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California Energy Commission

DRAFT STAFF REPORT

Analysis of Proposed Efficiency Standards for Commercial Ovens

2026 Appliance Efficiency Rulemaking

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California Energy Commission

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- IOU CASE Team
- Earthjustice
- North American Association of Food Equipment Manufacturers (NAFEM)
- UNOX
- Revent Inc.
- Appliance Standards Awareness Project (ASAP)
- American Council for an Energy-Efficient Economy (ACEEE)
- Frontier Energy
- ITW Food Equipment Group

PREFACE

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

On November 14, 2023, the CEC issued a request for information (RFI) and invitation to submit proposals (ITSP) for commercial food service equipment to seek information from the public and invite interested members of the public to submit proposals. This RFI and ITSP specifically requested information about commercial convection ovens and not other commercial oven types.

On September 4, 2024, the CEC issued an additional RFI and ITSP for commercial ovens to seek information from the public and invite interested members of the public to submit proposals. This RFI and ITSP expanded the scope of commercial ovens to include not only commercial convection ovens but also other types of commercial ovens.

CEC staff reviewed all information submitted in writing to the CEC's docket for this rulemaking. This staff report proposes efficiency standards for commercial ovens and describes the basis for such standards.

ABSTRACT

This report discusses CEC staff's analysis of proposed energy and water efficiency standards for commercial ovens. Staff performed market research, analyzed available performance data, calculated potential energy and water savings, and analyzed the technical feasibility and cost-effectiveness of three alternative efficiency proposals before deciding on the most reasonable and feasible proposal. In this report, staff recommends setting energy and water efficiency standards for commercial convection, combination, and gas rack ovens aligned with the ENERGY STAR® v3.0 specifications for these equipment types. Furthermore, staff recommends establishing testing, reporting, and marking requirements for commercial deck, conveyor, high-speed, and electric rack ovens.

The proposed efficiency standards for commercial ovens would significantly reduce consumption of natural gas, electricity, and water, and would therefore be expected to result in significant environmental benefits. CEC staff estimated that, after full stock turnover in 2040, the annual statewide savings would be 11.94 million therms of natural gas, 17.15 gigawatt-hours (GWh) of electricity, 206 million gallons of water, and $37.0 million of utility cost. The grid peak demand reduction would be 4.16 megawatts (MW).

The proposed efficiency standards for commercial ovens would financially benefit California's consumers as well. The life-cycle benefit-cost ratio of commercial ovens ranges from 1.37 to 12.31, and the simple payback period ranges from 0.85 to 7.63 years, depending on the oven type and category.

In this report, staff provides specific recommendations for scope, test procedures, minimum energy and water efficiency requirements, reporting requirements, and marking requirements for commercial ovens. Once adopted, the proposed standards will be integrated into California's Appliance Efficiency Regulations (California Code of Regulations, Title 20, Sections 1601 to 1609). The standards are proposed to take effect January 1, 2029, or one year after adoption, whichever is later, and will apply to new commercial ovens manufactured on or after the effective date that are sold, rented, or leased in the state.

Keywords: Appliance efficiency regulations, energy efficiency, energy savings, water efficiency, water savings, commercial ovens, convection ovens, combination ovens, rack ovens, deck ovens, conveyor ovens, high-speed ovens, rapid cook ovens

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EXECUTIVE SUMMARY

Key Takeaways

- California Energy Commission (CEC) staff proposes to establish energy and water efficiency standards for commercial convection, combination, and gas rack ovens, and specifically to align the standards with the ENERGY STAR® v3.0 specifications that set voluntary performance criteria related to cooking energy efficiency, idle energy rate, and water consumption rate for these three types of ovens.
- CEC staff estimates that the proposed standards will save 11.94 million therms of natural gas, 17.15 gigawatt-hours (GWh) of electricity, 206 million gallons of water, and $37.0 million of utility cost annually statewide after full stock turnover, which is projected to occur in 2040 based on natural equipment lifespans and turnover. The estimated grid peak demand reduction will be 4.16 megawatts (MW).
- The proposed standards are feasible and cost-effective. The estimated total monetary benefits outweigh the total incremental cost by a factor of 1.37 to 12.31, depending on oven type and category. The simple payback time is less than four years for most commercial oven types.
- CEC staff also proposes establishing testing, reporting, and marking requirements for commercial deck, conveyor, high-speed, and electric rack ovens.
- The proposed efficiency standards for commercial ovens will take effect January 1, 2029, or one year after adoption, whichever is later, and will apply to new commercial ovens manufactured on or after the effective date that are sold, rented, or leased in the state.

Appliance Efficiency Standards Background

The CEC is California's primary energy policy and planning agency. As part of the CEC's responsibility to achieve energy efficiency in appliances and buildings, the agency has established and adopted appliance standards that set minimum thresholds for energy and water efficiency. Through the Appliances Efficiency Program, appliance efficiency standards have shifted the marketplace toward more efficient products and practices, reaping large benefits for California's consumers. In 2025 alone, recently adopted efficiency standards under the Appliance Efficiency Regulations helped Californians avoid the use of 39.2 terawatt-hours of electricity, 400 million therms of fossil gas, and 202 billion gallons of water. These savings translate into $14.7 billion of utility bill savings, an average of $373 per person in California.

Overview of Commercial Ovens

Commercial ovens are cooking appliances designed for high-volume cooking and baking in professional kitchens such as restaurants, bakeries, catering businesses, and other food service establishments. There are many types of commercial ovens on the market. Convection ovens are one of the most popular types used in restaurants due to the associated low cost and high production capacity. Combination ovens that offer convection and steam cooking capabilities are another popular oven type and often include advanced recipe programming features. Rack ovens are commonly used by bakeries to cook breads, cookies, cakes, and other products by rotating the rack near the heat source. Other oven types include conveyor, deck, and high-speed (rapid cook) ovens.

There are no mandatory federal energy and water efficiency standards for commercial ovens. However, the U.S. Environment Protection Agency developed the ENERGY STAR program, which sets voluntary performance requirements for certain types of commercial ovens. The first version of the ENERGY STAR specifications for commercial ovens, v1.1, became effective in May 2009. The subsequent version, v2.2, replaced v1.1 in October 2015. The latest version of the ENERGY STAR specifications for commercial ovens is v3.0, which went into effect in January 2023. Both v2.2 and v3.0 set energy and water efficiency standards for commercial convection, combination, and gas rack ovens. Although voluntary, the ENERGY STAR specifications are widely adopted by the food service equipment industry.

CEC staff's research found that seven other states have established energy efficiency regulations for commercial ovens. Colorado has adopted the ENERGY STAR v3.0 specifications into its mandatory appliance efficiency regulations, while six other states, Washington, Nevada, Rhode Island, New Jersey, New York, and Massachusetts, have adopted ENERGY STAR v2.2 specifications into their appliance efficiency regulations.

California's Appliance Efficiency Regulations (found in Title 20, Section 1601 et seq. of the California Code of Regulations) require that manufacturers test their commercial convection oven models to determine performance characteristics and that the results of testing are certified to the CEC for publication. They do not require that a minimum level of efficiency be met or that a maximum amount of energy or water consumption be adhered to. Other types of commercial ovens are not regulated in California. CEC staff estimated there are about 134,400 convection, combination, and gas rack ovens in California with an ENERGY STAR penetration rate of 53 percent. CEC staff's analysis results showed that establishing efficiency standards for commercial ovens would save significant amount of energy and water use in California.

Research and Analysis Methods

Staff performed market analysis on commercial ovens currently available on the market. Based on the market analysis, staff focused its analysis on three types of commercial ovens: convection, combination, and rack ovens. These three types of commercial ovens make up 47 percent of the market share and are covered by the latest ENERGY STAR specifications. Staff then collected oven performance data on these oven types from the following data sources and databases:

- ENERGY STAR commercial oven database
- State Appliance Standards Database (SASD) database
- California Electronic Technical Reference Manual (eTRM)
- Proposal from the California investor-owned utilities code and standards enhancement (IOU CASE) team

Staff used the collected data to calculate the total energy and water consumption of commercial ovens in California and the potential savings from efficiency standards.

Staff considered three alternative proposals for efficiency standards for commercial ovens: aligning to ENERGY STAR specifications v2.2, aligning to ENERGY STAR specifications v3.0, and adopting standards proposed by Earthjustice. After carefully reviewing the scope, energy and water efficiency requirements, potential energy and water savings, cost-effectiveness, and

impact on product availability for each alternative, staff recommends aligning the energy and water efficiency standards for commercial ovens with the ENERGY STAR v3.0 specifications.

Staff Proposal

Staff proposes to establish energy and water efficiency standards for the following types of commercial ovens: gas and electric convection ovens, gas and electric combination ovens, and gas rack ovens. Staff proposes to align state-level energy and water efficiency requirements with those specified in the ENERGY STAR v3.0 specifications for this appliance category. The proposed standards set performance requirements on cooking energy efficiency and idle energy rate for all three types of ovens, as well as on the maximum water consumption rate for combination ovens.

Staff also proposes to establish testing, certification, and marking requirements for the following types of commercial ovens: gas and electric deck ovens, gas and electric conveyor ovens, gas and electric high-speed (rapid cook) ovens, and electric rack ovens. These requirements will provide valuable data to support existing rebate programs and potentially to set future performance standards, and provide potential buyers with clear information about the operating costs of the equipment.

Staff proposes to adopt the use of applicable Advancing Standards Transforming Markets (ASTM) test methods for commercial ovens subject to certification requirements and proposes that manufacturers certify their data to CEC for publication in CEC's directory of appliance listings consistent with other regulated appliances. Lastly, staff recommends marking requirements for commercial ovens subject to these requirements to increase user awareness of energy and water efficiency performance of these appliances.

The standards are proposed to take effect January 1, 2029, or one year after adoption, whichever is later, and will apply to new commercial ovens manufactured on or after the effective date that are sold, rented, or leased in the state. Staff's analysis estimates that the savings over the lifetime of product ranges from $1,819 to $19,306 per unit, depending on oven type and category. The life-cycle benefit-cost ratio ranges from 1.37 to 12.31 depending on oven type and category, indicating the proposed standard is cost-effective for consumers. The simple payback time is less than four years for most commercial oven types.

Staff's analysis estimates that, after the proposed standards take effect, the first-year statewide savings would be 1.0 million therms of natural gas, 1.43 GWh of electricity, 17.14 million gallons of water, and $2.4 million of utility cost. The estimated first-year grid peak demand reduction would be 0.34 MW.

Staff's analysis estimates that, after full-stock turnover in 2040, the statewide savings would be 11.94 million therms of natural gas, 17.15 GWh of electricity, and 206 million gallons of water per year. These savings translate into $37 million in reduced utility costs each year for Californian consumers. The grid peak demand reduction would be 4.16 MW.

Rulemaking Process

The CEC encourages and welcomes feedback and input from industry representatives, energy advocates, and other interested members of the public. During the rulemaking so far, the CEC has received written proposals and comments from several participants, including the IOU CASE team, North American Association of Food Equipment Manufacturers (NAFEM), UNOX,

Revent, Appliance Standards Awareness Project (ASAP), American Council for an Energy-Efficient Economy (ACEEE), Earthjustice, ITW Food Equipment Group, and Frontier Energy. This proceeding is still in the pre-rulemaking stage, and this draft staff report represents the first CEC proposal for efficiency standards for commercial ovens available for public review. CEC staff appreciates the input received from the interested parties to date and welcomes additional feedback on this staff proposal and draft staff report and continued stakeholder engagement in subsequent rulemaking steps.

CHAPTER 1:
Legislative Criteria and Efficiency Policies

Legislative Criteria

Section 25402(c)(1) of the California Public Resources Code directs the California Energy Commission (CEC) to reduce the inefficient consumption of energy, including the energy associated with the use of water, on a statewide basis by prescribing efficiency standards and cost-effective measures for appliances that require a significant amount of energy or water to operate.[1] Such standards must be feasible and attainable and must not result in any added total cost to the consumer over the designed life of the appliance.

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

Efficiency Policies

For the past five decades, California has regularly increased the energy and water efficiency requirements for new appliances sold and new buildings constructed in California. Through the Appliances Efficiency Program, appliance efficiency standards have shifted the marketplace toward more efficient products and practices, reaping large benefits for California's consumers. In 2025 alone, recently adopted efficiency standards under the Appliance Efficiency Regulations helped Californians avoid the use of 39.2 terawatt-hours of electricity, 400 million therms of fossil gas, and 202 billion gallons of water. These savings translate into $14.7 billion dollars of utility bill savings, an average of $373 per person in California.[2]

In addition, in the 1990s, the California Public Utilities Commission (CPUC) decoupled utilities' financial results from their direct energy sales, promoting utility support for efficiency programs. These efforts have reduced peak load by more than 8,645 megawatts (MW) and continue to save about 32,594 GWh per year of electricity.[3]

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1 California Public Resources Code, Section 25402, https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=PRC&sectionNum=25402.

2 Based on internal CEC calculations. The saving estimates are taken from the final staff reports for each recently adopted appliance efficiency rulemaking. Results available at https://www.energy.ca.gov/programs-and-topics/programs/appliance-efficiency-program-outreach-and-education/appliance-0.

3 Kavalec, Chris, Nick Fugate, Cary Garcia, Asish Gautam, and Mehrzad Soltani Nia. January 2016. California Energy Demand 2016-2026 Revised Electricity Forecast, January 2016. California Energy Commission. Publication Number CEC-200-2016-001-V1, https://efiling.energy.ca.gov/GetDocument.aspx?tn=207439&DocumentContentId=21362.

Reducing Electrical Energy Consumption to Address Climate Change

Appliance energy efficiency is identified as a key component to achieving the greenhouse gas (GHG) emission reduction goals of Assembly Bill 32 (Núñez, Chapter 488, Statutes of 2006)[4] and Senate Bill 32 (Pavley, Chapter 249, Statutes of 2016),[5] as well as the recommendations contained in the California Air Resources Board's Climate Change Scoping Plan.[6] Energy efficiency regulations are also identified as key components in reducing electrical energy consumption in the California Energy Commission's *2025 Integrated Energy Policy Report (IEPR)*.[7] Governor Edmund G. Brown Jr. and the Legislature identified appliance efficiency standards as a key to doubling the energy efficiency savings necessary to put California on a path to reducing its GHG emissions to 80 percent below 1990 levels by 2050,[8] a commitment made to the Subnational Global Climate Leadership Memorandum of Understanding (MOU) agreement, along with 167 jurisdictions representing 33 countries.[9]

On October 7, 2015, Governor Brown signed the Clean Energy and Pollution Reduction Act of 2015 or Senate Bill 350 (De León, Chapter 547, Statutes of 2015), requiring the California Energy Commission to establish annual targets to double statewide energy efficiency savings in electricity and natural gas for final end uses by 2030.[10] Appliance efficiency standards will be critical in meeting this goal. In addition, the California Energy Commission's 2025 California Building Energy Action Plan recommends combining electrification measures with energy efficiency to ensure energy affordability and strategic peak-demand reduction.[11]

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4 AB 32, California Global Warming Solutions Act of 2006: Air Pollution: Greenhouse Gases, https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=200520060AB32.

5 SB 32, California Global Warming Solutions Act of 2006: Emissions Limit, https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201520160SB32.

6 California Air Resources Board (CARB). December 2022. *2022 Climate Change Scoping Plan for Achieving Carbon Neutrality,* https://ww2.arb.ca.gov/sites/default/files/2023-04/2022-sp.pdf.

7 Bailey, Stephanie, Jim Bartridge, Kadir Bedir, Mathew Cooper, Susan Ejalmaneshan, et al. July 2026. *2025 Integrated Energy Policy Report*. California Energy Commission. Publication Number CEC-100-2026-001-CMF, https://www.energy.ca.gov/publications/2026/2025-integrated-energy-policy-report.

8 Governor Edmund G. Brown Jr. January 5, 2015. 2015 Inaugural Address, https://archive.gov.ca.gov/archive/gov39/2015/01/05/news18828/index.html.

9 Climate Leadership Conference, Subnational Global Climate Leadership Memorandum of Understanding. 2017, https://archive.gov.ca.gov/archive/gov39/wp-content/uploads/2017/09/Under_2_MOU.pdf.

10 SB 350, Clean Energy and Pollution Reduction Act of 2015, https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB350.

11 Howlett, Owen, Shadi Aslebagh, Kristina Duloglo, Muhammad Ahmad, Amber Beck, Blake Dressel, Vanessa Durant, Bryan Early, Ingrid Neumann, Gabriel Taylor, Katelynn Webster, and Elicia Yoffee. August 2025. *California Building Energy Action Plan*. California Energy Commission. Publication Number: CEC-400-2025-001-F, https://www.energy.ca.gov/publications/2025/california-building-energy-action-plan.

Clean Energy Programs

In September 2022, Governor Gavin Newsom signed Assembly Bill 209 (Ting, Chapter 251, Statues of 2022) into law, requiring the CEC to establish and administer five clean energy programs:[12]

- Equitable Building Decarbonization Program
- Industrial Grid Decarbonization and Improvement of Grid Operations Program
- Food Production Investment Program
- Clean Hydrogen Program
- Offshore Wind Waterfront Facility Improvement Program

The Equitable Building Decarbonization (EBD) Program targets GHG emission reductions in homes and advancement of energy equity.[13] Three subprograms were developed for this program: 1) Statewide Direct Install Program, 2) Statewide Incentive Program, and 3) Tribal Direct Install Program. The Statewide Direct Install Program provides and installs energy-efficient upgrades to low-income households. The Statewide Incentive Program offers incentives for increasing the adoption of low-carbon technologies. The Tribal Direct Install Program serves residential buildings owned or managed by California Native American Tribes, tribal organizations, or tribal members. The EBD Program is an important tool for the state to encourage decarbonization of existing buildings and prioritize the buildings of those most in need.

The Industrial Grid Decarbonization and Improvement of Grid Operations[14] funds financial incentives for industry projects that demonstrate significant benefits to the electrical grid, reduce GHG emissions, achieve California's clean energy goals, and exceed compliance requirements. The Food Production Investment Program[15] provides grants to help food producers reduce GHG emissions and support electric grid reliability through the adoption of advanced energy technologies. The Clean Hydrogen Program[16] demonstrates or scales-up hydrogen projects that produce, process, deliver, store, or use hydrogen derived from water using eligible renewable energy resources, or produced from these eligible renewable energy resources.

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12 Werner, Misa, Cyrus Ghandi, Katie Webster, Alex Horangic, Rachel Shepherd, et al. August 2025. *Assembly Bill 209 Clean Energy Programs – 2024 Annual Report*. California Energy Commission. Publication Number: CEC-500-2025-033-CMF, https://www.energy.ca.gov/publications/2025/assembly-bill-209-clean-energy-programs-2024-annual-report.

13 CEC. "Equitable Building Decarbonization Program," https://www.energy.ca.gov/programs-and-topics/programs/equitable-building-decarbonization-program.

14 CEC. "Industrial Decarbonization and Improvement of Grid Operations — INDIGO," https://www.energy.ca.gov/programs-and-topics/programs/industrial-decarbonization-and-improvement-grid-operations-indigo.

15 CEC. "Food Production Investment Program," https://www.energy.ca.gov/programs-and-topics/programs/food-production-program.

16 CEC. "Clean Hydrogen Program," https://www.energy.ca.gov/programs-and-topics/programs/clean-hydrogen-program.

The Offshore Wind Waterfront Facility Improvement Grant Program[17] aims to support the build-out of offshore wind facilities and maximize the economic and environmental benefits of the offshore wind industry in California. The program supports plans to improve the capabilities of California ports, harbors, and waterfront facilities.

Heat Pump Initiative

In a 2022 letter to the chair of the California Air Resources Board (CARB), Governor Gavin Newsom established several goals in order to lay out a clear path to achieve California's climate goal of reducing greenhouse gas level by 40% below 1990 level by 2030 and statewide carbon neutrality in 2045.[18] One of the goals was to deploy 6 million heat pumps statewide by 2030. This initiative supports the broader legislative goal of achieving carbon neutrality by 2045 by cutting direct GHG emissions from residential and commercial space and water heating.

During the Building Electrification Summit event hosted by the CEC and Electric Power Research Institute (EPRI) in October 2023, 10 of the world's largest manufacturers, distributors, and suppliers of building heating and cooling equipment signed an agreement committing to actions aimed at achieving California's goal of having 6 million electric heat pumps installed by 2030.[19] In May 2024, California Heat Pump Partnership (CAHPP) was formed.

CAHPP is a public-private partnership that brings together state policy leaders, heat pump manufacturers, retailers, distributors, utilities, and other key interested parties to rapidly scale California's heat pump market and achieve Governor Newsom's goal of installing 6 million heat pumps in California's buildings by 2030.[20] CAHPP released its first blueprint plan in March 2025, outlining near-term strategies to address technical, market, and policy barriers to heat pump adoption.[21] The strategies include 1) improving customer economics, 2) streamlining sales and installation processes, 3) accelerating market adoption, and 4) increasing market visibility. As of April 2026, there are 2.4 million heat pump units installed in California.[22]

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17 CEC. "Offshore Wind Waterfront Facility Improvement Program," https://www.energy.ca.gov/programs-and-topics/programs/offshore-wind-waterfront-facility-improvement-program.

18 Governor Gavin Newsom's Letter to Chair Liane Randolph of the California Air Resources Board, July 22, 2022, https://www.gov.ca.gov/wp-content/uploads/2022/07/07.22.2022-Governors-Letter-to-CARB.pdf.

19 "CEC/Heat Pump Manufacturer Commitment at Building Electrification Summit," https://www.energy.ca.gov/sites/default/files/2023-10/CEC-OEM_Commitment_for_Oct_Summit_ada.docx.

20 "California Heat Pump Partnership Website," https://heatpumppartnership.org/.

21 California Heat Pump Partnership. March 2025. *California Heat Pump Partnership Blueprint*, https://heatpumppartnership.org/wp-content/uploads/2025/03/CAHPP_Blueprint_2025.pdf.

22 California Heat Pump Partnership. "Progress Toward 6,000,000 CA Heat Pumps," https://heatpumppartnership.org/.

Load-Shift Goal

In September 2022, Governor Newsom signed Senate Bill 846 (Dodd, Chapter 239, Statues of 2022) into law, which required the CEC to develop a statewide goal for load-shifting to reduce net-peak electrical demand. The CEC collaborated with the California Public Utilities Commission (CPUC) and the California Independent System Operator (CAISO) and developed a statewide load-flexibility goal of 7,000 MW by 2030.[23] The CEC laid pathways to achieving this load-shift goal by identifying three categories of load flexibility resources:

- **Load-modifying demand flexibility resources**: The most common category of load-modifying flexibility is time-varying rates, such as simple time-of-use (TOU) rates and hourly dynamic rates.
- **Resource planning and procurement load flexibility**: This category either contributes to meeting resource adequacy requirements or reduces resources adequacy requirements as a credit. Supply-side demand response participates in the CAISO as either economic demand response or reliability demand response that is activated under emergency conditions.
- **Incremental and emergency load flexibility programs**: These programs are intended to increase resource availability during extreme events that are difficult to account for in standard planning practices.

The CEC also prepared policy recommendations for each of these three categories. For example, the CPUC should instruct utilities to roll out dynamic pricing options for as many customers as possible, and the CEC could investigate the possibility of a centralized, competitive demand response marketplace for the state. Moreover, the CEC could look at piloting programs specifically meant for behind-the-meter storage.

Loading Order for Meeting the State's Energy Needs

California's loading order places energy efficiency as the top priority for meeting energy needs. The 2011 *Energy Efficiency Strategic Plan* strongly supports the loading order, which describes the priority sequence for actions to address increasing energy needs. Energy efficiency and demand response are the preferred means of meeting the state's growing energy needs.[24]

As California's energy policy agency, the CEC establishes building codes to increase energy efficiency of buildings, which provides a co-benefit of reducing GHGs. The core focus of the building standards has been efficiency given that homes and businesses use nearly 70% of California's electricity. The *2019 Building Energy Efficiency Standards*[25] ventured into onsite generation by requiring solar PV on new homes, and these efficiency and conservation measures have since also provided significant GHG reductions. The 2022 Build Energy

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23 Neumann, Ingrid and Erik Lyon. May 2023. *Senate Bill 846 Load-Shift Goal Report*. CEC Publication Number: CEC-200-2023-008, https://efiling.energy.ca.gov/GetDocument.aspx?tn=250357&DocumentContentId=85095.

24 CPUC, *Energy Efficiency Strategic Plan, updated January 2011*, https://www.cpuc.ca.gov/-/media/cpuc-website/files/legacyfiles/c/5303-caenergyefficiencystrategicplan-jan2011.pdf.

25 CEC. "2019 Building Energy Efficiency Standards," https://www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/2019-building-energy-efficiency.

Efficiency Standards[26] reinforced the goals of building efficiency and the associated GHG reductions by

1) Encouraging efficient electric heat pumps
2) Establishing electric-ready requirements for new homes
3) Expanding solar photovoltaic and battery storage standards
4) Strengthening ventilation standards that improve indoor air quality

The 2025 Building Energy Efficiency Standards continued to advance these strategies while introducing measures that encouraged automation of loads to be flexible to enhance grid reliability and improve efficiency in additions and alterations to existing homes and businesses.[27] The 2025 update of the California Energy Code went into effect January 1, 2026, and is expected to save an estimated $4.8 billion in energy costs over 30 years. It is also expected to reduce GHG emissions by about 4 million metric tons — equivalent to the annual energy consumption of more than half a million homes.[28]

For the past 40 years, while per-capita electricity consumption in the United States has increased by nearly 50 percent, California electricity use per capita has been nearly flat.[29] Continued progress in cost-effective buildings and appliance standards and ongoing enhancements to efficiency programs implemented by investor-owned utilities (IOUs), publicly owned utilities, and other entities have contributed significantly to this achievement.

Regional Energy Collaboration

Governor Newsom signed Assembly Bill 825 (Petrie-Norris, Chapter 116, Statutes of 2025)[30] into law in September 2025. Colloquially known as the "Pathways Bill," AB 825 paves the way for California to take part in an independently governed regional electricity market. The bill authorizes the California Independent System Operator (CAISO) to collaborate with utilities and regulators in neighboring states to establish a regional, day-ahead electricity market. By participating in the regional market, the bill expects to broaden the pool of potential buyers and sellers, attracting more investment in renewable energy projects, both within California and neighboring western states. AB 825 is likely to accelerate renewable energy development, enhance grid reliability, and expand market access for renewable energy projects across California and the border western states, supporting California's efforts to address climate change.

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26 CEC. "2022 Building Energy Efficiency Standards," https://www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/2022-building-energy-efficiency.

27 CEC. "2025 Building Energy Efficiency Standards," https://www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/2025-building-energy-efficiency.

28 CEC. January 13, 2026. News release. "California's Energy Code Update Guides the Construction of Cleaner, Healthier Buildings," https://www.energy.ca.gov/news/2026-01/californias-energy-code-update-guides-construction-cleaner-healthier-buildings.

29 Natural Resources Defense Council. July 2013. Fact sheet. *California's Energy Efficiency Success Story: Saving Billions of Dollars and Curbing Tons of Pollution*, https://lhc.ca.gov/wp-content/uploads/sites/lhc.ca.gov/files/Reports/223/WrittenTestimony/CavanaghAttachment.pdf.

30 AB 825, Independent System Operator: Independent Regional Organization, https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=202520260AB825.

CHAPTER 2:
CEC Rulemaking Process

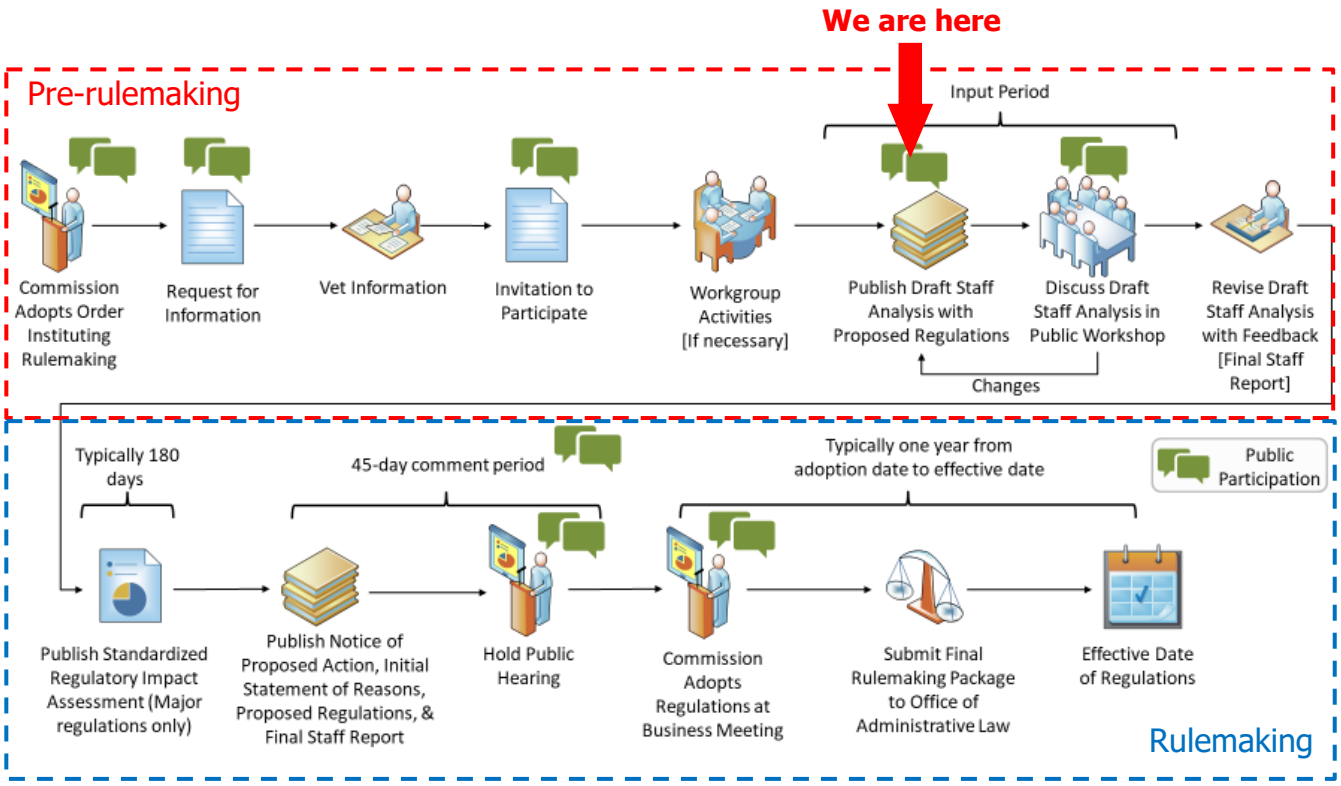
The California Energy Commission (CEC) is the state government agency with authority to establish energy and water efficiency standards for appliances in California. The CEC focuses on identifying opportunities for establishing energy and water efficiency standards for appliances that provide significant benefits to consumers and for which federal preemption does not apply, such as computers and computer monitors, televisions, battery chargers, commercial and industrial fans and blowers, showerheads, and plumbing fixtures. This chapter explains the rulemaking process the CEC follows when establishing energy and water efficiency standards for appliances. This chapter should not be used as a reference for the rulemaking process the CEC follows when the CEC is pursing administrative updates to the Appliance Efficiency Regulations, or for other regulatory proceedings unrelated to appliance efficiency standards.

Overview

The CEC establishes appliance efficiency regulations through a two-stage process: a pre-rulemaking stage and a (formal) rulemaking stage. Each stage consists of several steps, as shown in Figure 1 below. This process provides the public and interested parties with multiple opportunities to participate in the rulemaking process, submit verbal and written comments, and influence the process. At the end of the process, the CEC adopts the regulations at a business meeting and then submits the final rulemaking package to the Office of Administrative Law, who will review the record to ensure compliance with the California Administrative Procedure Act (APA).[31] The commercial ovens proceeding is in the pre-rulemaking stage, and this draft staff report is the CEC's first comprehensive proposal for efficiency standards for commercial ovens, published with the goal of receiving feedback and suggestions from stakeholders and interested members of the public.

31 Office of Administrative Law. "Administrative Procedure Act & OAL Regulations," https://oal.ca.gov/publications/administrative_procedure_act/.

