EXHIBIT C

Commercial Food Service Equipment Water Efficiency provisions

CALGreen Code Sections 5.303.4 and A5.303.3

ECONOMIC AND FISCAL IMPACT STATEMENT (REGULATIONS AND ORDERS) (FORM 399)

This appendix provides information required by the California Department of Finance Economic and Fiscal Impact Statement (Form 399) which is available on the California Building Commission website.[1] This information includes the proposed standards for commercial disposers, commercial dishwashers, commercial steam and combination ovens, and commercial pulpers. Information on the methodology used for these calculations is explained under item D.3 below.

Economic Impact Statement

A. ESTIMATED PRIVATE SECTOR COST IMPACTS

Estimated economic impact. (Form 399 Economic Impacts Section A.2)

The estimated total Economic and Fiscal Impact is $560,000 based on the Commercial Food Service Equipment Water Efficiency CALGreen CASE Report. Estimated impacts are based on 12 months of implementation, consistent with the instructions for the Economic Impact Statement item (E.4).

Number of businesses impacted. (Form 399 Economic Impacts Section A.3)

We estimate that 760 equipment units will be regulated based on the Commercial Food Service Equipment CALGreen Water Efficiency CASE Report Appendix B, and a smaller number of individual businesses will be regulated since many new businesses will have more than one piece of regulated equipment. (There are a total of 115,000 food service establishments in California).[2]

Number and type of businesses and jobs created and eliminated. (Form 399 Economic Impacts Section A.4, A.6, and A.7)

The proposed Standards are cost effective over the life of the measure and are likely to increase total jobs and businesses in California. Though increasing water efficiency in California's

---

[1] Form 399 is available, as of March 29, 2015, from this website: http://www.documents.dgs.ca.gov/bsc/proc_rsltn/2009/STD-399-EconomicandFiscalImpactStatement.pdf

[2] Total number of establishments from US Census Table 1281 https://www.census.gov/compendia/statab/2012/tables/12s1281.pdf and weighted by California population.

buildings will have short term initial costs, the long term benefits of decreased utility costs and increased statewide water supply outweigh the initial costs of compliance. The proposed Standards will also increase disposable income for individuals, which may increase in-state spending, though the total impact is modest.

While the specific number of businesses and jobs that will be created based from the implementation of the proposed Standards is not certain, several types of industries are likely to benefit. The University of California Berkeley evaluated the expected impacts of a range of residential and commercial sector policies including water efficiency, energy efficiency, renewable generation and demand response. The research found that the following industries, as classified under the North American Industry Classification System (NAICS), are the most likely to be positively impacted (UC Berkeley 2011; Table 3.10 et seq., pages 69-75)[3]:

Residential Building Construction (NAICS 2361)

Nonresidential Building Construction (NAICS 2362)

Electrical Contractors (NAICS 23821)

Plumbing, Heating, and Air-Conditioning Contractors (NAICS 23822)

Manufacturing (NAICS 32412, 3279, 3332, 3334, 3336, 3341, 3342, 3344, 3345, 3351, 3352, 3353, 3359 (part))

Advertising and Related Services (NAICS 5418)

Engineering Services, Architectural Services, Environmental Consulting Services, Other Scientific and Technical Consulting Services (NAICS 54 (part))

Management of Companies and Enterprises, Public Administration (NAICS 5511, 92 (part))

Office Administrative Services (NAICS 5611)

Drywall and Insulation Contractors (NAICS 23831

B. ESTIMATED COSTS

The total statewide dollar costs that businesses and individuals may incur to comply with this regulation over its lifetime. (Form 399 Economic Impacts Section B.1.)

The sum of the proposed measure costs for all newly constructed buildings, additions and alternations in 2017 is $560,000. No increased future maintenance nor increased equipment replacement costs are expected.

Initial costs for a small business and initial costs for a typical business. (Form 399 Economic Impacts Section B.1a and B.1b.)

The cost averaged across all commercial kitchens is $5 per commercial kitchen. The cost averaged across all small business commercial kitchens is likely to be less as they are likely to

[3] Note that the water-energy nexus is included in the scope of policies addressed per Table 3.1.

have less regulated food service equipment units. The cost for a new commercial kitchen could range from $0 to $2,050 per unit of regulated equipment.

Initial costs to an individual. (Form 399 Economic Impacts Section B.1(c).)

No direct costs to individuals are expected.

Describe other economic costs that may occur. (Form 399 Economic Impacts Section B.1d.)

No other economic costs are expected.

If multiple industries are impacted, enter the share of total costs for each industry. (Form 399 Economic Impacts Section B.2.)

NA

Impacts to housing costs. (Form 399 Economic Impacts Section B.4.)

No significant impacts to housing are expected.

Are there comparable Federal regulations? (Form 399 Economic Impacts Section B.5.)

No duplication or conflict exists between these measures and existing federal regulations. For instance, the commercial food waste disposer and pulper proposed measures do not conflict with federal regulations because no relevant federal standards apply.

The proposed code changes for commercial dishwashers will implement the voluntary requirements set forth by ENERGY STAR. Therefore, the proposed codes are complementary to the national voluntary standard which can be found in ENERGY STAR's Commercial Dishwashers Key Product Criteria, Version 2.0 (ENERGY STAR 2013a). Federal voluntary ENERGY STAR labeling requirements for commercial combination ovens (ENERGY STAR 2013c) and food steamers (ENERGY STAR 2003) are based on cooking energy efficiency, and do not directly regulate water usage thus no conflict with Energy Star requirements exists.

C. ESTIMATED BENEFITS

Briefly summarize the benefits of the regulation, which may include the health and welfare of California residents, worker safety, and the State's environment. (Form 399 Economic Impacts Section C.1.)

Individuals and businesses will benefit from the reduction in water and energy costs as noted below. Businesses that provide water conservation and energy efficiency products and services may experience an increase in revenue and employment. State and local government agencies and their tenants will benefit. Agriculture and other water-dependent industries will benefit from reduced competition for water supplies.

Additional environmental benefits include improved water quality and supply, benefits to aquatic ecosystems, and associated greenhouse gas reductions and air quality improvements.

Are benefits the result of specific statutory requirements, or goals developed by the agency based on broad statutory authority? (Form 399 Economic Impacts Section C.2.)

The Building Standards Commission (BSC) has authority granted by statute to adopt statewide building energy efficiency standards.

What are the total statewide benefits from this regulation over its lifetime? (Form 399 Economic Impacts Section C.3.)

The total economic benefits of the proposed Standards are $4.8 million. This value is the sum of the net water and energy savings for all newly constructed buildings, discounted to 2015 dollars, for implementation of the proposed measures in 2017. As noted above, this measure will also result in additional non-quantified benefits.

Briefly describe any expansion of businesses currently doing business within the State of California that would result from this regulation. (Form 399 Economic Impacts Section C.4.)

No significant change is expected.

D. ALTERNATIVES TO THE REGULATION

List alternatives considered and describe them below. If no alternatives were considered, explain why not. (Form 399 Economic Impacts Section D.1.)

No alternatives to the proposed regulations would be more effective in achieving water and energy efficiency goals, or equally effective and have a lower adverse impact on small businesses (or on any other economic interests). The BSC conducted an extensive stakeholder engagement process that considered many suggestions from stakeholders.

Summarize the total statewide costs and benefits from this regulation and each alternative considered. (Form 399 Economic Impacts Section D.2.)

The total statewide costs are $560,000 and benefits are $4.8 million in 2015 dollars over the lifetime of the proposed Standards (effective 2017). Since no alternatives were found to be equally or more effective than the proposed Standards, no alternatives were included in this analysis.

Briefly discuss any quantification issues that are relevant to a comparison of estimated costs and benefits for this regulation or alternatives. (Form 399 Economic Impacts Section D.3.)

Per unit costs are based on the Commercial Food Service Equipment CALGreen Water Efficiency CASE Report.

Per unit savings are based on estimated utilization rates and baseline water usage. Actual utilization and savings can vary between commercial kitchens.

One source of uncertainty is the number of local jurisdictions that will adopt voluntary commercial food service equipment water efficiency CALGreen measures. Local adoption rates (14%) are based on the assumption that the voluntary commercial kitchen local adoption rate will be equal to all jurisdiction that have previously adopted voluntary water conservation measures. The actual number could be higher, due to the drought emergency, or lower if some jurisdictions choose to exclude commercial kitchens.

Were performance standards considered to lower costs? (Form 399 Economic Impacts Section D.4.)

Performance standards will be adopted based on water usage rates.

E. MAJOR REGULATIONS

Will the regulation subject to OAL review have an estimated economic impact to business enterprises and individuals located in or doing business in California exceeding $50 million in any 12-month period between the date the major regulation is estimated to be filed with the Secretary of State through 12 months after the major regulation is estimated to be fully implemented? (Form 399 Economic Impacts Section E.4.)

The economic impact to business enterprises and individuals located in or doing business in California does not exceed $50 million during this period because the total economic impact is less than $50 million as stated on line A.2 of Form 399.

Fiscal Impact Statement

A. FISCAL EFFECT ON LOCAL GOVERNMENT

Additional expenditures and savings. (Form 399 Fiscal Impacts Statement A.2, A2.f and A.3.)

The first year the proposed standards will be in effect is 2017. Data on local government existing building stock is very limited, as is data on proposed local government building construction. Only local government owned buildings, not leased buildings, are relevant to these calculations. The expenditures per year in line A.2 of Form 399 are estimated at $34,000 or less while the net present value annual savings are estimated at about $290,000. This regulation is not reimbursable because it provides savings that will offset the additional costs (see line A.2.f of Form 399). These estimates are based on CEC Form 399 estimates that 6% of nonresidential buildings are owned by local governments.

B. FISCAL EFFECT ON STATE GOVERNMENT

Additional expenditures and savings. (Form 399 Fiscal Impacts Statement B.1 and 2.)

Additional costs of about $17,000 or less to state-owned or local government facilities are expected based on CEC estimates that 3% of nonresidential buildings are state-owned.

The state will realize direct cost savings of about $140,000 annually.

C. FISCAL EFFECT ON FEDERAL FUNDING OF STATE PROGRAMS. (Form 399 Fiscal Impacts Statement C.4.)

State agencies that are reimbursed for construction and/or utility costs by the federal government may have higher upfront costs and reduced utility costs. Changes in federal reimbursements could offset these costs and savings.

CALGREEN CODES AND STANDARDS ENHANCEMENT INITIATIVE (CALGREEN CASE)

COMMERCIAL FOOD SERVICE EQUIPMENT WATER EFFICIENCY

Nonresidential CALGreen Proposals (Division 5 and Section A5 of Part 11, Title 24)

2016 CALIFORNIA BUILDING ENERGY EFFICIENCY STANDARDS TECHNICAL REPORT

California Utilities Statewide Codes and Standards Team August 5, 2015

Prepared by: Celina Stratton, Kristina Barber and Ed Pike (Energy Solutions)

This report was prepared by the California Statewide Codes and Standards Enhancement (CASE) Program that is funded, in part, by California utility customers under the auspices of the California Public Utilities Commission.

Table of Contents

List of Tables

List of Figures

Type equation here.

Document Information

Category: Codes and Standards

Keywords: Statewide Codes and Standards Team, Statewide Utility C&S Team, Title 24, Part 11, CALGreen, water efficiency, embedded energy, commercial kitchen, food service, food waste disposer, dish machine, dishwasher, combination oven, food steamer, pulper

1. Executive Summary

Introduction

This report presents recommendations to support the California Building Standards Commission's (BSC) efforts to update California's Green Building Standards (CALGreen or Part 11 of Title 24) to include new requirements and amend existing water use requirements for commercial food service equipment. The goal of this effort is to prepare and submit proposals that will result in cost-effective enhancements to water efficiency in buildings. The four California Investor Owned Utilities (IOUs) – Pacific Gas and Electric Company, San Diego Gas and Electric, Southern California Edison and Southern California Gas Company – and Los Angeles Department of Water and Power (LADWP), sponsored this effort. This report and the code change proposal presented herein is a part of the effort to develop technical and cost-effectiveness information for the proposed code changes.

Summary of Proposed Code Changes

A summary of the proposed code changes for commercial food service equipment is provided below. All proposed changes are intended to apply to new construction, additions, and alterations. Marked-up code language is provided in Section 8 of this report.

Commercial Food Waste Disposer Efficiency (Mandatory)

The proposed code change would add a mandatory water efficiency requirement for food waste disposers in commercial buildings. The proposed requirement limits disposer water use to no more than 8 gallons per minute (gpm) and requires that disposers either modulate the use of water to no more than 1 gpm when the disposer is not in use (i.e. not actively grinding food waste or the no-load condition) or automatically shut off after no more than 10 minutes of inactivity.

Commercial Dishwasher Efficiency (Voluntary)

The proposed code change would update the existing voluntary requirement for commercial dishwashers. The existing voluntary CALGreen standard requires that dishwashers comply with the water usage maximum levels described in Table 1 below (and Table A5.303.3 of the 2013 standards):

Table 1. **Existing Voluntary CALGreen Commercial Dishwashers Standard** (BSC 2013a)

Type	High-Temperature - Maximum Gallons Per Rack	Chemical –Maximum Gallons Per Rack
Conveyer	0.70 (2.6 L)	0.62 (4.4 L)
Door	0.95 (3.6 L)	1.16 (2.6 L) [BSC] 2.26 (8.6 L) [DSA-SS]
Undercounter	0.90 (3.4 L)	0.98 (3.7 L)

Note: "BSC" is the California Building Standards Commission and "DSA-SS" is the California Division of the State Architect-Structural Safety.

The proposed code changes are not designed to enact substantial changes to CalGreen at this time and would modify the existing requirements so that they align with ENERGY STAR® by:

- Adding additional equipment types;
- Modifying the high temperature maximum gallon per rack requirements; and
- Replacing the chemical maximum gallon per rack requirements with low temperature maximum gallon per rack requirements.

See Table 2 below for a summary of the proposed commercial dishwasher standards.

Table 2. Proposed Commercial Dishwasher Standards

Type	**High-Temperature Maximum Gallons Per Rack** (unless otherwise noted)	**Low-Temperature Maximum Gallons Per Rack** (unless otherwise noted)
Single Tank Conveyor	0.70 (2.6 L)	≤ 0.79 (3 L)
Multiple Tank Conveyor	≤ 0.54 (2 L)	≤ 0.54 (2 L)
Stationary Single Door	≤ 0.89 (3.4 l)	≤ 1.18 (4.5 L)
Undercounter	≤ 0.86 (3.3 L)	≤ 1.19 (4.5 L)
Pot, Pan, and Utensil	≤ 0.58 GPSF	≤ 0.58 GPSF
Single Tank Flight Type	GPH ≤ 2.975x + 55.00	GPH ≤ 2.975x + 55.00
Multiple Tank Flight Type	GPH ≤ 4.96x + 17.00	GPH ≤ 4.96x + 17.00

Note: GPSF = gallons per square foot of rack; GPH = gallons per hour; x = maximum conveyor speed (feet/min as verified through NSF 3 certification) x conveyor belt width (feet).

Commercial Combination Oven Efficiency (Voluntary)

The proposed code change would update the existing voluntary requirement for commercial combination ovens. The existing voluntary CALGreen standard requires that combination ovens consume no more than 10 gallons (38 liters) per hour per pan in full operational mode (BSC 2013b). The proposed voluntary language sets a maximum water use of 1.5 gallons per hour per pan, including condensate water.

Commercial Food Steamer Efficiency (Voluntary)

The proposed code change would update the existing voluntary requirement for commercial food steamers. The existing voluntary CALGreen standard requires that food steamers be connectionless or boilerless (BSC 2013b). The proposed voluntary code sets water usage requirements by production design of steamer: batch and cook-to-order. While still requiring that food steamers be connectionless or boilerless, the requirement is amended to also mandate that batch type steamers consume no more than 2 gallons of water per pan per hour and cook-to-order steamers no more than 5 gallons of water per pan per hour, including condensate water.

Pulper Efficiency (Voluntary)

The proposed code change would add a voluntary water efficiency requirement for food waste pulpers in commercial buildings. The proposed requirement limits freshwater use of pulpers to no more than 2 gpm.

Commercial Kitchen Efficiency Benefits

The proposed code changes will result in cost-effective water and energy savings. Table 3 presents the first year statewide water and embedded energy savings from the proposed requirements for all commercial kitchen measures. The mandatory proposed code change for commercial food waste disposers will result in an estimated 48 million gallons of water savings during the first year the CALGreen standards are in effect (2017) with associated embedded energy savings of 486 MWh.

These estimates do not include the benefits of improved operational energy consumption. Dishwashers, steamers and combination ovens that meet the proposed standards are likely to also meet ENERGY STAR energy efficiency levels. Therefore, the benefits are likely greater than presented in these estimates.

It is estimated that the voluntary proposed code changes for commercial dishwashers, combination ovens and food steamers will results in approximately 9 million gallons of water savings during the first year the CALGreen standards are in effect (2017) and an associated embedded energy savings of 90 MWh. Pulper savings have not been included in the first year savings calculations. This was due to the low annual sales volume of pulpers (approximately 35 units per year) and uncertainty about the number of units that would be regulated by the new voluntary standard given relatively low initial sales volume.

Table 3. Commercial Food service Equipment Measure Statewide Water & Embedded Energy Savings for First Year Standard is in Effect (2017)

Equipment Type	Statewide Water Savings (Mgal/yr)	Statewide Embedded Electricity Savings (MWh/yr)
Commercial Food Waste Disposers (Mandatory)	48	486
Commercial Dishwashers (Voluntary)	4	30
Commercial Combination Ovens (Voluntary)	0.2	2
Commercial Food Steamers (Voluntary)	5	44
	Per Unit Water Savings (gallons/yr)	**Per Unit Embedded Electricity Savings (kWh/yr)**
Pulpers (Voluntary)	777,600	7,811

Note: For the mandatory measure (disposers), 100% compliance with the standards was assumed. For voluntary measures (dishwashers, combination ovens, and steamers), 14% of the market was assumed to be regulated by the standard.

Annual water savings in 2030, after the standards have achieved full deployment, will exceed 500 million gallons per year with embedded energy savings of over 5,000 MWh/yr (see Tables 19 and 21).

The per unit lifecycle cost savings for the proposed standards are presented in Table 4. Pulper lifecycle cost savings were not calculated because incremental costs are assumed to be zero, and thus the lifecycle cost savings per unit will be positive without further analysis.

Table 4. Per Unit Lifecycle Cost Savings for Proposed Standards

Equipment Type	Lifecycle Cost Savings Per Unit ($/year)
Commercial Food Waste Disposers (Mandatory)	$17,622
Commercial Dishwashers (Voluntary)	$1,879
Commercial Combination Ovens (Voluntary)	$446
Commercial Food Steamers (Voluntary)	$10,519

2. INTRODUCTION

2.1 Purpose of Report

This report presents recommendations to support the California Building Standards Commission (BSC) in its effort to update California's Green Building Standards (CALGreen or Part 11 of Title 24) to include new requirements and amend existing water use requirements for commercial food service equipment. The four California Investor Owned Utilities (IOUs) – Pacific Gas and Electric Company, San Diego Gas and Electric, Southern California Edison and Southern California Gas Company – and Los Angeles Department of Water and Power (LADWP), referred to in this report as the Utility Codes and Standards (C&S) Team, sponsored this effort. The goal of this effort is to prepare and submit proposals that will result in cost-effective enhancements to water efficiency in buildings. This report and the code change proposal presented herein is a part of the effort to develop technical and cost-effectiveness information for the proposed code changes.

This report proposes mandatory and voluntary water use efficiency requirements for commercial food service equipment. The report contains pertinent information that justifies the code change including:

- Description of the code change proposal (Section 2.2);
- Relationship to other standards and model codes (Sections 3.3 and 4.3);
- Market analysis, including a description of the market structure for specific technologies, and market availability (Section 5);
- Results of water and energy impacts analysis, cost-effectiveness analysis, and environmental impacts analysis (Section 5.3 and 5.4);
- Compliance and enforcement considerations (Section 6);
- Summary stakeholder consultation to develop measures and responses to stakeholder feedback (Section 7); and
- Proposed code change language (Section 8).
- When proposing changes to CALGreen, BSC is required to provide specific information about the impacts of the proposed standards in the Initial Statement of Reasons (ISOR),[1] and the Economic and Fiscal Impacts Statement (Form 399),[2] required by the Department of Finance. This report (including the Appendices) contains information that is responsive to the ISOR and Form 399. A completed Form 399 is provided in Appendix

---

1 The template for the ISOR is available on BSC's website: http://www.documents.dgs.ca.gov/bsc/proc_rsltn/documents/templates/BSC-TP-106-ISOR-Template.doc.

2 The blank Form 399 worksheet is available on BSC's website: http://www.documents.dgs.ca.gov/bsc/proc_rsltn/2009/STD-399-EconomicandFiscalImpactStatement.pdf.

A. In addition, BSC is required to provide a "Nine-point checklist."[3] This report provides information that is responsive to each relevant section of the checklist.

2.2 Measure Description

Descriptions of the proposed code changes for each equipment type are provided below. All proposed changes are intended to apply to new construction, additions, and alterations. Marked up code language is provided in Section 8 of this report.

