Combined Heat and Power: CHP Partnership and the WWTF Sector

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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.**
- The CHPP works with multiple CHP applications, technology options, and fuel types.
- The CHPP offers services and tools to assist with CHP project development, overcoming regulatory barriers, market transformation, and recognition.

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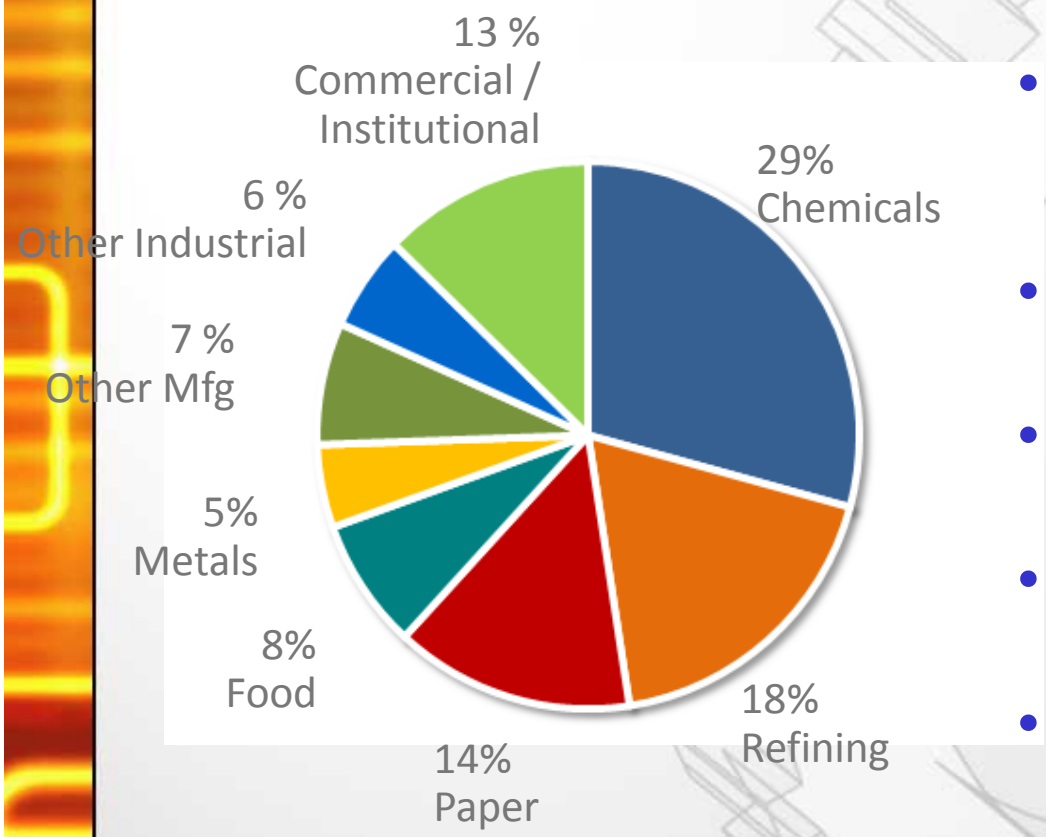
Existing CHP Capacity



- 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 CO_2** per year
- CO_2 reduction equivalent to removing **42 million cars** from the road
- CO_2 reduction equivalent to eliminating **43 1,000 MW coal power plants**

Source: ICF CHP Database

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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.

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Digester Gas Wastewater CHP Systems

State	Number of Sites	Capacity (MW)	State	Number of Sites	Capacity (MW)
AR	1	1.73	MT	3	1.09
AZ	1	0.29	NE	3	5.40
CA	33	62.67	NH	1	0.37
CO	2	7.07	NJ	4	8.72
CT	2	0.95	NY	6	3.01
FL	3	13.50	OH	3	16.29
IA	2	3.40	OR	10	6.42
ID	2	0.45	PA	3	1.99
IL	2	4.58	TX	1	4.20
IN	1	0.13	UT	2	2.65
MA	1	76.00	WA	5	14.18
MD	2	3.33	WI	5	2.02
MI	1	0.06	WY	1	0.03
MN	4	7.19	**Total**	**104**	**247.72**

Prime Mover	Number of Sites	Capacity (MW)
Reciprocating engine	54	85.8
Microturbine	29	5.2
Fuel cell	13	7.9
Combustion turbine	5	39.9
Steam turbine	2	81.0
Combined cycle	1	28.0
Total	**104**	**247.8**

Source: CHP Installation Database, ICF, June 2011

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.

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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 MMTCO$_2$ 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

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Lessons from the Field

- Interviewed 14 WWTF operators:
  - Drivers for installing CHP and operational benefits
  - Challenges to CHP project development and operation/maintenance (O&M)
  - Operational insights and observations

Key Findings:

- **CHP has been proven successful at WWTFs.**
- **Understanding operational realities is important for translating potential into a successful project.**

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Potential Market for CHP

WWTFs Flow Rate Range (MGD)	Total WWTFs	WWTFs with Anaerobic Digestion	Percentage of WWTFs with Anaerobic Digestion
> 200	10	7	70%
100–200	18	13	72%
75–100	25	17	68%
50–75	24	17	71%
20–50	137	82	60%
10–20	244	140	57%
5–10	451	230	51%
1–5	2,262	845	37%
Total	**3,171**	**1,351**	**43%**

Source: 2008 CWNS

Key Finding:

- **There is a high potential for CHP use at WWTFs.**

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Potential CHP Market Analysis

- EPA 2008 Clean Watershed Needs Survey Database.
- Primary indicators considered for a national analysis:
  - Number of facilities with anaerobic digestion
  - Total influent flow rate to those facilities
- Other available data sources
  - State data collection efforts – California, Wisconsin
  - WERF project on "Preparation of Baseline of the Current and Potential Use of Biogas from Anaerobic Digestion at Wastewater Plants" – initiated August 2011

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Technical Resources for Candidate Sites

- **Funding and Incentives Resources**
  - CHP Funding and Incentive Database
  - Incentive and Policy Analysis
- **Technology Resources**
  - CHP Catalog of Technologies
  - Biomass CHP Catalog of Technologies
- **Project Development Tools**
  - Spark Spread Screening for CHP Candidate Sites
  - Third-Party Review of Feasibility/Design Analysis
  - Project Development Handbook
  - Energy and Emissions Savings Calculator

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For More Information

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