Figure 1: Overview of the Rulemaking Process at the CEC



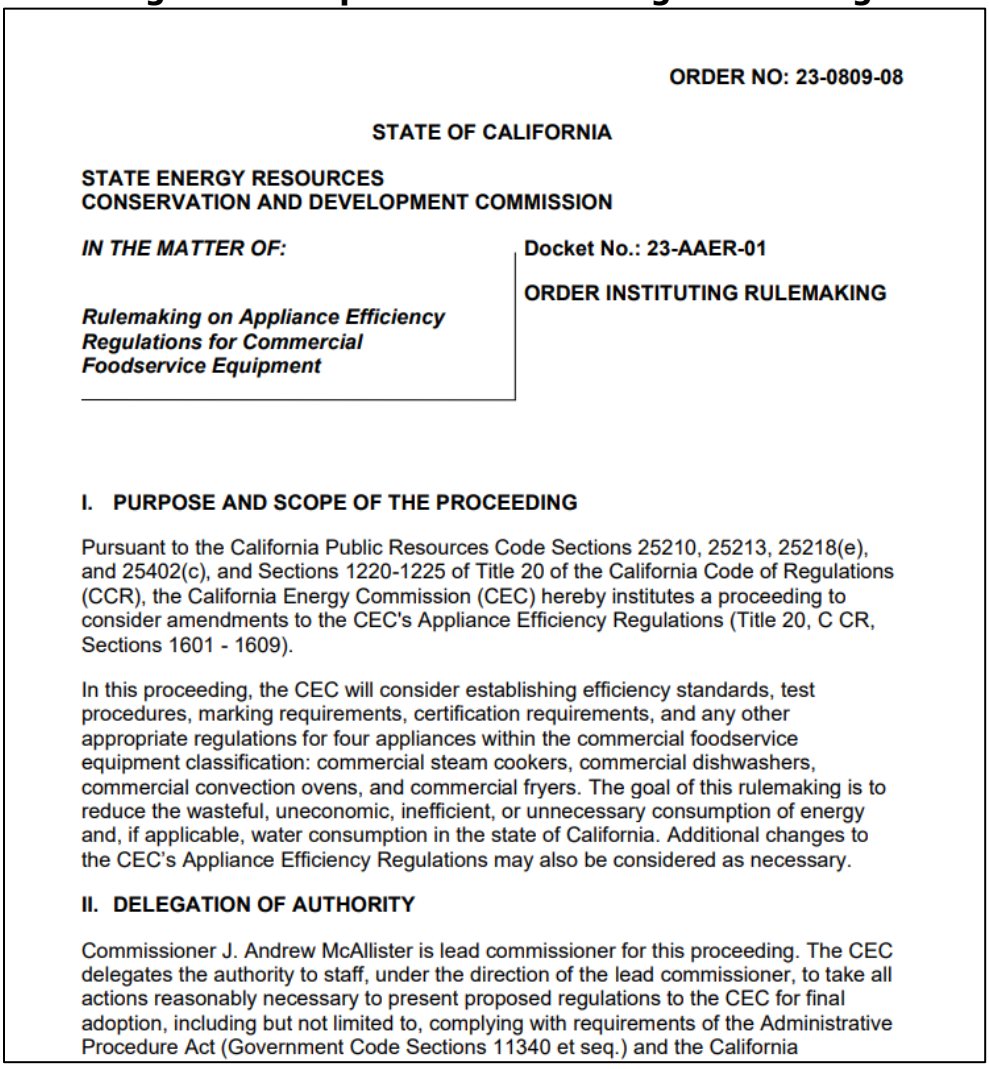
Source: CEC staff

Pre-rulemaking Stage

The pre-rulemaking stage consists of the preliminary activities necessary to develop a robust and well-researched regulatory proposal and gather the information needed for the (formal) rulemaking documents conforming to the legal requirements specified in the APA and the Warren-Alquist Act. For appliance efficiency proceedings, the pre-rulemaking stage typically involves the following steps:

1) **Order instituting rulemaking (OIR)** — This is the first document that the CEC typically issues to initiate a proceeding to adopt, revise, or repeal regulations. An OIR usually defines the purpose and scope of a rulemaking, introduces procedures for public participation, and outlines the proposed actions to address a specific policy objective. Figure 2 below shows a sample OIR that the CEC issued for the rulemaking on commercial foodservice equipment in August 2023.

Figure 2: Sample Order Instituting Rulemaking



ORDER NO: 23-0809-08

STATE OF CALIFORNIA

STATE ENERGY RESOURCES
CONSERVATION AND DEVELOPMENT COMMISSION

IN THE MATTER OF:

Rulemaking on Appliance Efficiency Regulations for Commercial Foodservice Equipment

Docket No.: 23-AAER-01

ORDER INSTITUTING RULEMAKING

I. PURPOSE AND SCOPE OF THE PROCEEDING

Pursuant to the California Public Resources Code Sections 25210, 25213, 25218(e), and 25402(c), and Sections 1220-1225 of Title 20 of the California Code of Regulations (CCR), the California Energy Commission (CEC) hereby institutes a proceeding to consider amendments to the CEC's Appliance Efficiency Regulations (Title 20, C CR, Sections 1601 - 1609).

In this proceeding, the CEC will consider establishing efficiency standards, test procedures, marking requirements, certification requirements, and any other appropriate regulations for four appliances within the commercial foodservice equipment classification: commercial steam cookers, commercial dishwashers, commercial convection ovens, and commercial fryers. The goal of this rulemaking is to reduce the wasteful, uneconomic, inefficient, or unnecessary consumption of energy and, if applicable, water consumption in the state of California. Additional changes to the CEC's Appliance Efficiency Regulations may also be considered as necessary.

II. DELEGATION OF AUTHORITY

Commissioner J. Andrew McAllister is lead commissioner for this proceeding. The CEC delegates the authority to staff, under the direction of the lead commissioner, to take all actions reasonably necessary to present proposed regulations to the CEC for final adoption, including but not limited to, complying with requirements of the Administrative Procedure Act (Government Code Sections 11340 et seq.) and the California

Source: CEC Docket #23-AAER-01

Once an OIR is issued, a docket is opened on the CEC's website and given a unique number that is specific to the associated topic area. The docket is used by the CEC to publish notices, reports, and other formal documents associated with the rulemaking proceeding. It is also used to receive written comments and proposals from participants in the proceeding and the public. For example, Docket 23-AAER-01[32] was created for the rulemaking on commercial foodservice equipment.

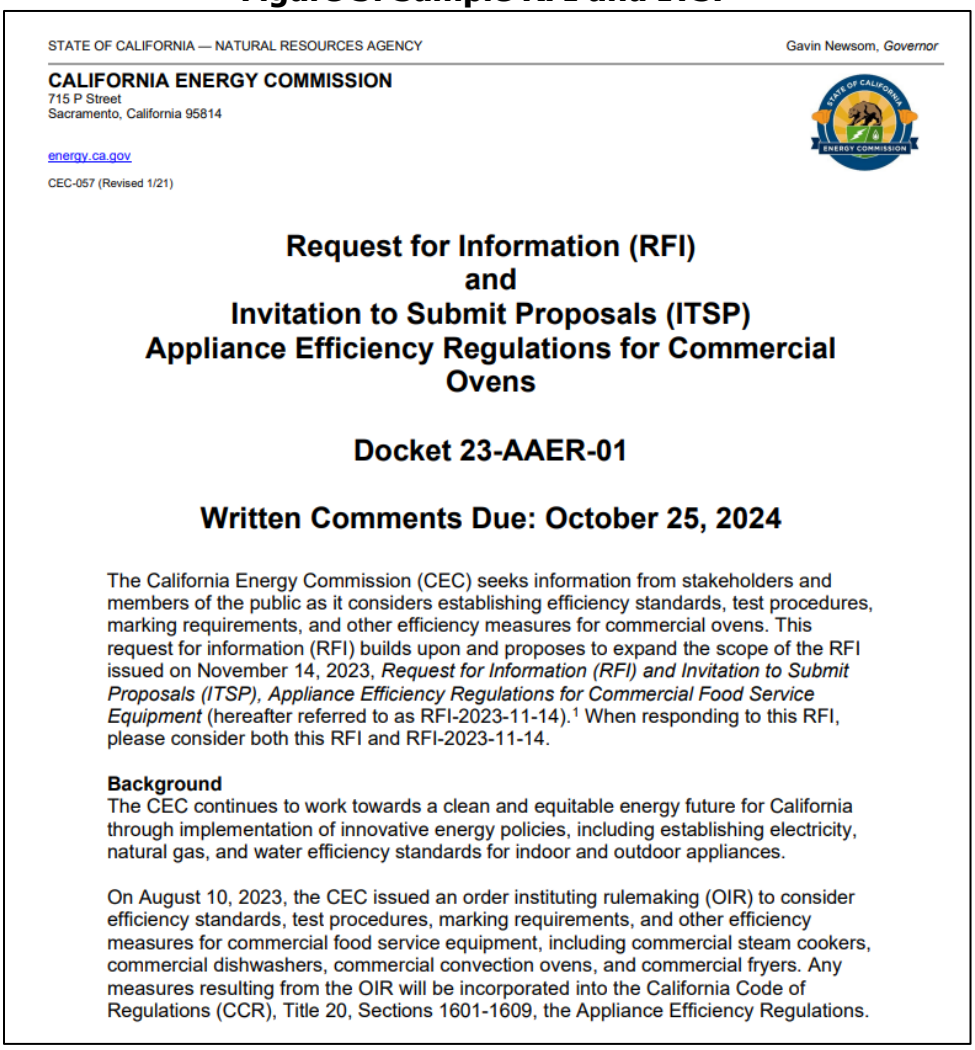
2) **Request for information (RFI)** — After issuing the OIR, the CEC usually prepares and publishes an RFI to gather technical and policy information and feedback from stakeholders and interested members of the public regarding the development of the

32 CEC. Docket 23-AAER-01, Commercial Foodservice Equipment, https://efiling.energy.ca.gov/Lists/DocketLog.aspx?docketnumber=23-AAER-01.

regulation. Sometimes an RFI is issued together with an invitation to submitting proposals, which is discussed in the next step.

3) **Invitation to submitting proposals (ITSP)** — An ITSP is a formal request published by the CEC to invite stakeholders and interested members of the public to provide complete written proposals on the development of the regulation. Both the RFI and the ITSP give public stakeholders an early opportunity to get involved in the development of regulations and provide valuable feedback. Figure 3 below shows a sample RFI and ITSP issued for regulations on commercial ovens in September 2024.

Figure 3: Sample RFI and ITSP



STATE OF CALIFORNIA — NATURAL RESOURCES AGENCY Gavin Newsom, *Governor*

CALIFORNIA ENERGY COMMISSION
715 P Street
Sacramento, California 95814

energy.ca.gov

CEC-057 (Revised 1/21)

Request for Information (RFI)
and
Invitation to Submit Proposals (ITSP)
Appliance Efficiency Regulations for Commercial Ovens

Docket 23-AAER-01

Written Comments Due: October 25, 2024

The California Energy Commission (CEC) seeks information from stakeholders and members of the public as it considers establishing efficiency standards, test procedures, marking requirements, and other efficiency measures for commercial ovens. This request for information (RFI) builds upon and proposes to expand the scope of the RFI issued on November 14, 2023, *Request for Information (RFI) and Invitation to Submit Proposals (ITSP), Appliance Efficiency Regulations for Commercial Food Service Equipment* (hereafter referred to as RFI-2023-11-14).[1] When responding to this RFI, please consider both this RFI and RFI-2023-11-14.

Background
The CEC continues to work towards a clean and equitable energy future for California through implementation of innovative energy policies, including establishing electricity, natural gas, and water efficiency standards for indoor and outdoor appliances.

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

Source: CEC Docket #23-AAER-01

4) **Public workgroup (if necessary)** – If deemed necessary, the CEC organizes a workgroup consisting of members from government agencies, industry representatives, energy advocates, and interested members of the public to work out issues that have been identified during the pre-rulemaking phase. A public workgroup process is deemed

necessary if there are specific issues that need an additional level of collaboration and consensus-building. The workgroup process could be organized after the RFI/ITSP and before preparing the draft staff report or it could be organized after receiving feedback on the draft staff report and before preparing the final staff report. A workgroup is an effective way to discuss and solve complex issues, allowing for informal exchanges and rapid iteration of proposed solutions and feedback. The duration of a workgroup usually ranges from four to nine months.

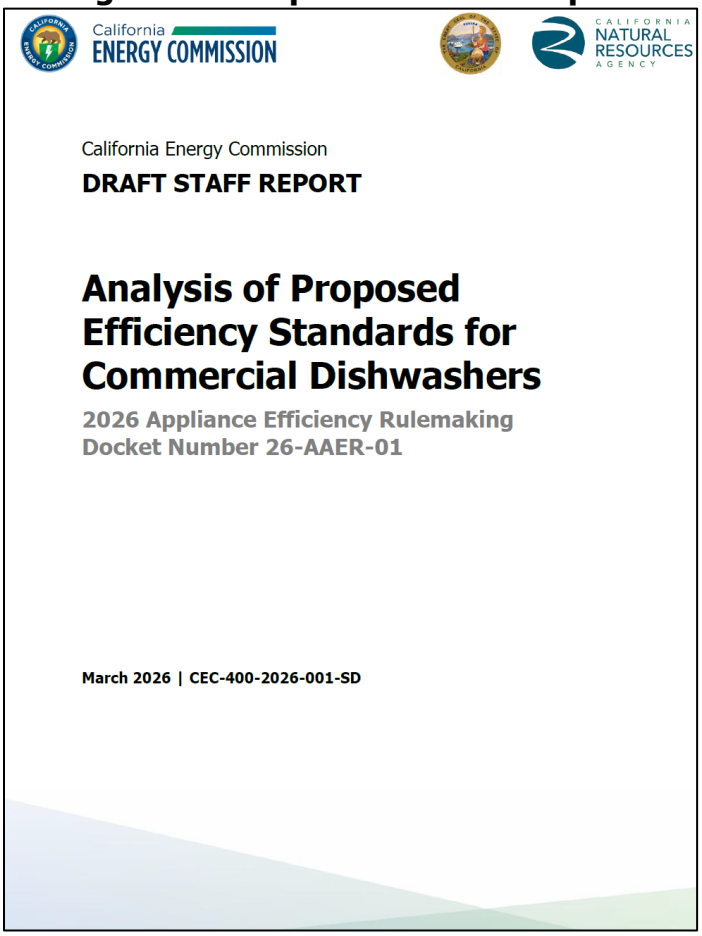
5) **Draft staff report with proposed regulations** — After gathering information and feedback from the public, the CEC staff performs market, technical, and cost-effectiveness analysis for the appliances covered in the rulemaking. The analysis is thorough and typically takes months to complete. Staff then writes a draft staff report documenting its analysis and recommendations, covering the background, analysis methods, analysis results, and the alternatives and recommendations for regulations based on the analysis results. In drafting the staff report, staff reviews the comments and proposals submitted by participants in the prior phases and integrates them into the report.

   When completed, the draft staff report is published in the docket corresponding to the proceeding. After publication, the public typically have 45–60 days to download, review, and provide written comments on the report and the proposed regulations it contains. This provides the public with another opportunity to participate in the rulemaking and provide feedback early in the rulemaking process when significant changes to the proposal can still be easily made. **Please note this is where CEC staff is in the efficiency rulemaking for commercial ovens as of the writing of this report.**

   The draft staff report is given a publication number when published consistent with other CEC publications. Figure 4 below shows the cover page of the draft staff report in the rulemaking for commercial dishwashers.

6) **Public workshop** — After the publication of the draft staff report, the public is typically provided 45-60 days to review and provide written comments. During this period, the CEC typically holds a public workshop to present an overview of the report, explain CEC staff's analysis and the proposed regulations as written in the report, and accept oral commentary. In the workshop, the CEC staff engages in an interactive dialogue with potentially affected and interested members of the public: staff answers questions brought up by the attendees and takes comments from them. This dialogue provides the public with another opportunity to participate in the rulemaking in a verbal format that might be preferable to some.

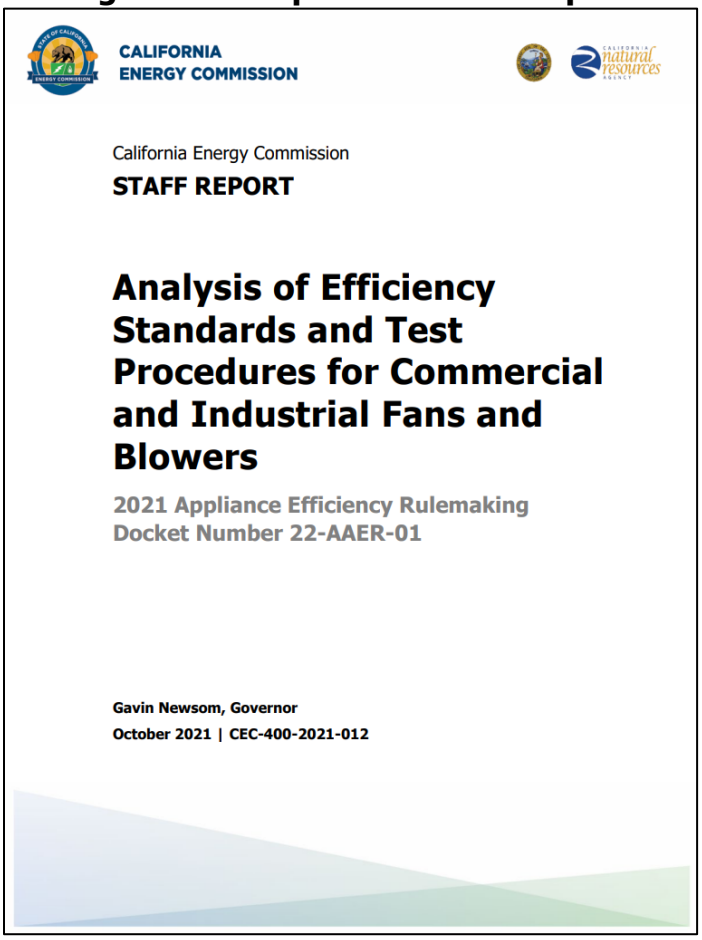
Figure 4: Sample Draft Staff Report



Source: CEC Dock #26-AAER-01

7) **Final staff report** – Once the public comment period closes, CEC staff collects and reviews the comments provided by the public. If these comments indicate that additional analysis is necessary, CEC staff will take appropriate additional steps, and, as stated in Step 4, a public workgroup could be convened. The draft staff report is then revised based on received feedback and new data. If the revisions are significant, the revised report could be published for additional feedback from the public during the pre-rulemaking stage, but often the revised staff report is published as a final staff report and is used as the primary document relied upon for initiating the formal rulemaking. The final staff report is typically published along with the other documents needed to initiate formal rulemaking in accordance with the APA, representing the transition from pre-rulemaking to formal rulemaking. Figure 5 below shows the cover page of the final staff report on the rulemaking for commercial and industrial fans and blowers.

Figure 5: Sample Final Staff Report



Source: CEC Docket #22-AAER-01

Rulemaking Stage

As the proceeding transitions into the rulemaking stage, a new docket is opened on the CEC website and given a new docket number. The CEC publishes notices, written responses, and legal documents to this new docket. The public also submits written comments to this new docket.

The steps in the rulemaking stage follow the APA requirements as explained below. Please note that this is a high-level review of the rulemaking steps. The complete details can be found in Sections 11346-11348 of the APA.[33]

1) **Determine proposed regulation category** — Before initiating the rulemaking, CEC staff determines whether the proposed regulation will be a "major" regulation. A major regulation will have economic impact of $50 million or more. If it is determined the proposed regulation will be a major regulation, CEC staff performs additional prenotice analysis, including preparing and publishing a standardized regulatory impact

33 Administrative Procedure Act, Sections 11346–11348, https://leginfo.legislature.ca.gov/faces/codes_displayText.xhtml?lawCode=GOV&division=3.&title=2.&part=1.&chapter=3.5.&article=5.

assessment (SRIA).[34] For regulations that are not major regulations, CEC staff prepares an economic impact assessment (EIA), which must be included as part of the initial statement of reasons (ISOR) in the next step.

In this step, CEC staff also determines whether the proposed regulation will be exempt from the California Environmental Quality Act (CEQA).[35] For regulations subject to CEQA, CEC staff performs studies and prepares either a negative declaration (ND), a mitigated negative declaration (MND), or an environmental impact report (EIR) to identify, disclose, and mitigate (or address) the environmental impacts. For regulations that are exempt from the CEQA, CEC staff prepares a notice of exemption (NOE) to submit with other documents in the next step.

2) **Initiate rulemaking** — The CEC initiates an APA rulemaking process by issuing a notice of the proposed action (NOPA). The notice is 1) published in the California Regulatory Notice Register, 2) mailed or emailed to the list of persons who have filed a request for notice of regulatory actions, and 3) posted on the CEC website in the corresponding docket. Once the notice is issued, the APA rulemaking process is officially open.

   Along with the notice, CEC staff develops and publishes the following documents for public review:

   - The express terms of the proposed regulatory language (PRL)
   - The initial statement of reasons (ISOR)
   - Economic and fiscal impact statement (Form STD 399)
   - Economic impact assessment (EIA) (for non-major regulations). EIA is included as part of the ISOR.
   - Standardized regulatory impact assessment (SRIA) (for major regulations only)
   - Notice of exemption (for regulations exempt from CEQA)
   - Environmental impact report, mitigated negative declaration, negative declaration, or other environmental documentation (for regulations subject to CEQA only)
   - Documents relied upon — including, but not limited to, a final staff report

3) **45-day comment period** — After the NOPA is issued, the public will have 45 days to review the proposed regulation and provide written comments. The public can provide comments by mail, fax, email, and online submittal. The NOPA specifies where the comments must be directed and when this comment period closes.

4) **Public hearing** — After the close of the 45-day comment period, the CEC hosts a public hearing on the proposed regulatory action. This hearing is an opportunity for stakeholders and interested members of the public to provide verbal comments and

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34 Administrative Procedure Act, Sections 11346.3 and 11346.36, https://leginfo.legislature.ca.gov/faces/codes_displayText.xhtml?lawCode=GOV&division=3.&title=2.&part=1.&chapter=3.5.&article=5.

35 California Environmental Quality Act (CEQA), https://oag.ca.gov/environment/ceqa.

feedback for the rulemaking. A transcript will be taken, and all comments will be part of the formal record of the rulemaking.

5) **15-day comment period (if needed)** — After the initial 45-day comment period and subsequent public hearing, CEC staff collects and reviews the comments provided by participants and may revise the initial proposal in response to public comments. If a change is substantial and sufficiently related[36] to the initial proposal as explained in the NOPA and ISOR, the CEC will publish a notice and summary of changes for a 15-day public comment period. Depending on the additional comments received, the CEC might decide to revise the proposed regulations and host additional 15-day comment periods. There is not a limit to the number of 15-day comment periods that the CEC could host, but the overall APA rulemaking needs to be completed within a year of publishing the NOPA.
6) **Adopt regulation** — After considering all timely and relevant comments and when no further revisions are considered necessary, CEC staff presents the final version of its proposal and recommendations to the CEC at one of its monthly business meetings, where the commissioners can vote to adopt the amendments to regulation recommended by staff or give other direction to staff as appropriate.
7) **Submit final rulemaking package to OAL** — After adopting amendments to regulation, the CEC transmits the final rulemaking package to the Office of Administrative Law (OAL) for review. The final rulemaking package typically includes, but is not limited to, the following documents:
    - All documents in the initial rulemaking package
    - Public comments and the CEC's responses to comments
    - 15-day notices and modified regulatory text (if applicable)
    - Updated informative digest
    - Statements of mailing notice

    The OAL has 30 working days to review the rulemaking record and the adopted regulatory text. Once OAL confirms that the final rulemaking package conforms with the legal requirements of the APA, it will file the approved regulatory text with Secretary of State. The approved regulatory text will then be printed in the California Code of Regulations.
8) **Regulation in effect** — The newly adopted regulation typically becomes operative in the California Code of Regulations within a few months of OAL approval. Manufacturers, retailers, and other stakeholders typically must begin complying with the regulations on the date specified in the regulatory text, which is usually one year after the date of adoption.

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36 Changes to the original text of a regulation shall be deemed to be "sufficiently related", …, "if a reasonable member of the directly affected public could have determined from the notice that the proposed change could have resulted." From CCR, Title 1, §42, https://shared-govt.westlaw.com/calregs/Document/I7E5D6D704C6611EC93A8000D3A7C4BC3?viewType=FullText&originationContext=documenttoc&transitionType=CategoryPageItem&contextData=(sc.Default).

Summary

As explained in this chapter, the CEC establishes appliance efficiency regulations through a two-stage process: a pre-rulemaking stage and a (formal) rulemaking stage. In the pre-rulemaking stage, CEC staff engages in preliminary activities to develop the documents that are necessary for the rulemaking stage. The preliminary activities include, but are not limited to, gathering information from stakeholders, conducting market research, collecting data from various sources, and performing technical and cost-effectiveness analysis. In the rulemaking stage, the CEC adheres to a procedure conforming with the legal requirements of the California Administrative Procedure Act before adopting proposed regulations.

Each stage consists of several steps and provides the public and interested parties with opportunities to participate in and influence the rulemaking process. In the pre-rulemaking stage, the CEC typically sends RFI and ITSP to stakeholders and interested members of the public to gather information. Another opportunity for the public to submit comments and feedback is after CEC staff publishes the draft staff report. In the rulemaking stage, stakeholders and interested members of the public can submit comments during the 45-day comment period and in the public hearing. If necessary, additional 15-day comment periods are given to gather comments and feedback on revised regulatory text.

CEC staff encourages and welcomes all types of feedback from the public, and the earlier feedback is received, the better. A robust stakeholder process is essential in creating regulations that maximize the benefits to California and end users while appropriately evaluating the cost of compliance.

After considering all timely and relevant comments and when no further revisions are considered necessary, CEC staff presents the final version of the proposed regulation to the CEC at one of its monthly business meetings and recommends that the Commission adopt the regulations. The newly adopted regulation typically becomes effective on a date specified in the regulatory text, noting that appliance efficiency standards are generally required to take effect no earlier than one year following adoption.

CHAPTER 3:
Product Description

It is estimated there are about 790,000 commercial ovens in California.[37] Efficiency improvements in commercial ovens can drive down the energy and water use in the desired application. This chapter describes commercial ovens in terms of cooking method, application, size, and power source.

Overview of Commercial Ovens

A commercial oven is a heavy-duty kitchen and restaurant appliance designed to simplify and enhance cooking in high-volume settings. Compared to residential ovens, commercial ovens feature powerful heating, durable construction, and more precise temperature control to handle daily use and high duty cycles while ensuring consistent cooking results.

There are many types of commercial ovens available on the market. Convection ovens, named for the inclusion of a fan that stirs air within the cooking chamber, are one of the most popular types used in restaurants due to the low cost and high production capacity. Combination ovens are another popular oven type, which offer steam-cooking capabilities and advanced recipe programming alongside convection features. Bakeries, meanwhile, use rack ovens to cook products by rotating the rack near the heat source. Most pizzerias use conveyor and deck ovens to cook pizzas, although hearth ovens are used in some pizza restaurants. Other oven types include high-speed (rapid cook), microwave, rotisserie, and cook-and-hold ovens. More information about each oven type is provided below.

Convection Ovens

A convection oven is a general-purpose oven that cooks food by forcing hot dry air over the surfaces of food products. They are equipped with one or more fans to improve the hot air circulation and achieve an even temperature distribution inside the cooking cavity. Convection ovens do not include ovens that can heat the cavity with saturated or superheated steam, as these are referred to by industry as "combination" or "combi" ovens. However, a convection oven may have limited moisture injection capabilities.

A convection oven can have either electric heating elements or gas burners that use natural gas or propane. The most common cooking temperatures in convection ovens range from 325°F to 375°F, although thermostats usually range from 200°F to 450°F.

A convection oven can be categorized as full-size or half-size. A full-size oven can accommodate one full-size sheet pan (18"x26"x1") or two half-size sheet pans (18"x13"x1") per rack position. Full-size convection ovens can cook close to 100 pounds of russet potatoes per hour, which are used as the reference food in the industry test procedure. A half-size oven can accommodates one half-size sheet pan (18"x13"x1) per rack position.

Figure 6 below shows a half-size and a full-size convection oven made by Southbend.

37 CEC staff estimated the total commercial oven inventory in California using the market data from North American Association of Food Equipment Manufacturers and the ENERGEY STAR penetration rate.

Figure 6: Half-Size and Full-Size Convection Ovens



(a) Half-size convection oven. (b) Full-size convection oven.

Source: southbend.com

Combination Ovens

A combination oven, as the name indicates, is a cooking device that can use a combination of hot-air convection and steam heating to cook food. A combination oven can be operated in one of three modes: convection, steam, and combination mode. Combination ovens offer steam-cooking capabilities and advanced recipe programming but can be two to four times more expensive than convection ovens of similar capacity. Combination ovens are also referred to as *combi ovens*.

Combination ovens generate steam using one of two methods. In the first method, a boiler or cauldron generates steam within a steam generator located outside the cooking chamber. Steam is then fed into the cooking chamber as needed. In the second method, an injection system generates steam directly inside the cooking chamber by spritzing water onto the heating element of a heat exchanger. The oven operator can control the humidity level from 0 percent to 100 percent. Combinations ovens are a good fit for many culinary applications, including baking, roasting, grilling, steaming, braising, blanching, and poaching.

Combination ovens come in different sizes. They typically use food pans with dimensions corresponding to the Gastronorm specifications (GN pans),[38] often referred to as *steam pans*. Common combination oven sizes include full-size, half-size, and 2/3-size. A full-size combination oven can accommodate two full-size steam pans or GN 1/1 pans (12.8”x20.8”x2.5”) per rack position. A half-size combination oven can accommodate one full-size steam pan (12.8”x20.8”x2.5”) per rack position. A 2/3-size combination oven can accommodate a 2/3-size steam pan or GN 2/3 pan (12.8”x13.8”x2.5”) per rack position. The 2/3-size combination oven may also be referred to as mini-size combination oven. The steam

38 Webstaurant Store. September 17, 2025. “A Guide to Food Pans,” https://www.webstaurantstore.com/guide/556/food-pan-buying-guide.html?srsltid=AfmBOorOrB0efYOgVUY2WXyrQK_YJjlU0j4r41y-IocNaIjK6HLLu_1Q.

pans have different dimensions than the sheet pans used for convection ovens. Since a full-size sheet pan (18”x26”) is larger than a full-size steam pan (12.8” x 20.8”), a full-size combination oven can accommodate either two full-size steam pans or one full-size sheet pan per rack position.

Like convection ovens, the combination ovens on the market are powered either by gas (including natural gas and propane) or electricity. Combination ovens can operate at temperatures ranging from 150°F to 500°F. However, most recipes range from 325°F to 375°F, and steaming is done at 212°F.

Figure 7 below shows a half-size and a full-size combination oven made by Alto-Shaam.

Figure 7: Half-Size and Full-Size Combination Ovens



(a) Half-Size Combination Oven. (b) Full-Size Combination Oven.

Source: alto-shaam.com

Rack Ovens

A rack oven is a high-capacity oven that uses a rack or cart system to hold multiple baking pans. It is fitted with a motor-driven mechanism for rotating multiple pans within the oven cavity. Rack ovens are mostly used for baking bread, pastries, cookies, and cakes.

Rack ovens come in different sizes. The most common sizes include single-rack and double-rack ovens, with double-rack ovens being more popular due to their higher capacity. A single-rack oven can accommodate one removable single rack of full-size sheet pans (18”x26”x1”). A double-rack oven can accommodate two removable single racks of full-size sheet pans (18”x26”x1”) or one removable double-width rack.

A rack oven can be heated either by gas (including natural gas and propane) or electricity. Rack ovens usually operate between 325°F and 400°F.

Figure 8 below shows a single-rack oven and a double-rack oven made by Revent.

Figure 8: Single-Rack and Double-Rack Ovens



(a) Single-rack oven. (b) Double-rack oven.

Source: revent.com

Conveyor Ovens

A conveyor oven uses a moving belt to transport food through a heated chamber. This design allows for a consistent and regulated cooking process and enables large volumes of food to be cooked with very little chef supervision. The ease of these ovens has made them popular for producing multiple pizzas in a short period and are especially effective in operations with limited menus and fast service.

A conveyor oven can be powered by either gas (including natural gas and propane) and electricity.

Figure 9 below shows a conveyor oven made by Cooking Performance Group.

Figure 9: A Conveyor Oven



Source: cookingperformancegroup.com

Deck Ovens

A deck oven cooks food directly on the floor of a heated chamber. The bottom of each compartment is called a *deck* and can be made of metal, stone, brick, or ceramic tiles. Heat is typically supplied by burners or elements located below each deck. The oven ceiling, floor, and walls are designed to absorb heat quickly and radiate that heat back slowly and evenly. Deck ovens are frequently seen in bakeries and pizzerias.

A deck oven can be heated either by gas (including natural gas and propane) or electricity.

Figure 10 below shows a deck oven made by Bleshaw.

Figure 10: A Deck Oven



Source: belshaw.com

High-Speed Ovens

A high-speed oven uses one or more nontraditional heat transfer technologies to cook food. The nontraditional heat transfer technologies used in high-speed ovens include quartz halogen, microwave, and high-velocity, hot-air impingement. High-speed ovens are also referred to as *rapid cook ovens*.

High-speed or rapid cook ovens are commonly used in food service businesses and restaurants for a variety of purposes, including reheating meals, melting cheese, and cooking various items like chicken breasts and pizzas. Although some high-speed ovens include microwave heating features or combine microwave heating with other heat sources, typical stand-alone, single-heat-source microwave ovens are not included in this category.

Figure 11 below shows a high-speed oven made by Panasonic.

Figure 11: A High-Speed Oven



Source: panasonic.com

Other Ovens

There are many other types of commercial ovens on the market, including but not limited to:

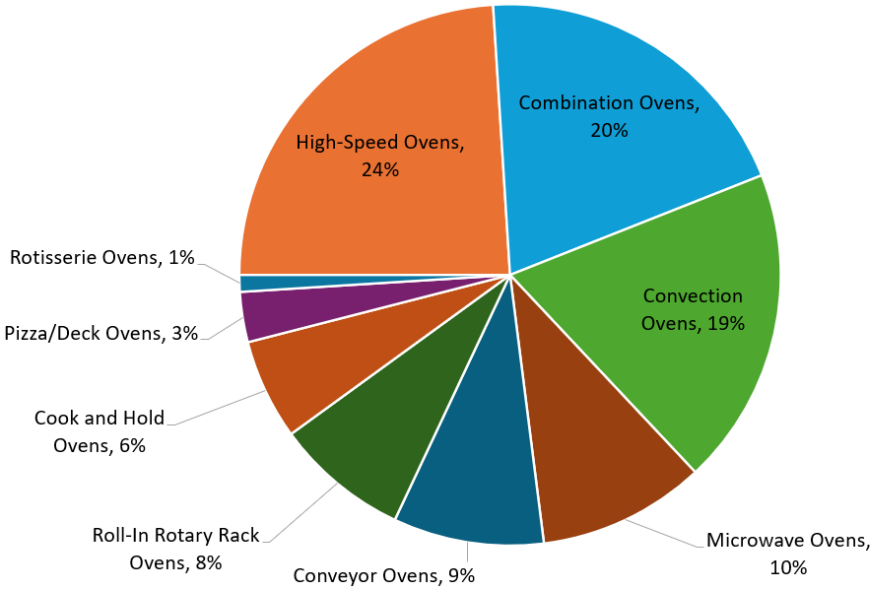
- **Rotisserie ovens** — An oven that features a mechanism to move or turn food around a fixed heat source while the food is slowly being cooked on all sides. A rotisserie oven can be powered by either gas (including natural gas and propane) or electricity. One popular use of rotisserie ovens is cooking whole chickens.
- **Range ovens** — An oven base for a commercial range top (that is, burners, electric elements, or hobs). Range ovens may use either standard or convection technologies to cook food.
- **Cook-and-hold ovens** — An oven designed specifically for low-temperature (< 300°F) cooking, followed by a holding period at a specified temperature.
- **Hearth ovens** — An oven designed with an open doorway and dome-shaped interior, usually composed of high-temperature refractory ceramic or concrete.
- **Rotating tray/reed ovens** — An oven with a motor-driven Ferris wheel device.
- **Microwave ovens** — An oven in which foods are heated or cooked when they absorb microwave energy generated by a magnetron.

