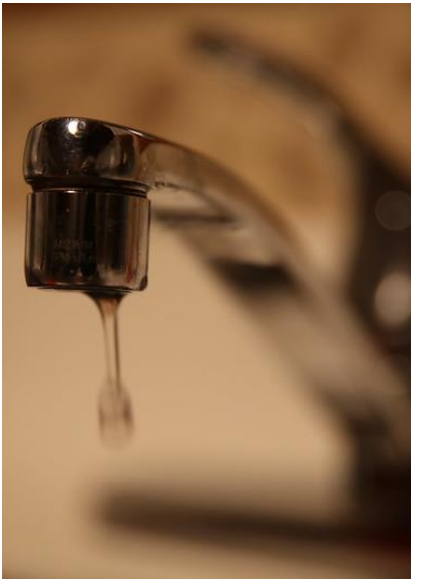
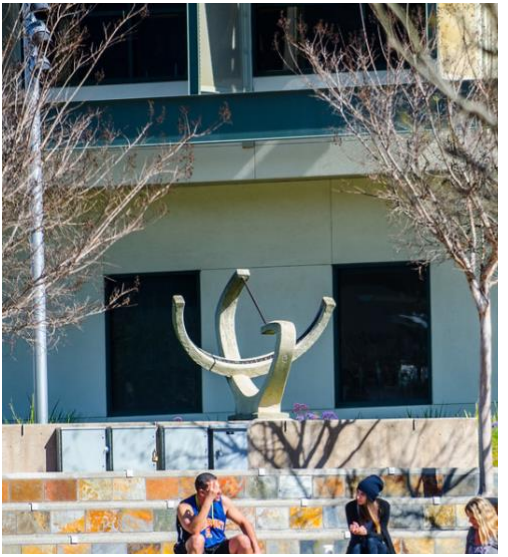
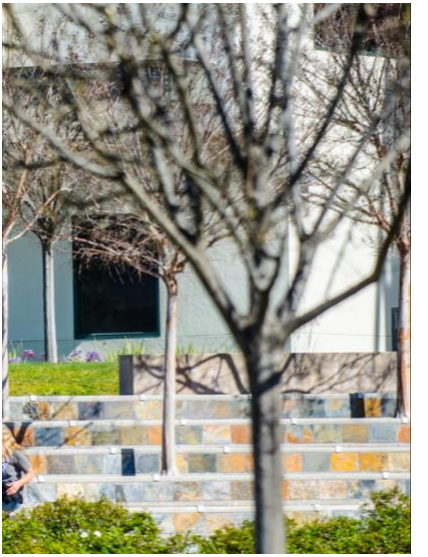
University Facility Managers' Guide to Water Efficiency







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NYC Environmental Protection

Overview and Getting Started

According to the United States Environmental Protection Agency (EPA), approximately six percent of the total water use in U.S. commercial and institutional facilities takes place in educational facilities. University facility managers can adopt water-efficient practices, such as increasing monitoring and upgrading equipment, that can provide both water and energy savings. Estimates from industry experts cited by the EPA suggest that water-efficient practices can decrease operating costs by approximately 11 percent and energy and water use by 10 and 15 percent, respectively.

Some of the key recommendations discussed in this guide are:

- Measure your water use to identify and to track water saving opportunities
- Develop a water management plan
- Check regularly for leaks and, when found, repair them promptly
- Retrofit or replace fixtures and equipment with more efficient models
- Eliminate single-pass cooling by recirculating cooling water or moving to air-cooled systems

Another recommendation that is not included in this guide, but encouraged, is to coordinate with your university's sustainability leaders to ensure that water conservation is included as part of your university's broader sustainability messaging to students, faculty, and staff. Interactive conservation campaigns, in particular, are useful for engaging and educating students on water conservation.

Cover Photo Credit: Canada College

Measure Your Water Use

The first step to conserving water is understanding how much water your campus consumes and where. Conducting a water audit is a good place to start. An audit includes collecting historic water bills and counting all the water-using fixtures and appliances inside and outside of your campus buildings. Specific areas to pay close attention to are:

- HVAC systems mechanical systems
- Cleaning of facilities such as public spaces and restrooms
- Equipment in cafeterias, research laboratories, and other campus facilities
- Bathrooms
- Water and energy consumption related to hot water use
- Landscaping and outdoor irrigation

Additional data such as student population and the academic calendar are useful to consider during your assessment of campus water use patterns. To understand your facilities' water use, you can use EPA's ENERGY STAR® Portfolio Manager, which helps you track water consumption and is also required by New York City Local Law 84 for buildings 50,000 square feet or more.

