies to IOUs and targets 30 percent of state electricity consumption to come from eligible resources by 2015. The program provides funding for CHP systems through a combination of capacity- and performance-based incentives. Eligible technologies include, but are not limited to, CHP systems fueled by anaerobic digestion biogas and (in certain regions) systems fueled by renewable biogas (including systems co-fired with renewable biogas). Incentives can be based on either capacity (kW) or output (kWh) and are awarded through competitive solicitations.

In August 2009, then-Governor David Paterson issued Executive Order 24, which established a state goal of reducing GHG emissions 80 percent below 1990 levels by 2050, and created the Climate Action Council to prepare a climate action plan. The plan is intended to be a dynamic and continually evolving strategy to assess and achieve the goal of sustained GHG emission reductions. The November 2010 *Climate Action Plan Interim Report* recognizes CHP as a method for increasing energy efficiency and reducing emissions. CHP is included under policy recommendation RCI-2, "Energy Efficiency Incentives," which promotes whole-building, integrated analysis to identify high performance efficiency measures, including CHP, for existing and new buildings. The report estimates that these policy actions could lead to additional CHP generation capable of producing 890 GWh/year in 2020 and 4,600 GWh/year in 2030. It also estimates that CHP use from 2011 to

2030 could potentially result in 7.1 million metric tons of CO_2 equivalent reductions. Additionally, the report includes recommendation RCI-10, “Rate Restructuring and Flexible Metering,” which promotes improved net metering regulations to facilitate renewable DG and CHP.

Issued in 2009 and updated in 2014, New York’s State Energy Plan provides a framework for the state to meet its future energy needs in a cost-effective and sustainable way, establishes policy objectives, and sets recommendations and strategies to achieve those objectives. In the wake of Superstorm Sandy, the current Draft Plan reiterates the need to encourage DG through additional technical and financial support, and remove any barriers to DG interconnection to the electric grid. The Draft Plan also encourages in-state renewable energy development through its RPS, which has a goal of providing 30 percent of New York’s electricity through renewables. The updated Draft Plan no longer explicitly mentions CHP. To help meet that goal, the Plan recommends the New York State Department of Environmental Conservation “establish regulatory standards to foster increased use of cleaner distributed resources while maintaining air quality and supporting reliability needs.“

In February 2013, New York Governor Andrew Cuomo announced that a $20 million investment would be made towards CHP, specifically those projects aimed at providing continuous power and heat during grid outages. This investment is based on recommendations made by NYS 2100, one of the three commissions Governor Cuomo created in the aftermath of Superstorm Sandy to improve the state’s emergency preparedness and response to natural disasters; it is administered by NYSERDA through the CHP Acceleration Program (NYSERDA, PON 2568). Later, in the spring of 2013, the Governor announced an additional $40 million in funding for large-scale CHP projects, termed the CHP Performance Program. This investment was also due to NYS 2100 recommendations. The funding for large-scale CHP projects (> 1.3 MW) will be available through NYSERDA until all funding is committed or until December 30, 2016. It is for natural gas-fueled CHP systems and CHP feasibility studies. Sites that pay the SBC are eligible for incentives. The base incentives for performance are limited to $2 million or 50 percent of project costs. Bonus incentives of up to an additional $600,000 are available for CHP systems that demonstrate superior energy performance; serve critical infrastructure facilities, including refuge facilities during disaster situations; and for projects located in a targeted zone established by ConEd. Due to flooding risks, CHP systems funded under this program must have all critical components located above the anticipated flood level (Governor’s Press Office 2013).

