



Combined Heat and Power: The Efficient Path for New Power Generation

One of a Series of ACEEE Fact Sheets

What Is Combined Heat and Power?

Combined heat and power (CHP) systems (also known as cogeneration) generate electricity and useful thermal energy in a single, integrated system (see figure right). This contrasts with the common practice of separate heat and power (SHP) where electricity is generated at a central power plant, while on-site heating and cooling equipment is used to meet non-electric energy requirements. The thermal energy recovered in a CHP system can be used for heating or cooling in industry or buildings. Because CHP captures the heat that would otherwise be rejected in traditional generation of electric power, the total efficiency of these integrated systems is much greater than from separate systems (e.g., in the example in the figure, the CHP system has an efficiency of 85% while the separate systems have a combined efficiency of only 45%).

CHP in America

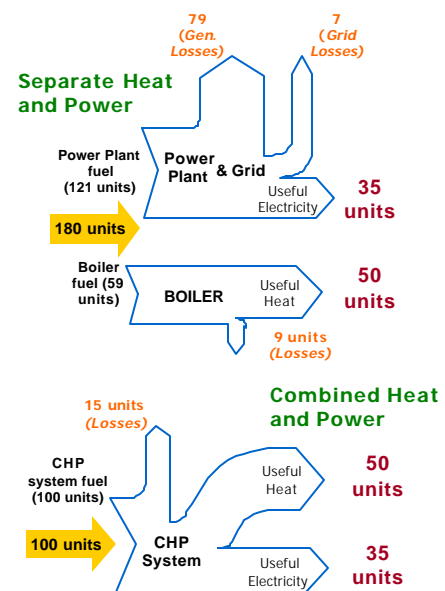
Currently, approximately 56,000 megawatts (MW) of CHP electric generation is in operation in the United States, up from less than 10,000 MW in 1980. CHP is widely used in the chemical, petroleum refining, and paper industries. In recent years, smaller CHP systems have begun to make inroads in the food, pharmaceutical, and light manufacturing industries, as well as in commercial buildings and on university campuses. In 1999, the most recent year for which data are available, CHP plants:

- Accounted for 7% of U.S. electricity generation capacity.
- Generated 310 billion kilowatt-hours (kWh), representing 9% of all electricity produced in the United States.
- Had a typical system efficiency of 68%, with some new systems exceeding 90%.
- Emitted on average one-tenth of the nitrogen oxides (NO_x) per kWh of average utility grid electricity.

CHP Potential

There are cost-effective opportunities for CHP capacity to grow several-fold in the United States.

- In Denmark and the Netherlands, more than 40% of electricity is obtained from CHP systems. In the United Kingdom, CHP's share of electric power production has doubled in the past decade, with additional growth targeted by the government.
- The CHP industry, U.S. Department of Energy (DOE), and Environmental Protection Agency (EPA) set an ambitious but achievable goal to double U.S. CHP capacity between 1999 and 2010 by adding approximately 50,000 MW of new capacity. If this goal is achieved, CHP would represent about 14% of U.S. 2010 electric generating capacity.



CHP: Less Input for Comparable Results

- ACEEE estimates that a further 95,000 MW of CHP capacity could be added between 2010 and 2020.

Regulatory and Market Barriers to CHP

Although technologies used in CHP systems have improved in recent years and CHP has become cost-effective in many applications, significant hurdles exist that limit widespread uses of CHP. The effect of these hurdles is to constrain use of CHP systems, meaning that less-efficient SPH systems continue to predominate. The main hurdles to CHP are:

- No national standards exist for the interconnection of distributed generation technologies to the electric utility grid, and as a result some utilities impose onerous and costly studies, and require the installation of unnecessarily expensive equipment to discourage CHP.
- Many utilities currently charge discriminatory backup rates and prohibitive “exit fees” to customers that build CHP facilities.
- Current regulations do not recognize the overall energy efficiency of CHP or credit the emissions avoided from displaced grid electricity generation.
- Depreciation schedules for CHP investments vary from 5 to 39 years depending on system ownership, and frequently don’t reflect the true economic lives of the equipment.
- Many facility managers are unaware of technology developments that have expanded the potential for cost-effective CHP.

Recommended Next Steps

- The Federal Energy Regulatory Commission (FERC) should promulgate a national interconnection standard and encourage state regulatory authorities to use this standard. FERC should also develop guidelines for the purchase of backup and supplemental power service for CHP facilities at fair and reasonable terms.
- EPA should shift to output-based emissions standards, which regulate emissions based on the power and heat produced and thereby implicitly credit efficiency. EPA should also educate and assist states regarding implementing this environmental permitting approach.
- The Internal Revenue Service (IRS) should set a depreciation schedule for CHP assets at 7 years, which reflects the true technical and economic life of most systems.
- Congress should enact tax credits to encourage efficient, low-emissions CHP systems.
- States should implement interconnect and access rules favorable to CHP, facilitate siting and permitting, cost-share CHP feasibility studies, and review state facilities for CHP opportunities.
- DOE should support educational and technical assistance efforts by state and regional initiatives to identify and implement CHP at appropriate sites.