2.2.1 Proposed Changes to Mandatory CALGreen Requirements

Commercial Food Waste Disposers (Mandatory)

The proposed code change would add a mandatory efficiency requirement for food waste disposers (FWD) in commercial buildings. The proposed requirement limits disposer water use to no more than 8 gpm and requires that disposers either modulate the use of water to no more than 1 gpm when the disposer is not in use (not actively grinding food waste/no-load) or automatically shut-off after no more than 10 minutes of inactivity.

The proposed disposer requirement seeks to take advantage of three currently available water-saving FWD features: restricting the upper limit flow rate, automatic time outs, and load sensor controls. The proposed standard would restrict disposer water usage to no more than 8 gpm. This restriction would only impact the most highly water-intensive equipment, estimated at less than 5% of the current disposer market (Easterla and Reynolds 2015). Additionally, the proposed code requires that disposers either:

- Utilize an automatic time-out controller that shuts down the disposer after no more than 10 minutes of inactivity; or
- Modulate the use of water such that it decreases to no more than 1 gpm when the disposer is not in use (i.e. when not actively grinding food waste).

The intent of the "either/or" language is to allow users two options for compliance and to provide flexibility in the marketplace. The lower upfront cost alternative is the automatic time-out feature that shuts down the disposer after no more than 10 minutes regardless of disposer activity level. The other alternative available on the market is the load control feature, which has higher upfront costs but saves more water over the life of the unit (see Section 5.2.1 or detailed information on the costs of disposers).

2.2.2 Proposed Changes to Voluntary CALGreen Requirements

Commercial Dishwashers (Voluntary)

The proposed code change would update the existing CALGreen voluntary requirements for commercial dishwashers. The existing standard requires that dishwashers comply with the water

[3] The Nine Points Criteria is available on BSC's website: http://www.documents.dgs.ca.gov/bsc/proc_rsltn/documents/templates/BSC-TP-109-Nine-Point-Criteria-Analysis-Template.doc.

usage maximums described in Table 5 below (and Table A5.303.3 in the 2013 CALGreen Standards):

Table 5. Existing Voluntary CALGreen Standard for Commercial Dishwashers (BSC 2013a)

Type	High-Temperature - Maximum Gallons Per Rack	Chemical –Maximum Gallons Per Rack
Conveyer	0.70 (2.6 L)	0.62 (4.4 L)
Door	0.95 (3.6 L)	1.16 (2.6 L) [BSC] 2.26 (8.6 L) [DSA-SS]
Undercounter	0.90 (3.4 L)	0.98 (3.7 L)

Note: "BSC" is the California Building Standards Commission and "DSA-SS" is the California Division of the State Architect-Structural Safety.

The proposed code changes would modify the existing requirements so that they align with ENERGY STAR by:

- Adding additional equipment types;
- Modifying the high temperature maximum gallon per rack requirements; and
- Replacing the chemical maximum gallon per rack requirements with low temperature maximum gallon per rack requirements.

See Table 6 below for the proposed commercial dishwasher standards.

Table 6. Proposed Commercial Dishwasher Standards

Type	**High-Temperature Maximum Gallons Per Rack** (unless otherwise noted)	**Low-Temperature Maximum Gallons Per Rack** (unless otherwise noted)
Single Tank Conveyor	0.70 (2.6 L)	≤ 0.79 (3 L)
Multiple Tank Conveyor	≤ 0.54 (2 L)	≤ 0.54 (2 L)
Stationary Single Door	≤ 0.89 (3.4 l)	≤ 1.18 (4.5 L)
Undercounter	≤ 0.86 (3.3 L)	≤ 1.19 (4.5 L)
Pot, Pan, and Utensil	≤ 0.58 GPSF	≤ 0.58 GPSF
Single Tank Flight Type	GPH ≤ 2.975x + 55.00	GPH ≤ 2.975x + 55.00
Multiple Tank Flight Type	GPH ≤ 4.96x + 17.00	GPH ≤ 4.96x + 17.00

Note: GPSF = gallons per square foot of rack; GPH = gallons per hour; x = maximum conveyor speed (feet/min as verified through NSF 3 certification) x conveyor belt width (feet).

Commercial Combination Ovens (Voluntary)

The proposed code change would update the existing voluntary requirement for commercial combination ovens. The existing voluntary CALGreen standard requires that combination ovens consume no more than 10 gallons per hour (38 liters per hour) per pan in full operational mode (BSC 2013b). The proposed voluntary language allows a maximum water use of 1.5 gallons per hour per pan, including condensate water.

Commercial Food Steamers (Voluntary)

The proposed code change would update the existing voluntary requirement for commercial food steamers. The existing voluntary CALGreen standard requires that food steamers be connectionless or boilerless (BSC 2013b). The proposed voluntary code sets water usage requirements by production design of steamer: batch and cook-to-order. While still requiring food steamers to be connectionless or boilerless, the requirement is amended to also mandate that batch type steamers consume no more than 2 gallons of water per pan per hour and cook-to-order steamers no more than 5 gallons of water per pan per hour, including condensate water.

Commercial Pulpers (Voluntary)

The proposed code change would add a voluntary efficiency requirement for food waste pulpers in commercial buildings. The proposed requirement limits the freshwater use of pulpers to no more than 2 gpm.

2.3 Rationale for Proposed Code Changes

2.3.1 Policy Context

Water is essential for supporting and sustaining California's environmental, economic, and public health needs. Improving water efficiency is a well-established statewide policy goal. Legislation enacted in 2009 (Senate Bill X7-7, Steinberg 2009) established the goal of achieving a 20 percent reduction in urban per capita water use in California by 2020. In addition, the California Public Utilities Commission has directed the Investor Owned Utilities (electricity utilities) to pursue water efficiency activities to help achieve energy savings goals because twenty percent of the electricity used in California is attributed to water supply, conveyance, treatment, and distribution (CEC 2006). The California's Global Warming Action Plan recognizes this water-energy nexus and calls for establishing indoor and outdoor water efficiency standards and water recycling to help achieve California's greenhouse gas (GHG) reduction goals.

The importance of California's well-established policy goals are highlighted by the current extreme and ongoing drought emergency. A 2014 study of the economic impacts of the current drought concluded that the 2014 drought will result in a total statewide economic cost of $2.2 billion, with a total loss of 17,100 seasonal and part-time jobs (UC Davis 2014). Improvements to water efficiency will help alleviate the extreme pressure on California's most vulnerable industries.

In recent years, advances in technology have resulted in commercial kitchen equipment that uses less water while maintaining the same high-quality performance users expect. Establishing more stringent water efficiency requirements in CALGreen will provide an opportunity to cost-effectively save water in the building standards in response to California's existing water efficiency goals.

2.3.2 Problem Statement - California Drought Emergency

On January 17, 2014 Governor Brown proclaimed a state of emergency and directed all state agencies to take all necessary actions to prepare and respond to drought conditions and also issued an additional Executive Order on April 1, 2015. California's record-breaking drought is evident in every corner of the state. All eleven regions of California are now officially in a drought, ranging from "Severe Drought" in some regions (3 on a scale of 1 to 5, with 5 being the worst) to "Exceptional Drought" in most regions (5 on scale) (U.S. Drought Portal 2015). Even the rainforests of northern Humboldt County are experiencing levels of drought seen in the deserts of southern California (see Figure 1 below for drought map). The Department of Water Resources' snowpack survey readings from February 2015 measured water levels in the state's snowpack at 19 percent of normal (DWR 2015). This is of grave concern since snowpack provides a third of the water for farms and cities. Furthermore, on average, California's major reservoirs are at less than 40 percent of total capacity and less than 60 percent of historical average, and the U.S. Geological Survey reports that 50 percent of its 220 stream flow gauges in California record either "below normal" or "much below normal" flows (USGS 2015).

Given the gravity of the situation, state water officials are beginning to implement drastic water reduction measures. For the first time in 37 years, the State Water Resources Control Board has significantly limited the amount of water farmers, municipalities, and other large water users are legally allowed to pump from rivers and. The California Farm Water Coalition estimated that due to the severe drought, farmers were expected to leave about 800,000 acres idle in 2014; this will undoubtedly cause food prices to rise (California Farm Water Coalition 2014). A 2014 study of the economic impacts of the current drought concluded that the 2014 drought will result in a total statewide economic cost of $2.2 billion, with a total loss of 17,100 seasonal and part-time jobs (UC Davis 2014).

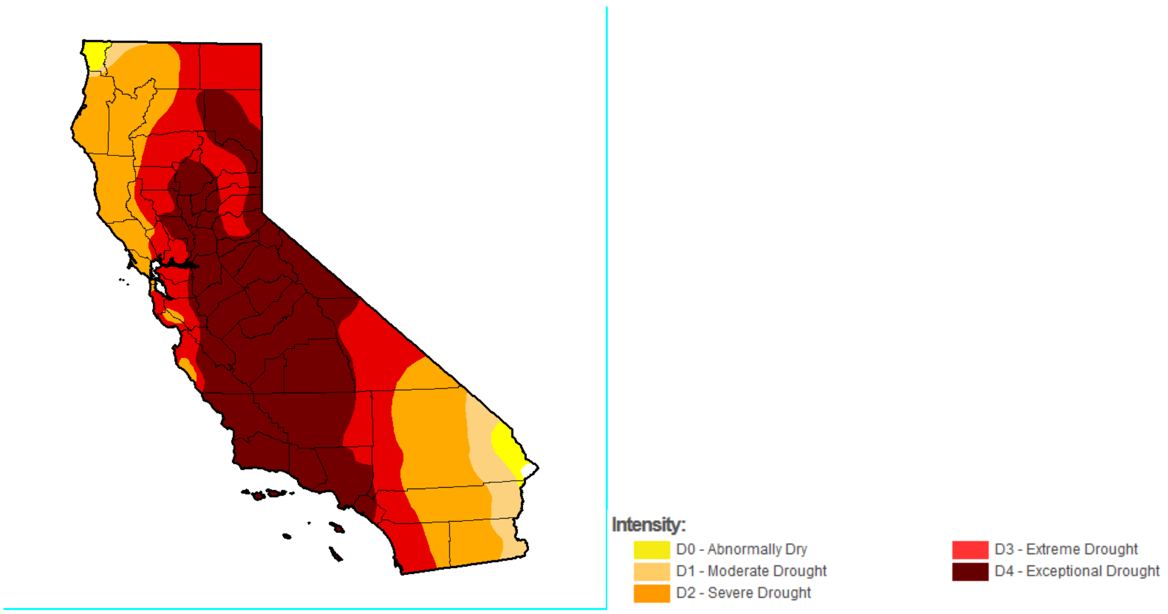

Figure 1: California Drought Classification by Region (United States Drought Portal 2015)

Water is essential to supporting and sustaining the environmental, economic, and public health needs of the State. Ongoing drought, shifts in regional climate patterns, and the State's population growth have increased demand for water. In addition, the demand for more energy also increases the demand for water used to produce electricity. Without reductions in water use, water-related energy use is projected to continue increasing (California Sustainability Alliance 2013). Thus, the installation of water-saving devices in residential, commercial, and industrial applications is extremely crucial for addressing California's water resource needs. Water use efficiency and conservation protects the future of our State's water supply for communities, businesses, industry, and the environment and helps to decrease the need to invest in costly, large-scale infrastructure projects (e.g., dams, canals, reservoirs) as noted further below, while also reducing operating costs for water utilities (e.g., pumping and treatment) (U.S. EPA 2013). We recognize the important opportunity for BSC to respond to the Governor's directive by prioritizing updates to the Title 24 CALGreen standards.

2.3.3 Stringent Water Efficiency Standards Will Reduce the Need for Costly Water Supply Development

Establishing more stringent water efficiency standards is a cost-effective intervention for reducing California's water demand. It may even be the most cost-effective intervention, particularly when compared to solutions that aim to increase and maintain reliable water supplies. For instance, methods such as desalination, dams, or new water conveyance projects often cost billions of dollars.[4] The water efficiency standards presented in this report, on the other hand, will reduce Californians' expenditures on water and energy bills while supporting manufacturers and builders that offer high efficiency fixtures and hot water distribution design practices. In addition, while large-scale water supply projects can create significant environmental impacts, efficient water use is expected to result in significant environmental benefits as noted in Section 5.5 of this report.

2.3.4 Water-Energy Nexus

The relationship between water use and energy use further justifies additional water efficiency standards. Nearly twenty percent of the electricity and thirty percent of natural gas used in California is used for moving, treating, and heating water (CEC 2015(a)). California consumes about 2.9 trillion gallons of water per year for urban uses (Christian-Smith, Heberger & Luch, 2012).[5] These 2.9 trillion gallons of water correspond to approximately 26.4 terawatt hours (TWh) of embedded electricity. Appendix D presents the embedded energy associated with various water end uses. More than 9.1 TWh of electricity is used every year to supply and treat potable water that is used inside residential buildings.

---

[4] Though it can produce a reliable source of water, desalination is a very expensive technology that has an impact on the local aquatic environment as well as consumers and ratepayers, as energy is the largest single cost for a desalination plant (Pacific Institute 2013). Upgrading infrastructure for water conveyance and storage can cost tens of billions of dollars. For example, the proposed twin tunnels project to convey water through the Sacramento-San Joaquin Delta to Southern California is expected to cost at least $25 billion. The Temperance Flat Dam, proposed to increase storage capacity in the San Joaquin River Basin upstream of Friant Dam is projected to cost $2.5 billion.

[5] Urban uses include outdoor and indoor residential water use; water used in commercial, institutional, and industrial applications; and unreported water use, which is primarily attributed to leaks.

Conversely, water is required to produce electricity; if electricity demand increases so does the demand for water. (California Sustainability Alliance 2013).

The California Global Warming Action Plan recognizes this water-energy nexus and calls for the establishment of indoor and outdoor water efficiency standards and water recycling initiatives to help achieve California's greenhouse gas (GHG) reduction goals.

See Appendix D for information about the methodology used to calculate the embedded energy estimates presented in this report.

3. RELATIONSHIP WITH OTHER STANDARDS AND MODEL CODES

3.1 Federal Regulations

This section of the report addresses the ISOR topic "Assessment of Whether Regulations Duplicate or Conflict With Federal Regulations" in response to Government Code Section 11346.2(b)(6).

No duplication or conflict exists between proposed measures and existing federal regulations. For instance, the commercial food waste disposer and pulper proposed measures do not conflict with federal regulations because no relevant federal standards apply.

The proposed code changes for commercial dishwashers will implement the voluntary requirements set forth by ENERGY STAR. Therefore, the proposed codes are complementary to the national voluntary standard which can be found in ENERGY STAR's Program Requirements Product Specification for Commercial Dishwashers, Version 2.0 (ENERGY STAR 2012a). Federal voluntary ENERGY STAR labeling requirements for commercial combination ovens (ENERGY STAR 2013c) and food steamers (ENERGY STAR 2003) are based on cooking energy efficiency, and indirectly affect water usage. These proposed code changes in this report for combination ovens and steamers are based mainly on water efficiency standards in recent model codes as explained below.

3.2 Relationship with Model Codes

A number of government and non-government entities have made substantial progress establishing model building codes and voluntary standards that address water efficiency. Many of these existing codes and standards have been developed through rigorous public vetting processes in which key industry stakeholders participated. In some cases the water efficiency standards in these existing standards are more robust than the mandatory and voluntary requirements in CALGreen. As such, these existing codes and standards can serve as a model for updates to the CALGreen water efficiency standards. The requirements in the International Association of Plumbing and Mechanical Officials (IAPMO) Green Plumbing and Mechanical Code Supplement (GPMCS) are particularly noteworthy as the GPMCS serves as the reach code for the Uniform Plumbing Code (UPC), which California uses as the basis of California's Plumbing Code (Part 5 of Title 24). Some of the model building codes and voluntary standards that the report authors evaluated when considering recommended code changes for the CALGreen commercial kitchens proposed measures are listed below:

- **2012 International Association of Plumbing and Mechanical Officials Green Plumbing and Mechanical Code Supplement For Use with all Codes (IAPMO GPMCS) and 2015 IAPMO GPMCS Proposed Changes for Public Comment:** Developed by the International Association of Plumbing and Mechanical Officials through a public vetting process. The 2015 proposed changes are currently being vetted through the public process. We expect that the final standards will be decided in April and released later in the year. More information is available at: http://www.iapmo.org/pages/iapmo_green.aspx.

- **International Green Construction Code 2012 (IGCC):** Developed by the International Code Council through a public vetting process. More is information available at: http://www.iccsafe.org/CS/IGCC/Pages/default.aspx
- **Leadership in Energy and Environmental Design (LEED) Building Design and Construction Rating System, Version 4:** Developed by the United States Green Building Council through a public vetting process. More information is available at: http://www.usgbc.org/leed#overview.
- **ENERGY STAR:** Developed by the Environmental Protection Agency (EPA) through a process that relies on market, engineering, and pollution savings analysis and includes input from other EPA programs, and industry and non-industry stakeholders (ENERGY STAR 2015a). More information is available at http://www.energystar.gov/

Commercial Food Waste Disposers (Mandatory)

The proposed code language has been modeled after similar language addressing water consumption of commercial Food Waste Disposers (FWDs) in 2015 IAPMO GPMCS Proposed Changes for Public Comment, LEED Version 4, and the IGCC (IAPMO 2015; International Code Council 2012; United States Green Building Council 2014). See Table 7 for the model code or standard language that was referenced in the development of the proposed CALGreen code for commercial FWDs.

Table 7. Model Codes and Standards Referenced during the Development of the Disposer Code Language for CALGreen

IAPMO GPMCS 2015 Proposed Changes for Public Comment	International Green Construction Code 2012	LEED Version 4
307.0 Food Waste Devices. Where food waste devices exist they shall meet the following requirements: **307.2 Food Waste Disposers.** The water use for the food waste grinder shall not exceed the 8 gpm under full load condition and 1 gpm under no-load condition. Flow restrictors shall be installed on the water supply to limit the water flow rate to a maximum of 8 gpm. A load sensing device shall be installed to monitor current demand and regulate water flow. **307.3 Time Out and Shut Off**. Pulpers, mechanical strainers, and food waste disposers shall have a time out system with push button to reactivate. The maximum allowable run time cycle shall be 10 minutes.	**702.16 Food waste disposers.** The water flow into a commercial food waste disposer shall be controlled by a load-sensing device such that the water flow does not exceed 1 gpm (3.78 Lpm) under no-load operating conditions and 8 gpm (30.2 Lpm) under full-load operating conditions	Disposer: 3-8 gpm, full load condition, 10 minute automatic shutoff or 1 gpm, no-load condition.

Commercial Dishwashers (Voluntary)

ENERGY STAR requirements serve as the model standard for the proposed commercial dishwasher voluntary code language. The requirements are based on the ENERGY STAR specification entitled, “Commercial Dishwashers Key Product Criteria Version 2.0” that went into effect on the effective date of February 1, 2013 (ENERGY STAR 2012a). Proposed code language for commercial dishwashers would amend the existing voluntary CALGreen standard for commercial dishwashers (BSC 2013). The existing voluntary CALGreen language limits water use for only the following three types of commercial dishwashers: conveyer type with maximum water use of 0.7 gallons per rack, door type with maximum water use of 0.95 gallons per rack, and undercounter-type dishwashers with maximum water use of 0.90 gallons per rack (see Table 1 above). The proposed code would increase the water use requirements for commercial dishwasher to align with the current ENERGY STAR requirements. Further, the proposed code change would include additional product categories and would specify requirements for "low temperature" rather than "chemical" equipment types (see Table 2)[6]. Table 8 below shows the ENERGY STAR product criteria referenced in the development of the proposed CALGreen standards.

Table 8. ENERGY STAR Commercial Dishwasher Key Product Criteria Referenced During Dishwasher Code Language Development (ENERGY STAR 2013a)

ENERGY STAR Commercial Dishwashers Key Product Criteria, Version 2.0				
Machine Type	High Temp Efficiency Requirements		High Temp Efficiency Requirements	
	Idle Energy Rate*	Water Consumption	Idle Energy Rate*	Water Consumption
Undercounter	≤ 0.50 kW	≤ 0.86 GPR	≤ 0.50 kW	≤ 1.19 GPR
Stationary Single Tank Door	≤ 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
*Idle results should be measured with the **door closed** and represent the total idle energy consumed by the machine including all tank heater(s) and controls. Booster heater (internal or external) energy consumption should not be part of this measurement unless it cannot be separately monitored per the ENERGY STAR Test Method. GPR = gallons per rack; GPSF = gallons per square foot of rack; GPH = gallons per hour; x = maximum conveyor speed (feet/min as verified through NSF 3 certification) * conveyor belt width (feet)				

Commercial Combination Ovens (Voluntary)

The proposed code language for combination ovens has been modeled after IAPMO GPMCS 2015 (IAMPO 2105). See Table 9 below for the model code language that was referenced in the development of the proposed CALGreen code for combination ovens.

