



Combined Heat and Power: CHP Partnership and the WWTF Sector

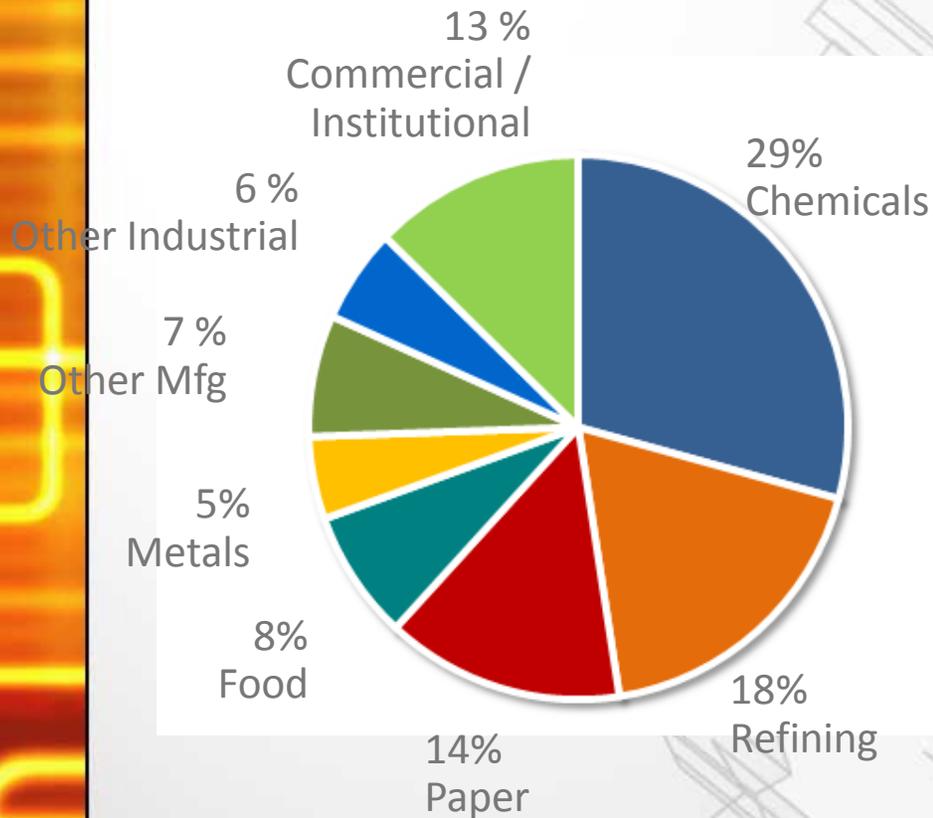
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Combined Heat & Power (CHP)

- CHP - key supply-side energy efficiency resource
- EPA recognizes CHP's unique role in:
 - Protecting public health and welfare
 - Addressing climate change
- Advances will help address key challenges:
 - Lowering the cost of reducing GHG emissions and other air pollutants
 - Increasing clean energy generation
 - Improving electricity system reliability

Existing CHP Capacity



- 81.7 GW of installed CHP at 3,700 industrial and commercial facilities (2011)
- Avoids **1.8 quadrillion Btus** of fuel consumption annually
- Avoids **240 million metric tons of CO₂** per year
- CO₂ reduction equivalent to removing **42 million cars** from the road
- CO₂ reduction equivalent to eliminating **43 1,000 MW coal power plants**

Source: ICF CHP Database

CHP Value Proposition

Category	10 MW CHP	10 MW Wind	10 MW Natural Gas Combined Cycle
Annual Capacity Factor	85%	34%	70%
Annual Electricity	74,446 MWh	29,784 MWh	61,320 MWh
Annual Useful Heat	103,417 MWh	None	None
Footprint Required	6,000 sq ft	76,000 sq ft	N/A
Capital Cost	\$20 million	\$24.4 million	\$9.8 million
Cost of Power	7.6 ¢/kWh	7.5 ¢/kWh	6.1 ¢/kWh
Annual Energy Savings	316,218 MMBtu	306,871 MMBtu	163,724 MMBtu
Annual CO ₂ Savings	42,506 Tons	27,546 Tons	28,233 Tons
Annual NO _x Savings	87.8 Tons	36.4 Tons	61.9 Tons

Source: ICF International, prepared for the EPA CHP Partnership

EPA & Combined Heat and Power

- The EPA CHP Partnership (CHPP) is a **voluntary program** that seeks to reduce the environmental impact of power generation by promoting the use of **highly efficient CHP / cogeneration**.
- Through 2010, the CHPP helped Partners put into operation more than **520 CHP projects** representing more than **5,000 MW of capacity**.
- The CHPP works with multiple CHP applications, technology options, and fuel types.
- The CHPP offers services and tools for Partners to assist with CHP project development, overcoming regulatory barriers, market transformation, and recognition.



