Cogeneration Technologies
An EcoGeneration Solutions LLC. Company
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Cooler, Cleaner, Greener Power & Energy Solutions

Now Building Cogeneration & Trigeneration Energy Plants

We Offer " Turnkey" Cogeneration & Trigeneration Power Plants from 400 kW to 10 MW with Efficiencies Exceeding 90% System Efficiencies - This Means Significantly Lower Energy Costs & Emissions!

We now offer turn-key Cogeneration and Trigeneration power plant development and installation services in the 400 kW to 10 MW range.

Our standard and customized Cogeneration and Trigeneration power plants use the leading brands of reciprocating engines or turbines and include our proprietary Waste Heat Recovery technologies that help us achieve system efficiencies greater than 90%. We can also provide customized Cogeneration and Trigeneration plants that meet our customer's most stringent economic and environmental requirements.

Our Cogeneration and Trigeneration Power Plants run on Biomethane, B100 Biodiesel and natural gas fuels as well as Solar energy in our Solar Trigeneration power plants. Efficiencies of our Cogeneration and Trigeneration power plants are now exceeding 90% with up to 95% lower emissions when using Biomethane and B100 Biodiesel fuel.

For pricing and delivery information on our Cogeneration or Trigeneration power plants, call (832) 758 - 0027 or send an email with your project's requirements to: info @ cogeneration .net

What is Cogeneration?

Cogeneration Explained

Cogeneration now produces almost 10% of our nation's electricity, saves its customers up to 40% on their energy expenses, and provides even greater savings to our environment.

Cogeneration, also known as “combined heat and power” (CHP), cogen, district energy, total energy, and combined cycle, is the simultaneous production of heat (usually in the form of hot water and/or steam) and power, utilizing one primary fuel. Cogeneration technology is not the latest industry buzz-word being touted as the solution to our nation's energy woes. Cogeneration is a proven technology that has been around for over 100 years. Our nation's first commercial power plant was a cogeneration plant that was designed and built by Thomas Edison in 1882 in New York.

Primary fuels commonly used in cogeneration include natural gas, oil, diesel fuel, propane, coal, wood, wood-waste and bio-mass. These "primary" fuels are used to make electricity, a "secondary" fuel. This is why electricity, when compared on a btu to btu basis, is typically 3-4 times more expensive than primary fuels such as natural gas.

An example of a cogeneration process would be the automobile in which the primary fuel (gasoline) is burned in an internal combustion engine - this produces both mechanical and electrical energy (cogeneration). These combined energies, derived from the combustion process of the car's engine, operate the various systems of the automobile, including the drive-train or transmission (mechanical power), lights (electrical power), air conditioning (mechanical and electrical power), and heating of the car's interior when heat is required to keep the car's occupants warm. This heat, which is manufactured by the engine during the combustion process, was “captured” from the engine and then re-directed to the passenger compartment.

Due to competitive pressures to cut costs and reduce emissions of air pollutants and greenhouse gasses, owners and operators of industrial and commercial facilities are actively looking for ways to use energy more efficiently. One option is cogeneration, also known as combined heat and power (CHP). Cogeneration/CHP is the simultaneous production of electricity and useful heat from the same fuel or energy. Facilities with cogeneration systems use them to produce their own electricity, and use the unused excess (waste) heat for process steam, hot water heating, space heating, and other thermal needs. They may also use excess process heat to produce steam for electricity production. Cogeneration currently coexists with a regulated industry that is going through major structural changes that may limit or expand its application.

Regulatory Issues

The concept of cogeneration is not new. Early in this century, before there was an extensive network of power lines, many industries had cogeneration plants. As utilities became established and grew, most states began to regulate them in order to limit their pricing power. The Public Utilities Holding Act of 1935 (PUHCA), together with amendments to the Federal Power Act (also in 1935), were the final steps in protecting utility companies from competition. These laws created vertically integrated utilities with responsibility for the production, transmission, and distribution of power. In exchange for their exclusive franchises (territories) and guaranteed revenues, utilities agreed to government regulation of rates and service. Under these rules, more investments in infrastructure and more sales meant more profits. As the network of power lines grew and electricity from utilities became more economical, industrial facilities bought more of their electricity from utilities. However, many industries still had to generate process heat on-site. The economies of scale that the utilities were able to obtain at that time, as well as the availability of low-priced process heat from cheap oil and gas, removed incentives to retain cogeneration equipment.

