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Combined Heat and Power (CHP)

About CHP

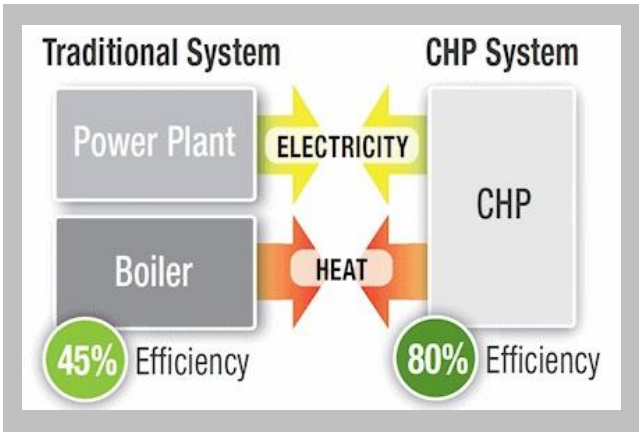
Combined Heat and Power (CHP), also known as cogeneration, is the concurrent production of electricity or mechanical power and useful thermal energy (heating and/or cooling) from a single source of energy.

CHP is a type of distributed generation, which, unlike central station generation, is located at or near the point of consumption. Instead of purchasing electricity from a local utility and then burning fuel in a furnace or boiler to produce thermal energy, consumers use CHP to provide these energy services in one energy-efficient step. As a result, CHP improves efficiency and reduces greenhouse gas (GHG) emissions. For optimal efficiency, CHP systems typically are designed and sized to meet the users' thermal baseload demand.

The U.S. Department of Energy projects that by 2030, CHP can supply 20% of U.S. generating capacity[1], about double what it is today. CHP can use a variety of fuels, both fossil - and renewable-based. It has been employed for many years, mostly in industrial, large commercial, and institutional applications.

What a CHP System Produces

CHP is unique among electricity-producing technologies and methods because it generates more than one output. For most industrial applications, the thermal energy produced by the systems is the most valued output; clean electricity is an ancillary benefit that helps to control energy costs and reduce demand for grid power.



CHP systems can provide the following products:

- Electricity
- Direct mechanical drive
- Steam or hot water
- Process heating
- Cooling and refrigeration
- Dehumidification

CHP Technologies

CHP systems are complex, integrated systems that consist of various components ranging from prime mover (heat engine), generator, and heat recovery, to electrical interconnection.

CHP systems typically are identified by their prime movers or technology types, which include:

- Reciprocating Engines
- Combustion or Gas Turbines
- Steam Turbines
- Microturbines
- Fuel Cells

Each of these CHP prime mover technologies produce excess heat that is recycled for another thermal energy need, such as space heating, domestic hot water, air conditioning, humidity control, process steam for industrial steam loads, product frying, greenhouses, or nearly any other thermal energy need. The end result is significantly more efficient than generating power, heating, and cooling separately. Some of the technologies that run on the recycled thermal energy are:

- Absorption Chillers
- Ammonia Absorption Chillers
- Desiccant Dehumidifiers
- Heat Recovery Steam Generators

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Fuels for CHP

CHP is not a fuel-specific technology. Even with price volatility in natural gas markets in recent years, natural gas is still the predominant fuel for CHP systems. While fossil fuels such as coal and oil will continue to be utilized, the ability of CHP systems to operate on cleaner fuels - including biomass, wood, and opportunity fuels such as landfill and digester gas—makes them key to developing a balanced and sustainable energy portfolio.

CHP Emissions

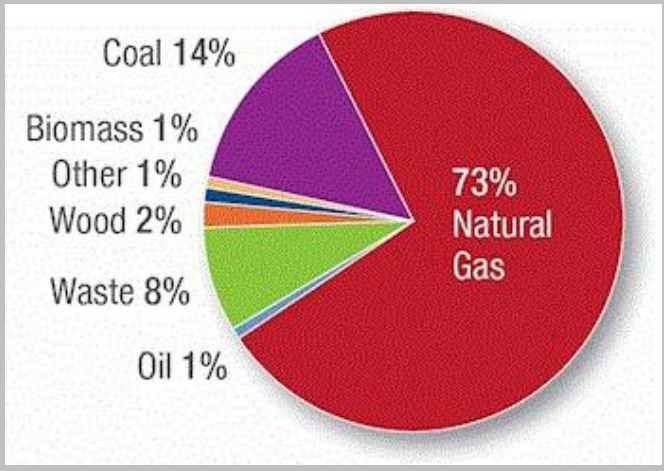
CHP and other forms of recycled energy typically reduce total air emissions compared to grid-supplied power and separate onsite thermal systems. However, CHP systems are still required to meet environmental permitting requirements that regulate the emission of pollutants into the air.

History of CHP

Decentralized CHP systems located at industrial sites and urban centers were the foundation of the early electric power industry in the United States. In fact, the nation's first commercial power plant, Thomas Edison's Pearl Street Station, which began operations in New York City in 1882, served lower Manhattan with both electricity for lighting and steam for local manufacturing. However, as power generation technologies advanced, the power industry began to build larger central station facilities to take advantage of increasing economies of scale.

Partly in response to the oil crisis of the early 1970s, Congress in 1978 passed the Public Utilities Regulatory Policies Act (PURPA) to promote energy efficiency. PURPA encouraged energy-efficient CHP and power production from renewables by requiring electric utilities to interconnect with "qualified facilities" and to purchase excess electricity from them at the utilities' avoided costs.

Today, CHP is being encouraged through tax credits, renewable and energy efficiency portfolio standards, and loan programs across the country.



CHP Capacity by Fuel Type
Source: EEA/ICF International

Southeast Clean Energy Application Center

The U.S. DOE Southeast Clean Energy Application Center is one of eight regional clean energy centers formed in 2003 by the U.S. Department of Energy to promote greater adoption of combined heat and power (CHP), district energy, and waste heat recovery. Co-located at the North Carolina Solar Center at NCSU and the Micro-CHP and Bio-Fuels Center at MSU, the Center serves the states of North Carolina, South Carolina, Georgia, Florida, Mississippi, Alabama, Tennessee, Kentucky, and Arkansas.

The Center educates prospective adopters of clean energy, fosters clean energy technologies as viable technical and economic options in the southeast, coordinates networks of stakeholders, works to remove policy barriers, and leverages existing and potential regional resources.

For more information visit www.chpcenterse.org.

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[1] US Department of Energy – Oak Ridge National Laboratories report "COMBINED HEAT AND POWER, Effective Energy Solutions for a Sustainable Energy Future", December 2008.

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