



Encouraging Combined Heat and Power in the Illinois Public Sector

Introduction

In 2014, the Illinois Department of Commerce and Economic Opportunity (DCEO) created an incentive pilot program to support the increased deployment of energy-efficient combined heat and power (CHP) systems at public sector facilities throughout the state. The pilot program had three incentivized and installed projects (selected from 17 initial applicants) and was considered a resounding success.

The road to achieving that success, however, was uncertain, even after the program began. The lessons learned from Illinois's experience in creating, promoting, and supporting the CHP Pilot Program can help educate stakeholders in other states looking to create similar programs.

Background

In 2007, Illinois passed the Illinois Power Agency Act (IPAA), which created the state's energy efficiency and demand response programs. This legislation established an energy efficiency resource standard (EERS) that set annual electric (kilowatt-hours) and natural gas (therms) savings targets. According to the IPAA, DCEO had the responsibility to plan and implement the state energy efficiency program for the public and low-income sectors, while the investor owned utilities had similar responsibilities for the private residential, commercial, and industrial sectors in their respective territories.

Under this law, CHP was not initially recognized as an approved energy-saving measure. Energy-saving measures that encouraged or required "fuel switching" were not allowed, and since CHP requires increased use of natural gas at the site to reduce the kilowatt-hours consumed from the electric grid, it was considered a "fuel switching" technology. However, Illinois passed legislation in 2013 amending the Public Utility Act to redefine energy efficiency as measures that reduce the total net British thermal units (Btus) of electricity *and* natural gas, rather than just one or the other. This redefinition opened the door for measures such as CHP, as long as one could show that the CHP system would consume fewer total Btus than the alternative sources.

DCEO Public Sector CHP Pilot Program

DCEO partnered with the Energy Resources Center (ERC) located at the University of Illinois at Chicago to establish a Public Sector CHP Pilot Incentive Program with Illinois Commerce Commission (ICC) approval. In June 2014, the program was initiated in the form of a competitive solicitation for CHP applications. Submissions were due in November 2014, with contracts scheduled for implementation in mid-2015. Project applications were accepted only from the public sector: local governments, municipal corporations, public school districts, public universities, state/federal facilities, waste water treatment facilities, correctional facilities, etc.

This pilot program was performance-based, requiring conventional topping cycle CHP systems to meet a minimum measured efficiency of 60% with at least 20% of the total useful energy output in the form of thermal energy. For waste heat to power (WHP) or bottoming cycle CHP systems, the pilot program had no efficiency requirements so long as no additional fuel was required to operate the system.

Incentives were capped at the lesser of \$2 million per CHP project or 50% of the total project cost. The incentive was divided into three parts:

- Design = \$75/kW issued at the completion of the detailed design phase
- Construction = \$175/kW issued at the commissioning of the system
- Production =
 - Topping cycle CHP: \$0.08/kWh for measured efficiency $\geq 70\%$ higher heating value (HHV) or \$0.06/kWh for measured efficiency $\geq 60\%$ HHV of useful electric energy produced, issued after 12 months of measured performance data
 - Bottoming cycle CHP: \$0.08/kWh for useful electric energy produced, issued after 12 months of operation

Note: The incentive for design and construction was capped at \$650,000 or 50% of the design and construction cost.

Calculating Energy Savings

For topping cycle CHP systems, the ICC approved a two-step process for calculating the qualifying energy savings:

Step 1: Calculate the fuel (Btus) the CHP system uses to generate electricity and useable thermal energy (F total CHP). Calculate the fuel (Btus) used by the grid to generate the same amount of electricity (F grid) and the fuel (Btus) used by an on-site boiler to generate the same amount of thermal energy (F thermal CHP). Subtract the former from the latter to determine fuel savings (S fuel CHP):

- $S \text{ fuel CHP} = F \text{ grid} + F \text{ thermal CHP} - F \text{ total CHP}$

Step 2: Convert the fuel savings (Btus) to allowable electricity and/or gas savings:

- To convert Btus saved to electricity saved (kWh):
 - First calculate the heat rate of the CHP system:
 $H \text{ CHP} = (F \text{ total CHP} - F \text{ thermal CHP}) \div E \text{ CHP}$
 - Then convert the Btus saved to kWh:
 $S \text{ CHP Elec} = S \text{ fuel CHP} \div H \text{ CHP}$
- To convert the Btus saved to natural gas saved (therms):
 $S \text{ CHP Gas} = S \text{ fuel CHP} \div 100,000 \text{ Btu/therm}$

F grid is the fuel in Btus that would have been consumed by the grid to generate the electricity output of the CHP system: $F \text{ grid} = E \text{ CHP} \times H \text{ grid}$ (H is the heat rate of the grid).

F thermal CHP is the fuel in Btus that would have been consumed onsite by a boiler to provide the thermal output provided by the CHP system. If the efficiency of the replaced boiler is unknown, assume 80%.

F total CHP is the total fuel in Btus consumed by the CHP system to generate both the electric and thermal energy.

E CHP is the annual electricity generated by the CHP system.

For projects that accrue both electric and gas savings, the Btu savings were split 80% electric and 20% gas.

For all bottoming cycle CHP systems, the energy savings are applied to the electric program and are equal to the total electricity (kWh) produced by the system (assuming no additional fossil fuels are used in the WHP system).

Program Administration and Results

As the technical advisor to DCEO on the CHP Pilot Program, the ERC was responsible for:

- Developing and preparing the competitive solicitation (Request for Applications [RFA])
- Developing the methodology for measuring and calculating CHP system efficiency and allowable energy savings
- Marketing the RFA to potential project partners through various outreach venues (DCEO's Trade Ally Program, the Midwest Cogeneration Association, market sector associations, and individual companies)
- Providing technical review of applications to DCEO for the final selection process

Pilot Program Results:

- 17 applications submitted under the RFA
- 7 applications selected for possible contract negotiations
- 3 projects successfully awarded, contracted, and completed: Argonne National Laboratory, Glenbard Wastewater Authority, and Downers Grove Sanitary District
- Estimated total achieved energy savings:
 - electric = 57,517,149 kWh/year
 - natural gas = 1,146,668 therms/year

As a result of DCEO leadership and the Public Sector CHP Pilot Program, CHP is now an approved energy efficiency measure included in the Illinois Technical Resource Manual, and all four investor owned utilities (ComEd, Ameren, Nicor Gas, and Peoples Gas) have included CHP in their ICC-approved three-year EERS program plans.

For More Information

U.S. DOE MIDWEST CHP TECHNICAL ASSISTANCE PARTNERSHIP (TAP)

312-996-4490

<http://www.mwchptap.org>

The Midwest CHP TAP is a U.S. DOE-sponsored program managed by the Energy Resources Center located at the University of Illinois at Chicago.