

M2M GREEN INITIATIVE COMBINED HEAT AND POWER (CHP) OVERVIEW

From the U.S. Environmental Protection Agency (www.epa.gov/chp)

What is CHP?

[Combined heat and power \(CHP\)](#), also known as cogeneration, is an efficient, clean, and reliable approach to generating power and thermal energy from a single fuel source. By installing a CHP system designed to meet the thermal and electrical base loads of a multifamily property, CHP can greatly increase the facility's operational efficiency and decrease energy costs. At the same time, CHP reduces the emission of greenhouse gases, which contribute to global climate change.

CHP is not a single technology, but an **integrated energy system** that can be modified depending upon the needs of the energy end user. It provides:

- **Onsite generation** of electrical and/or mechanical power.
- **Waste-heat recovery** for heating, cooling, dehumidification, or process applications.
- **Seamless system integration** for a variety of technologies, thermal applications, and fuel types into existing building infrastructure.

What is the process to determine if a property is suitable for CHP?

(<http://www.epa.gov/chp/project-development/index.html>)

Stage 1: Qualification

Goal: Determine whether CHP is worth considering at a candidate facility (see page 2)

Timeframe: 30 mins

Cost: none

Stage 2: Level 1 Feasibility Analysis

Goal: Identify project goals and potential barriers. Quantify technical and economic opportunities while minimizing time and effort. Use the attached "Calculating Preliminary Feasibility for Installing Combined Heat and Power in an Apartment Building".

Timeframe: 1-4 weeks

Cost: \$0 to \$5,000

Stage 3: Level 2 Feasibility Analysis

Goal: Optimize CHP system design, including capacity, thermal application, and operation. Determine final CHP system pricing and return on investment.

Timeframe: 1-4 months

Cost: \$0 to \$10,000

Stage 4: Procurement

Goal: Build an operational CHP system according to specifications, on schedule, and within budget.

Timeframe: 3-12 months

Cost: \$2,000 to \$4,000 per kilowatt installed

Stage 5: Operations and Maintenance

Goal: Maintain a CHP system that provides expected energy savings and reduces emissions by running reliably and efficiently.

Timeframe: Ongoing

Cost: \$0.015/kilowatt-hour (kWh) - \$0.02/kWh for maintenance, depending on type of equipment and operations and maintenance (O&M) procurement approach; possible cost for energy consultant to negotiate fuel purchase, depending on system size and in-house capabilities.

**M2M GREEN INITIATIVE
COMBINED HEAT AND POWER (CHP) CHECKLIST**

- 1. Does your building have an existing central plant and master metering?

- 2. Does your property contain 80 or more multifamily apartments?

- 3. Do you pay more than \$.07/ kilowatt-hour on average for electricity (including generation, transmission, and distribution)?

- 4. Is your facility located in a deregulated electricity market?

- 5. Does your facility operate for more than 5,000 hours/year?

- 6. Do you have thermal loads throughout the year (including steam, hot water, chilled water, hot air, etc.)?

- 7. Do you expect to replace, upgrade, or retrofit central plant equipment within the next 3-5 years?

If you checked at least the first three boxes, your property may be suitable for a CHP system. Consider completing the HUD Feasibility Screening software (available at [http://eber.ed.ornl.gov/HUD CHP guide version 2d](http://eber.ed.ornl.gov/HUD_CHP_guide_version_2d)). If the payback is under 10 years, recommend considering a second level, more detailed feasibility analysis.



CALCULATING PRELIMINARY FEASIBILITY FOR INSTALLING COMBINED HEAT AND POWER IN AN APARTMENT BUILDING

The U.S. Department of Housing and Urban Development (HUD), the Department of Energy (DOE) Oak Ridge National Laboratory and the eight DOE Regional Application Centers have an initiative to promote the use of combined heat and power (CHP) in apartment buildings. The average efficiency of the fossil-fueled central power generating plants in the U.S. is around 33% and has remained virtually unchanged for 40 years. This means that two-thirds of the energy in the fuel is lost as heat. CHP systems generate electricity at the apartment building, recycle waste heat and convert it to useful energy. They can achieve overall efficiencies higher than 80% without transmission losses. The value of that heat is what drives the economics for using CHP.