In the past three decades, however, the long-term trend of energy prices generally moved upward. Building more and more large power plants no longer provided economies of scale. This was a major factor in the increasing use of cogeneration by commercial and industrial facilities.

The Public Utilities Regulatory Policies Act of 1978 (PURPA) provided further encouragement for developers of cogeneration plants. Section 210 required utilities to purchase excess electricity generated by "qualified facilities" (QFs) and to provide backup power at a reasonable cost. QFs included plants that used renewable resources and/or cogeneration technologies to produce electricity. PURPA cogenerators must use at least 5% of their thermal output for process or space heating (10% for facilities that burn oil or natural gas). In many cases, this forced independent cogenerators to accept very low rates for their steam production in order to become a qualified facility under PURPA. Another problem is the rate at which utilities purchase a cogenerator's excess power production.

Regulatory Issues (continued)

Most states set the price at "avoided cost," or the cost to the utility of producing that extra power. Utilities with excess power generation capacity are often allowed to have extremely low avoided costs. This practice has created artificial barriers to cogeneration as well as to independent power generators.

The Energy Policy Act of 1992 (EPAct) tried to create a more competitive marketplace for electricity generation. It created a new class of power generators known as Exempt Wholesale Generators (EWGs). These are exempt from PUHCA regulation and can sell power competitively to wholesale customers. A cogeneration facility can be (but does not have to be) a QF under PURPA and an EWG under EPAct. This happens when the facility is in the exclusive business of wholesale power sales, and makes no retail power sales to its "steam host" (customer).

Cogeneration Technology

A typical cogeneration system consists of an engine, steam turbine, or combustion turbine that drives an electrical generator. A waste heat exchanger recovers waste heat from the engine and/or exhaust gas to produce hot water or steam. Cogeneration produces a given amount of electric power and process heat with 10% to 30% less fuel than it takes to produce the electricity and process heat separately.

There are two main types of cogeneration concepts: "Topping Cycle" plants, and "Bottoming Cycle" plants. A topping cycle plant generates electricity or mechanical power first. Facilities that generate electrical power may produce the electricity for their own use, and then sell any excess power to a utility. There are four types of topping cycle cogeneration systems. The first type burns fuel in a gas turbine or diesel engine to produce electrical or mechanical power. The exhaust provides process heat, or goes to a heat recovery boiler to create steam to drive a secondary steam turbine. This is a combined-cycle topping system. The second type of system burns fuel (any type) to produce high-pressure steam that then passes through a steam turbine to produce power. The exhaust provides low-pressure process steam. This is a steam-turbine topping system. A third type burns a fuel such as natural gas, diesel, wood, gasified coal, or landfill gas. The hot water from the engine jacket cooling system flows to a heat recovery boiler, where it is converted to process steam and hot water for space heating. The fourth type is a gas-turbine topping system. A natural gas turbine drives a generator. The exhaust gas goes to a heat recovery boiler that makes process steam and process heat. A topping cycle cogeneration plant always uses some additional fuel, beyond what is needed for manufacturing, so there is an operating cost associated with the power production.

Bottoming cycle plants are much less common than topping cycle plants. These plants exist in heavy industries such as glass or metals manufacturing where very high temperature furnaces are used. A waste heat recovery boiler recaptures waste heat from a manufacturing heating process. This waste heat is then used to produce steam that drives a steam turbine to produce electricity. Since fuel is burned first in the production process, no extra fuel is required to produce electricity.

An emerging technology that has cogeneration possibilities is the fuel cell. A fuel cell is a device that converts hydrogen to electricity without combustion. Heat is also produced. Most fuel cells use natural gas (composed mainly of methane) as the source of hydrogen. The first commercial availability of fuel cell technology was the phosphoric acid fuel cell, which has been on the market for a few years. There are about 50 installed and operating in the United States. Other fuel cell technologies (molten carbonate and solid oxide) are in early stages of development. Solid oxide fuel cells (SOFCs) may be potential source for cogeneration, due to the high temperature heat generated by their operation.

Cogeneration Applications

Cogeneration systems have been designed and built for many different applications. Large-scale systems can be built on-site at a plant, or off-site. Off-site plants need to be close enough to a steam customer (or municipal steam loop) to cover the cost of a steam pipeline. Industrial or commercial facility owners can operate the plants, or a utility or a non-utility generator (NUG) may own and operate them. Manufacturers use 90% of all cogeneration systems. Some industries and waste incinerator operators who own their own equipment realize sizable profits with cogeneration.

