CenterPoint Energy

Always There.®

On-site generation

Microturbines and fuel cells

To reduce the cost of electricity, demonstrate the technology and document performance, CenterPoint Energy installed a 30 kW microturbine at its Dakota Peak Shaving Station in Burnsville, Minnesota on March 14, 2000. It was the first commercial microturbine generator to start up in Minnesota. In November of 2000, a second, 60 kW microturbine was installed.

In 1995 CenterPoint Energy partnered with the 934th Tactical Airlift Group and the Department of Energy to install a 200 kW phosphoric acid fuel cell in Minneapolis.

On-site power generation reduces waste.

On-site generation, also commonly referred to as distributed generation, may be the wave of the future for the energy industry. “Distributed generation” simply means producing the electricity where it is used instead of at large central generating stations and then sending it over the wires to the user. On-site generation eliminates the expense, transmission problems and pollution of large central generating stations.

Microturbines and fuel cells, which are primarily powered by natural gas, can make widespread distributed generation possible. Both products are environmentally friendly and energy efficient. Although microturbines and fuel cells can be used for both residential and commercial purposes, there is expected to be more interest initially for commercial and industrial use.

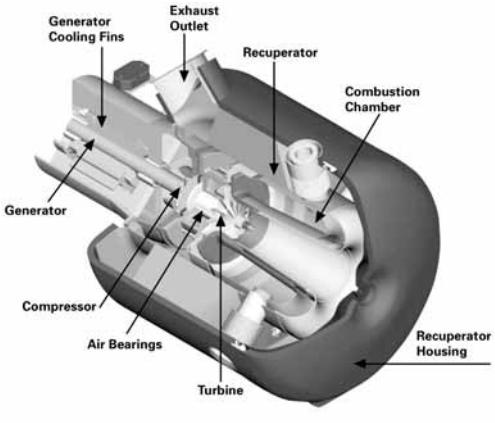
Microturbines

Microturbines are low emission electric generators that provide on-site power generation with the following benefits:

- **Environmental friendliness:** Exhaust contains almost no nitrogen oxides, carbon monoxide or sulfur dioxide, the primary precursors of smog.
- **Cost effectiveness:** Reductions in energy costs result in an attractive payback. In addition to producing energy, microturbines also produce exhaust heat that is useable for heating water and air, drying and more.
- **Efficiency:** Microturbines can run at efficiencies up to 80 percent (with heat recovery) compared to 30 to 40 percent in a typical coal-fired power plant.
- **Reliability:** Microturbines are able to operate connected to a power grid or in stand-alone modes to provide dependable power generation when power is down or in remote areas.

How a microturbine works

A microturbine produces electricity by combusting a fuel, which spins a turbine connected on a shaft to a permanent magnet generator. The small turbine rotates at speeds in excess of 80,000 revolutions per minute (rpm). A recuperator can be used to preheat the combustion air, making the unit more efficient.



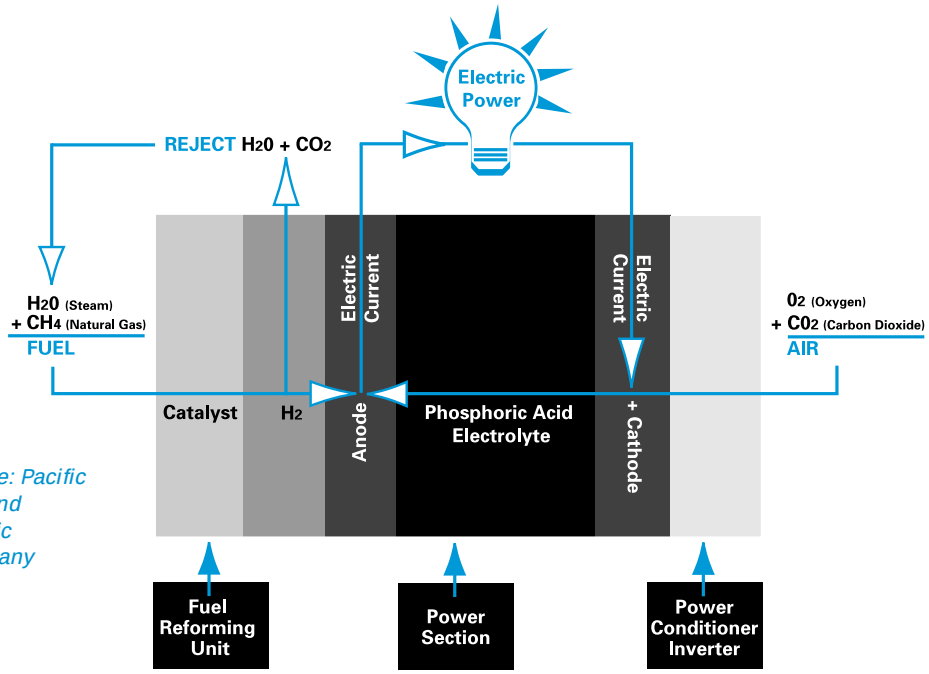
Source: Capstone Turbine Corporation

For more information, call our Business Customer Hotline 612-321-4939 (1-800-809-3803)

Fuel cells

A fuel cell operates like a battery, creating electricity through a reaction that combines the hydrogen in fuel (such as natural gas or propane) and oxygen from air to produce electricity. Fuel cells extract hydrogen ions from hydrocarbon fuels and combine them with oxygen to generate power. The reaction produces electricity, water and heat. Fuel cells provide on-site power generation with these benefits:

- **Environmental friendliness:** Generating electricity virtually emission free, no particulate matter, nitrogen or sulfur oxides are produced.
- **Cost effectiveness:** Can run at up to 80 to 90 percent overall efficiency, reducing energy costs and improving payback.
- **Fewer power outages:** Able to operate attached to the power grid or in stand-alone mode for dependable power generation in almost any situation.
- **Independence from the power grid:** Can provide power generation for those who choose to be independent from a major power company or who build in remote areas where running power lines is expensive or inconvenient.



Source: Pacific Gas and Electric Company

How a fuel cell works

Natural gas and steam enter the reformer where pure hydrogen is extracted. The hydrogen passes through a catalyst which splits off the electrons in an exothermic reaction (creating heat). The electrons are captured and directed in a flow to produce DC (direct current) power. The power conditioning section inverts DC to AC (alternating current) power for regular use.

Future expectations

Continued restructuring of the energy industry will create many opportunities for on-site generation. By 2010, it is expected that use of microturbines and fuel cells will increase significantly for both commercial and residential applications. Major corporations have begun investing in the technology, which will improve overall economics, increase demand, and lower prices. Equipment cost for fuel cells and microturbines is still fairly high, but is expected to decrease in the future.