Combined Heat and Power (CHP)

Combined Heat and Power (CHP) can be an efficient and clean method of generating electric power and useful thermal energy from a single fuel source at the point of use. Instead of purchasing electricity from the local utility and burning fuel in an on-site furnace or boiler to produce needed thermal energy, an industrial or commercial user can use CHP to provide both energy services in one energy-efficient step. Consequently, CHP can provide significant energy efficiency and environmental advantages over separate heat and power. 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 typically only cost effective in industries 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 153 CHP sites with a total capacity of 3308 MW. Nationally, there are over 4,000 CPH sites with a capacity of 82 GW (8% of the U.S.) which produce more than 12% of total megawatt-hours generated annually. 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 extrapolation of 2025 projections set for Pennsylvania in the 2009 American Council for an Energy-Efficient Economy (ACEEE) report entitled, “Potential for Energy Efficiency, Demand Response, and Onsite Solar Energy in Pennsylvania”.

Potential Work Plan Costs and GHG Reductions:

*** Table 1 Work Plan Costs and GHG Results ($2010)**

Annual Results (2030)			Cumulative Results (2015-2030)		
GHG Reductions ($MMtCO_2e$)	Cost (Million $)	Cost-Effectiveness ($\$/tCO_2e$)	GHG Reductions ($MMtCO_2e$)	Costs (NPV, Million $)	Cost-Effectiveness ($\$/tCO_2e$)
1.75	$-313	$-179	19.3	$2,834	$-146.8

* *Projections based on additional 939 MW capacity industrial CHP and 598 MW capacity commercial CHP by 2030.*

The composition of the costs presented in Table 1 differs according to the type of CHP. Commercial CHP has the highest costs, in part because of the relatively low capacity factor (64% vs. 75% for industrial) implied in the ACEEE et al. (2009) report. These low capacity factors are due to the typical operating hours for a commercial building being less than an industrial building.

- The CHP supply estimates in the ACEEE et al. (2009) report targets the year 2025. For interim years such as 2020 and 2030, supplies are linearly interpolated.
- As noted earlier, the sectors for deployment include commercial (includes institutions) and industrial.

- Electrical transmission and distribution losses are estimated 6.6%.

- Estimating the costs of CHP into the distant future is tentative, because cost estimates are highly sensitive to natural gas prices, the cost of avoided power, and the assumption about the CO_2 intensity of displaced electricity. Different electric generation technology will also have different costs and emissions associated with each one.

State Case Studies and approximate savings associated with each:

- **Evergreen Community Power Plant** (33 MW, using biomass fuel, ~59 kilotons of CO_2e saved annually) CHP became operational 2008.
- **Bucknell University** (6 MW, using Natural Gas fuel, ~ $1.25 million saved annually). CHP became operational 1998.
- **Geisinger Medical Center** (5MW, using Natural Gas fuel, ~ $1.5 Million saved annually, ~ 16 kilotons of CO_2e saved annually). CHP became operational 2012.
- **Philadelphia Gas Works** (.20 MW, using Natural Gas fuel, ~ $130,000 saved annually, ~ 524 tons of CO_2e saved annually). CHP became operational 2011.
- **PSECU** (.80 MW, using Natural Gas fuel, ~ 1.5 kilotons of CO_2e saved annually). CHP became operational 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 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 replacing high-cost fuel imports and gain carbon benefits while limiting transportation costs of the feedstock. This model has been shown to allow displacement of significant quantities of current or projected fossil carbon release from a broad range of users through reduced electrically driven cooling and distributed generation of electricity through CHP facilities.

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.
- Include CHP as an eligible for clean energy portfolio standards.
- 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.