



Water Efficiency Management Guide

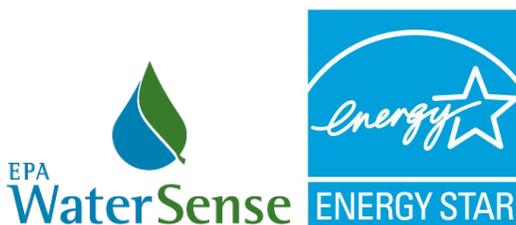
Residential Kitchen and Laundry

The U.S. Environmental Protection Agency (EPA) WaterSense® program encourages property managers and owners to regularly input their buildings' water use data in [ENERGY STAR® Portfolio Manager®](#), an online tool for tracking energy and water consumption. Tracking water use is an important first step in managing and reducing property water use.

WaterSense has worked with ENERGY STAR to develop the EPA Water Score for multifamily housing. This 0-100 score, based on an entire property's water use relative to the average national water use of similar properties, will allow owners and managers to assess their properties' water performance and complements the ENERGY STAR score for multifamily housing energy use.

This series of Water Efficiency Management Guides was developed to help multifamily housing property owners and managers improve their water management, reduce property water use, and subsequently improve their EPA Water Score. However, many of the best practices in this guide can be used by facility managers for non-residential properties.

More information about the Water Score and additional Water Efficiency Management Guides are available at www.epa.gov/watersense/commercial-buildings.



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Background

From making meals to washing clothes, many tasks in households and multifamily residences require water. With today's technology, these tasks can be done in a way that uses much less water and energy without sacrificing comfort or performance. Proper maintenance of laundry facilities, kitchen fixtures, and appliances is also key to property water efficiency. Further, because many of these tasks use hot water, tenants and property owners will benefit from energy savings that accompany hot water savings.

Kitchens

The water-using fixtures and appliances in the kitchen, namely kitchen faucets and dishwashers, provide opportunity to reduce water use and costs for you and your residents.

In 1998, the U.S. Department of Energy adopted a uniform standard of 2.2 gallons per minute (gpm) at 60 pounds per square inch (psi) maximum flow rate standard for all faucets, including kitchen faucets. For comparison, the maximum flow rates for many of the pre-1992 faucets ranged from 3 to 7 gpm. That means a huge potential for savings in properties where kitchens haven't been updated.

Because kitchen faucets perform tasks such as filling pots and containers, as well as rinsing dishes and food; EPA's WaterSense program does not label them at this time. However, California recently passed an efficiency standard for kitchen faucets to have a maximum flow rate of 1.8 gpm with optional temporary flow of 2.2 gpm at 60 psi.¹ Many green building and water efficiency codes, such as the International Green Construction Code (IgCC)² and the International Association of Plumbing and Mechanical Officials (IAPMO) Green Plumbing and Mechanical Code Supplement,³ have also adopted similar requirements.

Similarly, today's dishwashers use significantly less water than older models to perform sufficiently. The average dishwasher now uses about 6 gallons per load of dishes, but older models require as much as 10 gallons per load.⁴ WaterSense does not label dishwashers, but ENERGY STAR[®] incorporates water efficiency factors in its certification criteria for dishwashers that earn the ENERGY STAR label. Standard-sized ENERGY STAR certified dishwashers may not exceed 3.5 gallons per load, whereas compact models that may be more common in multifamily properties may not exceed 3.1 gallons per load.⁵ Replacing existing dishwashers with ENERGY STAR labeled models reduces water use by up to 65 percent and reduces energy use by more than 10 percent.

¹ California Energy Commission (CEC). California Code of Regulations Title 20. Public Utilities and Energy Division 2. State Energy Resources Conservation and Development Commission. August 2016.

² The International Code Council (ICC). 2015 International Green Construction Code (IgCC). June 2015.

³ International Association of Plumbing and Mechanical Officials (IAPMO). 2015 Green Plumbing and Mechanical Code Supplement.