[6] The ENERGY STAR Program Requirements for Commercial Dishwashers uses the following definitions: "Chemical Sanitizing (Low Temp) Machine: A machine that applies a chemical sanitizing solution to the surfaces of dishes to achieve sanitation" and "Hot Water Sanitizing (High Temp) Machine: A machine that applies hot water to the surfaces of dishes to achieve sanitation" (ENERGY STAR 2012a). Thus, chemical and low temperature can be used interchangeably to describe the machine type.

Table 9. Model Code and Standards Referenced during the Development of the Combination Oven Code Language for CALGreen

IAPMO GPMCS 2015 Proposed Changes for Public Comment)	LEED Version 4
406.1.3 Combination Ovens. Combination ovens shall not use water in the convection mode except when utilizing a moisture nozzle for food products in the oven. The total amount of water used by the moisture nozzle in the convection mode shall not exceed a half a gallon per hour per oven cavity. When operating in the steamer mode, combination ovens shall use no more than 1.5 gallons per hour per pan (Amended to clarify the operational modes of combination ovens).	≤ 1.5 gal/hour/pan including condensate cooling water

Commercial Food Steamers (Voluntary)

The proposed code language for food steamers was modeled after LEED version 4 (United States Green Building Council 2014). The proposed provisions for the 2015 IAPMO GPMCS and International Green Construction Code (2012) were also referenced in the development of the code language. See Table 10 for the model code or standard language that was referenced in the development of the proposed CALGreen code.

Table 10. Model Codes and Standards Referenced during the Development of the Food Steamer Code Language for CALGreen

LEED version 4	International Green Construction Code 2012	IAPMO GPMCS 2015 Proposed Changes for Public Comment
Steam Cooker, batch. ≤ 2 gal/hour/pan including condensate cooling water Steam Cooker, cook-to-order. ≤ 5 gal/hour/pan including condensate cooling water	**From Table 609.2.3** Connectionless steam cookers have maximum water use of 2 gallons (18.9L) per hour per pan. Connected steam cookers have maximum water use of 5 gallons (7.6L) per hour per pan.	**406.1.2.** All steamers shall consume not more than 5.0 gallons (19 L) per hour per steamer pan in the full operational mode.

Commercial Pulpers (Voluntary)

The proposed code language was modeled after similar language addressing reducing water consumption of pulpers in LEED Version 4 (United States Green Building Council 2014). See Table 11 for the model code language that was referenced in the development of the proposed CALGreen code for pulpers.

Table 11. Model Code and Standards Referenced during the Development of the Pulper Code Language for CALGreen

IAPMO GPMCS 2015 Proposed Changes for Public Comment	LEED Version 4
307.0 Food Waste Devices. Where food waste devices exist they shall meet the following requirements: **307.1 Pulpers and Mechanical Strainers.** The water use for the pulpers or mechanical strainers shall not exceed 2 gpm. A flow restrictor shall be installed on the water supply to limit the water flow. **307.3 Time Out and Shut Off.** Pulpers, mechanical strainers, and food waste disposers shall have a time out system with push button to reactivate. The maximum allowable run time cycle shall be 10 minutes.	Pulper: Maximum 2 gpm makeup water

3.3 Relationship with Other State Standards

3.3.1 Existing CALGreen

Commercial Food Waste Disposers (Mandatory) and Pulpers (Voluntary)

Commercial FWDs and pulpers are not currently included in CALGreen.

Commercial Dishwashers, Combination Ovens, and Food Steamers (Voluntary)

The 2013 CALGreen Standards include voluntary requirements for commercial dishwashers, combination ovens, and food steamers (Section A5.303) (BSC 2013).

3.3.2 California Plumbing code

The proposed mandatory and voluntary commercial food service equipment code changes do not interfere with 2013 California Plumbing Code requirements.

3.3.3 Relationship to Existing Local Requirements

Commercial Food Waste Disposers (Mandatory)

There are some jurisdictions in California that prohibit the installation of commercial FWDs, while others require them. Inclusion of the proposed code change for disposers does not affect the authority of local jurisdictions to prohibit or require the installation of commercial FWDs.

Commercial Dishwashers, Combination Ovens, Food Steamers and Pulpers (Voluntary)

The Utility C&S Team has not identified through its research any existing local requirements applicable to the voluntary code changes proposed for commercial dishwashers, combination ovens, food steamers, or pulpers.

3.4 BSC Jurisdiction

The responsibility of developing CALGreen codes is divided among several agencies. Codes developed by BSC address nonresidential buildings regulated by CALGreen Code Division 5 and Appendix A5 including privately owned buildings used for retail, office and medical services and others. The goals of CALGreen include (1) reducing greenhouse gas emissions from buildings; (2) promoting environmentally responsible, cost-effective, healthier places to live and work; (3) reducing energy and water consumption (BSC 2014).

Tier 1 and Tier 2 voluntary codes (Appendix A4 and Appendix A5 of CALGreen for instance) relate to measures that are voluntarily adopted as mandatory by a local jurisdiction. A Tier 2 standard would achieve greater water savings than the Tier 1 measure if the voluntary code includes two tiers (BSC 2014).

4. PRODUCT AND MARKET DESCRIPTION

The Utility C&S Team performed a market analysis with the goals of identifying current technology availability, current product availability, and market trends. The Utility C&S Team considered how the proposed code changes may impact the market in general as well as individual market players (e.g., manufacturers, building owners, consumers). Estimates of market size and measure applicability were identified through research and outreach with key stakeholders identified in Section 7 of this report.

4.1 Product Description

4.1.1 Product Description: Commercial Food Waste Disposers (Mandatory)

Commercial FWDs are prevalent in commercial food service establishments, and range in size from ½ horsepower (hp) up to 10 hp, with two and three hp units being the most commonly sold sizes (InSinkErator 2015). Disposers grind up food waste into small particles to allow it to pass through the plumbing system into the sewer. They are commonly found in food preparation areas and dish rooms of food service establishments of all sizes (NYE DEP 2008). Disposers can be mounted alone or attached to a sink. While in operation, disposers require a constant flow of water, with new units consuming between 3 and 13 gpm. Some large older units can consume up to 15 gpm. See Figure 2 and Figure 3 for images of commercial FWDs.

Figure 2: An example of a commercial food waste disposer (NYC DEP 2008)

The cost of commercial FWDs depends on the horsepower of the unit and can vary widely. Disposers are commonly sold separately from disposer controllers, which also vary in cost and can include a variety of features such as auto-reversing of the grinding components, automatic timed shut-off, load-sensing, and operator-sensing. Baseline feature controllers typically include a manual on/off switch that allows the unit to grind in only one direction. Controllers with an automatic time-out feature that shuts down the unit after no more than 10 minutes also typically include automatic reversing of the grinder mechanism and magnetic contactors. Controllers with the load control feature include two flow control valves and solenoids in addition to the features of the automatic time-out controller. The cost of commercial FWDs from a number of leading manufacturers[7], range from between $1,300 for a 1 hp unit to $6,500 for a 7.5 hp unit. Control models range from $400 to $3,000.

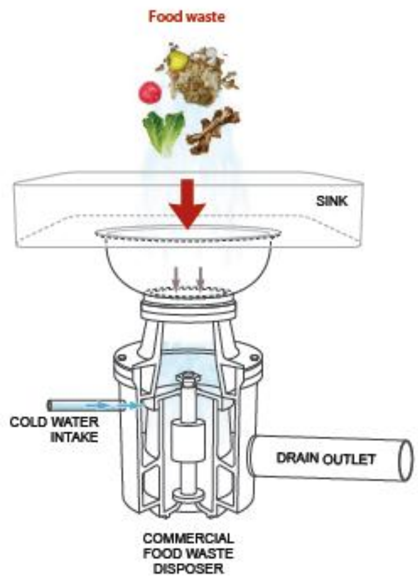

Figure 3: Diagram of Commercial Food Waste Disposer (NYC DEP 2008)

Commercial FWDs can be left on the entire time a kitchen is in operation, which can be for nine or more hours a day in some cases (Michaud 2014). Since water is continuously running when a disposer is on, there is a significant amount of water that is wasted down the drain while it is not actively being used to grind food waste. To address this tremendous water waste, manufacturers have designed disposers and disposer controllers with options to limit water use in the following ways:

(1) *Restrict the flow rate of water into the disposer with a flow control valve when it is operating*. Water conservation flow control valves are currently available to limit the flow rate to 3 - 10 gpm, depending on the size of the disposer (1/2 - 10 hp) and manufacturer.

(2) *Automatically turn off the disposer after a designated period of time to minimize how long the unit is on*. Four manufacturers (Insinkerator, Hammerall, Master Disposer and Salvajor) currently offer disposer controllers with a simple timeout feature that automatically turns off the unit after a pre-set period of time. Additionally, two manufacturers (Salvajor and InSinkErator) pair their load/occupancy sensing controller

[7] Pricing information was gathered from a number of manufacturers, including Salvajor, InSinkErator, Master Disposers, Waste King, and Hammerall.

with an automatic time clock that turns the units completely off after no operator movement or load is sensed during a pre-set period of time (typically 2-10 minutes).

(3) *Modulate the flow rate of water into the disposer based on the load (i.e. whether or not it is actively grinding food waste).* There are currently two manufacturers (InSinkErator and Salvajor) that offer controllers with a load control feature. The InSinkErator model senses the amperage of the disposer motor and regulates the amount of water used for grinding and non-grinding (no load) situations. When the controller senses no load, the disposer water usage drops to 1 gpm. The Salvajor model uses an occupancy sensor to sense operator movement in the vicinity of the disposer. When no movement is sensed for 10-15 seconds, the controller drops the water usage to 2 gpm. Both the InSinkErator and Salvajor controller models pair the load/occupancy sensing feature with their automatic timeclock feature for added water savings.

Because water and sewer costs can be quite significant for building owners or commercial food service operators, the water-saving disposer features typically pay for themselves within the first year or two if disposers are used for 6 hours each day. For example, in a commercial kitchen where a 5 hp disposer runs 6 hours per day water, cost savings and simple payback is presented for four scenarios representing a base case and each of the three water-saving options described above in Table 11 12.

Table 12. Commercial Food Waste Disposer Water Efficiency Scenarios

Disposer Scenarios (5 hp unit)	Unit Cost	Estimated Annual Water Usage (gallons/year)	Water Savings (gallons/ year)	Sewer and Water Cost Savings ($/year)	Simple Payback Period (years)
(0) Standard (8 gpm)	$3,197.00	1,036,800	-	-	-
(1) Disposer with flow control (7 gpm)	$3,243.20	907,200	129,600	$1,023	0.05
(2) Disposer with 10 min timeout (reduces runtime by 10%)	$4,507.00	933,120	103,680	$818	1.6
(3) Disposer with load control (drops flow rate to 1 gpm when no load) and 10 min timeout	$4,888.00	361,584	675,216	$5,327	0.3

Notes: Assumes standard unit runs 6 hours/day, 360 days/year. Unit pricing based on 5 hp basic InSinkErator brand unit, collected from online retailer RestaurantClub.com on 3/10/2015. Cost for combined water and sewer charges in CA is $7.60 per 1,000 gallons; see Appendix E for calculation methodology.

4.1.2 Product Description: Commercial Dishwashers (Voluntary)

Commercial dishwashers are used in non-residential settings such as restaurants, schools, and hospitals to mechanically clean and sanitize non-disposable dishes, glassware, and utensils. Commercial dishwashers utilize hot water, soap, and rinse chemicals to clean and sanitize high volumes of kitchen goods quickly. Commercial dishwashers often consume two-thirds of the total water use of a commercial kitchen (Alliance for Water Efficiency 2010). However, models compliant with the proposed voluntary code are 40 percent more energy efficient and 40 percent more water efficient on average than standard models (ENERGY STAR 2015b). Dishwasher modes include wash, rinse, dwell, and load cycles.

Dishwashers may be classified as high-temperature or low-temperature. Low temperature dishwashers can also be referred to as "chemical." High and low temperature machines are differentiated by the temperature of water used in the rinse cycle. All dishwashers provide hot water (at least 110° to 140° F) for the wash cycle. But while low-temperature machines use hot water and chemicals to sanitize during the rinse cycle, high-temperature designs utilize higher-heat (≥180° F) water without chemicals during the rinse cycle to sanitize wares (Alliance for Water Efficiency 2010).

Additionally, there are several design classes for dishwashers. These are described in more detail in Table 13.

Table 13. Common Dishwasher Design Types (ENERGY STAR 2012a)

	**Stationary Rack-Door Type**. Door type models have a large door through which racks are loaded and unloaded. Racks remain stationary while wash water is forced through spray nozzles onto wares from above and below inside the machine. Rinse water is introduced by separate spray nozzles.
	**Stationary Rack-Pot, Pan, and Utensil**. Pot, Pan, and Utensil models operate in the same manner as the Stationary Rack-Door Type (above) but are marketed specifically to clean pots, pans, and utensils.
	**Stationary Rack-Undercounter.** Undercounter models are designed to be placed under commercial kitchen workspaces (<38 inches high) and have a large front door for loading and unloading racks. Machines often have a flash heat function to sanitize dishes at the end of rinse cycle.
	**Conveyor Rack-Single or Multiple Tank.** Conveyor rack designs are used for high volume applications. Racks are loaded into the machine from the end or side. Wares are then sprayed from above and below with wash water as racks are carried back and forth through the path of the wash water via conveyor. The process is repeated during the rinse cycle.
	**Flight Type–Single or Multiple Tank.** Flight type designs are also used for high volume applications. Wares are placed directly on a continuous conveyor which passes though the machine like a moving sidewalk. Wash and rinse operation match that of the Conveyor Rack machine, above.

Image Source: Hobart 2015

4.1.3 Product Description: Commercial Combination Ovens (Voluntary)

A combination oven is a self-contained, hybrid oven that can cook in convection mode (dry heat), steam mode (saturated or steamed heating), or a combination of both modes over the course of a cooking cycle (IAPMO 2012).

Figure 4: Image of a Generic, Unstacked Combination Oven (FSTC 2015a)

Combination ovens generally have complex programmable controls to assist the operator with executing its varied features. In convection mode, hot, dry air is forced into the cooking cavity and is circulated around product with fans. When steaming, evaporated water (steam) is used to humidify the cavity and product is cooked though contact with the steam. In order to produce steam, some models use an external boiler which boils water from a connected water line. Some models are boilerless and produce steam by spraying water into the heated oven cavity. A combination oven uses different amounts of energy and water depending on the cooking mode it is operating in and the steam production configuration. Steam generation makes up the majority of water use. See Table 13 in Section 4.1.4 for further information on boiler-based versus boilerless steaming.

Commercial ovens, including combination ovens can use various fuel sources including natural gas, electricity, natural gas and propane. Combination ovens can be freestanding or countertop and may be single cavity or stackable to produce a multi-cavity configuration. Various combination oven designs are offered by different manufacturers. This can be attributed to the fact that the technology is still relatively new to the market with rapidly updating features and the industry has not yet developed a “standard” design. Additionally, many combination ovens are manufactured in Europe which may differ from North America in its design concept (Fisher 2002).

4.1.4 Product Description: Commercial Food Steamers (Voluntary)

A food steamer is a device that heats food through direct contact with hot evaporated water (steam) within a closed compartment (IAPMO 2012).

Figure 5: Image of Generic, Unstacked Food Steamer (FSTC 2015b)

Steamers may produce steam in three ways. First, the appliance may use an external boiler (boiler-based). Second, the appliance may use a steam generator built into the cooking compartment (boilerless). Third, the appliance may use a steam generator built into the cooking compartment to boil water poured directly into the compartment prior to operation (connectionless). During and after steaming, water used for steaming condenses in the steamer base and must be recycled or drained; this is called condensate water. Steaming method and design is described in more detail in Table 14.

Table 14. Steam Production in Commercial Food Steamers (Fisher 2002)

Boiler-based	A boiler located externally to the unit produces steam under pressure using water from a connected waterline. Although external to the steamer unit, the boiler is purchased with the unit. Because the boiler is located separately from the unit, steam must be pressurized and delivered to the cooking cavity by controls. Once pressurized steam enters the lower-temperature and pressure compartment, condensation occurs. Condensate water (and sometimes steam depending on the model) exits the cavity through a condensate drain. Boiler-based steamers tend to have high water use as a result of the condensation of pressurized steam and the amount of condensate produced.
Boilerless	A steam generator located within the unit produces steam with water from a waterline connected to the unit. Steam produced within the unit enters the cavity. As steam is produced at or near atmospheric pressure, there is little condensation, greatly reducing the amount of condensate water and water usage as compared to the boiler-based steamer.
Connectionless	A steam generator located within the unit produces steam with water that has been manually poured into the unit before cooking. Operation and reduced total water use are similar to that of the boilerless steamer.

Steamers come in a variety of designs including countertop, wall-mounted, and floor models. They may consist of one cavity or have multiple stacked cavities. There are two food production styles that apply to food steamer design: batch-style and cook-to-order cooking. With batch steamers, the operator steams a single batch of product in a cooking cycle without the need to open the cavity to change-out product. Batch cooking is typical for institutions such as schools and hospitals where a large volume of food is produced in bulk and served at once. With cook-to-order steamers, the operator may open the cavity door as required to meet customer food orders. This requires that the steam cycle recover quickly since it is commonly interrupted. Cook-to-order cooking is common for full service restaurants that prepare dishes to order (Unified Brands 2011). Cook-to-order steamers, when used in cook-to-order mode, consume more water that batch-type steamers due to the drop in cavity pressure, resulting condensate water, and need for new steam production that occurs with each door opening during the steam cycle.

4.1.5 Product Description: Commercial Pulpers (Voluntary)

Pulper systems, or pulpers, are used to reduce the volume of waste in commercial food service establishments. Pulpers can shred all kinds of food service trash including food waste, Styrofoam, plastics, and paper. Pulper systems are comprised of a grinder, which adds water to waste and grinds it into slurry, and a liquid extractor, which uses a rotating augur and perforated screen to reduce the water content of the pulp and pushes it out through a discharge chute. The end result is a semi-dry pulp that drops into a trash or compost bin. Pulper grinding motors are typically 5 to 7.5 hp. Pulpers can be close-coupled (i.e. grinder and extractor near one another) or remote (i.e. extractor located in different room or different floor of the building than the grinder unit(s)) (Lorenzini 2011). Pulpers require a constant flow of running water while operating, with most pulpers using 2 to 3 gpm of freshwater because they recirculate some of the water that is extracted back to the grinder (Lorenzini 2011; Michailo 2015). See Figure 6 for a pulper system diagram.

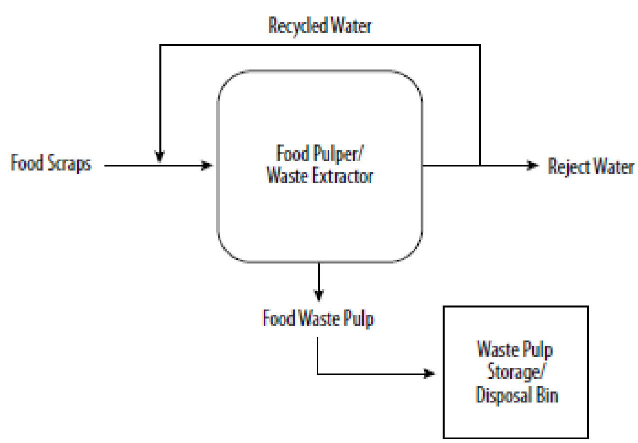

Figure 6: Pulper System Diagram (EPA 2012b)

Pulpers are predominantly found in very large food service establishments, such as hotels, hospitals, prisons, and colleges/universities (Niemi 2003). The vast majority of pulpers are large pulpers. In recent years a couple manufacturers have introduced small or mini pulpers that pair commercial food waste disposers with extractors and/or only accept majority food waste. There are three main ways that pulper equipment can reduce water consumption.

(1) *Control the flow rate of fresh water into the pulper while it is operating.* This feature is common and is accomplished using a flow control valve or is set by the installer using the programmable logic controller (PLC).

(2) *Recirculate some or all of the extracted water to be used in the grinder component*. In large pulper systems, recirculating water is very common and recirculating pumps come as standard components for both Somat and Hobart brand units (Michailo 2015) and Champion Industries technical service group indicated that 95% of Champion pulpers are installed with recirculation systems. Systems that recirculate extracted water typically require 1-3 gpm of makeup water (fresh water) be added to the system to limit sediment build up.

(3) *Use gray water (e.g., from dishwashers) rather than fresh water as the inlet water source*. This feature is offered by four manufacturers and can potentially eliminate the need for fresh water.

4.2 Market Structure

4.2.1 Commercial Food service Equipment Market Structure

Equipment Manufacturers

Commercial food service equipment manufacturers design, fabricate, and assemble equipment. Manufacturers rarely do manufacturer-direct sales; they utilize equipment representatives such as manufacturing representatives and vendor/dealers to distribute product, work with customers, and/or facilitate sales. Examples of food service equipment manufacturers include InSinkErator, Hobart, Rational, Vulcan, and Somat.

Manufacturer Representatives

Manufacturer representatives order directly from manufacturers in most cases and distribute to equipment vendors/dealers and commercial kitchen designers/consultants. Manufacturing representatives may represent multiple types of equipment for a suite of non-competing manufacturers (Michaud and Kalpman 2015). Manufacturing representatives are typically very knowledgeable about the equipment features and technical specifications and may help customers select the most appropriate equipment for their needs.

