

### MICROTURBINES BY CAPSTONE

Microturbines are combined heat and power generation systems that drastically reduce energy costs while helping protect the environment with near-zero emissions. These Capstone microturbines are able to produce electric power, heating, and cooling in a single, integrated system. The Capstone microturbine is an energy system that provides consumers with a payback in operating costs because the turbine already comes equipped with high voltage AC-DC-AC conversion so the consumer would not need to buy another conventional one. Additionally, the traditional diesel generator used in case of backup emergencies could be eliminated because the Capstone turbine is capable of providing enough power in such a case. Lastly, the Capstone microturbines could pay their way by potentially eliminating the utility bills because their fuel conversion efficiency more than doubles that of the average utility power. Advantages of using Capstone microturbines include, but are not limited to the following: low total cost of ownership, ultra low emissions, high reliability, and minimal scheduled maintenance. Microturbines are able to run on various fuel sources such as natural gas and most renewable fuel sources. The maintenance on microturbines is minimal, being only one moving part in the system versus over 150 in reciprocating engines. Additionally, oil and fluid changes are not required, which drastically decreases the cost of maintenance.

Capstone microturbines have been successfully operating in many buildings around the United States. Two successful projects where microturbines were installed include the Sea Gate Convention Centre and the Toledo Museum of Art, both located in Toledo, Ohio. Capstone microturbines were installed at the Toledo Museum of Art with integrated heat exchangers to produce electric power and hot water needed for art conservation. The most known project that operates from electric power produced by Capstone microturbines is the Syracuse University Green Data Center. The Green Data Center at Syracuse University was completed in early 2010 and is one of the world's most energy efficient data centers. The 12,000 square foot facility uses 50 percent less energy and produces fewer greenhouse gases than traditional data centers. The Green Data Center's electrical system uses 12 natural gas fueled microturbines to provide electricity for the data center. Ten of the microturbines are able to generate all power needed, enabling the data center to operate completely off-grid. A typical data center converts alternating current power from the utility's electrical grid to direct current to power the servers, these microturbines can generate any combination of AC and DC power on site. Additionally, the heat generated by the turbines is not wasted. The heat exhaust is piped to the chiller room, where it is used to generate cooling for the servers and heating and cooling for the adjacent office building. The partnership of Capstone Turbine Corporation, BHP Energy, IBM, Syracuse University, and New York State has created one of the world's most energy-efficient data centers in the world.

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Microturbines in use at the Syracuse University Green Data Center.