Another large-scale application of cogeneration is for district heating and cooling. Many colleges, hospitals, office buildings and even cities, that have extensive district heating and cooling systems, have at their core, a cogeneration or trigeneration power plant. The University of Florida has a 42 Megawatt (MW) gas turbine cogeneration plant, built in partnership with the Florida Power Corporation. Some large cogeneration facilities were built primarily to produce power. They produce only enough steam to meet the requirements for qualified facilities under PURPA. If no steam host is nearby, one can be built. For example, there are large (80 MW) plants operating under PURPA that have large greenhouses as "steam hosts." The greenhouses operate without losing money only because their steam heat is virtually free of charge. These types of plants are candidates to become EWGs in the new regulatory environment.

Many utilities have formed subsidiaries to own and operate cogeneration plants. These subsidiaries are successful due to the operation and maintenance experience that the utilities bring to them. They also usually have a long-term sales contract lined up before the plant is built. One example is a 300 MW plant that is owned and operated by a subsidiary co-owned by a utility and an oil company. The utility feeds the power directly into its grid. The oil company uses the steam to increase production from its nearby oil wells.

Cogeneration Applications (continued)

Cogeneration systems are also available to small-scale users of electricity. Small-scale packaged or "modular" systems are being manufactured for commercial and light industrial applications. Modular cogeneration systems are compact, and can be manufactured economically. These systems, ranging in size from 20 kilowatts (kW) to 650 kW produce electricity and hot water from engine waste heat. It is usually best to size the systems to meet the hot water needs of a building. Thus, the best applications are for buildings such as hospitals or restaurants that have a year-round need for hot water or steam. They can be operated continuously or only during peak load hours to reduce peak demand charges, although continuous operation usually has the quickest payback period.

Several companies also attempted to develop systems that burn natural gas and fuel oil for private residences. These home-sized cogeneration packages had a capacity of up to 10 kW, and were capable of providing most of the heating and electrical needs for a home. As of May 2000, none of the companies that developed these systems are selling these units. Several fuel call manufacturers are targeting residential and small commercial applications.

Environmental Issues

While cogeneration provides several environmental benefits by making use of waste heat and waste products, air pollution is a concern any time fossil fuels or biomass are burned. The major regulated pollutants include particulates, sulfur dioxide (SO2), and nitrous oxides (NOx). Water quality, while a lesser concern, can also be a problem. New cogeneration plants are subject to an Environmental Protection Agency (EPA) permit process designed to meet National Ambient Air Quality Standards (NAAQS). Many states have stricter regulations than the EPA. This can add significantly to the initial cost of some cogeneration facilities located in urban areas.

Some cogeneration systems, such as diesel engines, do not capture as much waste heat as other systems. Others may not be able to use all the thermal energy that they produce because of their location. They are therefore less efficient, and the corresponding environmental benefits are less than they could be. The environmental impacts of air and water pollution and waste disposal are very site-specific for cogeneration. This is a problem for some cogeneration plants because the special equipment (water treatment, air scrubbers, etc.) required to meet environmental regulations adds to the cost of the project. If, on the other hand, pollution control equipment is required for the primary industrial or commercial process anyway, cogeneration can be economically attractive.

Even the environmental groups are on the cogeneration bandwagon. Since its' founding, the Sierra Club has supported total energy (cogeneration). See the Sierra Club's statement on energy policy.

Future Market Development

Several factors will affect the growth of cogeneration activities. They include the initial cost of buying and bringing a cogeneration system on-line, maintenance costs, and environmental control requirements. Some electric utilities do not need additional electricity. They may have excess generation capacity or a stable customer base. This leads to lower "avoided cost" rates, which reduces the viability of cogeneration projects that rely heavily on power sales to utilities.

The restructuring of the electric power generation and distribution industry that is currently underway in many states, makes it more attractive for developers to become independent power producers and to build "electricity only" power plants, instead of cogeneration plants. There has also been a great deal of pressure from utility and industrial special interests to repeal or amend PURPA. If they are successful, it could be difficult for new cogeneration projects to get off the ground. Barring that development, improved technology and cooperation among industries, businesses, utilities, and financiers should provide impetus to the continued development of both cogeneration projects and independent power production projects.

One significant impetus for cogeneration is the issue of global climate change from global warming caused by the greenhouse effect, of which fossil fuel combustion is a major contributor.

Cogeneration is the environmentally-friendly, economically-sensible way to produce power, simultaneously saving significant amounts of money and also dramatically reducing total greenhouse gas emissions.