



WaterSense at Work

Sanitary Fixtures and Equipment 3.5 Laundry Equipment



Best Management Practices for Commercial and Institutional Facilities



May 2023

WaterSense[®] is a voluntary partnership program sponsored by the U.S. Environmental Protection Agency (EPA) that seeks to protect the nation's water supply by transforming the market for water-efficient products, services, and practices.

WaterSense at Work is a compilation of water efficiency best management practices intended to help commercial and institutional facility owners and managers from multiple sectors understand and better manage their water use. It provides guidance to help establish an effective facility water management program and identify projects and practices that can reduce facility water use.

An overview of the sections in *WaterSense at Work* is below. This document, covering water efficiency for laundry equipment, is part of **Section 3: Sanitary Fixtures and Equipment**. The complete list of best management practices is available at www.epa.gov/watersense/best-management-practices. WaterSense has also developed worksheets to assist with water management planning and case studies that highlight successful water efficiency efforts of building owners and facility managers throughout the country, available at www.epa.gov/watersense/commercial-buildings.

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This document is one section from *WaterSense at Work: Best Management Practices for Commercial and Institutional Facilities* (EPA-832-F-23-003). Other sections can be downloaded from www.epa.gov/watersense/best-management-practices. Sections will be reviewed and periodically updated to reflect new information. The work was supported under contract 68HERC20D0026 with Eastern Research Group, Inc. (ERG).

Sanitary Fixtures and Equipment Laundry Equipment



Overview

The washing equipment used in laundry operations in commercial settings varies by the type of building or laundry facility, the quantity and type of textiles to be cleaned, and the frequency that washing is needed. It is common for commercial buildings to use residential-style washers for miscellaneous clothes washing needs. However, there are many building types either dedicated to commercial laundry operations or that operate commercial laundry equipment to support onsite textile washing. Selfservice laundromats provide a



Self-service laundromat

centralized location where individuals can bring their laundry. These types of laundry facilities typically use commercial coin- or card-operated, single-load (residential-style) or multi-load washers. On-premises laundries are larger onsite facilities dedicated to washing linens and other textiles used at the location and are typically found in facilities such as hotels, hospitals, nursing homes, prisons, and universities. Industrial laundries are typically centralized contract laundries that wash items from other businesses. Industrial laundries and on-premises laundries tend to use large, multi-load washers and washer extractors. Very large, on-premises laundries may use tunnel washers. The specific types of commercial laundry equipment are discussed in more detail below.

Recent advances in commercial laundry equipment, including the availability of more efficient equipment, water recycling, and ozone technologies, have provided options for reducing water use in nearly all types of commercial laundry operations.

Residential Washers

Residential washers are those commonly found in individual homes, but they are also commonly used in many different commercial building types, from offices to laboratories to commercial kitchens, to assist in washing small loads, such as uniforms, towels, or napkins. Residential washers can either be top-loading or front-loading; high-efficiency front-loading washers have become more prevalent in recent years. Both U.S. Department of Energy (DOE) regulations and the ENERGY STAR[®] program differentiate residential clothes washers by size. Standard products have a capacity of 1.6 cubic feet (45 liters) or greater, and compact products have a capacity of less than 1.6 cubic feet (45 liters).

DOE maintains energy and water consumption criteria for residential clothes washers. Water consumption of residential clothes washers is measured in terms of an integrated water factor (IWF), which represents gallons of water consumed per wash cycle per cubic foot.^{1,2} A lower IWF equates to a more efficient clothes washer. Table 1 presents DOE's energy conservation standards for residential clothes washers. The IWF presented in Table 1 represents DOE's water efficiency criteria as it has changed over time.