⁴ Water Research Foundation. DeOreo, William B., Peter W. Mayer, B. Deziegielwski and J. Kiefer. Residential End Uses of Water, Version 2. 2016. Table 6.15, Page 128.

⁵ U.S. Environmental Protection Agency (EPA) ENERGY STAR. ENERGY STAR Program Requirements Product Specification for Residential Dishwashers. Eligibility Criteria Version 6.0. Effective January 29, 2016.

Laundries

Second only to bathrooms, laundry is the second biggest residential water use. The average resident with in-unit laundry washes more than five loads of laundry per week, whereas tenants with common area laundry wash more than three loads per week.⁶ The average clothes washer uses 31 gallons per load, but older models can use more than 40 gallons per load.⁷ Washers built before 2003 use significantly more water than newer ones. High-efficiency, front-loading clothes washers can use as little as 13 gallons of water per load.⁸

Many properties provide centralized laundry facilities where residents wash their laundry. These areas often use commercial coin- or card-operated models. ENERGY STAR certified commercial washers have more capacity than conventional top-load models with an agitator. Some front-loaders can wash over 20 pounds of laundry at once, compared to 10 to 15 pounds for a standard top-loader, meaning residents can complete their laundry in fewer loads and with less water and energy. Commercial clothes washers that have earned the ENERGY STAR label use about 45 percent less water and up to 60 percent less energy than standard models.

WaterSense does not label clothes washers, but ENERGY STAR has established energy and water efficiency criteria for residential models (typically installed in-unit) and commercial models (installed in laundry rooms or common areas).⁹ Replacing existing clothes washers with ENERGY STAR labeled appliances provides the benefit of saving energy, water, and utility costs while also making your property more attractive to current and prospective residents.



Case Study: ENERGY STAR Clothes Washers Save Money, Please Residents

The property manager of Colesville Towers, an upscale multifamily apartment building with 272 units in Silver Spring, Maryland, sought to lower utility bills, reduce maintenance costs, and market a greener lifestyle to potential residents. As part of its revitalization, the apartment installed 14 new ENERGY STAR certified washing machines three years before the building's route operating contract came up for renewal. The new washers are at least 50 percent more water- and energy-efficient than standard commercial units, and reduced water use by 60 percent compared to their existing machines. The new units are expected to save Colesville Towers about \$2,600 per year on its utility bills. The property manager, Realty Management Services, and residents were satisfied with the switch. Long-time resident Janice Vaughan liked that the new clothes washers are quieter and more user friendly. She shared that, "you don't have to use as much detergent, which is nice. And I think they get the clothes cleaner."

More information on this case study can be found at:
www.energystar.gov/ia/products/appliances/clotheswash/508_ColesvilleTowers.pdf

⁶ National Research Center Inc. *A National Study of Water & Energy Consumption in Multifamily Housing*. November 2012 (revised). www.mla-online.com/pdf/NRC-2002-A-National-Study-of-Water-and-Energy-Consumption-in-Multi-Family-Housing.pdf

⁷ Water Research Foundation. DeOreo, William B., Peter W. Mayer, B. Deziegielwski and J. Kiefer. *Residential End Uses of Water*, Version 2. 2016. Table 6.14, Page 127.

⁸ ENERGY STAR. *Clothes Washers Overview*. www.energystar.gov/products/appliances/clothes_washers

⁹ ENERGY STAR defines a commercial clothes washer as "a soft-mounted front-loading or soft-mounted top-loading clothes washer that is designed for use in applications in which the occupants of more than one household will be using the clothes washer, such as multifamily housing common areas and coin laundries."

Maintenance Best Management Practices

Performing periodic inspections within your kitchens and laundry areas will help keep equipment operating efficiently and catch water waste before it impacts your water bill. Aim to conduct inspections at least annually, or consider how checks might be incorporated during tenant changes or combined with other unit inspections. Table 1 provides a summary of inspection items that should be performed periodically and other operational best management practices.

