

DOCKETED

Docket Number:	26-AAER-01
Project Title:	Commercial Dishwashers
TN #:	268978
Document Title:	Analysis of Proposed Efficiency Standards for Commercial Dishwashers
Description:	Draft staff report presenting an analysis of the proposed standards for commercial dishwashers.
Filer:	Alex Galdamez
Organization:	California Energy Commission
Submitter Role:	Energy Commission
Submission Date:	3/9/2026 2:17:37 PM
Docketed Date:	3/9/2026



California
ENERGY COMMISSION



California Energy Commission

DRAFT STAFF REPORT

Analysis of Proposed Efficiency Standards for Commercial Dishwashers

**2026 Appliance Efficiency Rulemaking
Docket Number 26-AAER-01**

March 2026 | CEC-400-2026-001-SD



California Energy Commission

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PREFACE

On August 10, 2023, the California Energy Commission (CEC) issued an order instituting rulemaking (OIR) to consider efficiency standards, test procedures, marking requirements, and other efficiency measures for commercial food service equipment, including commercial steam cookers, commercial dishwashers, commercial convection ovens, and commercial fryers. Measures resulting from the OIR will be incorporated into the California Code of Regulations (CCR), Title 20 Sections 1601–1609, the Appliance Efficiency Regulations.

On November 14, 2023, the CEC issued a request for information (RFI) and invitation to submit proposals (ITSP) for commercial food service equipment to seek information from industry, energy efficiency advocates, California investor-owned utilities (IOUs), and interested members of the public to submit information or proposals or both relating to potential efficiency standards for specified types of commercial food service equipment.

On February 13, 2024, the public comment period to submit information or proposals or both concluded. The CEC received comments from four stakeholders: ITW Food Equipment Group, North American Association of Food Equipment Manufacturers (NAFEM), CMA Dishmachines, and Frontier Energy. The CEC also received one standards regulation proposal for commercial dishwashers from California IOUs.

ABSTRACT

This report discusses test procedures, efficiency standards, and reporting requirements for commercial dishwashers that the California Energy Commission (CEC) is considering for incorporation into the *Appliance Efficiency Regulations* (California Code of Regulations, Title 20, Section 1601 to 1609). CEC staff analyzed the technical feasibility and cost-effectiveness of the proposed efficiency standards for commercial dishwashers and determined these standards are feasible and will cost-effectively create utility savings and provide environmental benefits relating to avoided resource use.

The standards for commercial dishwashers described in this report are proposed to take effect one year after their formal adoption. The standards are proposed to apply to the following commercial dishwashers: undercounter; door-type; pots, pans, and utensils; conveyor; as well as larger flight types that are generally used by the food service industry, including those used by educational services, healthcare industries, and corrections.

The proposed standards are estimated to save roughly 400 gigawatt-hours (GWh) per year of electricity, 18 million therms per year of fossil gas, and 2.6 billion gallons per year of water after full stock turnover, which is projected to occur 20 years after the standards become effective. These savings equate to about \$200 million per year in utility bill savings (\$113 million savings in electricity costs, \$70 million savings in fossil gas costs, and \$16 million savings in water costs).

Staff analyzed available market data for commercial dishwashers and concluded that the proposed standard would significantly reduce California's energy resource use (fossil gas and electricity) and water consumption. Staff also determined that the minimum levels for the proposed standard for commercial dishwashers are technically feasible and cost-effective in accordance with the Warren Alquist Act.

Keywords: Appliance Efficiency Regulations, appliance regulations, energy efficiency, commercial dishwashers, dishwashers, cost-effective, feasible

Please use the following citation for this report:

Galdámez, Alejandro. 2026. *Analysis of Proposed Efficiency Standards for Commercial Dishwashers*. California Energy Commission. Publication Number: CEC-400-2026-001-SD.

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EXECUTIVE SUMMARY

This report presents the California Energy Commission's (CEC's) staff analysis of proposed efficiency standards, test procedures, certification requirements, and marking and labeling requirements for the most common types of commercial dishwashers. The proposed efficiency standards for commercial dishwashers are estimated to save \$11.8 million in utility bills during the first year of implementation. At full stock turnover, 20 years after the effective date, the regulations will save around \$200 million per year on utility bills.

The proposed efficiency standards for commercial dishwashers would apply to the following types: undercounter commercial dishwashers; door-type commercial dishwashers; conveyor commercial dishwashers; flight type commercial dishwashers; certain glasswashers; and "pots, pans, and utensils" washers (commonly abbreviated as PPU). The proposed standards seek to apply specific idle energy, washing energy, and water consumption thresholds to each type of dishwasher.

The proposal is derived from information and data provided by stakeholders, from the voluntary ENERGY STAR® program, and data compiled by CEC staff. As available information for products not certified to ENERGY STAR is sparse, staff partially relied on data contained in specification sheets downloaded from manufacturers' websites. Staff reviewed and analyzed the data and information submitted by stakeholders to the pre-rulemaking docket for commercial food service equipment.

The estimated net benefit for users of commercial dishwashers ranges between \$4,300 to \$246,000, depending on the type of commercial dishwasher. Staff estimates that the proposed standards will save California about 28 gigawatt-hours (GWh) of electricity, 2.5 million therms of fossil gas, and 373 million gallons of water in the first year the standard is in effect, with a total benefit of roughly 400 GWh per year, 18 million therms per year, and 2.6 billion gallons of water per year in 2045 when the entire stock in California has been converted to compliant commercial dishwashers.

The benefit-to-cost ratio ranges from 1.4 to 15, depending on the model type, indicating that this proposal is cost-effective and that some types have a fast simple payback.

Staff analysis also demonstrates that the proposed standards for commercial dishwashers are technically feasible: staff determined that commercial dishwashers able to operate at or above the efficiencies required for compliance with the proposed standards are commonly available in the current marketplace.

CHAPTER 1:

Legislative Criteria and Policy

The Warren-Alquist Act establishes the California Energy Commission (CEC) as California's primary energy policy and planning agency.¹ Section 25402(c)(1) of the California Public Resources Code directs the CEC to reduce the inefficient consumption of energy and water by prescribing efficiency standards and other cost-effective measures for appliances whose use requires a significant amount of energy or water statewide.² Such standards must be technically feasible and attainable and must not result in any added total cost to the consumer over the designed life of the appliance.

For nearly five decades, California has regularly increased the energy and water efficiency requirements for new appliances sold and new buildings constructed in California. Through the Appliances Efficiency Program, appliance efficiency standards have shifted the marketplace toward more efficient products and practices, reaping large benefits for California's consumers. In 2025 alone, recently adopted efficiency standards under the Appliance Efficiency Regulations helped Californians avoid the use of 39.2 terawatt-hours of electricity, 400 million therms of fossil gas, and 202 billion gallons of water. These savings translate into \$14.6 billion dollars of utility bill savings, an average of \$373 per person in California.³ In addition, in the 1990s, the California Public Utilities Commission (CPUC) decoupled utilities' financial results from their direct energy sales, promoting utility support for efficiency programs. These efforts have reduced peak load by more than 8,645 megawatts (MW) and continue to save about 32,500 GWh per year of electricity.⁴

In determining cost-effectiveness, the CEC considers the value of the water or energy saved, the effect on product efficacy for the consumer, and the life-cycle cost of complying with the standard. The Commission also considers other relevant factors including, but not limited to, the statewide cost and benefits of the standard over the lifetime of the appliance, the economic impact on California businesses, and alternative approaches with its associated cost and benefit.

1 The Warren-Alquist State Energy Resources Conservation and Development Act, Division 15 of the Public Resources Code, § 25000 et seq.

2 These include energy and water consumption labeling, fleet averaging, incentive programs, and consumer education programs.

3 Based on internal CEC calculations. The savings estimates are taken from the final staff reports of adopted appliance standards found in the [Appliance Efficiency Proceedings-Title 20](https://www.energy.ca.gov/rules-and-regulations/appliance-efficiency-regulations-title-20/appliance-efficiency-proceedings) website, <https://www.energy.ca.gov/rules-and-regulations/appliance-efficiency-regulations-title-20/appliance-efficiency-proceedings>.

4 Kavalec, Chris, Nick Fugate, Cary Garcia, Asish Gautam, and Mehrzad Soltani Nia. January 2016. [California Energy Demand 2016–2026 Revised Electricity Forecast](https://efiling.energy.ca.gov/GetDocument.aspx?tn=207439&DocumentContentId=21362). California Energy Commission, <https://efiling.energy.ca.gov/GetDocument.aspx?tn=207439&DocumentContentId=21362>.

Building Decarbonization

California's climate goals have made building decarbonization a priority. Since the 2021 adoption of Assembly Bill 3232 *California Building Decarbonization Assessment*, several new goals and proposed regulations have been introduced. The strategies include electrification, electricity generation, decarbonization, energy efficiency, refrigerant leakage reduction, distributed energy resources, decarbonizing the gas system, and demand flexibility. Efficient electrification of space and water heating in California's buildings combined with refrigerant leakage reduction presents the most readily achievable pathway to a greater than 40 percent reduction in greenhouse gas emissions by 2030. Challenges that exist can be overcome and implemented equitably with collaboration and planning among state and local officials, utilities, environmental justice organizations, equipment manufacturers and distributors, financiers, and community leaders.

While the efficiency standards proposed by this report are not expected to nor intend to cause gas equipment to be replaced with electric equivalents, upgrades to the operating efficiency of gas equipment contribute to decarbonization goals by reducing on-site combustion and total statewide gas demand. Additionally, the efficiency standards proposed by this report will reduce electricity demand and the emissions associated with the generation of electricity by fossil gas.

Improving California's Resiliency to Future Drought

On January 17, 2014, with California facing water shortfalls in the driest year in recorded state history, former Governor Edmund G. Brown Jr. proclaimed a state of emergency and directed state officials to take all necessary actions to prepare for and respond to drought conditions. Between 2020 and 2022, California once again experienced severe to exceptional drought conditions statewide. January, February, and March 2022 were the driest months recorded in the past 100 years as seen in the California Water Watch website for those months, confirming the need to ensure that water conservation remains a California way of life.⁵

Water-Energy Nexus

Urban water use, including commercial dishwashing, consumes significant energy to move and treat water. A 2005 Commission study estimated 7,500 GWh per year, or roughly 3 percent of California's electrical energy, is consumed to treat and supply water intended for urban consumption.⁶ A more recent study by the Codes and Standards Enhancement (CASE) Team, using data provided by CPUC, estimated the energy used to supply water to be approximately

5 California Water Watch. 2022. "[Statewide Hydroclimate and Water Supply Conditions Map Precipitation](https://cww.water.ca.gov/maps?tab=precipitation)," <https://cww.water.ca.gov/maps?tab=precipitation>.

6 Navigant Consulting. December 2006. [Refining Estimates of Water Related Energy Use in California](http://400.sydneyplus.com/CaliforniaEnergy_SydneyEnterprise/Download.aspx?template=Books&field=PublicURL&record=e8eddbab-2aa1-4cc9-9069-a3537dec1846&showSave=False&repeat=ca889315-efb3-4b2a-af37-cfb9d969b50e). California Energy Commission, CEC-500-2006-118. Pg. 16, http://400.sydneyplus.com/CaliforniaEnergy_SydneyEnterprise/Download.aspx?template=Books&field=PublicURL&record=e8eddbab-2aa1-4cc9-9069-a3537dec1846&showSave=False&repeat=ca889315-efb3-4b2a-af37-cfb9d969b50e.

3,565 kilowatt-hours (kWh) per million gallons.⁷ Consequently, appliance standards leading to the efficient use of water also lead to significant energy savings for California.

Reducing Electrical Energy Consumption to Address Climate Change

Appliance energy efficiency is a key to achieving the greenhouse gas emissions reduction goals of Senate Bill 100 (De León, Chapter 312, Statutes of 2018) and Assembly Bill 3232 (Friedman, Chapter 373, Statutes of 2018), as well as the recommendations contained in the California Air Resources Board's *2022 Scoping Plan for Achieving Carbon Neutrality*.⁸ Energy efficiency and load flexibility are also identified as critical components in limiting the amount and cost of new infrastructure in the CEC's *2023 Integrated Energy Policy Report (IEPR)*.⁹

On October 7, 2015, former Governor Brown signed the Clean Energy and Pollution Reduction Act of 2015 or Senate Bill 350 (De León, Chapter 547, Statutes of 2015), directing CEC to establish annual targets for statewide energy efficiency savings and demand reduction. SB 350 seeks to achieve a doubling of energy savings in buildings and retail end uses through energy efficiency and conservation by 2030. Appliance efficiency standards is one of several strategies identified to achieve the targets set by the CEC for existing buildings.

The efficiency standards proposed by this report will contribute to goals to reduce GHG emissions from electricity generation that have been set by California by reducing total statewide demand, which proportionally reduces fossil gas demand.

7 [Response to Invitation to Submit Proposals Irrigation Spray Sprinkler Bodies](https://efiling.energy.ca.gov/GetDocument.aspx?tn=221224&DocumentContentId=26740). Codes and Standards Enhancement (CASE) Initiative, pg. 49, <https://efiling.energy.ca.gov/GetDocument.aspx?tn=221224&DocumentContentId=26740>.

8 [Senate Bill 100, California Renewables Portfolio Standard Program: Emissions of Greenhouse Gases](https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201720180SB100), https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201720180SB100; Assembly Bill 3232, [Zero-Emissions Buildings and Sources of Heat Energy](https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180AB3232), https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180AB3232; California Air Resources Board. December 2022. [2022 Scoping Plan for Achieving Carbon Neutrality](https://ww2.arb.ca.gov/sites/default/files/2023-04/2022-sp.pdf), <https://ww2.arb.ca.gov/sites/default/files/2023-04/2022-sp.pdf>.

9 [Adopted 2023 Integrated Energy Policy Report With Errata](https://efiling.energy.ca.gov/GetDocument.aspx?tn=254463), <https://efiling.energy.ca.gov/GetDocument.aspx?tn=254463>.

CHAPTER 2:

Product Description

Overview of Commercial Dishwashers

Commercial dishwashers are designed to operate in nonresidential settings such as restaurants, schools, hospitals, residential care facilities, and so forth to clean and sanitize large numbers of non-disposable dishes, glassware, utensils, and other kitchenware by using hot water, detergent, and, in some cases, sanitizing chemicals. Unlike residential counterparts, commercial dishwashers are designed to manage large number of loads per day. Each load takes an average cleaning time of about two minutes, and in some cases commercial dishwashers operate continuously by using a conveyor system.

Commercial dishwashers fall into two major categories: stationary rack types and conveyor types. Stationary rack commercial dishwashers, as the name implies, use a rack that is manually loaded with dishes, placed into the washing compartment, then exposed to the different sequential wash and rinse sprays used to clean the dishware, after which the rack is manually removed or replaced. In contrast, conveyor-type commercial dishwashers use a continuous feed mechanism such as a conveyor belt to bring a steady stream of dishware into and through the wash compartment. These may use racks to hold or organize dishes or allow dishes to be placed directly on an open belt, the latter being a common feature of flight-type commercial dishwashers. Conveyor-type units will move dishes through different cleaning activity specific compartments to clean the dishware, not unlike an automated car wash.

Although all commercial dishwashers (stationary rack and conveyor type) maintain a wash cycle of 120° F to 140° F (48° to 60° C), they can be grouped into two major classifications based on peak temperatures during cleaning. Commercial dishwashers classified as “low-temperature” machines, also known as “chemical sanitizing” machines, add chemical sanitizers to rinse water to achieve sanitization at rinsewater temperatures between 140° F to 160° F. In contrast, “high-temperature” commercial dishwashers use water that exceeds 180° F (83° C) to achieve sanitation without the use of chemicals or additives. There are also “dual-rinse” or “dual-sanitation” units that can operate both low- and high-temperature sanitation cycles, providing additional options to consumers.

Both classifications generally make use of hot water provided by the water heater(s) of the building they are installed in, though high-temperature commercial dishwashers often use an additional “booster” water heater to achieve high peak temperatures. These secondary water heaters can be electric, fossil gas, or steam devices and can be installed within or outside the commercial dishwasher they serve.

Several factors drive consumer preference between these equipment categories. Although most consumers favor high-temperature commercial dishwashers due to the perceived superior cleaning capability and absence of chemical odors or residues or both on glassware, some locations cannot accommodate such machines due to physical limitations such as limited amperage or space for an external booster heater. Similarly, stationary rack units can occupy a smaller footprint than conveyor-type units, which can be critical in space-constrained bar or

kitchen areas, while high-volume restaurants may need a conveyor-type system to keep up with demand. The type of cooking being done or food being served also affects the decision. For example, high-temperature commercial dishwashers are effective at removing charred food from pots and pans, and a consumer may choose a dual-rinse model to use the low-temperature mode on regular ware throughout the day and the high-temperature mode to clean pots and pans after closing. Lastly, it's worth noting that commercial dishwashers that fall under the high-temperature classification are generally provided with optional heat recovery technology to improve dishwashing energy efficiency.

While traditional high-temperature units will be supplied with water from a water heater at 140°F (which is then raised to operating temperatures by the booster heater of the unit), units with heat recovery operate at an incoming water temperature as low as 120°F and use a combination of heat recovery and booster heating to reach operating temperature. The energy saved by lowering the hot water supply temperature may not be visible if comparing only the direct energy use of heat-recovery and non-heat-recovery devices, given that the savings occur at the water heater of a building.

Stationary Rack Commercial Dishwashers

Stationary rack commercial dishwashers uniformly wash, rinse, and sanitize eating and drinking utensils that are placed on a rack that is then inserted into a cleaning chamber where all cycles are applied. These dishwashers in general consist of legs, a cleaning chamber hood, doors, tank, spray assemblies, pumps, motors, controls, piping, valves, heating equipment, and other accessories. Most units take up to 3 minutes to complete a cleaning cycle and are commonly used in establishments that have a daily volume of roughly 50 to 300 racks per day. Stationary rack commercial dishwashers are available in high- or low-temperature classifications.

Stationary rack commercial dishwashers include several subtypes. One of the most common examples of stationary rack commercial dishwashers is the undercounter dishwasher (**Figure 2-1**), which is designed not to exceed 38 inches in height and is typically installed under a counter or bar of the establishment. Undercounter dishwashers generally operate on an

average 2-minute wash per rack (20 by 20 inches) and are commonly used by establishments with a daily volume of less than 50 racks of dirty ware.

Figure 2-1: Undercounter Stationary Rack Commercial Dishwasher



Source: California Investor-Owned Utilities Analysis of Standards Proposal for Commercial Dishwashers

Door-type commercial dishwashers (**Figure 2-2**) are designed to accept a 20-by-20-inch rack. The machine requires the raising of the door to place the rack into the “cleaning chamber,” where the different cycles are applied, and lowering or closing the door initiates the cleaning process. Door-type commercial dishwasher cleaning processes last about 2 to 3 minutes per rack and are commonly used in establishments with a daily average of about 300 racks. Many models of door-type commercial dishwashers can wash two racks simultaneously for establishments that need a higher rack throughput (more than 200 racks per hour).

Figure 2-2: Door-Type Stationary Rack Commercial Dishwasher



Source: California Investor-Owned Utilities Analysis of Standards Proposal for Commercial Dishwashers

Door-type “pots, pans, and utensils” (PPU) commercial dishwashers and “fill-and-dump” commercial dishwashers are additional design specializations of door-type commercial dishwashers. PPU are door-type commercial dishwashers with larger door openings designed to accommodate hard-to-clean items with baked-on food. These units are therefore high-

temperature classification only and have selectable wash cycles that range from 3 to 10 minutes. PPU's are typically found in large establishments where the number of hard-to-clean items justifies a dedicated washing device.

Fill-and-dump commercial dishwashers, also known as chemical dump dishwashers, are predominantly in the "low-temperature" classification. Unlike most door-type commercial dishwashers that store and reuse the wash water, fill-and-dump models dispose of the wash water after each cycle. Fill-and-dump commercial dishwashers are the most basic and least expensive option available for establishments in the commercial food service sector.

Conveyor Commercial Dishwashers

Conveyor commercial dishwashers use a conveyor belt or a similar mechanism to carry eating and drinking utensils through a series of wash and rinse sprays, or machine sections and may use either racks or a rackless system. Rack conveyor commercial dishwashers (**Figure 2-3**) generally use a 20-by-20-inch racks to hold the utensils that are going to be cleaned. The rack is loaded on one side of the machine and is carried by the conveyor belt through the wash and rinse sprays. Some units may move dishes back and forth through compartmentalized wash and rinse areas several times as a part of a single wash cycle.

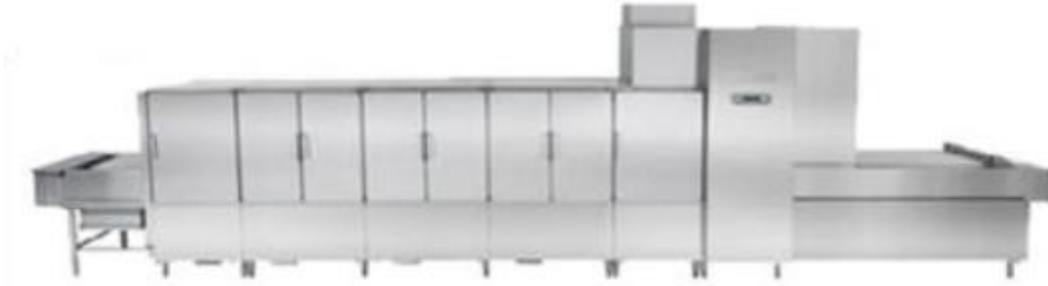
Figure 2-3: Single- or Multiple-Tank Rack Conveyor Commercial Dishwasher



Source: California Investor-Owned Utilities Analysis of Standards Proposal for Commercial Dishwashers

Flight-type commercial dishwashers use a rackless system where the utensils to be cleaned are placed directly on the moving mechanism (**Figure 2-4**). Although both types of conveyor commercial dishwashers (rack conveyor and flight type) are designed to operate on one of the two classifications (high- and low-temperature), there are some conveyor commercial dishwashers that are designed to operate interchangeably between both. Conveyor commercial dishwashers are generally used by large establishments that need to clean 300 racks or more per day and require multiple full-time employees to operate them.

Figure 2-4: Single- or Multiple-Tank Flight-Type Commercial Dishwasher



Source: California Investor-Owned Utilities Analysis of Standards Proposal for Commercial Dishwashers

Both rack-conveyor and flight-type commercial dishwashers are designed to operate using single or multiple dedicated hot water tank(s). A typical single-tank conveyor commercial dishwashers use a 20- to 30-gallon tank that is heated to a temperature of about 150°F to 160°F. Single-tank commercial dishwashers provide a wash and sanitizing rinse spays or machine sections to perform the washing and rinsing of the utensils to be cleaned. Single-tank conveyor commercial dishwashers have an average throughput of more than 300 racks per day.

Multiple-tank conveyor commercial dishwashers generally have a prerinse section in addition to the washing and sanitizing rinse sections. Multiple-tank commercial dishwashers use separate pumps and heating elements for the different prerinse, washing, and sanitizing rinse sprays or machine sections. Multiple-tank rack conveyor commercial dishwashers average between 400 to 600 racks per day. Multiple tank flight-type commercial dishwashers exceed 600 racks per day. Both multiple tank conveyor commercial dishwashers and flight-type commercial dishwashers are generally used for high-volume establishments.

Overview of Commercial Glass-Washing Machines

Commercial glass-washing machines are designed for establishments that have a high-volume of glassware use. In comparison with other commercial dishwashers, commercial glass-washing machines lack versatility and are designed to clean glassware only. Because of the lack of versatility and specific job function, most establishments will also operate a second, separate commercial dishwasher if other utensils (that is, other than glassware) need to be cleaned and sanitized. Most commercial glass-washing machines are comparable in size to undercounter stationary rack commercial dishwashers, though some commercial glass-washing machines have bigger dimensions and require a more complex installation.

Commercial glass washing machines can be divided into four descriptive categories:

- Stationary rack commercial glasswashers
- Carousel commercial glasswashers
- Conveyor commercial glasswashers
- Batch rotary commercial glasswashers

Stationary rack commercial glasswashers (**Figure 2-5**) accommodate a standard 20-by-20-inch rack. Glassware is placed on the rack, and the filled rack is placed in the cleaning chamber where the glassware is cleaned as it is exposed to the different wash and sanitizing rinse sprays in the machine. Stationary rack commercial glasswashers are essentially a specialized undercounter stationary rack commercial dishwashers that cleans glassware only. The authors emphasize that stationary rack commercial glasswashers are within the scope of ENERGY STAR V2.0 efficiency threshold and are tested following the same test procedure as the one required for stationary rack commercial dishwashers.

Figure 2-5: Stationary Rack Commercial Glasswasher



Source: California Investor-Owned Utilities Analysis of Standards Proposal for Commercial Dishwashers

Carousel commercial glasswashers (**Figure 2-6**) have a similar footprint as undercounter stationary rack commercial glasswashers and provide fast undercounter glass washing with an average throughput of around 1200 glasses per hour. Carousel commercial glasswashers have a central carousel where glassware to be cleaned is placed. The carousel rotates continuously and acts as a conveyor guiding the glassware through a cleaning and a sanitation rinse section of the machine before exiting.

Figure 2-6: Carousel Commercial Glasswasher



Source: California Investor-Owned Utilities Analysis of Standards Proposal for Commercial Dishwashers

Although conveyor commercial glasswashers (**Figure 2-7**) have a similar footprint as door-type stationary rack commercial dishwashers, they operate by using a rackless system. The glassware to be cleaned is placed directly on the conveyor belt, which guides the glassware through the wash and sanitizing rinse sections or sprays. Although conveyor glasswashers operate similarly to flight-type commercial dishwashers, they are significantly smaller.

Figure 2-7: Conveyor Commercial Glasswasher



Source: California Investor-Owned Utilities Analysis of Standards Proposal for Commercial Dishwashers

Batch rotary glasswashers (**Figure 2-8**) have an 18-to-24-inch-diameter compartment that is divided into two batch holding sections. The machine allows for glassware to be placed on one of the two open compartments (i.e., a batch). The filled compartment rotates, placing the first batch into the cleaning compartment. As the batch is being cleaned, a second batch can be

loaded in the empty second compartment. Once the first batch of glassware finishes the cleaning, it rotates placing the second batch dirty glassware into the cleaning compartment starting the cleaning process of the secondary batch as the first batch is unloaded from the compartment that rotated out of the cleaning compartment.

Figure 2-8: Batch Rotary Commercial Glasswasher



Source

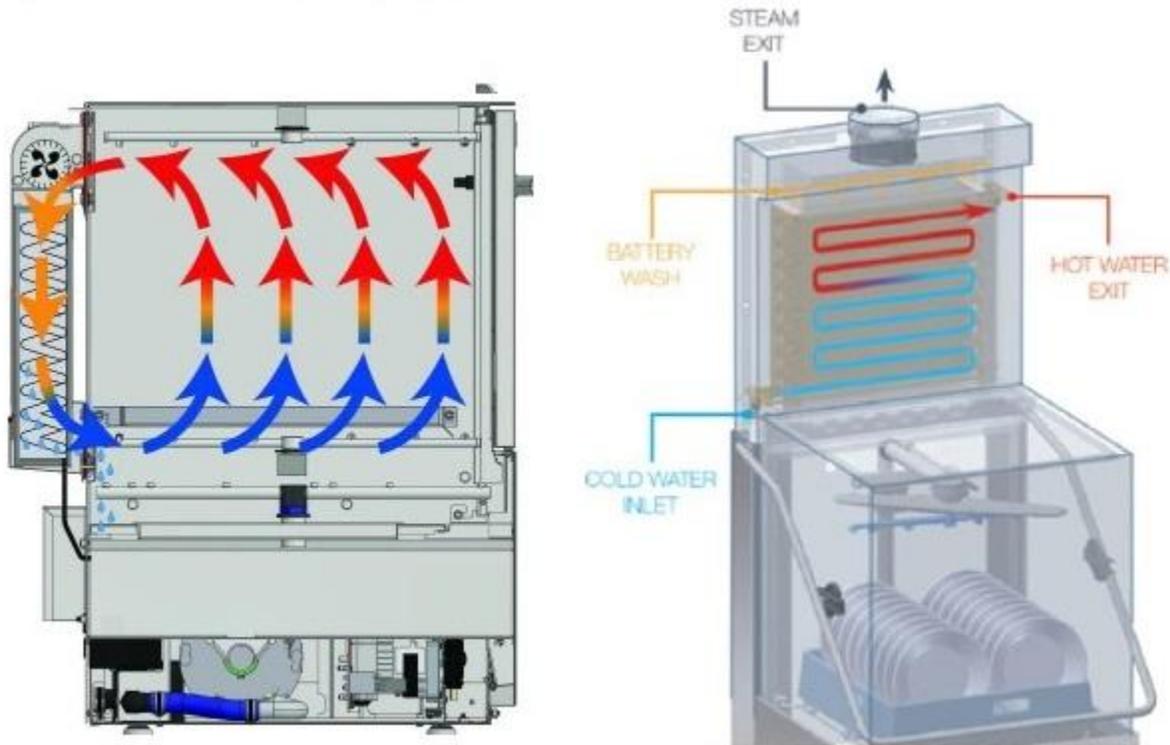
California Investor-Owned Utilities Analysis of Standards Proposal for Commercial Dishwashers Heat Recovery Features for Commercial Dishwashers :Heat Recovery Technology: The types of heat recovery technology found as options within commercial dishwashers vary according to the type of dishwasher. Nearly all heat recovery systems are found in high-temperature units (or units with high-temperature modes), as the large temperature difference between incoming and outgoing water is necessary for effective heat recovery.