	Compliance Data			
Product Class	January 1, 2011, to March 6, 2015, IWF	March 7, 2015, to January 1, 2018, IWF	January 1, 2018, to Present IWF	
Top-Loading, Compact (less than 1.6 cubic feet capacity)	9.5	14.4	12.0	
Top-Loading, Standard (1.6 cubic feet or greater capacity)	9.5	8.4	6.5	
Front-Loading, Compact (less than 1.6 cubic feet capacity)	9.5	8.3	8.3	
Front-Loading, Standard (1.6 cubic feet or greater capacity)	9.5	4.7	4.7	

Table 1. DOE IWF Standards for Residential Clothes Washers^{3,4}

To address efficiency and advances in residential clothes washers, ENERGY STAR certifies clothes washers⁵ that are 25 percent more energy-efficient than standard models and use 33 percent less water than standard models.

¹ Please note that integrated water factor (IWF) and water factor (WF) are terms that can be used interchangeably and are representative of the same metric.

² In Canada, IWF is representative of the liters of water consumed per wash cycle per liter of capacity and is calculated by multiplying the IWF presented throughout this section (which is based on the imperial units) by 0.1337.

³ Code of Federal Regulations. *Title 10 Part 430.32 Energy and Water Conservation Standards and Their Compliance Dates*. <u>www.ecfr.gov/current/title-10/chapter-II/subchapter-D/part-430/subpart-C/section-430.32</u>.

⁴ To convert from capacity in imperial units (cubic feet) to capacity in metric units (liters), multiply by 28. To convert from IWF in imperial units (gallons of water per wash cycle per cubic foot of capacity) to IWF in metric units (liters of water consumed per wash cycle per liter of capacity), multiply by 0.1337. ⁵ ENERGY STAR. ENERGY STAR Certified Residential Clothes Washers.

www.energystar.gov/productfinder/product/certified-clothes-washers/results.

Table 2 below presents the ENERGY STAR specification water efficiency criteria for residential clothes washers over time. The most efficient clothes washers labeled by ENERGY STAR have IWFs as low as 2.7.

	Compliance Data					
Product Class	January 1, 2007, to December 31, 2008, IWF	January 1, 2009, to December 31, 2010, IWF	January 1, 2011, to January 31, 2013, IWF	February 1, 2013, to March 6, 2015, IWF	March 7, 2015, to February 4, 2018, IWF	February 5, 2018, to Present IWF
Top-Loading (greater than 2.5 cubic feet capacity)	8.0	7.5	6.0	6.0	4.3	4.3
Front-Loading (greater than 2.5 cubic feet capacity)	8.0	7.5	6.0	6.0	3.7	3.2
Compact (less than or equal to 2.5 cubic feet capacity)	8.0	7.5	6.0	6.0	4.2	4.2

Table 2. ENERGY STAR IWF Criteria for Residential Clothes Washers^{6,7}

Beyond ENERGY STAR, some energy efficiency program administrators (e.g., utilities or municipality rebate programs) use criteria established by the Consortium for Energy Efficiency (CEE) to promote energy- and water-efficient residential clothes washers. CEE's Tier 1 criteria align with ENERGY STAR's; however, CEE offers additional tiers to encourage greater efficiency.⁸

Commercial and Multi-Load Washers (Coin- or Card-Operated)

Commercial washers used in self-service facilities (such as coin- or card-operated washers) are similar to conventional, residential-style washing machines. Top-loading machines have dominated this market, although they are being increasingly phased out and replaced by more efficient, front-loading machines. Some commercial laundromats have coin- or card-operated multi-load-capacity washers. Multi-load machines may be

⁶ ENERGY STAR. Product Specification & Partner Commitments Search. <u>www.energystar.gov/products/spec</u>. ⁷ To convert from capacity in imperial units (cubic feet) to capacity in metric units (liters), multiply by 28. To convert from IWF in imperial units (gallons of water per wash cycle per cubic foot of capacity) to IWF in metric units (liters of water consumed per wash cycle per liter of capacity), multiply by 0.1337. ⁸ Consortium for Energy Efficiency (CEE). CEE Program Resources. https://cee1.org/content/cee-program-

⁸ Consortium for Energy Efficiency (CEE). CEE Program Resources. <u>https://cee1.org/content/cee-program-resources</u>.

top- or front-loading, hard-mount (bolted to the floor) or conventional soft-mount machines with larger capacities up to 80 pounds (36 kilograms [kg]) of laundry per load, compared to less than 20 pounds (9 kg) per load for a conventional commercial washing machine.