Equipment Vendors or Dealers

Vendors are brick and mortar stores or online retailers that sell equipment directly to consumers. Consumers can work with dealers to make equipment selections that may be stocked in the store or special ordered. Larger vendors have a design-build component of their business where staff take client requirements and specify products for new kitchens and large remodels. These vendors will often also participate in contract-bid activities where staff will propose a suite of kitchen equipment based on customer specification and bid on the project against other vendors for the equipment sales contract.

Buying Groups

Buying groups are made up of various equipment vendors/dealers who sell a high enough volume of equipment to qualify for participation. The buying group negotiates with the manufacturers on behalf of the participating equipment vendors/dealers for the best price for offered brands. Participating in a buying group is generally beneficial for an equipment vendor as it allows them to get a lower price and additional rebate promotions on certain equipment, but does limit the manufacturer brands they are willing to provide to the customer.

Designers/Consultants

Designers/consultants do not generally have a brick and mortar sales floor or offer online sales, but often have a showroom where they can meet with customers to design custom kitchens either from scratch or from existing specifications. Consultants specialize in full kitchen or large remodels. The consultant's design-build and contract-bid activities are similar to those of vendors.

Installers

Equipment is commonly installed by a general contractor, a plumber, and/or an electrician.

4.2.2 Measure Specific Market Considerations

Commercial Food Waste Disposers (Mandatory)

For FWDs, the market structure aligns closely with the commercial food service equipment market structure described above. One additional market actor for FWDs is fabricators. Commonly, disposers are attached to large steel dish tables or troughs. In new construction or remodel projects if a new table is also needed, the FWDs are often shipped directly from the equipment manufacturer to a fabricator, where it will be attached to the specified bowl, sink, table or trough that the fabricator has built. The fabricator will then deliver the whole unit to the food service establishment or assemble it onsite.

Commercial Dishwashers (Voluntary)

As described by a leading dishwasher manufacturer representative and regional sales representative, while approximately 50 percent of dishwashers are purchased by food service establishments through the market structure described in Section 4.2.1, the remaining 50% are leased from a chemical sales company that will also provide the necessary warewashing chemicals. This structure can create a split-incentive because the company leasing the equipment would pay any incremental costs for more water efficient equipment, while the lessor would receive the financial savings. Dishwasher leasing is most common in the restaurant setting, as most institutional facilities tend to purchase equipment (Koeller and Company 2010). Chemical company leasing agents are a more significant market actor in the provision of single rack, undercounter, or door type machines. Leasing agents play a minor role as a product channel for larger machines, with nearly all (>44 inch) rack conveyor and flight type machines being sold by manufacturers and dealers within the traditional food service market structure.

Commercial Combination Ovens, Commercial Food Streamers, and Pulpers (Voluntary)

No measure-specific market considerations were identified for combination ovens, food steamers, or pulpers.

4.3 Market Availability and Current Practice

4.3.1 Market Availability and Current Practice: Commercial Food Waste Disposers (Mandatory)

Food waste disposers are used in a wide variety of commercial kitchens, with some larger kitchens having multiple disposers. They are most commonly found in colleges/universities, hospitals, factories, hotels, supermarkets, restaurants, caterers, senior centers/facilities and non-public schools (NYC DEP 2008). A 2008 report for the New York City Department of Environmental Protection (NYC DEP) reported that approximately 25,000 systems are sold nationwide each year. Of these, it is estimated that the California market is relatively small, with less than 1,000 new units installed in California annually in recent years.[8]

The market for commercial FWDs in California has fallen significantly in the past five to ten years as an increasing number of local jurisdictions either formally prohibit or disallow the installation of FWDs in new construction projects during local building department plan checks. Additionally, some jurisdictions are no longer allowing FWD replacements (Michaud 2014; NYC DEP 2008).

FWD operation can vary widely since they are commonly used in foodservice establishments of all sizes. Some foodservice establishments, such as large restaurants, institutions or hotels have multiple disposers. Some keep their disposers running all day long while others run them just a few hours a day or less (Keleman & Furlong 2015; Michaud 2014; NYC DEP 2008).

Qualifying products are widely available through the existing commercial FWD market structure. Table 15 below presents the flow rates by model size for six leading manufacturers of disposers as well as time-out and load control features. The commercial FWD market is dominated by two manufacturers, InSinkErator and Salvajor, which hold 80-90% of the total market share (Easterla & Goodin 2015). As indicated in the table, three manufacturers currently offer one or more controllers with a time-out feature that automatically shuts down the unit after no more than 10 minutes. One manufacturer offers a load control feature that reduces water consumption to 1 gpm when the disposer is not in use. All manufacturers provide a number of models that do not exceed the maximum 8 gpm flow rate threshold.

[8] Based on estimated sales data from 2014 from the two largest disposer manufacturers.

Table 15. Commercial Waste Disposer Flow Rates and Water Saving Features by Manufacturer and Size

Manufacturer	Model Size							Time-out (≤ 10 minutes) (Y/N)	Load control (Reduces flow rate to ≤1 gpm when no load) (Y/N)
	<1 hp	1-2 hp	2-3 hp	3-4 hp	5 hp	7 hp	10 hp		
Hammerall		3	3	3				N*	N
Hobart	5	5, 8	8	8	10			N	N
InSinkErator	3	3,5	5	7	7	10	10	Y	Y
Master Disposer	3	3, 8	8	8, 13	8, 13	13	13	Y	N
Salvajor	5	5	5		8	8		Y	N**
Waste King		5	5	5	5			N	N

Note: All flow rates are in gpm and are the minimum flow rate (or average flow rate if a minimum was not indicated) for each model size. All data were collected from manufacturer websites and/or conversations with manufacturer representatives.
*Hammerall offers a time-out feature that can be set for time-outs of 15-45 minutes
**Salvajor offers a load control feature that uses an occupancy sensor and reduces flow to 2 gpm when no operator activity is sensed near the unit.

Despite the wide availability of controllers with automatic time-out features, which are the most prevalent water saving feature on the market, these controllers only comprise about a quarter of the market (Easterla 2015; InSinkErator 2015). Automatic time-out controllers have been available for over 20 years and InSinkErator's load control feature has been available for over ten years (InSinkErator 2015). Leading manufacturers indicate they anticipate some growth in market interest for water-saving features, as has been the trend over the past few years; however, this growth is not expected to be significant.

The slow uptake of automatic time-out features and advanced controls indicate there are some barriers to natural market adoption of water-saving FWDs. The most definitive barrier has been the higher initial cost of the water-saving controllers (Keleman & Furlong 2015). A survey of pricing from three top manufacturers indicates that the average cost difference between their most basic controller and a controller with automatic time-out feature is approximately $1,200. In many cases, the simple payback from this upfront investment is less than two years; however, this has not seemed to sway the majority of the market.

Other potential barriers may include user preferences for non-manual controls (i.e. not wanting to manually activate the disposer each time it is used), a lack of knowledge regarding the water-saving features when purchasing equipment, and the disconnect between the individual or entity that is responsible for water and sewer fees and the individual or entity responsible for equipment specification and/or purchase.

4.3.2 Market Availability and Current Practice: Commercial Dishwashers (Voluntary)

Commercial dishwashers that meet the proposed standards are readily available in the market. In 2013, dishwashers meeting the proposed voluntary standards presented in this report accounted for 38,000 of the units shipped, which represents a 63% market penetration of qualifying products nationally (ENERGY STAR 2013b).

Hobart holds the largest market share in the commercial dishwasher market, with other major manufacturers including Jackson, Stero, and Champion/Moyer Diebel. All five of these manufacturers carry multiple ENERGY STAR compliant models, as do 16 additional dishwasher brands found in the ENERGY STAR Certified Commercial Dishwasher Product Finder (ENERGY STAR 2015c).

Dishwashers meeting proposed code are widely available to consumers. However, the current practice of leasing machines may slow the adoption of efficient units without active code in place because chemical company leasing agents do not have an incentive to lower the water or energy usage at a site as the company does not pay the utility bill. Leased equipment is 50 percent of market, according to interviews with manufacturers.

While most end users purchase ENERGY STAR equipment, education may still be a barrier for some end users. One dealer noted that some end users are concerned that since more efficient models use less water, they may not clean as effectively and may require a second cycle.

4.3.3 Market Availability and Current Practice: Commercial Combination Ovens (Voluntary)

Combination ovens are readily available in the marketplace, including units that would meet the proposed code. Based upon calculations drawn from ENERGY STAR unit shipment data and a survey of the market, the Utility C&S Team estimates that approximately 790 units were shipped in California in 2013 with at least 70% meeting the proposed code (ENERGY STAR 2013b; Michaud & Kalpman 2015) [9].

Combination ovens are most often fueled by natural gas and electricity, with propane fueled models also available (Bean 2015). The major manufacturers, including Rational, Hobart, Alto Shaam, Electrolux Professional and Cleveland Range, have product lines that meet the proposed code. Since the initial cost of the equipment may be a limiting factor in the natural adoption of water-efficient units, the proposed code change would help move the market toward more efficient equipment.[10]

4.3.4 Market Availability and Current Practice: Commercial Food Steamers (Voluntary)

Food steamers that meet the proposed standards are readily available in the market. Approximately 18,000 food steamers were shipped in the United States in 2013 according to calculations from national unit shipment data (ENERGY STAR 2013b). Efficient models that

---

[9] Analysis is based on product data provided by combination oven manufacturers, Blodgett Market Forge, Rational USA, and Cleveland Range.

[10] Ibid.

qualify for ENERGY STAR requirements make up 34% of the market. Almost all ENERGY STAR qualifying units are rated with water efficiency levels that would comply with the proposed standards in this report, and thus it is likely that 6,000 or more code qualifying models were shipped and available to the market in 2013 (ENERGY STAR 2013b).

For the past half-decade, food steamer models have been trending toward a boiler-less design. Concern for water usage within the commercial kitchen has been a factor in this trend, combined with concern over the maintenance costs associated with removing scale caused by hard water that collects over time in the external boilers. A major manufacturer recently introduced the first water–efficient food steamer with an external-boiler. It uses relatively little water and meets ENERGY STAR guidelines for energy usage; therefore, the trend towards boiler-less units could slow or reverse as more efficient, boiler-based products enter the market (Michaud & Kalpman 2015).

Vulcan, Groen, and Cleveland are the largest manufacturers of large (batch) steamers on the market and Accutemp and AltoShaam areare the largest manufacturers for smaller (countertop/cook-to-order) food steamers. Approximately another dozen steamer manufacturers with smaller market share also sell product (Michaud & Kalpman 2015).

4.3.5 Market Availability and Current Practice: Commercial Pulpers (Voluntary)

The estimated annual nationwide pulper sales are less than 400 units. Of those, only approximately 35 units per year are installed in California (Michailo 2015; Michaud 2014). The pulper market is dominated by two brands, Somat and Hobart (owned by Somat), comprising 80-90% of market share with Champion and the other brands comprising the reminder of the market (Michailo 2015). Small (or mini) pulper prices range from $14,000 to $30,000. Large pulpers range from $34,000 to more than $100,000 for large remote systems (Lorenzini 2011).

While large pulpers are typically used in large commercial kitchens, such as universities, prisons, and large hospitals, small pulpers may become more common in large restaurants and other medium-sized commercial kitchens over the next few years (Michaud 2014). Pulpers commonly operate from 2-4 hours per meal in the large institutional settings where they are used (Michailo 2015). Table 16 below compares the flow rates and water saving features of six pulper brands. As indicated, most of the manufacturers offer pulpers that can be used with a recirculation system and/or recycled water and offer flow rates of 2 gpm or less. Thus, pulpers that meet the proposed maximum flow rate of 2 gpm are readily available in the marketplace.

Table 16. Pulper Equipment Flow Rate and Water Saving Features Comparison

Manufacturer	Grinding motor (hp)	Waste capacity (lbs/hr)	Description of Allowed Waste	Flow rate (gpm)	Option to recirculate	Option to use recycled water (from dishwasher)
Insinkerator*	3	700	Food scraps + up to 50% non-food waste	2-13	N	N
Somat*	Typically 5 hp	900	Food scraps only	1-3 with recirculation	Y	N
Meiko	8.8	992	Mixed kitchen waste: food waste, Styrofoam, paper, cardboard	1-2	Y	Y
Adamation	10		Food waste, bones, paper, plastic	8 – less if connected to dishwasher	Y	Y
Champion	5-7.5	500-1,000	Food waste, paper	2-3 with recirculation, 5-6 without	Y	N
Hobart	6	1,250 - 3,000	Food waste, paper, plastic, Styrofoam	0-4	Y	Y
Somat	6 -7.5	1,000-1,250	Food scraps, plastic flat-ware, paper, milk cartons, Styrofoam, aluminum foil, cardboard, polyethylene bags, plastic	1-2	Y	Y

Note: All data were collected from manufacturer websites and/or phone interviews with manufacturer representatives.
*Considered small or mini pulpers

4.4 Maintenance and Useful Life

We do not expect that the proposed standards will increase maintenance costs for any of the commercial kitchen equipment types. Disposer controllers can reduce unnecessary run times, and thus may reduce overall maintenance cost and/or improve the lifespan of this equipment. We do not anticipate any routine maintenance costs for the controller units themselves. We expect that high efficiency dishwashers, combination ovens and steamers would have the same components and features as less efficient equipment, and thus do not anticipate any increase in maintenance costs for these units. Pulpers could potentially meet the proposed standards through the use of recirculation pumps; however, the majority of the market already employs recirculation pumps. We expect that the number of pulpers that may be required to add a recirculation pump and thus any potential different in maintenance costs would be small.

The equipment life of FWDs commonly ranges from seven to ten years and can include heavy or inappropriate use (i.e. items other than food waste to enter the disposer grinding chamber). While the lifetime can also exceed this range, the analysis in this report assumes commercial FWDs have a lifetime of eight years.

The effective useful life of commercial dishwashers is approximately 10 years; combination ovens is approximately 12 years; and steamers is approximately 12 years (U.S EPA and DOE 2015). The effective useful life of pulpers is approximately eight years (Michaud and Kaplan 2015).

5. COST BENEFIT ANALYSIS

The cost-benefit analysis presented in this report includes cost savings that will be realized through lower water bills and reduced water heating energy costs. Embedded energy savings presented include electricity used to collect, transport, treat and distribute water. The report does not contain a separate cost savings analysis associated with embedded energy savings. The electricity, natural gas, and water rates used in this analysis are presented in Appendix D.

5.1 Cost and Benefits Methodology

5.1.1 Per Unit Incremental Cost Methodology

The per unit incremental cost of the proposed measures is the cost difference between the baseline equipment (base case) and the equipment that would comply with the proposed standards (standards case). In other words, it is the expected increase, if any, in the cost that users will be expected to pay in order to comply with the standards.

Estimates of the incremental costs for commercial FWDs, pulpers, and combination ovens were derived by collecting cost information from: online restaurant and hospitality equipment vendors, manufacturer published pricing information, calls to manufacturers requesting pricing information, and interviews with equipment sales representatives and manufacturers. Incremental costs for commercial dishwashers were obtained from ENERGY STAR as the proposed code is designed to align with ENERGY STAR models and guidelines. Incremental costs for food steamers were also obtained from ENERGY STAR and then weighted for the percent gas and percent electric steamers reported by the industry in the California market. The Utility C&S Team assumes ENERGY STAR incremental costs to be a reasonable proxy for qualified and non-qualified steamer costs. We note that some food steamer models that qualify under the proposed code do not qualify under ENERGY STAR. It is reasonable to assume that there may be less expensive models in the market that would meet the proposed CALGreen standards. Therefore, the incremental cost of food steamers included in this report may be conservatively high.

We assume that the proposal will not affect installation costs. Some installation savings may occur with more water efficient equipment due to lower capacity water supply and drain lines. We do not expect that compliance with the proposed standards will result in additional maintenance costs as noted earlier.

5.1.2 Per Unit Energy and Water Savings Methodology

The Utility C&S Team calculated annual water and energy savings per unit (i.e. equipment type) by determining the difference in water and energy use between the base case and the standards case scenarios. For the standards case, the Utility C&S Team used the proposed efficiency levels. To calculate the base case annual water savings, the Utility C&S Team used the following efficiencies:

- Disposer: 8 gpm, no timeout or load controls.
- Dishwasher: 64,300 gallons per year (weighted average of various types)
- Combination Oven: 1.8 gph
- Food Steamer: 6 gph (batch); 8 gph (cook-to-order)
- Pulper: 6 gpm

5.1.3 Statewide Energy and Water Savings Methodology

Statewide savings estimates were calculated by multiplying the per unit savings by estimates of the number of products that will be installed in newly constructed buildings, additions or alterations in a given year. The Utility Team did not count water or energy savings from buildings that we anticipate will install products that comply with the proposed efficiency level even if the standard is not adopted (under as “business as usual” case). For the mandatory measure (disposers), 100 percent compliance with the standards was assumed. For voluntary measures, 14 percent of the market was assumed to be regulated by the standard due to local implementation.

These estimates do not include the benefits of improved operational energy consumption. Dishwashers, steamers and combination ovens that meet the proposed standards are likely to also meet ENERGY STAR energy efficiency levels. In addition, in some cases cold water tempering of hot water discharges is required and therefore reduced hot water use will have additional water efficiency benefits. The benefits of the proposed standards are likely greater than presented in these estimates.

We did not calculate total direct electricity savings at facilities with electrically heated hot water, which we assume will be relatively uncommon for commercial buildings.[11]

The key assumptions used in the per unit water and energy impacts analysis are presented in Appendix B along with a more detailed summary of the calculation methods for each product and estimates of how many products will be installed in newly constructed buildings for a given year.

5.1.4 Per Unit and Total Lifecycle Cost Savings Methodology

The lifecycle cost analysis presents the costs and savings of the measure for the product’s entire lifetime. This analysis is presented both on a per unit basis, and for all regulated products that would be affected by the standard. The lifecycle benefit to cost (B/C) ratio is a key metric used to measure cost effectiveness. The B/C ratio is calculated by dividing the total present value water and energy cost savings (the benefit) by the present value of the total incremental cost (the cost). If the B/C ratio is 1.0 or greater (i.e. the present valued benefits are greater than the present valued costs over the period of analysis), then the measure is cost effective. The

[11] While about 7%-8% of hot water at residential facilities in California is electrically heated, we assume that the fraction of electrically heated hot water for commercial kitchens is much lower because commercial buildings are more likely located in developed areas with gas service, and because the volume of hot water used in a commercial kitchen could make the operation of a electric hot water heater very costly.

cost savings presented in this report represent a savings to the ratepayer and all proposed measures are very cost-effective.

5.2 Per Unit Incremental Costs

5.2.1 Per Unit Incremental Cost: Disposers

The incremental equipment cost for commercial FWDs are based on a blended cost of the difference between manufacturers' base feature controller and both (1) automatic time-out controller and (2) load control controller. Disposer unit costs (not including controller) are typically not affected by the choice of controller. Pricing for 3 hp and 5 hp units was collected for each of the three manufacturers that offer the time-out feature and for the one manufacturer that offers the load control feature. The incremental cost was calculated as a weighted average based on the incremental prices and estimated market share of controllers. The incremental equipment cost is estimated at $1,371.

Because there are currently multiple options in the market for controllers in the 4 hp to 7 hp range that have flow rates of less than 8 gpm (see Table 15) and because equipment ≥ 10 hp makes up less than 5% of the market (Easterla and Reynolds 2015), the incremental cost associated with the proposed restriction of a maximum flow rate of 8 gpm of water use was assumed to be $0.

5.2.2 Per Unit Incremental Costs: Commercial Dishwashers, Combination Ovens, Steamers and Pulpers

The average incremental per unit cost of meeting the proposed dishwasher voluntary code is $377. Incremental cost, as determined by the U.S. EPA and DOE's ENERGY STAR Commercial Kitchen Equipment Calculator used is further broken down by dishwasher type in the table below.

Table 17. Incremental Cost of Dishwashers by Type

Dishwasher Type	Low Temperature	High Temperature
Undercounter	$50	$120
Stationary Single Tank Door	$0	$770
Single Tank Conveyor	$0	$2,050
Multi Tank Conveyor	$970	$970
Pot, Pan, and Utensil	n/a	1,710

The incremental cost of a code compliant combination oven is approximately $789, based on pricing data obtained from the market (prices collected from vendors and manufacturers).

The incremental cost for gas and electric steamers differ. Using the methodology described above, the Utility C&S Team utilized ENERGY STAR assumptions that the incremental cost of an ENERGY STAR gas unit is $870 and that of an electric unit is $630. Based on the weighted average of gas and electric ENERGY STAR units, we determined that the incremental cost of a food steamer meeting the proposed code would be less than $653.

The incremental costs for pulpers are assumed to be nil because most pulpers already include recirculation pumps as part of the base model (Michailo 2015). Recirculation pumps allow the pulper to recirculate water from the extractor to the grind chamber, enabling the equipment to achieve the proposed 2 gpm maximum flow rate.