Market Characteristics

According to NAFEM market data,[39] the breakdown of oven sales by revenue in 2022 is shown in Figure 12 below. When ranking by sales by revenue, the three types of ovens with the highest market share are high-speed ovens, combination ovens, and convection ovens.

39 *Size and Shape of the Industry*, a market analysis performed by North American Association of Food Equipment Manufacturers (NAFEM), 2022. A copy of the analysis report can be obtained by contacting NAFEM at https://nafem.org/about/contact/.

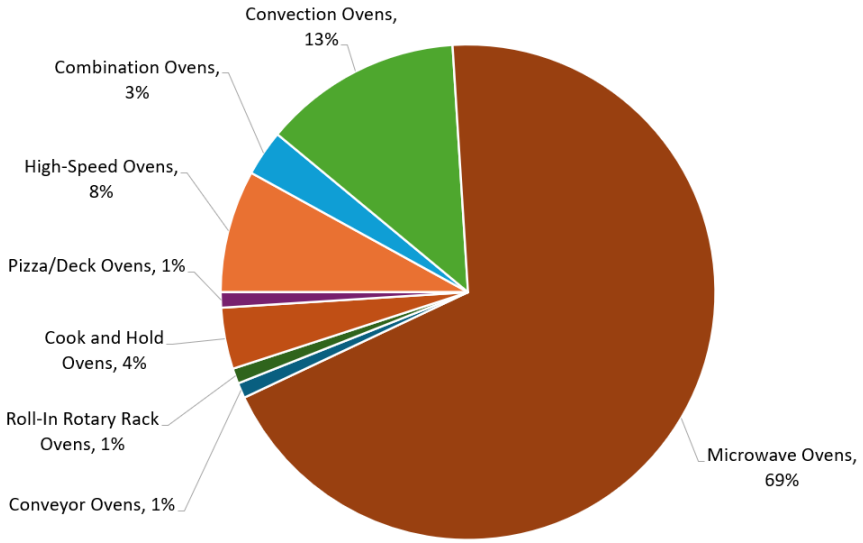
Figure 12: Market Share of Commercial Ovens by Sales Revenue in 2022



Source: CEC staff reproduced this graph using the information in IOU CASE Team's proposal,[40] which referenced NAFEM's market data.

Figure 13 below shows commercial oven market data by sales numbers in 2022. Microwave ovens have a dominant market share by sales numbers, followed by convection and high-speed ovens.

Figure 13: Market Share of Commercial Ovens by Sales Numbers in 2022

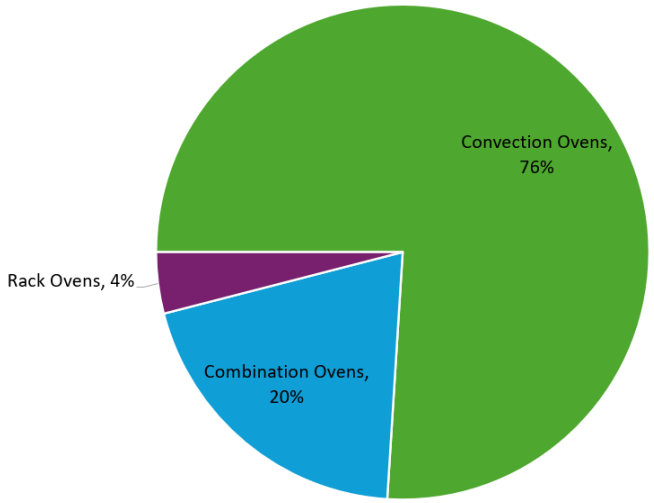


Source: CEC staff reproduced this graph using the information in IOU CASE Team's proposal which referenced NAFEM's market data.

40 Livchak, Denis, Rezvan Mohammadiziazi, Dong-Hyeon Joh, Jasmine Shepard, Sean Steffensen, and Helen Davis, November 21, 2024, *Food Service T20 CASE Report RFI Response Commercial Ovens*, https://efiling.energy.ca.gov/GetDocument.aspx?tn=260264&DocumentContentId=96480.

The ENERGY STAR v3.0 specifications only cover three types of commercial ovens: convection, combination, and rack ovens. Based on the commercial ovens market share by sales numbers, the percentages of these three types of ovens are shown in Figure 14 below.

Figure 14: Commercial Ovens Covered by ENERGY STAR v3.0 Specifications by Sales Numbers



Source: CEC staff reproduced this graph using the information in IOU CASE Team's proposal which referenced NAFEM's market data.

As one can see from the figure, convection ovens make up 76 percent of the ovens covered by ENERGY STAR v3.0. Combination ovens make up 20 percent, and the remaining 4 percent are rack ovens.

Rented and Leased Commercial Ovens

Several providers in California offer rental and leasing services for commercial foodservice equipment. For example, Del Rey Party Rentals is a company located in Los Angeles offering short-term rentals for catering, events, and temporary setup.[41] Light Soda On Tap is a company located in the San Francisco Bay Area offering long-term rentals for restaurants, bars, and ghost kitchens[42] with commercial foodservice equipment, such as ranges, ovens, fryers, and refrigerators.[43] Fantastic Kitchen and Juice is a company located in Sacramento offering commercial foodservice equipment leasing and sales.[44]

A market research by Fortune Business Insights valued the global commercial cooking equipment market size to be $40.7 billion in 2026 and projected it to grow to $60.48 billion by

41 Del Rey Party Rentals, https://delreypartyrentals.com.

42 A ghost kitchen is a professional food preparation facility that operates entriely without a traditional storefront, dining room, or walk-in customer seating, fulfilling orders exclusively through delivery apps and online ordering platform.

43 Light Soda On Tap, https://www.lightsodaontap.com.

44 Fantastic Kitchen and Juice, https://www.fantastickitchenandjuice.com.

2034.[45] A market research by Market Research Intellect valued the global commercial kitchen equipment for the rental market to be approximately $911 million in 2026 and projected it to grow to $1.83 billion by 2035.[46] Assuming the California market is proportional to the global market, the rental and lease market share in the state for commercial foodservice equipment is approximately 2.2 percent of the total market in 2026. The Market Research Intellect report also explained that the commercial foodservice equipment market is evolving towards more agile and cost-effective business models, and that the rental and lease market share is expected to grow in the coming years due to increased focus on the following factors:

- Cost efficiency: Renting and leasing commercial ovens provides flexibility for businesses seeking to optimize operational efficiency without significant upfront capital expenditure.
- Technology refresh: Quick-service restaurants and ghost kitchens frequently lease advanced convection and combination ovens to easily upgrade to the latest technology, including ventless and smart-connectivity.

Energy and Water Performance Metrics

Commercial ovens consume energy and, in several cases, water during operation. This section discusses some performance metrics used in evaluating the energy and water efficiency of commercial ovens. The exact methods for calculating these metrics are specified in the industry test methods discussed in Chapter 6.

Preheat Energy

Preheat energy is the amount of energy consumed by the oven while preheating the cavity from ambient temperature to a specified thermostat set point. It is expressed in British thermal units (Btu) or kilowatt-hours (kWh).

Cooking Energy Efficiency

Cooking energy efficiency is defined as the ratio of the quantity of energy absorbed by the food product to the quantity of energy input to the oven during the cooking event. Cooking energy efficiency is expressed in percentage (%).

Idle Energy Rate

Idle energy rate is defined as the rate of oven energy consumption while it is maintained or held at a stabilized operation condition or temperature. It is also called *standby energy rate* and expressed in British thermal units per hour (Btu/hr) or kilowatts (kW).

Water Consumption Rate

Combination oven water consumption rate — This is the water consumed during idle and heavy-load cooking periods in steam and convection mode, expressed as gallons per hour per steam pan (gal/hr/pan) during idle and gallons per steam pan (gal/pan) during cooking.

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45 Fortune Business Insights, "*Commercial Cooking Equipment Market Size, Share, and industry Analysis*", https://www.fortunebusinessinsights.com/commercial-cooking-equipment-market-110517.

46 Market Research Intellect, "*Commercial Kitchen Equipment for Rent Market Size, Share, Scope and Forecast 2035*", https://www.marketresearchintellect.com/download-sample/?rid=262474/?utm_source=Pulse-Aug-F4&utm_medium=820.

Gallons per hour per pan and gallons per pan are based on GN 1/1 steam pans for full-size and half-size combination ovens and GN 2/3 pans for 2/3-size combination ovens.

Convection oven water consumption rate — This is the water consumed during the moisture/steam injection mode. It is expressed as gallons per minute (gal/min).

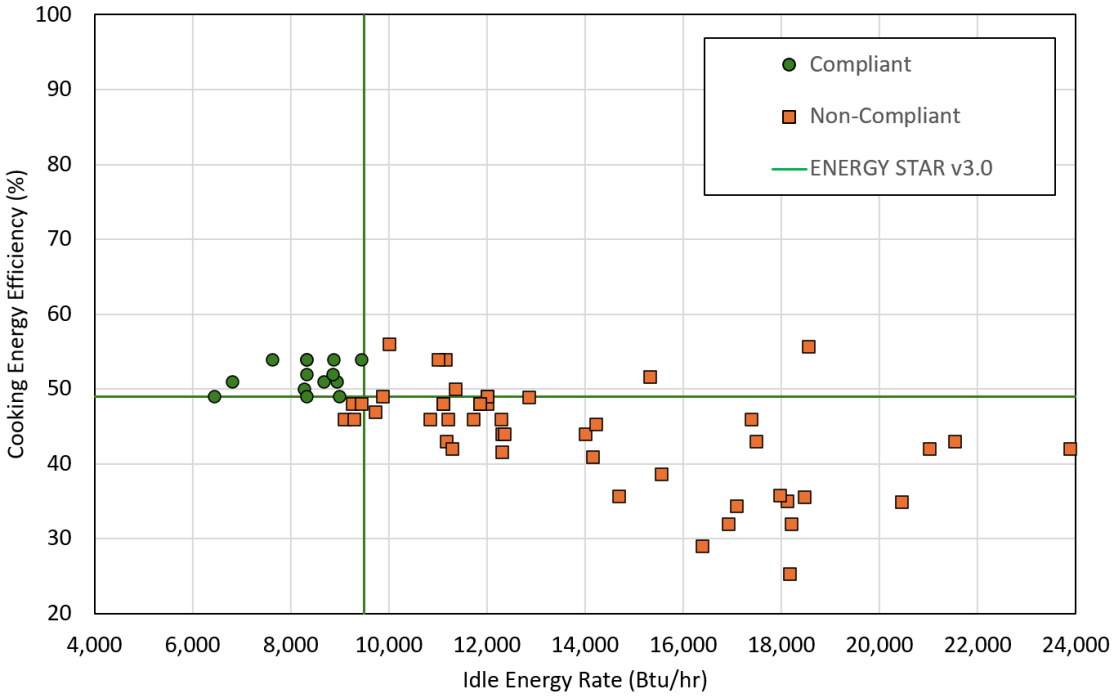
Rack oven water consumption rate — This is the water consumed during the moisture/steam injection mode. It is expressed as gallons per minute (gal/min).

Performance Analysis of Available Ovens

Convection Ovens

For convection ovens, cooking energy efficiency and idle energy rate are the key performance metrics. Figure 15 below shows the performance data of the full-size gas ovens found in the ENERGY STAR[47] and CA eTRM[48] databases. Figure 15 shows a wide range of energy performance for full-size gas convection ovens. The cooking efficiencies range from 26 percent to 56 percent. The idle energy rates range from 6,400 Btu/hr to 24,000 Btu/hr.

Figure 15: Performance of Available Full-Size Gas Convection Ovens



Source: CEC staff

The ENERGY STAR v3.0 requirements in idle energy rate and cooking energy efficiency are also plotted as vertical and horizontal green lines on the graph. For a convection oven to be

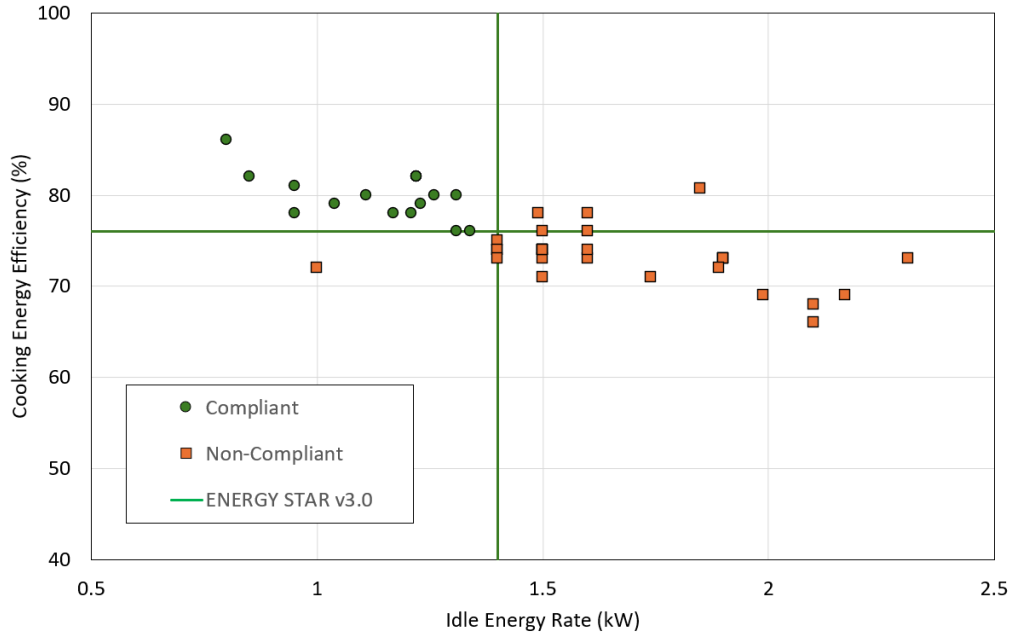
47 ENERGY STAR. "ENERGY STAR Certified Commercial Ovens," https://www.energystar.gov/productfinder/product/certified-commercial-ovens/results.

48 "California Electronic Technical Reference Manual," https://www.caetrm.com/.

ENERGY STAR-compliant, it must have both equal or lower idle energy rate and equal or higher cooking energy efficiency than the ENERGY STAR v3.0 requirements. Mapping the requirements back to the graph, the oven data points located in the upper left section of the green lines are compliant, while the oven data points located in the other sections are noncompliant. In the figure, green circles represent compliant ovens, and orange squares represent noncompliant ovens. As one can see from the graph, most ovens do not comply with the ENERGY STAR v3.0 specifications, and they would need design changes to improve cooking energy efficiency or idle energy rate or both to become compliant.

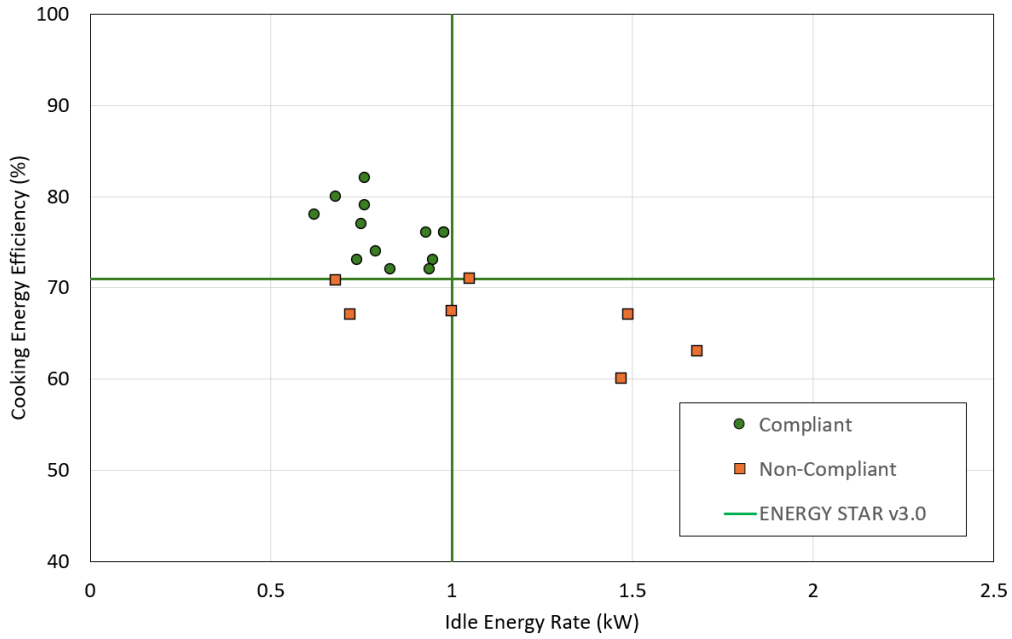
Figure 16 and Figure 17 below show the performance data of the full-size and half-size electric ovens found in the ENERGY STAR and CA eTRM databases, respectively. The graphs show a wide range of energy performance for full-size and half-size electric convection ovens. Again, the green circles located in the upper left section of the green lines are compliant, while the orange squares located in the other sections are noncompliant.

Figure 16: Performance of Available Full-Size Electric Convection Ovens



Source: CEC staff

Figure 17: Performance of Available Half-Size Electric Convection Ovens



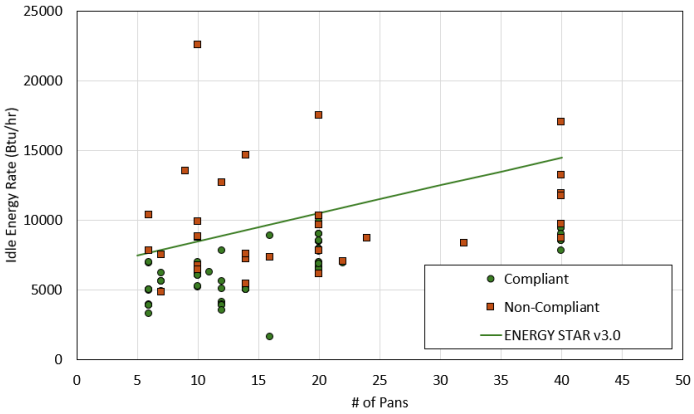
Source: CEC staff

Combination Ovens

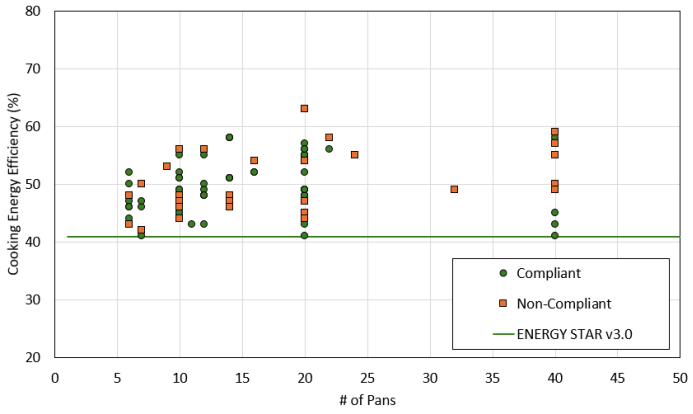
As mentioned earlier, a combination oven can be operated in one of three modes: convection mode, steam mode, and combination mode. The energy usage and performance vary in different modes.

Figure 18 below shows the performance data of gas combination ovens (including full-size and half-size ovens) found in the ENERGY STAR and CA eTRM databases. There are four graphs in the figure. Each graph shows either the idle energy rate or cooking energy efficiency with respect to the pan capacity in steam or convection mode. The cooking energy efficiencies in convection mode are higher than those in steam mode, while the idle energy rates in convection mode are lower than those in steam mode. Accordingly, the energy efficiency requirements in the ENERGY STAR v3.0 specifications are different in different modes, which are plotted as green lines in the graphs.

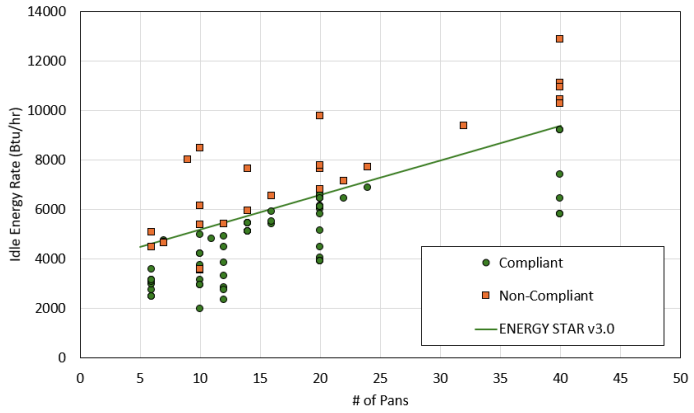
Figure 18: Performance of Available Gas Combination Ovens



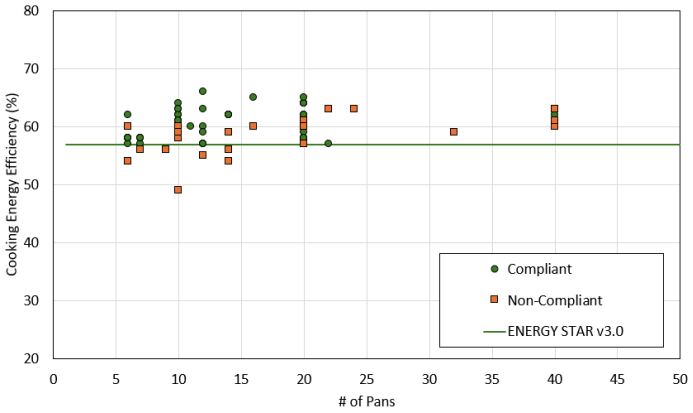
(a) Idle Energy Rate, Steam Mode.



(b) Cooking Energy Efficiency, Steam Mode.



(c) Idle Energy Rate, Convection Mode.



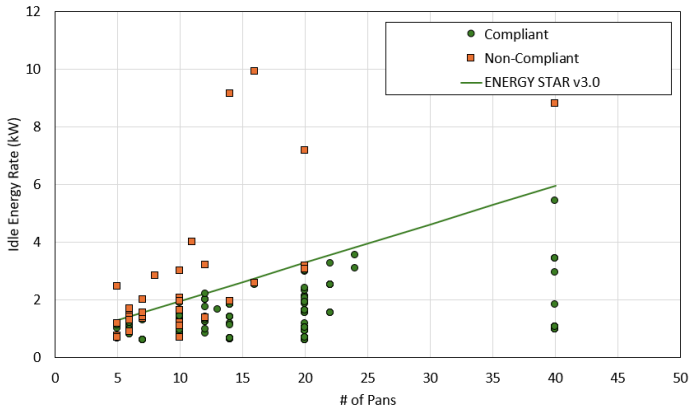
(d) Cooking Energy Efficiency, Convection Mode.

Source: CEC staff

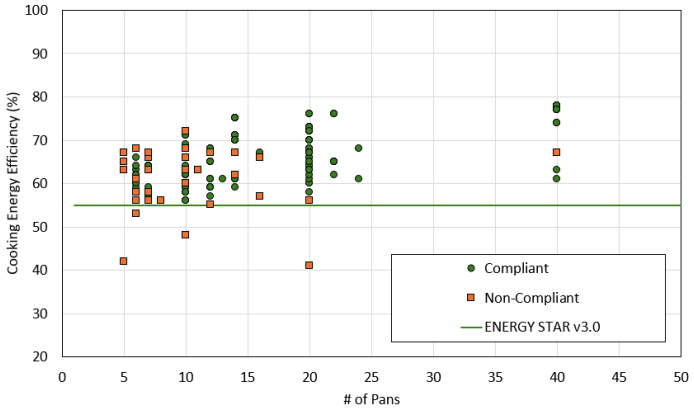
For a combination oven to comply with ENERGY STAR v3.0, it must meet or exceed the idle energy rate criteria and cooking energy efficiency criteria in both steam and convection modes. This is why one, for example, can see noncompliant units below the green line in Figure 18(a). Those units meet the ENERGY STAR v3.0 criteria for idle energy rate in steam mode but fail one of the other three requirements required to comply with ENERGY STAR v3.0.

Figure 19 below shows the performance data of electric combination ovens (including full-size and half-size ovens). Similarly, there are four graphs in the figure with each graph showing the idle energy rate or cooking energy efficiency in steam or convection mode.

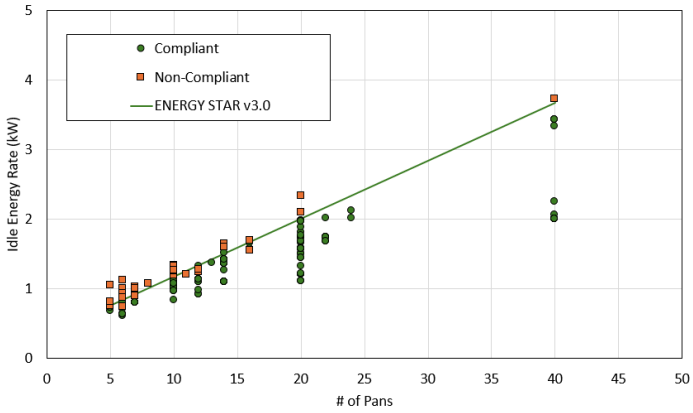
Figure 19: Performance of Available Electric Combination Ovens



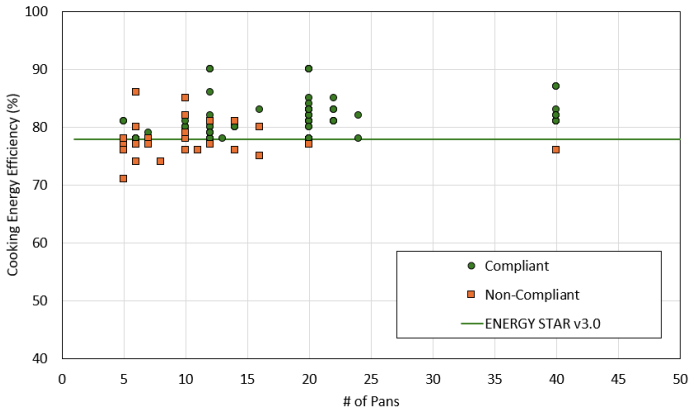
(a) Idle Energy Rate, Steam Mode.



(b) Cooking Energy Efficiency, Steam Mode.



(c) Idle Energy Rate, Convection Mode.



(d) Cooking Energy Efficiency, Convection Mode.

Source: CEC staff

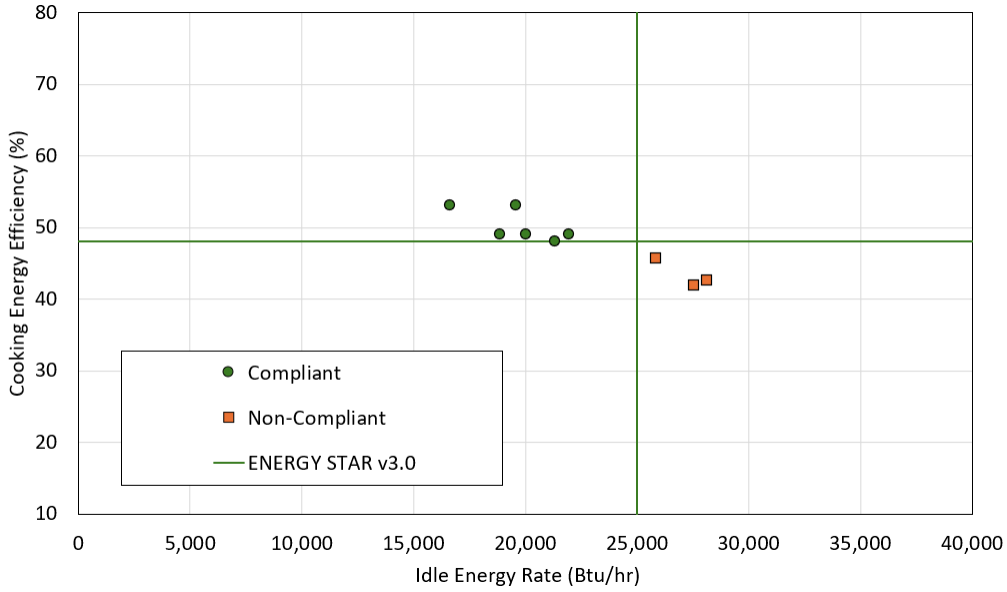
Rack Ovens

Figure 20 and Figure 21 below show the performance data of gas rack ovens found in the ENERGY STAR and CA eTRM databases. Due to the smaller market share of rack ovens, there are fewer models available than convection and combination oven models. The rack oven models available show a wide spread of energy performance and a significant potential for energy efficiency improvement. Among gas rack ovens, 80% are double-rack, and 20% are single-rack, according to the California rebate data.[49]

For single-rack gas ovens, the cooking energy efficiencies range from 42% to 53%, and the idle energy rates range from 16,650 Btu/hr to 28,200 Btu/hr. For double-rack gas ovens, the cooking energy efficiencies range from 47% to 62%, and the idle energy rates range from 19,300 Btu/hr to 47,700 Btu/hr.

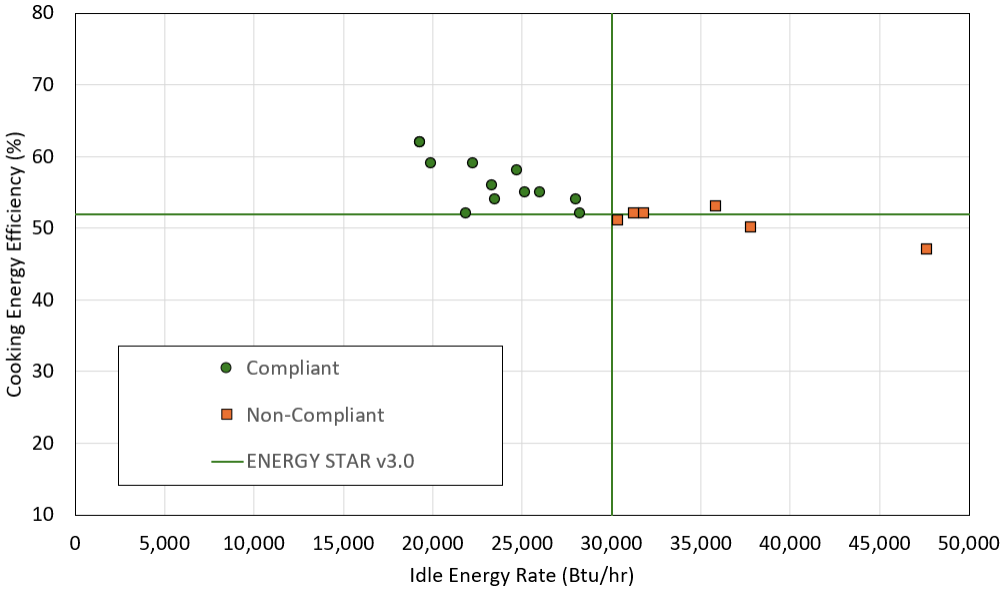
49 CA IOUs Comments – Food Service T20 CASE Report, 2025, page 31.

Figure 20: Performance of Available Single-Rack Gas Ovens



Source: CEC staff

Figure 21: Performance of Available Double-Rack Gas Ovens



Source: CEC staff

CHAPTER 4:
Regulatory Approaches

CEC staff researched and evaluated state, national, and international standards, as well as voluntary energy efficiency programs, stakeholder proposals, and industry test methods, to determine the best approaches to achieving energy and water efficiency standards for commercial ovens in California. This chapter provides an overview of these regulatory approaches, while Chapter 5 provides an evaluation of the most promising alternatives for appliance efficiency regulations for commercial ovens.

Federal Approaches

There is no mandatory federal energy efficiency standard for commercial ovens. However, the U.S. Environmental Protection Agency (EPA) developed the ENERGY STAR program through a process involving market, engineering, and pollution savings analysis, along with input from other EPA programs and industry and nonindustry interested parties. ENERGY STAR sets voluntary performance requirements for various appliances, including commercial ovens[50] and is regarded as an influential model code.

The first version of the ENERGY STAR specifications for commercial ovens was v1.1, which became effective in May 2009. This version included full-size gas and full-size and half-size electric convection ovens in the scope and set performance requirements on cooking energy efficiency and idle energy rate for them.

The second version of the ENERGY STAR specifications for commercial ovens was v2.2, which replaced v1.1 and became effective in October 2015. This version expanded the scope to cover convection ovens (full-size gas, full-size electric, and half-size electric), combination ovens (full-size and half-size gas, full-size and half-size electric), and rack ovens (single-rack and double-rack gas). New performance requirements were set for combination and rack ovens in this version, while the performance requirements for convection ovens were updated to be more stringent.

The latest version of the ENERGY STAR specifications for commercial ovens is v3.0, which went into effect in January 2023. Compared to v2.2, this version expanded the scope to include a wider range of pan capacities, including 2/3-size combination ovens. The performance requirements for convection ovens and combination ovens were updated to be more stringent than those in v2.2, while the performance requirements for rack ovens remained the same as v2.2.

50 ENERGY STAR. "Commercial Ovens", https://www.energystar.gov/products/commercial_ovens/.

California Regulations

In California, there are established test-and-list requirements for commercial convection ovens under Title 20 of the California Code of Regulations.[51] There are no performance standards for commercial convection ovens. The manufacturers are required to test their convection ovens per the test method specified in ASTM F1496-99 and certify the ovens' input energy rate and idle energy consumption rate to the CEC for publication in the agency's database of certified appliance data. These requirements remain unchanged from the initial adoption in 2002, and as of this writing, there are 300 commercial convection oven models listed in CEC's database.

Other types of commercial ovens, such as combination and rack ovens, are not regulated under Title 20 of California Code of Regulations.