The Energy Policy Act (EPAct) of 2005 previously set requirements for commercial coin- or card-operated single-load, soft-mount (i.e., not bolted to the floor), residential-style laundry equipment. DOE periodically reviews and, as necessary, revises the



Multi-load washers

energy conservation standards that apply to residential and commercial clothes washers. DOE's energy and water conservation requirements apply to top-loading commercial washers with capacities up to 4.0 cubic feet (113 liters) and front-loading commercial washers with capacities up to 3.5 cubic feet (99 liters). Commercial coin- or cardoperated laundry equipment manufactured on or after January 1, 2018, must now meet an IWF of 8.8 gallons per cycle per cubic foot (1.18 liters per cycle per liter) for top-loading washers and 4.1 gallons per cycle per cubic foot (0.55 liters per cycle per liter) for frontloading washers.⁹ Table 3 below presents the DOE's conservation standards for commercial clothes washers as they have changed over time.

	Compliance Data			
Product Class	January 1, 2007, to January 7, 2013, IWF	January 8, 2013, to December 31, 2017, IWF	January 1, 2018, to Present IWF	
Top-Loading	9.5	8.5	8.8	
Front-Loading	9.5	5.5	4.1	

Table 3. DOE IWF Standards for Commercial Clothes Washers^{10,11,12}

⁹ Code of Federal Regulations. *Title 10 Part 431.156 Energy and Water Conservation Standards and Effective Dates*. <u>www.ecfr.gov/current/title-10/chapter-II/subchapter-D/part-431/subpart-I/subject-group-ECFRbcafca7ea963a59/section-431.156#p-431.156(a)</u>.

¹⁰ U.S. Congress. August 8, 2005. *Public Law 109-58 Energy Policy Act of 2005 (EPAct 2005)*. www.congress.gov/109/plaws/publ58/PLAW-109publ58.pdf.

¹¹ Code of Federal Regulations. *Title 10 Part 431 Energy Efficiency Program for Certain Commercial and Industrial Equipment*. <u>www.ecfr.gov/current/title-10/chapter-II/subchapter-D/part-431/subpart-I/subject-group-ECFRbcafca7ea963a59/section-431.156</u>.

¹² To convert from IWF in imperial units (gallons of water per wash cycle per cubic foot of capacity) to IWF in metric units (liters of water consumed per wash cycle per liter of capacity), multiply by 0.1337.

To address efficiency and advances in commercial clothes washers, ENERGY STAR has developed voluntary criteria to qualify high-efficiency clothes washers with a capacity of up to 8.0 cubic feet (227 liters) to earn the ENERGY STAR. ENERGY STAR certified commercial clothes washers¹³ are 25 percent more energy-efficient and use 45 percent less water than standard models.¹⁴ Table 4 below presents the ENERGY STAR water efficiency criteria for commercial clothes washers as they have changed over time. Currently labeled ENERGY STAR commercial clothes washers have IWFs as low as 3.3.

	Compliance Data		
Product Class	January 1, 2007, to January 7, 2013, IWF	January 8, 2013, to December 31, 2017, IWF	January 1, 2018, to Present IWF
Top-Loading	9.5	8.5	8.8

Table 4. ENERGY STAR IWF Standards for Commercial Clothes Washers^{15,12}

Some multi-load washers have capacities that exceed 8.0 cubic feet (227 liters) and therefore are not regulated by DOE or eligible for ENERGY STAR certification.

Washer Extractors

Washer extractors are similar to multi-load washers, but can be larger, with capacities ranging from 30 to 800 pounds (14 to 363 kg) of laundry per load.¹⁶ Washer extractors remove water and detergent from clothes using high-speed, centrifugal force spin cycles and are only configured with a horizontal front-loading axis, which makes them more efficient. Washer extractor efficiency is usually measured in gallons of water per pound of laundry, as opposed to gallons per cubic foot or IWF, which is used for commercial washers.

