

Mechanical systems are used in nearly every type of commercial and institutional facility to provide building heating and cooling. Some facilities also use mechanical systems to cool specific pieces of equipment, such as vacuum pumps, X-ray equipment, and ice machines. In many instances, these mechanical systems use water as the heat transfer medium. As a result, the use of water for building and equipment heating and cooling can be significant, in some cases as much as 30 percent of the total water use within a facility, as shown in Figure 6-1 for various commercial facility types.¹



Figure 6-1. Water Use Attributed to Mechanical Equipment for Heating and Cooling in Various Commercial Facility Types

Common mechanical systems that use water as the heat transfer medium include single-pass cooling, cooling towers, chilled water systems, and boiler and steam systems. When looking to reduce mechanical system water use, facilities should first eliminate single-pass cooling or reuse that water, then evaluate other cooling and heating systems to maximize efficiency. Single-pass cooling systems use water to remove heat and cool specific pieces of equipment. However, after the water is passed through the equipment, it is typically discharged to the sewer, rather than being recooled and recirculated. In some cases, single-pass cooling can be the single largest water user at a facility, using approximately 40 times more water to remove the same heat load than a cooling tower operating at five cycles of concentration.²

² U.S. Environmental Protection Agency and U.S. Energy Department, Energy Efficiency and Renewable Energy, Federal Energy Management Program. May 2005. Laboratories for the 21st Century: Best Practices, Water Efficiency Guide for Laboratories. Page 4. www1.eere.energy.gov/femp/program/labs21_bmp.html.

¹ Created from analyzing data in: Schultz Communications. July 1999. A Water Conservation Guide for Commercial, Institutional and Industrial Water Users. Prepared for the New Mexico Office of the State Engineer. www.ose.state.nm.us/wucp_ici.html; Dziegielewski, Benedykt, et al. American Water Works Association (AWWA) and AWWA Research Foundation. 2000. Commercial and Institutional End Uses of Water; East Bay Municipal Utility District. 2008. WaterSmart Guidebook: A Water-Use Efficiency Plan Review Guide for New Businesses. www.ebmud.com/for-customers/conservation-rebates-and-services/commercial/watersmart-guidebook; AWWA. Helping Businesses Manage Water Use—A Guide for Water Utilities.

All facilities should be on the lookout for single-pass cooling, which is often a hidden but rather significant water use associated with certain heating, air conditioning, and refrigeration equipment; hydraulic equipment; CAT scanners; X-ray equipment; vacuum pumps; ice machines; and wok stoves.

Like single-pass cooling systems, cooling towers also use significant quantities of water by design. Cooling towers dissipate heat from recirculating water that is used to cool chillers, air conditioning equipment, or other process equipment. After assessing whether single-pass cooling can be eliminated, facilities should focus next on ensuring that the cooling tower is properly maintained to minimize the need for make-up water. Facilities can also consider alternative sources of water for cooling tower make-up to significantly reduce the demand for potable water.

In many cases, cooling towers are used in conjunction with chilled water systems to remove heat by passing recirculated cold water through equipment. Chilled water systems are often used to cool air passing through air handling units, but they can also be used to cool a number of other systems or specific pieces equipment. Chilled water systems and/or cooling towers can be found in relatively small facilities, such as office buildings, schools, and supermarkets and in large facilities, such as hospitals, office complexes, and university campuses. Energy-efficiency measures should be used to decrease the load of the entire system to significantly reduce water used in both chilled water systems and cooling towers.

Boiler and steam systems are used in large building heating systems for heating water or to produce steam for industrial processes, cooking, or other operations. For example, hospitals might have central steam systems to supply steam for sterilization, while large commercial kitchens use them to operate combination ovens, steam cookers, and steam kettles. Other types of facilities might use boilers to supply hot water. Returning steam condensate back to the boiler is an important first step in improving water efficiency of boiler and steam systems.

Section 6: Mechanical Systems of *WaterSense at Work* provides an overview of and guidance for effectively reducing the water use of:

- Single-pass cooling
- Cooling towers
- Chilled water systems
- Boiler and steam systems

Single-Pass Cooling Case Study

To learn how the U.S. Environmental Protection Agency's Mid-Continent Ecology Division Laboratory in Duluth, Minnesota, eliminated single-pass cooling and reduced its potable water use by 90 percent, read the case study in Appendix A.