Websites:
https://www.nyserda.ny.gov/Funding-Opportunities/Current-Funding-Opportunities/PON-2568-CHP-Acceleration-Program
http://www.nyserda.ny.gov/All-Programs/Programs/Combined-Heat-and-Power-Performance-Program
http://www.epa.gov/chp/policies/policies/nenewyorksystembenefitscharge.html
http://www3.dps.ny.gov/W/PSCWeb.nsf/All/DCF68EFCA391AD6085257687006F396B?OpenDocument
http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={FCB13975-E1FE-46B2-83B4-DBA1F0FFFAAA}
http://www.dec.ny.gov/energy/80930.html
http://www.dec.ny.gov/docs/administration_pdf/irexecsumm.pdf
http://www.dec.ny.gov/energy/71394.html
http://www.nyserda.ny.gov/About/System-Benefits-Charge
http://chp.nyserda.ny.gov/home/index.cfm
http://www.governor.ny.gov/news/governor-cuomo-announces-20-million-combined-heat-and-power-systems-generate-reliable-site

Rhode Island

Rhode Island has instituted a suite of policies and incentives that consider CHP benefits for both the state and energy end-users. There are two statewide plans that factor in CHP's benefits: the state energy plan and state climate change plan. CHP is also factored into the state EERS and environmental regulations, as well as several financial incentives. These include standards for utility system reliability, energy efficiency, and conservation procurement.

The State Planning Council adopted the Rhode Island Energy Plan on August 8, 2002, identifying the state's key energy issues and setting forth policies and actions to deal with them. CHP is incorporated. The Energy Plan lists a number of policy recommendations related to CHP, including economic competitiveness and energy security.

The Rhode Island Greenhouse Gas Action Plan was released in July 2002. One initiative would promote the use of CHP in industry with technical studies, program marketing, and financial incentives. Possible CHP technologies include combustion turbine type systems and internal combustion engines, likely fueled by natural gas. A second initiative would use the same measures to promote CHP use in non-industrial buildings and facilities. Potential CHP technologies include microturbines, fuel cells, combustion turbine type systems, and ICEs likely fueled by natural gas. Multi-building campuses are considered to be especially promising sites for CHP.

Rhode Island enacted energy efficiency standards in 2006, but no specific targets are outlined in the standards. Utilities must submit energy efficiency procurement plans annually and triennially with savings targets that establish standards for system reliability, energy efficiency, and conservation procurement. They must also establish standards for energy supply diversification, DG, demand response, and "prudent and reliable" energy efficiency and energy conservation measures. The state passed legislation in June 2012 requiring utilities to support CHP system installation at commercial, industrial, institutional, and municipal facilities, and requiring each utility to detail how it will do so in its annual plan. Utilities must establish energy efficiency procurement plans that include target percentages for CHP. The state has approved energy efficiency targets for National Grid. National Grid must design its energy efficiency plans with the goal of reducing energy consumption by 1.7 percent in 2012, 2.1 percent in 2013, and 2.5 percent in 2014 (National Grid 2014).

CHP projects in Rhode Island that National Grid electric customers are eligible for are a combination of energy efficiency, performance rebates, and advanced gas technology incentives. The total incentive package cannot exceed 70 percent of total project cost and is subject to budgetary limitations and caps. Customers are allowed to participate in both the energy efficiency and advanced gas technology programs, as long as they meet both sets of requirements.

Performance rebates and energy efficiency incentives include $900/kW per net kW for projects with 55 percent to 59.99 percent efficiency (net kW is nameplate kW output minus auxiliary) and $1,000/kW for projects with 60 percent or greater efficiency. A 25 percent bonus is available to facilities that have implemented (or plan on implementing) energy efficiency measures in the previous 5 years and reduced onsite energy use by at least 5 percent.

The advanced gas technology program is designed to add natural gas load during National Grid's off-peak period, rather than reducing load through conservation efforts. National Grid gives incentives to innovative projects that add non-heating load. The incentive amount is determined by adding the project's margin gain, up to 75 percent of the project's future margin, 75 percent of the project cost, the amount needed to buy down the payback period to 1.5 years, and the remaining advanced gas technology fund balance.

New and existing distributed generators may be subject to emissions limits (lb/MWh) pursuant to state air pollution control Regulation No. 43. Using the avoided emissions approach, the rule allows a CHP system to account for its secondary thermal output when determining compliance with nitrogen oxide, carbon monoxide, and CO_2 emission limits. A CHP system can take into account the secondary thermal output if the power-to-heat ratio is between 4.0 and 0.15 and the design system efficiency is at least 55 percent.