Commercial dishwashers that have heat recovery are engineered based on high-efficiency models and exhibit similar water consumption. Heat recovery can significantly reduce the hot water demand from high heat gas heaters used to accommodate tank fills and consecutive washing cycles. In addition, the California Plumbing Code limits the temperature of water discharge to 140°F or below. If a heat recovery system is not used to lower outgoing water temperatures, then a drain tempering device will instead need to be installed. Drain tempering devices add potable cold water to outgoing hot water to achieve required temperatures, and this use of water can be made unnecessary by inclusion of effective heat recovery.

Stationary Rack Commercial Dishwashers Heat Recovery

Undercounter and door-type stationary rack commercial dishwashers (**Figure 2-9**) that have heat recovery technology use steam from the sanitation process (i.e., rinse cycle) to preheat water for the next cycle. Units with heat recovery technology emit less heat into the dishwashing area of the kitchen reducing the air-conditioning load.

Figure 2-9: Stationary Rack Commercial Dishwashers Heat Recovery



Source: California Investor-Owned Utilities Analysis of Standards Proposal for Commercial Dishwashers

Conveyor Commercial Dishwasher Heat Recovery

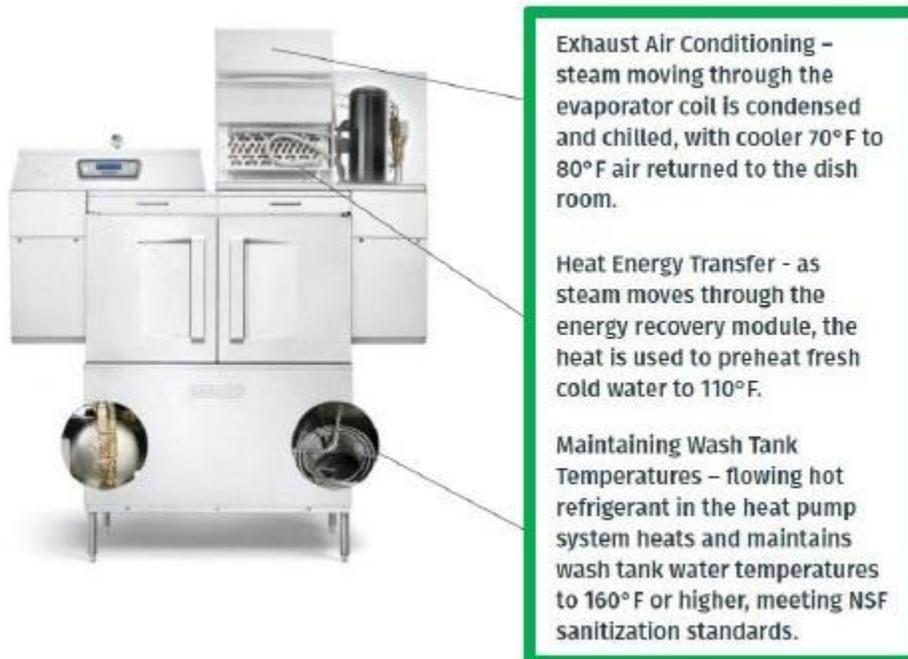
Due to the size of conveyor commercial dishwashers, different heat recovery technologies can be implemented independently or, in some cases, simultaneously. For example, while some conveyor commercial dishwashers may use an exhaust coil (**Figure 2-10**) at the exit and use the exhaust steam to preheat incoming water. Other models use a heat pump to capture the heat from the exhaust steam (**Figure 2-11**) or the hot water being drained to capture the heat used to preheat the incoming water (**Figure 2-12**). Conveyor commercial dishwashers with heat recovery technology, unlike stationary rack commercial dishwashers, take the same time as those without heat recovery technology.

Figure 2-10: Exhaust Coil Heat Recovery for Conveyor Commercial Dishwasher



Source: California Investor-Owned Utilities Analysis of Standards Proposal for Commercial Dishwashers

Figure 2-11: Heat Pump Heat Recovery for Conveyor Commercial Dishwasher



Source: California Investor-Owned Utilities Analysis of Standards Proposal for Commercial Dishwashers

Figure 2-12: Drain Water Heat Recovery for Conveyor Commercial Dishwashers



Source: California Investor-Owned Utilities Analysis of Standards Proposal for Commercial Dishwashers

CHAPTER 3:

Regulatory Approaches

California Energy Commission (CEC) staff examined pathways to achieve energy and water savings for commercial dishwashers. As part of that assessment the CEC studied existing standards adopted by other states, current federal requirements, requirements in the California Code of Regulations, and voluntary energy efficiency requirements set in the Energy Star Program.

Other State Standards

Eight states and the District of Columbia have adopted requirements for commercial dishwashers. All are based on ENERGY STAR 2.0 in whole or in part, as described below.

On May 21, 2018, Vermont adopted legislation for commercial dishwashers, setting standards for commercial dishwashers among other appliances.¹⁰ The standard adopted by the general assembly of Vermont requires that starting July 1, 2020, commercial dishwashers that meet the scope defined by ENERGY STAR and are sold or installed in Vermont comply with the requirements explained in ENERGY STAR Version 2.0 specifications for commercial dishwashers.

On May 30, 2019, Colorado adopted legislation for commercial dishwashers, setting standards for commercial dishwashers amongst other appliances.¹¹ The standard adopted by the seventy-second general assembly of the state of Colorado requires that starting January 1, 2021, commercial dishwashers sold in Colorado and included in the scope of the ENERGY STAR program must meet the qualifications specified in the ENERGY STAR Version 2.0 specifications.

On August 28, 2020, the Oregon Department of Energy approved and filed a permanent administrative order with the Office of the Secretary of State (DOE 2-2020) with its effective date of September 1, 2021.¹² The order, DOE 2-2020, requires that commercial dishwashers included in the scope of the ENERGY STAR program meet the qualifications specified in the ENERGY STAR Version 2.0 specifications.

On December 16, 2020, New Jersey introduced Assembly Bill No. A5160, where commercial dishwasher standards were included.¹³ New Jersey's bill No. A5160 was passed January 18,

10 [No. 139. An Act Relating to Appliance Efficiency, Energy Planning, and Electric Vehicle Parking](https://legislature.vermont.gov/Documents/2018/Docs/ACTS/ACT139/ACT139%20As%20Enacted.pdf), <https://legislature.vermont.gov/Documents/2018/Docs/ACTS/ACT139/ACT139%20As%20Enacted.pdf>.

11 [A Bill for an Act Concerning Efficiency Standards for Equipment Sold in Colorado, and, in Connection Therewith, Requiring Certain Appliances, Plumbing Fixtures, and Other Products Sold for Residential or Commercial Use to Meet Energy Efficiency and Water Efficiency Standards](https://leg.colorado.gov/sites/default/files/documents/2019A/bills/2019a_1231_rer.pdf), https://leg.colorado.gov/sites/default/files/documents/2019A/bills/2019a_1231_rer.pdf.

12 [Minimum Energy Efficiency Standards for State-Regulated Appliances and Equipment](https://secure.sos.state.or.us/oard/displayDivisionRules.action?selectedDivision=1103), <https://secure.sos.state.or.us/oard/displayDivisionRules.action?selectedDivision=1103>.

13 [Assembly, No. 5160, State of New Jersey 219th Legislature](https://www.njleg.state.nj.us/bill-search/2020/A5160), <https://www.njleg.state.nj.us/bill-search/2020/A5160>.

2022, requiring that any commercial dishwasher sold or installed no later than a year after the date of enactment of A5160 meets ENERGY STAR Version 2.0 specifications.

On December 22, 2020, the District of Columbia adopted Amendment D.C Act 23-539. Act 23-539 requires that all new commercial dishwashers sold, leased, rented, or offered for sale, lease, or rent, or installed that are included in the scope of the ENERGY STAR program shall meet the specifications of the Version 2.0 requirements for commercial dishwashers of the ENERGY STAR program effective a year after with an effective date of a year after it is signed by the governor.

On February 25, 2021, and February 26, 2021, Bills S0339 and H5966 relating to public utilities and carriers appliance and equipment energy and water efficiency standards act of 2021 were introduced to the Senate Commerce and the House Environment and Natural Resources respectively for the State of Rhode Island.¹⁴ Both were adopted July 12, 2021, requiring commercial dishwashers that meet the scope of ENERGY STAR, purchased or installed after January 1, 2023, to comply with ENERGY STAR Version 2.0 requirements for commercial dishwashers.

On March 26, 2021, the governor of the Commonwealth of Massachusetts signed into law an act creating a next-generation roadmap for Massachusetts climate policy that included standards for commercial dishwashers.¹⁵ The bill requires that commercial dishwashers that are included within the scope of the ENERGY STAR program shall meet the specifications set in ENERGY STAR's Version 2.0 requirements for commercial dishwashers, effective January 1, 2022.

On July 1, 2021, Assembly Bill No. 383 was adopted by the State of Nevada amending Chapter 701 of the Nevada Revised Statutes (NRS). The Nevada Revised Statute (NRS) 701.768, requires that on or after July 1, 2023, a new regulated commercial dishwasher may not be sold, leased or rented in Nevada unless it meets or exceeds the minimum standards of energy efficiency established by the director.¹⁶ The minimum standard established by NRS 701.768 requires that commercial dishwashers included in the scope of Version 2.0 of the ENERGY STAR program must meet criteria of that specification.

On February 3, 2022, House Bill (HB) 772, Maryland Energy Administration-Energy and Water Efficiency Standards – Alterations was introduced.¹⁷ House bill 772 was enacted under Article

14 [2021—S0339 Substitute A, State of Rhode Island, An Act relating to public utilities and carriers—Appliance and Equipment Energy and Water Efficiency Standards Act of 2021,](http://webserver.rilin.state.ri.us/BillText/BillText21/SenateText21/S0339A.pdf)
[http://webserver.rilin.state.ri.us/BillText/BillText21/SenateText21/S0339A.pdf.](http://webserver.rilin.state.ri.us/BillText/BillText21/SenateText21/S0339A.pdf)

15 [2021 – H5966 Substitute A, State of Rhode Island, An Act relating to public utilities and carriers- Appliance and Equipment Energy and Water Efficiency Standards Act of 2021,](http://webserver.rilin.state.ri.us/BillText/BillText21/HouseText21/H5966A.pdf)
[http://webserver.rilin.state.ri.us/BillText/BillText21/HouseText21/H5966A.pdf.](http://webserver.rilin.state.ri.us/BillText/BillText21/HouseText21/H5966A.pdf)

16 [An Act creating a next-generation roadmap for Massachusetts climate policy,](https://malegislature.gov/Bills/192/S9)
[https://malegislature.gov/Bills/192/S9.](https://malegislature.gov/Bills/192/S9)

17 [NRS 701.768 Establishment and amendment of minimum standards for regulated appliances and methods for verifying compliance; effective date; prohibition on sale, lease, rental or installation for compensation of new noncompliant appliances; regulations,](https://www.leg.state.nv.us/nrs/nrs-701.html#NRS701Sec768)
[https://www.leg.state.nv.us/nrs/nrs-701.html#NRS701Sec768.](https://www.leg.state.nv.us/nrs/nrs-701.html#NRS701Sec768)

18 [House Bill 772 Maryland Energy Administration – Energy and Water Efficiency Standards – Alterations,](https://mgaleg.maryland.gov/2022RS/Chapters_noln/CH_564_hb0772t.pdf)
[https://mgaleg.maryland.gov/2022RS/Chapters_noln/CH_564_hb0772t.pdf.](https://mgaleg.maryland.gov/2022RS/Chapters_noln/CH_564_hb0772t.pdf)

II, § 17(c) of the Maryland Constitution on May 29, 2022. HB 772 specifies beginning on January 1, 2024, a new commercial dishwasher that sold off offered for sale in the state that meets the applicable qualification criteria specified in the ENERGY STAR must meet the requirements specified in ENERGY STAR Version 2.0 for Commercial Dishwashers.

On August 7, 2023, the amendments of Colorado House Bill HB23-1161 became effective. The amendments remove reference to “Version 2.0,” effectively making the latest ENERGY STAR efficiency limit as Colorado’s state efficiency threshold for commercial dishwashers.

Federal Standards

On April 24, 2024, the U.S. Department of Energy (DOE) published a final rule updating the standards for consumer products that meet the definition of “dishwasher” as codified into 10 CFR Section 430.2.¹⁸ According to 10 CFR § 430.2 a “dishwasher means a cabinet-like appliance which with the aid of water and detergent, washes, rinses, and dries (when a drying process is included) dishware, glassware, eating utensils, and most cooking utensils by chemical, mechanical and/or electrical means and discharges to the plumbing drainage system.”

The updated standards require that starting April 23, 2027, standard-size dishwashers consume at most 223 kilowatt-hours (kW) per year and use a maximum of 3.3 gallons per cycle. The update also prescribes that compact-size dishwashers consume at most 174 kW per year and 3.1 gallons per cycle. The updated standards, as well as the current standards, apply only to consumer products.

Currently, under Part 431 of Subchapter D of Chapter II of 10 CFR (10 CFR §431.1), which covers standards and regulations for commercial and industrial equipment does not have any required standards for commercial dishwashers. Furthermore, the U.S. Congress has not included commercial dishwashers as an appliance listed or covered under the Energy Policy and Conservation Act (EPCA), which gives the authority to the U.S. Department of Energy in the development, revision, and implementation of minimum energy conservation standards for appliances and equipment. Therefore, CEC staff has concluded that there are no federal regulations that would preempt the state of California in pursuing and implementing minimum efficiency standards for commercial dishwashers under the Warren-Alquist Act.

California Regulations

The State of California does not have efficiency regulations for commercial dishwashers in the California Code of Regulations (CCR), Title 20. The only standards for commercial dishwashers reflected in CCR Title 20 are those published by DOE and reflected under Section 1605.1(o) for consumer products.

¹⁸ [2024-04-24 Energy Conservation Program: Energy Conservation Standards for Dishwashers; Direct final rule](https://www.regulations.gov/document/EERE-2019-BT-STD-0039-0065), <https://www.regulations.gov/document/EERE-2019-BT-STD-0039-0065>.

Voluntary Energy Efficiency Requirements

ENERGY STAR Version 2.0 Commercial Dishwashers Requirements

Commercial dishwasher types within the scope of ENERGY STAR Version 2.0 requirements include undercounter; single tank door-type; pot, pan, and utensil; glass-washing; single tank conveyor; multiple tank conveyor; and flight type commercial dishwashers.¹⁹ Sub-types include high- and low-temperature sanitizing machines; chemical dump type; and dual-sanitizing commercial dishwashers.

ENERGY STAR Version 2.0 excludes dishwashers intended for use in residential or laboratory applications. This version also excludes or prevents steam, gas, and other nonelectric models from ENERGY STAR qualification under this version.

Table 3-1 delineates the energy and water requirements under ENERGY STAR Version 2.0 for commercial dishwashers.

Table 3-1: ENERGY STAR Requirements for Commercial Dishwashers V2.0

Machine Type	High temp Idle Energy Rate	High temp Water Consumption	Low temp Idle Energy Rate	Low temp Water Consumption
Undercounter	≤ 0.50 kW	≤ 0.86 GPR	≤ 0.50 kW	≤ 1.19 GPR
Door Type	≤ 0.70 kW	≤ 0.89 GPR	≤ 0.60 kW	≤ 1.18 GPR
Pot, Pan, and Utensil	≤ 1.20 kW	≤ 0.58 GPSF	≤ 1.00 kW	≤ 0.58 GPSF
Single Tank Conveyor	≤ 1.50 kW	≤ 0.70 GPR	≤ 1.50 kW	≤ 0.79 GPR
Multiple Tank Conveyor	≤ 2.25 kW	≤ 0.54 GPR	≤ 2.00 kW	≤ 0.54 GPR
Single Tank Flight type	Reported	GPH ≤ (2.975x + 55.00)	Reported	GPH ≤ (2.975x + 55.00)
Multiple Tank Flight type	Reported	GPH ≤ (4.96x + 17.00)	Reported	GPH ≤ (4.96x + 17.00)

GPR = gallons per rack; GPSF = gallons per square foot of rack; GPH = gallons per hour; x = sf of conveyor belt (i.e., W*L)/min (max conveyor speed)

Source: Energy Star Eligibility Criteria Version 2.0

¹⁹ [Commercial Dishwashers Final Version 2.0 Specification](https://www.energystar.gov/sites/default/files/specs//private/ENERGY%20STAR_CD_V2.0_Final%20Specification.pdf),

https://www.energystar.gov/sites/default/files/specs//private/ENERGY%20STAR_CD_V2.0_Final%20Specification.pdf.

ENERGY STAR Version 3.0 Commercial Dishwashers

Commercial dishwashers within the scope of the ENERGY STAR Version 3.0 are undercounter; single-tank door-type; pot, pan, and utensil; glass-washing; single-tank conveyor; multiple-tank conveyor; and flight type commercial dishwashers.²⁰

ENERGY STAR Version 3.0 excludes dishwashers intended for use in residential or laboratory applications. This version also excludes or prevents steam, gas, and other nonelectric models from ENERGY STAR qualification under this version.

Tables 3-2 and **3-3** delineate the ENERGY STAR Version 3.0 requirements for low- and high-temperature sanitation commercial dishwashers respectively.

Table 3-2: ENERGY STAR Requirements for Commercial Dishwashers V3.0 (Low Temperature)

Machine Type	Idle Energy Rate	Washing Energy	Water Consumption
Undercounter	≤ 0.25 kW	≤ 0.15 kWh/rack	≤ 1.19 GPR
Door type	≤ 0.30 kW	≤ 0.15 kWh/rack	≤ 1.18 GPR
Single Tank Conveyor	≤ 0.85 kW	≤ 0.16 kWh/rack	≤ 0.79 GPR
Multiple Tank Conveyor	≤ 1.00 kW	≤ 0.22 kWh/rack	≤ 0.54 GPR

GPR = Gallons per rack

Source: ENERGY STAR Eligibility Criteria Version 3.0

²⁰ [ENERGY STAR Commercial Dishwashers Version 3.0 Specifications](https://www.energystar.gov/sites/default/files/Commercial%20Dishwashers%20Version%203.0%20Specification%20%28Rev.%20-%20September%202021%29.pdf),

<https://www.energystar.gov/sites/default/files/Commercial%20Dishwashers%20Version%203.0%20Specification%20%28Rev.%20-%20September%202021%29.pdf>.

**Table 3-3: ENERGY STAR Requirements for Commercial Dishwashers V3.0
(High Temperature)**

Machine Type	Idle Energy Rate	Washing Energy	Water Consumption
Undercounter	≤ 0.30 kW	≤ 0.35 kWh/rack	≤ 0.85 GPR
Door Type	≤ 0.55 kW	≤ 0.35 kWh/rack	≤ 0.89 GPR
Pot, Pan, and Utensil	≤ 0.90 kW	$\leq 0.55+0.05(SF_{rack})$	≤ 0.58 GPSF
Single Tank Conveyor	≤ 1.20 kW	≤ 0.36 kWh/rack	≤ 0.70 GPR
Multiple Tank Conveyor	≤ 1.85 kW	≤ 0.36 kWh/rack	≤ 0.54 GPR
Single Tank Flight Type	Reported	Reported	$GPH \leq (2.975x) + 55.00$
Multiple Tank Flight Type	Reported	Reported	$GPH \leq (4.96 x) + 17.00$

GPR = Gallons per rack, GPSF = Gallons per Square Foot, SF_{rack} = Square Feet Rack Area, x = maximum conveyor speed (ft/min) * conveyor belt width (ft)

Source: ENERGY STAR Eligibility Criteria Version 3.0

CHAPTER 4:

Alternative Considerations

CEC staff considered different potential standards to achieve energy and water savings for commercial dishwashers, including those submitted during the Request for Information (RFI) and Invitation to Submit Proposals (ITSP) for Commercial Food Service Equipment published November 14, 2023.²¹

Baseline: No Standard

Under baseline conditions, the CEC would not implement efficiency standards or test procedures for commercial dishwashers. No costs nor benefits would be realized. Although 53 percent of the commercial dishwashers shipped in the United States meet the requirements of ENERGY STAR Version 3.0, not setting standards for commercial dishwashers would represent a lost opportunity for fossil gas, electricity, and water savings in California and would not be in line with the state's energy efficiency, greenhouse gas emissions, and building decarbonization goals.

ENERGY STAR Version 2.0 for Commercial Dishwashers

During the RFI and ITSP comment period, some stakeholders recommended the implementation of the ENERGY STAR Version 2.0 requirements as California's standard for commercial dishwashers. CEC staff reviewed the energy savings and cost-effectiveness based on the ENERGY STAR Version 2.0 requirements as depicted in **Table 4-1**. Using the same analysis as the one used for the staff proposal in Chapter 6, CEC staff calculated total electricity savings for this alternative of about 123 gigawatt-hours per year (GWh/yr) at full stock turnover, which ranges between 12 to 20 years depending on the type of the commercial dishwasher. CEC staff also calculated that the life-cycle net benefit would range from about \$2,000 to a maximum of roughly \$321,000, depending on the type of commercial dishwashers.

Although the electricity savings of ENERGY STAR Version 2.0 requirements and scope are significant, staff did not use them as the basis of the standards proposal since those requirements only address the idle electricity consumption of commercial dishwashers, and do not address the electricity consumption while washing (washing energy). CEC staff believe additional feasible and cost-effective savings are possible by addressing washing energy and by increasing the scope of coverage to include fossil gas and steam units.

21 California Energy Commission. "[Request for Information for Commercial Food Service Equipment](https://efiling.energy.ca.gov/GetDocument.aspx?tn=253089&DocumentContentId=88297)," <https://efiling.energy.ca.gov/GetDocument.aspx?tn=253089&DocumentContentId=88297>.

Table 4-1: ENERGY STAR Requirements for Commercial Dishwasher Version 2.0

Machine Type	High temp	High temp	Low temp	Low temp
	Idle Energy Rate	Water Consumption	Idle Energy Rate	Water Consumption
Undercounter	≤ 0.50 kW	≤ 0.86 GPR	≤ 0.50 kW	≤ 1.19 GPR
Door Type	≤ 0.70 kW	≤ 0.89 GPR	≤ 0.60 kW	≤ 1.18 GPR
Pot, Pan, and Utensil	≤ 1.20 kW	≤ 0.58 GPSF	≤ 1.00 kW	≤ 0.58 GPSF
Single Tank Conveyor	≤ 1.50 kW	≤ 0.70 GPR	≤ 1.50 kW	≤ 0.79 GPR
Multiple Tank Conveyor	≤ 2.25 kW	≤ 0.54 GPR	≤ 2.00 kW	≤ 0.54 GPR
Single Tank Flight type	Reported	GPH ≤ (2.975x + 55.00)	Reported	GPH ≤ (2.975x + 55.00)
Multiple Tank Flight type	Reported	GPH ≤ (4.96x + 17.00)	Reported	GPH ≤ (4.96x + 17.00)

GPR = gallons per rack; GPSF = gallons per square foot of rack; GPH = gallons per hour; x = sf of conveyor belt (i.e., W*L)/min (max conveyor speed)

Source: ENERGY STAR Eligibility Criteria Version 2.0

ENERGY STAR Version 3.0 for Commercial Dishwashers

During the RFI and ITSP comment period, some stakeholders recommended adopting ENERGY STAR Version 3.0 as California’s standard for commercial dishwashers. CEC staff reviewed the energy savings and cost-effectiveness resulting from the thresholds set by ENERGY STAR Version 3.0 as depicted in **Tables 4-2** and **4-3**. As presented in Chapter 6, CEC staff determined that the thresholds set by ENERGY STAR Version 3.0 yield a greater benefit to the State of California than ENERGY STAR Version 2.0 and will result in positive life-cycle net benefit-to-cost ratios for all types of commercial dishwashers analyzed. However, the scope of ENERGY STAR Version 3.0 is limited to units that only use electricity and excludes those that use fossil gas and steam. CEC staff believe additional feasible and cost-effective savings are possible by increasing the scope of coverage to include fossil gas and steam units, as described in Chapters 5 and 6.

Table 4-2: ENERGY STAR Requirements for Commercial Dishwashers V3.0 (Low Temperature)

Machine Type	Idle Energy Rate	Washing Energy	Water Consumption
Undercounter	≤ 0.25 kW	≤ 0.15 kWh/rack	≤ 1.19 GPR
Door Type	≤ 0.30 kW	≤ 0.15 kWh/rack	≤ 1.18 GPR
Single-Tank Conveyor	≤ 0.85 kW	≤ 0.16 kWh/rack	≤ 0.79 GPR
Multiple-Tank Conveyor	≤ 1.00 kW	≤ 0.22 kWh/rack	≤ 0.54 GPR

GPR = Gallons per Rack

Source: ENERGY STAR Eligibility Criteria Version 3.0

Table 4-3: ENERGY STAR Requirements for Commercial Dishwashers V3.0 (High Temperature)

Machine Type	Idle Energy Rate	Washing Energy	Water Consumption
Undercounter	≤ 0.30 kW	≤ 0.35 kWh/rack	≤ 0.85 GPR
Door Type	≤ 0.55 kW	≤ 0.35 kWh/rack	≤ 0.89 GPR
Pot, Pan, and Utensil	≤ 0.90 kW	≤ 0.55+0.05(SF _{rack})	≤ 0.58 GPSF
Single-Tank Conveyor	≤ 1.20 kW	≤ 0.36 kWh/rack	≤ 0.70 GPR
Multiple-Tank Conveyor	≤ 1.85 kW	≤ 0.36 kWh/rack	≤ 0.54 GPR
Single-Tank Flight Type	Reported	Reported	GPH ≤ (2.975x) + 55.00
Multiple-Tank Flight Type	Reported	Reported	GPH ≤ (4.96 x) + 17.00

GPR = Gallons per Rack, GPSF = Gallons per Square Foot, SF_{rack} = Square Feet Rack Area, x = maximum conveyor speed (ft/min) * conveyor belt width (ft)

Source: ENERGY STAR Eligibility Criteria Version 3.0

CHAPTER 5:

Staff Proposal

Scope

Staff's proposed standards cover commercial dishwashers that use low-temperature machines, also known as chemical sanitation, as well as high-temperature machines that use water above 180 °F as the method of sanitation. A commercial dishwasher, as explained in Chapter 2, differs from consumer counterpart on their speed to wash and sanitize, the type loading system used (rack or rack less), and the type of sanitation used by the machine. The proposed standard will include high-temperature commercial dishwashers that use electricity, fossil gas, or steam. The proposal does not cover consumer products covered under subpart C of Part 430 of title 10 of the Code of Federal Regulations (i.e. §430.32(f)) and laboratory dishwashers. Laboratory dishwashers are specialized units designed with specific construction materials, cleaning process, water circulation, deionized water rinsing, specialized racks and injection, high temperature water (200°F), and specialized drying to prevent contaminants that could affect experimental results.

Staff's proposed standards cover the idle energy, washing energy, and water consumption under the proposed standard for undercounter commercial dishwashers; glass-washing commercial dishwashers that use a 20-inch by 20-inch stationary rack, door-type commercial dishwashers, PPUs, and single- and multiple-tank conveyor dishwashers. Further, CEC staff proposed flight-type commercial dishwashers comply with the proposed standard for water consumption only and that such commercial dishwashers report only idle energy and washing energy.

CEC staff proposes excluding glasswashers that do not use or accommodate a standard 20-inch by 20-inch stationary rack as explained in ASTM F1696-20 "Standard Test method for Energy Performance of Stationary-Rack, Door-Type Commercial Dishwashing Machines." Some examples of the proposed exclusions are carousel commercial glasswashers (**Figure 2-6**), conveyor commercial glasswashers (**Figure 2-7**), and batch rotary commercial glasswashers (**Figure 2-8**).

CEC staff propose using the ENERGY STAR Version 3.0 requirements for commercial dishwashers and applying the standard requirements to commercial dishwashers that use electricity, fossil gas, and steam.

Framework and Metrics

CEC staff's proposal will require that manufacturers test the basic model for each family type of dishwasher at its most energy consumptive set-up or mode. Manufacturers will use the results to calculate the idle energy, washing energy, and water consumption and submit those results for certification into CEC's appliance database.

CEC staff proposes that the metrics used to report the idle energy, washing energy, and water consumption be the same metrics used in the ENERGY STAR Version 3.0 requirements for commercial dishwashers. All dishwashers shall, under this proposal, report the idle energy in

kilowatts (kW) and the washing energy in kilowatt-hours per rack (kWh/rack) or kilowatt-hours per square foot (kWh/ft²), as applicable. The proposal will require the reporting of water consumption in gallons per rack (GPR), gallons per square foot (GPSF), or gallons per hour (GPH) depending on the type of commercial dishwasher that is being tested and certified to CEC’s appliance database.