The California Energy Code, under Title 24, Part 6, Section 140.9(b), specifies prescriptive requirements for commercial kitchens focusing on ventilation rather than oven energy performance. Section 120.6(k) adds mandatory requirements for electric readiness for newly constructed commercial kitchens:[52]

- Quick-service commercial kitchens and institutional commercial kitchens shall include a dedicated branch circuit wiring and outlet that would be accessible to cookline appliances and shall meet all the following requirements:
    1. The branch circuit conductors shall be rated 50 amps minimum.
    2. The electrical service panel shall have a minimum capacity of 800 connected amps.
- The electrical service panel shall be sized to accommodate an additional either 208V or 250V 50-amperes (amp) breaker.

California Foodservice Instant Rebate Program

California Energy Wise[53] manages the California Foodservice Instant Rebates Program, which offers incentives for qualified efficient commercial ovens. Nonresidential customers of Southern California Gas Company (SoCalGas), Pacific Gas and Electric Company (PG&E), Southern California Edison Company (SCE), and San Diego Gas and Electric Company (SDG&E) are eligible to receive instant rebates for commercial convection, combination, rack, conveyor, and deck ovens, as follows:

- The CA IOUs offer incentives for energy-efficient gas and electric convection ovens. For gas convection ovens, an incentive of $600 is offered for Tier 1 efficient ovens (cooking energy efficiency ≥ 49% and idle energy rate ≤ 9,500 Btu/hr), and an incentive of $750 is offered to Tier 2 efficient ovens (cooking energy efficient ≥ 51% and idle energy rate ≤ 7,500 Btu/hr). For electric convection ovens, an incentive of $600 is offered for full-size electric ovens, and an incentive of $450 is offered for half-size electric ovens.

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51 California Appliance Efficiency Regulations (Title 20), https://govt.westlaw.com/calregs/Browse/Home/California/CaliforniaCodeofRegulations?guid=ID0318F505CCE11EC9220000D3A7C4BC3&transitionType=Default&contextData=%28sc.Default%29.

52 California Energy Commission. July 2025. *2025 Building Energy Efficiency Standards for Residential and Nonresidential Buildings*, https://www.energy.ca.gov/sites/default/files/2025-07/CEC-400-2025-010-F_0.pdf.

53 California Energy Wise, available at https://caenergywise.com/rebates/.

These incentives are part of the California Energy Wise point-of-sale commercial food service rebate program for ovens that meet or exceed ENERGY STAR v3.0 requirements.

- The CA IOUs offer incentives for energy-efficient gas and electric combination ovens. Depending on the pan capacity, an incentive of $700–$1200 is offered for combination ovens regardless of whether they are gas or electric ($700 for ovens with pan capacity less than 15, $1,000 for ovens with pan capacities between 15 and 28, and $1,200 for ovens with pan capacities greater than 28). These incentives are part of the California Energy Wise point-of-sale commercial food service rebate program for ovens that meet or exceed ENERGY STAR v3.0 requirements.
- The CA IOUs offer $2,000 incentives for single-rack or double-rack ovens that meet or exceed 50% cooking energy efficiency through the California Energy Wise point-of-sale commercial food service rebate program. The rebate criteria differ from the ENERGY STAR requirements. The 50% cooking efficiency threshold falls between the ENERGY STAR threshold of 48% for single-rack and 52% for double-rack ovens.
- The CA IOUs offer incentives of $1,200 per cavity for gas conveyor ovens. These incentives are part of the California Energy Wise point-of-sale commercial food service rebate program. Qualifying models must have a baking energy efficiency equal to or greater than 42% and an idle energy rate equal to or less than 57,000 Btu/hr.
- The CA IOUs offer incentives of $1,500 per cavity for electric deck ovens. These incentives are part of the California Energy Wise point-of-sale commercial food service rebate program. Qualifying models must have a tested heavy-load cooking efficiency equal to or greater than 60% and an idle energy rate equal to or less than 1.30 kW.

Regulations in Other States

CEC staff's research found that seven states have adopted energy efficiency regulations for commercial ovens with scope and performance requirements aligned with ENERGY STAR specifications. Colorado[54] has adopted the requirement of ENERGY STAR v3.0 in its appliance efficiency regulations, while six other states — Washington,[55] Nevada,[56] Rhode Island,[57] New Jersey,[58] New York,[59] and Massachusetts[60] — have adopted the requirement of ENERGY STAR v2.2 in their appliance efficiency regulations.

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54 Colorado House Bill 23-1161, https://leg.colorado.gov/sites/default/files/2023a_1161_signed.pdf.

55 Washington House Bill Report HB 1619, https://lawfilesext.leg.wa.gov/biennium/2021-22/Pdf/Bill%20Reports/House/1619%20HBR%20ENVI%2022.pdf.

56 Nevada Assembly Bill 383, https://www.leg.state.nv.us/App/NELIS/REL/81st2021/Bill/7985/Text.

57 Rhode Island Assembly Bill 5966, http://webserver.rilin.state.ri.us/BillText/BillText21/HouseText21/H5966A.pdf.

58 New Jersey Assembly Bill 5160, https://pub.njleg.state.nj.us/Bills/2020/A9999/5160_I1.PDF.

59 New York 21 CRR-NY 509.8, https://govt.westlaw.com/nycrr/Document/If3b7754e5b3b11f0953afa8605889866?viewType=FullText&originationContext=documenttoc&transitionType=CategoryPageItem&contextData=(sc.Default).

60 Massachusetts 225 CMR, https://www.mass.gov/doc/225-cmr-900-appliance-standards-regulation/download.

International Regulations

CEC staff's research found no international energy efficiency standards for commercial ovens.

Stakeholder Proposals

IOU CASE Team Proposal

The investor-owned utilities codes and standards enhancement team (IOU CASE Team) is a collaborative group sponsored by California's IOUs to conduct technical, economic, and market research to support updates to California's clean energy regulations. In November 2024, the IOU CASE Team submitted a report in response to the CEC's RFI and ITSP published September 4, 2024.[61] The IOU CASE Team performed market analysis, energy and water savings calculations, and financial analysis on commercial ovens and proposed the following:

- Adopting definitions substantially similar to those in the ENERGY STAR v2.2 specifications for commercial ovens.
- Aligning the performance requirements of commercial convection ovens with ENERGY STAR v2.2.
- Aligning the performance requirements of commercial combination ovens with ENERGY STAR v3.0.
- Aligning the performance requirements of commercial rack ovens with ENERGY STAR v3.0.
- Adopting the most recent ASTM test procedures for convection, combination, and rack ovens.
- Excluding other types of commercial ovens from efficiency standards.

The IOU CASE team estimated that, after implementing its proposed standards and achieving full stock turnover, California would annually save 20.78 GWh of electricity, 9.26 million therms of natural gas, 79.4 million gallons of water, and $13.5 million in utility bills.

Earthjustice Proposal

Earthjustice is a nonprofit environmental law organization. On November 26, 2024, Earthjustice submitted a proposal in response to CEC's RFI and ITSP published September 4, 2024.[62] In its response, Earthjustice proposed the following:

- For electric commercial ovens, aligning energy and water efficiencies with the ENERGY STAR v3.0 specifications.

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61 Livchak, Denis, Rezvan Mohammadiziazi, Dong-Hyeon Joh, Jasmine Shepard, Sean Steffensen, and Helen Davis, November 21, 2024, *Food Service T20 CASE Report RFI Response Commercial Ovens*, https://efiling.energy.ca.gov/GetDocument.aspx?tn=260264&DocumentContentId=96480.

62 Earthjustice Comments on Title 20 Commercial Oven Efficiency Standards, https://efiling.energy.ca.gov/GetDocument.aspx?tn=260295&DocumentContentId=96514.

- For gas commercial ovens, adopting more stringent efficiency standards than the ENERGY STAR v3.0 specifications to encourage more electrification of commercial ovens. Earthjustice claims doing so will not incur additional incremental costs.
- Expanding the scope of the proceeding to include additional types of commercial ovens such as pizza/deck ovens, conveyor ovens, slow cook-and-hold ovens, and high-speed ovens.
- Using the gradual transformation forecast from CEC's I*ntegrated Energy Policy Report (IEPR)* for gas prices in CEC's cost-effectiveness analysis to better reflect the expected future increase in gas prices.

The CEC considered Earthjustice's proposal in staff's energy and water savings analysis and cost-effectiveness analysis for commercial ovens. Please refer to Chapter 5 of this report for details.

Industry Test Methods

ASTM International[63] has developed standard test methods to measure the performance of various types of commercial ovens. California rebate program also determines the eligibility of the applicable ovens based on the performance tested using ASTM standards.

Table 1 below lists the current ASTM test methods for different types of commercial ovens.

Table 1: Current ASTM Test Methods for Commercial Ovens

Oven Type	ASTM Test Method
Convection Ovens	ASTM F1496-13 (2019)
Combination Ovens	ASTM F2861-24
Rack Ovens	ASTM F2093-18 (2023)
Conveyor Ovens	ASTM F1817-17 (2022)
Deck Ovens	ASTM F1965-17 (2022)
Rapid Cook Ovens	ASTM F2238-20

Source: ASTM International website (astm.org)

63 ASTM International, available at https://www.astm.org/.

CHAPTER 5:
Alternative Considerations

CEC staff considered a baseline scenario and three alternative proposals to determine the most cost-effective and technically feasible energy efficiency standard for commercial ovens. The alternatives included potential standards from staff research and from proposals submitted to the docket by the stakeholders for this proceeding. In this chapter, the baseline scenario and the three alternatives are briefly discussed first. Then the three alternatives are compared from different perspectives based on CEC staff's analysis.

Baseline — No Standard (Do Nothing)

Were the CEC to choose not to establish efficiency standards for commercial ovens, the existing baseline would not be expected to change. No costs would be imposed, and no energy and water savings would be achieved relative to current conditions. Staff believes that proposing no standard for commercial ovens would represent a lost opportunity for energy and water savings in California and would not contribute to meeting the state's air quality, greenhouse gas emission reduction, and energy efficiency goals.

Three Alternatives

Alternative 1: Aligning Standard With ENERGY STAR V2.2

Under Alternative 1, CEC staff would propose aligning the energy efficiency standard for commercial ovens with the ENERGY STAR v2.2 (ES v2.2) specifications.[64] ENERGY STAR v2.2 became effective in October 2015 and has been widely adopted in the food service equipment industry. The scope includes gas and electric convection ovens, gas and electric combination ovens, and gas rack ovens. The ENERGY STAR v2.2 specifications do not have requirements on water consumption rate for commercial ovens.

It is estimated that 48% of convection ovens, 75% of combination ovens, and 70% of rack ovens on the market comply with ENERGY STAR v2.2.[65]

Alternative 2: Aligning Standard With ENERGY STAR V3.0

Under Alternative 2, CEC staff would propose aligning energy and water efficiency standards for commercial ovens with the ENERGY STAR v3.0 (ES v3.0) specifications.[66] ENERGY STAR v3.0 went into effect in January 2023. Compared to ENERGY STAR v2.2, it slightly expands the scope of covered commercial ovens. ENERGY STAR v3.0 also adopts more stringent energy

64 ENERGY STAR. *ENERGY STAR Program Requirements for Commercial Ovens v2.2 Specifications*, https://www.energystar.gov/sites/default/files/Commercial%20Ovens%20Final%20Version%202.2%20Specification_0.pdf.

65 CA IOU CASE Team, Food Service T20 CASE Report RFI Response Commercial Ovens, page 54.

66 ENERGY STAR. *ENERGY STAR Program Requirements for Commercial Ovens v3.0 Specifications*, https://www.energystar.gov/sites/default/files/ENERGY%20STAR%20Version%203.0%20Commercial%20Ovens%20Final%20Specification_0.pdf.

efficiency requirements for commercial convection and combination ovens and adds requirements on water consumption rate for commercial combination ovens.

Alternative 3: Earthjustice-Proposed Standard

Under Alternative 3, CEC staff considered the standard proposal submitted by Earthjustice in its response to the CEC's RFI and ITSP.[67]

In its proposal, for electric ovens, Earthjustice proposed aligning the energy and water efficiency requirements with those of the ENERGY STAR v3.0 specifications. For gas ovens, Earthjustice proposed a more stringent efficiency standard with the intention to move the commercial oven market toward electrification.

Comparison of Three Alternatives

CEC staff reviewed, analyzed, and compared the three alternatives from different perspectives, including scope, energy and water efficiency requirements, potential energy and water savings, cost-effectiveness, and product availability. The results are discussed below.

Scope

Table 2 below compares the scope of the included products among the three alternatives. Compared to Alternative 1 (ENERGY STAR v2.2), Alternative 2 (ENERGY STAR v3.0) adds 2/3-size electric combination ovens to the included products and expands the range of pan capacity for gas and electric combination ovens. Alternative 3 (Earthjustice) has the same scope as Alternative 2.

Table 2: Comparison of Scope

	Included Products
Alternative 1 (ES v2.2)	a. Full-size gas and half- and full-size electric convection ovens. b. Half- and full-size gas combination ovens with a pan capacity ≥ 6. c. Half- and full-size electric combination ovens with a pan capacity ≥ 5 and ≤ 20. d. Single and double gas rack ovens.
Alternative 2 (ES v3.0)	a. Full-size gas and half- and full-size electric convection ovens. b. Half- and full-size gas combination ovens with a pan capacity ≥ 5 and ≤ 40. c. Half- and full-size electric combination ovens with a pan capacity ≥ 3 and ≤ 40. d. 2/3-size electric combination ovens with a pan capacity ≥ 3 and ≤ 5. e. Single and double gas rack ovens.
Alternative 3 (Earthjustice)	Same as Alternative 2.

Source: CEC staff

67 Earthjustice Comments on Title 20 Commercial Oven Efficiency Standards.

Energy and Water Efficiency Requirements

The three tables below compare the requirements for energy efficiency and water consumption rate for the three alternatives for commercial convection, combination, and rack ovens, respectively.

Table 3: Comparison of Energy and Water Efficiency Requirements for Commercial Convection Ovens

	Oven Category	Idle Energy Rate (Btu/hr or kW)	Cooking Energy Efficiency (%)	Water Consumption Rate
Alternative 1 (ES v2.2)	Full-Size Gas	≤ 12,000	≥ 46%	No requirements.
	Full-Size Electric	≤ 1.60	≥ 71%	
	Half-Size Electric	≤ 1.00	≥ 71%	
Alternative 2 (ES v3.0)	Full-Size Gas	≤ 9,500	≥ 49%	Reporting water consumption rate in gal/min for moisture/steam injection mode (if applicable).
	Full-Size Electric (Pan Capacity ≥ 5)	≤ 1.40	≥ 76%	
	Full-Size Electric (Pan Capacity < 5)	≤ 1.00		
	Half-Size Electric	≤ 1.00	≥ 71%	
Alternative 3 (Earthjustice)	Full-Size Gas	≤ 9,000	≥ 51%	Same as Alternative 2.
	Full-Size and Half-Size Electric	Same as Alternative 2.		

Source: CEC staff

Table 4. Comparison of Energy and Water Efficiency Requirements for Commercial Combination Ovens

	Oven Category	Idle Energy Rate (Btu/hr or kW)*	Cooking Energy Efficiency (%)	Water Consumption Rate
Alternative 1 (ES v2.2)	Gas (6 ≤ Pan Capacity ≤ 40) – Steam Mode	≤ 200P+6,511	≥ 41%	No requirements.
	Gas (6 ≤ Pan Capacity ≤ 40) – Convection Mode	≤ 150P+5,425	≥ 56%	
	Electric (5 ≤ Pan Capacity ≤ 20) – Steam Mode	≤ 0.133P+0.6400	≥ 55%	
	Electric (5 ≤ Pan Capacity ≤ 20) – Convection Mode	≤ 0.080P+0.4989	≥ 76%	
Alternative 2 (ES v3.0)	Gas (5 ≤ Pan Capacity ≤ 40) – Steam Mode	≤ 200P+6,511	≥ 41%	- When idling: Reporting water consumption rate in gal/hr/pan. - When cooking: • Steam mode: < 0.5 gal/pan. • Convection mode: < 0.4 gal/pan.
	Gas (5 ≤ Pan Capacity ≤ 40) – Convection Mode	≤ 140P+3,800	≥ 57%	
	Electric (5 ≤ Pan Capacity ≤ 40) – Steam Mode	≤ 0.133P+0.6400	≥ 55%	
	Electric (5 ≤ Pan Capacity ≤ 40) – Convection Mode	≤ 0.083P+0.35	≥ 78%	
	Electric (3 ≤ Pan Capacity ≤ 4) and 2/3-Size (3 ≤ Pan Capacity ≤5) – Steam Mode	≤ 0.060P	≥ 51%	

	Oven Category	Idle Energy Rate (Btu/hr or kW)*	Cooking Energy Efficiency (%)	Water Consumption Rate
	Electric (3 ≤ Pan Capacity ≤ 4) and 2/3-Size (3 ≤ Pan Capacity ≤ 5) – Convection Mode	≤ 0.05P+0.55	≥ 70%	
Alternative 3 (Earthjustice)	Gas (5 ≤ Pan Capacity ≤ 40) – Steam Mode	≤ 200P+6,511	≥ 47%	Same as Alternative 2.
	Gas (5 ≤ Pan Capacity ≤ 40) – Convection Mode	≤ 140P+3,800	≥ 62%	
	Electric (5 ≤ Pan Capacity ≤ 40) – Steam Mode	Same as Alternative 2.		
	Electric (5 ≤ Pan Capacity ≤ 40) – Convection Mode			
	Electric (3 ≤ Pan Capacity ≤ 4) and 2/3-Size (3 ≤ Pan Capacity ≤5) – Steam Mode			
	Electric (3 ≤ Pan Capacity ≤ 4) and 2/3-Size (3 ≤ Pan Capacity ≤ 5) – Convection Mode			

* P is the pan capacity of the combination oven. Refer to Section 1602 in Appendix C for the definition of pan capacity.

Source: CEC staff

Table 5: Comparison of Energy and Water Efficiency Requirements for Commercial Rack Ovens

	Oven Category	Idle Energy Rate (Btu/hr)	Cooking Energy Efficiency (%)	Water Consumption Rate
Alternative 1 (ES v2.2)	Single-Rack Gas	≤ 25,000	≥ 48%	No requirements.
	Double-Rack Gas	≤ 30,000	≥ 52%	
Alternative 2 (ES v3.0)	Single-Rack Gas	≤ 25,000	≥ 48%	Reporting water consumption rate in gal/min for steam injection mode (if applicable).
	Double-Rack Gas	≤ 30,000	≥ 52%	
Alternative 3 (Earthjustice)	Single-Rack Gas	≤ 25,000	≥ 55%	Same as Alternative 2.
	Double-Rack Gas	≤ 30,000	≥ 55%	

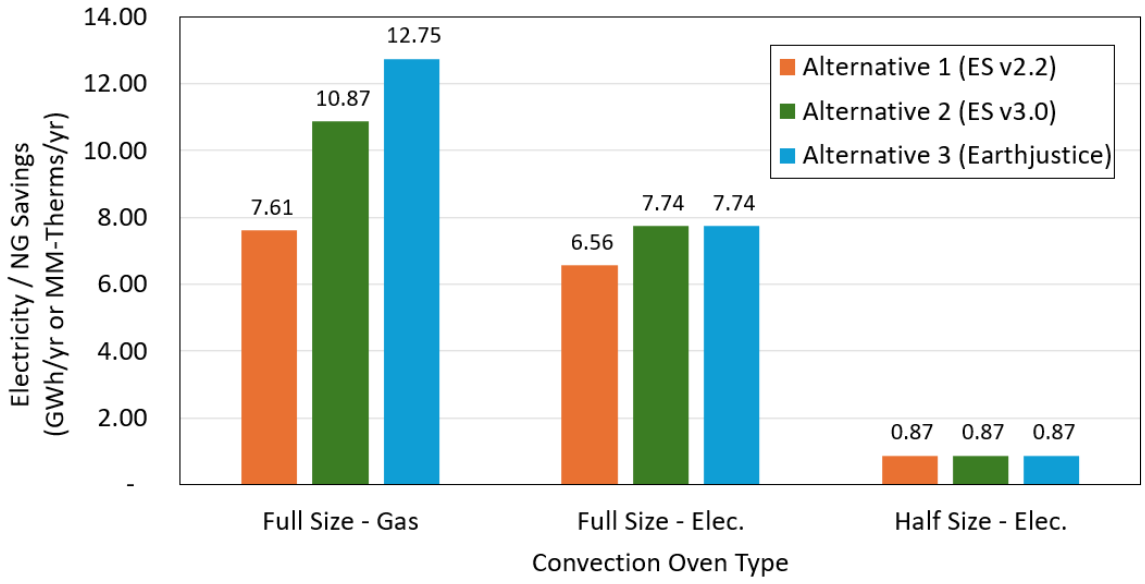
Source: CEC staff

Potential Energy Savings

CEC staff calculated potential statewide energy savings for each of the three alternatives for efficiency standards for commercial ovens. Please refer to Appendix A for details on calculation methods and key assumptions.

Figure 22 below shows the annual statewide energy savings for convection ovens after full stock turnover. All three alternatives result in significant energy savings. The annual natural gas savings range from 7.61 to 12.75 million therms, depending on which alternative standard is selected. The annual electricity savings range from 7.43 to 8.61 GWh (including savings from both full-size and half-size electric ovens).

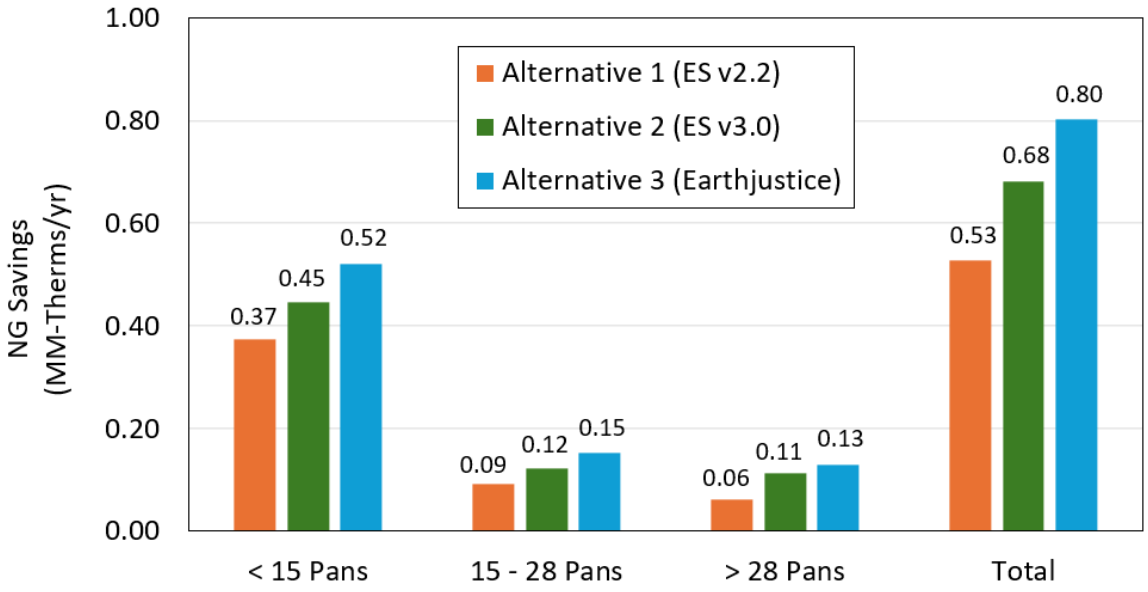
Figure 22: Annual Statewide Energy Savings for Convection Ovens After Full Stock Turnover



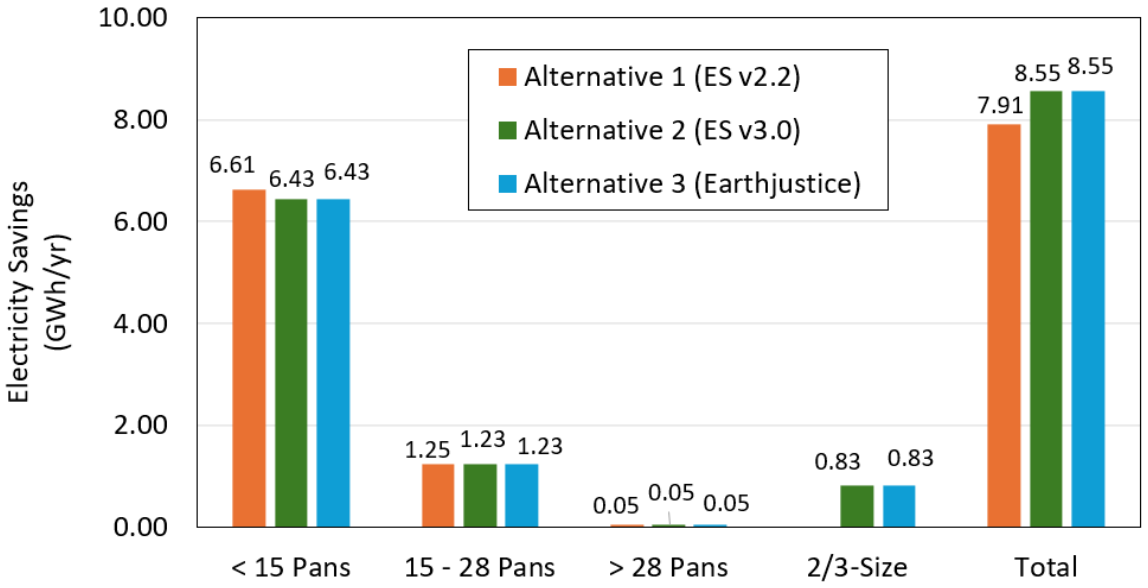
Source: CEC staff

Figure 23 below shows the annual statewide energy savings for combination ovens after full stock turnover. The annual natural gas savings range from 0.53 to 0.80 million therms, depending on which alternative standard is selected. The annual electricity savings range from 7.91 to 8.55 GWh.

Figure 23: Annual Statewide Energy Savings for Combination Ovens After Full Stock Turnover



(a) Gas Combination Ovens.

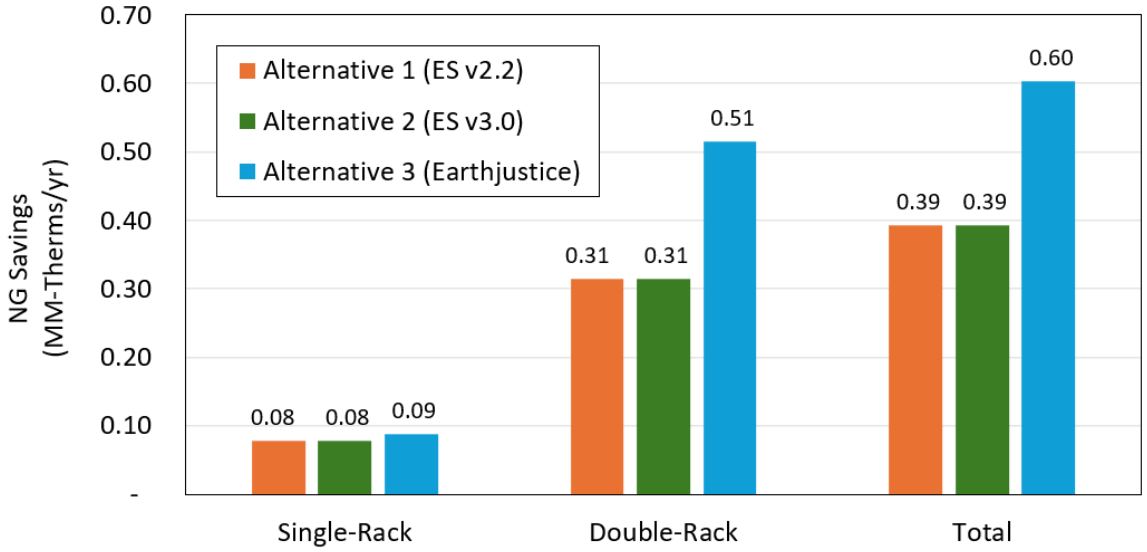


(b) Electric Combination Ovens.

Source: CEC staff

Figure 24 below shows the annual statewide energy savings for gas rack ovens after full stock turnover. The annual natural gas savings range from 0.39 to 0.60 million therms depending on which alternative standard is selected.

Figure 24: Annual Statewide Energy Savings for Gas Rack Ovens After Full Stock Turnover



Source: CEC staff

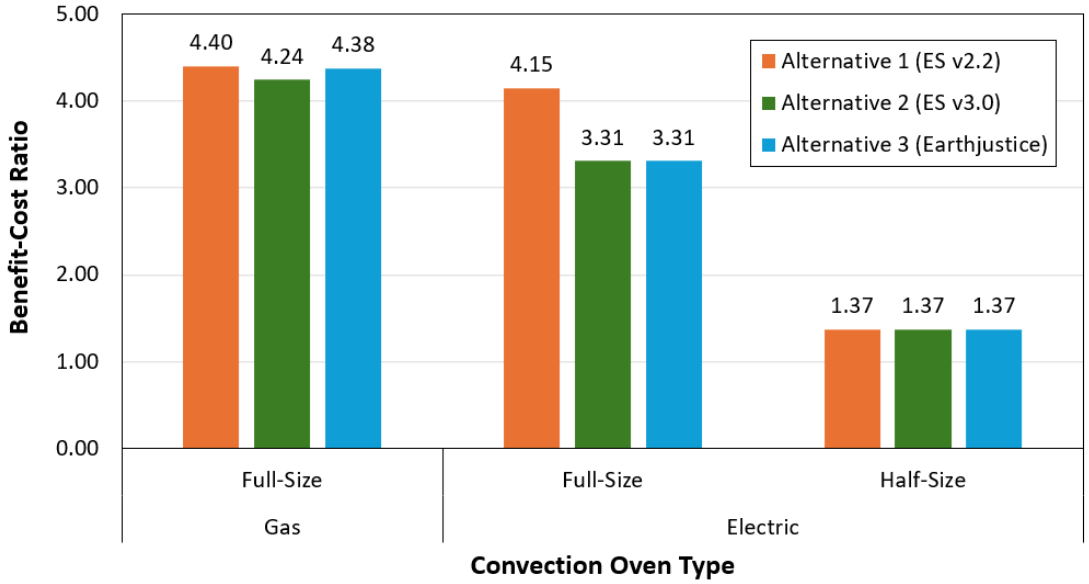
Among the three alternatives, Alternative 3 (Earthjustice) would result in the highest energy savings after full stock turnover. When determining which energy and water efficiency standard to propose, CEC staff also examined cost-effectiveness and product availability, which are discussed next.

Cost-Effectiveness

All appliance efficiency standards promulgated by the CEC are statutorily required to be cost-effective, making cost-effectiveness a key factor in evaluating energy and water efficiency standards. To compare the financial impacts for consumers, CEC staff calculated benefit-cost ratios (BCRs) for the three alternatives. BCRs were calculated by dividing the total monetary benefits by the incremental cost. A BCR of greater than 1.0 means consumers will benefit financially from purchasing and installing a compliant oven, compared to a noncompliant oven, over the lifespan of the oven. Since the present value of a sum of money is greater than its value at a future point in time, the calculation of the lifespan monetary benefits includes a 3% annual discount rate. Please refer to Appendix A for details on calculation methods of BCRs.

Figure 25 below shows the calculated benefit-cost ratios for convection ovens. The BCRs for convection ovens range from 1.37 to 4.40 for all three alternatives, indicating that all alternatives are cost-effective. For half-size electric convection ovens, the BCRs are the same as the proposed efficiency standards are the same for each alternative considered.

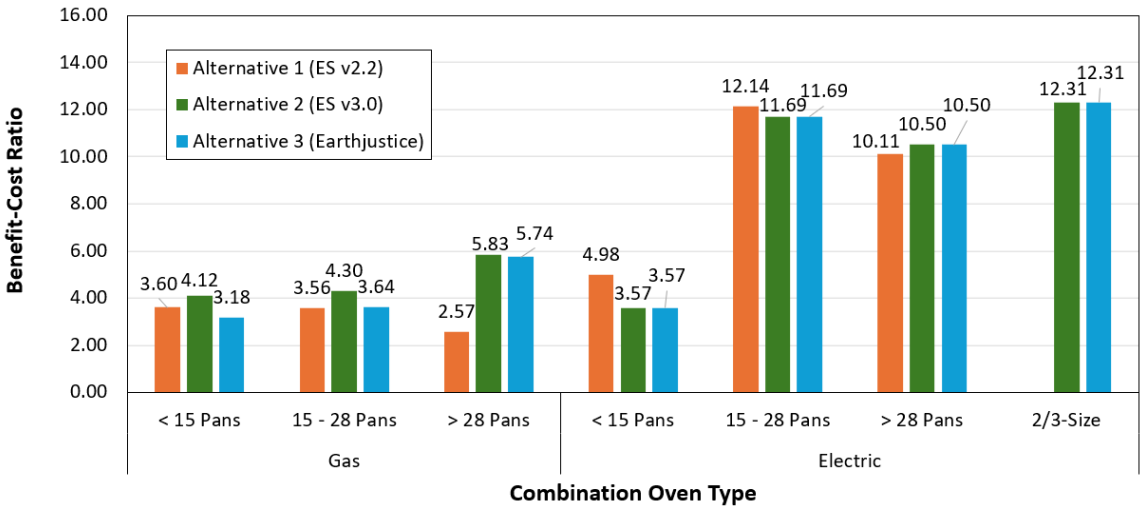
Figure 25: Benefit-Cost Ratios for Convection Ovens



Source: CEC staff

Figure 26 below shows the calculated benefit-cost ratios for combination ovens.