One significant difference between a washer extractor and a coin- or card-operated commercial washer is the ability to significantly vary the number of wash cycles. For example, washing lightly soiled sheets at a hotel may only require a three-cycle operation consisting of wash (detergent), bleach, and rinse cycles. More heavily soiled laundry may require additional cycles, including a first flush, an alkali cycle to adjust the pH, a wash cycle, a bleach cycle, several rinse cycles, another pH adjustment to return the pH to neutral, and a final rinse cycle. With each cycle, some machines even have the ability to

¹³ ENERGY STAR. ENERGY STAR Certified Commercial Clothes Washers.

www.energystar.gov/productfinder/product/certified-commercial-clothes-washers/results. ¹⁴ ENERGY STAR. Commercial Clothes Washers.

www.energystar.gov/products/commercial_clothes_washers.

¹⁵ ENERGY STAR. Product Specification & Partner Commitments Search, op. cit.

¹⁶ East Bay Municipal Utility District (EBMUD). 2008. *WaterSmart Guidebook: A Water-Use Efficiency Plan Review Guide for New Businesses*. Page LAUND3. <u>www.ebmud.com/water/conservation-and-rebates/commercial/watersmart-guidebook/</u>.

adjust water levels and the amount of hot or cold water used. This flexibility illustrates the importance of separating laundry by its level of soil, as doing so will determine the amount of water used for the total wash operation. Most washer extractors require 2 to 4 gallons of water per pound (17 to 33 liters per kg) of laundry cleaned, depending upon the machine, the number of wash cycles used, and the water level settings.¹⁷



Washer extractors

Tunnel Washers

Tunnel washers are large-volume, continuous-batch washers with long chambers and a series of compartments through which the laundry is pulled for soaking, washing, and rinsing. Tunnel washers are used in very large laundry operations serving institutional users, such as hospitals, prisons, hotels, motels, and restaurants. They are capable of handling up to 2,000 pounds (907 kg) of laundry per hour. Tunnel washers are more water-efficient, because the water moves in a counter-flow direction to the laundry starting with the last rinse, so that the water is used through several cycles of the wash before being sent to the drain (see Figure 1 on the next page). Tunnel washers can reduce water use by 30 to 60 percent.¹⁸ Tunnel washers are costly to install, but they are capable of saving more water than washer extractors and require less operation and maintenance labor. Tunnel washers typically use 2 gallons of water or less per pound (17 liters or less per kg) of laundry.¹⁹ Advancements have been made in tunnel washer design technology, specifically in that tunnel washers can now be programmed to different wash angles to better suit different types of items being washed and soil levels.²⁰

¹⁷ Ibid.

¹⁸ *Ibid.*, Page LAUND7.

 ¹⁹ T&L Equipment Company. May 3, 2016. "Differences Between Tunnel and Extracting Commercial Washers." <u>www.washcycle.com/difference-tunnel-washers-washer-extractors/</u>.
²⁰ American Laundry News. December 11, 2018. "Efficient, Flexible Tunnel Washers." <u>https://americanlaundrynews.com/articles/efficient-flexible-tunnel-washers</u>.



Figure 1. Tunnel Washer

Operation, Maintenance, and User Education

Facility mangers can reduce water use by taking simple steps to educate users on proper laundry equipment use and maintenance. In addition, consider the following:

- Encourage users to wash only full loads. Consider using a laundry scale to weigh loads to ensure the machine is filled to capacity.
- Consider separating and washing laundry based on the number of wash cycles needed (e.g., more soiled articles will require more wash cycles). Inform users that unless articles are heavily soiled, an extended rinse is not necessary.²¹
- Ensure commercial and multi-load washers are preset to operate at their more water-efficient operating cycle and otherwise encourage users to choose the most appropriate wash cycle for the load.
- Work with the equipment supplier to provide an ongoing service and maintenance program.
- Consult the laundry chemical supplier for laundry methods that require fewer wash and rinse steps.
- Use the right amount of laundry detergents, as well as detergents formulated for

²¹ Singapore's National Water Agency. November 2019. *Best Practice Guide in Water Efficiency— Commercial Laundry Sector, Version 1.* Page 5. www.pub.gov.sg/Documents/PUB_Water%20Efficiency_Commercial%20Laundry%20Sector.pdf.

high-efficiency clothes washers. Normal detergents may create too many suds and can leave laundry not completely washed or rinsed.