Product Type	Tip	Why
All	Look at the base of dishwashers, refrigerators (if they have a water connection for ice makers), and clothes washers to see if any puddling is occurring. Verify that water connection hoses and drain lines are installed properly so that leaks aren't occurring at the connections. Repair or replace any water lines that are leaking or showing signs of wear and tear.	Leaks not only waste water, but can also cause soft spots, mold, and other damage in flooring.
Kitchen faucets	Scale buildup can occur when minerals accrue on the faucet's aerator or end device. Inspect kitchen faucet aerators for scale buildup and clean or replace the aerator or other spout end device if necessary.	Scale buildup can cause performance issues, resulting in occupants removing faucet aerators and increasing the faucet flow rate.
Clothes washers	Work with your laundry route operator ¹⁰ or equipment vendor to provide ongoing service and maintenance. If using a service agreement for a common-use laundry facility, be sure to request ENERGY STAR certified commercial laundry appliances be installed, if available.	Just like a car or an A/C unit, having laundry equipment regularly serviced will help ensure it maintains its efficiency and lasts longer.
Clothes washers	For clothes washers in laundry rooms or other common areas, include educational materials or signage to save water by only washing full loads of laundry. If you have high-efficiency clothes washers, remind residents to use detergents specifically formulated for these types of machines. Signage should also include contact information for maintenance personnel so residents can report leaks or other malfunctions in the laundry areas.	Even the most environmentally conscious residents can use encouragement and reminders.

¹⁰ Laundry route operators are companies that supply commercial laundry equipment to properties, including multifamily properties, and maintain the equipment. Typically, the laundry route operator and the property will share the revenues from laundry equipment at the building.

Retrofit and Replacement Options

If installing new kitchen and laundry appliances or replacing older ones, consider installing ENERGY STAR certified models or other water efficient alternatives. ENERGY STAR labeled appliances are certified to save energy and water. As a general rule of thumb, consider replacing dishwashers and clothes washers that are more than 10 years old with new, ENERGY STAR certified models.

- **Kitchen faucets:** Many new kitchen faucets have a flow rate between 1.5 and 1.8 gpm, reducing flow by at least 18 percent when compared to standard kitchen faucets. Alternatively, if the aerator or flow control device on the kitchen faucet can be easily removed and replaced, install a new aerator flowing at 1.8 gpm or less. New aerators only cost a few dollars and will have an equivalent effect on saving water and energy.
- **Dishwashers:** ENERGY STAR's current water performance requirements for dishwashers allow a maximum water consumption of 3.5 gallons per cycle for standard dishwashers and 3.1 gallons per cycle for compact dishwashers, reducing water use by as much as 65 percent reduces energy use by more than 10 percent when compared to older models¹¹.
- **Clothes washers:** A full-sized, front-loading ENERGY STAR certified clothes washer uses 13 gallons of water per load, compared to a new, standard machine, which uses 23 gallons or more per load. The Integrated Water Factor (IWF) is a metric, measured in gallons per cycle per cubic foot, that is used in the ENERGY STAR requirements to help consumers identify products that use less water than standard models. The lower the water factor, the more water-efficient the washer. Commercial clothes washers that have earned the ENERGY STAR label use about 45 percent less water and up to 60 percent less energy than standard models.¹²



If laundry equipment is provided through a laundry route operator or equipment vendor, work with them to identify opportunities for replacing existing equipment with ENERGY STAR certified models. Alternatively, they can help identify other opportunities for water and energy savings. If your current vendor is unwilling or unable to support you in your efficiency goals, consider switching to a commercial laundry route operator that is an [ENERGY STAR partner](#).¹³

You can identify ENERGY STAR certified dishwasher and clothes washer models by using the [ENERGY STAR Product Finder Tool](#)¹⁴ and by looking for the ENERGY STAR label (shown above) on product packaging and websites. Be sure to check the [ENERGY STAR Rebate Finder](#)¹⁵ to see if there are any rebates available in your area.