5.3 Per Unit and Statewide Water and Energy Savings

5.3.1 Per Unit and Statewide Water and Energy Savings: Disposers

During the first year the proposed commercial FWD efficiency standard is in effect (2017), we estimate an annual water savings of approximately 304,000 gallons per unit. This is an annual savings of approximately 48 million gallons for all installed units. By 2030, the annual water savings from all FWDs installed in commercial new construction, additions and alterations would be 425 million gallons per year. These water savings would provide an associated embedded electricity savings of 4,269 megawatt hours (MWh) per year (see **Error! Reference source not found.** and Table 19)[12]. We use 2030 to represent the year when full deployment of all proposed commercial kitchen standards will be achieved (i.e. retirements of regulatory products would be offset by new installations).

Table 18. Commercial Food Waste Disposer Water and Energy Savings per Unit

Product Class	Water Use (gallons/yr)	Embedded Electricity (kWh/yr)
Baseline Case for Disposers	1,036,800	10,415
Standards Case for Disposers	733,082	7,364
Per Unit Savings	**303,718**	**3,051**

Table 19. Commercial Food Waste Disposer Statewide Water & Energy Savings For First Year Standard is in Effect (2017) and 2030

Product Class	Water Use (Mgal/yr)	Embedded Electricity Use (MWh/yr)
Baseline Case for Disposers	228	2,290
Standards Case for Disposers	180	1,804
First Year Statewide Savings (2017)	**48**	**486**
Statewide Savings (2030)	**425**	**4,269**

[12] We present future year benefits and costs for all commercial kitchen measures between the first year the standards go into effect (2017) and 2030, as all measures will have achieved full deployment by that time. For instance, in the case of a product with a 12-year lifespan, by 2030 new regulated products for new construction, alterations and repairs will be roughly offset by retirement of existing regulated products that reach the end of their lifespan. We assume that water savings are entirely cold water.

5.3.2 Per Unit and Statewide Water and Energy Savings: Commercial Dishwashers, Combination Ovens, Food Steamers and Pulpers

Table 20 presents per unit baseline water and embedded electricity use. Table 20 also presents per unit electricity for units using water heated with electricity; and per unit natural gas use for units heated with natural gas.

The first year of voluntary standards for dishwashers, combination ovens, and food steamers would result in an estimated annual water savings of 9 million gallons of water and 90 MWh of associated embedded electricity savings (Table 21). The cumulative water savings from all voluntary measures installed in commercial new construction, additions and alterations would be approximately 76 million gallons per year by 2030, with associated annual embedded electricity savings of 765 MWh (
Table 22).

We note that the standards are very likely to result in electricity savings because the water efficient models are likely to also include Energy Star electricity savings features from unit operations. We have not quantified those associated electricity savings.

Scenario	Per Unit Water Use (gallons/yr)	Per Unit Electricity for Hot Water Heating (kWh/yr)	Per Unit Embedded Electricity (kWh/yr)	Per Unit Natural Gas Use for Hot Water Heating (therms/yr)
Commercial Dishwashers				
Baseline Case	64,341	9,487	646	523
Standards Case	45,026	6,639	452	366
Per Unit Savings	**19,315**	**2,848**	**194**	**157**
Combination Ovens				
Baseline Case	56,566	8,340	568	460
Standards Case	45,990	6,781	462	374
Per Unit Savings	**10,576**	**1,559**	**106**	**86**
Food Steamers				
Baseline Case	176,602	26,039	1,774	1,436
Standards Case	80,942	11,935	813	658
Per Unit Savings	**95,659**	**14,105**	**961**	**778**
Pulpers1				
Baseline Case	1,166,400	-	11,717	-
Standards Case	388,800	-	3,906	-
Per Unit Savings	**777,600**	**-**	**7,811**	**-**

[1] There are no electricity or natural gas savings expected for water efficient pulpers.

Table 21 We did not include pulpers in Table 21 or

Table 22 since the sales volume is low compared to other products (approximately 35 units per year). Further, there is uncertainty about the number of pulpers that may potentially be regulated in the future due to low sales volumes. Because the Utility C&S Team does not anticipate significant additional costs associated with this measure, excluding pulpers provides conservative cost-benefit and lifecycle analysis results.

Table 20. Commercial Dishwasher, Combination Oven, Food Steamer and Pulper Per Unit Water and Energy Use and Savings

Scenario	Per Unit Water Use (gallons/yr)	Per Unit Electricity for Hot Water Heating (kWh/yr)	Per Unit Embedded Electricity (kWh/yr)	Per Unit Natural Gas Use for Hot Water Heating (therms/yr)
Commercial Dishwashers				
Baseline Case	64,341	9,487	646	523
Standards Case	45,026	6,639	452	366
Per Unit Savings	**19,315**	**2,848**	**194**	**157**
Combination Ovens				
Baseline Case	56,566	8,340	568	460
Standards Case	45,990	6,781	462	374
Per Unit Savings	**10,576**	**1,559**	**106**	**86**
Food Steamers				
Baseline Case	176,602	26,039	1,774	1,436
Standards Case	80,942	11,935	813	658
Per Unit Savings	**95,659**	**14,105**	**961**	**778**
Pulpers[1]				
Baseline Case	1,166,400	-	11,717	-
Standards Case	388,800	-	3,906	-
Per Unit Savings	**777,600**	**-**	**7,811**	**-**

[1] There are no electricity or natural gas savings expected for water efficient pulpers.

Table 21. Statewide Water and Energy Use and Savings for Commercial Dishwashers, Combination Ovens and Food Steamers for First Year Standards are in Effect (2017)

Product	Water use (Mgal/yr)	Natural Gas Use (10^6 therms/yr)	Embedded Electricity (MWh/yr)
Commercial Dishwashers	4	0.0	36
Combination ovens	0	0.0	2
Food Steamers	5	0.0	52
Total Statewide Savings	**9**	**0.1**	**90**

Table 22. Statewide Water and Energy Use and Savings for Commercial Dishwashers, Combination Ovens and Food Steamers in 2030

Product	Water Use (Mgal/yr)	Natural Gas Use (10^6 therms/yr)	Embedded Electricity (MWh/yr)
Commercial Dishwashers	30	0.2	304
Combination Ovens	2	0.0	18
Food Steamers	44	0.4	442
Total Statewide Savings in 2030	**76**	**1**	**764**

5.4 Lifecycle Cost Savings and Benefit/Cost Ratio

5.4.1 Lifecycle Cost Impacts: Disposers

Table 23 presents the incremental costs and lifecycle (8 year) cost savings of the proposed commercial FWD standard. The analysis was completed on a per disposer basis and for all products sold during the first year of the standard. The per unit water cost savings over the eight year period of analysis are estimated to be $18,993 (based on 2015 dollar values). There are no cost savings associated with heating water, as disposers typically only use cold water. The net cost benefit per unit would be $17,622. The benefit to cost (B/C) ratio is 13.8, which means the measure is cost-effective. The B/C ratio is the total benefit divided by the total incremental costs. The measure is cost effective if the B/C ratio is greater than 1.

Table 23. Lifecycle Cost Savings and Benefit/Cost Ratio for Qualifying Food Waste Disposers Sold in 2017

	Per Unit	Total all regulated products ($)
Incremental Equipment Cost	$1,371	$326,000
Water Cost Savings	$18,993	$2,960,000
Net Lifecycle Cost-Benefit	$17,622	$2,600,000
Benefit to Cost Ratio[2]	13.8	

[2] The Benefit to Cost (B/C) ratio is the total benefit divided by the total incremental costs

5.4.2 Lifecycle Cost Impacts: Dishwashers, Combination Ovens, Steamers, and Pulpers

Table 24 presents the incremental costs and lifecycle cost savings of the proposed commercial voluntary standards. The analysis was completed on a per unit basis and for all products sold during the first year of the standard and is based on 2015 dollar values. The lifecycle cost savings per unit range from $1,235 to $11,171. The net cost of all measures listed below in Table 24 is about $235,000 with lifecycle benefits of $2 million for products sold in 2017. The

B/C ratio averaged across the three measures is greater than 8:1, with each measure having a positive B/C ratio. This indicates that all three measures are cost-effective.

Table 24. Lifecycle Costs and Benefits for Qualifying Products Sold in 2017

	Commercial Dishwashers Cost/Benefit		Food Steamers Cost/Benefit		Combination Ovens Cost/Benefit	
	Per Unit	**Total ($)**	**Per Unit**	**Total ($)**	**Per Unit**	**Total ($)**
Incremental Equipment Cost	$377	$135,500	$653	$69,000	$789	$31,100
Water Cost Savings	$1,886	$677,700	$9,339	$987,000	$1,032	$40,600
Natural Gas Cost Savings	$370	$133,000	$1,832	$193,600	$203	$8,000
Total Benefit	$2,256	$810,700	$11,171	$1,180,600	$1,235	$48,600
Net Lifecycle Benefit	$1,879	$675,200	$10,519	$1,111,700	$446	$17,600
Benefit to Cost Ratio[2]	5.0		16		1.7	

[2] The Benefit to Cost (B/C) ratio is the total benefit divided by the total incremental costs. The measure is cost effective if the B/C ratio is greater than 1.0.

5.5 Additional Environmental Benefits

Water efficiency standards have a number of important environmental benefits in addition to the water supply benefits described in Section 2.3 of this report. These benefits include water quality, air quality, and greenhouse gas benefits as described below.

5.5.1 Water Supply and Water Quality Benefits

Improving water efficiency reduces demand; helps maintain higher water levels in lakes, rivers and streams; and improves water quality and protects human health and the environment (WaterSense 2013). As the ongoing drought diminishes surface water flows throughout California, fish and wildlife species that are reliant on these natural water sources are in grave danger of habitat quality loss, which may threaten these species' survival. Threatened and endangered species are most at risk, such as endangered fish species that rely on adequate water flows for water quality and volume for survival and reproduction. Water efficiency measures, such as the proposed code changes, will result in increased surface water flows in many habitats due to the reduced need for human consumption, and increase healthy habitats for species at risk.

Low water levels and lack of freshwater releases can increase the likelihood of water fouling due to saltwater intrusion, when an influx of seawater flowing into freshwater sources occurs. Furthermore, fouling due to algae blooms can also occur as the lack of freshwater inflows results in excess nutrient concentrations in some water bodies, which can harm fish, animals and humans. Therefore, improved water efficiency as a result of the proposed measures can help ensure that more water resources are available for beneficial human and environmental use.

Groundwater resources also benefit from the reduction in human use as a result of water conservation. Reducing the amount of water pumped out of stressed aquifers can increase water quality, since over-pumping results in precipitous drops in underground water levels and the deterioration of groundwater quality (USGS 2014). In reducing groundwater draws, water conservation can result in long term environmental benefits such as the avoidance of land subsidence and saltwater intrusion into aquifers due to over-pumping.

Just as water-dependent wildlife species benefit from water efficiency measures, people that rely on water resources for employment or enjoyment will also benefit from these measures. As noted earlier, lack of water availability has significantly impacted agricultural employment. Californians also depend on water resources for recreation activities and related jobs supporting activities such as boating, water sports, fishing and swimming. The current drought has dried up streams, lakes and reservoirs used for recreation, bringing them to unprecedented low levels and preventing freshwater releases from reservoirs to sources downstream and water efficiency standards will help mitigate demand on these resources.

5.5.2 Greenhouse Gas Emissions Benefits

Table 25 shows the annual greenhouse gas emissions (GHG) savings for the first year the standards takes effect for FWDs. Table 25 also presents the range of the societal benefits from avoided GHG as a result of the standard. The total avoided CO_2e is based on CARB's estimate of 437 MT CO_2e/GWh of energy savings from energy efficiency improvements, and includes additional electrical transmission and distribution loses estimated at 7.8% (CARB 2008). The range of societal benefits per year is based on a range of annual dollar per metric ton of CO2 (in 2013 dollars) sourced from the U.S. Government's Interagency Working Group on Social Cost of Carbon (SCC) (Interagency Working Group 2013). The low end uses the average SCC, while the high end incorporates SCC values which use climate sensitivity values in the 95th percentile, both with 3% discount rate. It is important to note that this range can be lower and higher, depending on the approach used, so policy judgments should consider this uncertainty. See Appendix C for more details regarding this and other approaches.

Table 25. Estimated Statewide Greenhouse Gas Savings and Cost Savings for Standards Case: Commercial Food Waste Disposers

Product Class	Annual GHG Savings for First Year Standards are in Effect - 2017	Value of GHG Savings for First Year Standards are in Effect – 2017	Value of GHG Savings for First Year Standards are in Effect – 2017
	($MTCO_2e$/yr)	Low Estimate	High Estimate
Disposers, Dishwashers, Combination Overs, Steamers, and Pulpers	300	$11,000	$16,000

5.5.3 Air Quality Benefits

The proposed measure will also result in air quality benefits such as reduced emissions of pollutants that cause fine particulate and ground-level ozone pollutants. Direct combustion for on-site heating results in local emission of nitrogen oxides (NOx) and carbon dioxide (CO). Energy used for water supply and treatment also results in emissions of these pollutants and others.

We did not quantify the air quality benefits of this proposal, and thus the estimated total benefits presented in this report are conservative.

5.5.4 Other Potential Environmental Effects

There are no known incremental hazardous materials impacts from the efficiency improvements as a result of the proposed standards. The Utility C&S Team has not identified other potential environmental impacts.

6. Code Compliance and Enforcement

6.1 Potential Areas that Would Enhance or Cause Barrier(s) to Compliance and Enforcement

6.1.1 Commercial Food Waste Disposers (Mandatory)

The Utility C&S Team has not identified any significant barriers to compliance for commercial food waste disposers. There are a variety of options on the market that meet the proposed standard from a variety of manufacturers. The proposed standard will require the installation of a more sophisticated disposer controller. However, disposer manufacturers indicated that installation of the qualified controllers is user-friendly, requires little to no programming, and is commonly done by an electrician or general contractor.

6.1.2 Commercial Dishwashers (Voluntary)

Dishwashers compliant with the proposed voluntary standards are easily identified by the consumer and readily available on the market. Additionally, based on feedback from dishwasher manufacturer representatives, the market is currently receptive to the ENERGY STAR brand that defines the proposed code language. These factors will likely enhance dishwasher code compliance.

6.1.3 Commercial Combination Ovens and Commercial Food Streamers (Voluntary)

While many qualifying equipment models exist on the market, it can be challenging for vendors or consumers to readily identify compliant models because water usage is often not listed in the equipment literature or manufacturer cut sheets. In these cases, the vendor/consumer may need to contact the manufacturer directly to obtain equipment water usage information. Further, it may be difficult for a field inspector to determine if a particular combination oven or food steamer is compliant with code if the equipment's nameplate is not visible We expect that over time, with increasing focus on water efficiency, manufacturers will increase the amount of information available regarding water consumption.

As described in this report, the proposed requirements for food steamers differ between batch and cook-to-order steamers. While the distinction between these steamers is well-understood in the industry, informational resources may be needed to help inspectors and plan checkers identify whether specific units are batch or cook-to-order models. In addition, there are some "versatile" steamer designs that are marketed as meeting both batch and cook-to-order uses (Unified Brands 2011) and thus verification of compliance with both sets of standards may be necessary.

6.1.4 Commercial Pulpers

The freshwater flow rate of pulpers is most commonly determined by the equipment's Programmable Logic Controller (PLC), which is programmed during installation or in the factory. The flow rate depends on the pressure of incoming water from the building's plumbing system, the diameter of inlet piping and the settings of the PLC. Flow control valves are not common on pulpers, with most manufacturers relying instead on PLCs (Sensenig 2015). The flow rate for each pulper is site-specific. Some equipment is programmed to add freshwater for a certain amount of time each minute (e.g., 10-second flow of freshwater for each minute of operation) and others add freshwater using a different logic (Sosebee 2014). Further, there is no standard method for determining the exact flow rate other than conducting onsite measurements; manufacturer equipment specification materials typically provide only a range of flow rates. As a result, it may be a challenge for inspectors to easily verify compliance without measuring the actual flow rate.

6.2 Potential Actions that would Address Compliance Concerns

6.2.1 Commercial Combination Ovens and Commercial Food Streamers (Voluntary)

An online guide to compliant vs. non-compliant units would streamline compliance for planners, inspector, and end-users. For instance, the Consortium for Energy Efficiency list for steamers provides a potential model (Consortium for Energy Efficiency 2015). Alternatively, planners and inspectors can be educated to request relevant information on equipment type and water usage to verify compliance. Manufacturers and distribution channels may benefit from a sample template for providing information to customers and local enforcement staff.

Additional clarification of batch and cook-to-order steamer definitions would also be helpful. Key characteristics could include steam cycle recovery rate, size, etc. As these products are not necessarily marked by type, a more refined definition of batch versus cook-to-order steamers would improve customer and market actors' ability to identify code compliant units and ease adoption of the voluntary code.

6.2.2 Commercial Pulpers

For pulpers, manufacturer representatives, vendors, and users within jurisdictions that adopt this voluntary standard will need to be informed of the code requirement so that when equipment is programmed, it aligns with the 2 gpm freshwater maximum in the proposed code. With only one known exception (the InSinkErator Waste Xpress mini pulper), all other manufacturer's pulpers utilize a recirculation pump to achieve the 2 gpm flow rate. During plan check stages, regulators can review equipment literature to confirm that the unit will include a recirculation pump. This will not ensure the unit will meet the 2 gpm standard once installed, but it will verify that the unit is capable of achieving the standard. Due to the precedent that 2 gpm is also the maximum flow rate set by the United States Green Building Council in LEED Version 4, awareness by manufacturers and manufacturer representatives is growing (United States Green Building Council 2014). This increased awareness may result in manufacturers making modifications to equipment literature or design such that it is easier to measure and enforce flow rate restrictions.

7. STAKEHOLDER CONSULTATION

7.1 Stakeholder Engagement Process

In the effort to research, develop, and vet the proposed standards, the Utility C&S Team reached out to numerous organizations, many of which are key players in the eventual implementation of the proposed code changes. These stakeholders include state government agencies, code setting bodies, industry representatives, union associations, manufacturers, trade associations, water resources advocates, environmental protection organizations, and water agencies.

The process to gather input from stakeholders was extensive. First, the Utility C&S Team conducted general outreach to inform all identified stakeholders of the code process. Some standardized email messaging was used for all stakeholders in order to present a uniform message and to ensure that all stakeholders were equally informed. Extensive personalized messaging was also used to solicit and address stakeholder specific concerns. We conducted both phone and in-person interviews to explain the proposals to many key stakeholders, to attain feedback and to address any potential concerns. Prior to our participation in the October 2104 and February 2015 BSC Workshops, we conducted outreach to gauge and address stakeholder support or opposition of the code change proposals. Furthermore, we presented the proposals for live feedback from workshop attendees at both the October 2015 and the February 2015 workshops.

Maintaining contact with these stakeholders throughout the code change process has ensured the consideration of a variety of stakeholder positions, as described further below.

7.2 Summary of Key Stakeholder Input

A number of industry and other stakeholders were contacted regarding the proposed commercial foodservice equipment standards. Early on in the process, the C&S Utility Team reached out to the Food Service Technology Center (FSTC) for input, data, and information on water-using equipment and the commercial foodservice market. We worked closely with the FSTC to identify feasible measures that would garner large water savings for California. The FSTC also provided input on equipment efficiency levels and code language, as well as acting as a liaison to other key players in the industry (e.g., manufacturers, commercial foodservice consultants and designers).

We also discussed the proposals with a number of organizations that represent the foodservice industry generally, including restaurant owners and local jurisdictions. We discussed the proposals with staff from the City of Los Angeles, the North American Association of Food Equipment Manufacturers (NAFEM), the California Restaurant Association, and the Golden Gate Restaurant Association. We are not aware of any specific concerns from these organizations regarding the proposed standards. We also discussed the measures with the East

Bay Municipal Water District and the Natural Resources Defense Council. Overall, the stakeholders we engaged were very supportive of the proposed code changes.

We also discussed the proposed measures with representatives from IAPMO. IAPMO representatives were supportive of using the IAPMO Green Code as a model for some of the CALGreen revisions.

7.2.1 Manufacturer Input

We also reached out to many individual manufacturers. For instance, food waste disposer stakeholders that provided input for the proposed code changes included individuals from the two largest disposer manufacturers, InSinkErator and The Salvajor Company, one smaller disposer manufacturer, Somat, and a Southern California InSinkErator manufacturer representative from KLH Marketing.

In general, all stakeholders were in support of the proposed code language and in agreement that it would contribute to water savings. Manufacturer feedback led us to modify the language presented during the BSC public workshop held on February 5, 2015 so that it would be more inclusive of new technologies such as automatic timer shut-offs, including a model that utilizes occupancy sensor technology to provide an automatic shut-off. Additionally, we confirmed that 1 gpm is an appropriate limit in combination with the automatic time-out provision.