Figure 26: Benefit-Cost Ratios for Combination Ovens

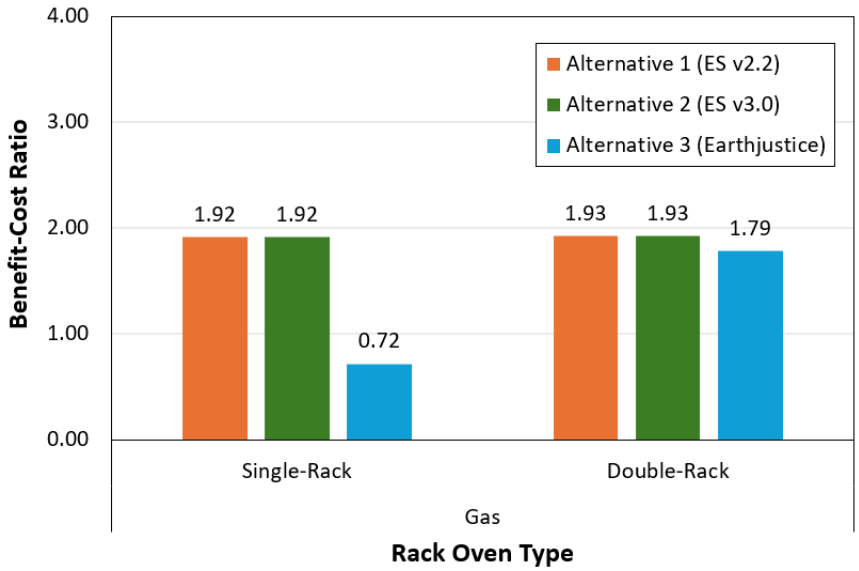


Source: CEC staff

For combination ovens, the BCRs range from 2.57 to 12.31 for all three alternatives, indicating that all alternatives are cost effective. The BCRs are particularly high for electric combination ovens with more than 15 pans and for 2/3-size combination ovens where the results show that the total benefits are more than 10 times the incremental cost.

Figure 27 below shows the calculated benefit-cost ratios for gas rack ovens. For Alternatives 1 and 2, the BCRs are 1.92 and 1.93 for single-rack and double-rack gas ovens for both Alternatives 1 and 2, indicating Alternatives 1 and 2 are cost-effective. For Alternative 3, however, the BCRs for single-rack and double-rack gas ovens are 0.72 and 1.79, respectively. This indicates that Alternative 3 is not cost effective for single-rack ovens. For this reason, CEC staff is not recommending Alterative 3 as the efficiency standard for gas rack ovens.

Figure 27: Benefit-Cost Ratios for Rack Ovens



Source: CEC staff

Product Availability

Another key factor to consider when comparing different standard alternatives is product availability. Establishing mandatory energy and water efficiency standards will eliminate the lowest-performing commercial ovens from the market. An appropriate balance needs to be found, however, as an overly stringent standard would reduce the availability of products on the market and could reduce consumer choice. This reduction could cause product shortages for certain subcategories of products and could result in customers having to choose higher-cost product types, which hurts consumers instead of benefiting them.

CEC staff calculated the compliance rate of different types of commercial ovens based on the available data from U.S. EPA's ENERGY STAR program,[68] State Appliance Standards Database (SASD),[69] and California Electronic Technical Reference Manual (CA eTRM).[70]

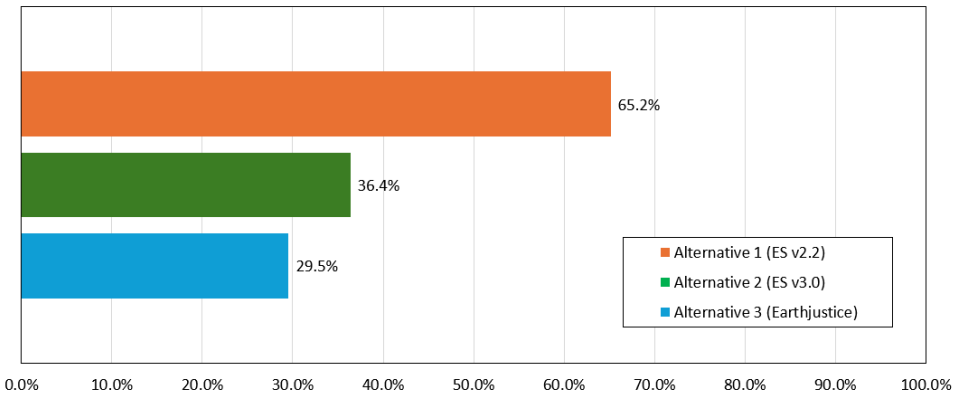
68 ENERGY STAR. "ENERGY STAR Certified Commercial Ovens."

69 State Appliance Standards Database.

70 "California Electronic Technical Reference Manual."

Figure 28 below shows the estimated compliance rate for convection ovens for the three different alternatives considered in this chapter. As the figure shows, the compliance rate decreases from 65.2% for Alternative 1 to 29.5% for Alternative 3.

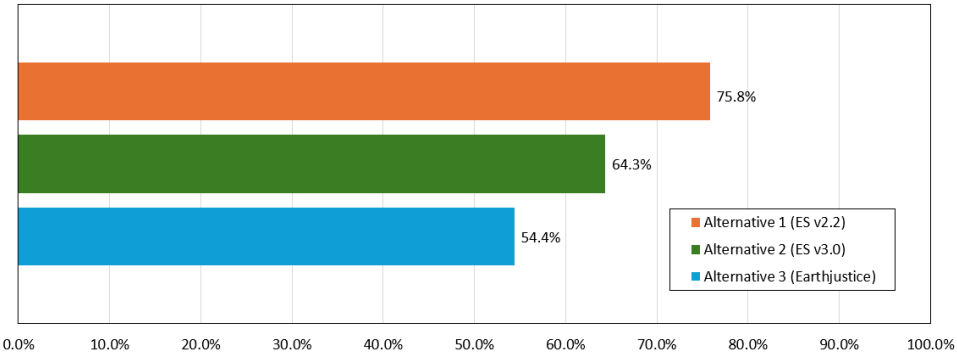
Figure 28: Compliance Rate of All Convection Ovens



Source: CEC staff

Figure 29 below shows the estimated compliance rate of combination ovens for the three alternatives, showing that the compliance rate decreases from 75.8% for Alternative 1 to 54.4% for Alternative 3.

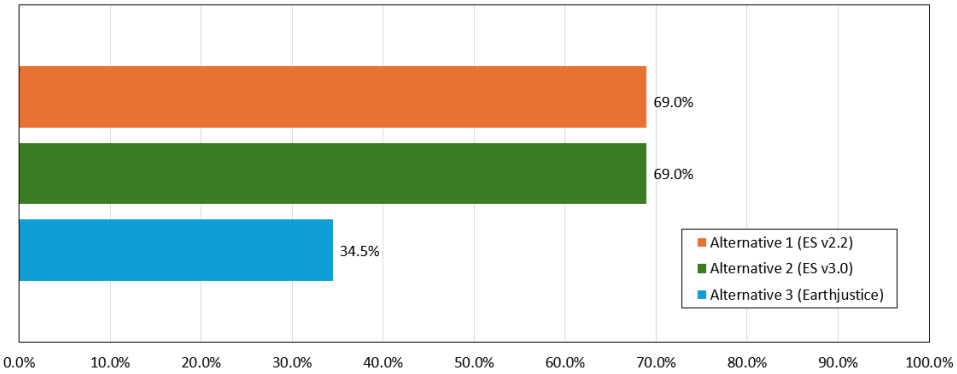
Figure 29: Compliance Rate of All Combination Ovens



Source: CEC staff

Figure 30 below shows the estimated compliance rate of rack ovens for the three alternatives, showing that the compliance rate decreases from 69.0% for Alternative 1 to 34.5% for Alternative 3.

Figure 30: Compliance Rate of All Gas Rack Ovens



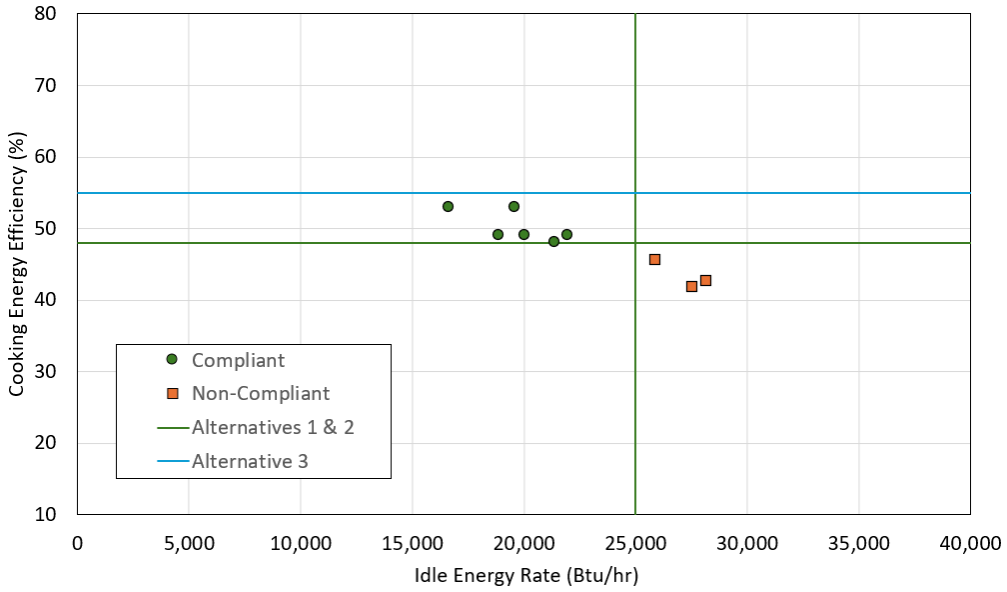
Source: CEC staff

CEC staff also checked product availability of different subcategories of commercial ovens for the three efficiency standard alternatives. CEC staff found Alternative 3 has stringent requirements for gas ovens which would significantly reduce the range of products available compared to Alternatives 1 and 2.

Taking single-rack gas ovens as an example, Figure 31 below shows the available single-rack gas ovens and how the performance of these ovens compares with different energy efficiency alternatives. In this case, Alternative 1 (ENERGY STAR v2.2) and Alterative 2 (ENERGY STAR v3.0) have the same requirements on cooking energy efficiency and idle energy rate and are plotted as green lines in the graph. Alternative 3 (Earthjustice) has higher requirement on cooking energy efficiency than the other two alternatives and is plotted as a blue line in the graph. The green circles represent ovens compliant with both Alternative 1 and Alternative 2.

If Alternative 3 were implemented as the state standards, all these ovens would become noncompliant since the associated cooking efficiencies are below the required value for Alternative 3. Alternative 3 would therefore be expected to eliminate all single-rack gas ovens currently available in the market and potentially induce customers to buy a double-rack gas oven even if the added capacity is not needed. This reduction in customer choice and potential for adverse behavior is clearly undesirable and should be avoided.

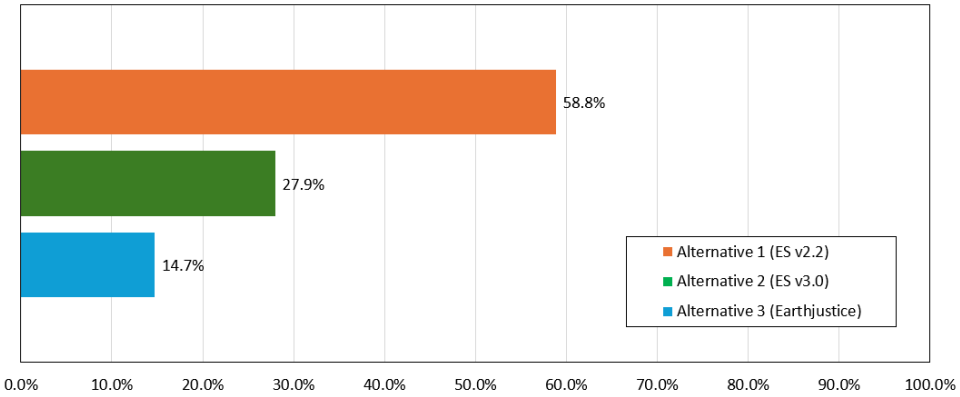
Figure 31: Performance of Available Gas Single-Rack Ovens



Source: CEC staff

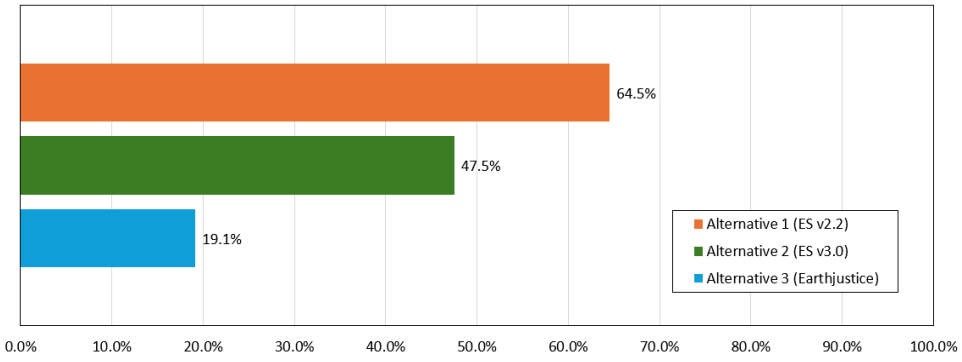
Figure 32 and Figure 33 below show the compliance rate of available gas convection and combination ovens, respectively. As the requirements on cooking energy efficiency and idle energy rate become more stringent when going from Alternative 1 (ENERGY STAR v2.2) to Alternative 2 (ENERGY STAR v3.0) to Alternative 3 (Earthjustice), the compliance rate decreases accordingly. For gas convection ovens, the compliance rate decreases from 58.8% to 14.7%. For gas combination ovens, the compliance rate decreases from 64.5% to 19.1%. If Alternative 3 were implemented as the state standards, more than 85% of the gas convection ovens and more than 80% of the gas combination ovens would be eliminated from the market, significantly reducing the range of available gas convection and combination ovens. This reduction in product availability risks disrupting the market and customers, and CEC staff believes a more incremental approach is therefore warranted.

Figure 32: Compliance Rate of Available Gas Convection Ovens



Source: CEC staff

Figure 33: Compliance Rate of Available Gas Combination Ovens



Source: CEC staff

CEC Staff Recommendations

When determining which energy and water efficiency standards to pursue, CEC staff considers the scope, performance efficiency requirements, potential energy and water savings, cost-effectiveness, and product availability of each alternative.

All three alternatives would yield significant energy savings. Alternative 1 (ES v2.2) and Alternative 2 (ES v3.0) would be cost effective for consumers for all the three types of commercial ovens with proposed performance standards. Alternative 2 would result in more energy savings than Alternative 1. Furthermore, Alternative 2 adds requirements on water consumption rate, yielding significant water savings.

Alternative 3 (Earthjustice) would be cost effective for commercial convection, combination, and double-rack ovens but not cost effective for single-rack ovens. In addition, the stringent requirements on cooking energy efficiencies of Alternative 3 would eliminate all the gas single-rack ovens and most gas convection and combination ovens currently available in the market.

As mentioned in Chapter 1, the ENERGY STAR specifications are widely adopted by the food service equipment manufacturing industry. Six other states have established efficiency standards for commercial ovens and aligned efficiency requirements the ENERGY STAR v2.2 specification, and Colorado has aligned with the ENERGY STAR v3.0 specification. In its latest model bill,[71] the Appliance Standards Awareness Project (ASAP) also proposed to align the efficiency requirements for commercial ovens with the ENERGY STAR v3.0 specifications, and as a result CEC staff anticipates more states to also align with this version of ENERGY STAR.

After careful consideration, CEC staff recommends Alternative 2 as the most reasonable and feasible alternative and therefore recommends aligning energy and water efficiency standards for commercial ovens with the ENERGY STAR v3.0 specifications.

In addition, CEC staff recommends observing market trends, oven technologies improvements, and changes in consumer needs and market shares, and then considering a more stringent efficiency standard for commercial ovens in the future.

71 Appliance Standards Awareness Project. November 2025. 2026 ASAP Model Bill, https://appliance-standards.org/sites/default/files/2026_ASAP_Model_Bill.doc.

CHAPTER 6:
Staff Proposal

CEC staff has researched, reviewed, and analyzed three alternatives for energy and water standards for commercial ovens, evaluating the potential energy and water savings, cost-effectiveness, and product availability for each. As explained in Chapter 5, CEC staff recommends aligning the energy and water efficiency standard for commercial ovens with the ENERGY STAR v3.0 specifications.

This chapter provides an overview of the energy and water efficiency standard for commercial ovens that would result from following this recommendation, including test-and-list requirements for commercial oven types not discussed in Chapter 5. The proposed regulatory language modifying the California Code of Regulations (CCR), Title 20, Sections 1601–1607, can be found in Appendix C of this report.

Scope

CEC staff proposes to establish energy and water efficiency standards for the following types of commercial ovens: gas and electric convection ovens, gas and electric combination ovens, and gas rack ovens. Furthermore, CEC staff proposes establishing test-and-list requirements for the following types of commercial ovens: gas and electric conveyor ovens, gas and electric deck ovens, gas and electric high-speed (rapid cook) ovens, and electric rack ovens.[72] Gas ovens include ovens using either natural gas or propane as the energy source.

Table 6 and Table 7 below summarize the scope of the covered commercial ovens, and the scope is subsequently discussed.

72 Since this report discusses the proposed efficiency standards for commercial ovens, the word "commercial" is often omitted for simplicity.

Table 6: Commercial Oven Types with Proposed Energy and Water Standards

Oven Type	Power Source and Oven Size	Pan Capacity	Energy and Water Efficiency Standard
Convection Ovens	Gas – Full Size	All pan capacities	Align with ENERGY STAR v3.0
	Electric – Full Size Electric – Half Size	All pan capacities	
Combination Ovens	Gas – Full Size Gas – Half Size	3 <= pan capacity <= 50	Align with ENERGY STAR v3.0
	Electric – Full Size Electric – Half Size	3 <= pan capacity <= 50	
	Electric – 2/3 Size	3 <= pan capacity <= 5	
Gas Rack Ovens	Gas – Single Rack	All pan capacities	Align with ENERGY STAR v3.0
	Gas – Double Rack	All pan capacities	

Source: CEC staff

Table 7: Commercial Oven Types with Proposed Test-and-List Requirements

Oven Type	Power Source and Oven Size	Water & Energy Standard	Test-and-List Requirements?
Conveyor Ovens	Gas & Electric	No standard	Yes
Deck Ovens	Gas & Electric	No standard	Yes
High-Speed (Rapid Cook) Ovens	Gas & Electric	No standard	Yes
Electric Rack Ovens	Electric – Single Rack	No standard	Yes
	Electric – Double Rack	No standard	Yes

Source: CEC staff

Commercial Ovens with Proposed Water and Energy Standards

Commercial Convection Ovens

For commercial convection ovens, there is no applicable energy and water efficiency standard in California law. However, there are test-and-list requirements that apply, which means

manufacturers are required to test the performance of their commercial convection ovens following the test procedures specified in Title 20 and certify the test results to the CEC before the ovens can be sold or offered for sale in California.

In this report, CEC staff proposes establishing energy efficiency standards for commercial convection ovens manufactured on or after January 1, 2029. These ovens will include full-size gas, full-size electric, and half-size electric convection ovens of all pan capacities. Half-size gas convection ovens are excluded from the scope because of low market share.

Commercial Combination Ovens

There are currently no established energy and water efficiency standards for commercial combination ovens in California. In this report, CEC staff proposes establishing energy and water efficiency standards for commercial combination ovens manufactured on or after January 1, 2029. Covered ovens will include 1) full-size and half-size gas combination ovens with pan capacities between 3 and 50, 2) full-size and half-size electric combination ovens with pan capacities between 3 and 50, and 3) 2/3-size electric combination ovens with pan capacities between 3 and 5. For full-size and half-size combination ovens, the proposed pan capacity range (3 <= pan capacity <= 50 for both gas and electric ovens) is wider than the range specified in ENERGY STAR v3.0 (5~40 pans for gas and 3~40 for electric ovens).

CEC staff believes the current product offerings in the expanded pan capacity scope is very limited, but with technological advancement and demand increase, higher- or lower-capacity ovens could emerge on the market in the future. The CEC staff proposal is intended to ensure those higher- or lower-capacity ovens are as efficient as the ovens more commonly offered for sale today. Furthermore, the CEC staff proposal aims to avoid the possibility of a marginal increase or decrease in pan capacity to be used as a method to avoid being subject to the proposed regulations.

Commercial Rack Ovens

There are no established energy and water efficiency standards for commercial rack ovens in California. In this report, CEC staff proposes establishing energy efficiency standards for commercial rack ovens manufactured on or after January 1, 2029. These standards will include single-rack and double-rack gas ovens of all pan capacities.

Commercial Ovens With Proposed Test-and-List Requirements

CEC staff proposes including the following types of commercial ovens for test-and-list: conveyor, deck, high-speed (rapid cook), and electric rack ovens. Conveyor and deck ovens make up 9% and 3% of the market share of commercial ovens by sales revenue, according to NAFEM's Size and Shape of the Industry report.[73] For these two types of ovens, there are established ASTM test procedures and existing California rebates available. Test-and-list requirements will support existing rebates programs and will provide the information needed to consider potential efficiency standards in the future.

For high-speed (rapid cook) ovens, there is an established ASTM test procedure, but there is no California rebate available for them. Considering that high-speed ovens represent about

73 Size and Shape of the Industry, North American Assosication of Food Equipment Manufacturers, 2022, available at https://nafem.org.

24% of the market share of commercial ovens by sales revenue, CEC staff proposes establishing test-and-list requirements for them so that the potential for efficiency improvements can be evaluated.

CEC staff also proposes establishing test-and-list requirements for electric rack ovens. Electric rack ovens are currently not covered by the ENERGY STAR specifications and there is no existing California rebate available for them. However, CEC staff predicts their market share will increase in the future as more commercial food establishments electrify. Test-and-list requirements for electric rack ovens will provide valuable data that can support future rebate programs as well as mandatory performance standards.

This subsection gives a high-level overview of the scope of the products covered by the proposed regulations. The exact scope is determined by the definitions provided in Section §1602 found in Appendix C of this report.

Rented, Imported, Distributed, and Leased Commercial Ovens

In August 2026, Governor Newsom signed AB 2458 (Bennett, Chapter 171, Statutes of 2026) into law.[74] Prior to the passage of AB 2458, California law prohibited the sale or offering for sale of appliances in the state that did not meet the energy and water efficiency standards prescribed by the CEC. AB 2458 broadens the scope of the state's existing Appliance Efficiency Regulations by extending coverage beyond new appliances sold or offered for sale in the state, to also include establishing regulations for appliances that are rented, imported, distributed, or leased within California. This closes the regulatory loophole that companies could bypass Title 20 efficiency regulations by purchasing non-compliant appliances outside the state and then rent or lease those appliances to customers in the state.

As a result of the passage of AB 2458, the proposed efficiency standards, testing, certification, and marking requirements will apply to the commercial ovens sold, rented, imported, distributed, or leased, or offered for sale, rental, importation, distribution, or lease in California, except those sold, rented, imported, distributed, or leased wholesale in California for final sale, rental, or lease outside the state.

Test Procedures

CEC staff proposes using established industry test procedures from Advancing Standards Transforming Markets (ASTM) International[75] for commercial ovens. ASTM International has developed standard test methods to measure the performance of various types of commercial ovens. Both the California rebate program and ENERGY STAR determine eligibility of the applicable ovens based on the performance results using those ASTM test procedures.

Table 8 below lists the proposed ASTM test methods for each of the commercial ovens included in the scope of the proposed regulations.

74 AB 2458, Energy: Appliance Standards and Cost-Effective Measures, https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=202520260AB2458.

75 ASTM International, available at https://www.astm.org/.

Table 8: Proposed Test Procedures for Commercial Ovens Manufactured On or After January 1, 2029

Oven Type	ASTM Test Method	
Convection Ovens	ASTM F1496-13 (2019)	Standard Test Method for Performance of Convection Ovens
Combination Ovens	ASTM F2861-24	Standard Test Method for Performance of Combination Ovens
Rack Ovens	ASTM F2093-18 (2023)	Standard Test Method for Performance of Rack Ovens
Conveyor Ovens	ASTM F1817-17 (2022)	Standard Test Method for Performance of Conveyor Ovens
Deck Ovens	ASTM F1965-17 (2022)	Standard Test Method for Performance of Deck Ovens
High-Speed (Rapid Cook) Ovens	ASTM F2238-20	Standard Test Method for Performance of Rapid Cook Ovens

Source: ASTM International website (astm.org)

For gas commercial ovens, if an oven model has both natural gas and propane configurations, the natural gas configuration should be tested. The natural gas configuration test results can be used to certify both the natural gas configuration and the propane configuration.

Energy and Water Efficiency Standards

CEC staff proposes to align the energy and water efficiency standards with those specified in ENERGY STAR v3.0 for commercial convection, combination, and rack ovens.

Table 9 below lists the details of the proposed standard levels.

Table 9: Proposed Standards for Commercial Convection, Combination, and Rack Ovens Manufactured on or After January 1, 2029

Oven Type	Oven Class	Maximum Idle Energy Rate (Btu/hr or kW)	Minimum Cooking-Energy Efficiency (%)	Maximum Water Consumption Rate
Commercial Convection Ovens	Full-Size Gas	9,500	49%	Reporting requirement (for units with steam injection capability only)
	Full-Size Electric (Pan Capacity >= 5)	1.40	76%	
	Full-Size Electric (Pan Capacity < 5)	1.00		
	Half-Size Electric	1.00	71%	
Commercial Combination Ovens[1]	Gas (3 <= Pan Capacity <= 50) – Steam Mode	200P+6,511	41%	- When idling: Reporting requirement - When cooking: • Steam mode: 0.5 gal/pan • Convection mode: 0.4 gal/pan
	Gas (3 <= Pan Capacity <= 50) – Convection Mode	140P+3,800	57%	
	Electric (5 <= Pan Capacity <= 50) – Steam Mode	0.133P+0.6400	55%	
	Electric (5 <= Pan Capacity <= 50) – Convection Mode	0.083P+0.35	78%	

Oven Type	Oven Class	Maximum Idle Energy Rate (Btu/hr or kW)	Minimum Cooking-Energy Efficiency (%)	Maximum Water Consumption Rate
	Electric (3 - 4 Pan Capacity) and 2/3-Size Electric (3 <= Pan Capacity <= 5) – Steam Mode	0.060P	51%	
	Electric (3 - 4 Pan Capacity) and 2/3-Size Electric (3 <= Pan Capacity <= 5) – Convection Mode	0.05P+0.55	70%	
Commercial Rack Ovens	Single-Rack Gas	25,000	48%	Reporting requirement (for units with steam injection capability only)
	Double-Rack Gas	30,000	52%	

[1] P is the pan capacity. Please refer to Appendix C for the definition of pan capacity of commercial combination ovens.

Source: CEC staff

Certification and Reporting Requirements

Manufacturers would be required to certify each in-scope commercial oven model to the CEC before selling it or offering it for sale in California. Certification enables both compliance and effective enforcement of the proposed standard, and manufacturers, distributors, and retailers can use the list to verify which products can be legally sold in California.

Through the certification process, manufacturers would be required to report certain information on the commercial oven model before the model gets listed in the CEC's database of certified appliance data. This information would include, but is not limited to, manufacturer's name, brand name, model number, oven type, heat energy source, preheat energy, cooking energy efficiency, idle energy rate, and water consumption rate. For detailed requirements, please refer to Table X in Section §1606 of the proposed regulatory language found in Appendix C of this report.

Marking Requirements

The CEC requires general marking requirements for all appliances subject to the Appliance Efficiency Regulations. This includes that all appliances will need to be marked with the manufacturer name, brand name, or trademark; the model number; and the date of manufacture, permanently, legibly, and conspicuously on an accessible place on each unit. The date of manufacture marking shall provide at a minimum the month and year that the product

was produced. This marking will enable effective enforcement of the proposed regulations for commercial ovens.

Furthermore, CEC staff proposes additional marking requirements to enhance consumer awareness of the energy and water performance of commercial ovens. The proposed marking requirements for commercial ovens are summarized below, and the full details can be found in Section §1607 of the proposed regulatory language found in Appendix C of this report.

1. All commercial ovens:
    a. Manufacturer name, brand name, or trademark;
    b. Model number;
    c. Date of manufacture;
    d. Energy input rate.
2. Commercial convection ovens:
    a. Pan capacity;
    b. Idle energy rate;
    c. Cooking energy efficiency.
3. Commercial combination ovens:
    a. Pan capacity;
    b. Idle energy rate – steam mode;
    c. Idle energy rate – convection mode;
    d. Cooking energy efficiency – steam mode;
    e. Cooking energy efficiency – convection mode;
    f. Water consumption rate – idle in steam mode;
    g. Water consumption rate – idle in convection mode;
    h. Water consumption rate – cooking in steam mode;
    i. Water consumption rate – cooking in convection mode.
4. Commercial rack, conveyor, deck, and high-speed (rapid cook) ovens:
    a. Idle energy rate;
    b. Cooking energy efficiency.

Effective Date

The effective date stated in the proposed regulations on commercial ovens is January 1, 2029, noting that this effective date is subject to change based on public commentary anticipated to be received on staff's proposal and report.

The proposed regulations on commercial ovens will only apply to products manufactured on or after the effective date, allowing sell-through of equipment manufactured in good faith compliance with state and federal laws prior to the law becoming effective. Refurbished ovens will also be excluded from the proposed regulations.

CHAPTER 7:
SAVINGS AND COST ANALYSIS

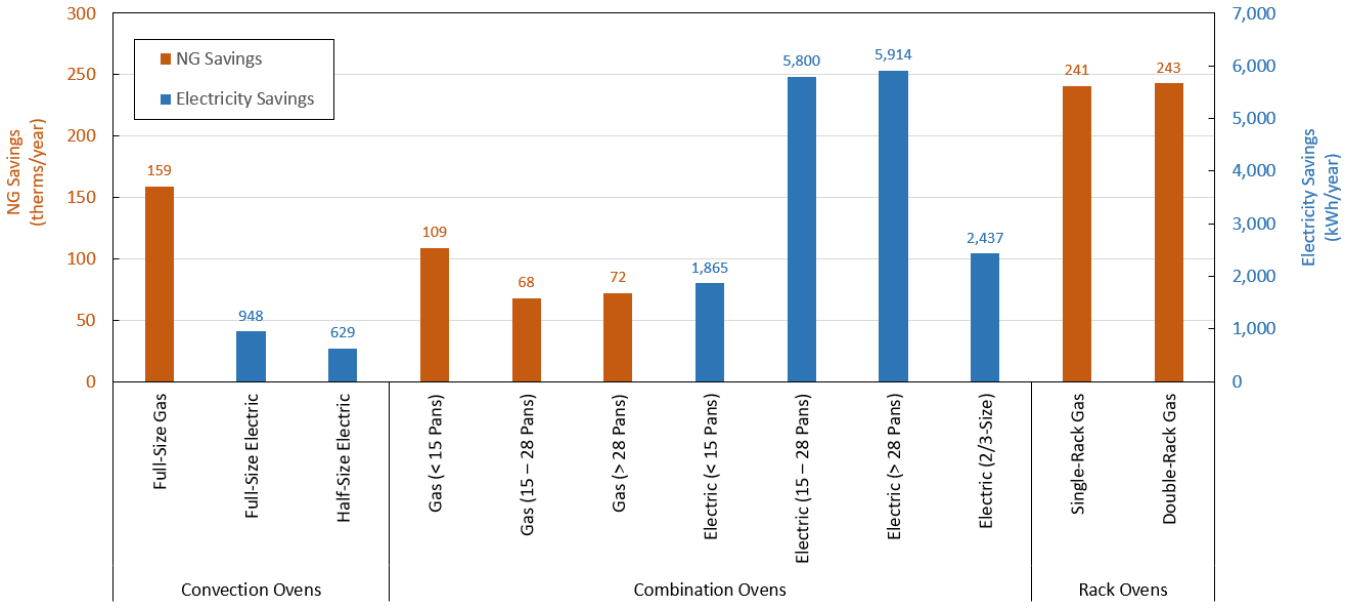
Energy Commission staff's proposal for energy and water efficiency standards for commercial ovens is cost-effective for consumers, feasible, and will yield significant energy, water, and utility savings in California. This chapter presents and discusses the per-unit energy and water savings, cost-effectiveness, and statewide energy and water savings. Readers can refer to Appendix A of this report for data sources, key assumptions, and methodology used for the calculations.

Per-Unit Energy and Water Savings

Staff performed analysis and calculated per-unit electricity consumption, peak demand, and natural gas consumption for baseline and compliant units, and then calculated the savings achieved per-unit that will be achieved after the proposed standards become effective.

Figure 34 below summarizes the estimated per-unit energy savings for three types of commercial ovens. The per-unit natural gas savings range from 68 therms per year to 243 therms per year, depending on the oven type and size. The per-unit electricity savings range from 629 kWh per year to 5,914 kWh per year, depending on the oven type and size.

Figure 34: Per-Unit Energy Savings for Commercial Ovens



Source: CEC staff

The estimated energy and water consumption and savings are discussed in the subsections for convection, combination, and rack ovens.

Convection Ovens

Energy savings were calculated for compliant units versus baseline units for full-size gas, full-size electric, and half-size electric convection ovens. The following three tables show the energy consumption of baseline units, compliant units, and estimated savings.

Table 10: Annual Per-Unit Energy Consumption of Baseline Convection Ovens

	Per-Unit Electricity Consumption (kWh/year)	Per-Unit Peak Demand (kW/unit)	Per-Unit Natural Gas Consumption (therms/year)
Full-Size Gas	-	-	668
Full-Size Electric	9,231	9.57	-
Half-Size Electric	5,866	4.71	-

Source: CEC staff

Table 11: Annual Per-Unit Energy Consumption of Compliant Convection Ovens

	Per-Unit Electricity Consumption (kWh/year)	Per-Unit Peak Demand (kW/unit)	Per-Unit Natural Gas Consumption (therms/year)
Full-Size Gas	-	-	509
Full-Size Electric	8,283	9.09	-
Half-Size Electric	5,237	4.60	-

Source: CEC staff

Table 12: Annual Per-Unit Energy Savings for Convection Ovens

	Per-Unit Electricity Savings (kWh/year)	Per-Unit Peak Demand Reduction (kW/unit)	Per-Unit Natural Gas Savings (therms/year)
Full-Size Gas	-	-	159
Full-Size Electric	948	0.48	-
Half-Size Electric	629	0.10	-

Source: CEC staff

Combination Ovens

Energy and water savings were calculated for compliant units versus baseline units for gas and electric combination ovens. Due to a wide range of pan capacities in the combination ovens, they are divided into three groups based on their pan capacities.

The following three tables show the annual per-unit energy consumption for baseline units, compliant units, and estimated savings.