¹¹ ENERGY STAR. Dishwashers Key Product Criteria. www.energystar.gov/products/appliances/dishwashers/key_product_criteria

¹² ENERGY STAR. Appliance Calculator. www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/save-energy/purchase-energy-saving-products

¹³ ENERGY STAR. Commercial Laundry Route Operators and Distributors. www.energystar.gov/products/appliances/commercial_clothes_washers/commercial_laundry_route_operators_and_distributors

¹⁴ ENERGY STAR. Product Finder. www.energystar.gov/productfinder/

¹⁵ ENERGY STAR. Rebate Finder. www.energystar.gov/rebate-finder

Water Savings Calculations and Assumptions

To estimate water and energy savings from replacing existing kitchen and laundry appliances and fixtures with more water-efficient models, review the calculations for each fixture type. The sources for assumptions included in the calculations are provided in the Appendix.

Kitchen Sink Faucets

Replacing existing kitchen faucets or faucet aerators flowing at 2.2 gpm or more with high-efficiency models rated at 1.8 gpm or less can help reduce water use.

Use Equation 1 below to estimate water savings from replacing kitchen faucets or faucet aerators flowing at 2.0 gpm or more with high-efficiency models rated at 1.8 gpm or less. This equation uses the maximum flow rates for your faucet, but average flow rates are typically lower, due to supply pressure and throttling of faucets by users (where faucets are not used at full flow). Therefore, the estimated savings provided by Equation 1 is the maximum potential savings from kitchen faucet retrofit. The California Energy Commission estimated that a household replacing an existing kitchen faucet with a high-efficiency model would save approximately 1,100 gallons annually.¹⁶

Equation 1. Water Savings From Kitchen Faucet/Faucet Aerator Replacement (gallons per year)

$$\left(\begin{array}{c} \boxed{} \\ \text{Existing} \\ \text{Average Kitchen} \\ \text{Faucet Flow} \\ \text{Rate} \end{array} - \begin{array}{c} \boxed{1.8 \text{ gpm}} \\ \text{or Less} \\ \text{Replacement} \\ \text{Average Kitchen} \\ \text{Faucet Flow} \\ \text{Rate} \end{array} \right) \times \begin{array}{c} \boxed{25.7} \\ \text{Minutes per} \\ \text{Household per} \\ \text{Day} \end{array} \times \begin{array}{c} \boxed{365} \\ \text{Days per Year} \end{array} = \begin{array}{c} \boxed{} \\ \text{Gallons Saved} \\ \text{per Year} \end{array}$$

Because kitchen faucets typically use hot water, any resulting water savings will also save energy. Electricity savings (for electric water heaters) and natural gas savings (for natural gas water heaters) can be calculated using Equation 2a and 2b, respectively. If the efficiency of the hot water heater is unknown, consider using 100 percent efficiency for electric heaters and 75 percent for natural gas heaters to conservatively estimate energy savings.

¹⁶ California (2013) Codes and Standards Enhancement Initiative (CASE): Analysis of Standards Proposal for Residential Faucets and Faucet Accessories. Tables 5.1 and 5.4, pages 9,14.

Equation 2a. Electricity Savings From Kitchen Faucet/Faucet Aerator Replacement (kilowatt hour [kWh] per year; for electric hot water heating)

$$\left(\boxed{} \times 57\% \times 0.183 \right) \div \boxed{} = \boxed{}$$

Kitchen Faucet Gallons of Water Savings per Year Percentage of Hot Water Used kWh of Electricity Required to Heat One Gallon of Water Water Heater Efficiency* kWh Saved per Year

**Use 100% if exact electric heater efficiency is unknown*

Equation 2b. Natural Gas Savings From Kitchen Faucet/Faucet Aerator Replacement (thousand cubic feet [Mcf] per year; for natural gas hot water heating)

$$\left(\boxed{} \times 57\% \times 0.0061 \right) \div \boxed{} = \boxed{}$$

Kitchen Faucet Gallons of Water Savings per Year Percentage of Hot Water Used Mcf on Natural Gas Required to Heat One Gallon of Water Water Heater Efficiency* Mcf Saved per Year

**Use 75% if exact natural gas heater efficiency is unknown*

Dishwashers

To estimate water savings from replacing older, inefficient dishwashers with ENERGY STAR certified models using less than 3.5 gallons per load, use Equation 3.

