

Cogeneration

The consecutive generation of thermal and electric or mechanical energy.

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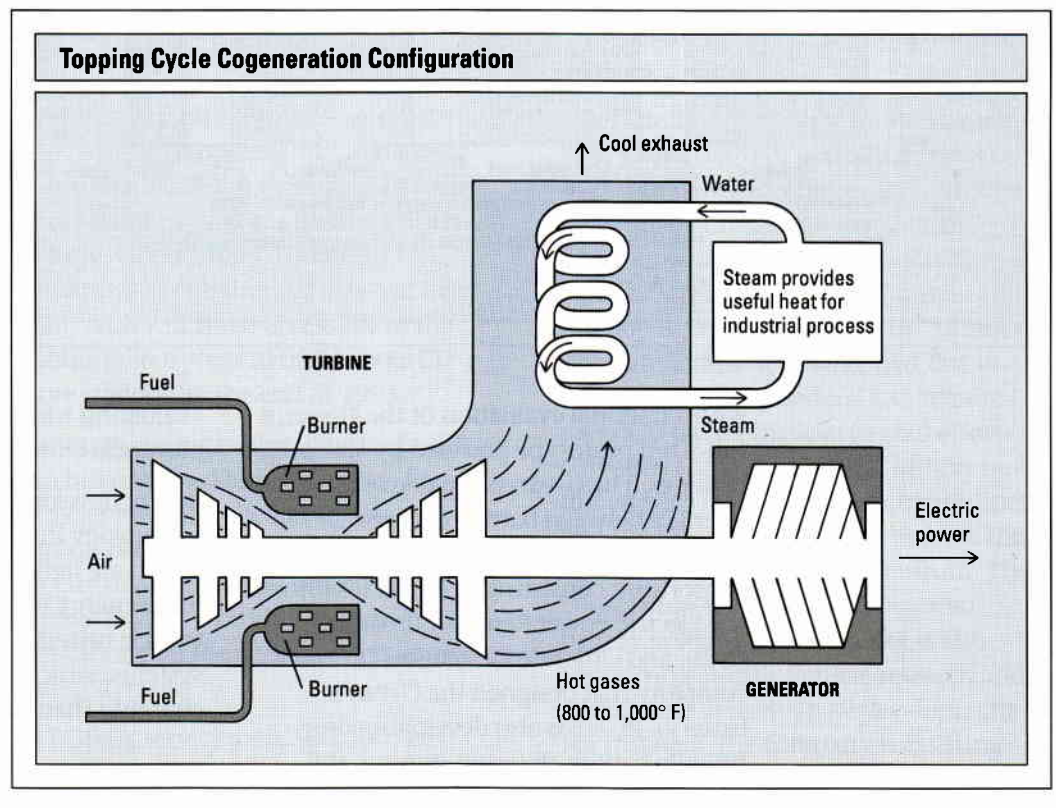
Many industrial processes use or produce thermal energy in the form of hot gases, hot water, or steam. Other processes, such as thermal electric power generation, also use or produce thermal energy in the form of steam or hot combustion gases. A process that reuses thermal energy by coupling a thermal industrial process with thermal electric generation is called cogeneration.

A cogeneration plant that first uses thermal energy to generate electricity and then uses the resulting hot combustion gases or heated fluid (such as steam) in an industrial process has a *topping cycle* configuration. A cogeneration plant that first uses hot water, hot gases, or steam in a manufacturing process and then uses the same working fluid to generate electricity has a *bottoming cycle* configuration.

Electric energy produced by a cogeneration facility may be used to meet the plant's own electric energy demand (*self-generation*), or the electric energy may be sold to a utility. If a large amount of energy is generated, the energy may be both used and sold.

Cogeneration was common during the late 1800s, but as reliable and inexpensive utility service became increasingly available after the early 1900s, the advantages to industry of maintaining on-site power generation facilities gradually disappeared. This trend was reversed in the 1970s, when fuel availability became less certain and fuel prices rose sharply. Energy conservation became essential, and national energy policy strongly supported energy-saving technologies.

This diagram shows a topping cycle cogeneration process that produces electric power using a combustion turbine and reuses the resulting hot exhaust gases to create steam for an industrial process.



The federal Public Utility Regulatory Policies Act (PURPA) of 1978 encourages the efficient use of energy by power producers. One provision under PURPA provides incentives to certain small power producers and cogenerators that comply with operating, efficiency, and fuel-use criteria set forth by the Federal Energy Regulatory Commission (FERC). These power producers are designated as qualifying facilities (QFs), and the power they produce must be purchased by electric utilities.

Existing and potential cogenerators include industries that produce or require large quantities of thermal energy, such as food processing, oil refining, and oil production (using thermally fueled enhanced oil recovery, or EOR). Other industries produce biomass waste by-products such as orchard, lumber, and agricultural residues that can be used as fuel to produce thermal energy.

PG&E purchases power produced by a wide range of these types of cogenerators. In 1990, PG&E's cogeneration power contracts exceeded 2,400 megawatts (MW) of generating capacity. During that same year, cogenerators also provided over 600 MW of self-generation capacity. (PG&E-owned generating capacity in 1992 totalled nearly 15,000 MW.)