Table 13: Annual Per-Unit Energy Consumption of Baseline Combination Ovens

	Per-Unit Electricity Consumption (kWh/year)	Per-Unit Peak Demand (kW/unit)	Per-Unit Natural Gas Consumption (therms/year)
Gas (< 15 Pans)	-	-	613
Gas (15 – 28 Pans)	-	-	666
Gas (> 28 Pans)	-	-	1,070
Electric (< 15 Pans)	11,672	7.53	-
Electric (15 – 28 Pans)	22,165	17.03	-
Electric (> 28 Pans)	35,946	27.19	-
Electric (2/3-Size)	6,606	2.72	-

Source: CEC staff

Table 14: Annual Per-Unit Energy Consumption of Compliant Combination Ovens

	Per-Unit Electricity Consumption (kWh/year)	Per-Unit Peak Demand (kW/unit)	Per-Unit Natural Gas Consumption (therms/year)
Gas (< 15 Pans)	-	-	503
Gas (15 – 28 Pans)	-	-	598
Gas (> 28 Pans)	-	-	998
Electric (< 15 Pans)	9,807	7.41	-
Electric (15 – 28 Pans)	16,365	16.51	-
Electric (> 28 Pans)	30,032	26.80	-
Electric (2/3-Size)	4,169	2.61	-

Source: CEC staff

Table 15: Annual Per-Unit Energy Savings for Combination Ovens

	Per-Unit Electricity Savings (kWh/year)	Per-Unit Peak Demand Reduction (kW/unit)	Per-Unit Natural Gas Savings (therms/year)
Gas (< 15 Pans)	-	-	109
Gas (15 – 28 Pans)	-	-	68
Gas (> 28 Pans)	-	-	72
Electric (< 15 Pans)	1,865	0.12	-
Electric (15 – 28 Pans)	5,800	0.52	-
Electric (> 28 Pans)	5,914	0.39	-
Electric (2/3-Size)	2,437	0.11	-

Source: CEC staff

Table 16 below shows the annual per-unit water consumption for baseline and compliant units and estimated savings.

Table 16: Annual Per-Unit Water Consumption and Savings for Combination Ovens

	Baseline Per-Unit Water Consumption (gal/year)	Compliant Per-Unit Water Consumption (gal/year)	Per-Unit Water Savings (gal/year)
Gas (< 15 Pans)	11,433	3,126	8,307
Gas (15 – 28 Pans)	35,752	3,965	31,387
Gas (> 28 Pans)	58,906	5,530	53,376
Electric (< 15 Pans)	9,159	2,596	6,563
Electric (15 – 28 Pans)	38,919	3,157	35,763
Electric (> 28 Pans)*	-	-	-
Electric (2/3-Size)*	-	-	-

* Not enough data.

Source: CEC staff

Rack Ovens

Energy savings were calculated for compliant units versus baseline units for single-rack and double-rack gas ovens. Electric rack ovens are not included in the calculations since staff is only proposing test-and-list requirements for electric rack ovens, as explained in Chapter 6.

Table 17 below shows the energy consumption of baseline and compliant units and estimated savings for gas rack ovens.

Table 17: Annual Per-Unit Energy Consumption and Savings for Rack Ovens

	Baseline Per-Unit Natural Gas Consumption (therms/year)	Compliant Per-Unit Natural Gas Consumption (therms/year)	Per-Unit Natural Gas Savings (therms/year)
Single-Rack Gas	2,006	1,765	241
Double-Rack Gas	3,077	2,835	243

Source: CEC staff

Cost Effectiveness

The sections below present the cost-effectiveness analysis, starting with incremental costs, before combining this with the per-unit energy and water savings discussed previously to determine the per-unit lifetime economic impact of the proposed efficiency standards.

Incremental Costs

The incremental cost is the cost difference between a compliant oven and a non-compliant oven, i.e., the marginal difference in cost to select a compliant product over a least-cost product in the current marketplace with all other product features and specifications remaining the same. The incremental costs are presumed to be incurred by the design changes needed to improve the efficiency of the oven to achieve the specified level of performance. Main design changes include improvements in the heater or burner efficiency, improvements to air circulation in the heating chamber, or improvements in insulation design, material selection, and structural optimization.

Staff aligned the incremental cost estimates with the incremental costs used in the ENERGY STAR's calculator for commercial food service equipment.[76] The three tables below list the incremental costs for different types of commercial ovens.

Table 18: Incremental Cost for Convection Ovens

Oven Type	Incremental Cost (2024 $)
Full-Size Gas	1,191
Full-Size Electric	828
Half-Size Electric	1,325

Source: ENERGY STAR Commercial Food Service Equipment Calculator

Table 19: Incremental Cost for Combination Ovens

Fuel Type	Pan Capacity	Incremental Cost (2024 $)
Gas	< 15 Pans	972
	15 – 28 Pans	972
	> 28 Pans	972
Electric	< 15 Pans	1,628
	15 – 28 Pans	1,628
	> 28 Pans	1,628
Electric (2/3-Size)	< 6 Pans	565

Source: ENERGY STAR Commercial Food Service Equipment Calculator

76 ENERGY STAR Commercial Food Service Equipment Calculator, available at https://www.energystar.gov/partner-resources/energy-star-training-center/commercial-food-service.

Table 20: Incremental Cost for Rack Ovens

Oven Size	Incremental Cost (2024 $)
Single-Rack Gas	4,000
Double-Rack Gas	4,000

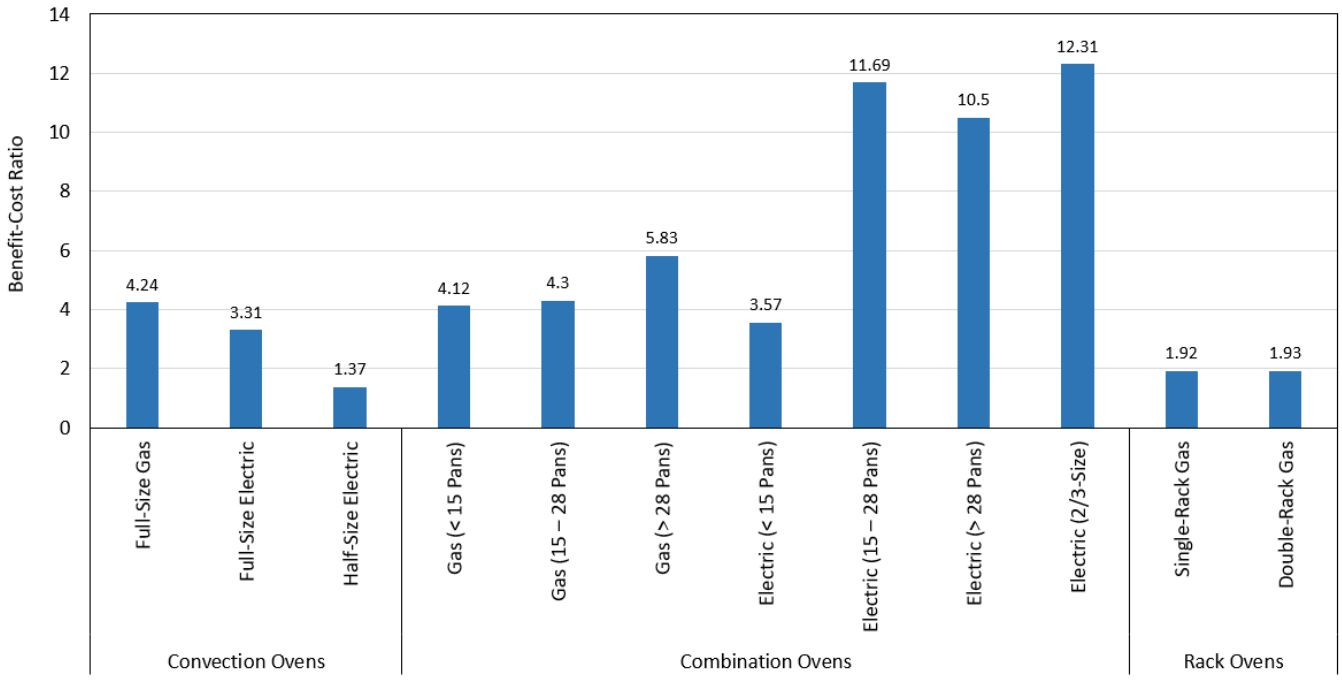
Source: ENERGY STAR Commercial Food Service Equipment Calculator

Per-Unit Lifetime Economic Impacts

The design life of convection, combination, and rack ovens is assumed to be 12 years per the CA eTRM[77]. Lifecycle benefits of the three types of commercial ovens were calculated based on the per-unit energy and water savings and the CEC-forecasted energy (natural gas and electricity) and water prices which can be found in Appendix B.

Figure 35 below summarizes the lifecycle benefit-cost ratios for three types of commercial ovens. The lifecycle benefit-cost ratios range from 1.37 to 12.31, depending on the oven type and size.

Figure 35: Lifecycle Benefit-Cost Ratios for Commercial Ovens



Source: CEC staff

77 "California Electronic Technical Reference Manual."

Table 21 below shows the per-unit lifecycle costs and benefits of the proposed standards. These standards are cost effective, with lifecycle benefits exceeding lifecycle costs for each product class. The lifecycle benefit-cost ratio ranges from 1.37 to 12.31, and the simple payback period ranges from 0.85 to 7.63 years.

Table 21: Per-Unit Lifetime Economic Impacts

Oven Type	Product Class	Design Life (years)	Present Value of Benefits (2024 $)	Present Value of Incremental Costs (2024 $)	Net Present Benefits (2024 $)	Simple Payback Period (years)	Lifecycle Benefit-Cost-Ratio
Convection Ovens	Full-Size Gas	12	5,055	1,191	3,864	3.90	4.24
	Full-Size Electric	12	2,741	828	1,913	3.16	3.31
	Half-Size Electric	12	1,819	1,325	494	7.63	1.37
Combinat-ion Ovens	Gas (< 15 Pans)	12	4,006	972	3,034	3.72	4.12
	Gas (15 – 28 Pans)	12	4,179	972	3,207	2.97	4.30
	Gas (> 28 Pans)	12	5,663	972	4,691	2.08	5.83
	Electric (< 15 Pans)	12	5,808	1,628	4,180	2.93	3.57
	Electric (15 – 28 Pans)	12	19,036	1,628	17,404	0.89	11.69
	Electric (> 28 Pans)	12	17,101	1,628	15,473	1.00	10.50
	Electric (2/3-Size)	12	6,956	565	6,391	0.85	12.31
Rack Ovens	Single-Rack Gas	12	7,670	4,000	3,670	8.63	1.92
	Double-Rack Gas	12	7,716	4,000	3,716	8.58	1.93

Source: CEC staff

Statewide Energy and Water Savings

Staff performed market analysis to estimate the total inventory of convection, combination, and rack ovens in California. Based on that market analysis, staff calculated statewide energy, water, and utility savings from the proposed standards.

Commercial Oven Inventory in California

The total number of convection, combination, and rack ovens in California was estimated based on the annual ENERGY STAR shipment data and penetration rate, the assumed 12-year lifespan of the commercial ovens, as well as the U.S. and California population.

The total annual shipment in California was estimated to be 11,200 and the total oven inventory in California was estimated to be 134,400. Please note these numbers only consist of commercial ovens covered by the ENERGY STAR specifications (convection, combination, and rack ovens) and include units for sale, rental, and lease.

According to NAFEM's Size and Shape of the Industry study,[78] convection ovens constitute 76% of the sales across the three oven categories, while combination ovens account for 20% and rack ovens make up 4%. Based on these percentages, there are approximately 102,000 convection ovens, 26,880 combination ovens, and 5,400 rack ovens in California. The annual sales are approximately 8,500 convection ovens, 2,240 combination ovens, and 450 rack ovens.

Convection Ovens

For convection ovens, the annual shipment is approximately 8,500 units. Among all the convection ovens 87% are gas and 13% are electric according to the CA rebate data.[79] This translates to 7,395 gas ovens and 1,105 electric ovens. Among electric ovens, 80% are full-size and 20% are half-size.

Table 22 below lists the estimated annual shipment of different types of convection ovens in California.

Table 22: Estimated Annual Shipment of Convection Ovens in California

Oven Size	Gas	Electric
Full-Size	7,395	884
Half-Size	-	221

Source: CEC staff

78 North American Association of Food Equipment Manufacturers, 2022. *Size and Shape of the Industry,* https://nafem.org/contact.

79 CA IOUs Comments – Food Service T20 CASE Report, 2024, page 53.

Combination Ovens

For combination ovens, the annual shipment is about 2,240 units. According to California rebate data,[80] combination ovens with fewer than 15 pans account for 67% of the units sold. Those with capacities between 15 and 28 pans account for 24%, and those with more than 28 pans represent 9% of the units sold.

California rebate data show that 45% of combination ovens with fewer than 15 pans are gas, while 55% are electric. For combination ovens with capacities ranging from 15 to 28 pans, 65% are gas, and 35% are electric. Ninety-two percent of 40-pan combination ovens, the only popular pan capacity above 28 pans are gas.

Table 23 below lists the estimated annual shipment for different types of combination ovens in California.

Table 23: Estimated Annual Shipment of Combination Ovens in California

Pan Capacity	Gas	Electric
Fewer than 15 Pans	663	811
15 to 28 Pans	343	185
Greater than 28 Pans	182	16
2/3-Size	N/A	40

Source: CEC staff

Rack Ovens

For rack ovens, the annual shipment is about 450 units. California rebate data show that nearly 80% of the rack ovens sold are double racks, while single racks make up 20%.[81] Table 24 below lists the annual shipment of rack ovens in California.

Table 24: Estimated Annual Shipment of Rack Ovens in California

Oven Size	Gas
Single-Rack	90
Double-Rack	360

Source: CEC staff

First-Year Statewide Energy and Water Savings

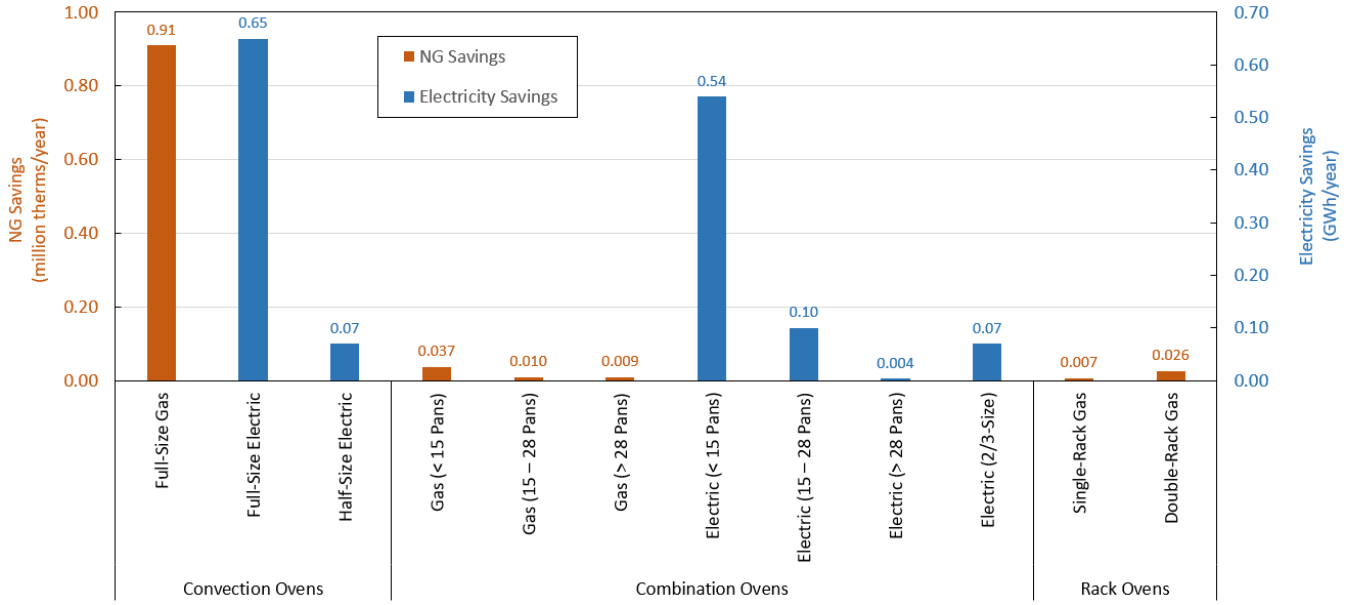
Figure 36 below shows the estimated statewide energy savings for different types of commercial ovens in the first year after the proposed standards become effective. The natural gas savings range from 6.5 thousand therms for single-rack ovens to 0.91 million therms for

80 Ibid.

81 Ibid.

full-size gas convection ovens. The electricity savings range from 4.4 MWh for large electric combination ovens to 0.65 GWh for full-size electric convection ovens.

Figure 36: First-Year Statewide Energy Savings for Commercial Ovens



Source: CEC staff

Table 25 below shows the estimated first-year statewide energy, water, and utility savings. As shown in the table, the estimated first-year statewide energy and water savings are

- 1.0 million therms of natural gas
- 1.43 GWh of electricity
- 17.14 million gallons of water

The estimated first-year peak demand reduction is 0.34 MW. The estimated first-year utility saving is $2.4 million.

Table 25: Estimated First-Year California Statewide Energy, Water, and Utility Savings

Oven Type	Natural Gas (million therms/year)	Electricity (GWh/year)	Peak Demand Reduction (MW)	Water (million gallons/year)	Utility Savings (thousand 2024 $/year)
Convection Oven: Full-Size Gas	0.91	-	-	-	1,748
Convection Oven: Full-Size Electric	-	0.65	0.26	-	180
Convection Oven: Half-Size Electric	-	0.07	0.01	-	19
Combination Oven: Gas (< 15 Pans)	0.037	-	-	2.82	88.9
Combination Oven: Gas (15 – 28 Pans)	0.010	-	-	4.75	49.0
Combination Oven: Gas (> 28 Pans)	0.009	-	-	7.05	61.7
Combination Oven: Electric (< 15 Pans)	-	0.54	0.052	1.89	159.7
Combination Oven: Electric (15 – 28 Pans)	-	0.10	0.011	0.63	32.3
Combination Oven: Electric (> 28 Pans)	-	0.004	0.00	-	1.2
Combination Oven: Electric (2/3-Size)	-	0.07	0.006	-	19.1
Rack Oven: Single-Rack Gas	0.007	-	-	-	12.51
Rack Oven: Double-Rack Gas	0.026	-	-	-	50.35
Total	1.0	1.43	0.34	17.14	2,422

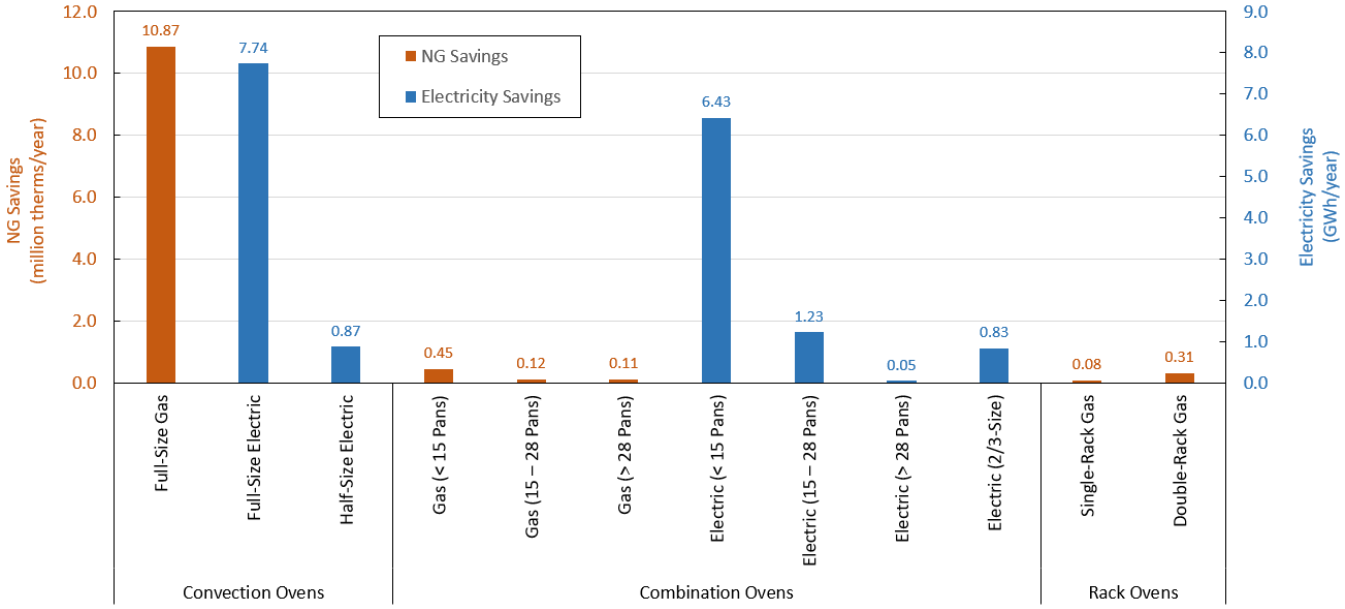
Source: CEC staff

Statewide Energy and Water Savings After Full Stock Turnover

The design lifespan for convection, combination, and rack ovens is 12 years. Assuming the proposed energy standards go into effect in 2029, the year of full stock turnover would therefore be 2040.

CEC staff estimated the statewide energy and water savings after full stock turnover. Figure 37 below shows the estimated statewide energy savings for different types of commercial ovens after full stock turnover. The natural gas savings range from 78 thousand therms per year for single-rack gas ovens to 10.87 million therms per year for full-size gas convection ovens. The electricity savings range from 53 MWh per year for big electric combination ovens to 7.74 GWh for full-size electric convection ovens.

Figure 37: Statewide Energy Savings after Full Stock Turnover for Commercial Ovens



Source: CEC staff

Table 26 below summarizes the estimated energy, water, and utility savings for different types of commercial ovens after full stock turnover. As shown in the table, after full stock turnover, the annual statewide energy and water savings are

- 11.94 million therms of natural gas.
- 17.15 GWh of electricity.
- 206 million gallons of water.

The peak demand reduction is 4.16 MW. The utility saving is $37.0 million per year.

Table 26: Estimated California Statewide Savings After Full Stock Turnover in 2040

Oven Type	Natural Gas (million therms/year)	Electricity (GWh/year)	Peak Demand Reduction (MW)	Water (million gallons/year)	Utility Savings (million 2024 $/year)
Convection Oven: Full-Size Gas	10.87	-	-	-	28.93
Convection Oven: Full-Size Electric	-	7.74	3.18	-	1.88
Convection Oven: Half-Size Electric	-	0.87	0.14	-	0.202
Combination Oven: Gas (< 15 Pans)	0.45	-	-	33.89	1.36
Combination Oven: Gas (15 – 28 Pans)	0.12	-	-	57.06	0.63
Combination Oven: Gas (> 28 Pans)	0.11	-	-	84.55	0.75
Combination Oven: Electric (< 15 Pans)	-	6.43	0.62	22.63	1.67
Combination Oven: Electric (15 – 28 Pans)	-	1.23	0.14	7.60	0.34
Combination Oven: Electric (> 28 Pans)	-	0.05	0.005	-	0.013
Combination Oven: Electric (2/3-Size)	-	0.83	0.07	-	0.20
Rack Oven: Single-Rack Gas	0.08	-	-	-	0.21
Rack Oven: Double-Rack Gas	0.31	-	-	-	0.83
Total	11.94	17.15	4.16	205.7	37.02

Source: CEC staff

CHAPTER 8:
Environmental Impacts and Benefits

Impacts

The proposed regulation requires three types of commercial ovens (convection, combination, and gas rack ovens) manufactured on or after the effective date of this regulation to comply with the proposed standards. Additionally, testing, certification, and marking requirements will apply to four other types of commercial ovens (conveyor, deck, high-speed, and electric rack ovens). This proposed regulation will not cause additional waste as the regulations do not require replacement of existing commercial ovens before the end of the normal product life cycle.

The proposed standards will not change the types of materials used in commercial ovens, significantly increase the number of materials used, or necessitate noteworthy modifications to the manufacturing process. Moreover, these standards are not expected to have any significant environmental and societal impacts. This proposal will not impact aesthetics, biological resources, geology, hydrology, recreation, agriculture, cultural resources, land use, transportation, housing, mineral resources, public services, or tribal cultural resources.

The marking requirement would require product information to appear on the appliance. The marking requirement could be accomplished with existing marking techniques and would not cause any significant environmental impact.

Benefits

The proposed standards on convection, combination, and gas rack ovens would save significant amounts of electricity, gas, and water. The annual savings are estimated to be about 11.94 million therms of gas, 17.15 GWh of electricity, and 205.7 million gallons of water after full-stock turnover. The decreased demand will reduce the strain on California's natural resources and lower the risk of environmental damage from fossil fuel extraction. Additionally, the testing, certification, and marking requirements for the four other types of commercial ovens (conveyor, deck, high-speed, and electric rack ovens) will contribute to direct savings by enhancing consumer awareness of energy performance of commercial ovens and by creating quality data enabling robust rebate programs and potentially future mandatory performance standards.

The proposed standards will also lead to improved air and environmental quality in California. First, the proposed standards will reduce the amount of gas burned directly in commercial ovens, decreasing greenhouse gas (CO_2) emissions while reducing the release of harmful pollutants like sulfur oxides (SO_x) and nitrogen oxides (NO_x) into the atmosphere. Second, since a significant portion of electricity in California still comes from burning fossil fuels, saving electricity also directly decreases the emissions of CO_2, NO_x, SO_x, and other air pollutants.

To estimate the amount of CO_2 emission reduction this proposal will lead to, staff considered the reduction from two sources: 1) the reduced electricity demand/generation and 2) the reduced firing of natural gas in commercial ovens. First, the CO_2 reduction can be estimated by multiplying the CO_2 emission factor published by U.S. Energy Information Administration

(U.S. EIA)[82] and the annual electricity saving (17.14 GWh/year). In California, the CO_2 emission factor is 0.41 lb CO_2/kWh in 2024. With those numbers, Part 1 of the CO_2 reduction comes out to be about 3,200 metric tons per year. For part 2, the estimation of the CO_2 reduction is straightforward since the generated CO_2 resulting from combustion has a 1:1 molar ratio with natural gas (which is mainly methane, CH_4). Based on the estimated natural gas saving (11.94 million therms), part 2 of the CO2 reduction is about 62,500 metric tons per year. Therefore, the total CO_2 emission reduction will be about 65,700 metric tons per year. This amount is roughly equivalent to the total CO2 emission from 14,300 passenger cars per year.[83]

Although the amount of reduction of SO_x and NO_x is difficult to estimate due to lack of emission data from commercial ovens, electricity and natural gas savings will reduce SO_x, NO_x, and other air pollutant emissions, which will be beneficial to the environment and human health.

Proposed Notice of Exemption Finding

California Environmental Quality Act

The California Environmental Quality Act (CEQA), Public Resources Code (PRC) sections 21000 *et seq.* (see also CEQA Guidelines, California Code of Regulations (CCR), Title 14, sections 15000 *et seq.*), requires that state agencies consider the environmental impact of certain discretionary decisions. CEQA allows certain projects to be exempted from its requirements. Of relevance here, and discussed further below, are the exemptions for certain projects that will benefit the environment (CCR, Title 14, sections 15307 and 15308).

Categorial Exemptions, Classes 7 and 8 Exemptions

CEQA exempts actions taken by a regulatory agency to:

- "assure the maintenance, restoration, or enhancement of a natural resource where the regulatory process involves procedures for protection of the environment.";[84] and
- "assure the maintenance, restoration, enhancement, or protection of the environment where the regulatory process involves procedures for protection of the environment."[85]

As demonstrated in this report, the proposed commercial oven standards will have no significant effect on natural resources or the environment and fall squarely within the categorical exemptions of Sections 15307 and 15308. Similarly, testing, certification, and

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82 U.S. Energy Information Administration, State Electricity Profiles. Available at https://www.eia.gov/electricity/state/california/.

83 The calculation was based on 4.6 metric tons of CO2 emission per passenger car. U.S. Environmental Protection Agency. "Greenhouse Gas Emissions From a Typical Passenger Vehicle," https://www.epa.gov/greenvehicles/greenhouse-gas-emissions-typical-passenger-vehicle.

84 California Code of Regulations, Title 14, Section 15307. Available at https://govt.westlaw.com/calregs/Document/I8CFEC90A5B4D11EC976B000D3A7C4BC3?viewType=FullText&originationContext=documenttoc&transitionType=CategoryPageItem&contextData=(sc.Default).

85 California Code of Regulations, Title 14, Section 15308. Available at https://govt.westlaw.com/calregs/Document/I8D0383FA5B4D11EC976B000D3A7C4BC3?viewType=FullText&originationContext=documenttoc&transitionType=CategoryPageItem&contextData=(sc.Default).

marking requirements that apply to the four other types of commercial ovens (conveyor, deck, high-speed, and electric rack ovens) also fall within those categorical exemptions.

The project activities are being undertaken in furtherance of the CEC's Title 20 Appliance Standards Program to reduce energy and water consumption. The project is designed to benefit the environment and natural resources by reducing energy and water consumption in the state. This rulemaking directly addresses environmental impacts associated with excess energy and water consumption and is an action to assure the maintenance, restoration, or enhancement of a natural resource and protection of the environment, as described in the above *Benefits* section.

Based on CEC staff review, there is no reasonably foreseeable possibility that the proposed regulation may result in a significant adverse impact on the environment or natural resources, or that any of the exceptions to these exemptions apply (California Code of Regulations, Title 14, Sections 15300.2); therefore, staff tentatively finds that adoption of the proposed regulations would be exempt from CEQA under the Class 7 & 8 exemptions.

Glossary

Acronym/Term	Meaning
AAFS	Additional achievable fuel substitution. AAFS is a term used in the *Integrated Energy Policy Report* published by the California Energy Commission annually. AAFS consists of six scenarios of increasing fuel substitution of electricity for gas where are considered in the report when forecasting state electricity demand and prices.
ACEEE	The American Council for an Energy-Efficient Economy (ACEEE) is a nonprofit research organization focusing on developing transformative policies to reduce energy waste and combat climate change.
amp	Short for ampere. An ampere is the base unit of electric current in the International System of Units.
APA	California Administrative Procedure Act. The APA establishes rulemaking procedures and standards for state agencies in California.
ASAP	The Appliance Standards Awareness Project (ASAP) is a nonprofit organization that advocates for appliance, equipment, and lighting standards that cut planet-warming emissions and other air pollution, save water, and reduce economic and environmental burdens for low- and moderate-income households.
ASTM	Advancing Standards Transforming Markets (formerly known as American Society for Testing and Materials). ASTM is a global leader in the development and delivery of voluntary consensus standards.
BCR	Benefit-cost ratio. A BCR is a financial indicator used in cost-benefit analysis to summarize the overall value and viability of a project. A BCR is calculated by dividing the total monetary benefit by the total incremental cost.
Btu	British thermal unit. Btu is a unit of thermal energy. It is defined as the amount of heat required to increase the temperature of 1 pound of water by 1 degree Fahrenheit.
Btu/hr	Btu/hr is a unit of power for heating and cooling systems. It measures how much heat a system adds, removes, or generates every hour.
CA eTRM	California Electronic Technical Reference Manual. The CA eTRM is a statewide repository of California's deemed measures, including supporting values and documentation.
CAHPP	California Heat Pump Partnership. The CAHPP is a public-private partnership that brings together state policy leaders, heat pump manufacturers, retailers, distributors, utilities, and other market stakeholders to rapidly scale California's heat pump market.

Acronym/Term	Meaning
CAISO	California Independent System Operator. The CAISO is a nonprofit corporation that manages the high-voltage electricity grid and wholesale power market for most of California and a small part of Nevada.
CARB	California Air Resources Board. The CARB is an agency of the government of California that aims to reduce air pollution. The CARB is the lead agency for climate change programs and oversees all air pollution control efforts in California.
CCR	California Code of Regulations. The CCR is the official compilation and publication of the regulations adopted, amended, or repealed by California state agencies. The CCR consists of 28 titles and contains the regulations of about 200 regulatory agencies.
CEC	California Energy Commission (formally known as Energy Resources Conservation and Development Commission). The CEC is the primary energy policy and planning agency for California. The CEC is committed to reducing energy costs, curtailing greenhouse gas emissions, and ensuring a safe, resilient, and reliable supply of energy.
CEQA	California Environmental Quality Act. The CEQA is a California statute passed in 1970 to institute a statewide policy of environmental protection. The CEQA requires state and local agencies within California to follow a protocol of analysis and public disclosure of environmental impacts of proposed projects and adopt all feasible measures to mitigate those impacts.
CFSE	Commercial food service equipment. CFSE encompasses heavy-duty appliances and tools designed for professional kitchens, restaurants, and catering operations. Major CFSE equipment includes ovens, fryers, dishwashers, steamers, ranges, griddles, refrigerators, food processors, and heated holding cabinets.
CO2	Carbon dioxide. CO2 is a clear, odorless gas at room temperature. In the air, CO2 is transparent to visible light but absorbs infrared radiation, acting as a greenhouse gas.
Combination oven	A combination oven is a cooking appliance that combines the function of hot, dry air convection and steam heating to cook food products. A combination oven can be operating in either convection, steam, or combination mode.

Acronym/Term	Meaning
Commercial oven	A commercial oven is a cooking appliance that is not a consumer product and is designed for high-volume cooking and baking in professional kitchens such as restaurants, bakeries, catering businesses, and other food service establishments.
Convection oven	A convection oven is a general-purpose oven that cooks food by forcing hot, dry air over the surfaces of the food. A convection oven is equipped with one or more fans to improve hot air circulation and achieve even temperature distribution inside the cooking chamber.
Conveyor oven	A conveyor oven is an oven that uses a moving belt to transport food products into and through a heated chamber for cooking.
Cooking energy efficiency	Cooking energy efficiency is an energy performance metric for commercial ovens. It is defined as the ratio of the quantity of energy imparted to the specified food load to the total energy consumed by the oven during the cooking process.
CPUC	California Public Utilities Commission. The CPUC is a California state agency that regulates privately owned electric, natural gas, telecommunications, water, railroad, rail transit, and passenger transportation companies.
Deck oven	A deck oven is an oven that cooks food project directly on the floor of a heated chamber. The bottom of each compartment is called a deck and can be made of metal, stone, brick, and ceramic tiles.
DWR	Department of Water Resources. The DWR is a California state agency that is responsible for the management and regulation of the state's water usage.
Earthjustice	Earthjustice is a nonprofit public interest environmental law organization dedicated to litigating environmental issues. Earthjustice is an active participant in the rulemaking proceedings for appliance efficiency standards.
EBD	Equitable building decarbonization. The EBD Program is a clean energy program established by the California Energy Commission. It targets GHG emission reductions in homes and advancement of energy equity.
EIR	Environmental impact report. An EIR is a detailed informational document required by the California Environmental Quality Act. It analyzes potential significant environmental effects of a proposed project, outlines mitigation measures, and evaluates project alternatives before a government agency makes a decision.

