CLEAN POWER AND INDUSTRIAL EFFICIENCY

NC CLEAN ENERGY TECHNOLOGY CENTER

COMBINED HEAT & POWER

About Combined Heat and Power

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.

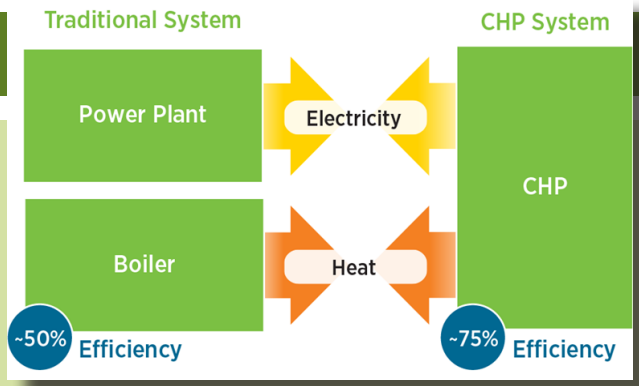
CHP has been employed for years, mainly in large commercial, industrial, and institutional applications. The U.S. Department of Energy reports 82 gigawatts (GW) of existing CHP capacity in the United States with technical potential for twice as much to meet existing energy demands.

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 grid power demand. CHP may not be widely recognized outside industrial, commercial, institutional, and utility circles, but it has been providing highly-efficient electricity and process heat to some of the most vital industries and largest employers, urban centers, and campuses in the United States.

CHP systems can provide the following useful outputs:

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



Efficiency Benefits of CHP

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
- Gas Combustion Turbines
- Steam Turbines
- Microturbines

Each of these CHP prime mover technologies produce excess heat that is recovered for another thermal energy need, such as space heating, domestic hot water, air conditioning, humidity control, process steam for industrial steam loads, product drying, 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 recovered thermal energy are:

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



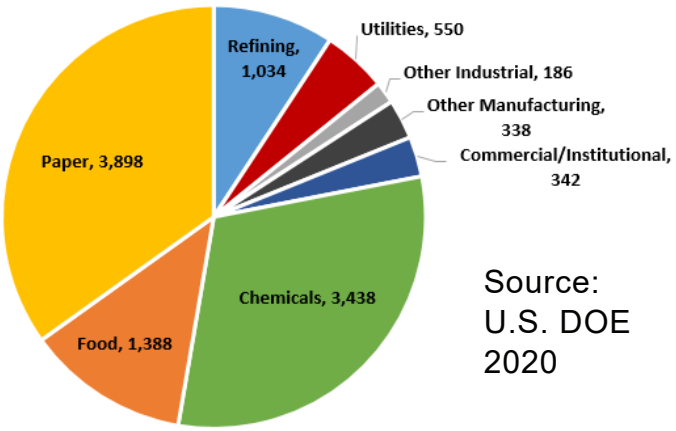
Fuels for CHP

CHP is not a fuel-specific technology. It can use a variety of fuels, both fossil- and renewable-based. 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 waste heat energy recovery typically reduce total air emissions by half 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.

Existing Southeast CHP Capacity by Industry (MW)



Source: U.S. DOE 2020

Combined Heat & Power Benefits

CHP positively impacts the health of local economies and supports national policy goals in a number of ways. Specifically, CHP can:

- Enhance our energy security by reducing our national energy requirements and helping businesses weather energy price volatility and supply disruptions
- Advance our environmental goals by reducing emissions of harmful pollutants
- Improve business competitiveness by increasing energy efficiency and managing costs
- Increase resiliency of our energy infrastructure by limiting congestion and offsetting transmission losses
- Diversify energy supply by enabling further integration of domestically-produced and renewable fuels
- Improve energy efficiency by capturing heat that is normally wasted.

U.S. DOE Southeast CHP Technical Assistance Partnership

The U.S. DOE CHP Technical Assistance Partnerships (CHP TAPs) promote and assist in transforming the market for combined heat and power, including waste heat to power and district energy, throughout the U.S. The Southeast CHP TAP works in eight states: Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee, as well as Puerto Rico and the US Virgin Islands.

The CHP TAP assists prospective adopters of clean energy, fosters clean energy technologies as viable technical and economic options in the region, coordinates networks of stakeholders, and supports energy policy makers.

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