- To save energy, consider washing laundry in cold water rather than warm or hot. Water heating consumes about 90 percent of the energy it takes to run a clothes washer.²² Many newer formulations of detergents are effective in cold water.
- Install and frequently monitor water submeters to establish average water use patterns. Check for leaks and maintenance issues regularly.

Retrofit Options

There are two main retrofit options to reduce water use associated with existing laundry equipment: water reuse/recycling and ozone systems.

Water Reuse/Recycling

Simple or complex recycling systems can be added to commercial washers, multi-load washers, and washer extractors to recycle a portion or all of the water for reuse in the next wash. Simple recycling systems recover discharge from the final rinse in a multi-cycle operation for use in the first rinse of the next cycle. The water from these systems rarely needs treatment prior to reuse, so potential water savings are 10 to 35 percent. Complex recycling systems treat the reclaimed water from wash and rinse cycles for use in all cycles of the next load and can save more than 80 percent of water used.^{23,24} Complex recycling systems usually require water treatment before reuse.

Water Recycling in Laundries Shows Real World Savings

In support of DOE, the Pacific Northwest National Laboratory (PNNL) conducted a study at the Grand Hyatt hotel in Seattle to demonstrate savings from laundry wastewater recycling systems. The hotel uses five hard-mount commercial washers to serve the laundry needs of all guest rooms and conference rooms and produces an estimated 280,000 pounds (127,006 kg) of laundry monthly. The recycling system captured, cleaned, and disinfected the laundry process discharge water to then reheat it and return it to the washers. The wastewater recycling system reduced water use by 80 percent, also providing significant hot water heating savings. There was a nominal increase in electricity needed to operate the recycling system; however, these additional costs were more than offset by water, sewer, and thermal energy cost saving. Due in large part to the high water and sewer costs experienced by the hotel, the project had a simple payback of less than one year. For more information, review the full study report at: www.pnnl.gov/main/publications/external /technical_reports/PNNL 23535.pdf.

Be sure to evaluate space constraints when considering water reuse/recycling options. Space may not be available to accommodate additional recycling equipment or storage

²² ENERGY STAR. Clothes Washers. <u>www.energystar.gov/products/clothes_washers</u>.

²³ Sawyer, Eisa. October 7, 2019. "Water Recycling Program Helps Commercial Laundries." Prepared for *Water Quality Products*. <u>www.wqpmag.com/commercial-water/article/10959141/water-recycling-program-helps-commercial-laundries</u>.

²⁴ EBMUD, op. cit.

tanks. Because recycling may also require adjustments in chemicals and detergents, contact the chemical supply vendor in any retrofit planning.

Ozone Systems

Ozone systems can be installed on all types of existing commercial laundry machines as retrofits, although they are not as common as a retrofit for tunnel washers. Ozone systems generate ozone, which is injected into the wash as a powerful oxidant that reacts with dirt and organic materials. It also provides disinfection and whitening properties. Ozone can allow for reduced water temperatures, typically from 140°F to about 80°F (60°C to 27°C)²⁵, which saves energy. It also can reduce the amount of detergents and other chemicals needed, lessening the amount of rinsing required, potentially reducing drying time, and lessening the damage to clothes.²⁶ Ozone systems work well on lightly soiled laundry, but they are not recommended for heavily soiled laundry. For heavily soiled laundry, conventional washing, detergents, and hot water work best. See Figure 2 for an example of the configuration of a laundry ozone system.