Test Procedures

Stakeholders recommended two test procedures published by the American Society for Testing and Materials (ASTM) during the public comment period for the RFI and ITSP. Stakeholders recommended ASTM F1696-20 “Standard Test Method for Energy Performance of Stationary-Rack, Door-type Commercial Dishwashing Machines” (F1696-20), and ASTM F1920-20 “Standard Test Method for Performance Rack Conveyor Commercial Dishwashing Machines” (F1920-20).

Staff reviewed the recommended test procedures, F1696-20 and F1920-20, and concluded that the two test procedures generate the necessary data for certification of the proposed standard levels for the commercial dishwashers within the scope of the proposal and provide a meaningful representation of the day-to-day operation. CEC staff found that F1696-20 is an adequate test procedure for commercial dishwashers that have a stationary rack, such as undercounter, door-type, and PPU’s, while F1920-20 is adequate for testing single- and multiple tank conveyor commercial dishwashers and flight-type commercial dishwashers. Both test procedures have instructions on how to calculate the energy used from electricity, fossil gas as well as the energy provided by steam.

CEC staff therefore proposes the use of ASTM F1696-20 and ASTM F1920-20 to test commercial dishwashers with stationary racks and conveyor types, respectively.

Standard Levels

CEC staff proposes that commercial dishwashers within the scope of the proposal meet the minimum efficiency requirements of **Table 5-1** (Commercial Dishwashers Low-Temperature Standards) and **Table 5-2** (Commercial Dishwashers High-Temperature Standards) for idle energy, washing energy, and water consumption where applicable.

Table 5-1: Commercial Dishwashers Low-Temperature Standards

Machine Type	Idle Energy Rate	Washing Energy	Water Consumption
Undercounter	≤ 0.25 kW	≤ 0.15 kWh/rack	≤ 1.19 GPR
Door Type	≤ 0.30 kW	≤ 0.15 kWh/rack	≤ 1.18 GPR
Single-Tank Conveyor	≤ 0.85 kW	≤ 0.16 kWh/rack	≤ 0.79 GPR
Multiple-Tank Conveyor	≤ 1.00 kW	≤ 0.22 kWh/rack	≤ 0.54 GPR
Undercounter Glasswashers	≤ 0.25 kW	≤ 0.15 kWh/rack	≤ 1.19 GPR

kW = Kilowatt, kWh/rack = Kilowatt-hour per rack, GPR = Gallons per Rack

Source: CEC Staff

Table 5-2: Commercial Dishwashers High-Temperature Standards

Machine Type	Idle Energy Rate	Washing Energy	Water Consumption
Undercounter	≤ 0.30 kW	≤ 0.35 kWh/rack	≤ 0.85 GPR
Door Type	≤ 0.55 kW	≤ 0.35 kWh/rack	≤ 0.89 GPR
Pot, Pan, and Utensil	≤ 0.90 kW	$\leq 0.55+0.05(SF_{rack})$	≤ 0.58 GPSF
Single Tank Conveyor	≤ 1.20 kW	≤ 0.36 kWh/rack	≤ 0.70 GPR
Multiple Tank Conveyor	≤ 1.85 kW	≤ 0.36 kWh/rack	≤ 0.54 GPR
Single Tank Flight Type	Report only	Report only	$GPH \leq (2.975x) + 55.00$
Multiple Tank Flight Type	Report only	Report only	$GPH \leq (4.96 x) + 17.00$
Undercounter Glasswashers	≤ 0.30 kW	≤ 0.35 kWh/rack	≤ 0.85 GPR

kW = Kilowatt, kWh/rack = Kilowatt-hour per rack, GPR = Gallons per Rack, GPSF = Gallons per square foot, GPH = Gallons per hour
 Source: CEC Staff

Although the proposed test procedure generates, in some cases, units in British thermal units (BTU) or BTU per hour, the standard conversion factor of 3412 BTUs per kWh or 3412 BTU/hr per 1 kW, can be applied to express the results in kW or kWh/rack for certification.

Reporting Requirements

CEC staff proposes that manufacturers report:

- The type of commercial dishwasher.
- The rinse type.
- The idle energy consumed.
- If it is a single or dual-purpose machine.
- The washing energy consumed.
- Water consumption.
- Whether a heat recovery mechanism is present or not.
- If there is a heat recovery mechanism, the percentage of cold water and hot water that is being supplied.

As described in **Table 5-3**.

Table 5-3: Commercial Dishwasher Certification Fields

Required Information	Possible Answers
Commercial Dishwasher Type	Undercounter, Door-Type, PPU, Conveyor Single-Tank, Conveyor Multiple-Tank, Flight-Type Single-Tank, Flight-Type Multiple-Tank, Undercounter Commercial Glasswasher
Rinse Type	Low-Temperature, High-Temperature, or Dual-Sanitizing
Dual-Sanitizing	True, False
High-temperature Idle Energy (kW)	
High-temperature Washing Energy (kWh/rack)	
High-temperature Water Consumption (GPR, GPSF, or GPH) (for conveyor and flight types, report at maximum conveyor speed)	
Low-temperature Idle Energy (kW)	
Low-temperature Washing Energy (kWh/rack)	
Low-temperature Water Consumption (GPR, GPSF, or GPH) (for conveyor and flight types, report at maximum conveyor speed)	
Heat Recovery	True, False
Percentage Cold Water Supply (If heat recovery = True) (Percentage value must be $\geq 95\%$)	
Percentage Hot Water Supply (If heat recovery = True) (Percentage value must be $\leq 5\%$)	
Primary Hot Water Energy Offset (kWh/rack) (If heat recovery = True)	

Source: CEC Staff

CHAPTER 6:

Savings and Cost Analysis

Staff's proposed standards for commercial dishwashers would significantly reduce water and energy resource consumption (electricity and fossil gas). The CEC reviewed data from ENERGY STAR, the State Appliance Standards Database (SASD) from the Northeast Energy Efficiency Partnership (NEEP), and Indiana California Energy Wise Qualifying Foodservice Equipment for commercial dishwashers. CEC staff then gathered information from various specification sheets for commercial dishwasher models that are not ENERGY STAR certified from manufacturers that do participate in the ENERGY STAR program.²² CEC staff implemented different terms, assumptions, and rate forecasting for electricity and fossil gas, and an average water rate in this section. After reviewing the analysis, the proposed regulation is not considered a major regulation since its direct and indirect economic impacts do not exceed the \$50 million dollars within 12 months after full implementation of the regulation, as discussed in Senate Bill 617. The proposed standard has a first-year economic impact of approximately \$13 million, as discussed in this chapter, of direct economic savings. The proposed standard also has a possible maximum indirect benefit of \$19 million related to health benefits, as discussed in Chapter 8, for a total impact of approximately \$32 million of direct and indirect savings for the first after full implementation. Alternatively, the total impact associated with this proposal can be estimated by doubling the direct benefits to also account for the indirect benefits; the total impact of this proposal would then be \$26 million for the first year after full implementation. Considering both estimates of total impacts discussed (\$32 and 26 million), it can be concluded that the proposal will not trigger the \$50 million threshold set for a major regulation per SB 617 requiring a standardized regulatory impact assessment (SRIA).

Terms, Abbreviations, and General Assumptions

Since commercial dishwashers have different energy needs based on the system used for sanitation, the CEC analyzed and separated each type of dishwasher (that is, undercounter, door-type, single- and multiple-tank conveyor, single and multiple tank flight type, PPUs, and the applicable glasswashers) into the low- and high-temperature categories. CEC staff created abbreviations for the different types of commercial dishwashers analyzed. Following the example of ENERGY STAR, CEC staff analyzed each type of dishwasher for low-temperature (LT) and high-temperature (HT) categories. **Table 6-1** lists the abbreviations of the commercial dishwashers that are within the proposed scope discussed in [Chapter 5](#) and included in [Appendix B](#).

22 "Product Search." Northeast Energy Efficiency Partnerships State Appliance Standards Database (SASD), <https://spl.mendixcloud.com/index.html>.

Center Point Energy. Updated January 29, 2024. [Indiana CEW Qualifying Foodservice Equipment](https://www.centerpointenergy.com/en-us/Documents/Midwest/In-Bussiness/in_foodservice_CEW_List.pdf), https://www.centerpointenergy.com/en-us/Documents/Midwest/In-Bussiness/in_foodservice_CEW_List.pdf.

Table 6-1: Commercial Dishwashers Within Scope

Type of Machine	High-Temp	Low-Temp	Abbreviation
Undercounter	Yes	-	UC-HT
Undercounter	-	Yes	UC-LT
Door-type	Yes	-	DT-HT
Door-type	-	Yes	DT-LT
Conveyor single tank	Yes	-	CST-HT
Conveyor single tank	-	Yes	CST-LT
Conveyor multiple tank	Yes	-	CMT-HT
Conveyor multiple tank	-	Yes	CMT-LT
Flight type single tank	Yes	No	FST-HT
Flight type multiple tank	Yes	No	FMT-HT
Pots, Pans, and Utensils	Yes	No	PPU-HT
Undercounter Glasswasher	Yes	-	GWW-HT
Undercounter Glasswasher	-	Yes	GWW-LT

Yes = within scope, "-" = not applicable, No = out of scope

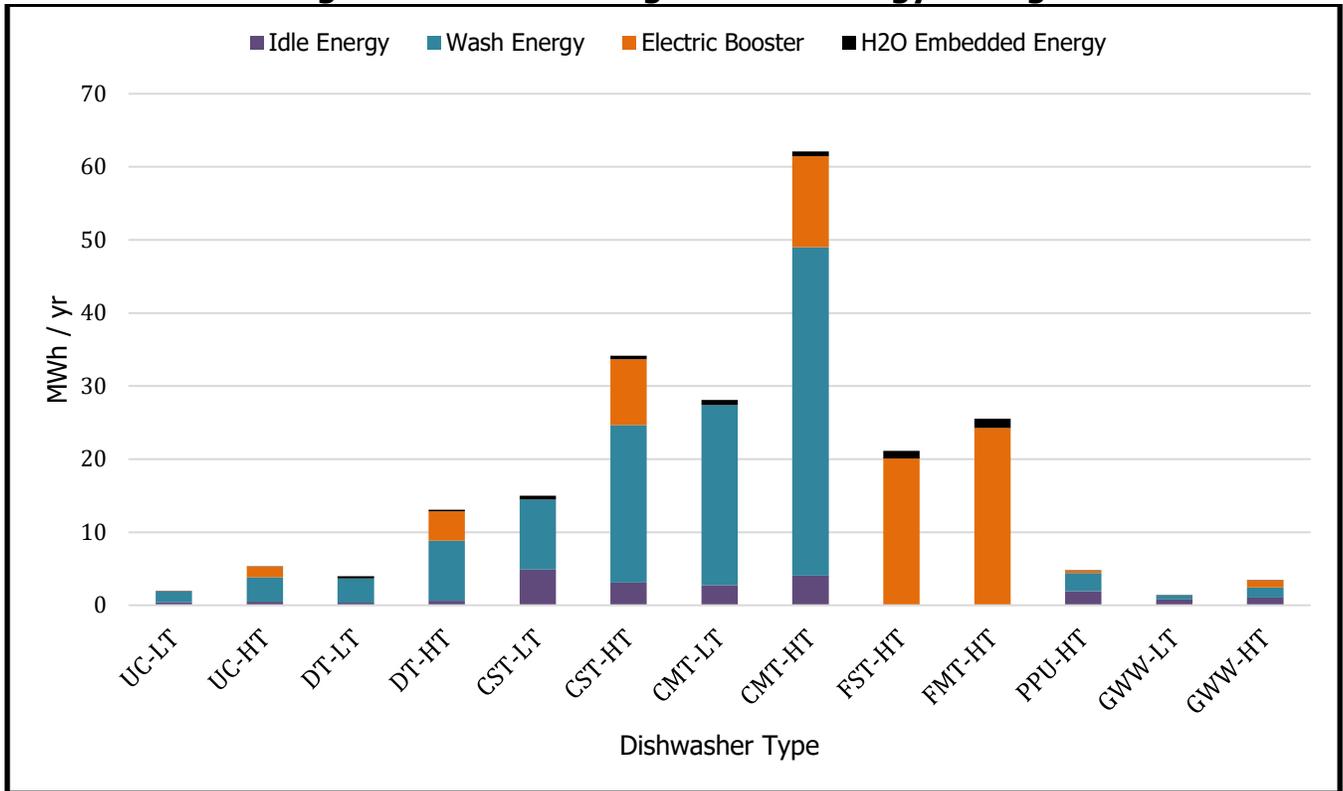
Source: CEC Staff

The State of California does not have standards for commercial dishwashers listed in the California Code of Regulations (Cal. Code of Regs.) Title 20. CEC staff therefore assessed the data received by stakeholders and data acquired from specification sheets of dishwashers available in the market to analyze the proposed standard. Staff analyzed each type listed in **Table 6-1** independently to assess the energy (electrical and fossil gas) and water savings including the net benefit for each unit.

Unit Energy and Water Savings

CEC staff calculated the average idle energy savings, average washing energy savings, average electric booster energy savings, and average energy embedded in potable water for each unit. (See **Table A-1**). **Figure 6-1** illustrates the total average electrical savings per unit.

Figure 6-1: Unit Average Electric Energy Savings



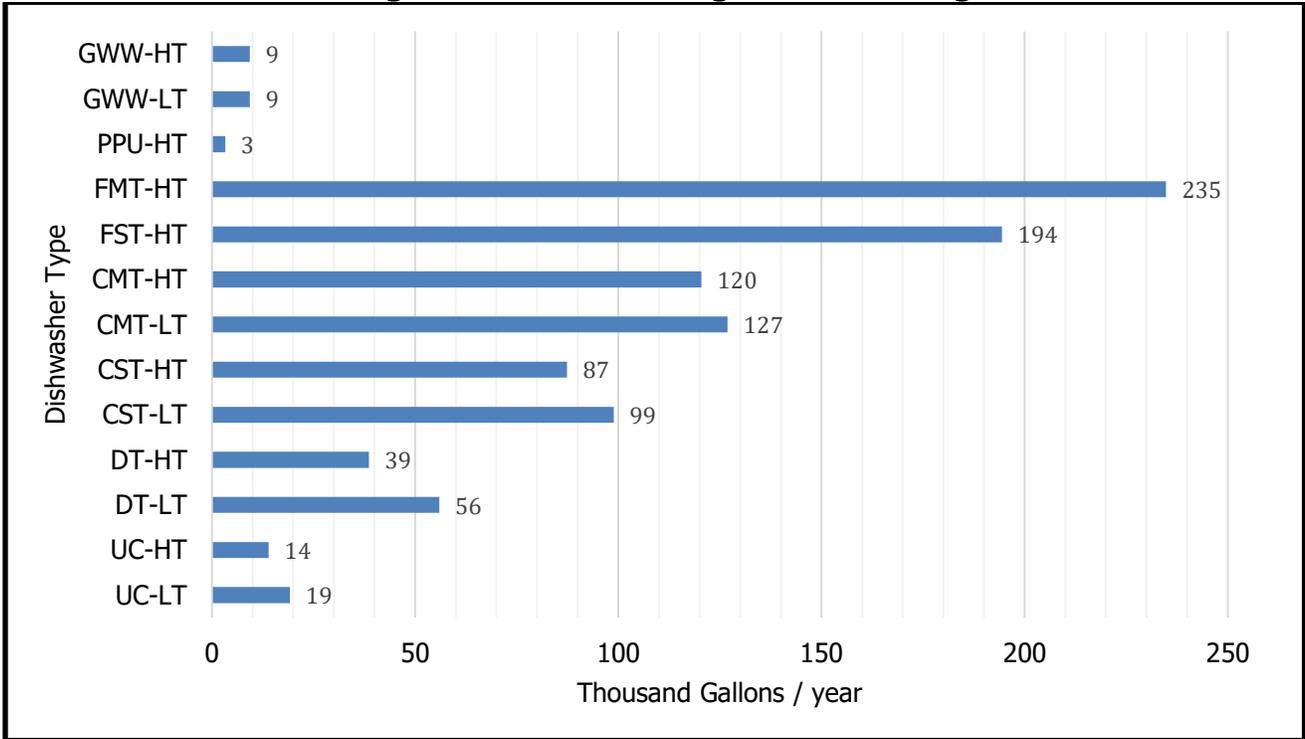
Source: CEC staff

The calculated unit average idle electrical energy varies between about 390 kWh per year to as much as about 4,800 kWh per year, depending on the type of dishwasher. For washing energy, staff calculated an average electrical savings per unit of about 561 kWh per year to roughly 45,000 kWh per year. The CEC calculated the average electrical savings for the high-temperature commercial dishwashers with an electrical booster ranging between 340 kWh per year to a maximum of about 24,000 kWh per year under the assumption of a 95 percent thermal efficient booster.

Moreover, because of the required electricity needed to move potable water to reach the consumer, around 5,440 kWh per million gallons, CEC staff calculated the embedded electricity saved per unit ranging from about 3 kWh per year to about 240 kWh per year. The total electrical energy saved calculated per unit when considering the idle, washing energy, electric booster, and the embedded energy in water varies between 1.4 megawatt-hours (MWh) per year to 62 MWh per year, depending on the type of commercial dishwasher as seen in **Figure 6-1**.

CEC staff calculated the anticipated water savings per unit for each commercial dishwasher type. The calculated average water savings represents the water savings for an entire year and was calculated to vary between about 3,000 gallons per year to as much as 235,000 gallons per year, as seen in **Figure 6-2**.

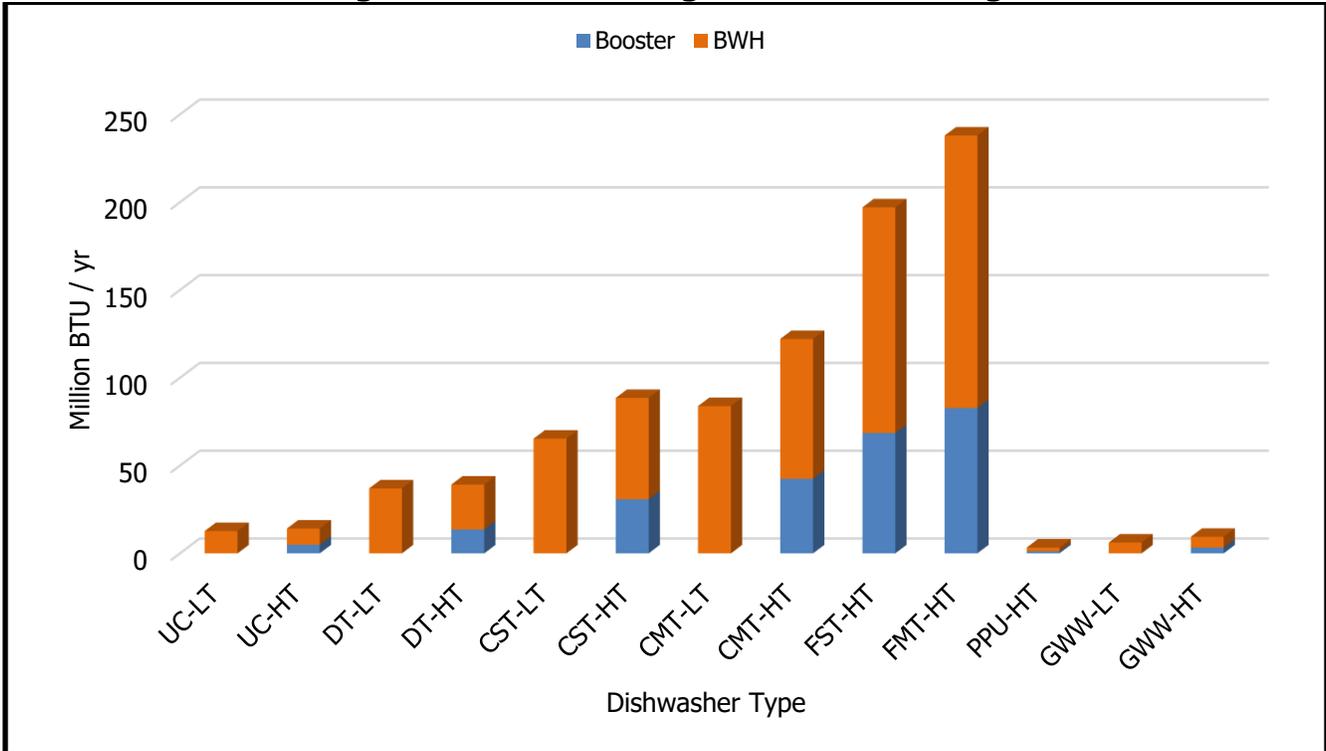
Figure 6-2: Unit Average Water Savings



Source: CEC staff

CEC staff also calculated the energy savings for commercial dishwashers that use fossil gas as the source of energy, including the heat used by the booster heater of the machine. The energy savings for fossil gas were calculated, assuming the water heater booster and the water heater of the building perform with a thermal efficiency of 95 percent, and have a change in temperature of 40°F and 75°F respectively. Using those assumptions and the savings associated with the volume of hot water savings, CEC staff calculated a unit average fossil gas savings that ranges from about 3.3 million (MM) BTU per year to 238 MM BTU per year, as seen in **Figure 6-3**.

Figure 6-3: Unit Average Fossil Gas Savings



Source: CEC staff

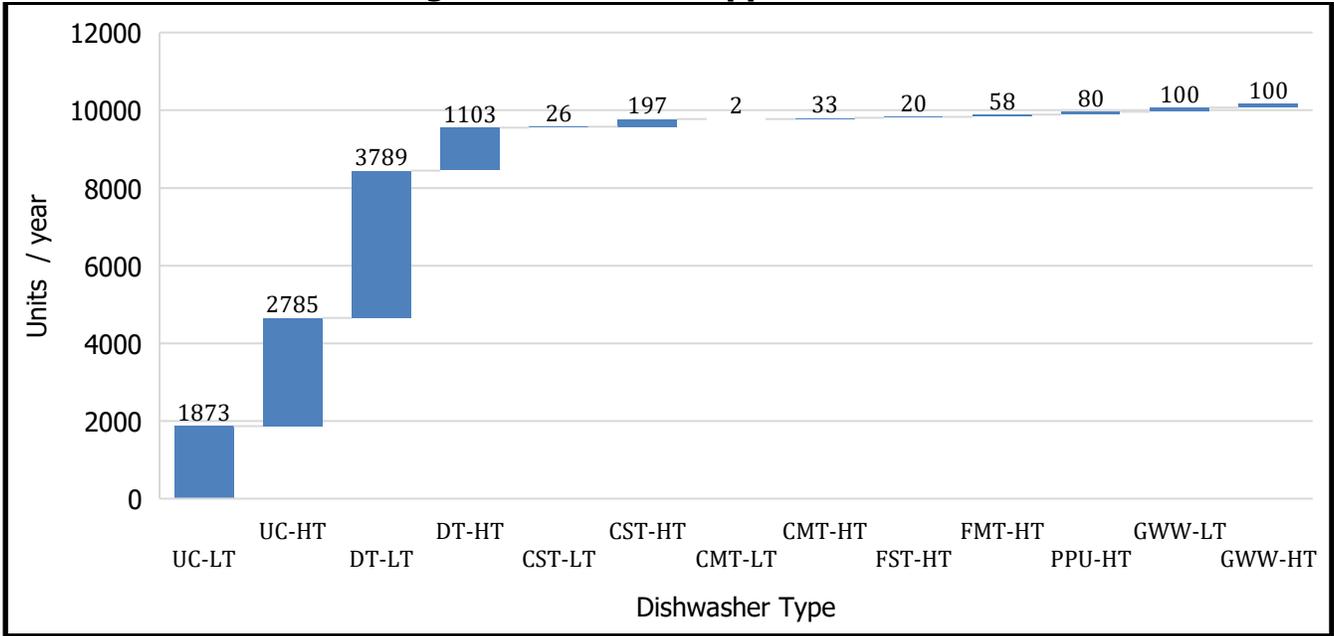
Utilities Savings

CEC staff calculated utility savings based on estimated annual shipment and full stock turnover, as seen in **Table A-5**, assuming a steady per year shipment rate due to the unpredictable sales growth in the food service industry due to the COVID-19 pandemic as seen in **Figure 6-4**. CEC staff therefore implemented the shipment data provided in the Analysis of Standards Proposal for Commercial Dishwashers submitted by the Code of Standards and Enhancement (CASE) initiative.²³

CEC staff implemented the same effective useful life as presented by the CASE team submittal for each type of commercial dishwashers, which varies between 12 to 20 years as seen in **Figure 6-5**.

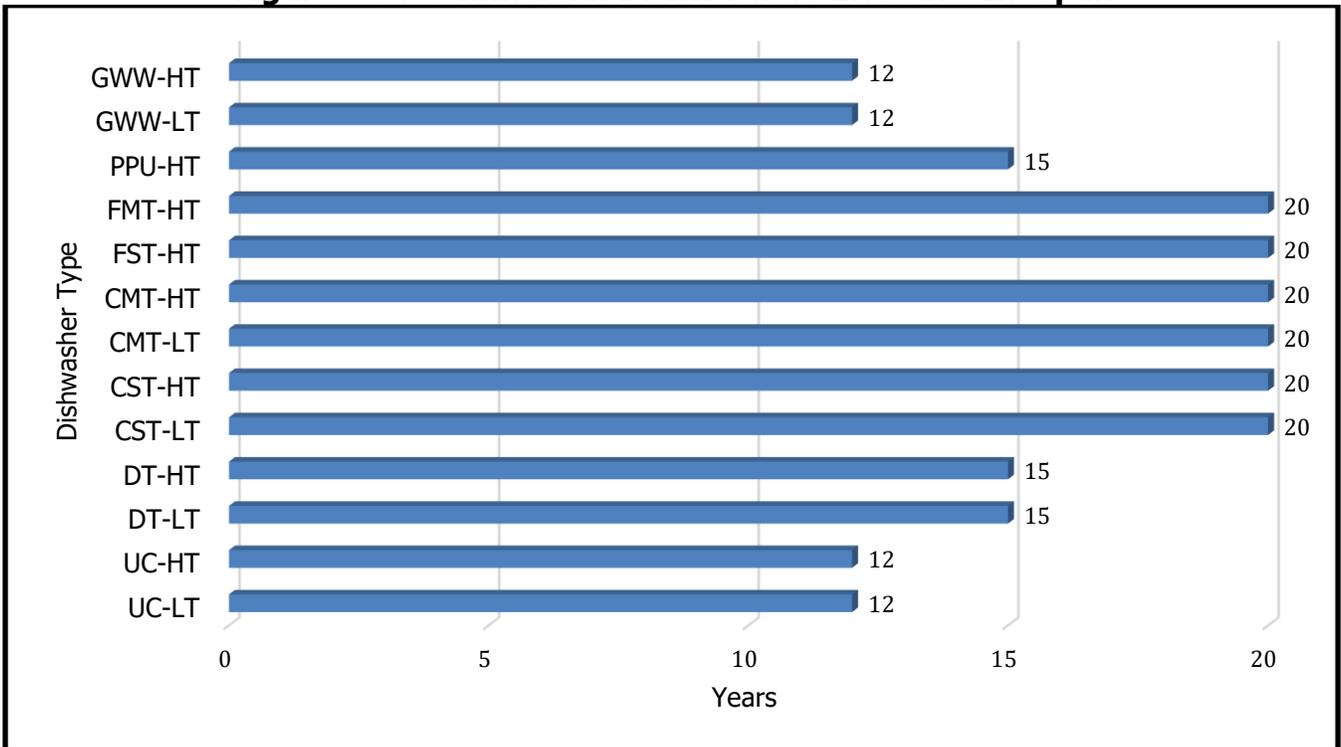
²³ [Analysis of Standards Proposal for Commercial Dishwashers](https://efiling.energy.ca.gov/GetDocument.aspx?tn=254440&DocumentContentId=89825), <https://efiling.energy.ca.gov/GetDocument.aspx?tn=254440&DocumentContentId=89825>

Figure 6-4: Units Shipped Per Year



Source: CEC staff

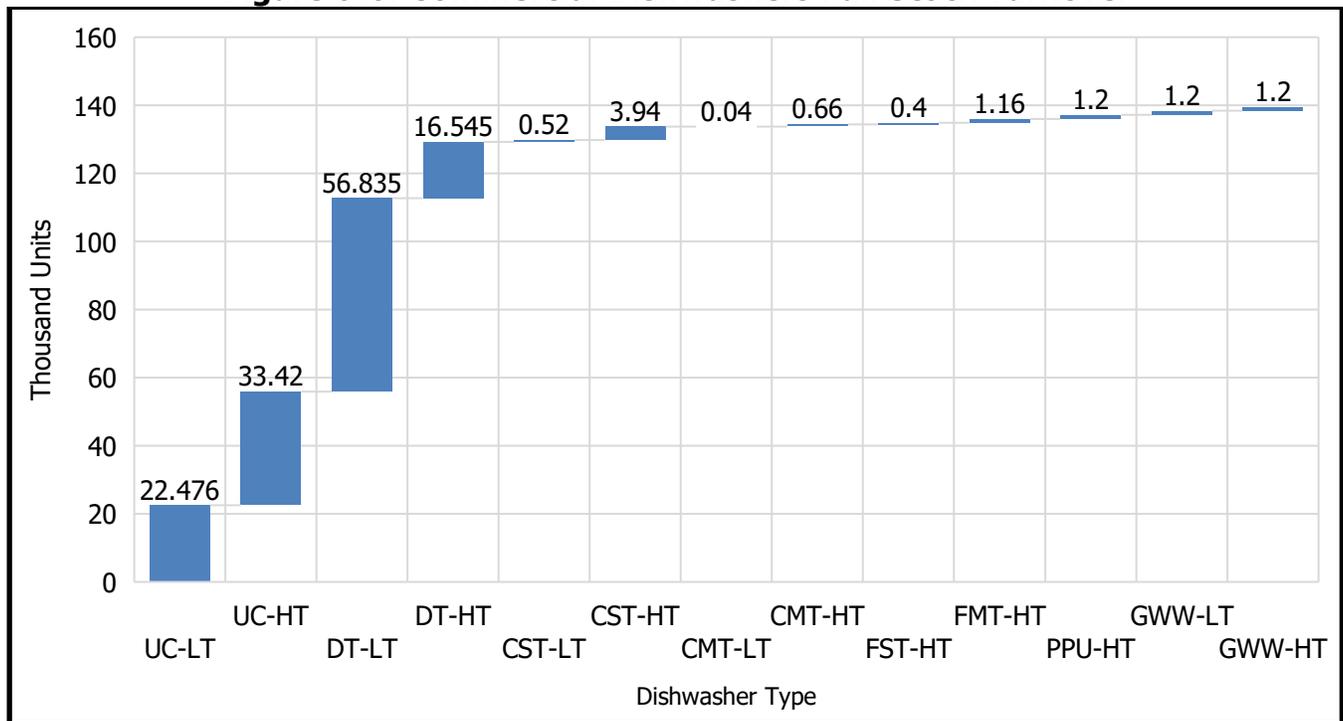
Figure 6-5: Commercial Dishwashers Effective Lifespan



Source: CEC staff

CEC staff calculated the full stock turnover in California achieved by the end of the effective lifespan for each type of commercial dishwasher. As such, it was calculated as the product of the shipments per year and the effective lifespan of each type of dishwasher. The full stock turnover varies between 40 and 57,000 units depending on the type of dishwasher as seen in **Figure 6-6**.

