

Combined Heat and Power (CHP)

Combined Heat and Power (CHP) describes an energy production system that produces not only electricity, but also useful thermal energy, typically in the form of steam.

CHP allows for a user of both thermal and electrical energy to integrate a production system that optimizes thermal energy to address electrical needs as well as thermal energy needs. CHP offers significant benefit to industry and our Commonwealth and the country through increased efficiency, improved environmental performance, reduced losses and improved reliability in electricity transmission, more effective use of natural resources, decreased costs and improved national competitiveness. As with all power generation, CHP deployment has unique cost, operational, and other characteristics, but it is a proven and effective available clean energy option that can help Pennsylvania enhance energy efficiency, reduce greenhouse gas (GHG) emissions, promote economic growth, and maintain a robust energy infrastructure. CHP also offers the opportunity to improve and contribute to critical infrastructure resiliency, mitigating the impacts of an emergency by keeping critical facilities running without any interruption in service. CHP is generally most cost-effective in industrial or commercial settings with large thermal heat loads that are in operation 24 hours a day. Currently there are CHP units located at food, paper, chemical, refinery, and metal industries along with solid waste, healthcare, colleges and other commercial settings across Pennsylvania. (SEEACTION.Energy.gov)

Other Involved Agencies: Public Utility Commission

Possible New Measure(s):

2012 data shows Pennsylvania with 124 CHP industrial and commercial sites with a total capacity of over 3000 MW. Over 1,000 MW of these are coal-fired generating plants. The average capacity of commercial and industrial CHP units installed in Pennsylvania between 2002 and 2012 is approximately 1.9 MW and the median is approximately 400 kW. An average of approximately 6.0 MW of industrial and commercial CHP has been installed annually in Pennsylvania between 2002 and 2012. An August 30, 2012 Executive Order from the White House called for a national goal of deploying 40 GW of new, cost effective industrial CHP in the United States by the end of 2020. Calculations listed in this work plan are based on installing 15 MW of industrial and commercial CHP annually between 2015 and 2030.

Potential Work Plan Costs and GHG Reductions:

*** Table 1 Work Plan Costs and GHG Results**

Annual Results (2030)			Cumulative Results (2015-2030)		
GHG Reductions (MMtCO ₂ e)	Cost (Million \$)	Cost-Effectiveness (\$/MtCO ₂ e)	GHG Reductions (MMtCO ₂ e)	Costs (NPV, Million \$)	Cost-Effectiveness (\$/MtCO ₂ e)
.96	\$-85.11	\$-88.66	8.16	\$-224.21	\$-27.48

* Projections based on additional 240 MW capacity industrial and commercial CHP.

The composition of the costs presented in Table 1 use EPA capital, operation, and maintenance cost estimates for a reciprocating engine prime mover CHP system. The cost estimates do not account for avoided boiler capital, operational, and maintenance costs. The cost estimates assume the overall

efficiency of the CHP system to be 75% and will be in operation 95% of the time. The cost estimates assumes a value of \$.09 / kWh for excess electricity. The cost estimates assume the reciprocating engine to be operating on natural gas.

- As noted earlier, the sectors for deployment include commercial (includes institutions) and industrial.
- Electrical transmission and distribution losses are estimated at 9.67%.
- Estimates of future CHP costs are inherently uncertain because cost estimates are highly sensitive to natural gas prices, the cost of avoided power, and the assumption about the CO₂ intensity of displaced electricity. Different electric generation technologies also have different associated costs and emissions.

State Case Studies and approximate savings associated with each:

- **Evergreen Community Power Plant** (33 MW, using biomass fuel, ~53,500 metric tons of CO₂e saved annually) CHP became operational in 2008.
- **Bucknell University** (6 MW, using Natural Gas fuel, ~ \$1.25 million saved annually). CHP became operational in 1998.
- **Geisinger Medical Center** (5MW, using Natural Gas fuel, ~ \$1.5 Million saved annually, ~ 14,500 metric tons of CO₂e saved annually). CHP became operational in 2012.
- **Philadelphia Gas Works** (200 kW, using Natural Gas fuel, ~ \$130,000 saved annually, ~ 475 metric tons of CO₂e saved annually). CHP became operational in 2011.
- **PSECU** (800 kW, using Natural Gas fuel, ~ 1,360 metric tons of CO₂e saved annually). CHP became operational in 2014.

Implementation Steps:

The key to implementing CHP systems is to provide adequate incentives for the development of infrastructure to capture and utilize the waste heat. Such incentives could come in many forms, such as recruiting suitable end users, such as industries, hospitals, government offices, or school campuses to a centralized location to utilize the waste heat, tax credits, grants, zoning, and offset credits for avoided emissions. A federal tax incentive allows for a 10% investment tax credit for CHP property up to 15MW. Facilities may be eligible for state grants or loans through the Pennsylvania Alternative and Clean Energy Program or from other individual power supply companies. Additionally, Section 9.4.8 of the Governor's Marcellus Shale Advisory Commission report, issued on July 22, 2011, recommends that, "The Commonwealth should promote the use of cogeneration technology (Combined Heat & Power (CHP)) through the use of Permit-by-Rule, standardized utility power grid interconnection rules and direct financial incentives." As previously mentioned, CHP systems, including those fueled by natural gas, are already an eligible Tier II resource under Pennsylvania's AEPS. The AEPS also established a set of statewide interconnection standards.

A large group of locally financed small projects spread widely across the Commonwealth could capture the value of carbon benefits while limiting transportation costs of the feedstock. This model has been shown to allow displacement of current or projected fossil carbon release from a broad range of users.

The following are policies that can potentially increase the installed capacity of CHP in Pennsylvania:

- Design of standby rates utilities can charge CHP facilities.
- Review interconnection standards for CHP facilities with no electricity export.
- Create a fair market for excess power sales from CHP facilities to overcome barriers for smaller generators.
- Continued inclusion of CHP as an eligible power source for clean energy portfolio standards.
- Review use of CHP in creating critical infrastructure (power during natural disasters)
- Evaluate ability of utilities to participate in CHP operation, either in ownership or service packages for CHP facilities.
- The Environmental Permitting Process need to be modified to encourage CHP Facilities.

The following are scenarios that can potentially be barriers to business owners incorporating CHP:

- A conversion within a company to CHP prompting additional Environmental permitting and could trigger New Source Review (NSR) resulting in more stringent emission requirements, permitting time and additional costs to install additional pollution control equipment.
- A non-EGU could be reclassified as an EGU and be covered by EGU emission and Effluent Guidelines that could impact the Non-EGUs operations.
- Since Pennsylvania is a deregulated state with open access provided to the PJM, PURPA does not require that the Utilities sign Power Purchase Agreements (PPA) tied to the avoided costs. As such, the PUC will need to encourage PPAs with CHP.
- A lack of cost certainty related to RTO or transmission access charges; if the CHP Unit would be classified as an EGU and requires access, including upgrades to the interconnection and transmission.
- Restrictive FERC and NERC imposed oversight and reporting requirements for a CHP site, which would be reclassified as an EGU.