Equation 3. Water Savings From Dishwasher Replacement (gallons per year)

$$\left(\boxed{\text{Existing Dishwasher Gallons per Load}} - \boxed{3.5 \text{ gal or Less}} \right) \times \boxed{0.1} \times \boxed{\text{\# of Occupants}} \times \boxed{365} = \boxed{\text{Gallons Saved per Year}}$$

Existing Dishwasher Gallons per Load
Replacement Dishwasher Gallons per Load
Loads per Person per Day
\# of Occupants
Days per Year
Gallons Saved per Year

Because dishwashers are supplied by hot water lines, water savings will also result in associated energy savings. Electricity savings (for electric water heaters) and natural gas savings (for natural gas water heaters) can be calculated using Equation 4a and 4b, respectively. If the efficiency of the hot water heater is unknown, consider using 100 percent efficiency for electric heaters and 75 percent for natural gas heaters to conservatively estimate energy savings.

Equation 4a. Electricity Savings From Dishwasher Replacement (kWh per year; for electric hot water heating)

$$\left(\boxed{\text{Dishwasher Gallons of Water Savings per Year}} \times \boxed{100\%} \times \boxed{0.183} \right) \div \boxed{\text{Water Heater Efficiency}^*} = \boxed{\text{Kwh Saved per Year}}$$

Dishwasher Gallons of Water Savings per Year
Percentage of Hot Water Used
kWh of Electricity Required to Heat One Gallon of Water
Water Heater Efficiency*
Kwh Saved per Year

**Use 100% if exact electric heater efficiency is unknown*

Equation 4b. Natural Gas Savings From Dishwasher Replacement (Mcf per year; for natural gas hot water heating)

$$\left(\boxed{\text{Dishwasher Gallons of Water Savings per Year}} \times \boxed{100\%} \times \boxed{0.0061} \right) \div \boxed{\text{Water Heater Efficiency}^*} = \boxed{\text{Mcf Saved per Year}}$$

Dishwasher Gallons of Water Savings per Year
Percentage of Hot Water Used
Mcf on Natural Gas Required to Heat One Gallon of Water
Water Heater Efficiency*
Mcf Saved per Year

**Use 75% if exact natural gas heater efficiency is unknown*

Clothes Washers

To estimate water savings from replacing older, inefficient clothes washers with ENERGY STAR certified models using less than 20 gallons per load, use Equation 5. If the gallons per load is unknown, use the default volumes provided in Table 2 to estimate savings.

Alternatively, use the [ENERGY STAR Appliance Calculator¹⁷](#) to estimate water and energy savings from installing ENERGY STAR appliances, including clothes washers.

Equation 5. Water Savings from Clothes Washer Replacement (gallons per year)

$$\left(\begin{array}{c} \boxed{} \\ \text{Existing Clothes} \\ \text{Washer Gallons} \\ \text{per Load} \end{array} - \begin{array}{c} \boxed{} \\ \text{Replacement} \\ \text{Clothes Washer} \\ \text{Gallons per} \\ \text{Load} \end{array} \right) \times \begin{array}{c} \boxed{0.3} \\ \text{Loads per} \\ \text{Person per Day} \end{array} \times \begin{array}{c} \boxed{} \\ \text{\# of Occupants} \end{array} \times \begin{array}{c} \boxed{365} \\ \text{Days per Year} \end{array} = \begin{array}{c} \boxed{} \\ \text{Gallons Saved} \\ \text{per Year} \end{array}$$