Figure 2. Laundry Ozone System

²⁵ Moneo, Eva. "Ozone for Industrial Laundries." Prepared for Lenntech.

www.lenntech.com/library/ozone/laundries/ozone-applications-laundry.htm.

²⁶ U.S. Department of Energy (DOE) Better Buildings[®]. "Case Study: Retrofits for Multi-load Commercial Washers."

https://betterbuildingssolutioncenter.energy.gov/sites/default/files/attachments/Multi_load_Washers_Tech _Demo_Flyer_508.pdf.

PNNL conducted a study for DOE to demonstrate water savings from ozone-based laundry systems.²⁷ This study was conducted in two facilities; the Charleston Place Hotel in Charleston, South Carolina, and Rogerson House assisted living facility in Boston, Massachusetts.

The Charleston Place Hotel laundry facility had three 250-pound (113-kg) multi-load washers and one 90-pound (41-kg) multi-load washer. The ozone system installation resulted in a 65 percent decrease in hot water usage and a 15 percent decrease in total water consumption.

The Rogerson House laundry facility had two 60-pound (27-kg) multi-load washers with an anticipated throughput of 500 pounds (227 kg) of laundry per day. While the hot water consumption decreased by 63 percent over the monthly period, the total water consumption saw a 19 percent increase. The study attributed this increase in total water usage to changes made to the wash cycle programs in the initial set up to achieve satisfactory cleaning results after the installation of the ozone system.

The results of the studies conducted at the Charleston Place Hotel and the Rogerson House using an ozone system showed that net water savings are achievable with proper system installation, as seen in the Charleston Place Hotel results. The Rogerson House study showed that water savings are not assured, and careful installation and operation practices need to be followed in order for an ozone system to function properly.

Replacement Options

When installing new laundry equipment or replacing existing equipment, consider the following replacement options:

• For residential or commercial clothes washers with up to 8.0 cubic feet (227 liters) of capacity, choose models that are ENERGY STAR certified.^{28,29} ENERGY STAR certified washers use significantly less energy, water, and detergent compared to standard models.



• For multi-load washers not eligible for ENERGY STAR certification, choose models that use no more than 4.0 gallons per cycle per cubic foot of capacity (0.53 liters per cycle per liter of capacity).

²⁷ Pacific Northwest National Laboratory (PNNL). August 2014. *Demonstration of Advanced Technologies for Multi-Load Washers in Hospitality and Healthcare–Ozone Based Laundry Systems*. Prepared for DOE. www.pnnl.gov/main/publications/external/technical_reports/PNNL-23536.pdf.

²⁸ ENERGY STAR. Clothes Washers, *op.cit*.

²⁹ ENERGY STAR. Commercial Clothes Washers, op. cit.

- For washer extractors, choose machines with built-in water recycling capabilities that can store the rinse water from the previous load for use in the next load. These types of washer extractors can use less than 2.5 gallons of water per pound (21 liters of water per kg) of laundry.
- For large industrial or commercial laundries, consider replacing old washer extractors or multi-load washers with tunnel washers if large volumes of laundry will be processed.
- Choose new machines that support remote diagnosis by the manufacturer to minimize maintenance cost and time associated with troubleshooting equipment problems.

Savings Potential

Water savings can be achieved through retrofitting existing laundry equipment to recycle wash water or reduce the amount of water required for rinsing, or by replacing existing laundry equipment with more efficient equipment. To estimate facility-specific water savings and payback, use the following information:

Laundry Equipment Retrofit

Use the following information to estimate water savings and payback potential that may be achieved with recycling or ozone retrofits. Water savings can vary based upon the water use and use patterns of the existing laundry equipment and the type of retrofit selected.