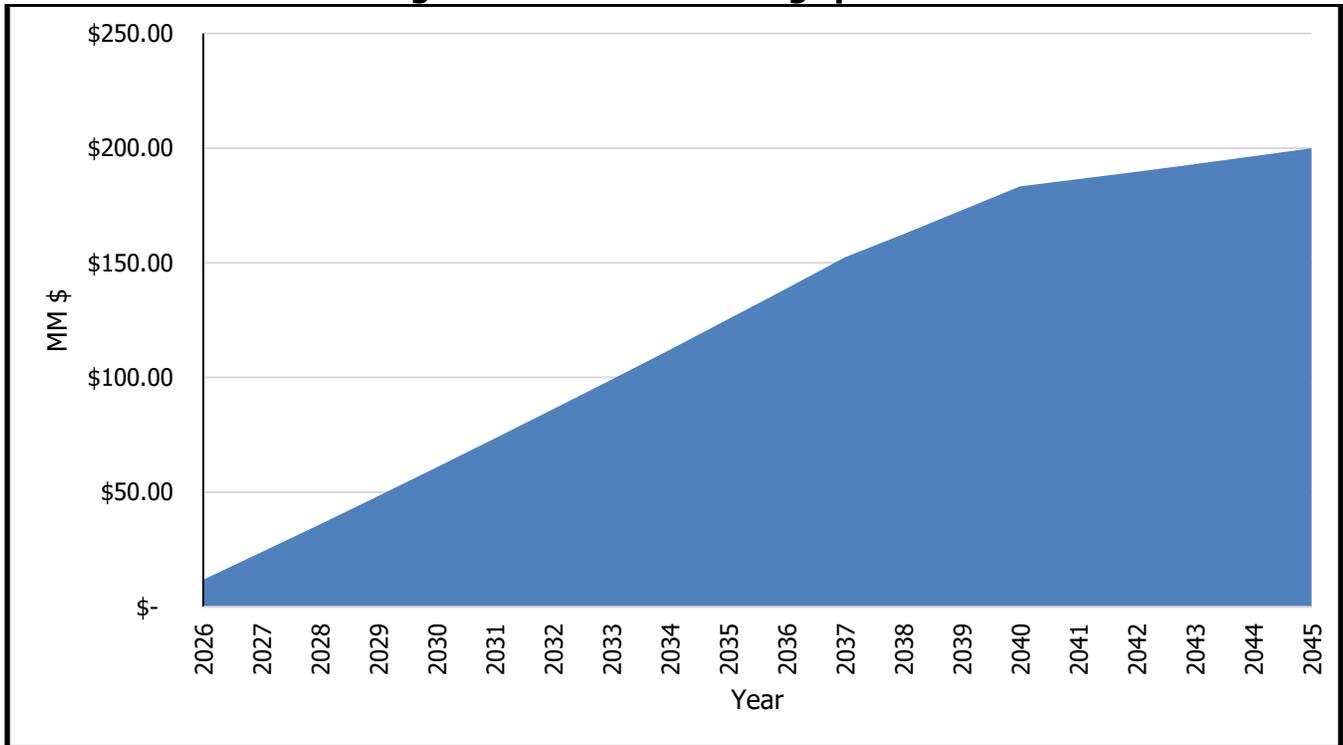
Figure 6-6: Commercial Dishwashers Full Stock Turnover



Source: CEC staff

When considering the number of units shipped in California, the effective lifespan of each unit, and the unit average electric, water, and fossil gas savings, the staff calculated the energy savings per year as described in **Figure 6-7**. The utility savings per year increase as more of the existing stock of commercial dishwashers is replaced with compliant units. The slope of the graph changes as the lifetime of commercial dishwashers varies between 12 and 20 years. When full stock turnover is reached in 2045, the utilities savings per year will remain constant indefinitely.

Figure 6-7: Utilities Savings per Year



Source: CEC staff

First-Year Savings

The first-year utilities savings is the approximate savings in utility bills for the shipped units within California for the first year of implementation of the proposed standard for the commercial dishwashers within the scope. The utility savings at full stock turnover is the estimated utility savings per year after full stock turnover is achieved in California, which is assumed to take place after the effective lifespan of each type of commercial dishwasher. CEC staff used the CEC’s forecasted rates for electricity and fossil gas of the California Energy Demand 2024–2040 reports.²⁴

In addition, CEC staff considered in its calculated savings the market penetration of the commercial dishwashers that currently meet the proposed standards according to the shipment information reported by ENERGY STAR since the proposed standards are equivalent to the thresholds used by the latest ENERGY STAR requirements for commercial dishwashers.²⁵ For more detail on the calculations performed, see Appendix A of this proposal.

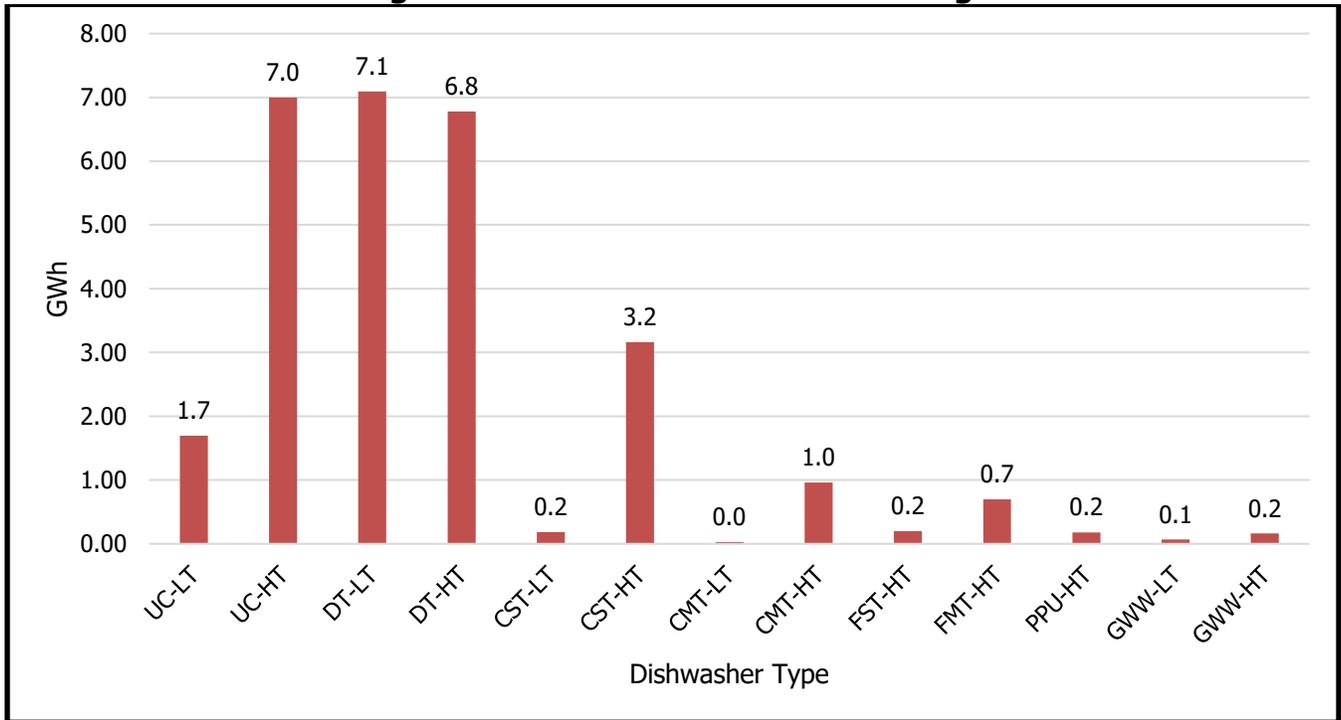
CEC staff calculated the first-year electricity savings ranging from 26 MWh to a maximum of 7.1 GWh, depending on the type of commercial dishwasher, as seen in **Figure 6-8**. The proposed standard will in total save about 28 GWh of electricity for the first year of implementation. The electrical savings include the idle energy, washing energy, electricity used

²⁴ [California Energy Demand 2024 Baseline Demand Forecast Files](https://www.energy.ca.gov/data-reports/reports/2024-integrated-energy-policy-report-update/2024-iepr-workshops-notice-and-0), <https://www.energy.ca.gov/data-reports/reports/2024-integrated-energy-policy-report-update/2024-iepr-workshops-notice-and-0>.

²⁵ [ENERGY STAR Unit Shipment and Market Penetration Report Calendar Year 2023 Summary](https://www.energystar.gov/sites/default/files/2024-09/2023%20Unit%20Shipment%20Data%20Summary%20Report_508.pdf), https://www.energystar.gov/sites/default/files/2024-09/2023%20Unit%20Shipment%20Data%20Summary%20Report_508.pdf.

by the booster, and the energy embedded in the water. As discussed previously, the presented electrical savings represent only 47 percent of the total savings due to the current 53 percent market penetration of compliant units.

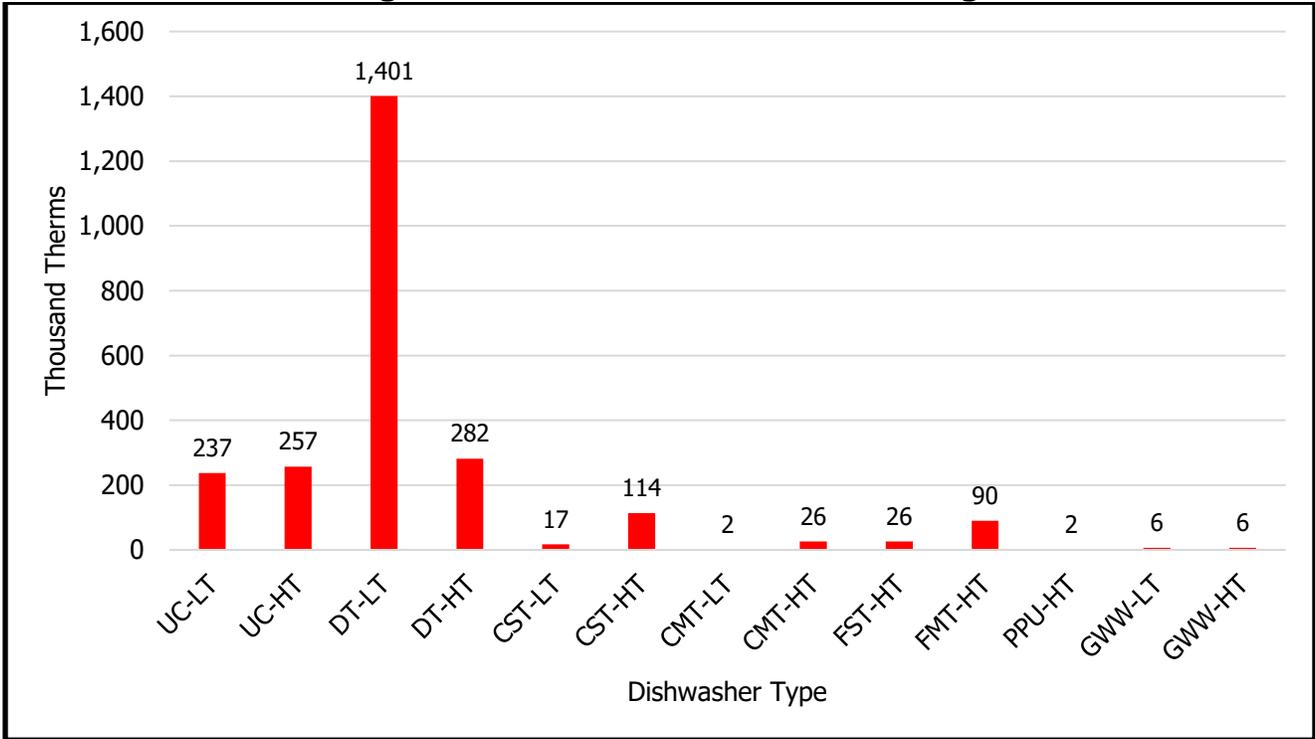
Figure 6-8: First Year Electrical Savings



Source: CEC staff

CEC staff also calculated the first-year energy savings for the commercial dishwashers that have models that use a fossil gas booster (including those that use steam) with the assumption that such units represent only 20 percent of the total shipments. The energy savings for fossil gas includes the fossil gas savings from a federally compliant commercial water heater and the fossil gas savings from a water heater booster, both with a thermal efficiency of 95 percent, as explained in Appendix A. The calculated first-year fossil gas savings fluctuate between 1,600 therms to a maximum of 1.4 MM therms, as described in **Figure 6-9**. The proposed standard will save about 2.5 million therms of fossil gas for the first year of implementation.

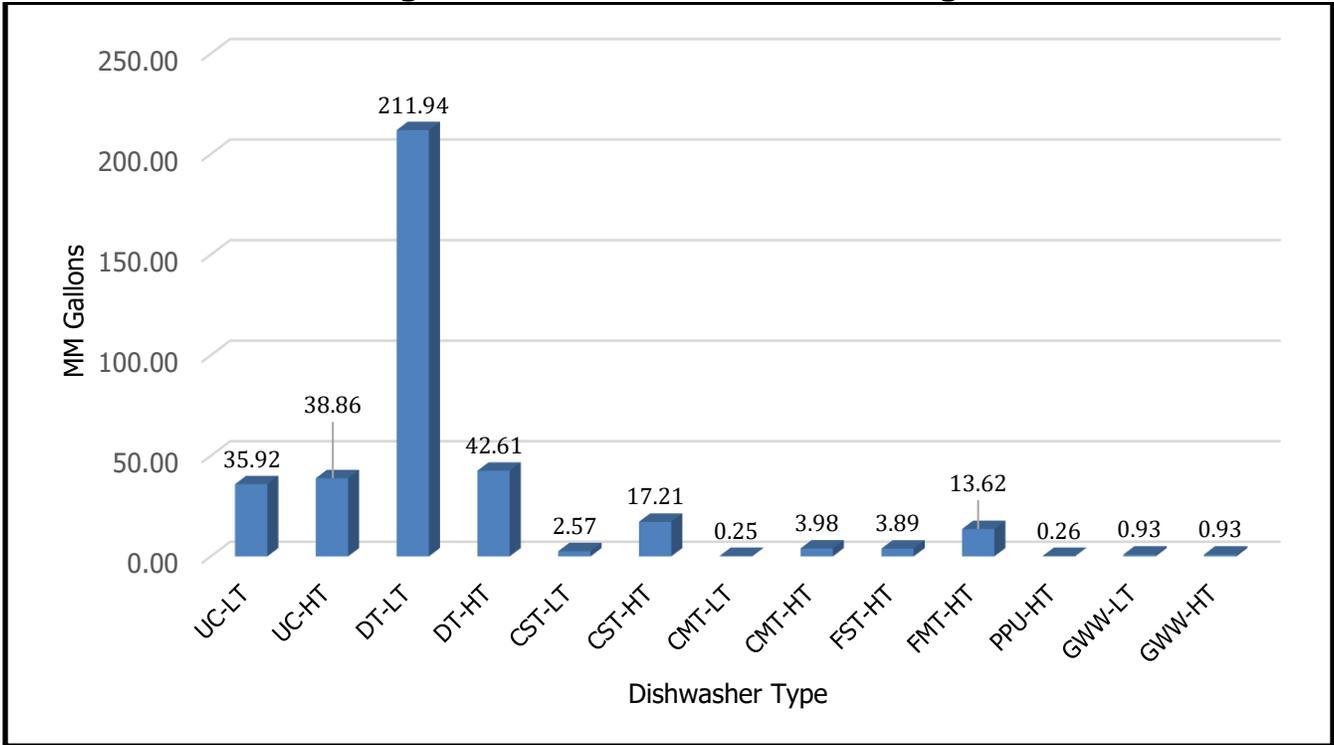
Figure 6-9: First-Year Fossil Gas Savings



Source: CEC staff

In addition to the first year electrical and fossil gas savings, staff calculated the water savings for the first year to range between 250,000 gallons to 211,940,000 gallons of water, depending on the type of dishwasher, as seen in **Figure 6-10**. The proposed standard will save about 373 million gallons of water for the first year of implementation.

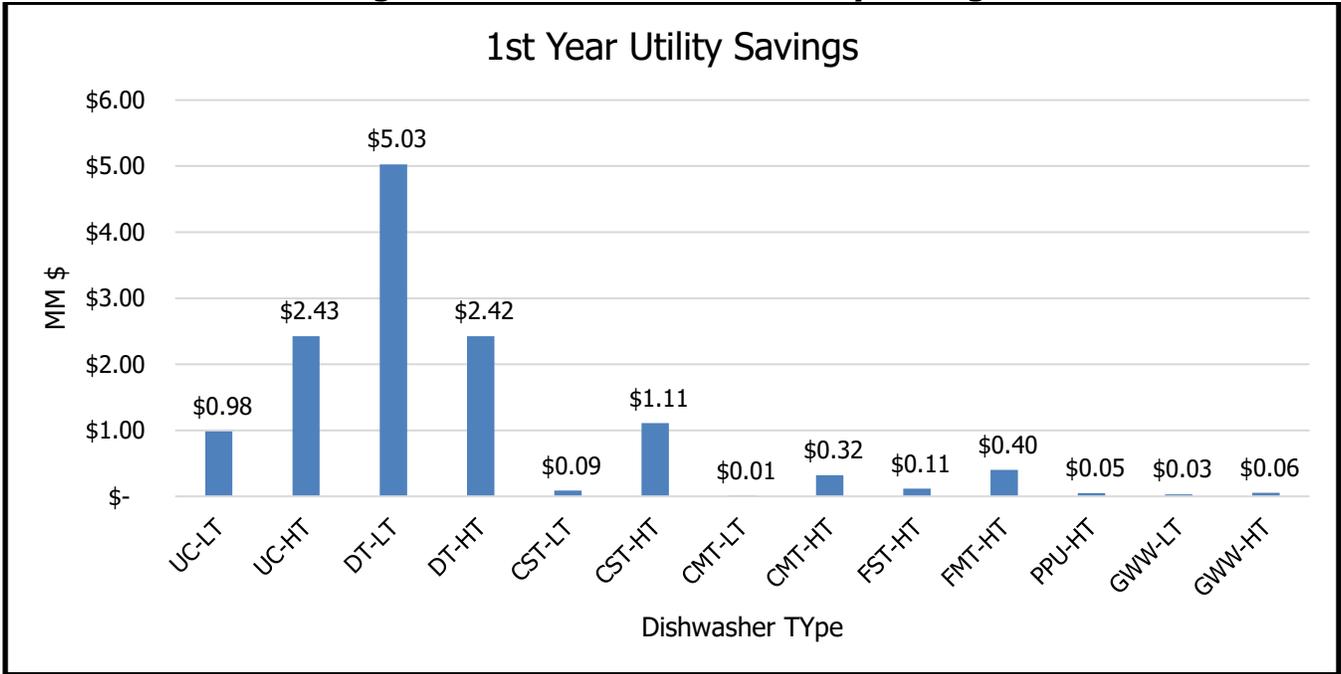
Figure 6-10: First-Year Water Savings



Source: CEC staff

Using the assumed rates for electricity, fossil gas, and water, staff calculated that the proposed standard will generate about \$13 million in utility savings for the first year the standard is implemented (**Figure 6-11**). The savings were calculated using the weighted electricity forecasted rates, the weighted fossil gas forecasted rate, and the average water rate in 2023 dollars.

Figure 6-11: First-Year Monetary Savings

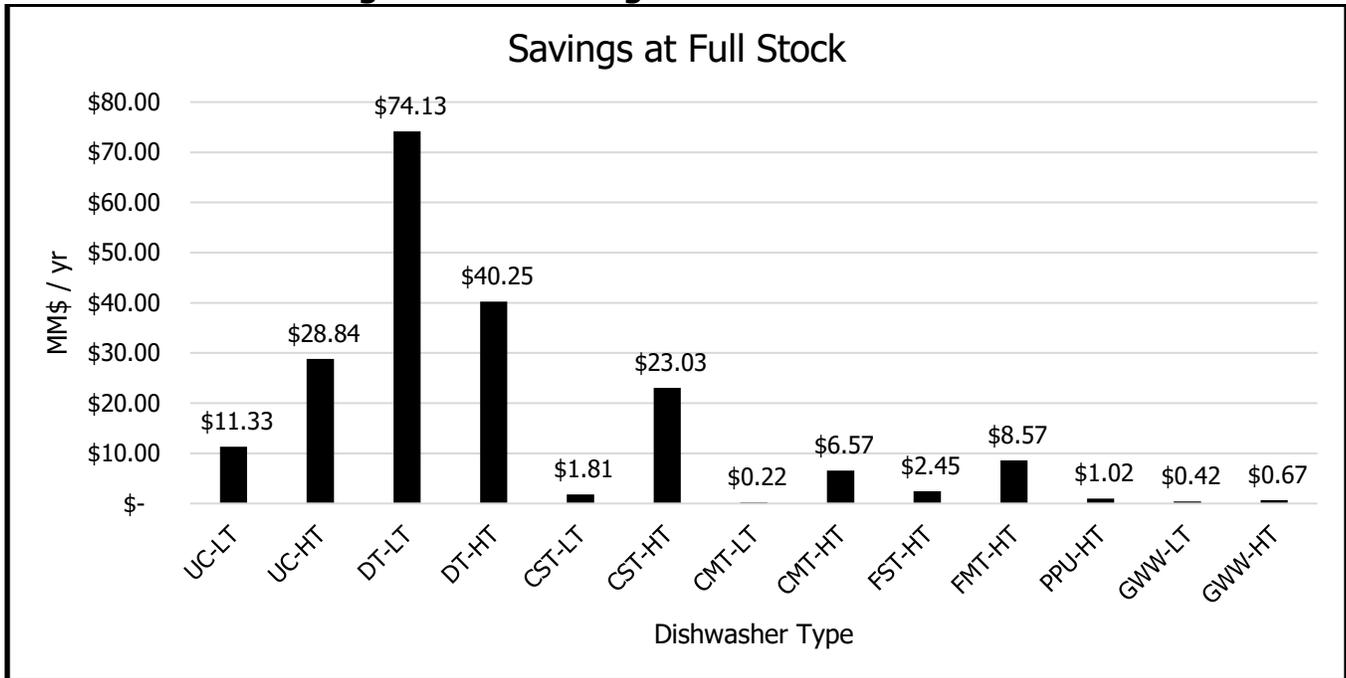


Source: CEC staff

Savings at Full Stock Turnover

CEC staff used the unit average electricity savings, unit average fossil gas savings, unit average water savings, units shipped per year, and effective lifespan of each commercial dishwasher to calculate the total savings at full stock turnover, as explained in Appendix A. To calculate the total money saved after full stock turnover is achieved, staff use the forecasted rates for electricity and fossil gas and the average water rate. The proposed standard will generate approximate savings of \$200 million per year after full stock turnover. As seen in **Figure 6-12**, utility savings after full stock turnover calculated range between about \$220,000 per year to \$74 million per year, depending on the type of commercial dishwasher.

Figure 6-12: Savings at Full Stock Turnover



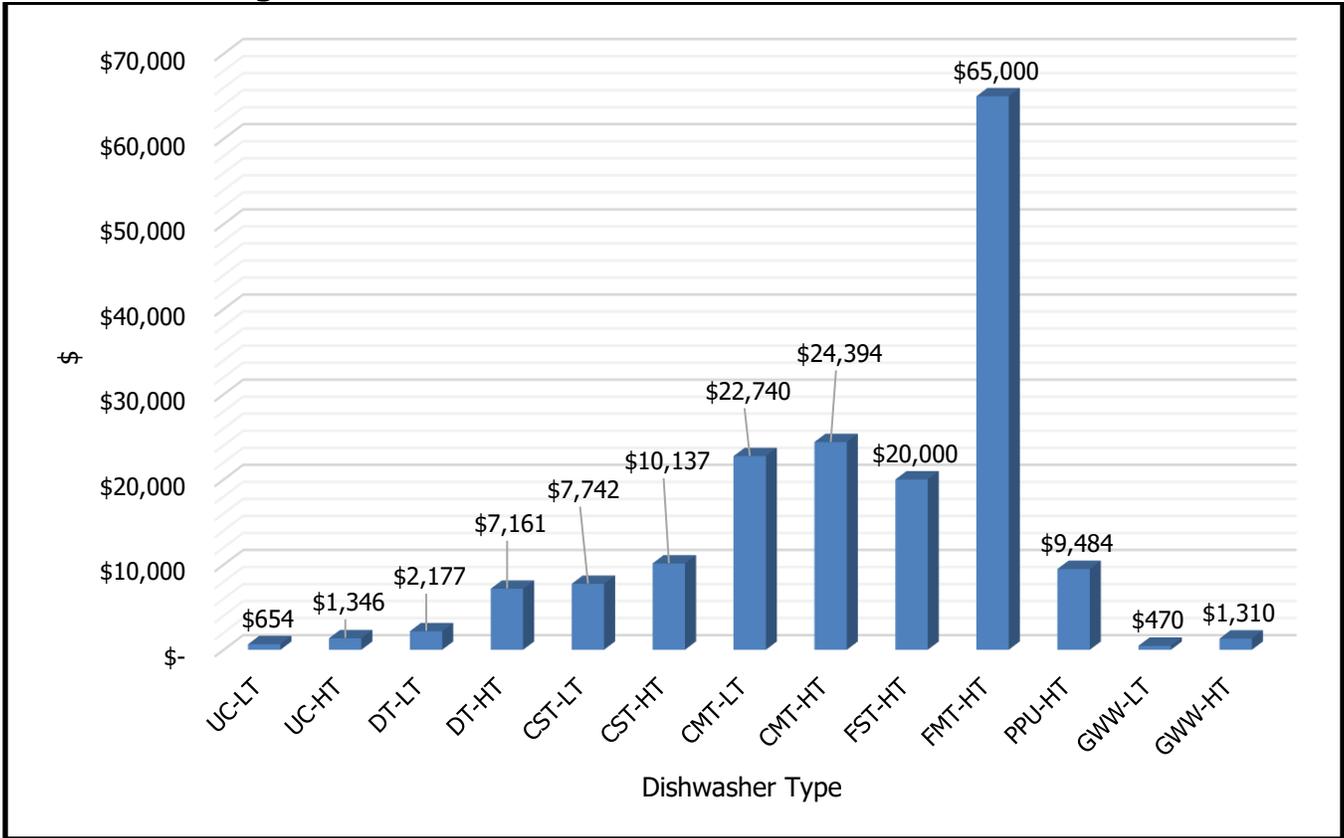
Source: CEC staff

Incremental Costs

Incremental costs are additional costs the manufacturers impart on the consumer for the manufacturing of compliant products that are incurred by the consumer at the time of purchase. The incremental cost of each type of commercial dishwasher was derived from the Savings Calculator for ENERGY STAR Commercial Food Service Products.²⁶ The estimated incremental cost per type of commercial dishwasher that complies with the proposed standards varies from \$470 to \$65,000, as seen in **Figure 6-13**. It was assumed that the proposed increase in price for each commercial dishwasher under the scope of the proposed standards includes the testing cost.