Benchmarking your water use against similarly-sized facilities can also be valuable. A helpful resource for this is the EPA's ENERGY STAR® Portfolio Manager DataTrends series.

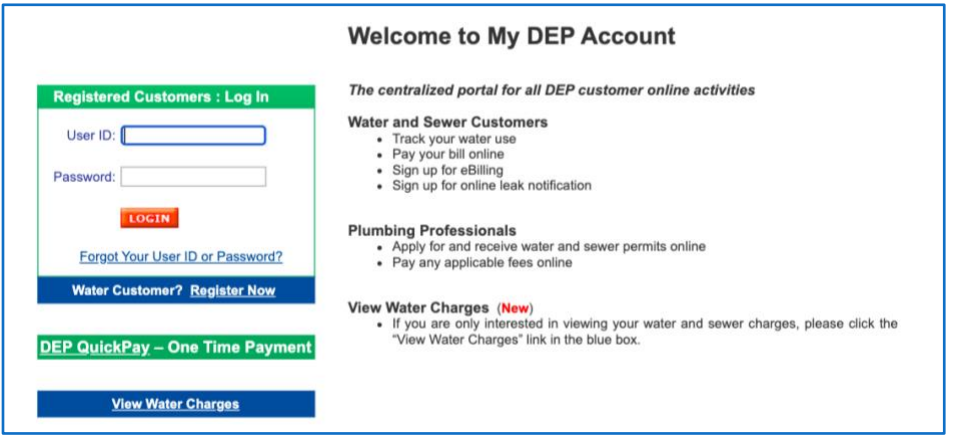
Identify, Evaluate, and Select Efficiency Measures

Evaluate and rank your various water conservation options, listed below, in terms of cost-effectiveness. Ideally, the selected measures

will have a good return on investment and have a neutral or positive impact on facility operations.

Plan, Implement, and Monitor

Create a water management plan that makes sense with your university's water use profile. It should identify potential efficiency measures, and account for expected costs and benefits. After the selected efficiency measures have been implemented, monitor the changes in water use. Most universities in New York City are equipped with water meters and Automated Meter Reading (AMR) devices that track buildings' daily (and in some cases hourly) water usage. To track your university's water use data, create a My DEP Account at nyc.gov/dep. A My DEP Account allows managers to track water use data, identify possible leaks, and monitor implemented water conservation strategies to assess their efficiency.



My DEP Account Home Screen

Common Areas and Plumbing

University Food Court

Leaks

A critical step in reducing water consumption is monitoring for and eliminating leaks throughout your campus plumbing system. This includes monitoring fixtures and appliances, research labs, and mechanical systems.

- Conducting a water audit of your campus, as described above, will help you identify leaks that can be repaired.
- It is important to stay vigilant to identify and repair new leaks as they occur. Even small leaks left unaddressed can waste thousands of gallons per month.

- Take advantage of the data provided by your AMR device and also, sign up for DEP's free Leak Notification Program by setting up a My DEP account online. This service is free and gives facility managers the proper tools to monitor water use.

Restrooms and Washrooms

Common area restrooms, such as in dormitories, can be updated to promote water efficiency.

- Consider replacing old, inefficient fixtures with WaterSense® certified fixtures. Common replacements include:
    - Toilets
    - Urinals
    - Flushometers
    - Aerators
    - Showerheads
- Encourage conscientious water use by placing signs promoting conservation near faucets and showers.
- Educate employees, faculty, and students about water efficiency to encourage water-saving behaviors.
- Involve janitorial staff in your water conservation planning. Encourage them to avoid wasting water, such as leaving faucets running.

> TIP: EPA WaterSense® labeled tank toilets have a flush volume of 1.28 gallons or less, EPA WaterSense® labeled showerheads have a flow rate of 2.0 gallons per minute or less, and EPA WaterSense® labeled faucets and aerators have a flow rate of 1.5 gallons per minute or less.