Technical Assistance for Candidate Sites

- **CHP Catalog of Technologies**
- **Biomass CHP Catalog of Technologies**
- **Spark Spread Screening for CHP Candidate Sites**
- **Third-Party Review of Feasibility/Design Analysis**
- **Incentive and Policy Analysis**

Technical Resources

Project Development Handbook

Overview

- Stage 1 - Qualification
- Stage 2 - Level 1 Feasibility
- Stage 3 - Level 2 Feasibility Analysis
- Stage 4 - Procurement
- Stage 5 - Operations & Maintenance



CHP Project Development Handbook



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



Energy and Emissions Savings Calculations

	A	B	C	D	E	F	G
1	CHP Results						
2	 						
3							
4							
5							
6	The results generated by the CHP Emissions Calculator are intended for educational and outreach purposes only;						
7	it is not designed for use in developing emission inventories or preparing air permit applications.						
8							
9	Annual Emissions Analysis						
10		CHP System	Displaced Electricity Production	Displaced Thermal Production	Emissions Reduction	Percent Reduction	
11	NOx (tons/year)	48.89	230.06	120.56	301.73	86%	
12	SO2 (tons/year)	0.33	744.79	593.49	1,337.95	100%	
13	CO2 (tons/year)	65,008	82,736	61,788	79,515	55%	
14	Carbon (metric tons/year)	17,729	22,564	16,851	21,686	55%	
15	Fuel Consumption (MMBtu/year)	1,111,249	807,202	602,806	298,760	21%	
16	Acres of Forest				21,686		
17	Number of Cars				13,554		

This CHP project will reduce emissions of Carbon Dioxide (CO2) by 79,515 tons per year

This is equal to 21,686 metric tons of carbon equivalent (MTCE) per year

This reduction is equal to removing the carbon that would be absorbed by 21,686 acres of forest



OR

This reduction is equal to removing the carbon emissions of 13,554 cars



Benefits of CHP to WWTFs

- Economic Benefits –
 - Produces power at a cost below retail electricity.
 - Displaces purchased fuels for thermal needs.
- Reliability Benefits - Enhances power reliability for the plant.
- Efficiency Benefits - Produces more useful energy than if the WWTF were to use biogas solely to meet digester heat loads.
- Environmental Benefits - Reduces emissions of greenhouse gas and other air pollutants, primarily by displacing utility grid power.

The Report

- Provides an overview of CHP and its benefits at WWTFs.
- Describes the existing CHP capacity at WWTFs and the potential market for additional CHP at WWTFs.
- Analyzes the technical and economic potential for CHP at WWTFs, presenting analyses of electric and thermal energy generation potential at WWTFs, as well as cost-to-generate estimates under three digester gas utilization cases.
- Presents first-hand observations gathered through interviews of WWTF operators regarding the benefits and challenges of CHP development and operation.

Summary of Key Findings

- CHP is a reliable, cost-effective option for WWTFs that have, or are planning to install, anaerobic digesters.
- There is strong potential for increased CHP at WWTFs.
- 1 MGD = 26 kW electric and 2.4 MMBtu/day thermal with CHP.
- Cost to generate electricity using CHP ranges from 1.1 to 8.3 cents per kilowatt hour (kWh).
 - Current retail electric rates range from 3.9 to over 21 cents per kWh
- National technical potential is >400 MW and 38,000 MMBtu/day.
 - Could prevent 3 MMTCO₂ annually (emissions of 596,000 cars)
- National economic potential ranges from 178-260 MW
- Translating CHP potential into actual successes requires an understanding of operational realities → 14 interviews

CHP Partnership Agreement

- Partners agree to:
 - provide data to EPA on
 - existing CHP projects
 - new project development
 - other CHP-related activities
- In return, EPA will:
 - Promote incentives for CHP
 - Provide project-specific assistance
 - Provide tools/services to accelerate projects
 - Recognize projects and partners

ENERGY STAR CHP Award

- Recognize exceptional CHP facilities that reduce emissions
- Are in commercial operation
- Use 5% less fuel than state-of-the-art separate heat-and-power generation
- Be operating within stipulated emission limits in permits.



For More Information

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