²⁶ [Commercial Food Service Equipment Calculator ENERGY STAR](https://www.energystar.gov/sites/default/files/2024-03/CFS%20Equipment%20Calculator.xlsx), <https://www.energystar.gov/sites/default/files/2024-03/CFS%20Equipment%20Calculator.xlsx>.

Figure 6-13: Commercial Dishwashers Incremental Cost

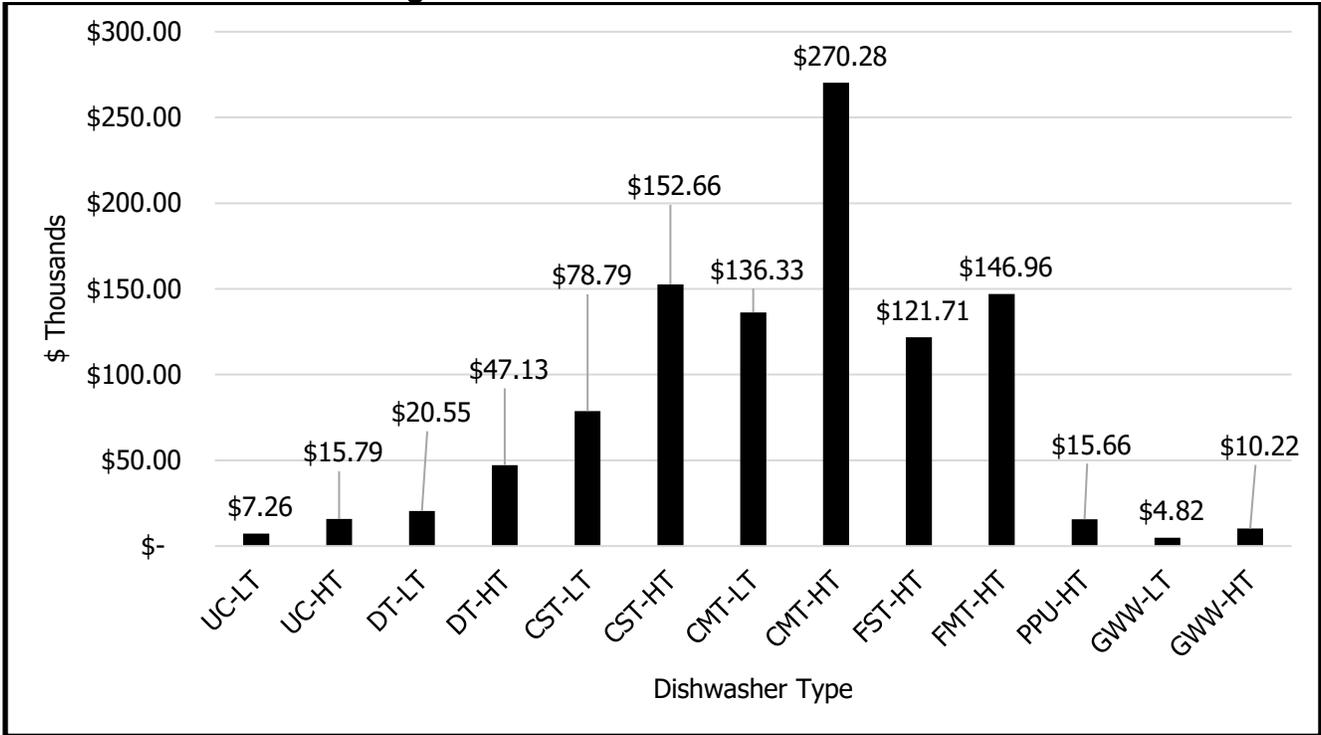


Source: CEC staff

Life-Cycle Benefit

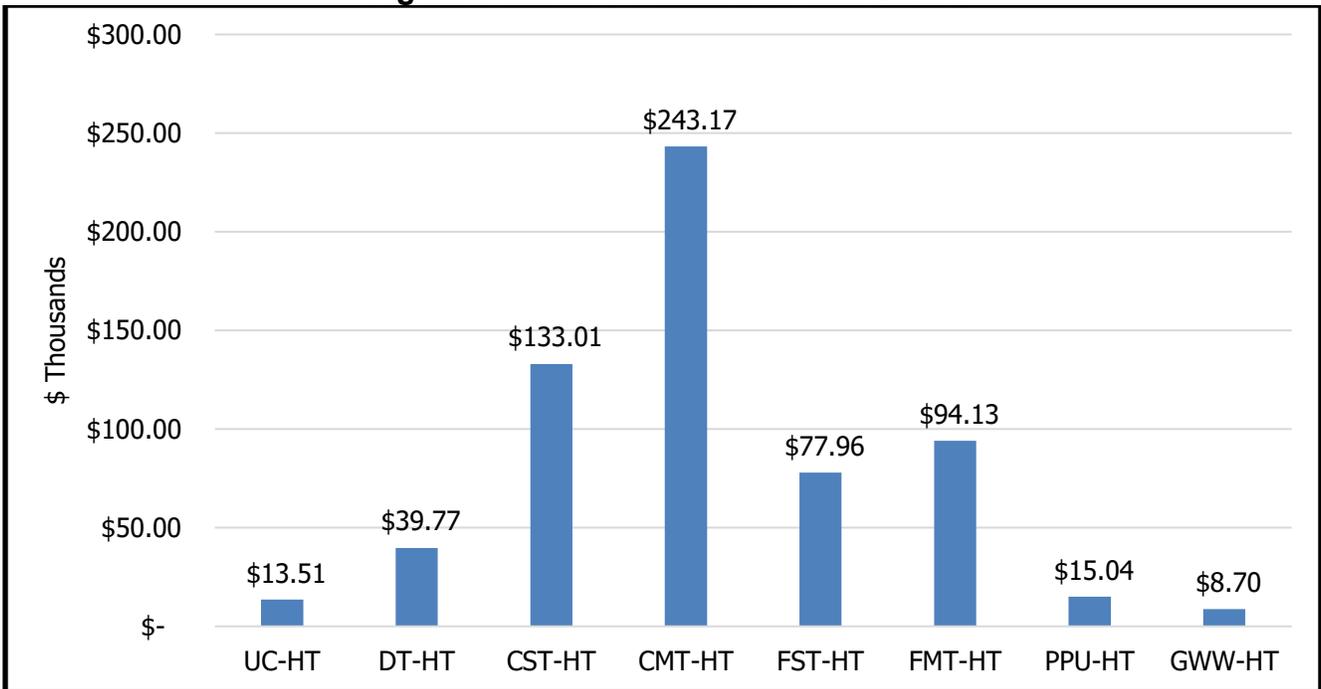
Staff used the calculated benefits for electricity, water, and fossil gas (**Figures 6-1, 6-2, and 6-3** respectively) to calculate the net present value (NPV) at a 3 percent discount rate for the average unit lifetime benefit for each type of commercial dishwasher. The calculated NPV at a 3 percent discount rate resulted in a unit lifetime benefit that ranges between \$4,800 and \$270,000 for the units that use electricity and \$8,700 to \$243,000 for those units that use fossil gas (**Figure 6-14** and **Figure 6-15** respectively). When graphing the benefits and costs for both units, the large benefit outweighs the incremental cost for each unit within the scope of the proposed standards (**Figures 6-16** and **Figure 6-17**).

Figure 6-14: NPV Electrical Unit Benefit



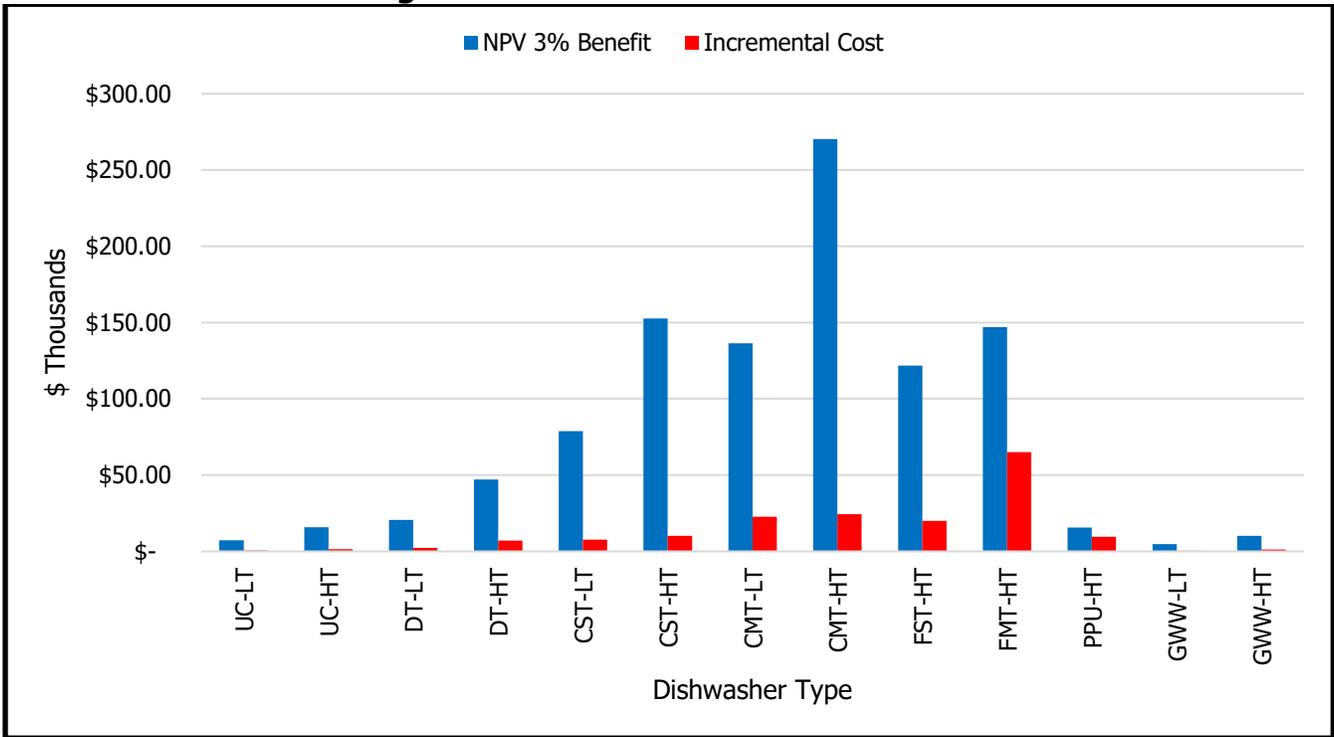
Source: CEC staff

Figure 6-15: NPV Fossil Gas Unit Benefit



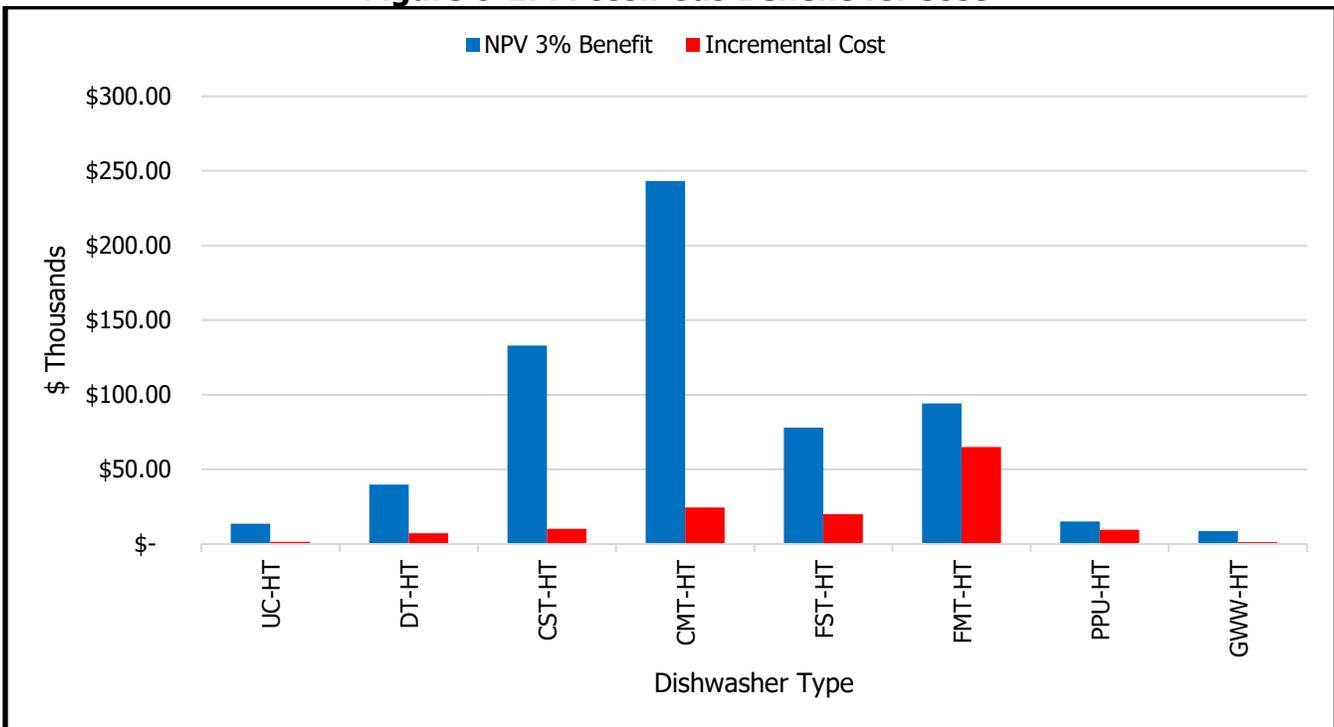
Source: CEC staff

Figure 6-16: Electrical Benefit vs. Cost



Source: CEC staff

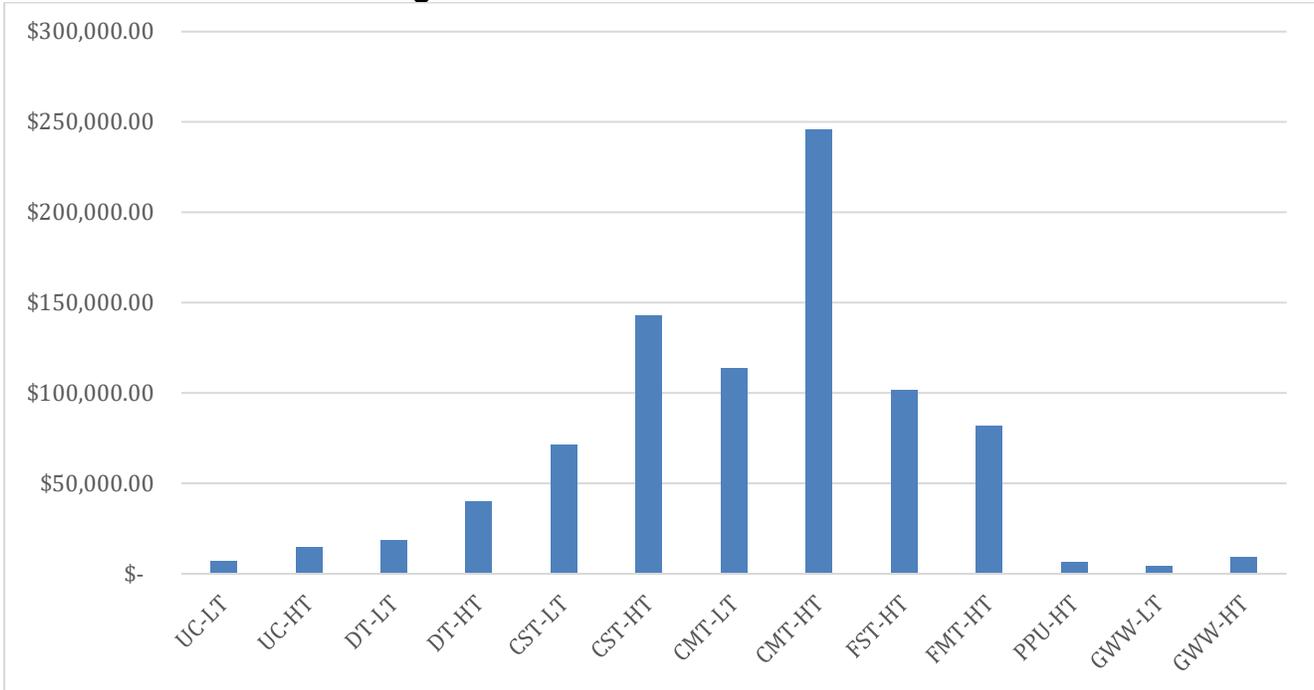
Figure 6-17: Fossil Gas Benefit vs. Cost



Source: CEC staff

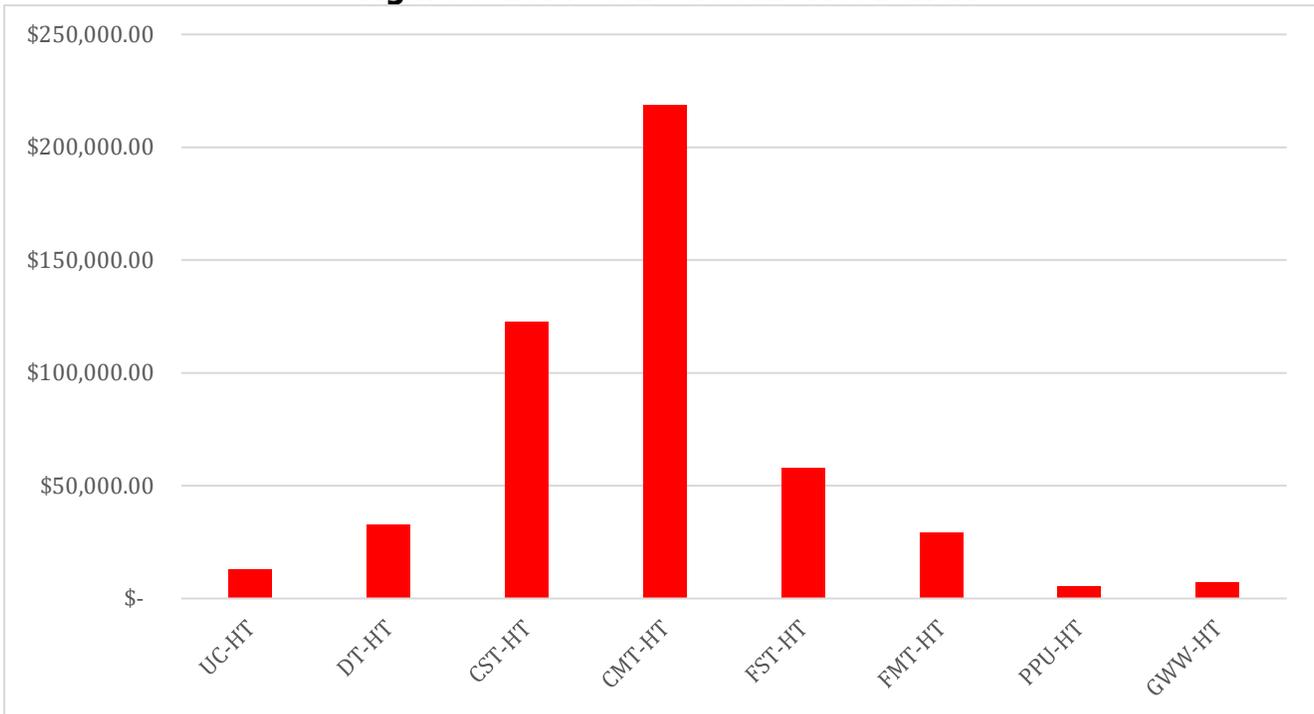
By removing the incremental cost from the benefit for each type of commercial dishwasher staff calculated the net benefit per unit. For the electrical units staff calculated a lifetime net benefit that ranges from \$4,300 to \$246,000 for electrical units and \$5,600 to \$219,000 for fossil gas units (**Figure 6-18** and **Figure 6-19**, respectively).

Figure 6-18: Electrical Unit Net Benefit



Source: CEC staff

Figure 6-19: Fossil Gas Unit Net Benefit



Source: CEC staff

Conclusion

Based on the life-cycle net benefit calculated for each type of commercial dishwasher, CEC staff concluded that the proposed standards are cost-effective. **Table 6-2** and **Table 6-3** summarize the per unit lifetime economic impacts for units with electric and fossil gas boosters, respectively. The lifetime benefit-to-cost ratios vary between 1.4 and 15.1, depending on the dishwasher type. This corresponds to simple payback periods between 0.82 and 13.2 years with 16 out of the 21 dishwasher types having a simple payback less than 2.5 years.

Table 6-2: Per Unit Lifetime Economic Impacts for Units with Electric Booster

Type of Commercial Dishwasher	Design Life	Unit Present Value of Benefits (2025 \$)	Present Value of Incremental Costs (2025 \$)	Net Present Value (2025 \$)	Simple Payback Period (years)	Lifecycle Benefit-Cost Ratio
UC-HT	12	\$7,265	\$654	\$6,611	0.82	11.1
UC-LT	12	\$15,789	\$1,346	\$14,443	0.83	11.7
DT-HT	15	\$20,546	\$2,177	\$18,369	1.16	9.4
DT-LT	15	\$47,132	\$7,161	\$39,971	1.78	6.6
CST-HT	20	\$78,793	\$7,742	\$71,051	1.42	10.2
CST-LT	20	\$152,664	\$10,137	\$142,527	0.98	15.1
CMT-HT	20	\$136,334	\$22,740	\$113,594	2.44	6.0
CMT-LT	20	\$270,280	\$24,394	\$245,886	1.34	11.1
FST-HT	20	\$121,714	\$20,000	\$101,714	2.36	6.1
FMT-HT	20	\$146,962	\$65,000	\$81,962	6.35	2.3
PPU-HT	15	\$15,665	\$9,484	\$6,181	7.26	1.7
GWW-HT	12	\$4,818	\$470	\$4,349	0.92	10.3
GWW-LT	12	\$10,221	\$1,310	\$8,911	1.25	7.8

Source: CEC Staff

Table 6-3: Per Unit Lifetime Economic Impacts for Units with Fossil Gas Booster

Type of Commercial Dishwasher	Design Life	Unit Present Value of Benefits (2025 \$)	Present Value of Incremental Costs (2025 \$)	Net Present Value (2025 \$)	Simple Payback Period (years)	Lifecycle Benefit-Cost Ratio
UC-HT	12	\$13,512	\$1,346	\$12,166	1.03	10.0
DT-HT	15	\$39,771	\$7,161	\$32,610	2.27	5.6
CST-HT	20	\$133,010	\$10,137	\$122,872	1.22	13.1
CMT-HT	20	\$243,174	\$24,394	\$218,780	1.58	10.0
FST-HT	20	\$77,962	\$20,000	\$57,962	4.91	3.9
FMT-HT	20	\$94,134	\$65,000	\$29,134	13.21	1.4
PPU-HT	15	\$15,043	\$9,484	\$5,559	7.69	1.6
GWV-HT	12	\$8,702	\$1,310	\$7,392	1.56	6.6

Source: CEC Staff

In aggregate, the proposed standards on commercial dishwashers are expected to save California 399 GWh of electricity, 18 million terms of fossil gas, and 2.62 billion gallons of water equivalent to about 199.3 million dollars of utility cost per year after full stock turnover, as seen in **Table 6-4**. These savings will reduce the need for new electricity generating stations, lower the consumption of fossil gas and potable water, and help California reach its energy efficiency, greenhouse gas emissions, and decarbonization goals.

Table 6-4: California Statewide Savings after Full Stock Turnover

	Electricity (GWh/yr)	Fossil Gas (MM Therms/yr)	Water (B Gallons/yr)	Utility Bill Savings (MM 2025 \$/yr)
Statewide Savings	399	18	2.62	199.3

Source: CEC Staff

CHAPTER 7:

Feasibility

The proposed standards for commercial dishwashers are feasible based on the information available from the U.S. Environmental Protection Agency (U.S. EPA) ENERGY STAR program and that provided by energy efficiency advocates, California IOUs, and other stakeholders.

Product Availability

From the analysis of information from ENERGY STAR, SASD, and stakeholders, commercial dishwashers that meet the proposed standard are broadly available for consumers. According to the ENERGY STAR unit shipment and market penetration report for 2023, about 39,000 units compliant with the proposed regulations are shipped throughout the United States.²⁷ Given that the gross domestic product (GDP) of California is 14.1 percent of the USA's GDP, staff assumes a similar proportion, or about 5,500 units, are shipped into California. Furthermore, some commercial dishwasher manufacturers have been participating in ENERGY STAR Version 3.0 requirements since the implementation in September 2021.²⁸ Staff also evaluated commercial dishwashers that use fossil gas and steam, although it is unclear the test procedure used to arrive at those totals, the different specification sheets demonstrate that there are available units that use fossil gas performing with higher efficiency than the proposed standards.

Product Testing

It is not clear if the results of the specification sheets analyzed by staff for commercial dishwashers that use fossil gas and steam were derived from the proposed test procedures. However, since the units analyzed by staff were from manufacturers that do participate in ENERGY STAR program with their electric products, staff assumed that the results provided in the different specification sheets were performed using the proposed test procedures. Manufacturers participating in the ENERGY STAR program for commercial dishwashers have tested and provided the required information to ENERGY STAR since November 2008. Unlike ENERGY STAR, which requires that the testing and certification be conducted by a third-party laboratory capable of performing the necessary tests for certification, California's requirements are specified in Section 1603 and do not require a third-party certification, which may facilitate the testing of the proposed standards.²⁹ (This does not prohibit manufacturers from using a third-party laboratory to test and certify the commercial dishwashers within the scope of the proposed standard; rather, it allows in-house testing.)

27 [ENERGY STAR Unit Shipment and Market Penetration Report Calendar Year 2023 Summary](#).

28 [ENERGY STAR Commercial Dishwashers Version 3 Specification](#), <https://www.energystar.gov/sites/default/files/Commercial%20Dishwashers%20Version%203.0%20Specification%20%28Rev.%20-%20September%202021%29.pdf>.

29 [Final Commercial Dishwasher Specification](#), https://www.energystar.gov/sites/default/files/specs//private/Final_Comm_Dish_Spec.pdf.

The most recent ENERGY STAR specifications require use of ASTM F1696-20: "Standard Test Method for Energy Performance of Stationary-Rack, Door-Type Commercial Dishwashing Machines" as the test procedure to determine the water use idle energy, and washing energy used by the commercial dishwasher that have a stationary rack. ENERGY STAR also requires the use of ASTM F1920-20: "Standard Test Method for Energy Performance of Rack Conveyor Commercial Dishwashing Machines" as the test procedure to determine the water use, idle energy use, and washing energy used by commercial dishwashers with conveyor belts.

Since manufacturers currently use the proposed test procedures and thresholds set by ENERGY STAR and because these are the same as under this proposal, CEC staff determined that the proposed standards are technically feasible.

Leased Equipment

Many food service establishments, especially small restaurants, opt to lease commercial dishwashers. On the other hand, larger institutional facilities often opt to purchase commercial dishwashers. Ecolab and Auto-Chlor System are the largest providers in the dishwasher leasing market, which purchase machines from manufacturers or contract with manufacturers to build machines to the requested specifications which, in turn, are leased to the end user.

Given the high failure rate of new restaurants, which was exacerbated by the COVID-19 epidemic, many small food service facility operators are hesitant to invest in purchasing new commercial dishwashers and prefer leasing them because of the low upfront cost. When leasing contracts are implemented, the consumer may receive a new or a refurbished unit. Refurbished units, however, tend to be less efficient than the new units due in part to aftermarket modifications. Few incentives exist to push leasing companies toward offering newer, more efficient units. This structure can create a split incentive where the leasing company pays any incremental costs for purchasing more efficient dishwashers while their customers receive the monetary benefits of reduced water and energy bills.

According to the California Investor-Owned Utilities Code and Standards Enhancement team, about half of the commercial dishwashers in California are leased.³⁰ The ratio of owned to leased commercial dishwashers differs depending on the type of dishwasher. For example, most low temperature door type commercial dishwashers are leased while most flight-type commercial dishwashers are owned by the food service establishment.

On February 20, 2026, California Assemblymember Steve Bennett introduced Assembly Bill (AB) 2458 which will, if enacted as it is currently written, broaden the scope of the state's Appliance Efficiency Regulations to include appliances that are "sold, rented, imported, distributed, or leased, or offered for sale, rental, importation, distribution, or lease, in the state".³¹ If this bill is enacted, the CEC would revise the proposed regulations presented in this report to reflect this expansion in scope, with the effect of applying the proposed minimum

³⁰ [California Investor Owned Utilities Comments — Title 20 Dishwasher CASE Report RFI Response Commercial Food Service TN#254440](https://efiling.energy.ca.gov/GetDocument.aspx?tn=254440&DocumentContentId=89825), pg. 38, <https://efiling.energy.ca.gov/GetDocument.aspx?tn=254440&DocumentContentId=89825>.