Key stakeholders that provided input for the proposed pulper code included two equipment manufacturers (Champion and InSinkErator); and representatives from Pete Michailo Associates Food Service Equipment Consulting, a Southern California Hobart manufacturer representative from KLH Marketing, and a Southern California Somat manufacturer representative from Food Service Equipment Agents. These stakeholders were supportive of the proposed pulper language. We determined that the majority of currently operating units could achieve the proposed standard of 2 gpm in practice, despite the wider published range in equipment specification materials. We also clarified the code language such that it includes only "makeup" water in response to stakeholder feedback.

We also reached out to commercial dishwasher, combination ovens, and food steamer manufacturers. A number of organizations provided helpful data on models that would meet the proposed code and additional information to inform our technical feasibility and cost-effectiveness evaluation.

8. Proposed Code Language

The proposed changes to the Nonresidential Mandatory Measures (Chapter 5 of CALGreen) and Nonresidential Voluntary Measures (Appendix A5 to CALGreen) are provided below. All changes to the current 2013 Interim Cycle Documents are marked in red with new language marked with underlining and deletions marked with ~~strikethroughs~~.

We note that they are not prescriptive standards, per Government Code Section 11346.2(b)(1), because they do not specific a specific technology or equipment and rather contain performance standards.

8.1 Draft Express Terms: Mandatory Measures (Chapter 5)

NONRESIDENTIAL MANDATORY MEASURES

SECTION 5.303
INDOOR WATER USE

5.303.7 Appliances and fixtures for commercial application.

5.303.7.1 Food Waste Disposers. Disposers shall either modulate the use of water to no more than 1 gpm when the disposer is not in use (not actively grinding food waste/no-load) or shall automatically shut off after no more than 10 minutes of inactivity. Disposers shall use no more than 8 gpm of water.

[Note: This code section does not affect local jurisdiction authority to prohibit or require disposer installation.]

8.2 Draft Express Terms: Voluntary Measures (Appendix A5)

NONRESIDENTIAL VOLUTARY MEASURES

SECTION A5.303
INDOOR WATER USE

A5.303.3 Appliances and fixtures for commercial application. Appliances and fixtures shall meet the following:

1. Clothes washers shall have a maximum Water Factor (WF) that will reduce the use of water by 20 percent below the California Energy Commissions' WF standards for commercial clothes washers located in Title 20 of the *California Code of Regulations.*
2. Dishwashers shall meet the following water use standards:

a. Residential – ENERGY STAR

   i. Standard Dishwashers – 4.25 gallons per cycle.

   ii. Compact Dishwashers – 3.5 gallons per cycle.

b. Commercial – ~~refer to Table A5.303.~~ Shall be in accordance with ENERGY STAR requirements. Refer to Table A5.303.

3. Ice makers shall be air cooled.

4. Food steamers shall be connectionless or boilerless~~.~~ and shall consume no more than 2 gallons of water per pan per hour, including condensate water, for batch type steamers, and no more than 5 gallons of water per pan per hour, including condensate water, for cook to order steamers.

5. [BSC] The use and installation of water softeners that discharge to the community sewer system may be limited or prohibited by local agencies if certain conditions are met.

6. Combination ovens shall ~~not consume more than 10 gph (38 L/h) in the full operational mode.~~ use a maximum of 1.5 gallons of water per hour per pan, including condensate water.

7. Commercial pre-rinse spray valves manufactured on or after January 1, 2006 shall function at equal to or less than 1.6 gpm (0.10 L/s) at 60 psi (414 kPa) and
   a. Be capable of cleaning 60 plates in an average time of not more than 30 seconds per plate.
   b. Be equipped with an integral automatic shutoff.
   c. Operate at static pressure of at least 30 psi (207 kPa) when designed for a flow rate of 1.3 gpm (0.08 L/s) or less.

8. No more than 2 gpm of freshwater shall be used in food waste pulping systems.

   Note: freshwater excludes on-site grey water use, such as dishwasher discharge water.

TABLE A5.303.3: COMMERICAL DISHWASHER WATER USE

Type	**High-Temperature - Maximum Gallons Per Rack** (unless otherwise noted)	**Low-Temperature – Maximum Gallons Per Rack** (unless otherwise noted)	~~**Chemical – Maximum Gallons Per Rack**~~
~~Conveyor~~ Single Tank Conveyor	0.70 (2.6 L)	≤ 0.79 (3 L)	~~0.62 (4.4 L)~~
Multiple Tank Conveyor	≤ 0.54 (2 L)	≤ 0.54 (2 L)	
Stationary Single Tank Door	~~0.95 (3.6 L)~~ ≤ 0.89 (3.4 l)	≤ 1.18 (4.5 L)	~~1.16 (2.6 L) (BSC)~~ ~~2.26 (8.6 L) [DSA-SS]~~
Undercounter	~~0.90 (3.4 L)~~ ≤ 0.86 (3.3 L)	≤ 1.19 (4.5 L)	~~0.98 (3.7 L)~~
Pot, Pan, and Utensil	≤ 0.58 GPSF	≤ 0.58 GPSF	

Single Tank Flight Type	GPH ≤ 2.975x + 55.00	GPH ≤ 2.975x + 55.00	
Multiple Tank Flight Type	GPH ≤ 4.96x + 17.00	GPH ≤ 4.96x + 17.00	

Note: GPSF = gallons per square foot of rack; GPH = gallons per hour; x = maximum conveyor speed (feet/min as verified through NSF 3 certification) x conveyor belt width (feet).

9. REFERENCES

Government Code Section 11346.2(b)(3) requires an identification of each technical, theoretical, and empirical study, report, or similar document, if any, upon which an agency relies in proposing new regulation(s). The following are relevant studies and reports relied upon for this CALGreen CASE report proposal.

Alliance for Water Efficiency. 2010. "Commercial Dishwashing." Commercial Dishwashing Introduction. http://www.allianceforwaterefficiency.org/commercial_dishwash_intro.aspx

[BSC] California Building Standards Commission. 2013a. "2013 California Green Building Standards Code." California Code of Regulations, Title 24, Part 11, Appendix A5, Table A5.303.3. pg 214.

__. 2013b. "2013 California Green Building Standards Code." California Code of Regulations, Title 24, Part 11, Appendix A5, Section A5.303.3. pg 214.

__. 2014. "Guide to the 2013 California Green Building Standards Code (Nonresidential)." California Code of Regulations, Title 24, Part 1.

[CARB] California Air Resources Board. 2008. "AB 32 Technical Stakeholder Working Group Meeting. Cost-Effectiveness." http://www.arb.ca.gov/cc/scopingplan/economicssp/meetings/060308/ce_white_paper.pdf. June, 3 2008.

California Farm Water Coalition. 2014. "Estimate of unplanted acres jumps to 800,000; consumers expected to feel impacts." http://farmwater.org/california-drought-information-mulitmedia/releases/new-31814-estimate-of-unplanted-acres-jumps-to-800000-consumers-expected-to-feel-impacts/.

California Sustainability Alliance. 2013. "Water - Energy Toolkit For Sustainable Development : A Practical Guide To Implementing Water-Energy Conservation Policies And Projects For Local Governments, Developers, Water Agencies And Supporting Parties."

[CEC]. California Energy Commission. 2006 "Refining Estimates of Water-related Energy Use in California." (CEC-500-2006-118). Prepared by Navigant Consulting, Inc., Public Interest Energy Research Program (December 2006). http://www.energy.ca.gov/2006publications/CEC-500-2006-118/CEC-500-2006-118.PDF.

Consortium for Energy Efficiency. 2015. "2015 January CEE Steamers QPL." Commercial Kitchen Steam Cookers Qualifying Product List. http://library.cee1.org/content/commercial-kitchen-steam-cookers-qualifying-product-list

Easterla, D. (The Salvajor Company). 2015. Personal communication. March 3 and 11.

Easterla, D. and S. Goodin (The Salvajor Company). 2015. Personal communication. February 3.

Easterla, D. and S. Reynolds (The Salvajor Company). 2015. Personal communication. February 19.

ENERGY STAR. 2003. “ENERGY STAR Program Requirements Product Specification for Commercial Steam Cookers, Eligibility Criteria Version 1.2.” http://www.energystar.gov/ia/partners/product_specs/program_reqs/Commercial_Steam_Cookers_Program_Requirements.pdf

__. 2012a. "ENERGY STAR Program Requirements Product Specification for Commercial Dishwashers, Eligibility Criteria Version 2.0." http://www.energystar.gov/ia/partners/product_specs/program_reqs/Commercial_Dishwasher_Program_Requirements.pdf

__. 2012b. "ENERGY STAR Unit Shipment and Market Penetration Report Calendar Year 2012 Summary." https://www.energystar.gov/ia/partners/downloads/unit_shipment_data/2012_USD_Summary_Report.pdf

__. 2013a. "Commercial Dishwashers Key Product Criteria, Version 2.0." http://www.energystar.gov/index.cfm?c=comm_dishwashers.pr_crit_comm_dishwashers

__. 2013b. "ENERGY STAR Unit Shipment and Market Penetration Report Calendar Year 2013 Summary." https://www.energystar.gov/ia/partners/downloads/unit_shipment_data/2013_USD_Summary_Report.pdf

__. 2013c. “EPA ENERGY STAR, ENERGY STAR Program Requirements Product Specification for Commercial Ovens, Eligibility Criteria Version 2.1.” http://www.energystar.gov/sites/default/files/specs//private/Commercial%20Ovens%20Program%20Requirements%20V2%201.pdf

__. 2015a “About Energy Star.” Accessed April 7, 2015 from http://www.energystar.gov/about/

__. 2015b "Commercial Dishwashers for Consumers". Accessed April 7, 2015 from http://www.energystar.gov/products/certified-products/detail/commercial-dishwashers-overview

__. 2015c "Certified Commercial Dishwashers." Accessed March 2, 2015 from http://www.energystar.gov/productfinder/product/certified-commercial-dishwashers/results

Fisher, D. 2002. “Commercial Cooking Appliance Technology Assessment.” Food Service Technology Center Report #5011.02.26. San Ramon, Calif.: Fisher-Nickel, Inc. http://www.fishnick.com/equipment/techassessment/Appliance_Tech_Assessment.pdf

[FSTC] Food Service Technology Center. 2015a. "Combination Ovens." http://www.fishnick.com/savewater/appliances/combinationovens/

__. 2015b. "Steamers." http://www.fishnick.com/savewater/appliances/steamers/

__. 2015. “Electric Steamer Life-Cycle Cost Calculator.” Lifecycle and Energy Cost Calculators. Accessed 3/12/15 from http://www.fishnick.com/saveenergy/tools/calculators/esteamercalc.php.

Hobart. 2015. "Find a Product." Commercial Dishwashers. http://www.hobartcorp.com/products/commercial-dishwashers/

InSinkErator 2011. Control Center Model AS101 Product Specification. http://www.insinkerator.com/en-us/Documents/Foodservice/as101_spec_sheet.pdf. Racine: InSinkErator

InSinkErator. 2013. "WasteXpress Food Waste Reduction System." http://www.insinkerator.com/en-us/Documents/Foodservice/wastexpress_spec_sheet.pdf. Racine, Wis.: InSinkErator Foodservice.

InSinkErator. 2015. Personal communication with InSinkErator General Manager, Foodservice Products. March 12.

[Interagency Working Group] Interagency Working Group on Social Cost of Carbon, United States Government. 2013. “Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866.” http://www.whitehouse.gov/sites/default/files/omb/inforeg/social_cost_of_carbon_for_ria_2013_update.pdf.

[IAPMO] 2012. International Association of Plumbing and Mechanical Officials. "2012 Green Plumbing & Mechanical Code Supplement for Use with all Codes." Section 406.1.3. pg 13.

__. 2015. "2015 Proposed Changes for Public Comment." IAPMO Green Plumbing and Mechanical Code Supplement (GPMCS). Item Number 40.

International Code Council. 2012. “Water Efficiency Provisions.” 2012 International Green Construction Code. Country Club Hills, Ill: International Code Council.

Keleman, K. and C. Furlong (InSinkErator). 2015. Personal communication. March 5.

Koeller and Company. 2010. "A Report on Potential Best Management Practices-Commerical Dishwashers." http://www.allianceforwaterefficiency.org/uploadedFiles/Resource_Center/Library/non_residential/commercial_food_service/Commercial-Dishwashers-CUWCC-PBMP-July-2010.pdf.

Lorenzini, B. 2011. "Pulper Proposition." Foodservice Equipment Reports. August 29. http://www.fermag.com/features/healthcare/single-article/pulper-proposition/2cde2cf5d5.html. Food Service Equipment Reports.

Michailo, P. (Pete Michailo Associates Food Service Equipment Consulting). 2015. Personal communication. January 5.

Michaud, S. (KLH Marketing). 2014. Personal communication. November 24.

Michaud, S. and D. Kalpman (KLH Marketing). 2015. Personal communication. March 16.

[NYC DEP] 2008. New York City Department of Environmental Protection. "Commercial Food Waste Disposal Study." New York City: New York City Department of Environmental Protection. http://www.nyc.gov/html/dep/pdf/dep_commercial_food_waste_disposal_study_12312008.pdf

Selden, M. 1995. Development and Validation of a Uniform Testing Procedure for Steam Cookers. FSTC Report 1022.95.19. http://www.fishnick.com/publications/appliancereports/stm/Steam_Cooker_STM_Development.pdf Sensenig, L. (Champion Industries). 2015. Personal communication. January 6.

Sosebee, G. (Food Service Equipment Agents). 2014. Personal communication. December 29.

Spoor, C., Zabrowski, D. and L. Mills (Fisher-Nickel, Inc). 2014. Characterizing the Energy Efficiency Potential of Gas-Fired Commercial Foodservice Equipment. California Energy Commission. Publication number: CEC-500-2014-095. http://www.energy.ca.gov/2014publications/CEC-500-2014-095/CEC-500-2014-095.pdf

[UC Davis]. University of California Davis Center for Watershed Sciences. 2014. “Economic Analysis of the 2014 Drought for California Agriculture.” Available online at: https://watershed.ucdavis.edu/files/biblio/DroughtReport_23July2014_0.pdf.

Unified Brands. 2011. "Style and Type Definitions" Groen Steamer Brochure. http://www.unifiedbrands.net/media/1062/groen-steamer-brochure.pdf

United States Census Bureau. 2015. "People Quick Facts." State & County Quick Facts. http://quickfacts.census.gov/qfd/states/06000.html. Washington, D.C.: U.S. Census Bureau.

United States Drought Portal. 2015. “U.S. Drought Monitor – California.” National Integrated Drought Information System. http://www.drought.gov/drought/area/ca

[U.S. EPA] United States Environmental Protection Agency. 2013. “Water: Sustainable Infrastructure: Sustainable Water Infrastructure.” EPA Water Website. Accessed July 2013. http://water.epa.gov/infrastructure/sustain/wec_wp.cfm

[U.S. EPA and DOE] United States Environmental Protection Agency and Department of Energy. 2015. "Savings Calculator for ENERGY STAR Certified Commercial Kitchen Equipment." Downloaded from http://www.energystar.gov/. Calculations completed 3/10/15.

United States Green Building Council. 2014. "Leadership in Energy and Environmental Design (LEED) Version 4 Credits." http://www.usgbc.org/credits/. Washington, D.C: United States Green Building Council.

[USGS] United States Geological Survey. 2014. “The California Drought.” California Water Science Center. http://ca.water.usgs.gov/data/drought/drought-impact.html

__. 2015. “Table of daily streamflow compared to historical streamflow for the day of the year (California)”. WaterWatch.

http://waterwatch.usgs.gov/index.php?region_cd=ca&map_type=pa01d&web_type=table2

[WaterSense]. 2013. "WaterSense: Our Water: Why Water Efficiency." WaterSense Website. Accessed July 2013. http://www.epa.gov/watersense/our_water/why_water_efficiency.html.

10. APPENDIX A: STATE OF CALIFORNIA — DEPARTMENT OF FINANCE ECONOMIC AND FISCAL IMPACT STATEMENT (FORM 399)

This appendix provides information required by the California Department of Finance Economic and Fiscal Impact Statement (Form 399) which is available on the California Building Commission website.[13] This information includes the proposed standards for commercial disposers, commercial dishwashers, commercial steam and combination ovens, and commercial pulpers. Information on the methodology used for these calculations is explained under item D.3 below.

Economic Impact Statement

A. ESTIMATED PRIVATE SECTOR COST IMPACTS

Estimated economic impact. (Form 399 Economic Impacts Section A.2)

The estimated total Economic and Fiscal Impact is $560,000 based on the Commercial Food Service Equipment Water Efficiency CALGreen CASE Report. Estimated impacts are based on 12 months of implementation, consistent with the instructions for the Economic Impact Statement item (E.4).

Number of businesses impacted. (Form 399 Economic Impacts Section A.3)

We estimate that 760 equipment units will be regulated based on the Commercial Food Service Equipment CALGreen Water Efficiency CASE Report Appendix B, and a smaller number of individual businesses will be regulated since many new businesses will have more than one piece of regulated equipment. (There are a total of 115,000 food service establishments in California).[14]

Number and type of businesses and jobs created and eliminated. (Form 399 Economic Impacts Section A.4, A.6, and A.7)

The proposed Standards are cost effective over the life of the measure and are likely to increase total jobs and businesses in California. Though increasing water efficiency in California's buildings will have short term initial costs, the long term benefits of decreased utility costs and increased statewide water supply outweigh the initial costs of compliance. The proposed

[13] Form 399 is available, as of March 29, 2015, from this website: http://www.documents.dgs.ca.gov/bsc/proc_rsltn/2009/STD-399-EconomicandFiscalImpactStatement.pdf

[14] Total number of establishments from US Census Table 1281 https://www.census.gov/compendia/statab/2012/tables/12s1281.pdf and weighted by California population.

Standards will also increase disposable income for individuals, which may increase in-state spending, though the total impact is modest.

While the specific number of businesses and jobs that will be created based from the implementation of the proposed Standards is not certain, several types of industries are likely to benefit. The University of California Berkeley evaluated the expected impacts of a range of residential and commercial sector policies including water efficiency, energy efficiency, renewable generation and demand response. The research found that the following industries, as classified under the North American Industry Classification System (NAICS), are the most likely to be positively impacted (UC Berkeley 2011; Table 3.10 et seq., pages 69-75)[15]:

- Residential Building Construction (NAICS 2361)
- Nonresidential Building Construction (NAICS 2362)
- Electrical Contractors (NAICS 23821)
- Plumbing, Heating, and Air-Conditioning Contractors (NAICS 23822)
- Manufacturing (NAICS 32412, 3279, 3332, 3334, 3336, 3341, 3342, 3344, 3345, 3351, 3352, 3353, 3359 (part))
- Advertising and Related Services (NAICS 5418)
- Engineering Services, Architectural Services, Environmental Consulting Services, Other Scientific and Technical Consulting Services (NAICS 54 (part))
- Management of Companies and Enterprises, Public Administration (NAICS 5511, 92 (part))
- Office Administrative Services (NAICS 5611)
- Drywall and Insulation Contractors (NAICS 23831

B. ESTIMATED COSTS

The total statewide dollar costs that businesses and individuals may incur to comply with this regulation over its lifetime. (Form 399 Economic Impacts Section B.1.)

The sum of the proposed measure costs for all newly constructed buildings, additions and alternations in 2017 is $560,000. No increased future maintenance nor increased equipment replacement costs are expected.

15 Note that the water-energy nexus is included in the scope of policies addressed per Table 3.1.

Initial costs for a small business and initial costs for a typical business. (Form 399 Economic Impacts Section B.1a and B.1b.)

The cost averaged across all commercial kitchens is $5 per commercial kitchen. The cost averaged across all small business commercial kitchens is likely to be less as they are likely to have less regulated food service equipment units. The cost for a new commercial kitchen could range from $0 to $2,050 per unit of regulated equipment.

Initial costs to an individual. (Form 399 Economic Impacts Section B.1(c).)

No direct costs to individuals are expected.

Describe other economic costs that may occur. (Form 399 Economic Impacts Section B.1d.)

No other economic costs are expected.

If multiple industries are impacted, enter the share of total costs for each industry. (Form 399 Economic Impacts Section B.2.)

NA

Impacts to housing costs. (Form 399 Economic Impacts Section B.4.)

No significant impacts to housing are expected.

Are there comparable Federal regulations? (Form 399 Economic Impacts Section B.5.)

No duplication or conflict exists between these measures and existing federal regulations. For instance, the commercial food waste disposer and pulper proposed measures do not conflict with federal regulations because no relevant federal standards apply.

The proposed code changes for commercial dishwashers will implement the voluntary requirements set forth by ENERGY STAR. Therefore, the proposed codes are complementary to the national voluntary standard which can be found in ENERGY STAR's Commercial Dishwashers Key Product Criteria, Version 2.0 (ENERGY STAR 2013a). Federal voluntary ENERGY STAR labeling requirements for commercial combination ovens (ENERGY STAR 2013c) and food steamers (ENERGY STAR 2003) are based on cooking energy efficiency, and do not directly regulate water usage thus no conflict with Energy Star requirements exists.

C. ESTIMATED BENEFITS

Briefly summarize the benefits of the regulation, which may include the health and welfare of California residents, worker safety, and the State's environment. (Form 399 Economic Impacts Section C.1.)