Ice Machines

Water-cooled ice machines, particularly those with a once-through cooling system, may consume substantially more water than is needed to make ice.

- Air-cooled units are typically more water efficient than water-cooled machines. However, not all air-cooled units are energy efficient. ENERGY STAR® has air-cooled ice makers that save water and energy compared to conventional models. The Consortium for Energy Efficiency also maintains a list of water and energy-efficient ice machine specifications to help guide your decision making process.

Laundry

Encourage students to run laundry machines with full loads and at proper water levels.

- Sub-metering water consumption in laundry facilities will also help monitor for leaks. There may also be opportunities for water reuse, which is permitted under the New York City Plumbing Code.

Food Service

To reduce water waste, replace inefficient fixtures and appliances. Changes in behavior or operations are also important. Below are some common items to address.

- Old pre-rinse spray valves may use 2 to 5 gallons of water per minute. Replace with an EPA WaterSense® labeled model that uses 1.28 gallons per minute. This can yield significant savings at a low cost.
- Dishwashers are often one of the largest water and energy consumers in a commercial kitchen. Dishwashers have a life expectancy of 20 to 25 years, so many inefficient units can be replaced with newer and more efficient technology.
- Food steamers that use a central boiler often consume large amounts of water. It may be cost-effective to replace them with more efficient connectionless steamers or combination ovens.
- Modifying any water wasting behavior will provide a benefit at a very low or even zero cost, such as turning off the faucet when it is not needed.

- Sub-metering water consumption in food service facilities will also help monitor for high levels of use. The New York City Plumbing Code requires water distribution pipelines serving a commercial kitchen facility to be equipped with a sub-meter.

A Commercial Kitchen Space

Science Research Facilities and Laboratories

Steam Sterilizers

Disinfection/sterilization is common in research institutions where it is necessary to destroy microorganisms. A steam sterilizer (a subcategory of autoclaves) is the most common type of system used to disinfect and sterilize laboratory equipment and other materials requiring sterilization.

To optimize the water efficiency of a steam sterilizer, consider the following operation, maintenance, and user education techniques:

- Shut off the steam sterilizer unit when not in use. Be prepared to communicate this in advance with the unit operators to address any questions or concerns they may have.
- Adjust the tempering water needle valve flow rate to the minimum manufacturer recommendations and periodically review and readjust to ensure no unnecessary water is discharged to the drain.

- Change out the needle valve annually, because they can wear quickly. Worn valves can discharge excess water.
- If the steam sterilizer is already equipped with a thermostatically actuated valve to control tempering water flow, periodically check the valve to ensure it is opening and closing properly, so tempering water is not continuously discharged.

Vacuum Pumps

Laboratories use vacuum pumps to collect waste gases, liquids, or debris from a vessel or enclosure. These vacuum pump systems range in size, depending upon whether they are used to supply a vacuum to several rooms or for point of use. Existing liquid-ring vacuum pumps can be replaced with dry vacuum pumps that are air-cooled rather than water-cooled. This replacement entirely eliminates the water used to create a vacuum, as well as the water used to cool the vacuum pump.

Retrofitting existing liquid-ring vacuum pumps with full or partial recovery and recirculation systems can result in significant water savings, while replacing existing water-cooled and/or liquid-ring vacuum pumps with air-cooled, dry vacuum pumps can entirely eliminate water use.

University Mechanical Systems

Part of Building's HVAC System

Mechanical systems are used in nearly every type of institutional facility to provide building heating and cooling. These mechanical systems often use water as the heat transfer medium, which can result in significant use of water for building and equipment heating and cooling. In some cases, as much as 20 percent of the total water use within a facility is used for heating and cooling, according to the EPA.

Common mechanical systems that use water as the heat transfer medium include:

- Single-pass cooling
- Cooling towers

- Chilled water systems
- Boiler and steam systems

When looking to reduce mechanical system water use, facilities should:

- Eliminate single-pass cooling or identify a way to reuse that water. Water reuse is permitted under the New York City Plumbing Code.
- Evaluate other types of cooling and heating systems that could maximize efficiency.

All facility managers should be aware of any single-pass cooling systems, which are often a hidden but significant use of water. Single-pass cooling is associated with certain heating, air conditioning, and refrigeration equipment; hydraulic equipment; vacuum pumps; ice machines; and wok stoves.