³¹ [Today's Law As Amended - AB-2458 Energy: appliance standards and cost-effective measures](https://leginfo.legislature.ca.gov/faces/billCompareClient.xhtml?bill_id=202520260AB2458&showamends=false), https://leginfo.legislature.ca.gov/faces/billCompareClient.xhtml?bill_id=202520260AB2458&showamends=false

efficiency standards to commercial dishwashers that are leased or rented alongside those sold or offered for sale. In this scenario, the benefits and costs of minimum efficiency standards described within this report would apply equally to rented or leased equipment, providing a level playing field and equivalent benefits to end users who may prefer to rent rather than own such equipment.

CHAPTER 8:

Environmental and Human Health Analysis

Commercial dishwashers are either refurbished or replaced at the end of their useful lives. This proposal does not require any commercial dishwasher to be replaced before the end of its useful life, nor does it affect the amount or type of materials used in manufacturing commercial dishwashers, or prevent the refurbishment, use, or sale of used equipment. Therefore, the proposed standards do not risk causing a negative impact to the environment with respect to the materials from which these products are constructed.

Improving efficiency reduces consumption of inputs, in this case energy and water, thereby avoiding associated environmental impacts. The proposed standards do not risk causing a negative environmental impact with respect to use of energy or water during operation and are, instead, expected to have beneficial impacts.

Benefit Impacts

The environmental benefits of the proposed standards are associated with reduced use of electricity, fossil gas, and potable water, as discussed in the next subsections.

Electricity

As discussed in Chapter 6, for commercial dishwashers that use electricity as the main source of energy, the proposed standards will result in about 27 gigawatt-hours (GWh) of reduced electricity use in the first year of implementation. After full stock turnover, about 20 years after the effective date of the regulations, staff estimated the resulting electrical savings to be nearly 400 GWh per year. When analyzed using the Avoided Emissions and Generation Tool (AVERT) from U.S. Environmental Protection Agency (U.S. EPA), the 399 GWh per year of annual electricity savings will result in an avoided increase in air emissions by about 187,000 metric tons of carbon dioxide (CO₂), 30 metric tons of nitric oxides (NO_x), 10 metric tons of ammonia (NH₃), and 10 metric tons of particulate matter with a diameter of 2.5 micrometers or less (PM_{2.5}) (**Figure 8-1**).³²

Although the AVERT analysis assumes that the emission profile of electricity generation in California will remain unchanged 20 years after the effective date of the regulations as that of 2023, California is increasing its clean energy generation portfolio and recently achieved the milestone of generating 67 percent of its electricity from clean energy.³³ As the electric grid in California continues to transition toward a 100 percent clean energy source, it is safe to conclude that this emission analysis represents an upper bound on the emission reductions resulting from the proposed regulations.

32 [AVoided Emissions and geneRation Tool \(AVERT\)](https://www.epa.gov/avert), <https://www.epa.gov/avert>.

33 Governor Gavin Newsom. News Release. "[In Historic First, California Powered by Two-Thirds Clean Energy — Becoming Largest Economy in the World to Achieve Milestone](https://www.gov.ca.gov/2025/07/14/in-historic-first-california-powered-by-two-thirds-clean-energy-becoming-largest-economy-in-the-world-to-achieve-milestone/)" | Governor of California, <https://www.gov.ca.gov/2025/07/14/in-historic-first-california-powered-by-two-thirds-clean-energy-becoming-largest-economy-in-the-world-to-achieve-milestone/>.

Figure 8-1: AVERT Annual Emission Reductions From Saved Electricity

Output: Annual Regional Results

[Click here to return to Step 4: Display Outputs](#)

	Original	Post Change	Change
Generation (MWh)	81,596,320	81,160,680	-435,630
Heat Input (MMBtu)	644,926,190	641,537,500	-3,388,690
Total Emissions from Fossil Generation Fleet (metric tons)			
SO ₂	900	900	—
NO _x	7,010	6,990	-30
Ozone season NO _x	2,830	2,820	-10
CO ₂	36,690,100	36,502,940	-187,160
PM _{2.5}	1,570	1,570	-10
VOCs	510	500	—
NH ₃	1,090	1,080	-10
AVERT-derived Emission Rates (metric tons/M\			
	Average Fossil		Marginal Fossil
SO ₂	0.000		—
NO _x	0.000		0.000
Ozone season NO _x	0.000		0.000
CO ₂	0.450		0.430
PM _{2.5}	0.000		0.000
VOCs	0.000		—
NH ₃	0.000		0.000

Select unit for emissions:

Ozone season is defined as May 1 - September 30. Ozone season emissions are a subset of annual emissions.

Negative numbers indicate displaced generation and emissions.

All results are rounded to the nearest 10. A dash ("—") indicates non-zero results, but within +/- 10 units.

When users evaluate a portfolio scenario including EVs and EE or RE, marginal fossil values are not reported and a null sign ("Ø") is

Data on this page do not include changes to ICE vehicle emissions (e.g., emissions from tailpipes).

Source: CEC staff

According to the CO-Benefits Risk Assessment Health Impacts Screening and Mapping Tool (COBRA) from U.S. EPA, the emission reductions calculated by AVERT from power generation will result in an avoided increase in the annual incidences in mortality by 0.26 to 0.45, hospital respiratory admissions by 0.031, respiratory emergency room visits by 0.41, asthma onset by 1.5, and asthma symptoms by 240.³⁴ For a detailed list of all the health benefits calculated by COBRA see **Table 8-1**.

³⁴ [CO-Benefits Risk Assessment Health Impacts Screening and Mapping Tool \(COBRA\)](https://cobra.epa.gov/), <https://cobra.epa.gov/>.

Table 8-1: COBRA Health Benefits From Saved Electricity

Health Endpoint	Pollutant	Change in Incidence per year (low)	Change in Incidence per year (High)
Mortality	PM _{2.5} / O ₃	0.26	0.45
Nonfatal Heart Attacks	PM _{2.5}	0.12	0.12
Infant Mortality	PM _{2.5}	0.0013	0.0013
Hospital Admits, All Respiratory	PM _{2.5} / O ₃	0.031	0.031
Emergency Room Visits, Respiratory	PM _{2.5} / O ₃	0.41	0.41
Asthma Onset	PM _{2.5} / O ₃	1.5	1.5
Asthma Symptoms	PM _{2.5} / O ₃	240	240
Emergency Room Visits, Asthma	O ₃	0.0016	0.0016
Lung Cancer Incidence	PM _{2.5}	0.014	0.014
Hospital Admits, Cardio-Cerebro/Peripheral Vascular Disease	PM _{2.5}	0.025	0.025
Hospital Admits, Alzheimer's Disease	PM _{2.5}	0.064	0.064
Hospital Admits, Parkinsons Disease	PM _{2.5}	0.0094	0.0094
Stroke Incidence	PM _{2.5}	0.011	0.011
Hay Fever/Rhinitis Incidence	PM _{2.5} / O ₃	9.4	9.4
Cardiac Arrest, Out of Hospital	PM _{2.5}	0.0028	0.0028
Emergency Room Visits, All Cardiac	PM _{2.5}	0.05	0.05
Minor Restricted Activity Days	PM _{2.5}	160	160
School Loss Days	O ₃	87	87
Work Loss Days	PM _{2.5}	28	28

Source: CEC staff

Fossil Gas

As discussed in Chapter 6, CEC staff calculated fossil gas savings of about 18 million therms per year after full stock turnover. Staff used the Natural Gas Calculator in the Combustion Portal to calculate the emissions generated that are associated with water heating.³⁵ **Table 8-2** reflects the emission reductions associated with the 18 million therms of fossil gas saved by the proposed regulations. For comparison, the fossil gas savings after full stock turnover is equivalent to about 79,000 electric-powered passenger vehicles driven per year as calculated by the U.S. EPA Greenhouse Gas Equivalencies Calculator.³⁶

35 Combustion Portal. "[Environmental Compliance for Combustion Processes Natural Gas Calculator](https://www.combustionportal.org/bcalc3.php)," <https://www.combustionportal.org/bcalc3.php>.

36 U.S. EPA. "[Greenhouse Gas Equivalencies Calculator](https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator#results)," <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator#results>.

Table 8-2: Annual Emission Reductions from Fossil Gas Saved

Emissions	Tons/Year
Carbon Monoxide (CO)	71.4
Carbon Dioxide (CO ₂)	102,000
Methane (CH ₄)	1.9550
Nitrous Oxide (N ₂ O)	1.87
Ammonia (NH ₃)	2.72
Nitrogen Oxides (NO _x)	85
Particulate Matter at 10 Microns (PM ₁₀)	6.46
Particulate Matter at 2.5 Microns (PM _{2.5})	6.46
Sulfur Dioxide (SO ₂)	0.51
Volatile Organic Matter (VOC)	4.675

Source: CEC staff

The health benefits associated with the emission reductions calculated in Table 8-2 were calculated using COBRA. The COBRA results reflect the avoided increase in annual incidences in mortality by 0.5 to 0.77, hospital respiratory admissions by 0.59, respiratory emergency room visits by 0.95, asthma onset by 3.3, and asthma symptoms by 520. For a detail list of all the health benefits associated with the fossil gas savings from the proposed regulations see **Table 8-3**.

Table 8-3: COBRA Saved Fossil Gas Benefit Results

Health Endpoint	Pollutant	Change in Incidence per year (low)	Change in Incidence per year (High)
Mortality	PM _{2.5} / O ₃	0.5	0.77
Nonfatal Heart Attacks	PM _{2.5}	0.17	0.17
Infant Mortality	PM _{2.5}	0.0018	0.0018
Hospital Admits, All Respiratory	PM _{2.5} / O ₃	0.059	0.059
Emergency Room Visits, Respiratory	PM _{2.5} / O ₃	0.95	0.95
Asthma Onset	PM _{2.5} / O ₃	3.3	3.3
Asthma Symptoms	PM _{2.5} / O ₃	520	520
Emergency Room Visits, Asthma	O ₃	0.0043	0.0043
Lung Cancer Incidence	PM _{2.5}	0.02	0.02
Hospital Admits, Cardio-Cerebro/Peripheral Vascular Disease	PM _{2.5}	0.036	0.036
Hospital Admits, Alzheimer's Disease	PM _{2.5}	0.094	0.094
Hospital Admits, Parkinsons Disease	PM _{2.5}	0.014	0.014
Stroke Incidence	PM _{2.5}	0.016	0.016
Hay Fever/Rhinitis Incidence	PM _{2.5} / O ₃	21	21
Cardiac Arrest, Out of Hospital	PM _{2.5}	0.0041	0.0041
Emergency Room Visits, All Cardiac	PM _{2.5}	0.073	0.073
Minor Restricted Activity Days	PM _{2.5}	240	240
School Loss Days	O ₃	230	230
Work Loss Days	PM _{2.5}	41	41

Source: CEC staff

Water

For homes and workplaces, reducing water consumption reduces the demand for available and shrinking water supplies, which helps decrease the need for future costly investments in large-scale infrastructure projects such as dams, canals, and reservoirs. It also results in a reduction in operating costs for water utilities given that it takes a significant amount of energy to extract water from a source, treat it, distribute it, then collect and treat it after use before releasing it back into the environment.

As discussed in Chapter 6, staff estimates the proposed standard to reduce water consumption by about 5.6 billion gallons per year after full stock turnover.

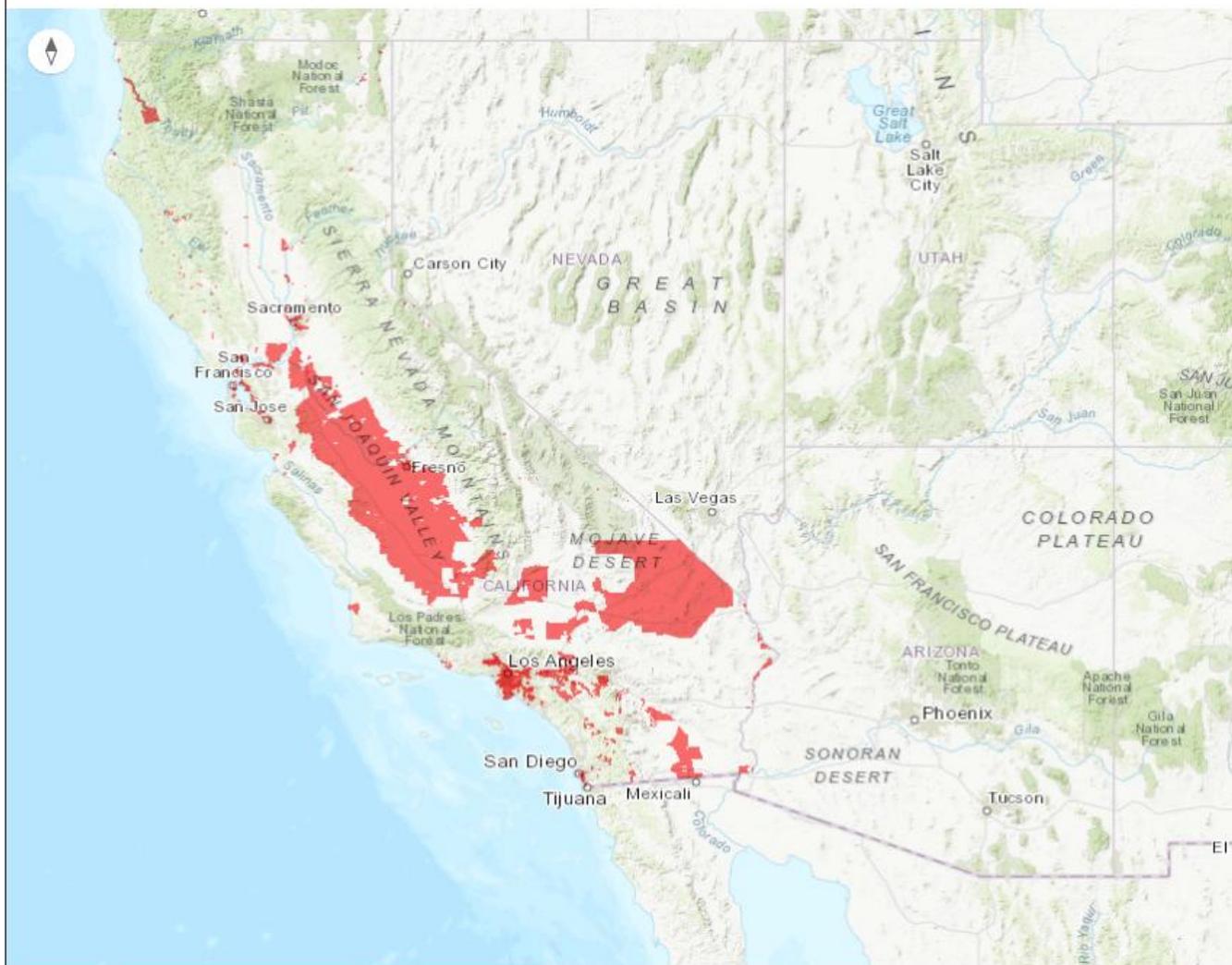
The decrease in water consumption of commercial dishwashers will result in increased availability of water for other uses, decreased need for diversions, decreased associated environmental impact to wetland and riparian habitats from those diversions, and decreased drought impacts in California.

Human Health and Environmental Benefits

The State of California Office of Environmental Health Hazard Assessment (OEHHA) has identified the disadvantaged communities in California in accordance with Senate Bill 535, as seen in **Figure 8-2**. As discussed in the electricity subsection of this chapter, the electricity saved for the proposed standard will lower CO₂ and other emissions associated with electrical generation. **Figure 8-3** shows the location of the reduced CO₂ emissions, and by comparing it with Figure 8-2, a significant overlap of CO₂ reduction and the identified disadvantaged communities can be observed. PM_{2.5} and ozone emissions associated electricity generation and water heating will be prevented throughout the state, as seen in **Figure 8-4** and **Figure 8-5**.

Figure 8-2: Disadvantaged Communities Map

SB 535 Disadvantaged Communities 2022



SB 535 Disadvantaged Communities 2022

SB 535 Disadvantaged Communities 2022 (Census Tracts)



SB 535 Disadvantaged Communities 2022 (Federal Tribal Areas)

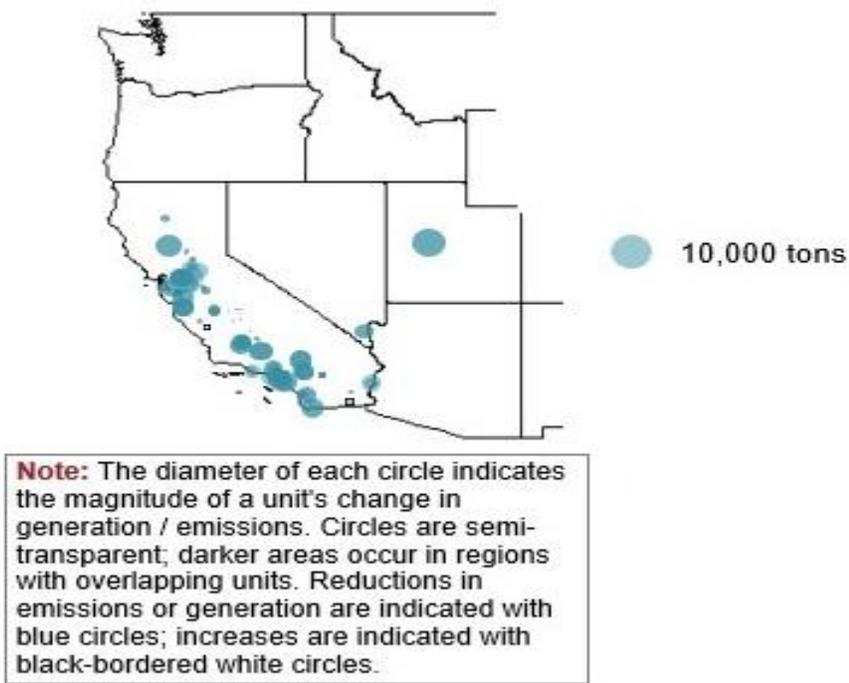


SB 535 Disadvantaged Communities (Additional Tribal Areas) 



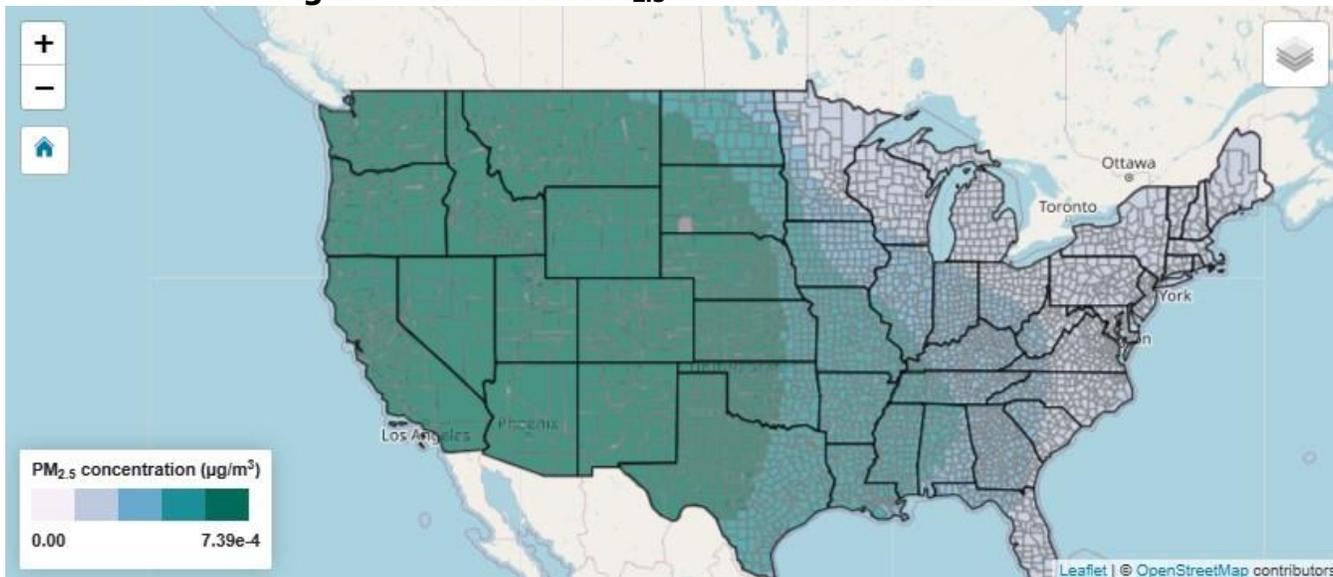
Source: OEHHA

Figure 8-3: AVERT Annual CO₂ Reduction Map



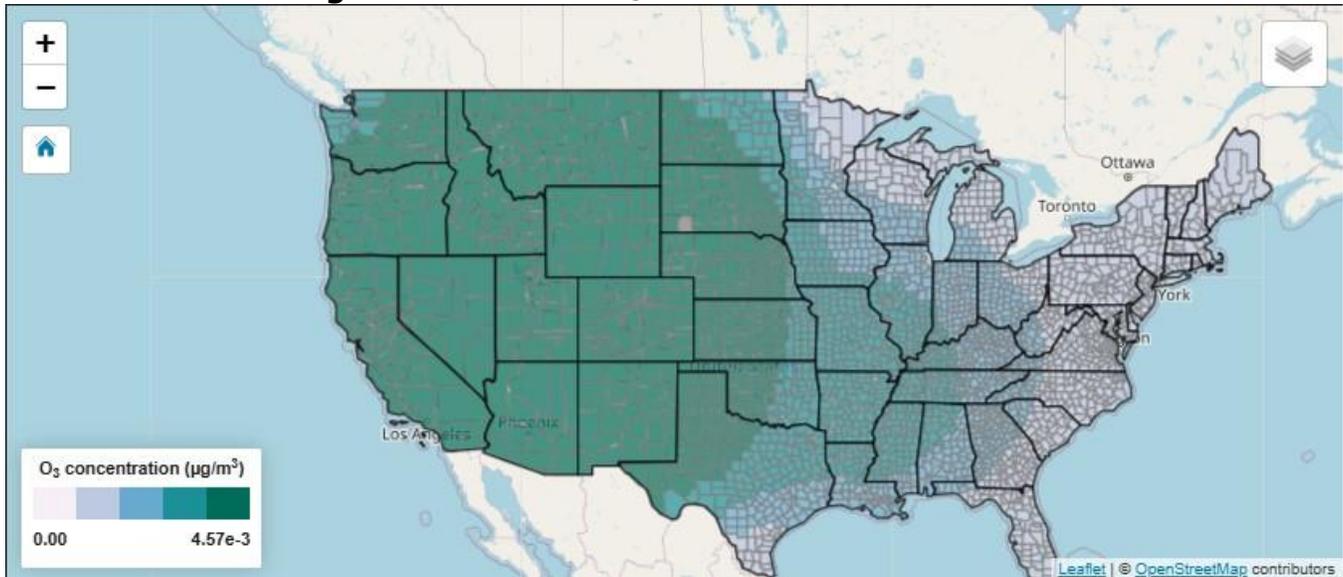
Source: CEC staff

Figure 8-4: COBRA PM_{2.5} Concentration Reduction



Source: U.S. EPA COBRA

Figure 8-5: COBRA O₃ Concentration Reduction



Source: U.S. EPA COBRA

Staff calculated the human health monetary savings using COBRA. These benefits will impact all Californians and neighboring states as depicted in **Figures 8-4** and **8-5**. **Table 8-4**, however, reflects the monetization of the health benefits calculated through COBRA using a 2 percent discount rate for the State of California only. **Table 8-4** includes the health benefits associated with the reduction of emissions related to electrical generation and reduced fossil gas combustion, as described earlier in this chapter. In total, the monetary value of the health benefits for Californians is estimated to be between \$12 million and \$19 million dollars per year after the regulations reach full stock turnover.

Table 8-4: Indirect Human Health Total Cost Benefit at Full Stock Turnover

Health Endpoint	Pollutant	Monetary Value (\$/yr) Low	Monetary Value (\$/yr) High
Mortality	PM _{2.5} / O ₃	11,000,000	18,000,000
Nonfatal Heart Attacks	PM _{2.5}	24,000	24,000
Infant Mortality	PM _{2.5}	49,000	49,000
Hospital Admits, All Respiratory	PM _{2.5} / O ₃	2,000	2,000
Emergency Room Visits, Respiratory	PM _{2.5} / O ₃	2,200	2,200
Asthma Onset	PM _{2.5} / O ₃	1,300	1,300
Asthma Symptoms	PM _{2.5} / O ₃	200,000	200,000
Emergency Room Visits, Asthma	O ₃	5	5
Lung Cancer Incidence	PM _{2.5}	1,500	1,500
Hospital Admits, Cardio-Cerebro/Peripheral Vascular Disease	PM _{2.5}	1,700	1,700
Hospital Admits, Alzheimer's Disease	PM _{2.5}	3,500	3,500
Hospital Admits, Parkinsons Disease	PM _{2.5}	550	550
Stroke Incidence	PM _{2.5}	1,700	1,700
Hay Fever/Rhinitis Incidence	PM _{2.5} / O ₃	34,000	34,000
Cardiac Arrest, Out of Hospital	PM _{2.5}	430	430
Emergency Room Visits, All Cardiac	PM _{2.5}	270	270
Minor Restricted Activity Days	PM _{2.5}	51,000	51,000
School Loss Days	O ₃	540,000	540,000
Work Loss Days	PM _{2.5}	22,000	22,000
Total Health Benefits from PM _{2.5}		5,900,000	13,000,000
Total Health Benefit from O ₃		6,100,000	6,100,000
Total Health Benefit		12,000,000	19,000,000

Source: U.S. EPA COBRA

California Environmental Quality Act (CEQA)

CEC staff has preliminarily determined that adoption of the proposed standards for commercial dishwashers would be categorically exempt from CEQA under the “Class 7 and Class 8” exemptions (California Code of Regulations, Title 14, Sections 15307–15308).

Class 7 consists of actions taken by regulatory agencies as authorized by state law or local ordinance to assure the maintenance, restoration, or enhancement of a natural resource where the regulatory process involves procedures for protection of the environment.

Class 8 consists of actions taken by regulatory agencies, as authorized by state or local ordinance, to assure the maintenance, restoration, enhancement, or protection of the environment where the regulatory process involves procedures for protection of the environment.

In this case, adoption of the proposed standards for commercial dishwashers is an action taken by a regulatory agency for the maintenance and protection of the state’s natural resources and environment. As noted in the “Benefit Impacts” section, the standards will reduce energy use and the related pollution and GHGs associated with energy generation and water heating. This reduction will provide long-term benefits to the environment as contemplated in Class 7 and Class 8 exemptions. As older, less efficient commercial dishwashers are replaced with newer, more efficient commercial dishwashers, these long-lasting products will continue to save energy and water for years to come.

Based on CEC staff review, there is no reasonably foreseeable possibility that the proposed standards may result in a significant adverse impact on the environment or that any of the exceptions to these exemptions apply (California Code of Regulations, Title 14, Section 15300.2); therefore, adoption of the proposed regulations is exempt from CEQA.

