# COMBINED HEAT AND POWER

A Brief Primer

***Combined Heat and Power*** (CHP) describes an energy production system that produces not only electricity, but also useful thermal energy, typically in the form of steam.

In a traditional electric utility boiler system (those facilities that produce electricity solely for sale to the public over a distribution "grid"), steam generated by a boiler is passed through a steam turbine driven generator in order to produce electricity. After passing through the turbine and losing one third of its heat energy along the way, the steam is condensed to begin the cycle again. Because utility boilers have no use for the steam after it has passed through the turbine generators, the heat energy lost from the steam as it condenses is subsequently wasted to the environment via the air or water, providing at best no benefit to the producer; at worst a thermal impact on the environment.

Unlike an electric utility plant that wastes up to two-thirds of the original heat energy of the steam directly to the environment, a CHP, or "co-generation" system beneficially uses the remaining heat energy for further work at the CHP's facility, or neighboring facilities. Depending upon the primary needs of the thermal user facility, this steam may be used in any or all of the following useful ways:

- distributed to buildings for room heating and/or hot-water supplies;
- used in labs or hospitals for sterilization;
- distributed to industrial facilities to heat processes and to operate pumps or other machinery;
- used for food preparation;
- used to run chillers for facility cooling needs.

In some systems, this steam is then returned to the powerhouse where it is condensed to begin the cycle again. In other systems with multiple users, the steam is fully depleted of its energy, leaving only condensate water that can either be returned to the plant (to save on water treatment costs) or discharged to the sewer.

Due to their ability to make best use of all energy contained in the steam generated by the boilers or combustion turbines, CHP systems typically have a much higher efficiency in terms of energy produced per unit of fuel consumed than a traditional electric utility boiler. Theoretical efficiencies of a CHP system can approach 85%; actual efficiencies range from 55% to 70%. In contrast, traditional electric utility boiler systems typically approach efficiencies of only 33%. The steam provided by CHP facilities also displaces steam that would otherwise be generated in conventional steam boilers. CHP thus provides energy savings at both the industrial facility and the electric generating station. In industrial settings with high power consumption as well as a need for thermal energy, CHP provides an avenue to meet both of these needs in a manner that is not only energy efficient but environmentally efficient.