Table 2. Estimated Water Use per Load of Laundry for Various Clothes Washers

Clothes Washer Type	Gallons per Load
Residential Top-Loading	
Older, Inefficient Top-Loading (4.5 cubic feet)	41 gallons (or more) per load
New Conventional Top-Loading (4.5 cubic feet)	37.8 gallons per load
ENERGY STAR Certified Top-Loading (4.5 cubic feet)	19.4 gallons per load
Residential Front-Loading	
New Conventional Front-Loading (4.0 cubic feet)	18.8 gallons per load
ENERGY STAR Certified Front-Loading (4.0 cubic feet)	14.8 gallons (or less) per load
ENERGY STAR Certified Compact (≤ 2.5 cubic feet)	10.5 gallons per load
Commercial	
New Conventional Top-Loading Commercial (2.8 cubic feet)	23.8 gallons per load
New Conventional Front-Loading Commercial (2.8 cubic feet)	15.4 gallons per load
ENERGY STAR Certified Commercial (2.8 cubic feet)	12.6 gallons (or less) per load

¹⁷ ENERGY STAR. Appliance Calculator. www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/save-energy/purchase-energy-saving-products

Because clothes washers used hot water, saving water will also save energy. To calculate electricity savings (for electric water heaters) and natural gas savings (for natural gas water heaters), substitute the Annual Diverter Water Savings with the Annual Showerhead Water Savings in Equations 5a and 5b on the previous page.

Equation 5a. Electricity Savings From Clothes Washer Replacement (kWh per year; for electric hot water heating)

$$\left(\begin{array}{c} \square \\ \text{Clothes Washer} \\ \text{Gallons of Water} \\ \text{Savings per Year} \end{array} \right) \times \begin{array}{c} \square \\ 20\% \\ \text{Percentage of} \\ \text{Hot Water Used} \end{array} \times \begin{array}{c} \square \\ 0.183 \\ \text{kWh of Electricity} \\ \text{Required to Heat} \\ \text{One Gallon of} \\ \text{Water} \end{array} \div \begin{array}{c} \square \\ \text{Water Heater} \\ \text{Efficiency}^* \end{array} = \begin{array}{c} \square \\ \text{Kwh Saved per} \\ \text{Year} \end{array}$$

**Use 100% if exact electric heater efficiency is unknown*

Equation 5b. Natural Gas Savings From Clothes Washer Replacement (Mcf per year; for natural gas hot water heating)

$$\left(\begin{array}{c} \square \\ \text{Clothes Washer} \\ \text{Gallons of Water} \\ \text{Savings per Year} \end{array} \right) \times \begin{array}{c} \square \\ 20\% \\ \text{Percentage of} \\ \text{Hot Water Used} \end{array} \times \begin{array}{c} \square \\ 0.0061 \\ \text{Mcf on Natural} \\ \text{Gas Required to} \\ \text{Heat One Gallon of} \\ \text{Water} \end{array} \div \begin{array}{c} \square \\ \text{Water Heater} \\ \text{Efficiency}^* \end{array} = \begin{array}{c} \square \\ \text{Mcf Saved per} \\ \text{Year} \end{array}$$

**Use 75% if exact natural gas heater efficiency is unknown*

Additional Resources

Alliance for Water Efficiency Resource Library. Residential Clothes Washer Introduction.
www.allianceforwaterefficiency.org/Residential_Clothes_Washer_Introduction.aspx

Alliance for Water Efficiency Resource Library. Residential Dishwasher Introduction.
www.allianceforwaterefficiency.org/Residential_Dishwasher_Introduction.aspx

EPA's ENERGY STAR Program Resources:

Clothes Washers.

www.energystar.gov/products/appliances/clothes_washers

Commercial Clothes Washers.

www.energystar.gov/products/appliances/commercial_clothes_washers

Commercial Laundry Route Operators and Distributors.

www.energystar.gov/products/appliances/commercial_clothes_washers/commercial_laundry_route_operators_and_distributors

Dishwashers.

www.energystar.gov/products/appliances/dishwashers

EPA's WaterSense program. *WaterSense at Work. Best Management Practices for Commercial and Institutional Facilities.*

www.epa.gov/watersense/best-management-practices

Appendix A: Summary of Water Efficiency Measures and Savings

This appendix can be used to summarize water efficiency measures, upgrades, and projects that are identified at your property, based on a water assessment and/or review of this Water Efficiency Management Guide.