GLOSSARY

Acronym/Term	Description/Definition
ASTM	American Society for Testing Materials is a nonprofit organization in which procedures, users, consumers, and representatives of government and academia develop voluntary consensus standards for materials, products, systems, and services.
BTU	A British thermal unit is an energy unit that measure the amount of heat energy needed to raise one pound of water by one degree Fahrenheit.
Btu/h	Unit of power measuring energy per unit time, equal to 1 Btu per hour. Commonly used to describe the power output of different appliances
Cal. Code of Regs.	California Code of Regulations
CARB	California Air Resources Board is the state agency responsible for protecting the public health from the harmful effects of air pollution and climate change.
CASE	The Codes and Standards Enhancement is program set by a CPUC initiative to improve the state’s energy efficiency regulations. It requires California’s major utilities to develop and submit proposals to the California Energy Commission to improve energy efficiency, encourage the use of new energy-efficient technologies, reduce energy use for consumers, decrease greenhouse gas emissions, and improve compliance with existing energy regulations.
CCR	California Code of Regulations is the official compilation of regulations adopted by California state agencies that have the force of law once they are filed with the Secretary of State. It is a comprehensive collection of administrative rules that govern nearly all aspects of economic activity and public life in California.
CEC	California Energy Commission is the state’s primary energy policy and planning agency, working to guide California towards 100% clean energy. Its core responsibility includes developing renewable energy, transforming transportation, increasing energy efficiency, and ensuring energy system reliability.
CEQA	California Environmental Quality Act is a state law that requires California public agencies to identify and disclose

	the potential environmental impacts of their proposed activities and to avoid or mitigate those impacts if feasible.
CFR	Code of Federal Regulations is the codification of the general and permanent rules published by U.S. federal executive departments and agencies. It is divided into 50 titles that cover broad areas of federal regulation, such as agriculture, transportation, and internal revenue.
CMT	Conveyor multiple tank commercial dishwasher is a commercial dishwasher that uses a conveyor belt and utilizes more than one tank for pumped rinse water, wash water, and sanitizing rinse.
CPUC	California Public Utilities Commission is a state agency that regulates privately-owned utility companies, ensuring they provide safe, reliable, and affordable service in areas like energy, water, and telecommunications.
CST	Conveyor single tank commercial dishwasher is a commercial dishwasher that uses a conveyor belt and utilizes one tank for pumped rinse water, wash water, and sanitizing rinse.
Decarbonization	The process of reducing or eliminating carbon dioxide (CO ₂) and other greenhouse gas (GHG) emissions into the atmosphere
DOE	U.S. Department of Energy is an executive department responsible for managing national energy policy, including promoting energy efficiency and renewable energy, funding scientific research, and overseeing the nation's nuclear infrastructure and stockpile.
DT	Door type commercial dishwasher is a stationary rack commercial dishwasher designed to accept a standard rack (20-inch by 20-inch dimension) that requires the raising of a door to place the rack into the wash/rinse chamber; closing of the door typically initiates the wash cycle.
EPCA	Energy Policy and Conservation Act of 1975 is a U.S. law that created a comprehensive federal energy policy to increase energy supply, reduce demand, improve efficiency, and prepare for energy emergencies.
FMT	Flight type multiple tank commercial dishwasher is a rack-less conveyor commercial dishwasher where the dishware is loaded directly on the conveyor rather than transported

	within a rack. This commercial dishwasher is also referred to as a rack-less conveyor commercial dishwasher and uses more than one tank for pumped rinse water, wash water, and sanitizing rinse.
FST	Flight type single tank commercial dishwasher is a rack-less conveyor commercial dishwasher where the dishware is loaded directly on the conveyor rather than transported within a rack. This commercial dishwasher is also referred to as a rack-less conveyor commercial dishwasher and uses one tank for pumped rinse water, wash water, and sanitizing rinse.
GDP	Gross domestic product. It is a measure of the total market value of all final goods and services produced within a set of borders in a specific period.
GHG	Greenhouse gases are any gas that has the property of absorbing infrared radiation emitted from Earth's surface and reradiating it back to the Earth's surface, thus contributing to the greenhouse effect. Carbon dioxide, methane, and water vapor are some examples of greenhouse gases.
GPH	Gallons Per Hour. Measurement of volume flow of water during an hour time.
GPR	Gallons per rack. Measurement of the volume of water used per conventional (20 inches by 20 inches) rack.
GPSF	Gallons per square foot. Measurement of the volume of water used per square foot.
GWh	Gigawatt-hour, a unit of energy that quantifies electricity consumption, equivalent to 1 million kWh.
GWh/yr	Gigawatt-hour per year. Unit of electricity consumption over time.
GWW	Commercial glasswasher is a dishwasher designed to clean and sanitize plates, pots, pans, glasses, cups, bowls, utensils, and trays by applying sprays of detergent solution (with or without blasting media granulates) and a sanitizing rinse.
HB	House Bill. A proposal for a new law or change to an existing law introduced by a house of representatives, for this report is pertinent to the applicable to the house of state representatives.

HT	High Temperature is water heated to a temperature above 180 °F.
ITSP	Invitation to Submit Proposals
kW	Unit of power representing a rate of energy use
kWh	Kilowatt-hour, a unit of energy that quantifies electricity consumption.
kWh/rack	Unit of energy used per conventional (20 inches by 20 inches) rack.
kWh/ft ²	Unit of energy used per area.
LT	Low temperature water heated between 140 °F and 180 °F.
MM	Abbreviation for millions
MWh	Megawatt-hours, a unit of energy that quantifies electricity consumption, equivalent to 1000 kWh.
NEEP	Northeast Energy Efficiency Partnerships
NRS	Abbreviation for Nevada Revised Statute
PPU	Pots, pans, and utensils commercial dishwasher
RFI	Request for information
SASD	State Appliance Standards Database (database by NEEP)
SRIA	Standardized Regulatory Impact Assessment. According to Senate Bill 617, state agencies must conduct this assessment when it is estimated that the proposed regulation has an economic impact exceeding \$50 million in any 12-month periods between filing with the Secretary of State through 12-months after the regulation is estimated to be fully implemented.
UC	Undercounter commercial dishwashers is a stationary rack commercial dishwasher with an overall height of 38 inches or less, designed to be installed under food preparation workplaces.
U.S. EPA	United States Environmental Protection Agency is a federal agency established to protect human health and the environment by creating and enforcing regulations for clean air, water, and land.

APPENDIX A:

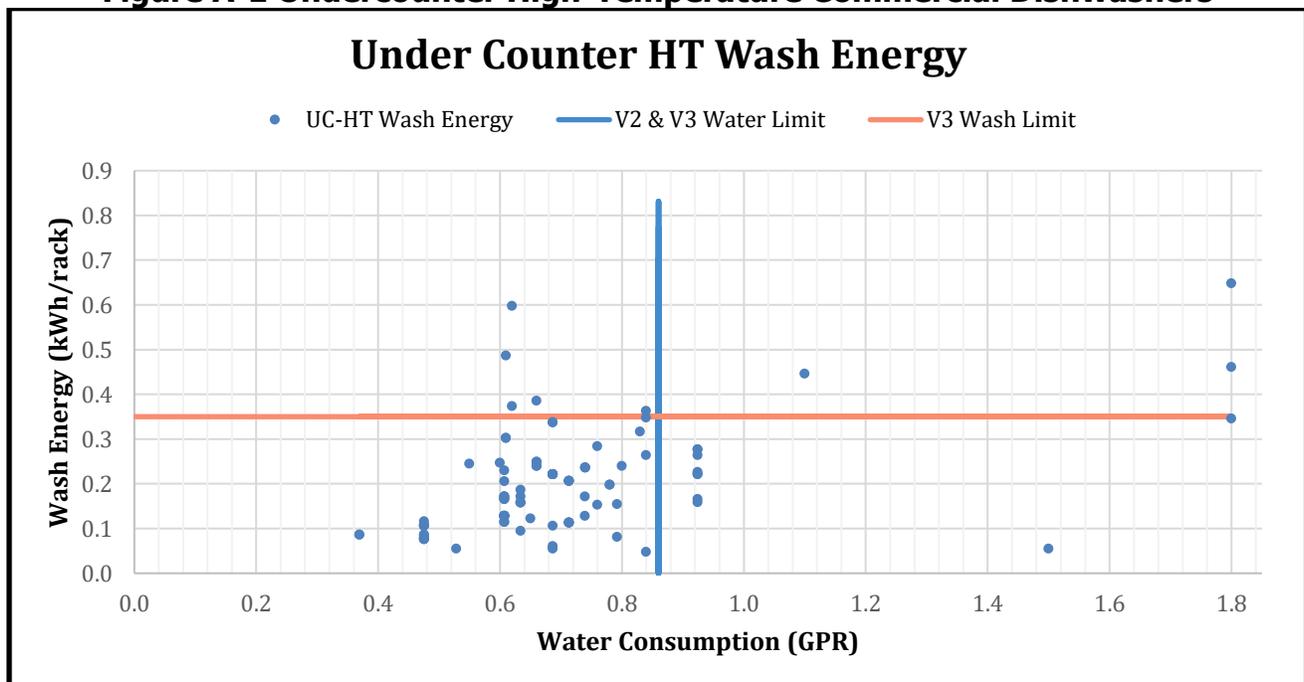
Staff Assumptions and Calculation Methods

Appendix A discusses the information and calculations used to characterize idle energy, washing energy, water consumption, and associated potential energy and water savings of commercial dishwashers in California. The information analyzed in the appendix was presented in Chapter 6 and 7 of this report. The sources of information were submitted to the public docket by energy efficiency advocates and industry and researched by California Energy Commission (CEC) staff.

Average Energy and Water Savings per Unit

During the analysis of the data received staff concluded that it was not representative of the entire market since it was data from ENERGY STAR which accounts for, or logs, efficient units only and not the total market. Staff therefore analyzed data from specification sheets of other products offered by the same manufacturers that participate in the ENERGY STAR program that are currently available in the market. In some cases, the average energy savings calculated were largely due to the low population of inefficient commercial dishwashers that performed worse than the proposed threshold. For example, as seen in **Figure A-1**, the average energy and water savings (if calculated using only nonperforming commercial dishwashers) would be based on about 8 to 10 types of commercial dishwashers.

Figure A-1 Undercounter High-Temperature Commercial Dishwashers



Source: CEC staff

To avoid a biased result due to the data available, staff used two energy savings assumptions to lower the value of average energy and water savings calculated for each type of commercial dishwasher. Staff calculated the average energy savings of each type of commercial

dishwasher by averaging the sum of the “realized” energy and water savings and the “possible” energy and water savings. The “realized” energy and water savings is the minimum energy savings that a commercial dishwasher that performs better than the proposed thresholds based on memoranda issued by ENERGY STAR on June 25, 2012 and October 27, 2020. The “realized” energy and water savings vary between 15 percent and 47 percent, depending on the type of energy or water savings for each type of commercial dishwasher.³⁷ The “possible” energy savings, on the other hand, are the energy and water savings that an inefficient commercial dishwasher would save when being replaced by one that complies with the proposed thresholds.

CEC staff then used the “realized” and “possible” energy and water savings to calculate the average idle energy savings, average washing energy savings, and average water savings for each type of commercial dishwasher. By averaging both (“realized” and “possible”), CEC staff achieves a conservative approach in the energy savings calculations.

Staff then analyzed the change in thresholds between Version 2.0 and Version 3.0 of the ENERGY STAR requirements for commercial dishwashers. Staff noticed that the thresholds that changed were the idle energy requirements for the high-temperature dishwashers, and the inclusion of a new threshold for the washing energy for all the different types (low and high temperature) of commercial dishwashers. Further analysis of both versions also allowed CEC staff to conclude that the water consumption for all commercial dishwashers remained the same. Based on that analysis, CEC staff assumed that the base model is 47 percent less efficient in idle energy mode, 17 percent less efficient in washing energy mode, and 30 percent to 40 percent less efficient in the water consumption for rack and rack less systems (flight type), respectively. CEC staff calculated average idle energy, washing energy, and water savings as presented in **Table A-1**.

CEC staff used the data provided by the Codes and Standards Enhancement (CASE) Initiative Analysis of Standards Proposal for Commercial Dishwasher submitted to Docket 23-AAER-01 regarding the embedded energy in water of about 5440 kilowatt hours per every million gallons of water.³⁸ This embedded energy assumption accounts for the water acquisition, treatment, and pumping through the waste infrastructure.

37 U.S. EPA. June 25, 2012. [Commercial Dishwashers Final Version 2.0 Cover Memo](https://www.energystar.gov/sites/default/files/specs//private/CD_Final_V2.0_Spec_Memo.pdf), https://www.energystar.gov/sites/default/files/specs//private/CD_Final_V2.0_Spec_Memo.pdf.

U.S. EPA. October 27, 2020. [Commercial Dishwashers Final Version 3.0 Cover Memo](https://www.energystar.gov/sites/default/files/asset/document/Commercial%20Dishwashers%20Final%20Version%203.0%20Cover%20Memo_0.pdf), https://www.energystar.gov/sites/default/files/asset/document/Commercial%20Dishwashers%20Final%20Version%203.0%20Cover%20Memo_0.pdf.

38 [California Investor Owned Utilities Comments — Title 20 Dishwasher CASE Report RFI Response Commercial Food Service TN#254440](https://efiling.energy.ca.gov/GetDocument.aspx?tn=254440&DocumentContentId=89825), <https://efiling.energy.ca.gov/GetDocument.aspx?tn=254440&DocumentContentId=89825>.

Table A-1: Unit Average Savings

Unit Type	Unit Average Idle Energy (kWh/yr)	Unit Average Washing-Energy (kWh/yr)	Electrical Booster (kWh/yr)	Embedded Electricity Water (kWh/yr)	Unit Average Water Savings (Gal/yr)
UC-LT	390	1,430	0	104	19,176
UC-HT	480	3,347	1,442	76	13,954
DT-LT	369	3,310	0	304	55,937
DT-HT	625	8,244	3,992	210	38,632
CST-LT	4,897	9,569	0	538	98,863
CST-HT	3,180	21,531	9,025	475	87,346
CMT-LT	2,748	24,670	0	690	126,895
CMT-HT	4,078	44,922	12,447	655	120,461
FST-HT	0	0	20,090	1,058	194,435
FMT-HT	0	0	24,257	1,277	234,767
PPU-HT	1,933	2,476	337	18	3,263
GWW-LT	808	561	0	51	9,308
GWW-HT	1,047	1,389	962	51	9,312
Total	20,555	121,449	72,552	5,507	1,012,349

Source: CEC staff

Life Cycle

CEC staff used the data provided by the CASE Initiative Analysis of Standards Proposal for Commercial Dishwasher for the effective lifespan of the different types of commercial dishwashers within the standards' proposed scope, as seen in **Table A-2**.

Table A-2: Commercial Dishwashers Lifespan

Unit Type	Lifespan (yrs)
Under Counter (LT and HT)	12
Door Type (LT and HT)	15
Conveyor Single Tank (LT and HT)	20
Conveyor Multiple Tank (LT and HT)	20
Flight type (Single and Multiple Tank)	20
Pots, Pans, and Utensils (HT)	15
Glasswashers (LT and HT)	12

LT = Low Temperature, HT = High Temperature

Source: CEC staff

Utility Rates

CEC staff used forecasted commercial rates for electricity and fossil gas, expressed in 2023 dollars, from the California Energy Demand of the 2024 Integrated Energy Policy Report Update, as shown in **Table A-3**.³⁹ These statewide numbers represent the average across utilities weighted by the volume of electricity and fossil gas sales.

CEC staff determined a representative population-averaged commercial water rate of \$6.18 per 1000 gallons by analyzing the 2020 urban water management plans (UWMPs) submitted by urban water suppliers to the California Department of Water Resources (DWR).⁴⁰ The California Water Code defines an "urban water supplier" as a supplier, either publicly or privately owned, providing water for municipal purposes either directly or indirectly to more than 3,000 customers or supplying more than 3,000 acre-feet of water annually. Water rates from a total of 578 California urban water suppliers were considered. When the UWMP data contained multiple entries from the same urban water supplier, the most recent data were kept and the redundant data entries removed.

Staff also reviewed the UWMP data to ensure consistency in units and eliminate faulty data. When faulty data were encountered, and for all the largest service districts, staff looked up rate information directly from the urban water suppliers' website. Staff considered service connections a reasonable proxy for the population and used the reported number of service connections to calculate the population-averaged commercial water rate.

³⁹ [California Energy Demand 2024-2040, Baseline Demand Forecast Files](https://www.energy.ca.gov/data-reports/reports/integrated-energy-policy-report-iepr/2024-integrated-energy-policy-report-0), <https://www.energy.ca.gov/data-reports/reports/integrated-energy-policy-report-iepr/2024-integrated-energy-policy-report-0>

⁴⁰ 2020 urban water management plans (UWMPs) submitted to the Department of Water Resources: <https://wuedata.water.ca.gov/default.asp>.

Table A-3: Commercial Electrical and Fossil Gas Rates

Year	Electricity Rate (2023\$ / kWh)	Fossil Gas Rate (2023\$ / therm)
2026	0.2667	1.3171
2027	0.2664	1.3690
2028	0.2673	1.4217
2029	0.2676	1.4752
2030	0.2690	1.5307
2031	0.2686	1.5882
2032	0.2691	1.6480
2033	0.2680	1.7085
2034	0.2684	1.7702
2035	0.2677	1.8341
2036	0.2674	1.9019
2037	0.2672	1.9774
2038	0.2671	2.0607
2039	0.2670	2.1528
2040	0.2670	2.2528
2041	0.2670	2.4915
2042	0.2670	2.6165
2043	0.2670	2.7487
2044	0.2670	2.8883
2045	0.2670	3.0358

kWh = Kilowatt-hour, Therm = 1 X 10⁵ BTUs (British thermal unit)
Source: CEC staff

Idling and Washing

CEC staff used values provided by the IOU’s CASE team proposal and specification sheets as the basis to generate new values listed in **Table A-4** for washed racks per day, hours of washing per day, facility hours of operation per day, and days of operation per year. These assumptions were used to calculate energy and water savings for the proposed standards and were the same for high- and low-temperature commercial dishwashers within each type of commercial dishwasher.

Table A-4: Unit Operational and Idle Times

Unit Type	Washed Racks per Day	Hours of Washing per day	Facility Hours of Operation per day	Days of Operation Per year
Undercounter	150	-	12	260
Door Type	400	-	14	260
Single Tank Conveyor	800	-	14	365
Multiple Tank Conveyor	1500	-	14	365
Single and Multiple Tank Flight Type	-	8	18	365
Pots, Pans, and Utensils	50	-	14	260
Glasswashers	50	-	12	365

- : Not applicable

Source: CEC staff

Shipments and Stock

The CEC used information provided by the CASE team for the number of shipments in California for 2024 to calculate the full stock turnover assuming no growth in the shipments per year (**Table A-5**.)⁴¹ The full stock turnover is calculated as the product of the first-year shipments and the lifespan of each type of commercial dishwasher as listed in **Table A-2**.

⁴¹ [California Investor Owned Utilities Comments-Title 20 Dishwasher CASE Report RFI Response Commercial Food Service TN#254440](https://efiling.energy.ca.gov/GetDocument.aspx?tn=254440&DocumentContentId=89825), p. 50, <https://efiling.energy.ca.gov/GetDocument.aspx?tn=254440&DocumentContentId=89825>.

Table A-5: First-Year Shipments and Full Stock Turnover

Unit Type	First-Year Shipments	Full Stock Turnover
UC-LT	1,873	22,476
UC-HT	2,785	33,420
DT-LT	3,789	56,835
DT-HT	1,103	16,545
CST-LT	26	520
CST-HT	197	3940
CMT-LT	2	40
CMT-HT	33	660
FST-HT	20	400
FMT-HT	58	1,160
PPU-HT	80	1,200
GWW-LT	100	1,200
GWW-HT	100	1,200

Source: CEC staff

Water Heater and Booster Energy Savings

CEC staff assumed 95 percent (0.95) thermal efficiencies for the commercial water heater and the commercial dishwasher booster heater. The energy calculated is associated with the volume of water saved. To calculate the energy used to heat water, CEC staff used the following equation:

$$Q = \frac{(K * ((V * W) * \Delta T))}{E_t}$$

Where:

- Q = Burned fossil gas in BTU per year
- K = Water-specific heat (1.040 BTU/(lb*°F))
- V = Water savings per year in Gallons per year (Gal/yr)
- W = Weight of water per gallon (8.34 lb/gal)
- ΔT = Water temperature change in °F
 - o 40 °F for Commercial Dishwasher Booster
 - o 75 °F for Commercial Water Heater
- E_t = Thermal efficiency (0.95 for both water heater and Booster)

Energy Savings

Because of the limited test data and the longevity of the different commercial dishwashers, CEC staff implemented the assumptions in **Table A-6** to calculate the energy savings for each type of commercial dishwasher. These assumptions were based on the number of units available from the different manufacturers models available for consumers based on the

specification sheets reviewed and shipping information from ENERGY STAR. These calculations will generate conservative values since they will reduce the total savings calculated.

Table A-6: General Assumptions

Assumption	Value	Source
High Temperature Fossil Gas Booster Units Shipped	25%	CEC Staff
High Temperature Electric Booster Units Shipped	75%	CEC Staff
Percentage of units being shipped to California that are non-compliant	100% - (MP=53%) = 47%	Energy Star unit Shipment and Market Penetration (MP) Report 2023. ⁴²

MP = Market Penetration
Source: CEC staff

Calculations

Electricity Savings

The total gigawatt-hours per unit saved for the first year of implementation (**Table A-7**) were calculated by CEC staff using the following equation:

$$ESaved_{1st\ year} = \left[\frac{((IE + WE + EB + EEPW) \times SU) \times MNP}{1year \times 1000000} \right]$$

Where:

- $ESaved_{1st\ year}$ = Electricity saved for the 1st year (Gigawatt hours)
- IE = Unit idle energy per year
- WE = Unit washing energy per year
- EB = Unit electric booster Energy per year
- EEPW = Embedded electric in potable water per year
- SU = Shipped units for the first year.
- MNP = Market non-penetration (0.47)

⁴² [ENERGY STAR Unit Shipment and Market Penetration Report Calendar Year 2023 Summary.](#)

Table A-7: First-Year Electrical Savings

Unit Type	IE (kWh/yr)	WE (kWh/yr)	EB (kWh/yr)	EEPW (kWh/yr)	SU	ESaved_{1st year} (GWh)
UC-LT	390	1,430	0	104	1,873	1.69
UC-HT	480	3,347	1,442	76	2,785	7.00
DT-LT	369	3,310	0	304	3,789	7.09
DT-HT	625	8,244	3,992	210	1,103	6.78
CST-LT	4,897	9,569	0	538	26	0.18
CST-HT	3,108	21,531	9,025	475	197	3.16
CMT-LT	2,748	24,670	0	690	2	0.03
CMT-HT	4,078	44,922	12,447	655	33	0.96
FST-HT	0	0	20,090	1,058	20	0.20
FMT-HT	0	0	24,257	1,277	58	0.70
PPU-HT	1,933	2,476	337	18	80	0.18
GWW-LT	808	561	0	51	100	0.07
GWW-HT	1,047	1,389	962	51	100	0.16
Totals	20,483	121,449	72,552	5,507	10,166	28.2

Source: CEC staff

CEC staff assume that full stock turnover in California will take place by the end of the assumed lifespan of each machine. The total Gigawatt hours per year saved after full stock turnover is calculated in **Table A-8** using the following formula:

$$ES = \left[\frac{((IE + WE + (EB \times PEB) + EEPW) \times STK) \times MNP}{1000000} \right]$$

Where:

- ES = Electricity saved per year after full stock (Gigawatt hours)
- IE = Unit Idle Energy per year
- WE = Unit Washing Energy per year
- EB = Unit Electric Booster Energy per year
- PEB = % of electrical units shipped (75%)
- EEPW = Embedded Electric in Potable Water per year
- STK = Full Stock
- MNP = Market Non-Penetration (0.47)

Table A-8: Electrical Savings Per Year After Full Stock Turnover

Unit Type	IE (kWh/yr)	WE (kWh/yr)	EB (kWh/yr)	EEPW (kWh/yr)	STK	ES (GWh/yr)
UC-LT	390	1,430	0	104	22,476	20.3
UC-HT	480	3,347	1,442	76	33,420	78.3
DT-LT	369	3,310	0	304	56,835	106.4
DT-HT	625	8,244	3,992	210	16,545	93.9
CST-LT	4,897	9,569	0	538	520	3.7
CST-HT	3,108	21,531	9,025	475	3,940	59.0
CMT-LT	2,748	24,670	0	690	40	0.5
CMT-HT	4,078	44,922	12,447	655	660	18.3
FST-HT	0	0	20,090	1,058	400	3.0
FMT-HT	0	0	24,257	1,277	1,160	10.6
PPU-HT	1,933	2,476	337	18	1,200	2.6
GWV-LT	808	561	0	51	1,200	0.8
GWV-HT	1,047	1,389	962	51	1,200	1.8
Total	20,483	121,449	72,552	5,507	139,596	399.2

Source: CEC Staff

Fossil Gas Savings

The total number of Therms per unit saved for the first year of implementation was applied to the commercial dishwashers that may use fossil gas booster, i.e. CST-HT, CMT-HT, FMT-HT, and PPUs. UC-HT, DT-HT, and GWV-HT were assumed to be sold with an electrical booster only and do not have a fossil gas option. **Table A-9** reflects the possible savings of fossil gas in Therms using the following equation:

$$NGS_{1st\ year} = \left[\left[\frac{K \times (V \times W) \times \Delta T_{wh}}{E_{twh}} \right] + \left[\left[\frac{K \times (V \times W) \times \Delta T_{bt}}{E_{bt}} \right] \times PNGB \right] \right] \times TCF \times SU$$

Where:

- K = Water Specific Heat (1.040 BTU/(lb*°F))
- V = Water savings per year in Gallons per year per unit (Gal/yr)
- W = Weight of water per gallon (8.34 lb/gal)
- ΔT_{wh} = Water temperature change Water heater (75 °F)
- ΔT_{bt} = Water temperature change Booster (40 °F)
- E_{twh} = Water heater thermal efficiency (0.95)
- E_{bt} = Booster heater thermal efficiency (0.95)
- PNGB = Percent of units shipped with fossil gas water heater
- TCF = Conversion factor from BTU to Therms
- SU = First year shipped units (See **Table A-7**)

Table A-9: 1st Year Fossil Gas Savings

Unit Type	First Year FG Savings from Water Heater (Therms)	First year FG Savings from FG Booster (Therms)	FG _{1st year} (Therms)
UC-LT	237,423	0	237,423
UC-HT	256,896	0	256,896
DT-LT	1,401,071	0	1,401,071
DT-HT	281,681	0	281,681
CST-LT	16,992	0	16,992
CST-HT	113,748	15,166	128,915
CMT-LT	1,678	0	1,678
CMT-HT	26,278	3,504	29,782
FST-HT	25,706	3,428	29,134
FMT-HT	90,012	12,002	102,014
PPU-HT	1,726	58	1,783
GWW-LT	6,153	0	6,153
GWW-HT	6,156	0	6,156
Total	2,465,520	34,158	2,449,678

Source: CEC Staff

To calculate the fossil gas savings per year after full stock turnover in **Table A-10** CEC staff

used the following equation:
$$NGS_{Stk} = \frac{\left[\frac{K \times (V \times W) \times \Delta T_{wh}}{E_{twh}} \right] + \left[\frac{K \times (V \times W) \times \Delta T_{bt}}{E_{bt}} \right] \times PNGB}{1,000,000} \times TCF \times STK$$

Where:

- K = Water Specific Heat (1.040 BTU/(lb*°F))
- V = Water savings per year in Gallons per year per unit (Gal/yr)
- W = Weight of water per gallon (8.34 lb/gal)
- ΔT_{wh} = Water temperature change Water heater (75 °F)
- ΔT_{bt} = Water temperature change Booster (40 °F)
- E_{twh} = Water heater thermal efficiency (0.95)
- E_{bt} = Booster heater thermal efficiency (0.95)
- PNGB = Percent of units shipped with fossil gas water heater
- TCF = Conversion factor from BTU to Therms
- STK = Full Stock First year shipped units (See **Table A-8**)

Table A-10: Fossil Gas Savings Per Year After Full Stock Turnover

Unit Type	FG Savings from Water Heater at Full Stock Turnover (Therms/yr)	FG from Savings from NG Booster Full Stock Turnover (Therms/yr)	FG_{stk} (MM Therms/yr)
UC-LT	1,339,068	0	1.34
UC-HT	1,448,896	0	1.45
DT-LT	9,877,554	0	9.88
DT-HT	1,985,848	0	1.99
CST-LT	159,725	0	0.16
CST-HT	1,069,234	303,328	1.37
CMT-LT	15,770	0	0.02
CMT-HT	247,017	70,075	0.32
FST-HT	241,640	68,550	0.31
FMT-HT	846,117	240,033	1.09
PPU-HT	12,165	3,451	0.02
GWV-LT	34,702	0	0.03
GWV-HT	34,720	0	0.03
Total	17,312,456	685,437	18.01

Source: CEC Staff

Water Savings

The water savings for the 1st year of implementation in **Table A-11** were calculated using the following formula:

$$WS_{1st\ year} = \frac{V \times SU}{1,000,000}$$

Where:

- $WS_{1st\ year}$ = Water Savings 1st year
- V = Water savings per year in Gallons per year for each unit (Gal/yr)
- SU = First year shipped units (See **Table A-7**)

Table A-11: 1st Year Water Savings

Unit Type	Unit Water Savings (Gal)	WS_{1st year} (MM Gal)
UC-LT	19,176	35.95
UC-HT	13,954	38.86
DT-LT	55,937	211.94
DT-HT	38,632	42.61
CST-LT	98,863	2.57
CST-HT	87,346	17.21
CMT-LT	126,895	0.25
CMT-HT	120,461	3.98
FST-HT	194,435	3.89
FMT-HT	234,767	13.62
PPU-HT	3,263	0.26
GWW-LT	9,308	0.93
GWW-HT	9,312	0.93
Total	1,012,349	373.0

Source: CEC Staff

To calculate the water savings per year after full stock turnover, see **Table A-12**, CEC staff used the following equation:

$$WS_{SK} = \left[\frac{V \times STK}{1,000,000} \right] \times MNP$$

Where:

- WS_{SK} = Water Savings after Full Stock
- V = Water savings per year in Gallons per year for each unit (Gal/yr)
- STK = Full Stock (See **Table A-8**)
- MNP = Market Non-Penetration (0.47)

Table A-12: Water Savings Per Year After Full Stock Turnover

Unit Type	Unit Water Savings (Gal/yr)	WS_{sk} (MM Gal/yr)
UC-LT	19,176	202.57
UC-HT	13,954	219.18
DT-LT	55,937	1,494.21
DT-HT	38,632	300.41
CST-LT	98,863	24.16
CST-HT	87,346	161.75
CMT-LT	126,895	2.39
CMT-HT	120,461	37.37
FST-HT	194,435	36.55
FMT-HT	234,767	127.99
PPU-HT	3,263	1.84
GWW-LT	9,308	5.25
GWW-HT	9,312	5.25
Total	1,012,349	2,619