Individuals and businesses will benefit from the reduction in water and energy costs as noted below. Businesses that provide water conservation and energy efficiency products and services may experience an increase in revenue and employment. State and local government agencies and their tenants will benefit. Agriculture and other water-dependent industries will benefit from reduced competition for water supplies.

Additional environmental benefits include improved water quality and supply, benefits to aquatic ecosystems, and associated greenhouse gas reductions and air quality improvements.

Are benefits the result of specific statutory requirements, or goals developed by the agency based on broad statutory authority? (Form 399 Economic Impacts Section C.2.)

The Building Standards Commission (BSC) has authority granted by statute to adopt statewide building energy efficiency standards.

What are the total statewide benefits from this regulation over its lifetime? (Form 399 Economic Impacts Section C.3.)

The total economic benefits of the proposed Standards are $4.8 million. This value is the sum of the net water and energy savings for all newly constructed buildings, discounted to 2015 dollars, for implementation of the proposed measures in 2017. As noted above, this measure will also result in additional non-quantified benefits.

Briefly describe any expansion of businesses currently doing business within the State of California that would result from this regulation. (Form 399 Economic Impacts Section C.4.)

No significant change is expected.

D. ALTERNATIVES TO THE REGULATION

List alternatives considered and describe them below. If no alternatives were considered, explain why not. (Form 399 Economic Impacts Section D.1.)

No alternatives to the proposed regulations would be more effective in achieving water and energy efficiency goals, or equally effective and have a lower adverse impact on small businesses (or on any other economic interests). The BSC conducted an extensive stakeholder engagement process that considered many suggestions from stakeholders.

Summarize the total statewide costs and benefits from this regulation and each alternative considered. (Form 399 Economic Impacts Section D.2.)

The total statewide costs are $560,000 and benefits are $4.8 million in 2015 dollars over the lifetime of the proposed Standards (effective 2017). Since no alternatives were found to be equally or more effective than the proposed Standards, no alternatives were included in this analysis.

Briefly discuss any quantification issues that are relevant to a comparison of estimated costs and benefits for this regulation or alternatives. (Form 399 Economic Impacts Section D.3.)

Per unit costs are based on the Commercial Food Service Equipment CALGreen Water Efficiency CASE Report.

Per unit savings are based on estimated utilization rates and baseline water usage. Actual utilization and savings can vary between commercial kitchens.

One source of uncertainty is the number of local jurisdictions that will adopt voluntary commercial food service equipment water efficiency CALGreen measures. Local adoption rates (14%) are based on the assumption that the voluntary commercial kitchen local adoption rate will be equal to all jurisdiction that have previously adopted voluntary water conservation measures. The actual number could be higher, due to the drought emergency, or lower if some jurisdictions choose to exclude commercial kitchens.

Were performance standards considered to lower costs? (Form 399 Economic Impacts Section D.4.)

Performance standards will be adopted based on water usage rates.

E. MAJOR REGULATIONS

Will the regulation subject to OAL review have an estimated economic impact to business enterprises and individuals located in or doing business in California exceeding $50 million in any 12-month period between the date the major regulation is estimated to be filed with the Secretary of State through 12 months after the major regulation is estimated to be fully implemented? (Form 399 Economic Impacts Section E.4.)

The economic impact to business enterprises and individuals located in or doing business in California does not exceed $50 million during this period because the total economic impact is less than $50 million as stated on line A.2 of Form 399.

Fiscal Impact Statement

A. FISCAL EFFECT ON LOCAL GOVERNMENT

Additional expenditures and savings. (Form 399 Fiscal Impacts Statement A.2, A2.f and A.3.)

The first year the proposed standards will be in effect is 2017. Data on local government existing building stock is very limited, as is data on proposed local government building construction. Only local government owned buildings, not leased buildings, are relevant to these calculations. The expenditures per year in line A.2 of Form 399 are estimated at $34,000 or less while the net present value annual savings are estimated at about $290,000. This regulation is not reimbursable because it provides savings that will offset the additional costs (see line A.2.f of Form 399). These estimates are based on CEC Form 399 estimates that 6% of nonresidential buildings are owned by local governments.

B. FISCAL EFFECT ON STATE GOVERNMENT

Additional expenditures and savings. (Form 399 Fiscal Impacts Statement B.1 and 2.)

Additional costs of about $17,000 or less to state-owned or local government facilities are expected based on CEC estimates that 3% of nonresidential buildings are state-owned.

The state will realize direct cost savings of about $140,000 annually.

C. FISCAL EFFECT ON FEDERAL FUNDING OF STATE PROGRAMS. (Form 399 Fiscal Impacts Statement C.4.)

State agencies that are reimbursed for construction and/or utility costs by the federal government may have higher upfront costs and reduced utility costs. Changes in federal reimbursements could offset these costs and savings.

11. Appendix B: Additional Details for Cost-Benefit Methodology

11.1 Water and Energy Savings Analysis Methodology

11.1.1 Water and Energy Savings Analysis Methodology: Commercial Food Waste Disposers

To calculate statewide water and energy impacts of the proposed commercial food waste disposer proposal, we first estimated annual impacts per unit, as explained in Section 5.3.1. The per unit impacts in Table 18 of the main report were extrapolated to statewide savings using the disposer installation estimates shown in Table 27. The analysis presented here includes units that are installed in newly constructed buildings, additions and alterations.

When calculating statewide impacts, it was assumed that 35 percent of commercial disposers installed in new construction, alterations or additions would meet the proposed standard even if the proposed standard is not adopted. Only those savings from the other 65 percent of disposers that did not meet the standard before the standard is adopted are included in estimates of energy and water savings presented in Table 19 of the main report.

The tables on the following pages present the energy and water savings assumptions and calculation methodology used to arrive at our results.

Table 26. Water Savings Assumptions and Findings for Commercial Food Waste Disposers

Metric	Value	Source/Notes
ASSUMPTIONS		
Flow Rate [A]	8 gallons/minute	Assumes 3 hp unit as baseline unit; InSinkErator 2015
Days per Year [B]	360 days/year	EPA 2012b
Operational Hours per Day [C]	6 hours/day	NYC DEP 2008
Percent Savings from Run Timer (Unit Off) [D]	10%	We estimated percent water savings due to timer controls based on the percentage that would be necessary to achieve a 1.5 year payback. For a small business, a 1-2 year payback is typical. We believe that a product with a 1.5 year payback would therefore have a market share consistent with the 35% market share indicated by manufacturer interviews for disposers with timer controls.
Equipment on Hours (with Timer) [E]	5.4 hours/day	E = C*(1-D)
Equipment Full Load Percent of Time (full flow rate) [F]	30%	InSinkErator 2015
Equipment Full Load Hours [G]	1.8 hours/day	G = C*F
Equipment No-Load Percent of Time (reduced flow rate) [H]	70%	InSinkErator 2015
Equipment No-Load Hours [I]	4.2 hours/day	I = E*H
No Load Flow Rate [J]	1 gallons/minute	InSinkErator 2011
Incremental Cost [K]	$1,371	Pricing for InSinkErator units from RestaurantEquipmentClub.com (3/10/15), Salvajor units from Salvajor published price list (http://www.salvajor.com/pdf/salvajorpricelist.pdf) with 20% reduction for vendor pricing, and Master Disposer units from Peachsuite.com (3/2/2015); IMC calculated as weighted average based on sales fraction for current market of units with timer only and units with timer and load control; Easterla 2015; InSinkErator 2015
Percent market Sales in 2017 that would meet proposed standard without standard going into effect [L]	35%	Easterla 2015; InSinkErator 2015

Percent market sales in 2017 that will qualify using 10-min Timer Controller [M]	42%	M=(1-L)*0.65 Based on extending current market into future. Assumes current market share of 65% of basic controllers will move to time controls under proposed standard.
Percent market sales in 2017 that will qualify using Load-control Controller [N]	23%	N=(1-L)*0.35 Based on extending current market into future. Assumes current market share of 35% of advanced controllers (timer controls + load controls) will move to load controls under proposed standard.
Embedded Electricity Factor [0]	10.045 MWh/million gallons	CEC 2006, Population-weighted average embedded electricity value for indoor water use assuming 39% of California's population is in Northern California and 61% in Southern California.
Disposers added per year in new construction, additions and alterations (2017) [P]	245	Easterla and Goodin 2015; InSinkErator 2015; Michaud and Kalpman 2015
Combined Water and Sewer Charge [Q]	$0.00789 per gallon	See Appendix C
RESULTS		
Annual Water Use Per Unit (Baseline) [R]	1,036,800 gallons/yr	R= A * 60 min/hr * B * C
Annual Water Use Per Unit with 10-minute Timer Controller (Proposed) [S]	933,120 gallons/yr	S = A * 60 min/hr * B * E
Annual Water Use Per Unit with Load-control Controller (Proposed) [T]	361,584 gallons/yr	T = (A * 60 min/hr * B * G) + (J *60 min/hr * B * I)
Annual Water Use Per Unit Average (Proposed) [U]	733,082 gallons/yr	U = (S * M + T * N) / (M + N)
Annual Water Savings per unit [V]	303,718 gallons/yr	V = R - U
Statewide Annual Water Savings in 2017 (first year standards are in place) [W]	228 Million gallons/yr	W = V * (1-L) * P / 10^6

Statewide Annual Embedded Electricity Savings in 2017 (first year standards are in place) [X]	486 MWh/yr	X = W * O

Table 27. Commercial Food Waste Disposers California Sales

Year	New Construction, Alterations and Additions Annual Sales (Units)
2017	245
2018	247
2019	250
2020	252
2021	255
2022	257
2023	260
2024	262
2025	265
2026	268

11.1.2 Water and Energy Savings Analysis Methodology: Commercial Dishwashers, Combination Ovens, Commercial Food Steamers, and Commercial Pulpers

The Utility C&S Team based the water and energy savings analysis on several sources of data. First, we assumed a market deployment rate across commercial dishwashers, combination ovens, and food steamers by using Energy Star data (ENERGY STAR 2012b) as a proxy and averaging the market penetration rates for commercial dishwashers, food steamers, and commercial ovens. We then rounded the result, which was close to 50%, to 50% due to uncertainty. We also created an estimate for the share of the California market that would be regulated based on local adoption of the standards. Please see the tables on the following pages for additional information**.**

We excluded pulpers from the statewide cost and benefit analysis, as unit sales volumes are low and we anticipate no per unit cost from the measure.

Table 28. Assumptions, Values and Sources for Dishwasher, Combination Oven, Food Steamer, and Pulper Calculations

Metric	Value	Source / Notes
ASSUMPTIONS		
Dishwashers		
Units added per year in new construction, additions and alterations within CALGreen Voluntary Adoption areas (2017) [A]	370	Based on national sales data scaled based on CA percentage of US population with 1% annual growth rate, 35% of sales as new construction, additions and alterations, and scaled to 14% CALGreen Voluntary Adoption Rate; ENERGY STAR 2013b; United States Census Bureau 2015; Spoor et al. 2014
Incremental Cost [B]	$377	Weighted average for all types, using percent sales of each type determined by Utility Team market research; U.S. EPA and DOE 2015;
Non-Qualifying/Qualifying Product Average Lifetime [C]	12 years	Weighted average for all types, using percent sales of each type determined by Utility Team market research; U.S. EPA and DOE 2015;
Non-Qualifying Unit Water Usage [D]	64,341 gallons/yr	Weighted average for all types, using percent sales of each type determined by Utility Team market research; U.S. EPA and DOE 2015;
Qualifying Unit Water Usage [E]	45,026 gallons/yr	Weighted average for all types, using percent sales of each type determined by Utility Team market research; U.S. EPA and DOE 2015;
Percent of Water Heated [F]	100%	Alliance for Water Efficiency 2010
Percent market Sales in 2017 that would meet proposed standard without standard going into effect [G]	50%	Based on a blended average of data reported for all voluntary standards products covered by Energy Star.
Embedded Electricity Factor [H]	10.045 MWh/million gallons	CEC 2006, Population-weighted average embedded electricity value for indoor water use assuming 39% of California's population is in Northern California and 61% in Southern California.
Non-Qualifying Unit Electricity Use [I]	9,487 kWh/yr	Calculated from hot water use and 98% electric hot water heating end-use efficiency.
Qualifying Unit Electricity Use [J]	6,639 kWh/yr	Same as above
Non-Qualifying Unit Natural Gas Use [K]	523 therms/yr	Calculated from hot water use and 80% natural gas how water heating end-use efficiency.

Qualifying Unit Natural Gas Use [L]	366 therms/yr	Same as above
CALGreen Voluntary Adoption Rate as Percent of State [M]	14%	The list of cities identified by BSC as customizing building codes and identified by Utility C&S Team as adopting water measures: Daily City, Irwindale, Los Angeles, Mountain View, Napa, Palo Alto, Pomona, San Francisco, Santa Rosa with a total of 14% of the state population. Note that while not every city has adopted all CALGreen water measures, we assume that the number of cities adopting CALGreen measures that do not include commercial kitchens would be offset by increased uptake by cities that adopt CALGreen Tier 1 due to the drought emergency.
Combination Ovens		
Units added per year in new construction, additions and alterations within CALGreen Voluntary Adoption areas (2017) [A]	41	Includes 1% annual growth rate, 35% of sales as new construction, additions and alterations, and scaled to 14% CALGreen Voluntary Adoption Rate; Michaud 2015; ENERGY STAR 2013b; Spoor et al. 2014
Incremental Cost [B]	$789.27	Calculated by the Utility Team based on a survey of products currently available on the market.
Non-Qualifying/Qualifying Product Average Lifetime [C]	12/12 years	U.S. EPA and DOE 2015
Non-Qualifying Unit Water Usage [D]	44,444 gallons/yr	D = 1.845 gallons/pan/hr * N * O * 365 days/yr Estimated by Utility team based on survey of products currently available on the market.
Qualifying Unit Water Usage [E]	31,135 gallons/yr	E = 1.50 gallons/pan/hr * N * O * 365 days/yr 1.5 gal/pan/hr is proposed code
Percent of Water Heated [F]	100%	Alliance for Water Efficiency 2010
Percent market Sales in 2017 that would meet proposed standard without standard going into effect [G]	50%	Based on a blended average of data reported for all voluntary standards products covered by Energy Star.
Embedded Electricity Factor [H]	10.045 MWh/million gallons	CEC 2006, Population-weighted average embedded electricity value for indoor water use assuming 39% of California's population is in Northern California and 61% in Southern California.
Non-Qualifying Unit Electricity Use [I]	8,340 kWh/yr	Calculated from hot water use and 98% electric hot water heating end-use efficiency.

Qualifying Unit Electricity Use [J]	6,781 kWh/yr	Same as above
Non-Qualifying Unit Natural Gas Use [K]	460 therms/yr	Calculated from hot water use and 80% natural gas how water heating end-use efficiency.
Qualifying Unit Natural Gas Use [L]	374 therms/yr	Same as above
CALGreen Voluntary Adoption Rate as Percent of State [M]	14%	The list of cities identified by BSC as customizing building codes and identified by Utility C&S Team as adopting water measures: Daily City, Irwindale, Los Angeles, Mountain View, Napa, Palo Alto, Pomona, San Francisco, Santa Rosa with a total of 14% of the state population. Note that while not every city has adopted all CALGreen water measures, we assume that the number of cities adopting CALGreen measures that do not include commercial kitchens would be offset by increased uptake by cities that adopt CALGreen Tier 1 due to the drought emergency.
Average Pans Qualifying [N]	11 pans	Estimated by Utility team based on survey of products currently available on the market.
Operational Hours per Day [O]	6 hours/day	Assumes 50 percent of time in a 12 hour day in steam mode.
Steamers		
Units added per year in new construction, additions and alterations within CALGreen Voluntary Adoption areas (2017) [A]	109	Based on national sales data scaled based on CA percentage of US population with 1% annual growth rate, 35% of sales as new construction, additions and alterations and scaled to 14% CALGreen Voluntary Adoption Rate; ENERGY STAR 2013b; United States Census Bureau 2015; Spoor et al. 2014
Incremental Cost [B]	$653	B = ($870 * 9% + $630 * 91%)/ (100%) IMC for Gas ($870) and electric ($630) from U.S. EPA and DOE 2015; Percent sales gas (9%)/electric (91%) from ENERGY STAR 2015d
Non-Qualifying/Qualifying Product Average Lifetime [C]	12 years/12 years	U.S. EPA and DOE 2015
Non-Qualifying Unit Water Usage [D]	176,602 gallons/yr	D = V * T * U
Qualifying Unit Water Usage [E]	80,942 gallons/yr	E = W * T * U

Percent of Water Heated [F]	100%	Alliance for Water Efficiency 2010
Percent market Sales in 2017 that would meet proposed standard without standard going into effect [G]	50%	Based on a blended average of data reported for all voluntary standards products covered by Energy Star.
Embedded Electricity Factor [H]	10.045 MWh/million gallons	CEC 2006, Population-weighted average embedded electricity value for indoor water use assuming 39% of California's population is in Northern California and 61% in Southern California.
Non-Qualifying Unit Electricity Use [I]	26,039 kWh/yr	Calculated from hot water use and 98% electric hot water heating end-use efficiency.
Qualifying Unit Electricity Use [J]	11,935 kWh/yr	Same as above
Non-Qualifying Unit Natural Gas Use [K]	1,436 therms/yr	Calculated from hot water use and 80% natural gas how water heating end-use efficiency.
Qualifying Unit Natural Gas Use [L]	658 therms/yr	Same as above
CALGreen Voluntary Adoption Rate as Percent of State [M]	14%	The list of cities identified by BSC as customizing building codes and identified by Utility C&S Team as adopting water measures: Daily City, Irwindale, Los Angeles, Mountain View, Napa, Palo Alto, Pomona, San Francisco, Santa Rosa with a total of 14% of the state population. Note that while not every city has adopted all CALGreen water measures, we assume that the number of cities adopting CALGreen measures that do not include commercial kitchens would be offset by increased uptake by cities that adopt CALGreen Tier 1 due to the drought emergency.
Percent of Market Batch [N]	64%	Consortium for Energy Efficiency 2015
Percent of Market Cook to Order [O]	36%	Consortium for Energy Efficiency 2015
Batch Non-Qualifying Unit Water Usage [P]	6 gallons/pan/hr	Selden 1995
Batch Qualifying Unit Water Usage [Q]	2 gallons/pan/hr	Proposed code
Cook to Order Non-Qualifying Unit Water Usage [R]	8 gallons/pan/hr	Selden 1995

Cook to Order Qualifying Unit Water Usage [S]	5 gallons/pan/hr	Proposed code
Pans per Steamer [T]	6	FSTC 2015
Operational Hours per Year [U]	4380 hours/year	FSTC 2015; Assumes 12 hours/day usage, and 365 days operated per year.
Non-Qualifying per unit water usage [V]	6.72 gallons/pan/hr	V = P *N + R * O
Qualifying per unit water usage [W]	3.08 gallons/pan/hr	W = Q * N + S * O
Pulpers		
Units added per year in new construction, additions and alterations within CALGreen Voluntary Adoption areas (2017) [A]	N/A	Since only ~35 units are sold per year and large percentage of units meet proposed standard, have not estimated statewide savings values.
Incremental Cost [B]	$0	Michailo 2015. Assumes the IMC for pulpers is $0 because the recirculating pump comes standard on the majority of brands and recirculation pump allows units to achieve 2 gpm.
Non-Qualifying/Qualifying Product Average Lifetime [C]	8 years/8 years	Michaud and Kalpman 2015
Non-Qualifying Unit Water Usage [D]	1,166,400 gallons/yr	D = N * Z * 60 min/hr
Qualifying Unit Water Usage [E]	388,800 gallons/yr	E = M * Z * 60 min/hr
Percent of Water Heated [F]	0%	Pulpers commonly use hot water for cleaning, however proposed code will not impact cleaning water use.
Percent market Sales in 2017 that would meet proposed standard without standard going into effect [G]	80%	Sensenig 2015
Embedded Electricity Factor [H]	10.045 MWh/million gallons	CEC 2006, Population-weighted average embedded electricity value for indoor water use assuming 39% of California's population is in Northern California and 61% in Southern California.