CHP can significantly reduce a multi-family building's annual energy costs. Instead of buying all the building's electricity from a utility and separately purchasing fuel for its heating (mechanical) equipment, most—or even all—of the electricity and heat can be produced for less money by a small power plant in the building operating at a higher combined efficiency. CHP can help relieve grid congestion and can improve the environment by reducing emissions. The recent ICPP report recognized CHP as “one of the leading responses to climate change currently commercially available”.

The type of CHP system commonly installed in multi-family housing uses a package that contains a gas-fired reciprocating engine (a refined version of that found in a car or truck), or a microturbine, that drives a generator to produce electricity. The heat (thermal energy) produced by this process is recovered and used to produce hot water or steam for space heating, to operate an absorption chiller or power a desiccant (drying) machine, instead of being exhausted.

For the May 17 HUD webcast summary of HUD promotion of CHP, go to: <http://www.hud.gov/webcasts/archives/envirhealth.cfm> and bring up Part 2; CHP begins at after the 51 minute point and runs about 20 minutes. For more technical information see: "CHP Technologies"

**http://www.eere.energy.gov/de/chp/chp_technologies/tech_status.html
www.epa.gov/chp**

For a list of DOE Regional Application Centers see:

http://www.eere.energy.gov/de/chp/chp_applications/chp_application_centers.html

The initiative has provided two guides to CHP in multifamily housing that are on the HUD website at: <http://www.hud.gov/offices/cpd/library/energy/index.cfm>

-CHP Guide #1: “Q&A on Combined Heat and Power for Multifamily Housing” explains the basics of CHP for apartment building owners.

-CHP Guide #2: “Feasibility Screening for Combined Heat and Power in Multifamily Housing” describes EPA’s preliminary screening tool and the computer software prepared by the Oak Ridge National Laboratory for completing worksheets in the Guide. ORNL has expanded the scope of the software to consider cooling and space heating, in addition to the original analysis of the potential based on use of domestic hot water. Please use Version 2d of the expanded software (with different sample data from 2c); both are available at:

[http://eber.ed.ornl.gov/HUD CHP guide version 2d](http://eber.ed.ornl.gov/HUD_CHP_guide_version_2d)

The Help file in **Version 2** contains detailed explanations of who should use it, what it does, and how to use it. It explains menu commands that enable you to print “Results” and save the screen information in a Word file. There also is detailed information about the types of equipment used, e.g. reciprocating engines and microturbines.

Utility Information:

	Electricity			Natural Gas		Fuel #2	
	kWh	kW	\$	()therms ()CCF	\$	quantity ()gallons	\$
Jan							
Feb							
Mar							
Apr							
May							
Jun							
Jul							
Aug							
Sep							
Oct							
Nov							
Dec							
Annual Total			\$		\$		\$
Average Cost	xxxxxx	xxxxxx	\$	xxxxxx	\$	xxxxxx	\$

Building Information:

Name of Contact _____ Telephone # _____
Email address _____
Name of development _____
Year constructed _____ # floors _____ # dwelling units _____ #
residents _____
Square footage to be heated _____ and/or cooled _____

Electric Rate Schedule Data

a. name of electric utility _____
b. name of electric rate _____
c. energy charge _____ /kWh
d. demand charge _____ /kW per month
e. standby or supplemental demand charge _____ /kW per month
f. fuel adjustment charge from most recent bill _____ /kWh

Natural Gas Rate Schedule Data

a. name of gas utility _____
b. name of gas rate _____
c. gas cost per unit of consumption _____
d. units of consumption () per million Btu (MMBtu)
 () per therm
 () per decatherm
 () per hundred cubic feet (CCF)
 () per thousand cubic feet (MCF)

Buildings with 80 or more units with access to natural gas may be appropriate. If you would like to consider, please access the software, enter the data, save and print the Results. You can then fax the files to HUD at the number listed below

We will review your data with help from the DOE Regional Application Centers and provide follow-up comments.

The analysis performed by this program is adequate for a coarse screening to let building operators know whether or not they should consider CHP more seriously. Encouraging results are only a prelude to a more rigorous analysis to be performed by engineering professionals using much more detailed information on building heating and electricity loads and CHP equipment.

Please send comments and suggestions on the use of this material. Thank you for your interest.

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