Cogeneration

What is Cogeneration?

Cogeneration is a process that simultaneously generates both electrical power and useful heat, using one primary fuel. It is also known as combined heat and power (CHP), or integrated energy systems (IES). Cogeneration is more energy efficient than the separate generation of electricity and thermal energy. Heat that is normally wasted in conventional power generation is recovered as useful energy for satisfying an existing thermal demand, the heating and cooling of buildings, and the heating of water (usually in the form of steam or water). Conventional electricity generation is inherently inefficient, converting only about a third of a fuel’s potential energy into usable energy.¹ In cogeneration, electrical efficiencies average 50-70%.² The significant increase in efficiency with cogeneration means lower fuel consumption and reduced emissions when compared to separate generation of heat and power. The reduction of primary fuel consumption is fundamental to the environmental benefits of cogeneration, because burning less of the same fuel more efficiently means fewer emissions for the same level of output.

The major components of a cogeneration system are:

- A heating engine/turbine
- Generator
- Heat recovery

How to Integrate Cogeneration

Heat and energy systems are important building components in existing building upgrades. Other upgrades and renovations may increase the overall energy efficiency of a building, resulting in oversized HVAC systems. This is a good opportunity to consider increasing energy and the overall efficiency of a building with cogeneration. Moving to a cogeneration system is a process

that works well with existing/established energy and heating/cooling systems. Cogeneration works well in buildings that have a year-round need for hot water or steam.

Cogeneration takes a heat engine (ex. reciprocating engine or gas turbine) that uses a fuel (ex. natural gas) to power a generator that creates electricity. During this process, heat is emitted. At this step, a cogeneration system will capture that heat (heat recovery), process it and use it for space heating. Additional equipment needed for cogeneration include water treatment mechanisms and air scrubbers.

**Example**

Rutgers Center for Advanced Energy Systems (CAES)

CAES has conducted several case studies related to CHP, including downsizing CHP, a feasibility study for CHP, and the addition of a CHP facility into a hospital.

http://njchp.rutgers.edu/Advanced.php

**Benefits**

- Improves versatility – works with existing and planned technologies for various applications in industrial, commercial, and residential sectors
- Saves energy and resources– simultaneous production of useful thermal and electrical energy leads to increased fuel efficiency and lower emissions
- Increases efficiency – localized energy generation avoids grid transmission and distribution losses associated with decentralized power stations

**Costs**

From the facility owner’s perspective, the initial cost of a cogeneration system is substantially higher than for a conventional heating system. However, the facility’s overall operating costs are likely to drop enough to pay off this investment. The economic attractiveness of cogeneration is a function of the relative prices of electricity and natural gas: the best case is when electricity prices are high and natural gas prices are low.

**Resources**

New Jersey’s Clean Energy Program
http://www.njcleanenergy.com/commercial-industrial/programs/combined-heat-power/combined-heat-power
NJ CHP
http://njchp.rutgers.edu/

National Labs ORNL provides a helpful fact sheet on CHPs

Learn more about decentralized energy, such as Cogeneration at WADE
http://wadecanada.ca/can_deb_technologies.html#chp