

COMBINED HEAT AND POWER AND A CHANGING CLIMATE: REDUCING EMISSIONS AND IMPROVING RESILIENCE

The global climate is changing, and many are working to reduce emissions and build up resiliency across sectors, including electricity generation, transportation, industry, and commercial and residential buildings. Combined heat and power (CHP) can help to confront climate change challenges on both fronts: as an electric and thermal energy generation resource with lower greenhouse gas (GHG) emissions than other generation options, and as a resilient asset that can keep the lights on during grid outages.

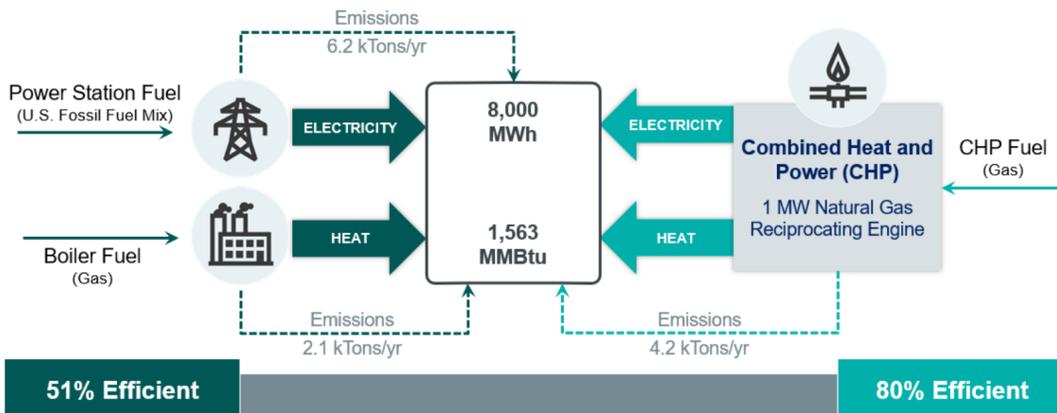
In almost all regions of the U.S., CHP systems installed through 2035 and operating through 2050 are expected to cause a net reduction in carbon emissions over their system life.

CHP REDUCES EMISSIONS

CHP can play a significant role in decarbonizing the electricity, buildings, and industrial sectors. CHP systems require less fuel inputs for the same energy outputs, have a high capacity factor allowing them to displace high-emitting marginal grid resources, and can enable the addition of intermittent renewable resources to the grid by providing a consistent source of power.

In addition, CHP systems can use lower-carbon fuels to generate power and thermal energy. While the first wave of CHP technologies, "CHP 1.0," has historically relied on fossil fuels, "CHP 2.0" units can be fueled by renewable or lower-carbon fuels such as biogas, renewable natural gas (RNG) or biomethane, and hydrogen. Using these fuels allows CHP 2.0 systems to reduce emissions even further than CHP 1.0 systems. As governments, businesses, and the public look to reduce emissions, CHP is among the solutions that can lead to a decarbonized future.

Figure 1: Energy and Emissions Savings Associated with CHP
Conventional Generation **Combined Heat and Power (CHP)**



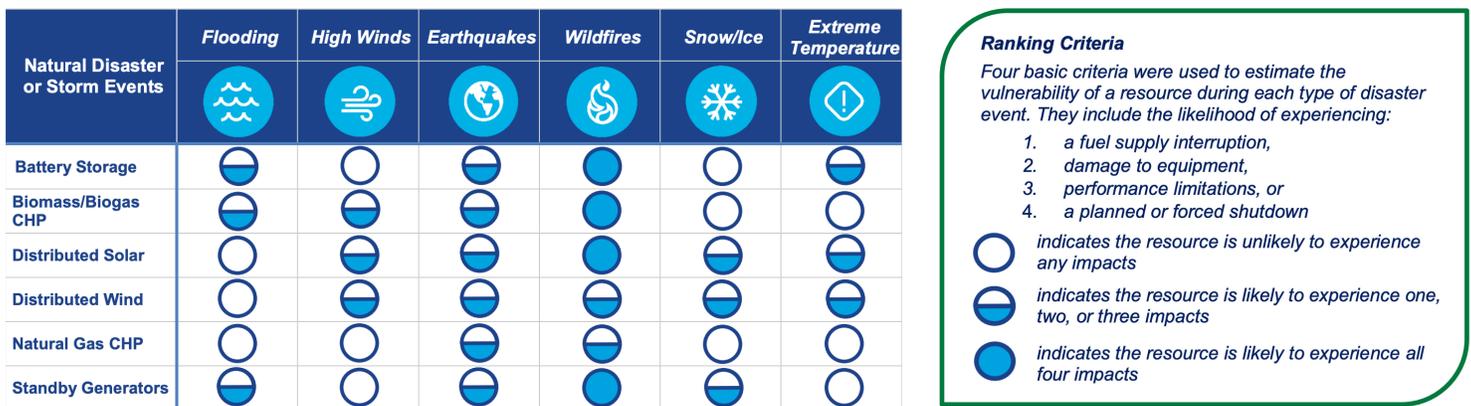
CHP AND IMPROVED RESILIENCE

Climate change will exacerbate extreme weather events, which are already disrupting the electric grid. Weather-related events currently cause about 78 percent of the major interruptions in the power distribution system. As risks of grid disruption increase, CHP can reliably deliver power and thermal energy locally and to critical infrastructure. Additionally, the electrification of the transportation, industrial, and buildings sectors will intensify energy security demands.

Reliable CHP systems can help facilities to be resilient in the face of a changing climate, keeping the lights on during electric grid disruptions.

CHP is a distributed energy resource that is highly resilient to a variety of weather events. Natural gas fueled CHP is less likely to experience impacts from these disasters than other types of distributed generation. CHP supports critical infrastructure such as hospitals, military bases, and colleges and universities with electric and thermal energy during emergency situations and grid outages. It also supports commercial, industrial, and manufacturing facilities that are essential to the reliable supply of food, medical supplies, and health and safety products.

Figure 2: Matrix of DER Vulnerability to Weather Events



In addition to providing power and thermal energy to an individual building or facility, CHP systems can provide reliable power to a local community as part of a microgrid, allowing several buildings or facilities to keep the lights on during a grid outage. Microgrids are smaller grids that can disconnect from a larger system, and support their own electricity distribution, transmission, and generation.

CHP units can also enable renewable resources as part of a microgrid, as microgrids can include multiple sources of electric generation, including solar and wind. CHP supplies a consistent source of power, allowing localized systems to connect more intermittent resources while maintaining reliability. While climate-related impacts increase risks for critical, interconnected systems, microgrids can strengthen grid resilience and mitigate grid disturbances for end users by localizing power generation close to critical services and providing faster system response and recovery.

Learn more by reading the full report, [Combined Heat and a Changing Climate: Reducing Emissions and Improving Resilience](#), [here](#).

Figure 1 Source: ICF. "Combined Heat and Power Potential for Carbon Emission Reductions: National Assessment 2020–2050."
 Figure 2 Source: Better Buildings: U.S. Department of Energy. "Issue Brief: Distributed Energy Resources Disaster Matrix."