Additionally, Rhode Island has several financial incentives that encourage CHP system installation, such as those provided by Commerce RI through the Rhode Island Renewable Energy Fund and energy efficiency, performance rebates, and advanced gas technology incentives.

Websites:
http://www.energy.ri.gov/energyplan/index.php
http://www.dem.ri.gov/climate/
http://webserver.rilin.state.ri.us/Statutes/TITLE39/39-1/39-1-27.7.HTM
http://www.dem.ri.gov/pubs/regs/regs/air/air43_12.pdf

What States Can Do

States play a critical role in advancing CHP growth through policies and incentives that can take several forms in meeting broader state objectives. States have recognized CHP, district energy, and waste heat recovery as important energy efficiency options in legislation and programs. Where feasible, they have supported expanded technology research, demonstration, and deployment, particularly in emerging biomass and small-to-medium sized applications. While progress has been made, work remains to be done to better encourage CHP development with explicitly supportive policies (ACEEE 2014a). States can help level the playing field for CHP through regulatory and policy changes, including implementing standardized interconnection rules; developing transparent standby rate policies that recognize the benefits of CHP while appropriately compensating the utility for its provided services; encouraging uniform siting and environmental compliance policies; establishing uniform tax policies, which provide incentives to overcome market barriers and promote societal benefits; incorporating CHP in renewable and/or energy efficiency portfolio standards, or exploring other tax incentives, where appropriate; and providing a market solution for excess power produced by systems sized to meet thermal load.

Information Resources

General Information

Title/Description	URL Address
CHP/DHC Country Scorecard: United States. IEA's 2014 U.S. scorecard discusses the status of CHP and district energy in the United States, along with existing barriers and drivers for CHP development.	http://www.iea.org/publications/insights/insightpublications/the-iea-chp-and-dhc-collaborative-chpdhc-country-scorecard-united-states.html
Combined Heat and Power: Frequently Asked Questions. This EPA CHPP fact sheet addresses several frequently asked questions about how CHP works, as well as the costs and benefits associated with CHP.	http://epa.gov/chp/documents/faq.pdf
Combined Heat and Power: A Clean Energy Solution. This 2012 DOE and EPA report provides a foundation for national discussions on effective ways to reach the President's 40 GW CHP target, and includes an overview of the key issues currently impacting CHP deployment and the factors that need to be considered by stakeholders participating in the dialogue.	http://www.epa.gov/chp/documents/clean_energy_solution.pdf
Combined Heat and Power: A Resource Guide for State Energy Officials. This 2013 resource guide from the National Association of State Energy Officials provides State Energy Officials with a technology and market overview of CHP and ways in which they can support CHP through state energy and energy assurance planning, energy policies and utility regulations, and funding/financing opportunities for CHP.	http://www.naseo.org/data/sites/1/documents/publications/CHP-for-State-Energy-Officials.pdf
Combined Heat and Power Playbook. Municipalities interested in deploying CHP and district energy can draw on resources in this document. It delineates which resources are most useful at particular periods of project development and explains how to overcome barriers and challenges.	http://www.aceee.org/sites/default/files/publications/researchreports/ie1404.pdf
Gas-Fired Combined Heat and Power Going Forward: What Can State Utility Commissions Do? This 2014 document from the National Regulatory Research Institute examines barriers in state regulations that obstruct the development of CHP.	http://energy.ky.gov/Programs/Documents/NRRI%20Report-What%20Can%20Commissions%20Do.pdf
Guide to the Successful Implementation of State Combined Heat and Power Policies. This 2013 report from the SEE Action Network provides state utility regulators and other state policy-makers with actionable information to assist them in implementing key state policies that impact CHP.	https://www4.eere.energy.gov/seeaction/publication/guide-successful-implementation-state-combined-heat-and-power-policies
Guide to Using Combined Heat and Power for Enhancing Reliability and Resiliency in Buildings. In the wake of Superstorm Sandy, this 2013 DOE, U.S. Department of Housing and Urban Development, and EPA report discusses opportunities for CHP to contribute to reliability and resiliency, options for CHP financing, and how to determine if CHP is an appropriate fit for various applications.	http://epa.gov/chp/documents/chp_for_reliability_guidance.pdf
The Opportunity for Combined Heat and Power in the United States. This 2013 document from the American Gas Association and ICF International provides a market assessment of CHP potential in the United States, with a focus on impacts to the natural gas industry.	https://www.aga.org/opportunity-chp-us