Summary of Water Efficiency Measures and Savings

Item Number	Location	Measure or Project Name and Description	Projected Annual Water Savings (gallons)	Projected Annual Energy Savings	Projected Annual Water, Wastewater, and Energy Cost Savings (\$)	Total Measure or Project Cost (\$)	Simple Project Payback (years)
Example	Basement laundry area	Replace five existing clothes washers with ENERGY STAR certified commercial front-loading clothes washers. New clothes washers are each \$1,500; however water utility will provide a \$100 rebate for each.	180,000 gallons	7,300 kWh	Water & Wastewater Cost Savings: \$1,980 Energy Cost Savings: \$750 Total: \$2,730	\$7,000	2.6 years
1							
2							
3							
4							
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6							
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10							
11							
12							

Appendix B: References for Calculation Assumptions

Variable	Suggested Value	Units	Reference
Kitchen Faucets			
Existing Average Kitchen Faucet Flow Rate	2.2	gallons per minute (gpm)	EPA 1992
Replacement Average Kitchen Faucet Flow Rate	1.8 or less	gpm	Best practice based on various green construction and water efficiency codes.
Minutes per Household per Day	25.7	minutes	California (2013) Codes and Standards Enhancement Initiative (CASE): Analysis of Standards Proposal for Residential Faucets and Faucet Accessories. Table 5.4, page 13.
Days per Year	365	days	Constant
Percentage of Faucet Water Used That Is Hot Water	57.0	percent	Water Research Foundation (WRF). DeOreo, William B., Peter Mayer, Benedykt Dziegielewski and Jack Kiefer. <i>Residential End Uses of Water, Version 2</i> . 2016. Table 6.25, Page 138.
Electric Hot Water Heater Efficiency	Building/Unit Specific (use 100 percent efficiency if unknown)		U.S. Department of Energy (2014) <i>Technical Support Document: Energy Efficiency Program for Consumer Products and Commercial and Industrial Equipment: Residential Clothes Washers</i> . Office of Energy Efficiency and Renewable Energy (EERE), Building Technologies Program, Appliances and Commercial Equipment Standards, p. 7-1
Mcf of Natural Gas Required to Heat One Gallon of Water 75°F	0.00061	Mcf/gallon	WaterSense calculation assuming: <ul style="list-style-type: none"> • Specific heat of water = 1.0 Btu/lb x °F • 1 gallon of water = 8.34 lbs • 1 Therm = 99,976 Btus • 1 Mcf of natural gas = 10.307 therms Incoming water temperature is raised 75°F
Natural Gas Hot Water Heater Efficiency	Building/Unit Specific (use 75 percent efficiency if unknown)		U.S. Department of Energy (2014). <i>Op. Cit.</i>
Dishwashers			
Replacement Dishwasher Gallons per Load	3.5 or less	gallons	EPA ENERGY STAR, 2016. Dishwashers Key Product Criteria. Effective January 29, 2016
Dishwasher Loads per Person per Day	0.1	loads per person per day	WRF. <i>Op. Cit.</i> Table 6.15, Page 128.
Days per Year	365	days	Constant
Percentage of Dishwater Water Used That Is Hot Water	100	percent	WRF. <i>Op. Cit.</i> Table 6.25, Page 138.
kWh of Electricity Required to Heat One Gallon of Water 75°F	0.183	kWh/gallon	WaterSense calculation assuming: <ul style="list-style-type: none"> • Specific heat of water = 1.0 Btu/lb x °F • 1 gallon of water = 8.34 lbs • 1 kWh = 3,412 Btus • Incoming water temperature is raised 75°F

