

## COMBINED HEAT AND POWER (CHP) GENERATOR SYSTEMS

# BUILDING RESILIENCY, COST SAVINGS, AND SUSTAINABILITY INTO YOUR OPERATIONS

Every large-scale operation or building needs significant amounts of electrical power and heat. With combined heat and power generation, also known as CHP or cogeneration, heat that is normally wasted is harnessed to provide thermal energy. This not only lowers your fuel use and resulting greenhouse gas emissions, it lets you decide how much you depend on the utility grid.

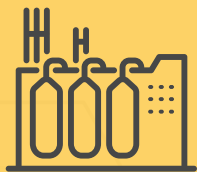
Heat captured by cogeneration can be used for:

- + Space heating
- + Cooling
- + Hot water
- + Industrial processes
- + Steam

**CATERPILLAR OFFERS A WIDE RANGE OF SOLUTIONS  
TO MEET YOUR EXACT NEEDS.**



# CHP BY THE NUMBERS



# 4,400

CHP is used in over 4,400 large buildings and facilities nationwide



**9,658 Tons** of CO<sub>2</sub> with separate boiler and power plant



**4,749 Tons** of CO<sub>2</sub> with CHP (1 MW system)

**700 kg** of CO<sub>2</sub>/MWh

Central station gas turbine plant

**250 kg** of CO<sub>2</sub>/MWh

CHP engine-based plant

Typical **Fossil Fueled** Power Plant: 35%-44% efficient

Typical **Gas-Fueled CHP** Plant: 65%-90% efficient

**37%** of CHP plants are part of a resilient microgrid that combines renewables and energy storage with cogeneration



Information provided by the Combined Heat and Power Alliance.



## HISTORY OF SUCCESS, POWER FOR THE FUTURE

Caterpillar has been selling and maintaining CHP solutions for the past 60 years. Today, CHP systems are capable of running on diverse fuels such as natural gas as it becomes more affordable, diesel, and biogas from organic waste such as those used in agricultural and food waste biodigesters and wastewater treatment plants.

Caterpillar is also developing products for the energy transition to zero-carbon emissions such as generator sets and CHP systems capable of operating on blends of hydrogen and natural gas as well as 100% hydrogen.

## MEET YOUR SUSTAINABILITY GOALS

Cogeneration is a simple, cost-effective way to reduce your greenhouse gas emissions and other environmental impacts. Grid electricity and natural gas boilers often offer less than 50% efficiency, but combining them into a single plant can provide efficiencies up to 90%. Gas-fueled CHP can also reduce carbon emissions by 50% over conventional electricity generation.

## LOWER YOUR INVESTMENT AND OPERATING COSTS WITH CHP

CHP can lower costs in different ways, depending on the current power use in your facility. Using an onsite boiler and grid electric power, for example, can reduce efficiency to 39% or less, and the traditional boiler and power plant combination requires two separate storage and distribution systems.

In most environments where heat and power are required, the traditional solution has been to have boilers produce heat and electricity separately. CHP allows production of heat and power with one machine which lowers costs in the following ways:

- + **Less investment in real estate** due to a smaller footprint
- + **Reduced maintenance** as only one plant and machine require care
- + **A payback of only 3-5 years**



**CALCULATE SAVINGS**



## REMAIN TRULY RESILIENT WITH CHP

Winter Storm Uri and the subsequent statewide blackouts in Texas in 2021 showed that every facility needs reliable, sustainable power systems to prevent unplanned outages. When the grid fails or power rates soar, you need to have available power at a reasonable cost. CHP plants deliver electrical power and heat.

A Cat® natural gas generator set makes it possible to generate your own power when grid rates soar and may allow you to participate in demand response programs that lower your total electrical expense. For maximum resilience, incorporate a CHP plant into a microgrid that combines it with renewables, power storage systems, and advanced controls. This lets you choose the most cost-efficient power source at any given time. In fact, 37% of CHP plants are part of a resilient microgrid.

# COGENERATION: MANY INDUSTRIES, CONSISTENT RESULTS

A wide range of industrial sites and facilities can employ CHP to reach their sustainability and budget goals.



## MANUFACTURING

**W.R. Grace Davison Chemical Division**  
*Baltimore, Maryland*

W.R. Grace commissioned their CHP plant in 2019. Two gensets produce about 5 MW of power, which is about 40% of the plant's annual power consumption. The heat recovery system was designed to receive 450 gpm of city water varying from 47°F in winter to 70°F in summer and deliver water to their manufacturing facility at about 130°F.

- + Annual savings of \$1.2 million
- + Annual GHG reduction of 14,415 tons
- + Provides resilience during grid outages



## GREENHOUSES

**JMP Flowers**  
*Steżycza, Poland*

JMP's Cat CG260-16 gas genset produces 4.5 MW of electricity and a thermal output of 5.25 MW with over 90% efficiency. Thanks to cogeneration, JMP Flowers reduced their energy cost compared to a classic supply (utility and boiler) and reached a payback time of 3 to 4 years.

- + Carbon dioxide (CO<sub>2</sub>) from the CHP plant is circulated through the greenhouse, stimulating flower growth
- + CHP has reduced emissions and increased profits for the greenhouse

## UNIVERSITIES

**Brock University**  
*St. Catharines, Ontario, Canada*

Brock University is a public research university with a total enrollment of over 19,000 students. Brock produces world-class research while educating students in environmental sustainability. The university stands by its sustainability values by producing 100% of its own energy through an efficient CHP plant, significantly reducing their carbon footprint.