Acronym/Term	Meaning
Energy consumption	Energy consumption is the total amount of energy used by an appliance, system, building, vehicle, or region over a specific period.
Energy savings	Energy savings means the amount of energy saved following implementation of energy efficient measures or practices.
EPA	Environmental Protection Agency. The U.S. EPA is an independent agency of the federal government tasked with environmental protection matters.
EPRI	Electric Power Research Institute. The EPRI is a nonprofit organization that conducts research and development related to the generation, delivery, and use of electricity to help address challenges in the energy industry, including reliability, efficiency, affordability, health and safety, and resiliency.
ES	ENERGY STAR. ENERGY STAR is a voluntary program developed by the U.S. Environmental Protection Agency (EPA) that sets voluntary performance requirements for various appliances. ENERGY STAR is regarded as an influential model code. On March 3, 2026, EPA and the Department of Energy (DOE) signed a memorandum of understanding to transition the ENERGY STAR program from EPA to DOE. The transition is expected to be complete by August 28, 2027.
GHG	Greenhouse Gas. The GHGs are atmospheric gases that trap heat from the sun. They act like a warm blanket around the earth. The main GHGs are water vapor, carbon dioxide, methane, nitrous oxide, and fluorinated gases.
Ghost kitchen	A ghost kitchen is a professional food preparation facility that operates entirely without a traditional storefront, dining room, or walk-in customer seating, fulfilling orders exclusively through delivery apps and online ordering platforms.
GW	Gigawatt. GW is a unit of electrical power. 1 GW = 1,000,000 kW.
GWh	Gigawatt-hour. GWh is a unit of electrical energy. 1 GWh = 1,000,000 kWh.
High-speed oven	A high-speed oven is an oven that uses one or more heat transfer technologies to cook food within a chamber and can cook the food significantly faster than is possible using solely radiant or convection oven technologies. A high-speed oven is also called a rapid cook oven.

Acronym/Term	Meaning
Idle energy rate	The idle energy rate is an energy performance metric for commercial ovens. It is defined as the rate of oven energy consumption while an oven is maintained or held at a stabilized operation condition or temperature.
IEPR	Integrated Energy Policy Report. An IEPR is a report published by the California Energy Commission that provides a cohesive approach to identifying and solving the state's pressing energy needs and issues. The report is crafted in collaboration with a range of interested parties and develops and implements energy plans and policies.
IOUs	Investor-owned utilities (IOUs) are for-profit private companies owned by shareholders that provide essential services like electricity, gas, and water. California has four major IOUs: PG&E, SCE, SDG&E, and SoCalGas.
IOU CASE Team	The investor-owned utilities codes and standards enhancement team (IOU CASE Team) is a collaborative group sponsored by California's IOUs to conduct technical, economic, and market research to support updates to California's clean energy regulations.
ISOR	The initial statement of reasons is a required document in California state administrative rulemaking under the Administrative Procedure Act. It is prepared by a state agency and explains, among other things, the public problem, purpose, rationale, and legal necessity for proposing, amending, or repealing a specific regulation.
ITSP	An invitation to submitting proposals is a document published by a state agency to invite stakeholders and the interested members of the public to submit proposals related to a rulemaking.
kW	Kilowatt. kW is a unit of electrical power. 1 kW = 1,000 W.
kWh	Kilowatt-hour. kWh is a unit of electrical energy. One kWh equals to the energy delivered by 1,000 watts of power for 1 hour. 1 kWh = 1,000 Wh.
MAEDbS	Modernized Appliance Efficiency Database System. The MAEDbS is an online public database managed by the California Energy Commission. It is used to verify which appliances meet California's Title 20 energy and water efficiency standards and are legal to sell or offer for sale in California.
metric ton	A metric ton is a unit of mass equal to 1,000 kilograms or 2,204.6 pounds.
MW	Megawatt. MW is a unit of electrical power. 1 MW = 1,000 kW.

Acronym/Term	Meaning
MWh	Megawatt-hour. MWh is a unit of electrical energy. 1 MWh = 1,000 kWh.
NAFEM	North American Association of Food Equipment Manufacturers. NAFEM is a trade association founded in 1948 and is based in Chicago, Illinois. NAFEM represents more than 500 commercial foodservice equipment and supplies manufacturers worldwide.
ND	Negative Declaration. An ND is a written statement by a public agency under the California Environmental Quality Act declaring that a proposed project will not have a significant adverse effect on the environment and therefore does not require an Environmental Impact Report.
NG	Natural gas is a fossil fuel energy source. Natural gas contains many compounds, but the primary component is methane.
NOE	Notice of Exemption. An NOE is a form filed by a state agency after approving a project is exempt from the California Environmental Quality Act.
NOPA	A notice of proposed action is a required document in California state administrative rulemaking under the Administrative Procedure Act. It is issued by a state agency and must be submitted to the Office of Administrative Law. The stage agency also posts the NOPA on its website for public review.
NOx	Nitrogen oxides are a group of chemical compounds composed of nitrogen and oxygen. The most common nitrogen oxides are nitric oxide (NO) and nitrogen dioxide (NO_2). NOx are air pollutants. They contribute to the formation of smog and acid rain, as well as affecting tropospheric ozone.
OAL	Office of Administrative Law. The OAL is the California agency responsible for carrying out the rulemaking part of the California Administrative Procedure Act. The OAL is responsible for publishing the weekly California Regulatory Notice Register and the resulting California Code of Regulations.
OIR	An order instituting rulemaking is a formal document that a state agency issues to initiate a proceeding to adopt, revise, or repeal regulations. An OIR usually defines the purpose and scope of the rulemaking, introduces procedures for public participation, and outlines the proposed actions to address a specific policy objective.
Pan capacity	Pan capacity means the maximum number of cooking pans an oven can accommodate when fully loaded.

Acronym/Term	Meaning
Peak demand	Peak demand is the highest electrical power demand on an electric grid over a specific period and has a unit of power (kW).
Peak demand reduction	Peak demand reduction means the reduced amount of power demand following implementation of energy-efficient measures or practices.
PG&E	Pacific Gas and Electric Company is an investor-owned utility company that provides natural gas and electricity to residents in Northern California.
Preheat energy	The amount of energy used to warm an oven up from a cold start to a preset temperature. Expressed in Btu for gas ovens or kWh for electric ovens.
PRL	Proposed regulatory language is the exact text an agency writes to create, change, or repeal a regulation.
Production capacity	Production capacity means the amount of food that an oven can cook in a specified period. It is expressed in lbs/hr.
Rack oven	A rack oven is an oven that uses a removable or fixed rack system to hold multiple baking pans. It is equipped with a motor-driven mechanism for rotating the racks within the oven cavity.
RFI	A request for information is a notice or document that a state agency issues to gather technical and policy information and feedback from stakeholders and interested members of the public regarding the development of a regulation.
SASD	The State Appliance Standards Database is a resource developed by the Northeast Energy Efficiency Partnerships to ease compliance with state appliance standards.
SCE	Southern California Edison Company is an investor-owned utility company that provides electricity to much of Southern California.
SDG&E	San Diego Gas & Electric Company is an investor-owned utility company that provides natural gas and electricity to San Diego County and Southern Orange County in Southwestern California.
Simple payback period	The simple payback period is the amount of time it takes to recover the initial investment cost, without considering a discount rate.
SoCalGas	Southern California Gas Company is an investor-owned utility company that provides natural gas to Los Angeles and Southern California.

Acronym/Term	Meaning
SO_x	Sulfur oxides are a group of chemical compounds composed of sulfur and oxygen. The most common sulfur oxides are sulfur dioxide (SO_2) and sulfur trioxide (SO_3). SO_x are air pollutants that can harm trees and plants at high concentration. SO_2 contributes to acid rain and can harm human respiratory system if inhaled.
SRIA	A Standardized Regulatory Impact Assessment is a detailed economic analysis required by the Department of Finance in California for proposed major regulations.
therm	A therm is a unit of thermal energy. One therm equals to 100,000 British therm units (BTUs).
TW	Terawatt. TW is a unit of electrical power. 1 TW = 1,000 GW.
TWh	Terawatt-hour. TWh is a unit of energy. 1 TWh = 1,000 GWh.
Water consumption	Water consumption is the total amount of water used by an appliance, system, building, vehicle, or region over a specific period.
Water savings	Water savings means the amount of water saved following implementation of energy efficient measures or practices.
W	Watt. W is a unit of power. It is used to quantify the rate of energy transfer.
Wh	Watt-hour. Wh is a unit of energy. One Wh is the energy delivered by one watt of power for one hour.

APPENDIX A:
Staff Assumptions, Calculations, Tables, And Equations

This appendix discusses the key assumptions and calculation methods that staff used to characterize commercial ovens[86] and calculate energy and water consumption, utility cost, and estimated savings. California Energy Commission staff considered data and information from a variety of sources, including U.S. EPA's ENERGY STAR Program,[87] commercial oven measures from California Electronic Technical Reference Manual (CA eTRM),[88] NAFEM's Size and Shape of the Industry Study,[89] California Food Service Rebate Program,[90] State Appliance Standards Database (SASD),[91] and IOU CASE Team's proposal.[92]

Per-Unit Energy, Water, and Utility Savings

To calculate the per-unit energy, water, and utility savings for a potential energy efficiency standard, all the ovens in the collected dataset were divided into two groups based on performance. The baseline group consisted of all the units that failed to meet the minimum requirements on the idle energy rate, cooking energy efficiency, and water consumption rate specified by the selected standard. The compliant group consisted of all the units that met or exceeded the minimum requirements on the idle energy rate, cooking energy efficiency, and water consumption rate.

The daily per-unit energy consumption was calculated for each group, as explained in detail in this appendix. The daily per-unit energy savings were then calculated by taking the difference in energy consumption between the baseline and compliant groups. Multiplying that difference by the total number of working days in a year yielded the annual per-unit energy savings.

Staff calculated the daily per-unit water consumption for each group. The daily per-unit water savings were then calculated by taking the difference in water consumption between the baseline and compliant groups. Multiplying that by the total number of working days in a year yielded the annual per-unit water savings. The minimum requirements on water consumption rate applies only to the combination ovens in the ENERGY STAR v3.0 specification and the Earthjustice-proposed efficiency standard.

The annual per-unit utility savings were calculated by summing the utility savings from energy (electricity and natural gas) and water, which were obtained by multiplying the annual per-unit

86 The key assumptions and calculation methods discussed in this appendix only apply to commercial convection, combination, and rack ovens. The commercial ovens with test-and-list requirements are not included.

87 ENERGY STAR. "ENERGY STAR Certified Commercial Ovens."

88 "California Electronic Technical Reference Manual."

89 "North American Association of Food Equipment Manufacturers."

90 "California Foodservice Instant Rebates," https://fs.californiainstantrebates.com/.

91 "State Appliance Standards Database," https://spl.mendixcloud.com/index.html.

92 CA IOUs Comments — Food Service T20 CASE Report.

energy and water savings with the energy price and water rate, respectively. The CEC-forecasted commercial natural gas prices, commercial electricity prices, and commercial water rates can be found in Tables B-1, B-2, and B-3 in Appendix B, respectively.

Convection Ovens – Key Assumptions

To complete the per-unit energy savings calculations for convection ovens,[93] CEC staff made assumptions based on the information from the most current commercial convection oven CA eTRM measure (Commercial Convection Oven, Version SWFS001-04). The following assumptions were applied to both baseline and compliant convection ovens:

- 13.12 hours of operation per day.
- 270.28 days of operation per year.
- 133 lbs. of food cooked per day for full-size ovens and 67 lbs for half-size ovens. The food was assumed to be russet potatoes to be consistent with the ASTM test procedure.
- Energy-to-food ratio: 250 Btu/lb (taken from CA eTRM Commercial Convection Oven Measure SWFS001-04).

The following parameters differed from baseline to compliant convection ovens:

- Preheat time and energy
- Idle energy rate
- Cooking energy efficiency
- Production capacity

For baseline units, the preheat time and energy, idle energy rate, cooking energy efficiency, and production capacity were taken from the average values of the oven data in the baseline group.

For compliant units, the preheat time and energy and production capacity were taken from the average values of the oven data in the compliant group. However, for the idle energy rate and cooking energy efficiency, the values specified in the selected energy standard were used in the calculations. This means that only the energy savings going from the baseline units to a minimally compliant unit are counted. This calculation would result in a conservative estimate of energy savings since most compliant units have better performance than the minimum requirements specified by the selected energy standard.

93 Since this report discusses the proposed efficiency standards for commercial ovens, the word "commercial" is often omitted for simplicity. Therefore, connection, combination, and rack ovens mean commercial convection, combination, and rack ovens in this report.

Convection Ovens — Calculation Methods

Energy Consumption and Savings

For convection ovens, the daily energy consumption of a unit is calculated using the following equation:

$$E_{daily} = E_{cooking} + E_{idle} + E_{preheat} \quad (1)$$

where E_{daily} is the daily energy consumption of an oven (Btu/day or kWh/day), $E_{cooking}$ is the energy used to cook food (Btu/day or kWh/day), E_{idle} is the energy used to maintain a preset temperature when the oven is idle (Btu/day or kWh/day), and $E_{preheat}$ is the energy used to warm the oven up from a cold start to a preset temperature (Btu/day or kWh/day).

The cooking energy is calculated using the following equation:

$$E_{cooking} = \frac{M_{food} \times E_{food}}{\eta_{cooking}} \quad (2)$$

where M_{food} is the total amount of the food cooked daily (lbs/day), E_{food} is the energy-to-food ratio or the energy absorbed by food during cooking (Btu/lb), $\eta_{cooking}$ is the cooking energy efficiency of the oven (%). For baseline units, the average value of the cooking energy efficiency from the available oven data was used in the calculation. For compliant units, the minimum required cooking energy efficiency of the selected energy standard was used in the calculation.

The idle energy is calculated using the following equation:

$$E_{idle} = T_{idle} \times W_{idle} \quad (3)$$

where T_{idle} is the total time the oven is idle (hrs/day) and W_{idle} is the idle energy rate of the oven (Btu/hr or kW). For baseline units, the average value of the idle energy rate from the available oven data was used in the calculation. For compliant units, the minimum required idle energy rate of the selected energy standard was used in the calculation.

The total idle time T_{idle} is calculated using the following equation:

$$T_{idle} = T_{daily} - \frac{M_{food}}{PC_{food}} \quad (4)$$

where T_{daily} is the total operation hours per day for the oven (13.12 hours for convection ovens), M_{food} is the total amount of the food cooked daily (lbs/day), and PC_{food} is the production capacity of the oven (lbs/hr).

The preheat energy $E_{preheat}$ is not specified by the energy standards considered in this report. Therefore, the average value of the preheat energy from the oven data was used in the calculations for baseline and compliant groups.

After obtaining the cooking energy, $E_{cooking}$, the idle energy, E_{idle}, and the preheat energy, $E_{preheat}$, the daily energy consumption of a unit can be calculated using Equation (1). With that, the annual energy consumption of a unit is calculated using the following equation:

$$E_{annual} = E_{daily} \times N_{working_days} \quad (5)$$

where E_{annual} is the annual energy consumption of an oven (Btu/year or kWh/year), E_{daily} is the daily energy consumption of the oven (Btu/day or kWh/day), and $N_{working_days}$ is the number of working days in a year (days/year) that the oven is in operation.

Finally, the annual energy savings are calculated by taking the difference between the energy consumption of the baseline and compliant ovens:

$$E_{annual_saving} = E_{annual_baseline} - E_{annaul_compliant} \qquad (6)$$

where E_{annual_saving} is the annual per-unit energy savings (Btu/year or kWh/year), $E_{annual_baseline}$ is the annual energy consumption of a baseline unit (Btu/year or kWh/year), and $E_{annual_compliant}$ is the annual energy consumption of a compliant unit (Btu/year or kWh/year).

Utility Cost and Savings

To calculate the utility cost and savings, the forecasted electricity and natural gas prices were used in the calculations. The annual utility cost is calculated using the following equation:

$$UC_{annual} = E_{annual} \times P_{unit_energy} \times CF \qquad (7)$$

where UC_{annual} is the annual utility cost ($/year), E_{annual} is the annual energy consumption of an oven (Btu/year or kWh/year), P_{unit_energy} is the forecasted unit price for electricity or natural gas ($/kWh or $/therm), and CF is a conversion factor ($CF = 1.0 \times 10^{-5}$ therm/Btu for gas ovens and $CF = 1$ for electric ovens). In Table B-1, the natural gas price is listed in $/therm since natural gas is usually sold in therms, hence a conversion factor is needed for gas ovens in Equation (7).

The annual utility savings are calculated using the following equation:

$$UC_{annual_saving} = UC_{annual_baseline} - UC_{annual_compliant} \qquad (8)$$

where UC_{annual_saving} is the annual utility savings ($/year), $UC_{annual_baseline}$ is the annual utility cost for a baseline unit ($/year), and $UC_{annual_compliant}$ is the annual utility cost for a compliant unit ($/year).

Peak Demand

Peak demand is the highest electrical power demand on an electrical grid over a specified period and has the unit of power (kW). For electric convection ovens in cooking mode, the per-unit peak demand is calculated using the following equation:

$$PD_{per_unit} = \frac{E_{cooking}}{T_{cooking_hours}} \qquad (9)$$

where PD_{per_unit} is the per-unit peak demand (kW), $E_{cooking}$ is the electricity consumption for cooking in a day (kWh/day), and $T_{cooking_hours}$ is the number of hours the oven is used for cooking food in a day (hours/day).

To calculate the peak demand reduction, the per-unit peak demand is calculated for the baseline and compliant groups. The difference between the two groups is the reduction in per-unit peak demand, as shown below:

$$PDR_{per_unit} = PD_{per_unit_baseline} - PD_{per_unit_compliant} \qquad (10)$$

where PDR_{per_unit} is the per-unit peak demand reduction, $PD_{per_unit_baseline}$ is the baseline group per-unit peak demand, and $PD_{per_unit_compliant}$ is the compliant group per-unit peak demand. Equation (10) was used to calculate the per-unit peak demand reduction. Please see the statewide savings calculations later in this appendix for how the statewide peak demand reduction was calculated.

Benefit-Cost-Ratio

To examine the financial viability of purchasing a compliant oven for consumers, staff calculated the benefit-cost-ratio (BCR). The BCR was calculated by dividing the lifetime monetary benefit by the total incremental cost. The design lifespan for a convection oven was assumed to be 12 years,[94] and a 3% discount rate was used in the BCR calculation.

The BCR is calculated using the following equation:

$$BCR = \frac{UC_{lifetime_saving}}{IC_{incremental}} \qquad (11)$$

where BCR is the benefit-cost-ratio, $UC_{lifetime_saving}$ is the lifetime utility savings for a compliant oven compared to a baseline oven, and $IC_{incremental}$ is the incremental cost incurred when purchasing and installing a compliant oven.

The lifetime utility savings were calculated using the following equation:

$$UC_{lifetime_saving} = \sum_{i=1}^{12} \frac{E_{annual_saving} \times \left[P_{unit_energy}\right]_i \times CF}{(1+DR)^{i-1}} \qquad (12)$$

where E_{annual_saving} is the annual energy savings of an oven (Btu/year or kWh/year), i is the number of the year for which the oven has been in service, $\left[P_{unit_energy}\right]_i$ is the forecasted natural gas or electricity price in the ith year of service ($/therm or $/kWh), CF is a conversion factor ($CF = 1.0 \times 10^{-5}$ therm/Btu for gas ovens and $CF = 1$ for electric ovens), and DR is the annual discount rate of the utility savings (3% was used in the calculations in this report).

The incremental cost $IC_{incremental}$ includes the additional cost that a consumer needs to pay when purchasing and installing a compliant oven than a baseline oven. CEC staff decided to align with the incremental cost in ENERGY STAR's commercial food service equipment calculator.[95] Table A-1 below lists the incremental cost used in the calculations for convection ovens.

94 The assumed 12-year lifespan was taken from the CA eTRM Commercial Convection Oven Measure SWFS001-04.

95 ENERGY STAR. "ENERGY STAR Commercial Food Service Equipment Calculator," https://www.energystar.gov/partner-resources/energy-star-training-center/commercial-food-service.

Table A-1: Incremental Cost for Convection Ovens

Oven Type	Incremental Cost (2024 $)
Full-Size Gas	1,191
Full-Size Electric	828
Half-Size Electric	1,325

Source: ENERGY STAR Commercial Food Service Equipment Calculator

Simple Payback Period

The simple payback period is the amount of time it takes to recover the initial investment cost, without considering a discount rate. It is calculated by dividing the total incremental cost by the first-year utility savings, as shown below:

$$PB_{simple} = \frac{IC_{incremental}}{UC_{saving_1st_year}} \qquad (13)$$

where PB_{simple} is the simple payback period (years), $IC_{incremental}$ is the incremental cost ($), and $UC_{saving_1st_year}$ is the first-year utility savings ($/year).

Combination Ovens — Key Assumptions

To complete the per-unit energy savings calculations for combination ovens, staff made some assumptions based on the information from the CA eTRM measure (Commercial Combination Oven, Version SWFS003-05). The following assumptions were applied to both baseline and compliant combination ovens:

- 12.64 hours of operation per day
- 341.76 days of operation per year
- Food cooked per day (assumed to be red potatoes for steam mode and russet potatoes for convection mode to be consistent with the ASTM test procedure):
  - 200 lbs for ovens with fewer than 15 pans
  - 250 lbs for ovens with greater than 14 pans but less than 29 pans
  - 400 lbs for ovens with greater than 28 pans
- Energy to food: 105 Btu/lb in steam mode and 250 Btu/lb in convection mode (taken from CA eTRM Commercial Combination Oven Measure SWFS003-05)
- Percentage of time spent in convection mode: 50%
- Percentage of time spent in steam mode: 50%.

Combination Ovens — Calculation Methods

Energy Consumption and Savings

For combination ovens, the calculation of daily energy consumption is more complicated than that for convection ovens since combination ovens can be operating in one of three modes: steam mode, convection mode, and mixed mode. The energy consumption and cooking energy efficiency vary depending on which mode the oven is operating in. To calculate the

daily energy consumption, staff assumed there was one preheat process every day for a combination oven. Then the oven would be operating in steam mode for 50% of the time and in convection mode for 50% of the time for the rest of the day. To simplify the energy calculations, staff assumed that the combination oven did not operate in mixed mode.

The daily energy consumption was calculated using the following equation:

$$E_{daily} = E_{preheat} + [E_{cooking} + E_{idle}]_{steam_mode} + [E_{cooking} + E_{idle}]_{convection_mode} \quad (14)$$

where E_{daily} is the daily energy consumption of an oven (Btu/day or kWh/day), $E_{preheat}$ is the energy used to warm the oven up from a cold start to a preset temperature (Btu/day or kWh/day), $E_{cooking}$ is the energy used to cook food (Btu/day or kWh/day), and E_{idle} is the energy used to maintain a preset temperature when the oven is idle (Btu/day or kWh/day). The subscripts $steam_mode$ and $convection_mode$ indicate the cooking and idle energy consumed in steam mode and convection mode, respectively.

For both steam and convection modes, the cooking energy is calculated using the following equation:

$$E_{cooking} = \frac{M_{food} \times E_{food}}{\eta_{cooking}} \quad (15)$$

where M_{food} is the total amount of the food cooked daily (lbs/day), E_{food} is the energy to food ratio or the energy absorbed by food during cooking (Btu/lb), and $\eta_{cooking}$ is the cooking energy efficiency of the oven (%). Please note the energy to food ratio and the cooking energy efficiency have different values for different modes.

Similarly, for both steam and convection modes, the idle energy is calculated using the following equation:

$$E_{idle} = T_{idle} \times W_{idle} \quad (16)$$

where T_{idle} is the total time the oven is idle (hrs/day) and W_{idle} is the idle energy rate of the oven (Btu/hr or kW). The idle energy rate has different values for different modes.

The total idle time T_{idle} is calculated using the following equation:

$$T_{idle} = T_{daily} - \frac{M_{food}}{PC_{food}} \quad (17)$$

where T_{daily} is the total operation hours per day for the oven (6.32 hours in steam mode and 6.32 hours in convection mode for combination ovens), M_{food} is the total amount of the food cooked daily (lbs/day) of which 50% is cooked in steam mode and 50% in convection mode), and PC_{food} is the production capacity of the oven (lbs/hr) for the corresponding mode.

The preheat energy $E_{preheat}$ is not specified by the energy standards considered in this report. Therefore, the average value of the preheat energy from the available oven performance data was used in the calculations.

The annual energy consumption is calculated using the following equation:

$$E_{annual} = E_{daily} \times N_{working_days} \quad (18)$$

where E_{annual} is the annual energy consumption of an oven (Btu/year or kWh/year), E_{daily} is the daily energy consumption of the oven (Btu/day or kWh/day), and $N_{working_days}$ is the number of working days in a year (days/year) that the oven is used to cook food.

The methods used to calculate the annual energy savings for combination ovens are different than those for convection ovens. For combination ovens, the annual energy consumption of each baseline unit, $[E_{annual_baseline}]_i$, was calculated first using Equations (14) to (18). Then the annual energy consumption for a baseline unit was calculated by taking the average of all the baseline units:

$$E_{annual_basline} = \frac{\sum_{i=1}^{N}[E_{annual_baseline}]_i}{N} \qquad (19)$$

where $E_{annual_baseline}$ is the annual energy consumption of a baseline unit (Btu/year or kWh/year), $[E_{annual_baseline}]_i$ is the annual energy consumption of the ith baseline unit (Btu/day or kWh/day), and N is the total number of baseline units.

To calculate the annual energy consumption of a compliant unit, $E_{annual_compliant}$, the performance of all the **baseline** units was examined. A combination oven needs to meet the minimum requirements on the idle energy rate and cooking energy efficiency in both steam and convection modes (denoted as $[\eta_{cooking}]_{steam_mode}$, $[\eta_{cooking}]_{convection_mode}$, $[W_{idle}]_{steam_mode}$, and $[W_{idle}]_{convection_mode}$) to be compliant with a selected energy efficiency standard. When examining the performance of a baseline unit, if any of the above-mentioned four parameters failed to meet the minimum requirement specified by the selected energy standard, that specific parameter was replaced by the minimum requirement of the selected standard. Otherwise, the parameter value remained intact. The rest of the parameters for the unit, such as preheat energy and food production capacity, also remained intact. By doing this, all the baseline units are now complaint with the selected efficiency standard. After that, the annual energy consumption of the now compliant unit, $[E_{annual_compliant}]_i$, was calculated using Equations (14) to (18) with updated parameters. Then the annual energy consumption of a compliant unit was calculated by taking the average of all the now compliant units:

$$E_{annual_compliant} = \frac{\sum_{i=1}^{N}[E_{annual_compliant}]_i}{N} \qquad (20)$$

where $E_{annual_compliant}$ is the annual energy consumption of a compliant unit (Btu/year or kWh/year), $[E_{annual_complaint}]_i$ is the annual energy consumption of the ith compliant unit (Btu/day or kWh/day), and N is the total number of baseline units that are now compliant given the assumptions stated above.

Finally, the annual energy savings are calculated by taking the difference between the energy consumption of the baseline and compliant units:

$$E_{annual_saving} = E_{annual_baseline} - E_{annaul_compliant} \qquad (21)$$

where E_{annual_saving} is the annual per-unit energy savings (Btu/year or kWh/year), $E_{annual_baseline}$ is the annual energy consumption of a baseline unit (Btu/year or kWh/year), and $E_{annual_compliant}$ is the annual energy consumption of a compliant unit (Btu/year or kWh/year).

Water Consumption and Savings

The daily water consumption of a combination oven is calculated using the following equation:

$$WC_{daily} = [WC]_{steam_mode} + [WC]_{convection_mode} \quad (22)$$

where WC_{daily} is the daily water consumption (gallons/day), WC is the water consumption of an oven (gallons/day) and the subscripts $steam_mode$ and $convection_mode$ indicate the mode the oven is operating in.

For each mode, the water consumption is calculated using the following equation:

$$WC = WR_{cooking} \times N_{pan} + WR_{idle} \times T_{idle} \times N_{pan} \quad (23)$$

where $WR_{cooking}$ is the water consumption rate during cooking (gal/pan), N_{pan} is the pan capacity of the oven, WR_{idle} is the water consumption rate during idle (gal/hr/pan), and T_{idle} is the time duration when the oven is idle (hrs/day) calculated using Equation (17).

The annual water consumption is calculated using the following equation:

$$WC_{annual} = WC_{daily} \times N_{working_days} \quad (24)$$

where WC_{annual} is the annual water consumption of an oven (gal/year), WC_{daily} is the daily water consumption of the oven (gal/day), and $N_{working_days}$ is the number of working days in a year (days/year) that the oven is in use.

Finally, the annual water savings are calculated by taking the difference between the water consumption of the baseline and compliant ovens:

$$WC_{annual_saving} = WC_{annual_baseline} - WC_{annaul_compliant} \quad (25)$$

where WC_{annual_saving} is the annual per-unit water savings (gal/year), $WC_{annual_baseline}$ is the annual water consumption of a baseline unit (gal/year), and $WC_{annual_compliant}$ is the annual water consumption of a compliant unit (gal/year).

Utility Cost and Savings

The annual utility cost is calculated using the following equation:

$$UC_{annual} = E_{annual} \times P_{unit_energy} \times CF + WC_{annual} \times P_{unit_water} \quad (26)$$

where UC_{annual} is the annual utility cost ($/year), E_{annual} is the annual energy consumption of an oven (Btu/year or kWh/year), P_{unit_energy} is the forecasted unit price for electricity or natural gas ($/kWh or $/therm), CF is a conversion factor ($CF = 1.0 \times 10^{-5}$ therm/Btu for gas ovens and $CF = 1$ for electric ovens), WC_{annual} is the annual water consumption of the oven (gal/year), and P_{unit_water} is the forecasted unit price for water ($/gal).

The annual utility savings calculated using the following equation:

$$UC_{annual_saving} = UC_{annual_baseline} - UC_{annual_compliant} \quad (27)$$

where UC_{annual_saving} is the annual utility savings ($/year), $UC_{annual_baseline}$ is the annual utility cost for a baseline unit ($/year), and $UC_{annual_compliant}$ is the annual utility cost for a compliant unit ($/year).

Peak Demand and Peak Demand Reduction

Peak demand is the highest electrical power demand on an electrical grid over a specified period and has the unit of power (kW). For electric combination ovens during cooking, the per-unit peak demand is calculated using the following equation

$$PD_{per_unit} = \frac{E_{cooking}}{T_{cooking_hours}} \quad (28)$$

where PD_{per_unit} is the per-unit peak demand (kW), $E_{cooking}$ is the electricity consumption for cooking in a day (kWh/day), and $T_{cooking_hours}$ is the number of hours the oven is used for cooking food in a day (hours/day). The calculation assumes that the oven is operating in steam mode for 50% of the time and in convection mode for 50% of the time.

To calculate the peak demand reduction, the per-unit peak demand is calculated for the baseline and compliant groups. The difference between the two groups is the reduction in per-unit peak demand, as shown below:

$$PDR_{per_unit} = PD_{per_unit_baseline} - PD_{per_unit_compliant} \quad (29)$$

where PDR_{per_unit} is the per-unit peak demand reduction, $PD_{per_unit_baseline}$ is the baseline group per-unit peak demand, and $PD_{per_unit_compliant}$ is the compliant group per-unit peak demand. Equation (29) was used to calculate the per-unit peak demand reduction. Please see the statewide savings calculations later in this appendix for how the statewide peak demand reduction was calculated.

Benefit-Cost-Ratio

To examine the financial viability of purchasing a compliant oven for consumers, the benefit-cost-ratio (BCR) was calculated. The BCR was calculated by dividing the lifetime monetary benefit by the total incremental cost. A design lifespan for combination ovens of 12 years[96] and a 3% discount rate for the utility savings were assumed in the BCR calculation.

The BCR was calculated using the following equation:

$$BCR = \frac{UC_{lifetime_saving}}{IC_{incremental}} \quad (30)$$

where BCR is the benefit-cost-ratio, $UC_{lifetime_saving}$ is the lifetime utility savings for a compliant oven, and $IC_{incremental}$ is the incremental cost incurred when purchasing and installing a compliant oven.

The lifetime utility savings were calculated using the following equation:

$$UC_{lifetime_saving} = \sum_{i=1}^{12} \frac{E_{annual_saving} \times \left[P_{unit_energy}\right]_i \times CF + WC_{annual_saving} \times P_{unit_water}}{(1+DR)^{i-1}} \quad (31)$$

96 The assumed 12-year lifespan was taken from CA eTRM Commercial Combination Oven Measure SWFS003-05.

where E_{annual_saving} is the annual energy savings of an oven (Btu/year or kWh/year), i is the number of the year for which an oven has been in service, $[P_{unit_energy}]_i$ is the forecasted natural gas or electricity price in the ith year of service ($/therm or $/kWh), CF is a conversion factor ($CF = 1.0 \times 10^{-5}$ therm/Btu for gas ovens and $CF = 1$ for electric ovens), WC_{annual_saving} is the annual water savings of an oven (gal/year), P_{unit_water} is the forecasted water rate ($/gal), and DR is the annual discount rate of the utility savings (3% was used in the calculations in this report).

The incremental cost $IC_{incremental}$ includes the additional cost that a consumer needs to pay when purchasing and installing a compliant oven than a baseline oven. CEC staff decided to align with the incremental cost in ENERGY STAR's commercial food service equipment calculator. Table A-2 below lists the incremental cost used in the calculations for combination ovens.

