A HOT IDEA

CHP systems reduce operating costs

Many commercial facilities such as resorts, shopping malls, high-rise office buildings, universities, data centers and hospitals can reduce operating costs by implementing a Caterpillar combined heat and power (CHP) system (also known as cogeneration). Using clean pipeline natural gas as a fuel source, Cat® gas generator sets can simultaneously provide electricity and heat energy for a facility's thermal requirements. Benefits from CHP projects include:

- Energy efficiency up to 90 percent
- Reduced energy costs versus separate heating, cooling and electrical generation systems
- Reduced emissions versus separate thermal and electrical generation systems
- Leadership in Energy and Environmental Design (LEED) Certification via Energy Efficiency Credits

Where the capture and use of waste heat is not viable, many commercial facilities may still benefit financially via distributed generation, where electricity is produced locally without beneficial use of recovered heat. This is especially true when one or more of the following circumstances apply:

- The local electric grid is unreliable
- Natural gas-fueled power generation is an inexpensive alternative to grid electricity
- Reduced emissions are possible compared to separate thermal and electrical generation systems
- Generators can be applied during peak times of day in cooperation with the local electric utility to reduce electricity demand charges or cost of energy

How CHP Works

Any Cat natural gas-fueled engine can be configured for applications involving heat recovery. The gas engine powers a Cat generator to produce electricity, while jacket water and/or exhaust thermal energy are fed through heat exchangers to transfer the waste heat from the engine to a customer's hot water or steam circuit.

Caterpillar provides customized CHP package proposals, including:

- Modular heat recovery skids that include water pumps, heat exchangers, heat control and bypass valves, and all system controls. Engine and customer process water flange connections are included.
- Heat balance radiators for continued generator set power production during operation without heat recovery.
- Natural gas fuel pressure regulation and safeties.
- Exhaust emissions control technology for use in highly regulated emission environments.
- Utility-grade, paralleling switchgear and system master controls, capable of paralleling multiple generator sets together, exporting energy to the local electric grid, and controlling all thermal output requirements.

Cogeneration systems can provide total energy cost savings that more than offset the total owning and operating costs, delivering a payback in as little as two to three years.

Rules of Thumb

Many facility owners and operators ask about some common rules of thumb related to the amount of recoverable heat from a CHP generator set. The maximum total amount of recoverable heat energy is generally similar to the amount of electrical power produced by a reciprocating gas generator set. A 2000 kW_e generator set could deliver around 2000 kW_{th} of thermal power when operating at full load.

Specifically, around 1.15 kg/hour (2.5 lb/hr) of steam is possible per useable kW of exhaust heat. Using the same 2000 kW_e generator set example, one could provide 1.5 tonne/hr (1.65 ton/hr) of saturated process steam at 10 bar (145 psi) using the exhaust heat recovery and simultaneously deliver 32.2 m^3/hr (148 gpm) of 90°C (194°F) hot water from the engine jacket water circuit assuming a process water return temperature of 70°C (158°F).

Alternatively, all of the recovered heat could be utilized solely for hot water production, or even transformed into chilled water via application of an absorption chiller for facility cooling.

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In It For the Long Haul

As important to up-front system design and implementation is the development of a detailed maintenance plan. The cost of a comprehensive customer support agreement can cost less than $US 0.01 per kWh of energy produced, which represents a fraction of the total owning and operating costs of a CHP system. This investment has the capability to improve availability and scheduled uptime, which is essential to achieving planned financial performance. Your Cat Dealer can provide any level of service tailored to meet your specific needs.

Acceptance of combined heat and power systems for a variety of different facilities is becoming increasingly prevalent in North America given the short payback periods and the wide availability of natural gas fuel. Federal, state and provincial governments today offer a number of grants and incentives that help push cogeneration projects over their final hurdles.

Cat Financial offers a variety of financial programs and leases that incorporate installation costs to help make CHP projects viable. Caterpillar is an active member in a number of CHP organizations, such as the United States Combined Heat & Power Association (USCHPA) and the International District Energy Association (IDEA), that have a vested interest to further acceptance of CHP based on producing more reliable, affordable and cleaner energy.

Whatever your needs, Caterpillar and Cat Dealer application specialists and power systems engineers are ready to help you achieve maximum efficiencies based on your CHP requirements.

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