- + Replaced 8 Cat G3516A engines with 4 Cat 3516H high efficiency natural gas generator sets
- + New plant produces 8 MW of electricity and 6 million BTUs
- + Lower consumption of water and natural gas
- + Provides resiliency to university during grid outages



## HOSPITALS

**Saint Peter's University Hospital**  
*New Brunswick, New Jersey*

Saint Peter's offers acute care for adults and operates a major children's hospital. During Superstorm Sandy, their diesel standby generators only had the capacity to power critical care areas of the hospital. As a result, they decided to seek out solutions to deal with future grid failures.

- + 2 MW CHP plant, powered by a Cat G3516H natural gas genset, with Cat switchgear
- + Now uses 1 to 1.5 kilowatt hours per square foot (kWh/ft<sup>2</sup>), while the average for New Jersey hospitals is 3.5 to 4 kWh/ft<sup>2</sup>
- + Saving \$200,000 to \$300,000 per year in energy costs
- + Load capacity available for future campus expansion

## WASTEWATER TREATMENT

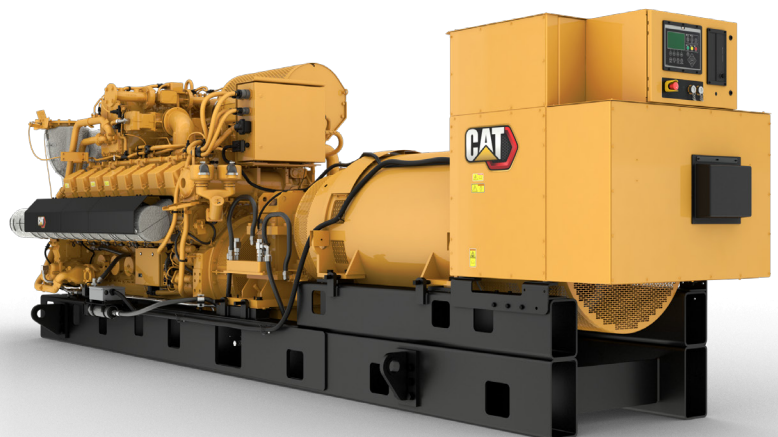
**Gresham Wastewater Treatment Plant**  
*Gresham, Oregon*



For over 30 years, efforts were made to curb the big energy appetite at this plant, which is located northeast of Portland.

The breakthrough solution? A Cat CHP plant with a paralleling switchgear system and two G3508 gas gensets powered by biogas from fats, oils, and grease (FOG). 30,000 gallons of FOG per day are fed into biological digesters, and the gensets are run on the resulting gas.

- + Treatment plant has been net zero since February 2015
- + \$1 million in annual savings to ratepayers, which includes \$350,000 gained from FOG tipping fees
- + 95% genset uptime
- + Water heated by the gensets heats the buildings





Snowbird, a premier ski destination in Utah, installed a 5.3 MW CHP system to provide electricity for key operations of the resort, including an aerial tram and chairlift, and capture waste heat to warm its buildings. In the event of an outage, three Cat generator sets can provide backup power.



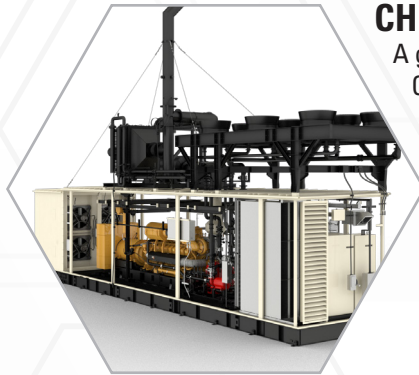
**LEARN MORE**



Watch how CHP systems provide electricity and heat simultaneously, increasing overall efficiency by up to 90%. Cogeneration helps reduce emissions today and can be upgraded to run on blends of natural gas and filtered biogas or hydrogen in the future.



**WATCH**



## CHP CONTAINERS

A growing line of CHP containers, including Cat CG132B, Cat CG170, Cat G3512H, Cat G3516H, and Cat G3520H generator sets, are available in standardized, factory-assembled enclosures for swift set up. The solution's compact footprint and roof-mounted radiator system, exhaust and air system, fuel system, and other components make it a flexible and cost-effective way to deliver efficient, sustainable, and cost-saving CHP power.

## CHP SYSTEMS THAT POWER YOUR FUTURE

Caterpillar offers CHP generator systems ranging from 400 kW to 4.5 MW, including factory enclosures to offer you a complete cogeneration solution. This eliminates the need to outsource additional engineering, easing installation and reducing lead time for implementing CHP projects – so you can start reaping the benefits of CHP sooner. Connect with a Caterpillar CHP expert today to evaluate your potential savings.



## CATERPILLAR PERFORMANCE. EXCEPTIONAL SUPPORT.

When you invest in Caterpillar, you get security and peace of mind from expert support and equipment management. From remote asset monitoring to easy parts ordering, a Cat Customer Value Agreement (CVA) helps you protect your power system with a customized service agreement between you and your Cat dealer.