Federal Resources

Title/Description	URL Address
DOE Deployment Program. Provides stakeholders with the resources necessary to identify CHP market opportunities and supports implementation of CHP systems in all applications. The regional CHP TAPs, which promote and help transform the market for CHP, WHP, and district energy technologies/concepts nationwide, are key to the Program. CHP TAPs offer key services, including technical assistance, education and outreach, and market opportunity analyses.	http://www.energy.gov/eere/amo/chp-deployment http://www.energy.gov/eere/amo/chp-technical-assistance-partnerships-chp-taps
EPA CHPP. The CHPP is a voluntary program seeking to reduce the environmental impact of power generation by promoting CHP use. The Partnership works closely with energy users, the CHP industry, state and local governments, and other clean energy stakeholders to facilitate the development of new projects and to promote their environmental and economic benefits.	http://www.epa.gov/chp/

Information about States

Title/Description	URL Address
Challenges Facing Combined Heat and Power Today: A State-by-State Assessment. This 2011 ACEEE discusses barriers to CHP along with suggestions for how CHP stakeholders can further the development of the CHP market in the United States and individual states.	http://www.aceee.org/research-report/ie111
The 2014 State Energy Efficiency Scorecard. The Scorecard has measured the progress of state policies and programs that save energy while also benefiting the environment and promoting economic growth. Using data vetted by state energy officials, ACEEE ranks states in six categories—utility programs, transportation, building energy codes, CHP, state initiatives, and appliance standards.	http://www.aceee.org/research-report/u1408
Database of State Incentives for Renewables and Efficiency. This website contains extensive information on federal, state, and local programs, policies, and incentives for energy efficiency and renewable energy, including CHP. The database can be searched by program type, including green power programs.	http://www.dsireusa.org
EPA CHPP Policy Portal dCHPP (CHP Policies and Incentives Database). This online database allows users to search for CHP policies and incentives by state or at the federal level.	http://www.epa.gov/chp/policies/database.html

Examples of State Legislation and Regulations

State	Title/Description	URL Address
Arizona	In the Matter of the Notice of Proposed Rulemaking on Electric Energy Efficiency. This document provides the details about the adoption and rules of Arizona's EERS.	http://images.edocket.azcc.gov/docketpdf/0000116125.pdf

State	Title/Description	URL Address
California	Clean Energy Jobs Plan. This document outlines Governor Brown's goals for California's energy future, including the goal to develop 12,000 MW of new distributed energy facilities by 2020.	http://gov.ca.gov/docs/Clean_Energy_Plan.pdf
Connecticut	An Act Enhancing Emergency Preparedness and Response (Substitute Senate Bill No. 23). Section 7 of this Public Act establishes the Microgrid Pilot Program, which provides grants and loans to local distributed energy projects at critical facilities around the state. The program was established in the wake of Hurricane Irene and the October 2011 snowstorm to promote CHP and resiliency for the grid.	http://www.cga.ct.gov/2012/act/pa/pdf/2012PA-00148-R00SB-00023-PA.pdf
Georgia	Electric Service Tariff: Back-Up Service. This document provides the details about Georgia Power's back-up schedule and service, which is available under a tariff rider.	http://www.georgiapower.com/pricing/files/rates-and-schedules/12.30_BU-8.pdf
Louisiana	House Resolution No. 167. This is the resolution passed in 2012 in Louisiana stating that all critical government buildings must evaluate installing CHP in new construction or major retrofits of existing buildings.	http://legiscan.com/LA/text/HR167/id/651999/Louisiana-2012-HR167-Enrolled.pdf
Massachusetts	Massachusetts General Law Chapter 111, Sections 142 A through 142 M. This document contains Massachusetts' output-based emissions regulations, which include conventional emissions limits, emissions limits on small DG, allowance set-asides, allowance trading, and an emissions performance standard. Massachusetts Alternative Energy Portfolio Standard (AEPS). This AEPS describes the statewide CHP program.	https://malegislature.gov/laws/generallaws/parti/titlexvi/chapter111 http://www.mass.gov/eea/energy-utilities-clean-tech/renewable-energy/rps-aps/
Minnesota	Minnesota Climate Change Action Plan: A Framework for Climate Change Action. This document is the final climate change plan issued by the state, which outlines recommendations to the Governor for reducing Minnesota's GHG emissions.	http://www.pca.state.mn.us/index.php/view-document.html?gid=9237
New Jersey	NJPBU Order of Approval in the Matter of a Voluntary Green Power Choice Program (Docket No. E005010001). This document contains final NJPBU approval for the statewide green power program and also includes the document containing the final program description, framework, rules, and technical standards.	http://www.nj.gov/bpu/pdf/boardorders/EO05010001_20050413.pdf
	New Jersey Cogeneration Law (2007). This law exempts qualified cogeneration facilities from sales and use tax for natural gas and provides market access for sale of electricity to affiliated or contiguous users.	http://www.state.nj.us/treasury/taxation/cogennot.shtml