Cooling Towers

Cooling towers and water-cooled chillers are an extremely efficient method for cooling large buildings or campuses. Although designed to recycle water, cooling towers require a great deal of water and chemicals to operate and may represent a large portion of your property's water consumption.

There is usually an opportunity to operate these systems more efficiently, or even reduce the hours they run, and save water and money in the process. During your water audit, pay close attention to cooling towers.

- Prioritize proper maintenance.
- Improve make-up water quality to increase cycles of concentration.
- Consider retrofits, such as conductivity controllers and pH controllers, which can greatly reduce water use.
- The New York City Plumbing Code requires newly installed cooling towers to be equipped with a makeup line sub-meter.

Universities can also receive a DEP wastewater allowance for cooling tower evaporation.

- Properties must have a dedicated meter for cooling tower make-up lines in order to qualify for a wastewater allowance from DEP.
- A wastewater allowance prevents a property from being charged for water that does not get discharged into the sewer.

Chilled Water System

Chilled water systems remove heat by passing recirculated cold water through equipment. They are often used in place of single-pass cooling because the water is recirculated, rather than being discharged, to the drain. There are several main components of a chilled water system: chillers, pumps, heat exchangers, piping, and valves.

The efficiency of a chilled water system is dictated by its net useful refrigerating effect, or its ability to remove heat, compared to the energy supplied to do so. A system that removes more heat per unit of supplied energy is considered more efficient than a comparable system.

A Chilled Water System

Chilled water systems are completely closed loops and thus consume no water when operating properly with no leaking components. By improving the efficiency of the chilled water system, the heat load on the cooling tower can be reduced, thereby reducing the evaporative cooling load and the water use of the system as a whole.

- Install a make-up water meter on the chilled water loop, which will allow for leaks to be easily identified.

- Insulate the pipes on the chilled water loop to ensure that the chilled water does not absorb unnecessary heat, therefore requiring more water to cool.

Hot Water Boilers

Hot water boilers provide hot water for common uses like bathing, laundry, dishwashing, or similar operations. There are a number of ways to improve water efficiency of boiler and steam systems by changing operation, maintenance, and user education techniques.

Best management practices include:

- Maintaining boilers, steam lines, and steam traps
- Reading meters and water chemistry reports to closely monitor water use
- Minimizing blowdown

When maintaining boilers, steam lines, and steam traps, consider the following:

- Regularly check steam and hot water lines for leaks and make repairs promptly
- Regularly clean and inspect boiler water and fire tubes
- Develop and implement an annual boiler tune-up program
- Make sure there is proper insulation on piping and the central storage tank to conserve heat
- Implement a steam trap inspection program for boiler systems with condensate recovery

Checklist for Mechanical Systems

- ☐ Eliminate single-pass cooling
- ☐ Professionally monitor cooling tower and boiler chemistry and maximize cycles of concentration

- Install cooling tower meters and control systems to control chemical feed and blowdown based on conductivity
- Inspect chillers and air handler coils regularly and remove dirt and scale buildup
- Regularly check and maintain boilers, steam lines, and steam traps

Irrigation

Many New York City universities have outdoor spaces that use potable water for irrigation. Incorporating efficient irrigation practices can yield large water savings.

Operational modifications can help reduce the amount of water used to irrigate, such as:

- Watering plants or lawn during cooler times of day, like morning or evening
- Planting a water-smart landscape with native plants that require little irrigation and using soils that hold moisture
- Modifying your automatic irrigation system with water-saving devices and checking for leaks
- Installing rain sensors, soil moisture sensors, and weather-based irrigation controllers utilizing evapotranspiration information
- Exploring opportunities for rainwater capture and other types of on-site water reuse that can be used for irrigation. For more information, reference the New York City Plumbing Code.

Water Conserving Irrigation Hose

Resources

Below is a list of helpful resources to better understand water conservation for institutional facilities.

- WaterSense At Work
- Alliance for Water Efficiency (AWE).
- ENERGY STAR® Portfolio Manager
- ENERGY STAR® Portfolio Manager DataTrends series
- Consortium for Energy Efficiency's List of Water and Energy Efficient Ice Machines
- New York City Plumbing Code Appendix C: Water Recycling Systems