Non-Qualifying Unit Electricity Use [I]	N/A	No estimated change in electricity use for qualifying units compared to non-qualifying
Qualifying Unit Electricity Use [J]	N/A	No estimated change in electricity use for qualifying units compared to non-qualifying
Non-Qualifying Unit Natural Gas Use [K]	N/A	Pulpers do not use natural gas
Qualifying Unit Natural Gas Use [L]	N/A	Pulpers do not use natural gas
CALGreen Voluntary Adoption Rate as Percent of State [M]	14%	The list of cities identified by BSC as customizing building codes and identified by Utility C&S Team as adopting water measures: Daily City, Irwindale, Los Angeles, Mountain View, Napa, Palo Alto, Pomona, San Francisco, Santa Rosa with a total of 14% of the state population. Note that while not every city has adopted all CALGreen water measures, we assume that the number of cities adopting CALGreen measures that do not include commercial kitchens would be offset by increased uptake by cities that adopt CALGreen Tier 1 due to the drought emergency.
Non-Qualifying Flow Rate [N]	6 gallons/ minute	Michailo 2015; InSinkErator 2013; Michaud and Kalpman 2015; InSinkErator 2015
Qualifying Flow Rate [M]	2 gallons /minute	Proposed code
Operational Hours per Year [Z]	3240 hours/year	Estimate range of 2-4 operating hours per meal. Assuming 9 operating hours per day and 360 days/year a; Michailo 2015

Table 29. Results Calculations for Dishwashers, Combination Ovens, and Food Steamers

Results	Calculations (See table above for variable values)
Annual Water Savings per Unit [AA]	AA = D - E
Annual Electricity Savings per Unit (kWh/yr) [AB]	AB = I - J
Annual Embedded Electricity Savings per Unit (kWh/yr) [AC]	AC = AA * H
Annual Natural Gas Savings per Unit (therms/yr) [AD]	AD = K - L
Statewide Annual Water Savings in 2017 (first year standards are in place [AE]	AE = AA * A *(1-G)
Statewide Annual Embedded Electricity Savings in 2017 (first year standards are in place) [AF]	AF = AE * H
Statewide Annual Electricity Savings in 2017 (first year standards are in place) (kWh/yr) [AG]	AG = AB * A *(1-G)
Statewide Annual Natural Gas Savings in 2017 (first year standards are in place) (therms/yr) [AH]	AH = AD * A *(1-G)

Table 30. Dishwasher Weighted Average Calculations for Key Metrics

Metric	Low Temperature Under Counter	Low Temperature Stationary Single Tank Door	Low Temperature Single Tank Conveyor	Low Temperature Multi Tank Conveyor	High Temperature Under Counter	High Temperature Stationary Single Tank Door	High Temperature Single Tank Conveyor	High Temperature Multi Tank Conveyor	High Temperature Pot, Pan and Utensil	Weighted Average
Incremental cost ($/unit)	$50	$ 0	$ 0	$970	$120	$770	$2,050	$ 970	$1,710	$377
Percent of sales	15%	2%	1%	1%	58%	10%	6%	4%	3%	
Product average lifetime, qualifying and non-qualifying (years)	10	15	20	20	10	15	20	20	10	12
Non-qualifying unit water usage (gallons/year)	47,359	214,620	191,260	227,760	29,839	131,838	127,020	212,430	71,540	64,341
Qualifying unit water usage (gallons/year)	32,576	120,596	115,340	118,260	23,543	90,958	102,200	118,260	59,276	45,026

Note: Flight type conveyors are included within the single and multi tank conveyor categories.

Table 31. California Sales of Commercial Dishwashers, Combination Ovens, and Food Steamers - New Construction, Alterations and Additions

	Total Regulated Commercial Dishwashers	Total Regulated Combination Ovens	Total Regulated Steamers
Year	**Annual Sales (Units)**	**Annual Sales (Units)**	**Annual Sales (Units)**
2017	370	41	109
2018	374	41	110
2019	378	41	111
2020	381	42	112
2021	385	42	113
2022	389	43	114
2023	393	43	116
2024	397	43	117
2025	401	44	118
2026	405	44	119

Note: Based on national sales data scaled based on CA percentage of US population with 1% annual growth rate, 35% of sales as new construction, additions and alterations, and scaled to 14% CALGreen Voluntary Adoption Rate; ENERGY STAR 2013b; United States Cenus Bureau 2015; Michaud 2015; Spoor et al. 2014

12. Appendix C: Greenhouse Gas Emissions Quantification

12.1 Greenhouse Gas Emissions Impacts Methodology

The avoided GHG emissions were calculated assuming an emission factor of 353 metric tons of carbon dioxide equivalents ($MTCO_2e$) per GWh of electricity savings. The Statewide CASE Team calculated air quality impacts associated with the electricity savings from the proposed measure using emission factors that indicate emissions per GWh of electricity generated.[16] When evaluating the impact of increasing the Renewable Portfolio Standard (RPS) from 20 percent renewables by 2020 to 33 percent renewables by 2020, California Air Resources Board (CARB) published data on expected air pollution emissions for various future electricity generation scenarios (CARB 2010). The Statewide CASE Team used data from CARB's analysis to inform the air quality analysis presented in this report.

The GHG emissions factor is a projection for 2020 assuming the state will meet the 33 percent RPS goal. CARB calculated the emissions for two scenarios: (1) a high load scenario in which load continues at the same rate; and (2) a low load rate that assumes the state will successfully implement energy efficiency strategies outlined in the AB32 scoping plan thereby reducing overall electricity load in the state.

To be conservative, the Statewide CASE Team calculated the emissions factors of the incremental electricity between the low and high load scenarios. These emission factors are intended to provide a benchmark of emission reductions attributable to energy efficiency measures that could help achieve the low load scenario. The incremental emissions were calculated by dividing the difference between California emissions in the high and low generation forecasts by the difference between total electricity generated in those two scenarios. While emission rates may change over time, 2020 was considered a representative year for this measure.

Avoided GHG emissions from natural gas savings were calculated using an emission factor of 5,303 $MTCO_2e$/million therms (U.S. EPA 2011).

12.2 Greenhouse Gas Valuation Discussion

The climate impacts of pollution from fossil fuel combustion and other human activities, including the greenhouse gas effect, present a major risk to global economies, public health and the environment. While there are uncertainties of the exact magnitude given the interconnectedness of ecological systems, at least three methods exist for estimating the societal costs of greenhouse gases: 1) the Damage Cost Approach 2) the Abatement Cost

[16] California power plants are subject to a GHG cap and trade program and linked offset programs until 2020 and potentially beyond.

Approach and 3) the Regulated Carbon Market Approach. See below for more details regarding each approach.

12.2.1 Damage Cost Approach

In 2007, the U.S. Court of Appeals for the Ninth Circuit ruled that the National Highway Transportation Traffic Safety Administration (NHTSA) was required to assign a dollar value to benefits from abated carbon dioxide emissions. The court stated that while there are a wide range of estimates of monetary values, the price of carbon dioxide abatement is indisputably non-zero. In 2009, to meet the necessity of a consistent value for use by government agencies, the Obama Administration established the Interagency Working Group on the Social Cost of Carbon to establish official estimates (Johnson and Hope).

The Interagency Working Group primarily uses estimates of avoided damages from climate change which are valued at a price per ton of carbon dioxide, a method known as the damage cost approach.

12.2.2 Interagency Working Group Estimates

The Interagency Working Group SCC estimates, based on the damage cost approach, were calculated using three climate economic models called integrated assessment models which include the Dynamic Integrated Climate Economy (DICE), Policy Analysis of the Greenhouse Effect (PAGE), and Climate Framework for Uncertainty, Negotiation, and Distribution (FUND) models. These models incorporate projections of future emissions translated into atmospheric concentration levels which are then translated into temperature changes and human welfare and ecosystem impacts with inherent economic values. As part of the Federal rulemaking process, DOE publishes estimated monetary benefits using Interagency Working Group SCC values for each Trial Standard Level considered in their analyses, calculated as a net present value of benefits received by society from emission reductions and avoided damages over the lifetime of the product. The recent U.S. DOE Final Rulemaking for microwave ovens contains a Social Cost of Carbon section that presents the Interagency Working Group’s most recent SCC values over a range of discount rates (DOE 2013) as shown in Table 32. The two $ metric ton of values used in this CASE report were taken from the two middle columns, and converted to 2013 dollars.

Table 32. Social Cost of CO_2 2010 – 2050 (in 2007 dollars per metric ton of CO_2) (source: Interagency Working Group on Social Cost of Carbon, United States Government, 2013)

Discount Rate	5.0%	3.0%	2.5%	3.0%
Year	**Average**	**Average**	**Average**	**95th**
2010	11	33	52	90
2015	12	38	58	109
2020	12	43	65	129
2025	14	48	70	144
2030	16	52	76	159
2035	19	57	81	176
2040	21	62	87	192
2045	24	66	92	206
2050	27	71	98	221

The Interagency Working Group decision to implement a global estimate of the SCC rather than a domestic value reflects the reality of environmental damages which are expected to occur worldwide. Excluding global damages is inconsistent with U.S. regulatory policy aimed at incorporating international issues related to resource use, humanitarian interests, and national security. As such, a regional SCC value specific to the Western United States or California specifically should be at similarly inclusive of global damages. Various studies state that certain values may be understated due to the asymmetrical risk of catastrophic damage if climate change impacts are above median predictions, and some estimates indicate that the upper end of possible damage costs could be substantially higher than indicated by the IWG (Ackerman and Stanton 2012; Horii and Williams 2013).

12.2.3 Abatement Cost Approach

Abating carbon dioxide emissions can impose costs associated with more efficient technologies and processes, and policy-makers could also compare strategies using a different by estimating the annualized costs of reducing one ton of carbon dioxide net of savings and co-benefits. The cost of abatement approach could reflect established greenhouse gas reduction policies and establish values for carbon dioxide reductions relative to electricity de-carbonization and other measures. (While recognizing the potential usefulness of this method, this report utilizes the IWG SCC approach and we note that the value lies within the range of abatement costs discussed further below.)

The cost abatement approach utilizes market information regarding emission abatement technologies and processes and presents a wide-range of values for the price per ton of carbon dioxide. The California Air Resources Board data of the cost-effectiveness of energy efficiency measures and emission regulations would provide one source of potential data for an analysis under this method. To meet the AB 32 target, ARB has established the “Cost of a Bundle of Strategies Approach” which includes a range of cost-effective strategies and regulations

(CARB 2008b). The results of this approach within the framework of the Climate Action Team Macroeconomic Analysis are provided for California, Arizona, New Mexico, the United States, and a global total identified in that same report, as shown in Table 33 below.

Table 33. Cost-effectiveness Range for the CAT Macroeconomic Analysis

State	Cost-effectiveness Range ($/ton CO_2 e/year)	Tons Reduced (MMt CO_2 e/year)	Percent of BAU
California 2020 (CAT[1], CEC[2])	-528 to 615	132	22
Arizona[3] 2020	-90 to 65	69	47
New Mexico[4] 2020	-120 to 105	35	34
United States (2030)[5]	-93 to 91	3,000	31
Global Total (2030)	-225 to 91	26,000	45

1. Climate Action Team Updated Macroeconomic Analysis of Climate Strategies. Presented in the March 2006 Climate Action Team Report, September 2007.
2. California Energy Commission, Emission Reduction Opportunities for Non-CO2 Greenhouse Gases in California, July 2005, ICF ($/MTCO2 eq).
3. Arizona Climate Change Advisory Group, Climate Change Action Plan, August 2006, ($/MTCO2 eq).
4. New Mexico Climate Change Advisory Group, Final Report, December 2006.
5. McKinsey & Company, Reducing U.S. Greenhouse Gas Emissions: How Much at What Cost? December 2007.
6. The McKinsey Quarterly, McKinsey & Company, A Cost Curve for Greenhouse Gas Reduction, Fall 2007.

Source: CARB 2008

Energy and Environmental Economics (E3) study defines the cost abatement approach more specifically as electricity de-carbonization and is based on annual emissions targets consistent with existing California climate policy. Long-term costs are determined by large-scale factors such as electricity grid stability, technological advancements, and alternative fuel prices. Near-term costs per ton of avoided carbon could be$200/ton in the near-term (Horii and Williams 2013), thus as noted earlier the value used in this report may be conservative.

12.2.4 Regulated Carbon Market Approach

Emissions allowance markets provide a third potential method for valuing carbon dioxide. Examples include the European Union Emissions Trading System and the California AB32 cap and trade system as described below. Allowances serve as permits authorizing emissions and are traded through the cap-and-trade market between actors whose economic demands dictate the sale or purchase of permits. In theory, allowance prices could serve as a proxy for the cost of abatement. However, this report does not rely on the prices of cap-and-trade allowances due to the vulnerability of the allowance market to external fluctuations, and the influence of regulatory decisions affecting scarcity or over-allocation unrelated to damages or abatement costs.

European Union Emissions Trading System

The European Union Emissions Trading System (EU ETS) covers more than 11,000 power stations, industrial plants, and airlines in 31 countries. However, the market is constantly affected by over-supply following the 2008 global recession and has seen prices drop to dramatic lows in early 2013, resulting in the practice of "back-loading" (delaying issuances of permits) by the European parliament. At the end of June 2013, prices of permits dropped to $5.41/ton, a price which is well below damage cost estimates and sub-optimal for encouraging innovative carbon dioxide emission abatement strategies.

California Cap & Trade

In comparison, California cap-and-trade allowance prices were reported to be at least $14/ton in May of 2013, with over 14.5 million total allowances sold for 2013 (CARB 2013b). However, cap-and-trade markets are likely to cover only subsets of emitting sectors of the industry covered by AB 32. In addition, the market prices of allowances are determined only partly by costs incurred by society or industry actors and largely by the stringency of the cap determined by regulatory agencies and uncontrollable market forces, as seen by the failure of the EU ETS to set a consistent and effective signal to curb carbon dioxide emissions.

13. Appendix D: Water, Electricity and Natural Gas Rate Assumptions

13.1 Electricity Rates

The electricity rates used in the analysis presented in this report were derived from projected future prices for residential, commercial and industrial sectors in the CEC's "Mid-case" projection of the 2012 Demand Forecast (2012), which used a 3% discount rate and provide prices in 2010 dollars. The sales weighted average of the 5 largest utilities in California was converted to 2015 dollars using an inflation adjustment of 1.07 (DOL 2013). See the rates by year below in Table 34.

Table 34. Statewide Sales Weighted Average Electricity Rates 2017 – 2026 (PG&E, SCE, SDG&E, LADWP and SMUD - 5 largest Utilities) in 2015 cents/kWh

Year	Electricity Rate (2015 cents/kWh)	
	Residential	Commercial
2017	17.24	15.02
2018	17.47	15.22
2019	17.71	15.42
2020	18.00	15.67
2021	18.34	15.98
2022	18.70	16.29
2023	19.06	16.61
2024	19.43	16.93
2025	19.81	17.27
2026	20.19	17.60
2027	20.59	17.95
2028	20.98	18.30

13.2 Natural Gas Rates

The natural rates used in the analysis presented in this report were derived from projected future prices for residential, commercial and industrial sectors in the CEC's "Mid-case" projection of the 2012 Demand Forecast (2012), which used a 3% discount rate and provide prices in 2010 dollars. The sales weighted average of the three largest utilities in California was converted to 2015 dollars using an inflation adjustment of 1.07 (DOL 2013). See the rates by year below in Table 35.

Table 35. Statewide Sales Weighted Average Residential Natural Gas Rates 2017 - 2026 (PG&E, SCE, and SDG&E - 3 largest Utilities) in 2015$/therm

Year	Natural Gas Rate (2015$/therm)	
	Residential	Commercial
2017	0.87	0.89
2018	0.89	0.90
2019	0.90	0.91
2020	0.93	0.94
2021	0.95	0.97
2022	0.98	0.99
2023	1.01	1.02
2024	1.04	1.05
2025	1.07	1.08
2026	1.10	1.11
2027	1.13	1.14
2028	1.16	1.17

13.3 Potable Water and Wastewater Rates

The potable water rates used in the analysis are based on water rate data from Raftelis Financial Consultants Inc. (Raftelis 2008; Raftelis 2011). The residential potable water rate was derived using data from a 2011 study of rates from 216 water utilities in California. The commercial rates are derived from the 2008 American Water Works Association Water and Wastewater Survey using values from the western region.

Wastewater rates are based on data from Black & Veatch on rates in the eight largest cities17 in California (Black & Veatch 2010). About 30 percent of Californians live in one of these eight cities, and it is assumed that these city's rates are representative of rates throughout the state. The CASE analysis uses the population-weighted wastewater rate from the eight cities. The 2009 residential rate is based on cost data that assumes customers use 15,000 gallons per month. The 2009 commercial wastewater rates were derived from cost data that assumes customers use 100,000 gallons per month.

Future potable water and wastewater rates were projected based on the Consumer Price Index (CPI) for Water and Sewer Maintenance and assuming a three percent annual discount rate. In recent years water rates have been increasing faster than CPI projections (Black & Veatch

[17] The eight largest cities in California are: Fresno, Long Beach, Los Angeles, Oakland, Sacramento, San Diego, San Francisco, and San Jose.

2010; Raftelis 2011). It is likely that water rates will increase faster than the analysis predicts, and it follows that the cost savings presented in this report could understate the true potential savings. The rates by year are provided below in Table 36.

Table 36. Statewide Average Potable Water and Wastewater Rates 2017 - 2026 in 2015$/1000 gallons

Year	Water Rates (2015$/1,000 gallons)					
	Residential			Commercial		
	Potable Water	Waste-water	Total Water Cost	Potable Water	Waste-water	Total Water Cost
2017	$2.86	$4.73	$7.60	$2.64	$4.91	$7.55
2018	$2.92	$4.84	$7.76	$2.70	$5.01	$7.71
2019	$2.99	$4.94	$7.93	$2.76	$5.12	$7.88
2020	$3.05	$5.04	$8.09	$2.81	$5.23	$8.04
2021	$3.11	$5.15	$8.26	$2.87	$5.33	$8.20
2022	$3.17	$5.25	$8.42	$2.93	$5.44	$8.37
2023	$3.24	$5.35	$8.59	$2.99	$5.55	$8.53
2024	$3.30	$5.45	$8.75	$3.04	$5.65	$8.70
2025	$3.36	$5.56	$8.92	$3.10	$5.76	$8.86
2026	$3.42	$5.66	$9.08	$3.16	$5.87	$9.03
2027	$3.48	$5.76	$9.25	$3.22	$5.97	$9.19
2028	$3.55	$5.87	$9.41	$3.27	$6.08	$9.35
2029	$3.61	$5.97	$9.58	$3.33	$6.19	$9.52
2030	$3.67	$6.07	$9.74	$3.39	$6.29	$9.68
2031	$3.73	$6.18	$9.91	$3.45	$6.40	$9.85
2032	$3.80	$6.28	$10.07	$3.50	$6.51	$10.01
2033	$3.86	$6.38	$10.24	$3.56	$6.61	$10.18
2034	$3.92	$6.48	$10.41	$3.62	$6.72	$10.34
2035	$3.98	$6.59	$10.57	$3.68	$6.83	$10.50
2036	$4.05	$6.69	$10.74	$3.73	$6.93	$10.67
2037	$4.11	$6.79	$10.90	$3.79	$7.04	$10.83
2038	$4.17	$6.90	$11.07	$3.85	$7.15	$11.00
2039	$4.23	$7.00	$11.23	$3.91	$7.25	$11.16

13.4 Embedded Electricity in Water

The embedded energy value used in the analysis is 10,045 kWh/million gallons of water (MG). This value was derived from a California Energy Commission PIER study (CEC 2006), which states the embedded energy values shown in the table below “are sufficient for informing policy and prioritization of research and development investments.”

Table 37. Recommended Embedded Energy Estimates (CEC 2006, Table 7)

	Indoor Uses		Outdoor Uses	
	Northern California kWh/MG	Southern California kWh/MG	Northern California kWh/MG	Southern California kWh/MG
Water Supply and Conveyance	2,117	9,727	2,117	9,727
Water Treatment	111	111	111	111
Water Distribution	1,272	1,272	1,272	1,272
Wastewater Treatment	1,911	1,911	0	0
Regional Total	5,411	13,022	3,500	11,111

The total regional values shown in Table 37 were weighted based on the population in Northern and Southern California in 2011 (U.S. Census Bureau). All water used in toilets and urinals is used indoors, so only the indoor embedded energy values apply.

The California Public Utilities Commission (CPUC) has conducted additional research on embedded energy since CEC’s 2006 report was released. However, the values presented in CEC’s 2006 report are still the most up-to-date values recommended for use to inform policies the Statewide CASE Team has used CEC’s 2006 embedded energy values for this analysis.

The CPUC has made notable progress in improving understanding of the relationship between water and energy in California. CPUC’s Decision 07-12-050, issued December 20, 2007, authorized the largest electricity utilities to partner with water utilities and administer pilot programs that aimed to save water and energy (CPUC 2011c). The Decision also authorized three studies to validate claims that saving water can save energy and explore whether embedded energy savings associated with water use efficiency are measurable and verifiable. The pilot programs succeed at demonstrating that water conservation measures also result in energy savings.

The CPUC studies were effective at obtaining a more granular understanding of how energy use varies based on a number of factors including supply, (i.e. surface, ground, brackish, or ocean desalination), geography, and treatment technology. The authors found “that the value of energy embedded in water is higher than initially estimated in CEC’s 2005 and 2006 studies.” Although the data collected for the studies is the most comprehensive set of data on energy used to meet water demand, the data is still just a small sampling of all the potential data points in California. Since the authors did not find strong patterns within the sample data and there was no strong evidence that the sample data was representative for a particular region, process, or technology type, the authors did not have a strong basis to estimate the embedded energy values for specific geographic regions. Further, the CPUC studies did not recommend changes to the embedded energy values presented in CEC's 2006 report.

While the CASE Report analysis uses the embedded energy values associated with water supply and conveyance, there is no evidence that reducing water use at the building level will impact water supply and conveyance activities. Thus, water efficiency standards may result in reductions to energy used to supply and convey water.