Source: CEC Staff

Total Utility Savings

To calculate the total utility savings from implementation to full stock turnover. The savings were calculated using the assumption that shipments will remain the same as the first year but taking into consideration the forecasted rates for electricity and fossil gas. Due to the extensive municipalities of water, the CEC used an average water rate of \$6.18 for 1000 gallons of potable water. The total utility bill savings, **Table A-13**, were calculated using the following formula:

$$TUS = \sum_{i=2026}^{2045} [(YUES \times YER_i) + (YUGS \times YNGR_i) + (YUWS \times WR)]$$

Where:

- YUES = Unit Total Electrical Energy Per Year
- YUGS = Unit Total Gas Savings Per Year
- YUWS = Unit Total Water Savings per Year
- YER_i = Electrical Rate for the year (**Table A-3**)
- YNGR_i = Fossil Gas Rate for the year (**Table A-3**)
- WR = Average Water Rate (\$6.18 per 1,000 gallons of water)

Table A-13: Total Utility Bills Savings

Unit Type	Total Electrical Savings (2023 MM\$/yr)	Total FG Savings (2023 MM\$/yr)	Total Water Savings (2023 MM\$/yr)	Total Utility Savings at Full Stock Turnover (2023 MM\$/yr)
UC-LT	5.44	4.64	1.25	11.33
UC-HT	22.46	5.02	1.35	28.84
DT-LT	28.45	36.44	9.23	74.13
DT-HT	27.18	11.21	1.86	40.25
CST-LT	0.98	0.68	0.15	1.81
CST-HT	16.90	5.13	1.00	23.03
CMT-LT	0.14	0.07	0.01	0.22
CMT-HT	5.15	1.18	0.23	6.57
FST-HT	1.06	1.16	0.23	2.45
FMT-HT	3.72	4.06	0.79	8.57
PPU-HT	0.96	0.05	0.01	1.02
GWW-LT	0.27	0.12	0.03	0.42
GWW-HT	0.52	0.12	0.03	0.67
Total	113.23	69.87	16.18	199.29

Source: CEC Staff

Unit Lifecycle Net Benefit

CEC staff calculated the unit lifecycle net benefit for all electrical commercial dishwashers. The unit electrical lifecycle net benefit, **Table A-14**, was calculated using the following formula:

$$EUNB = \left[\sum_{i=1}^n \frac{EB + NGB + WB}{(1 - DisR)^i} \right] - UIC$$

Where:

- EUNB = Electrical Unit Net Benefit
- EB = Electrical Benefit (idle, washing, booster, and electricity embedded in water) for each year within the lifespan of the unit.
- NGB = Fossil Gas Unit Benefit from the water heater for each year within the lifespan of the unit.
- WB = Water Unit Benefit for each year within the lifespan of the unit.
- DisR = 3% discount rate (0.03)
- n = Unit lifecycle in years (**Table A-2**)
- UIC = Unit Incremental Cost

Table A-14: Electrical Unit Lifecycle Net Benefit

Unit Type	Unit Total Electrical Lifecycle Benefit (\$)	Incremental Cost (\$)	Unit Electricity Net Benefit (\$)
UC-LT	7,264.81	653.75	6,611.06
UC-HT	15,788.58	1,345.82	14,442.76
DT-LT	20,545.92	2,177.04	18,368.88
DT-HT	47,132.43	7,161.14	39,971.29
CST-LT	78,792.75	7,742.00	71,050.75
CST-HT	152,664.22	10,137.08	142,527.14
CMT-LT	136,333.76	22,740.17	113,593.59
CMT-HT	270,280.47	24,394.25	245,886.22
FST-HT	121,714.09	20,000.00	101,714.09
FMT-HT	146,961.63	65,000.00	81,961.63
PPU-HT	15,664.64	9,484.00	6,180.64
GWW-LT	4,818.30	469.75	4,348.55
GWW-HT	10,221.24	1,309.82	8,911.42
Total	1,028,182.84	172,614.82	842,568.02

Source: CEC Staff

CEC staff also calculated the unit lifecycle net benefit for the commercial dishwashers that could use a fossil gas booster for the commercial dishwashers that operate under a high-temperature rinse cycle (i.e. UC-HT, DT-HT, CST-HT, CMT-HT, FST-HT, FMT-HT, PPU-HT, and GWW-HT). The unit fossil gas lifecycle net benefit, **Table A-15**, was calculated using the following formula:

$$NGUNB = \left[\sum_{1}^{n} \frac{EBG + NGBG + WB}{(1 - DisR)^i} \right] - UIC$$

Where:

- NGUNB = Fossil Gas Unit Net Benefit
- EBG = Electrical Benefit for NG units (idle, washing, and electricity embedded in water) for each year within the lifespan of the unit.
- NGBG = Fossil Gas Unit Benefit for NG units (water heater and booster) for each year within the lifespan of the unit.
- WB = Water Unit Benefit for each year within the lifespan of the unit.
- DisR = 3% discount rate (0.03)
- n = Unit lifecycle in years
- UIC = Unit Incremental Cost

Table A-15: Fossil Gas Unit Lifecycle Net Benefit

Unit Type	Unit Total Fossil Gas Lifecycle Benefit (\$)	Incremental Cost (\$)	Unit Electricity Net Benefit (\$)
UC-HT	13,512.27	1,345.82	12,858.52
DT-HT	39,770.79	7,161.14	32,609.65
CST-HT	133,009.56	10,137.08	122,872.48
CMT-HT	243,174.07	24,394.25	218,779.82
FST-HT	77,962.06	20,000	57,962.06
FMT-HT	94,133.97	65,000	29,133.97
PPU-HT	15,042.87	9,484.00	5,558.87
GWW-HT	8,702.09	1,309.82	7,392.27
Total	625,307.68	138,826.11	487,167.64

Source: CEC staff

APPENDIX B:

Staff Proposed Regulatory Language

California Code of Regulations
Title 20. Public Utilities and Energy
Division 2. State Energy Resources Conservation and Development
Commission
Chapter 4. Energy Conservation
Article 4. Appliance Efficiency Regulations

The proposed changes to the Title 20 regulations are provided below. Changes to the regulations are marked with underlining (new language) and ~~strikethroughs~~ (deletions). Three dots or "... " represent the substance of the existing regulations that will remain unchanged between the sections containing proposed language changes.

§ 1601. Scope

... [skipping (a) though (n)]

(o) Dishwashers That Are Federally Regulated Consumer Products, and Commercial Dishwashers.

... [skipping to the end of section 1601]

Note: Authority cited: Sections 25213, 25218(e), 25401.9, 25402(a)-25402(c), and 25960, Public Resources Code; and sections 16, 26, and 30, Governor's Exec. Order No. B-29-15 (April 1, 2015). Reference: Sections 25216.5(d), 25401.9, 25402(a)-25402(c), 25402.5.4, 25402.11 and 25960, Public Resources Code; and Section 16, Governor's Exec. Order No. B-29-15 (April 1, 2015).

§ 1602. Definitions.

... [skipping (a) though (n)]

(o) Dishwashers.

"Auxiliary rinse" means recirculated water pumped from a tank or sump and sprayed onto dishes after the wash or pumped rinse cycle and before the sanitizing rinse is applied.

"Basic commercial dishwasher model" means the model tested is configured such that it reflects the worst-case energy performance for the product line. Variations within the product line shall be limited to finish/color; length of prewash section, voltage, and orientation (e.g. corner, straight through models).

"Booster heater" of a commercial dishwasher, means a water heater that raises the temperature of preheated water 40 to 80 degrees Fahrenheit. Preheated water is supplied to the booster heater at temperatures that are typically between 100 and 140 degrees Fahrenheit. The booster heater can be either integral to the dishwasher or externally connected.

“Commercial dishwasher” means a machine designed to clean and sanitize plates, pots, pans, glasses, cups, bowls, utensils, and trays by applying sprays of detergent solution (with or without blasting media granulates) and a sanitizing rinse.

- (1) Included: Undercounter commercial dishwasher; door-type commercial dishwasher; single-tank conveyor commercial dishwasher; multiple-tank conveyor commercial dishwasher; flight-type commercial dishwasher; undercounter commercial glasswasher; and pot, pan, and utensil (PPU) commercial dishwasher.
- (2) Excluded: Dishwashers covered under §430.32(f) of title 10 of the Code of Federal regulations, laboratory dishwashers, low-temperature flight-type commercial dishwasher, and low-temperature PPU commercial dishwasher.

... [skipping “Compact dishwasher”]

“Conveyor commercial dishwasher” means a commercial dishwasher that employs a conveyor or similar mechanism to carry dish containing rack through a series of wash and rinse sprays within the commercial dishwasher.

... [skipping from “Cycle” to “Dishwasher”]

“Door-type commercial dishwasher” means a stationary rack commercial dishwasher designed to accept a standard rack (20-inch by 20-inch dimension) that requires the raising of a door to place the rack into the wash/rinse chamber; closing of the door typically initiates the wash cycle. Subcategories include single rack, double rack chemical dump-and-fill type, and hooded wash compartment (“hood type”). It can be either low-temperature or high-temperature sanitizing types, with an internal or external booster heater for the latter.

“Dual-sanitizing commercial dishwasher” means a commercial dishwasher designed to operate as either a high-temperature or low-temperature sanitizing commercial dishwasher.

“Dump-and-fill commercial dishwasher” mean a door-type commercial dishwasher where after the wash cycle, the drain automatically opens to dump the wash water to a holding tank or to a drain. The rinse tank fills then become the water for the next wash cycle.

... [skipping “Energy Factor”]

“Flight-type commercial dishwasher” means a rackless conveyor commercial dishwasher where the dishware is loaded directly on the conveyor rather than transported within a rack. This commercial dishwasher is also referred to as a rackless conveyor commercial dishwasher. Flight-type commercial dishwashers can be either low-temperature or high-temperature sanitizing types, with an internal or external booster heater for the latter. Flight-type commercial dishwashers can be designed with a single- or multiple-tank design.

“Heat recovery equipment” means the equipment within a commercial dishwasher that recovers energy from other sources for the purpose of heating potable water. This includes but is not limited to drain water, wash compartment, and/or exhaust heat exchangers, and supplemental heat pumps.

“High-temperature commercial dishwasher” means a commercial dishwasher that use high-temperature water (water at or above 180 °F) to achieve sanitization of the ware being washed.

“Idle energy rate” means the rate of energy consumed by the commercial dishwasher while holding or maintaining wash tank water at the thermostat(s) set point during the period specified and outside of an active cycle.

“Idle mode” means the commercial dishwasher is not actively running but is still powered on and ready to wash ware at the required temperature.

“Laboratory dishwasher” means a dishwasher marketed and designed to thoroughly and consistently clean, sanitize, and dry reusable labware such as beakers, flasks, and test tubes to meet the stringent demands of scientific applications. These dishwashers use specialized alkaline and acidic detergents, have modular racking systems, and use deionized water to prevent introduction of ions or contaminants that can be found in potable water.

“Low-temperature commercial dishwasher” means a commercial dishwasher that uses low-temperature water (water between 140 °F to 180 °F) and a chemical solution for the sanitization of the ware being washed.

“Multiple-tank conveyor commercial dishwasher” means a conveyor commercial dishwasher that includes more than one tank for wash water and one or more tanks for pumped rinse water, followed by a sanitizing rinse. This type of commercial dishwasher may include a prewashing section before the washing section and an auxiliary rinse section, for purposes of reusing the sanitizing rinse water, between the power rinse and sanitizing rinse section. It can be either low-temperature or high-temperature sanitizing, with an internal or external booster heater for the latter.

“Nonrecirculating pumped final sanitizing rinse” means a fresh potable water rinse that is pumped once over wares and achieves sanitization using either low-temperature or high-temperature sanitizing.

... [skipping “non-soil-sensing dishwasher”]

“Pot, pan, and utensil commercial dishwashers (PPU)” means a door-type commercial dishwasher designed to clean and sanitize pots, pans, and kitchen utensils. PPU models can be designed to accept multiple racks at once (generally two) and/or larger dimensioned racks that exceed the 20-inches-by-20-inches standard dish rack.

“Post-sanitizing rinse” means a rinse using sprays of fresh, potable water applied after the sanitizing step.

“Pumped rinse” means a rinse that uses recirculated water that is pumped from a tank and sprayed onto dishes after washing and before the final sanitizing rinse is applied.

“Recirculating final sanitizing rinse” means a rinse that uses fresh potable water that is pumped repeatedly over wares and achieves sanitization using either chemical sanitizers or high temperature.

“Rinse mode” for stationary-rack commercial dishwashers, means the commercial dishwasher is at the end of the actively running cycle and is spraying high-temperature water, low-temperature sanitizing rinse water, or a post-sanitizing rinse.

“Single-tank conveyor commercial dishwasher” means a conveyor commercial dishwasher that includes a tank for wash water followed by a sanitizing rinse (pumped or fresh water). This

type of commercial dishwasher does not have a pumped rinse tank. This type of commercial dishwasher may include a prewashing section ahead of the washing section and an auxiliary rinse section, for purposes of reusing the sanitizing rinse water, between the wash and sanitizing rinse sections. It can be either low-temperature or high-temperature types with an internal or external booster heater for the latter.

... [skipping from "Soil-sensing dishwasher" to "Standard dishwasher"]

"Stationary-rack commercial dishwasher" means a commercial dishwasher in which a removable rack of dishes remains stationary within the machine while subjected to sequential wash and rinse sprays.

... [skipping "Truncated normal cycle"]

"Undercounter commercial dishwasher" means a stationary rack commercial dishwasher with an overall height of 38 inches or less, designed to be installed under food preparation workplaces. Undercounter commercial dishwashers can be either chemical (low-temperature) or hot-water (high-temperature) sanitizing, with an internal or external booster heater for the latter.

"Undercounter commercial glasswasher" means a undercounter commercial dishwasher specifically designed to clean and sanitize glass only.

... [skipping "Water heating dishwasher"]

"Washing energy" means the rate of energy consumed by the commercial dishwasher while "washing" or "sanitizing" dish loads, as expressed in kilowatt-hours per rack (kWh/rack). All rinse modes (i.e., pumped rinse, auxiliary rinse, nonrecirculating pumped final sanitizing rinse, recirculating final sanitizing rinse, and post-sanitizing rinse) are included in washing energy calculations.

"Water consumption" means the rate of water usage in gallons per rack, gallons per square foot, or gallons per hour, depending on the type of commercial dishwasher monitored during testing. Measurement is taken after the commercial dishwasher is stabilized, therefore excluding water for filling or replenishing tanks.

... [skipping to the end of section 1602]

Note: Authority cited: Sections 25213, 25218(e), 25401.9, 25402(a)-25402(c) and 25960, Public Resources Code; and Sections 16, 26 and 30, Governor's Exec. Order No. B-29-15 (April 1, 2015). Reference: Sections 25216.5(d), 25401.9, 25402(a)-25402(c), 25402.5.4, 25402.11, and 25960, Public Resources Code; and Section 16, Governor's Exec. Order No. B-29-15 (April 1, 2015).

§ 1602.1 Rules of Construction

(No change)

§ 1603. Testing: All Appliances

(No change)

§ 1604. Test Methods for Specific Appliances.

... [skipping (a) through (n)]

(o) Dishwashers

(1) Dishwashers That Are Consumer Products. The test method for dishwashers that are consumer products is 10 C.F.R. section 430.23(c) (Appendix C1 to subpart B of part 430) (January 19, 2025).

(2) Commercial Dishwashers. The test methods for commercial dishwashers are shown in Table O-1 with additional requirements shown in sections 1604(o)(2)(A) – (H) of this Article.

Table O-1

Commercial Dishwasher Test Methods

<u>Commercial Dishwasher Category</u>	<u>Test Method</u>
<u>Undercounter, single-tank door type, and pot, pan, and utensils (PPU)</u>	<u>ASTM F1696-20, Standard Test Method for Energy Performance of Stationary-Rack, Door-type Commercial Dishwashing Machines</u>
<u>Single-tank conveyor, multiple-tank conveyor, single-tank flight type, and multiple-tank flight type</u>	<u>ASTM F1920-20, Standard Test Method for Energy Performance of Rack Conveyor Commercial Dishwashing Machines</u>

(A) For commercial dishwashers with multiple-voltage versatility and those that are available in different voltage configurations, the basic commercial dishwasher model shall be tested at the most energy consumptive (worst case scenario) rating.

(B) All calculations shall be carried out with directly measured (unrounded) values.

(C) For commercial dishwashers with heat recovery systems applying the energy offset, report the percentage of hot water supply (maximum of 5%).

(D) Conveyor commercial dishwashers that offer multiple conveyor speeds adjustable by the user must be set to the maximum conveyor speed setting for testing. Water consumption values using the maximum conveyor speed setting shall be used for certification purposes of section 1606 of this Article.

(E) Commercial dishwashers offering a postsanitizing rinse shall be evaluated with the post-sanitizing rinse turned on during testing. The final rinse water consumption must include both sanitizing and post-sanitizing rinses.

(F) Idle results should be measured with the door closed and represent the total idle energy consumed by the commercial dishwasher, including tank(s), heater(s), and controls.

(G) Heat recovery equipment shall meet the following requirements to qualify for the hot water energy offset:

1. A minimum of 95% of water volume from the cold-water inlet for the wash and rinse cycle. The machine can have both cold-water and hot-water inlets, but a maximum of 5% of wash and rinse cycle water shall come from the hot water during testing.
2. The temperature of the water at the commercial dishwasher's inlet must be 70°F ± 3°F during testing; and
3. The commercial dishwasher must operate at or above 180°F rinse temperature.

(H) The total washing energy shall include internal or external booster heater energy in addition to the tank, heat, motor, control, and any additional auxiliary energy, expressed in kWh/rack. If a high-temperature commercial dishwasher has heat recovery equipment, the energy use of the commercial dishwasher shall be adjusted by the hot water energy offset value. The hot water offset subtracted from the ASTM measured washing energy value shall be calculated by using the equation in section 1604(o)(2)(H)1 (below) of this Article.

1. To calculate the primary hot water energy offset by the high-temperature heat recovery equipment fed by the cold-water inlet during the washing energy rate use:

$$E_{primaryoffset} = \left(\frac{(V_{water} \times 583.1)}{0.77} \right) \times 0.00293$$

Where:

E_{primaryoffset} = Calculated primary hot water energy offset in kWh/rack

V_{water} = measured water volume consumed by dishwasher (gallons/rack)

[end of (o)]

... [skipping (p) through "AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)]

ASTM INTERNATIONAL

ANSI/ASTM F1496-99

Standard Test Method for Performance of
Convection Ovens

ANSI/ASTM F1521-96

Standard Test Methods for Performance of
Range Tops

ANSI/ASTM F1696-20

Standard Test Method for Energy Performance of Stationary-Rack, Door-Type Commercial Dishwashing Machines

ANSI/ASTM F1920-20

Standard Test Method for Energy Performance of Rack Conveyor Commercial Dishwashing Machines

... [skipping to end of Section 1604]

Note: Authority cited: Sections 25213, 25218(e), 25401.9, 25402(a)-25402(c) and 25960, Public Resources Code; and Sections 16, 26 and 30, Governor’s Exec. Order No. B-29-15 (April 1, 2015).

Reference: Sections 25216.5(d), 25401.9, 25402(a)-25402(c) and 25960, Public Resources Code; and Section 16, Governor’s Exec. Order No. B-29-15 (April 1, 2015).

§ 1605.1 Federal and State Standards for Federally Regulated Appliances

... [skipping (a) through (n)]

(o) Dishwashers.

- (1) **Dishwashers That Are Consumer Products.** The maximum energy use and maximum water use of dishwashers that are consumer products manufactured on or after the effective dates shown shall meet the applicable values shown in Table O-12 and Table O-23.

Table O-~~12~~

Standards for Dishwashers That Are Consumer Products Manufactured on or After May 30, 2013, but Before April 23, 2027

<i>Appliance</i>	<i>Effective May 30, 2013</i>	
	<i>Maximum Energy Use (kWh/year)</i>	<i>Maximum Water Use (gallons/cycle)</i>
Compact dishwashers	222	3.5
Standard dishwashers	307	5.0

Table O-23

**Standards for Dishwashers That Are Consumer Products Manufactured on or After
April 23, 2027**

<i>Dishwasher Product Class</i>	<i>Maximum Annual Energy Use (kWh/year)</i>	<i>Maximum Water Use (gallons/cycle)</i>
Standard-size ¹ (≥ 8 place settings plus 6 serving pieces) ²	223	3.3
Compact-size (< 8 place settings plus 6 serving pieces) ²	174	3.1

¹ The energy conservation standards in this table do not apply to standard-size dishwashers that are consumer products with a cycle time for the normal cycle of 60 minutes or less.

² Place settings and the test load are as specified in the dishwasher that are consumer products testing requirements shown in section 1604(o) of this Article.

(2) **Commercial Dishwashers.** See section 1605.3(o) of this Article for energy and water efficiency standards for commercial dishwashers manufactured on or after [**MONTH DD, YYYY**].

... [end of (o)]

... [skipping the rest of section 1605.1]

Note: Authority cited: Sections 25213, 25218(e), 25401.9, 25402(a)-25402(c) and 25960, Public Resources Code; and Sections 16, 26, and 30, Governor's Exec. Order No. B-29-15 (April 1, 2015).

Reference: Sections 25216.5(d), 25401.9, 25402(a)-25402(c) and 25960, Public Resources Code; and Section 16, Governor's Exec. Order No. B-29-15 (April 1, 2015).

§ 1605.2 State Standards for Non-Federally Regulated Appliances

... [skipping (a) through (n)]

(o) Dishwashers.

(1) **Dishwashers That Are Consumer Products.** See section 1605.1(o) of this Article for energy and water efficiency standards for dishwashers that are federally regulated consumer products.

(2) **Commercial Dishwashers.** See section 1605.3(o) of this Article for energy and water efficiency standards for commercial dishwashers manufactured on or after [**MONTH DD, YYYY**].

... [skipping the rest of section 1605.2]

Note: Authority cited: Sections 25213, 25218(e), 25401.9, 25402(a)-25402(c), and 25960, Public Resources Code; and sections 16, 26, and 30, Governor's Exec. Order No. B-29-15 (April 1, 2015).

Reference: Sections 25216.5(d), 25401.9, 25402(a)-25402(c), and 25960, Public Resources Code; and Section 16, Governor's Exec. Order No. B-29-15 (April 1, 2015).

§ 1605.3 State Standards for Non-Federally Regulated Appliances

... [skipping (a) through (n)]

(o) Dishwashers.

- (1) **Dishwashers That Are Consumer Products.** See section 1605.1(o)(1) of this Article for energy and water efficiency standards for dishwashers that are consumer products.
- (2) **Commercial Dishwashers.** The energy and water efficiency standards for high-temperature and low-temperature commercial dishwashers manufactured on or after **[MONTH DD, YYYY]**, are shown in Table O-4 and Table O-5, respectively.
 - (A) Dual-purpose door type commercial dishwashers designed to be used either as a door type or a PPU shall meet all applicable standards.
 - (B) Commercial dishwasher with dual sanitizing capability that switch between high- or low-temperature sanitation shall comply with all applicable standards.

Table O-4

Standards for High-Temperature Commercial Dishwashers Manufactured on or After **[MONTH DD, YYYY]**

<u>Commercial Dishwasher Type</u>	<u>Idle Energy</u>	<u>Washing Energy</u>	<u>Water Consumption¹</u>
<u>Under Counter and Under Counter Commercial Glasswashers</u>	$\leq 0.30 \text{ kW}$	$\leq 0.35 \text{ kWh/rack}$	$\leq 0.86 \text{ GPR}$
<u>Door Type</u>	$\leq 0.55 \text{ kW}$	$\leq 0.35 \text{ kWh/rack}$	$\leq 0.89 \text{ GPR}$
<u>Pot, Pan, and Utensil (PPU)²</u>	$\leq 0.90 \text{ kW}$	$\leq 0.55 + 0.05 \times \text{SFR}$	$\leq 0.58 \text{ GPSF}$
<u>Single Tank Conveyor</u>	$\leq 1.20 \text{ kW}$	$\leq 0.36 \text{ kWh/rack}$	$\leq 0.70 \text{ GPR}$
<u>Multiple Tank Conveyor</u>	$\leq 1.85 \text{ kW}$	$\leq 0.36 \text{ kWh/rack}$	$\leq 0.54 \text{ GPR}$
<u>Single Tank Flight Type</u>	<u>Report</u>	<u>Report</u>	$\text{GPH} \leq 2.975x + 55.00$
<u>Multiple Tank Flight Type</u>	<u>Report</u>	<u>Report</u>	$\text{GPH} \leq 4.96x + 17.00$

¹ GPR = gallons per rack; GPSF = gallons per square foot or rack; GPH = gallons per hour; x = maximum conveyor speed (feet/min) X conveyor belt width (feet).

² PPU washing energy is still in format kWh/rack when evaluated; SFR is Square Feet of Rack area, same as in PPU water consumption metric.

Table O-5

Standards for Low-Temperature Commercial Dishwashers Manufactured on or After **[MONTH DD, YYYY]**

<u>Commercial Dishwasher Type</u>	<u>Idle Energy</u>	<u>Washing Energy</u>	<u>Water Consumption¹</u>
<u>Under Counter and Under Counter Commercial Glasswashers</u>	$\leq 0.25 \text{ kW}$	$\leq 0.15 \text{ kWh/rack}$	$\leq 1.19 \text{ GPR}$
<u>Door Type</u>	$\leq 0.30 \text{ kW}$	$\leq 0.15 \text{ kWh/rack}$	$\leq 1.18 \text{ GPR}$
<u>Single Tank Conveyor</u>	$\leq 0.85 \text{ kW}$	$\leq 0.16 \text{ kWh/rack}$	$\leq 0.79 \text{ GPR}$
<u>Multiple Tank Conveyor</u>	$\leq 1.00 \text{ kW}$	$\leq 0.22 \text{ kWh/rack}$	$\leq 0.54 \text{ GPR}$

¹ GPR = gallons per rack

... [end of (o)]

... [skipping to end of section 1605.3]

Note: Authority cited: Sections 25213, 25218(e), 25401.9, 25402(a)-25402(c) and 25960, Public Resources Code; and Sections 16, 26, and 30, Governor’s Exec. Order No. B-29-15 (April 1, 2015). Reference: Sections 25216.5(d), 25401.9, 25402(a)-25402(c) and 25960, Public Resources Code; and Section 16, Governor’s Exec. Order No. B-29-15 (April 1, 2015).

§ 1606. Filing by Manufacturers; Listing of Appliances in the MAEDbS.

... [Skipping (a) through “Metal Halide Luminaires” section N of Table X]

	Appliance	Required Information	Possible Answers
O	<u>Commercial Dishwashers</u>	<u>Commercial Dishwasher Type</u>	<u>Undercounter, Door-Type, PPU, Conveyor Single-Tank, Conveyor Multiple-Tank, Flight-Type Single-Tank, Flight-Type Multiple-Tank, Undercounter Commercial Glasswasher</u>
		<u>Rinse Type</u>	<u>Low-Temperature, High-Temperature, or Dual-Sanitizing</u>
		<u>Dual-Sanitizing</u>	<u>True, False</u>
		<u>High-temperature Idle Energy (kW)</u>	
		<u>High-temperature Washing Energy (kWh/rack)</u>	
		<u>High-temperature Water Consumption (GPR, GPSE, or GPH) (for conveyor and flight types, report at maximum conveyor speed)</u>	
		<u>Low-temperature Idle Energy (kW)</u>	
		<u>Low-temperature Washing Energy (kWh/rack)</u>	

		<u>Low-temperature Water Consumption (GPR, GPSF, or GPH) (for conveyor and flight types, report at maximum conveyor speed)</u>	
		<u>Heat Recovery</u>	<u>True, False</u>
		<u>Percentage Cold Water Supply (If heat recovery = True) (Percentage value must be $\geq 95\%$)</u>	
		<u>Percentage Hot Water Supply (If heat recovery = True) (Percentage value must be $\leq 5\%$)</u>	
		<u>Primary Hot Water Energy Offset (kWh/rack) (If heat recovery = True)</u>	

... [skipping to end of section 1606]

Note: Authority cited: Sections 25213, 25218(e), 25401.9, 25402(a)-25402(c) and 25960, Public Resources Code; and Sections 16, 26, and 30, Governor’s Exec. Order No. B-29-15 (April 1, 2015). Reference: Sections 25216.5(d), 25401.9, 25402(a)-25402(c), 25402.5.4 and 25960, Public Resources Code; and Section 16, Governor’s Exec. Order No. B-29-15 (April 1, 2015).

§ 1607. Marking of Appliances

(No change)

§ 1608. Compliance, Enforcement, and General Administrative Matters

(No Change)

§ 1609. Administrative Civil Penalties

(No Change)