State	Title/Description	URL Address
New Mexico	Renewable Energy Act (S.B.43). This state legislation further clarifies elements of the state RPS and also specifies that sales through the voluntary green pricing programs are in addition to the RPS requirements (see Section 7).	http://www.nmlegis.gov/sessions/04%20Regular/bills/senate/SB0043FSS.HTML
New York	State of New York Public Service Commission: Order and Opinion Regarding Competitive Opportunities for Electric Service (Cases 94-E-0952 et al.). This document contains the original order that established New York's SBC. The second document contains the order for the continuation and expansion of the SBC.	http://www3.dps.ny.gov/pscweb/WebFileRoom.nsf/Web/E05EBC3E5C3E79B385256DF10075624C/$File/doc886.pdf?OpenElement http://www3.dps.ny.gov/pscweb/WebFileRoom.nsf/Web/98254B5953E8F4AC85256DF10075626B/$File/doc9157.pdf?OpenElement
North Carolina	Renewable Energy and Energy Efficiency Portfolio Standard (Senate Bill 3). This is the text of the North Carolina REPS, which defines rules and guidelines to meet the state's renewable energy and energy efficiency goals.	http://www.ncleg.net/Sessions/2007/Bills/Senate/PDF/S3v6.pdf
Oregon	Investigation Related to Electric Utility Purchases from Qualifying Facilities (Docket No. UM 1129). This is the investigation by the Oregon PUC into electric utility purchases from Qualifying Facilities.	http://apps.puc.state.or.us/edockets/docket.asp?DocketID=11114
Texas	Texas House Bill No. 1864. This bill states that critical government buildings must evaluate adding CHP as part of new construction or major retrofits to existing facilities.	http://www.capitol.state.tx.us/tlodocs/83R/billtext/pdf/HB01864F.pdf#navpanes=0
	Texas House Bill No. 3268. This bill requires the commission to adopt a permit by rule for natural gas engines and turbines that are part of a CHP system.	http://legiscan.com/TX/text/HB3268/id/314530/Texas-2011-HB3268-Enrolled.html
Utah	In the Matter of Analysis of an Integrated Resource Plan for PACIFICORP (Docket No. 90-2035-01). This document contains the IRP guidelines established for PACIFICORP by the PSC of Utah.	http://www.airquality.utah.gov/Public-Interest/Current-Issues/Regionalhazesip/RegionalHazeTSDdocs/Utah_PSC_Integrated_Planning_Rules.pdf
Washington	Revised Code of Washington: Voluntary Option to Purchase Qualified Alternative Energy Resources (19.29A.090). This is the enabling legislation for the Washington State Utilities and Transportation Commission green power program.	http://law.justia.com/codes/washington/2005/title19/19.29a.090.html

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