Current Water Use of Residential, Commercial, or Multi-Load Washers

To estimate the current water use from a residential, commercial, or multi-load washer, identify the following information and use Equation 1 on the next page:

- Washer's integrated water factor in gallons per cycle per cubic foot of capacity. Residential washers manufactured before 2015 and commercial washers manufactured before 2013 will have an integrated water factor of 9.5 gallons per cycle per cubic foot of capacity (1.27 liters per cycle per liter of capacity) or less. Clothes washers installed more recently or that are ENERGY STAR certified will have integrated water factors at or below the values indicated in Tables 1, 2, 3, and 4.
- Capacity of the washer.
- Average number of cycles per load. The number of cycles refers to the number of times the washer is filled with water. There may be one or two wash cycles and one or two rinse cycles in typical coin- or card-operated washers or multi-load washers.
- Average number of loads per year.

Equation 1. Water Use of Residential, Commercial, or Multi-Load Washer (gallons or liters per year)

= Integrated Water Factor x Washer Capacity x Number of Cycles x Number of Loads

Where:

- Integrated Water Factor: gallons per cycle per cubic foot (or liters per cycle per liter) of capacity
- Washer Capacity: cubic feet (or liters) of capacity
- Number of Cycles: cycles per load
- Number of Loads: loads per year

Current Water Use of Washer Extractor or Tunnel Washer

To estimate the average current water use from a washer extractor or tunnel washer, identify the following information and use Equation 2:

- Washer's water-efficiency factor in gallons per pound (or liters per kg) of laundry.
- Average number of pounds (or kg) of laundry per load.
- Average number of loads per year.

Equation 2. Water Use of Washer Extractor or Tunnel Washer (gallons or liters per year)

= Water-Efficiency Factor x Weight of Laundry x Number of Loads

Where:

- Water-Efficiency Factor: average gallons per pound (or liters per kg) of laundry
- Weight of Laundry: pounds (or kg) of laundry per load
- Number of Loads: loads per year

Water Savings

Studies have documented water savings for retrofits with a simple recycling system, retrofits with a complex recycling system, and ozone system retrofits. To estimate water savings that can be achieved from retrofitting existing laundry equipment, multiply the water use of the existing laundry equipment (Equation 1 or Equation 2) by the savings potential for the appropriate retrofit option indicated in Table 5 (see Equation 3 on the next page).

Table 5. Potential Water Savings From Commercial Laundry Retrofit Options³⁰

Retrofit Option	Water Savings Potential	
Retrofit With Simple Recycling System	10 to 35 percent	
Retrofit With Complex Recycling System	85 to 90 percent	
Retrofit With Ozone System	10 to 25 percent	

Equation 3. Water Savings From Commercial Laundry Equipment Retrofit (gallons or liters per year)

= Current Water Use of Laundry Equipment x Water Savings Potential

Where:

- Current Water Use of Laundry Equipment: gallons or liters per year
- Water Savings Potential: percent, from Table 5

Energy Savings

Because clothes washers use hot water, a reduction in water use will also result in energy savings. The energy required to heat water can be dependent on the proportion of water used in clothes washers that is hot, fuel used for water heating (e.g., electricity, natural gas), the efficiency of the water heater, and water heater temperature set points. Since this information is not always readily available, energy savings that can be achieved from retrofitting existing laundry equipment can be estimated using the water savings calculated using Equation 3 and the assumptions presented in Equation 4 on the next page:

³⁰ EBMUD. Pages LAUND4-7, op. cit.

Equation 4. Energy Savings From Clothes Washers Retrofit or Replacement (kWh of electricity or Mcf of natural gas per year)

= Water Savings (gallons or liters per year) x Average Percent of Water That Is Hot x (Energy per Gallon or Liter Heated ÷ Water Heater Efficiency)

Where:

- Water Savings: gallons (or liters) per year
- Average Percent of Clothes Washer Water That Is Hot: facilityspecific
- Energy per Gallon or Liter Heated [assuming 75°F (24°C) water temperature increase]:
 - 0.183 kWh of electricity per gallon (0.048 kWh per liter); or
 - 0.0006 Mcf of natural gas per gallon (0.00016 Mcf per liter)
- Water Heater Efficiency (unless otherwise known by the facility):
 - 1.0 for an electric hot water heater; or
 - 0.75 for a natural gas hot water heater

More detailed information to assist in calculating energy savings that result from saving water can be found on WaterSense's data and information web page at www.epa.gov/watersense/data-and-information-used-watersense.