Variable	Suggested Value	Units	Reference
Electric Hot Water Heater Efficiency	Building/Unit Specific (use 100 percent efficiency if unknown)		U.S. Department of Energy (2014). <i>Op. Cit.</i>
Mcf of Natural Gas Required to Heat One Gallon of Water 75°F	0.00061	Mcf/gallon	WaterSense calculation assuming: <ul style="list-style-type: none"> • Specific heat of water = 1.0 Btu/lb x °F • 1 gallon of water = 8.34 lbs • 1 Therm = 99,976 Btus • 1 Mcf of natural gas = 10.307 therms • Incoming water temperature is raised 75°F
Natural Gas Hot Water Heater Efficiency	Building/Unit Specific (use 75 percent efficiency if unknown)		U.S. Department of Energy (2014). <i>Op. Cit.</i>
Clothes Washers			
Older, Inefficient Top-Loading (4.5 cubic feet)	41	gallons per load	Water Research Foundation. DeOreo, William B., Peter W. Mayer, B. Deziegielwski and J. Kiefer. Residential End Uses of Water, Version 2. 2016. Table 6.14, Page 127.
New Conventional Top-Loading (4.5 cubic feet)	37.8	gallons per load	ENERGY STAR. Appliance Calculator.
ENERGY STAR Certified Top-Loading (4.5 cubic feet)	19.4	gallons per load	ENERGY STAR. Appliance Calculator.
New Conventional Front-Loading (4.0 cubic feet)	18.8	gallons per load	ENERGY STAR. Appliance Calculator.
ENERGY STAR Certified Front-Loading (4.0 cubic feet)	14.8	gallons per load	ENERGY STAR. Appliance Calculator.
ENERGY STAR Certified Compact (≤ 2.5 cubic feet)	10.5	gallons per load	ENERGY STAR. Appliance Calculator.
New Conventional Top-Loading Commercial (2.8 cubic feet)	23.8	gallons per load	ENERGY STAR. Appliance Calculator.
New Conventional Front-Loading Commercial (2.8 cubic feet)	15.4	gallons per load	ENERGY STAR. Appliance Calculator.
ENERGY STAR Certified Commercial (2.8 cubic feet)	12.6	gallons per load	ENERGY STAR. Appliance Calculator.
Clothes Washer Loads per Person per Day	0.3	loads per person per day	WRF. <i>Op. Cit.</i> Table 6.14, Page 127.
Days per Year	365	days	Constant
Percentage of Clothes Washer Water Used That Is Hot Water	20.0	percent	WRF. <i>Op. Cit.</i> Table 6.25, Page 138.
kWh of Electricity Required to Heat One Gallon of Water 75°F	0.183	kWh/gallon	WaterSense calculation assuming: <ul style="list-style-type: none"> • Specific heat of water = 1.0 Btu/lb x °F • 1 gallon of water = 8.34 lbs • 1 kWh = 3,412 Btus • Incoming water temperature is raised 75°F

Variable	Suggested Value	Units	Reference
Electric Hot Water Heater Efficiency	Building/Unit Specific (use 100 percent efficiency if unknown)		U.S. Department of Energy (2014). <i>Op. Cit.</i>
Mcf of Natural Gas Required to Heat One Gallon of Water 75°F	0.00061	Mcf/gallon	WaterSense calculation assuming: <ul style="list-style-type: none"> • Specific heat of water = 1.0 Btu/lb x °F • 1 gallon of water = 8.34 lbs • 1 Therm = 99,976 Btus • 1 Mcf of natural gas = 10.307 therms • Incoming water temperature is raised 75°F
Natural Gas Hot Water Heater Efficiency	Building/Unit Specific (use 75 percent efficiency if unknown)		U.S. Department of Energy (2014). <i>Op. Cit.</i>