Payback

To calculate the simple payback from the water and energy savings associated with retrofitting existing laundry equipment, consider the equipment and installation cost of the retrofit option, the water and energy savings as calculated using Equation 3 and Equation 4, respectively, and the facility-specific cost of water, wastewater, and energy.

More efficient washers may also require less detergent. If the facility is paying for the detergent used, this may reduce overall operating costs and reduce the payback period.

Residential, Commercial, or Multi-Load Washer Replacement

Residential, commercial, or multi-load washers can be replaced with more efficient laundry equipment. Look for washers with the ENERGY STAR label.

Current Water Use

To estimate the current water use of a residential, commercial, or multi-load washer, use Equation 1.

Water Use After Replacement

To estimate the water use of a more efficient replacement residential, commercial, or multi-load washer, use Equation 1, substituting the integrated water factor and washer capacity of the replacement equipment. ENERGY STAR certified residential and commercial washers will have an integrated water factor in accordance with the current requirements listed in Table 2 and Table 4.

Water Savings

To calculate water savings that can be achieved from replacing an existing residential, commercial, or multi-load washer, identify the following information and use Equation 5 below:

- Current water use as calculated using Equation 1.
- Water use after replacement as calculated using Equation 1.

Equation 5. Water Savings From Laundry Equipment Replacement (gallons or liters per year)

= Current Laundry Equipment Water Use – Water Use of Laundry Equipment After Replacement

Where:

- Current Laundry Equipment Water Use: gallons or liters per year
- Water Use of Laundry Equipment After Replacement: gallons or liters per year

Energy Savings

Because clothes washers use hot water, a reduction in water use will also result in energy savings. The energy required to heat water can be dependent on the proportion of water used in clothes washers that is hot, fuel used for water heating (e.g., electricity, natural gas), the efficiency of the water heater, and water heater temperature set points. Since this information is not always readily available, energy savings that can be achieved from replacing existing laundry equipment can be estimated using the water savings calculated using Equation 5 and the assumptions presented in Equation 4.

More detailed information to assist in calculating energy savings that result from saving water can be found on WaterSense's data and information web page at www.epa.gov/watersense/data-and-information-used-watersense.

Payback

To calculate the simple payback from the water and energy savings associated with replacing an existing residential, commercial, or multi-load washer with an ENERGY STAR certified model, consider the equipment and installation cost of the new equipment, the water and energy savings as calculated using Equation 5 and Equation 4, respectively, and the facility-specific cost of water, wastewater, and energy. More efficient washers may also require less detergent. If the facility is paying for the detergent used, this may reduce overall operating costs and reduce the payback period.

Washer Extractor or Tunnel Washer Replacement

Existing washer extractors or tunnel washers can be replaced with more efficient laundry equipment.

Current Water Use

To estimate the current water use from a washer extractor or tunnel washer, use Equation 2.

Water Use After Replacement

To estimate the water use of a more efficient, replacement washer extractor or tunnel washer, use Equation 2, substituting the new washer's water efficiency. Existing washer extractors can be replaced with machines with built-in water recycling capabilities that use less than 2.5 gallons of water per pound (21 liters per kg) of laundry. Efficient tunnel washers typically use 2 gallons of water or less per pound (17 liters or less per kg) of laundry.

Water Savings

To calculate water savings that can be achieved from replacing an existing washer extractor or tunnel washer, use Equation 5.

Energy Savings

To calculate energy savings that can be achieved from replacing an existing washer extractor or tunnel washer, use Equation 4.

Payback

To calculate the simple payback from the water and energy savings associated with replacing an existing washer extractor or tunnel washer, consider the equipment and installation cost of new equipment, the water and energy savings as calculated using Equation 5 and Equation 4, respectively, and the facility-specific cost of water, wastewater, and energy.

More efficient washers may also require less detergent, which may reduce overall operating costs and reduce the payback period.

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