Fuel Type	Pan Capacity	Incremental Cost (2024 $)
Gas	< 15 Pans	1,628
	15 – 28 Pans	1,628
	> 28 Pans	1,628
Electric	< 15 Pans	972
	15 – 28 Pans	972
	> 28 Pans	972
Electric (2/3-Size)	< 6 Pans	565

Source: ENERGY STAR Commercial Food Service Equipment Calculator

Simple Payback Period

The simple payback period is the amount of time it takes to recover the initial investment cost, without considering a discount rate. One calculates it by dividing the total incremental cost by the first-year utility savings, as shown below:

$$PB_{simple} = \frac{IC_{incremental}}{UC_{saving_1st_year}} \qquad (32)$$

where PB_{simple} is the simple payback period (years), $IC_{incremental}$ is the incremental cost ($), and $UC_{saving_1st_year}$ is the first-year utility savings ($/year). For commercial combination ovens, the utility savings include the savings from both energy and water consumption.

Rack Ovens — Key Assumptions

To complete the per-unit energy savings calculations for rack ovens, staff made assumptions based on the information from the CA eTRM measure (Commercial Rack Oven, Version SWFS014-04). The following assumptions were applied to baseline and compliant rack ovens:

- 12.00 hours of operation per day

- 338.80 days of operation per year
- Food cooked per day (assumed to be frozen apple pies to be consistent with the ASTM test procedure):
    - 600 lbs for single rack ovens
    - 1200 lbs for double rack ovens
- Energy-to-food ratio: 235 Btu/lb

The following parameters differed from baseline to compliant rack ovens:

- Preheat time and energy
- Idle energy rate
- Cooking energy efficiency
- Production capacity

For baseline units, the preheat time and energy, idle energy rate, cooking energy efficiency, and production capacity were taken from the average values of the oven data in the baseline group.

For compliant units, the preheat time and energy and production capacity were taken from the average values of the oven data in the compliant group. However, for the idle energy rate and cooking energy efficiency, the values specified in the selected energy standard were used in the calculations. This calculation method would result in a conservative estimate on energy savings since most compliant units have better performance than the minimum requirements specified by the selected standard. Staff proposes only to set energy efficiency standards for gas rack ovens, and set test-and-list requirements for electric rack ovens. The energy-saving calculations below hence reflect only gas savings.

Rack Ovens — Calculation Methods

Energy Consumption and Savings

For rack ovens, the daily energy consumption of a unit is calculated using the following equation:

$$E_{daily} = E_{cooking} + E_{idle} + E_{preheat} \qquad (33)$$

where E_{daily} is the daily energy consumption of an oven (Btu/day), $E_{cooking}$ is the energy used to cook food (Btu/day), E_{idle} is the energy used to maintain a preset temperature when the oven is idle (Btu/day), and $E_{preheat}$ is the energy used to warm the oven up from a cold start to a preset temperature (Btu/day).

The cooking energy is calculated using the following equation:

$$E_{cooking} = \frac{M_{food} \times E_{food}}{\eta_{cooking}} \qquad (34)$$

where M_{food} is the total weight of the food cooked daily (lbs/day), E_{food} is the energy to food ratio or the energy absorbed by food during cooking (Btu/lb), and $\eta_{cooking}$ is the cooking

energy efficiency of the oven (%). For baseline units, the average value of the cooking energy efficiency from the available oven data was used in the calculation. For compliant units, the minimum required cooking energy efficiency by selected energy standard was used in the calculation.

The idle energy is calculated using the following equation:

$$E_{idle} = T_{idle} \times W_{idle} \quad (35)$$

where T_{idle} is the total time the oven is idle (hrs/day) and W_{idle} is the idle energy rate of the oven (Btu/hr).

The total idle time T_{idle} is calculated using the following equation:

$$T_{idle} = T_{daily} - \frac{M_{food}}{PC_{food}} \quad (36)$$

where T_{daily} is the total operation hours per day for the oven (12.0 hours for rack ovens), M_{food} is the total amount of the food cooked daily (lbs/day), and PC_{food} is the production capacity of the oven (lbs/hr).

The preheat energy $E_{preheat}$ is not specified by the energy standards considered in this report. Therefore, the average value of the preheat energy from the oven performance data was used in the calculations.

The annual energy consumption is calculated using the following equation:

$$E_{annual} = E_{daily} \times N_{working_days} \quad (37)$$

where E_{annual} is the annual energy consumption of an oven (Btu/year), E_{daily} is the daily energy consumption of an oven (Btu/day), and $N_{working_days}$ is the number of working days in a year (days/year) that the oven is used to cook food.

Finally, the annual energy savings are calculated by taking the difference between the energy consumption of the baseline and compliant ovens:

$$E_{annual_saving} = E_{annual_baseline} - E_{annaul_compliant} \quad (38)$$

where E_{annual_saving} is the annual per-unit energy savings (Btu/year), $E_{annual_baseline}$ is the annual energy consumption of the baseline unit (Btu/year), and $E_{annual_compliant}$ is the annual energy consumption of the compliant unit (Btu/year).

Utility Cost and Savings

The annual utility cost is calculated using the following equation:

$$UC_{annual} = E_{annual} \times P_{unit_energy} \times CF \quad (39)$$

where UC_{annual} is the annual utility cost ($/year), E_{annual} is the annual energy consumption of an oven (Btu/year), P_{unit_energy} is the forecasted unit price for natural gas ($/therm), and CF is a conversion factor ($CF = 1.0 \times 10^{-5}$ therm/Btu). In Table B-1, the natural gas price is listed in $/therm since natural gas is usually sold in therms, hence a conversion factor is needed in Equation (39).

The annual utility savings are calculated using the following equation:

$$UC_{annual_saving} = UC_{annual_baseline} - UC_{annual_compliant} \quad (40)$$

where UC_{annual_saving} is the annual utility savings ($/year), $UC_{annual_baseline}$ is the annual utility cost for a baseline unit ($/year), and $UC_{annual_compliant}$ is the annual utility cost for a compliant unit ($/year).

Benefit-Cost-Ratio

To examine the financial viability of purchasing a compliant oven for consumers, the benefit-cost-ratio (BCR) was calculated. The BCR was calculated by dividing the lifetime monetary benefit by the total incremental cost. A design lifespan for rack ovens of 12 years[97] and a 3% discount rate for utility savings were assumed in the BCR calculation.

The BCR was calculated using the following equation:

$$BCR = \frac{UC_{lifetime_saving}}{IC_{incremental}} \quad (41)$$

where BCR is the benefit-cost-ratio, $UC_{lifetime_saving}$ is the lifetime utility savings for a compliant oven, and $IC_{incremental}$ is the incremental cost incurred when buying a compliant oven.

The lifetime utility savings were calculated using the following equation:

$$UC_{lifetime_saving} = \sum_{i=1}^{12} \frac{E_{annual_saving} \times \left[P_{unit_energy}\right]_i \times CF}{(1+DR)^{i-1}} \quad (42)$$

where E_{annual_saving} is the annual energy savings of an oven (Btu/year), i is the number of the year for which the oven has been in service, $\left[P_{unit_energy}\right]_i$ is the forecasted natural gas price in the ith year of service ($/therm), CF is a conversion factor ($CF = 1.0 \times 10^{-5}$ therm/Btu), and DR is the annual discount rate of the utility savings (3% was used in the calculations in this report).

The incremental cost $IC_{incremental}$ includes the additional cost that a consumer needs to pay when purchasing and installing a compliant oven than a baseline oven. CEC staff decided to align with the incremental cost in ENERGY STAR's commercial food service equipment calculator. Table A-3 below lists the incremental cost used in the calculations for rack ovens.

Table A-3: Incremental Cost for Rack Ovens.

Oven Size	Incremental Cost (2024 $)
Single-Rack Gas	4,000
Double-Rack Gas	4,000

Source: ENERGY STAR Commercial Food Service Equipment Calculator

97 The assumed 12-year lifespan was taken from CA eTRM Commercial Rack Oven Measure SWFS014-04.

Simple Payback Period

The simple payback period is the amount of time it takes to recover the initial investment cost, without considering a discount rate. It is calculated by dividing the total incremental cost by the first-year utility savings, as shown below:

$$PB_{simple} = \frac{IC_{incremental}}{UC_{saving_1st_year}} \quad (43)$$

where PB_{simple} is the simple payback period (years), $IC_{incremental}$ is the incremental cost ($), and $UC_{saving_1st_year}$ is the first-year utility savings ($/year).

Statewide Energy, Water, and Utility Savings

California Market Analysis

Total Oven Inventory in California

To calculate the statewide energy, water, and utility savings, it is necessary to estimate the total oven inventory in California. The total number of commercial convection, combination, and rack ovens in California was estimated based on the annual ENERGY STAR shipment data and penetration rate, the assumed 12-year lifespan of the ovens, as well as the U.S. and California population.

The ENERGY STAR shipment data shows that the total number of ENERGY STAR certified ovens shipped in 2022 was 52,000 and the penetration rate of ENERGY STAR compliant units was 53%.[98] The ratio of the California population to the US population was 11.415% in 2024.[99] Therefore, the total annual shipment in California was estimated to be

$$N_{CA_annual} = \frac{52{,}000 \times 11.415\%}{53\%} \approx 11{,}200 \quad (44)$$

where N_{CA_annual} is the annual shipped number of ovens in California. Please note this number only consists of ENERGY STAR covered ovens (commercial convection, combination, and rack ovens) and includes units for sale, rental and lease.

The total oven inventory in California was estimated to be

$$N_{CA} = 11{,}200 \times 12 = 134{,}400 \quad (45)$$

where N_{CA} is the total oven inventory in California. Again, this number only consists of commercial convection, combination, and rack ovens.

According to NAFEM's Size and Shape of the Industry study,[100] convection ovens constitute 76% of the sales across the three oven categories, while combination ovens account for 20%

98 ENERGY STAR shipment data, 2022. Available at https://www.energystar.gov/partner-resources/products_partner_resources/brand-owner/unit-shipment-data.

99 US Cencus Bureau, State Population Totals: 2020-2025, available at https://www.census.gov/data/tables/time-series/demo/popest/2020s-state-total.html.

100 Size and Shape of the Industry, North American Association of Food Equipment Manufacturers, 2022. Available at https://nafem.org/.

and rack ovens make up 4%. Based on these percentages, there are approximately 102,000 convection ovens, 26,880 combination ovens, and 5,400 rack ovens in California. The annual sales are approximately 8,500 convection ovens, 2,240 combination ovens, and 450 rack ovens.

Convection Ovens

For convection ovens, the annual shipment is approximately 8,500 units. Among all the convection ovens 87% are gas and 13% are electric according to the CA rebate data.[101] This translates to 7,395 gas ovens and 1,105 electric ovens. Among electric ovens, 80% are full-size and 20% are half-size.[102]

Table A-4 below lists the estimated annual shipment of different types of convection ovens in California.

Table A-4: Estimated Annual Shipment for Convection Ovens in California.

Oven Size	Gas	Electric
Full-Size	7,395	884
Half-Size	N/A	221

Source: CEC staff

Combination Ovens

For combination ovens, the annual shipment is approximately 2,240 units. According to California rebate data,[103] combination ovens with fewer than 15 pans account for approximately 66% of the units sold, those with capacities between 15 and 28 pans account for 24%, and those with more than 28 pans account for 9% of the units sold. 2/3-size combination ovens only account for 1.7% of the units sold.

California rebate data shows that 45% of combination ovens with fewer than 15 pans are gas, while 55% are electric. For combination ovens with capacities ranging from 15 to 28 pans, 65% are gas and 35% are electric. For 40-pan combination ovens, the only popular pan capacity above 28 pans, 92% are gas and 8% are electric.

Table A-5 below lists the estimated annual shipment for different types of combination ovens in California.

101 CA IOUs Comments – Food Service T20 CASE Report, 2024. Available at https://efiling.energy.ca.gov/GetDocument.aspx?tn=260264&DocumentContentId=96480.

102 Ibid.

103 Ibid.

Table A-5: Estimated Annual Shipment for Combination Ovens in California

Pan Capacity	Gas	Electric
Fewer than 15 Pans	663	811
15 to 28 Pans	343	185
Greater than 28 Pans	182	16
2/3-Size	N/A	40

Source: CEC staff

Rack Ovens

For rack ovens, the annual shipment is about 450 units. California rebate data show that nearly 80% of the rack ovens sold are double racks, while single racks make up 20%.[104] Table A-6 below lists the annual shipment of rack ovens in California.

Table A-6: Estimated Annual Shipment for Rack Ovens in California

Oven Size	Gas
Single-Rack	90
Double-Rack	360

Source: CEC staff

Current Market Share of Qualified Products

CEC staff analyzed available oven performance data from ENERGY STAR and CA eTRM. Table A-7 below shows the percentage of convection, combination, and rack ovens that meet the minimum performance requirements of different energy standards.

Table A-7: Compliance Rate of Ovens for Different Energy Standards

Oven Type	ENERGY STAR v2.2	ENERGY STAR v3.0	Earthjustice
Convection Ovens	65.2%	36.4%	29.5%
Combination Ovens	75.8%	64.3%	54.4%
Rack Ovens	52.4%	52.4%	33.3%

Source: CEC staff

Calculation Methods

Energy Savings

Statewide energy savings are calculated based on the calculated per-unit savings and estimated number of oven units in California. Since the compliant units already meet or exceed the minimum energy requirements specified by the selected energy efficiency standard, saving

104 Ibid.

energy can only be achieved by improving the performance of baseline units. Therefore, the calculations of statewide energy savings only use the estimated number of baseline units in the state.

First-year statewide energy savings are calculated using the following equation:

$$E_{CA_saving_1st_year} = E_{annual_saving} \times N_{CA_annual_baseline} \quad (46)$$

where $E_{CA_saving_1st_year}$ is the first-year statewide energy savings (Btu/year or kWh/year), E_{annual_saving} is the per-unit annual energy savings (Btu/year or kWh/year), and $N_{CA_annual_baseline}$ is the estimated annual shipment of baseline units in the state. The above equation applies to convection, combination, and rack ovens.

The design lifespan of convection, combination, and rack ovens is 12 years. After full stock turnover, the annual statewide energy savings will be

$$E_{CA_saving_full_stock} = E_{CA_saving_1st_year} \times DL \quad (47)$$

where $E_{CA_saving_full_stock}$ is the annual statewide energy savings after full stock turnover (Btu/year or kWh/year) and DL is the design lifespan of the ovens (12 years). Again, the above equation applies to convection, combination, and rack ovens.

Water Savings

Staff calculated statewide water savings based on the calculated per-unit savings and estimated number of oven units in California. First-year statewide water savings are calculated using the following equation:

$$WC_{CA_saving_1st_year} = WC_{annual_saving} \times N_{CA_annual_baseline} \quad (48)$$

where $WC_{CA_saving_1st_year}$ is the first-year statewide water savings (gal/year), WC_{annual_saving} is the per-unit annual water savings (gal/year), and $N_{CA_annual_baseline}$ is the estimated annual shipment of baseline units in the state. The above equation applies only to the combination ovens since there are only water consumption requirements in the ENERGY STAR v3.0 specification and the Earthjustice-proposed standard for combination ovens.

The design lifespan of combination ovens is 12 years. After full stock turnover in 2040, the annual statewide water savings will be

$$WC_{CA_saving_full_stock} = WC_{CA_saving_1st_year} \times DL \quad (49)$$

where $WC_{CA_saving_full_stock}$ is the annual statewide water savings after full stock turnover (gal/year) and DL is the design lifespan of the ovens (12 years).

Utility Savings

Staff calculated statewide utility savings are based on the statewide energy and water savings and the forecasted energy (electricity and natural gas) price and water rate.

First-year statewide utility savings are calculated using the following equation:

$$UC_{CA_saving_1st_year} = E_{CA_saving_1st_year} \times P_{unit_energy} \times CF + WC_{CA_saving_1st_year} \times P_{unit_water} \quad (50)$$

where $UC_{CA_saving_1st_year}$ is the first-year statewide utility savings ($/year), $E_{CA_saving_1st_yar}$ is the first-year statewide energy savings (Btu/year or kWh/year), P_{unit_energy} is the forecasted electricity or natural gas price ($/kWh or $/therm), CF is a conversion factor ($CF = 1.0 \times 10^{-5}$ therm/Btu and $CF = 1$ for electric ovens), $WC_{CA_saving_1st_yar}$ is the first-year statewide water savings (gal/year), and P_{unit_water} is the water rate ($/gal).

The statewide utility savings after full stock turnover are calculated using the following equation:

$$UC_{CA_saving_full_stock} = \sum_{i=1}^{12} \frac{E_{CA_saving_1st_year} \times [P_{unit_energy}]_i \times CF + WC_{CA_saving_1st_year} \times P_{unit_water}}{(1+DR)^{i-1}} \quad (51)$$

Where $UC_{CA_saving_full_stock}$ is the statewide annual utility savings after full stock turnover ($/year), $E_{CA_saving_1st_year}$ is the first-year statewide energy savings (Btu/year or kWh/year), i is the number of the year for which an oven has been in service, $[P_{unit_energy}]_i$ is the unit natural gas or electricity price in the ith year of service ($/therm or $/kWh), CF is a conversion factor ($CF = 1.0 \times 10^{-5}$ therm/Btu for gas ovens and CF = 1 for electric ovens), $WC_{CA_saving_1st_year}$ is the first-year statewide water savings (gal/year), P_{unit_water} is the water rate ($/gal), and DR is the annual discount rate of the utility savings (3% was used in the calculations in this report).

Peak Demand

The demand on the California electric grid is typically highest during a hot summer day in the late afternoons and evenings, when the solar electricity generation is declining as the sun is setting and the electric demand is surging as people return home and turn on their air conditioners. The heaviest usage of commercial ovens also happens in the late afternoons and evenings during dinner time. The peak demand reduction during this period because of the proposed efficiency standards is a direct benefit to the management of the electrical grid, and this section explains how this benefit was quantified.

Not all commercial ovens are operating at the same time during dinner time since restaurants, hotels, hospitals, schools, and other food service establishments typically have different operating schedules. To estimate the statewide peak demand of commercial ovens, staff made the following assumptions in the calculations:

1) 70% of all commercial ovens are cooking food
2) 20% of all commercial ovens are idle
3) For combination ovens, 50% are operating in steam mode and 50% are operating in convection mode
4) 10% of all commercial ovens are turned off

With the above assumptions, statewide peak demand for electric ovens is calculated using the following equation:

$$PD_{statewide} = PD_{per_unit} \times N_{cooking} + P_{idle_per_unit} \times N_{idle} \quad (52)$$

where $PD_{statewide}$ is the statewide peak demand (kW), PD_{per_unit} is the per-unit peak demand of electric ovens (kW), $N_{cooking}$ is the number of units that are cooking food, $P_{idle_per_unit}$ is the per-unit idle energy rate for electric ovens (kW), and N_{idle} is the number of units that are idle.

To calculate the statewide peak demand reduction, the statewide peak demand is calculated for the baseline and compliant groups. The difference between the two groups is the reduction in statewide peak demand, as shown below:

$$PDR_{statewide_reduction} = PD_{statewide_unit_baseline} - PD_{statewide_compliant} \quad (53)$$

where $PDR_{statewide_reduction}$ is the statewide peak demand reduction, $PD_{statewide_baseline}$ is the baseline group statewide peak demand, and $PD_{statewide_compliant}$ is the compliant group statewide peak demand.

APPENDIX B: Electricity, Natural Gas, and Water Price Forecasts

CEC staff used forecasted commercial rates for electricity and fossil gas, expressed in 2024 dollars, from the California Energy Demand of the *2025 Integrated Energy Policy Report (IEPR)*.[105] These statewide numbers represent the average across utilities weighted by the volume of electricity and fossil gas sales.

Natural Gas Prices

Table B-1 lists the commercial natural gas prices from 2025 to 2040 forecasted by CEC staff for the *2025 IEPR*. There are two sets of natural gas prices corresponding to two different forecasting scenarios: 1) 2023 baseline demand scenario and 2) 2024 Additional Achievable Fuel Substitution 2 (AAFS 2) scenario. The 2023 baseline demand scenario represents a "business-as-usual" scenario where the gas demand is stable over the next few decades. The 2024 AAFS 2 scenario, on the other hand, considers a gradual decline in gas demand and that the gas demand will reduce to about half of today by 2050.

Staff believes it is reasonable to consider and rely on a scenario that shows some natural gas rate impacts due to ongoing electrification efforts rather than to assume no impacts at all. The *2025 IEPR* also considers AAFS 3 and AAFS 4 scenarios, which show a higher degree of electrification in the short term than the AAFS 2 scenario, but staff consider those scenarios overly aggressive for the planning considered in this report. Therefore, staff used natural gas prices corresponding to the 2024 AAFS 2 scenario in staff's utility saving calculations in the benefit-cost analysis for commercial convection, combination, and rack ovens.

105 California Energy Commission. "California Energy Demand, 2025–2045," https://www.energy.ca.gov/data-reports/reports/integrated-energy-policy-report-iepr/2025-integrated-energy-policy-report-0.

Table B-1: CEC-Forecasted Commercial Natural Gas Prices (2024$/Therm)

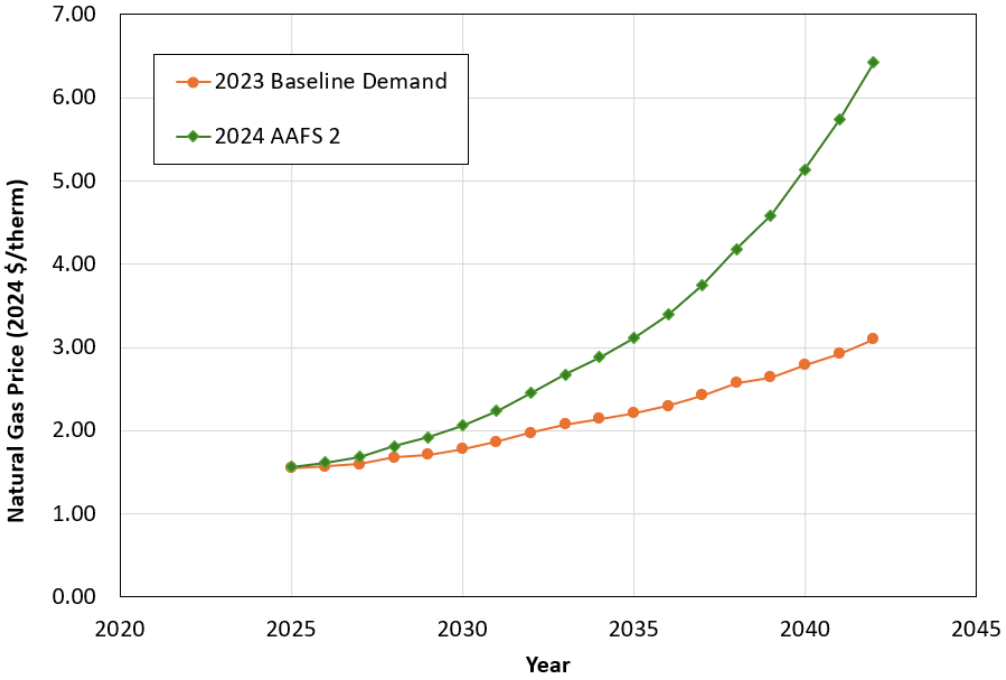
	2023 Baseline Demand Scenario	2024 AAFS 2 Scenario (Used in Benefit-Cost Analysis)
2025	$1.55	$1.57
2026	$1.57	$1.62
2027	$1.59	$1.68
2028	$1.68	$1.82
2029	$1.71	$1.92
2030	$1.78	$2.06
2031	$1.86	$2.24
2032	$1.97	$2.45
2033	$2.08	$2.67
2034	$2.14	$2.88
2035	$2.21	$3.11
2036	$2.30	$3.40
2037	$2.42	$3.75
2038	$2.57	$4.18
2039	$2.64	$4.59
2040	$2.79	$5.14

Source: CEC staff

Sensitivity Study

Figure B-1 below compares the CEC-forecasted natural gas prices for the 2023 baseline demand scenario and the 2024 AAFS 2 scenario. The natural gas prices in 2025 are almost the same between the two scenarios. However, the natural gas prices for the 2024 AAFS 2 scenario increase more rapidly with time than that for the 2023 baseline demand scenario. By 2040, the natural gas price for the 2024 AAFS 2 scenario is 84% higher than that for the 2023 baseline demand scenario.

Figure B-1: Comparison of Forecasted Natural Gas Prices Between 2023 Baseline Demand Scenario and 2024 AAFS 2 Scenario

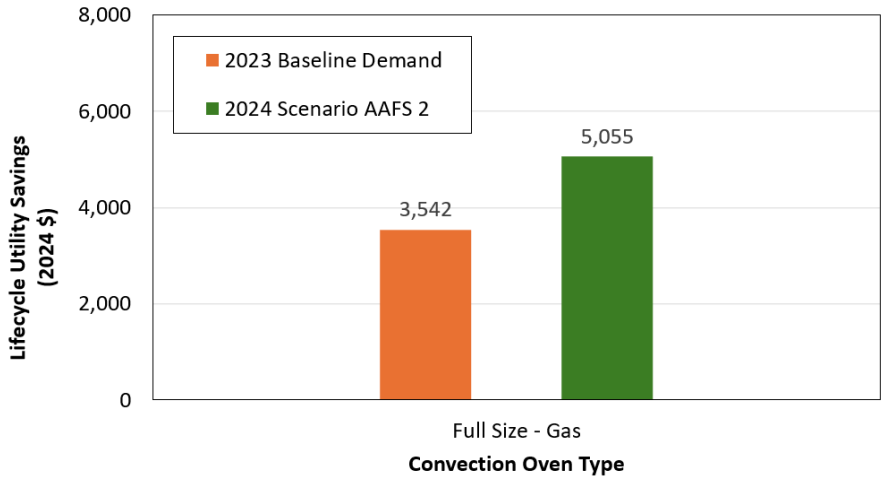


Source: CEC staff

Understandably, using natural gas prices from the 2024 AAFS 2 scenario instead of the 2023 baseline demand scenario in the benefit-cost analysis yielded higher utility savings. However, even if the 2023 baseline demand scenario prices were used, the proposed standards would still be cost-effective and provide significant utility savings for consumers. Staff performed a sensitivity analysis on the natural gas prices and compared benefit-cost analysis results between the two scenarios.

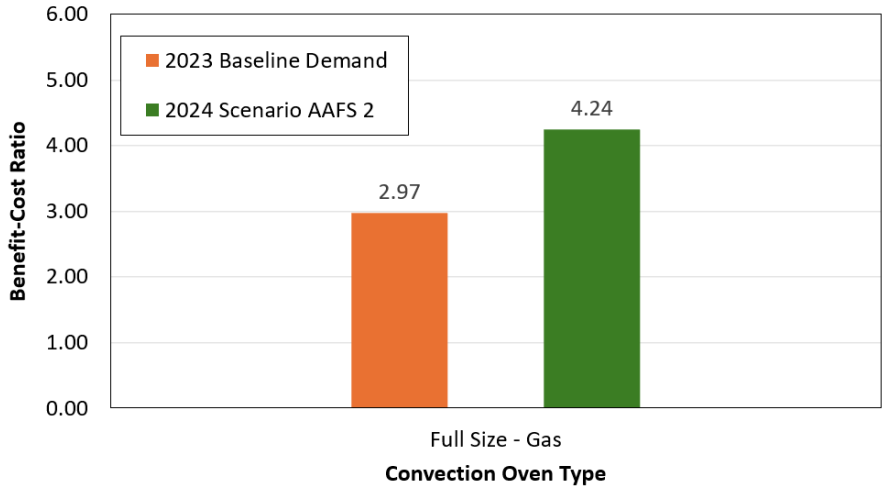
Figure B-2 and Figure B-3 show the life-cycle utility savings and benefit-cost ratios, respectively, for full-size gas convection ovens for the two scenarios. When using the 2024 AAFS 2 natural gas prices, the life-cycle utility savings and benefit-cost ratios are $5,055 (in 2024$) and 4.24, respectively. This comparison indicates that the proposed standards are highly cost-effective and that consumers will benefit financially from purchasing and operating a compliant full-size gas convection oven.

Figure B-2: Life-Cycle Utility Savings of Gas Convection Ovens for Two Forecasting Scenarios



Source: CEC staff

Figure B-3: Life-Cycle Benefit-Cost Ratios of Gas Convection Ovens for Two Forecasting Scenarios



Source: CEC staff

As a comparison, when using the 2023 baseline demand natural gas prices, the life-cycle utility savings and benefit-cost ratio are $3,542 and 2.97, respectively. This comparison indicates, even with the more conservative 2023 baseline demand natural gas prices, that the proposed standards are highly cost-effective and that consumers will still benefit financially from purchasing and operating a compliant full-size gas convection oven.

Staff also performed similar sensitivity study on commercial combination and rack ovens. Although not shown here, the analysis confirmed that using either 2023 baseline demand natural gas prices or 2024 AAFS 2 natural gas prices would yield cost-effective standards and financially favorable results for consumers.

Electricity Prices

Table B-2 lists the forecasted electricity prices from 2025 to 2040 used in the *2025 IEPR*. CEC staff prepared only one electricity price forecast for the *2025 IEPR*, corresponding to the 2023 baseline demand scenario. The electricity prices from 2029 to 2040 were used for the utility saving calculations in the benefit-cost analysis for commercial convection, combination, and rack ovens.

Table B-2: CEC-Forecasted Commercial Electricity Prices (2024$/kWh)

	2025 IEPR Electricity Price Forecast
2025	$0.271
2026	$0.267
2027	$0.268
2028	$0.276
2029	$0.276
2030	$0.279
2031	$0.280
2032	$0.281
2033	$0.280
2034	$0.279
2035	$0.281
2036	$0.284
2037	$0.285
2038	$0.287
2039	$0.288
2040	$0.291

Source: CEC staff

Water Rate

By analyzing the 2020 urban water management plans (UWMPs) submitted by urban water suppliers to the California Department of Water Resources (DWR),[106] CEC staff determined a representative population-averaged commercial water rate of $6.18 (in 2024$) per 1000 gallons, as shown in Table B-3.

The California Water Code defines an "urban water supplier" as a supplier, either publicly or privately owned, providing water for municipal purposes either directly or indirectly to more than 3,000 customers or supplying more than 3,000 acre-feet of water annually. Water rates from the 578 urban water suppliers in California were considered. When the UWMP data

106 2020 urban water management plans (UWMPs) submitted to the Department of Water Resources: https://wuedata.water.ca.gov/default.asp.

contained multiple entries from the same urban water supplier, the most recent data were kept and the redundant data entries removed.

Staff also reviewed the UWMP data to ensure consistency in units and eliminate faulty data. When faulty data were encountered, and for all the largest service districts, staff looked up rate information directly from the urban water suppliers' website. Staff considered service connections a reasonable proxy for the population and used the reported number of service connections to calculate the population-averaged commercial water rate. The UWMPs do not contain projected water rates for upcoming years, and CEC staff is not aware of a comprehensive data set for all the 578 urban water suppliers that provides projections of future water rates in California. Given the lack of comprehensive data, staff assumed that the nominal price of $6.18 per 1000 gallons remains constant until 2040. This is a conservative assumption as many water suppliers have announced significant increases in water rates in coming years, and higher water rates only improve the benefits of the proposed regulations.

Table B-3: Commercial Water Rate (2024$/Thousand Gallons)

Commercial Water Rate (2024$/Thousand Gallons)
$6.18

Source: CEC staff

APPENDIX C:
Proposed Regulatory Language

The proposed changes to the Title 20 standards are provided below. Changes to the standards are marked with underlining (new language) and ~~strikethroughs~~ (deletions). Three dots or "…" represents the substance of the regulations that exists between the proposed language and current language.

Summary of Proposed Standards

The proposed regulatory language will:

1. Expand regulation scope to include commercial ovens sold, rented, or leased in the state.
2. Provide relevant regulatory definitions.
3. Specify the test methods to measure the energy and water efficiency of commercial ovens.
4. Establish requirements for minimum cooking efficiency, maximum idle energy rate, and maximum water consumption rate for commercial ovens.
5. Establish manufacturer data submittal requirements for certification of commercial ovens.
6. Establish marking requirements for commercial ovens.

The efficiency standards for commercial ovens would apply to the in-scope ovens manufactured on or after January 1, 2029, or one year from the adoption of this regulation, whichever is later.

Proposed Changes to Title 20 Code Language

§ 1601. Scope.

This Article applies to the following types of new appliances, if they are sold or offered for sale in California, except those sold wholesale in California for final retail sale outside the state and those designed and sold exclusively for use in recreational vehicles, or other mobile equipment. Unless otherwise specified, each provision applies only to units manufactured on or after the effective date of the provision.

For the following new appliances, this Article applies if they are sold, rented, imported, distributed, or leased, or offered for sale, rental, importation, distribution, or lease in California, except those sold, rented, imported, distributed, or leased wholesale in California for final retail sale, rental, or lease outside the state. In sections 1605(c), 1606, 1608, and 1609 of this Article when the term "sold or offered for sale" is used, it shall for the following appliances be interpreted to mean "sold, rented, imported, distributed, or leased, or offered for sale, rental, importation, distribution, or lease".

i. Commercial ovens manufactured on or after January 1, 2029

Note: For the applicability of these regulations to appliances installed in new building construction, see sections 110.0 and 110.1 of part 6 of Title 24 of the California Code of Regulations.

…[skipping (a) through (q)]

(r) Cooking products that are federally regulated consumer products; and commercial food service equipment.

…[skipping through the end of section 1601]

§ 1602. Definitions.

…[skipping (a) through (q)]

(r) Cooking Products and Commercial Food Service Equipment

"2/3-size combination oven" means a commercial combination oven that can accommodate one 2/3-size steam pan or Gastronorm (GN) 2/3 pan measuring approximately 12.8 x 13.8 x 2.5 inches per rack position, loaded from front to back or lengthwise. A 2/3-size combination oven is also known as a mini-size combination oven.

…[skipping "Built-in microwave oven"]

"Commercial combination oven" means a commercial oven that combines the function of hot, dry air convection and steam heating to cook food products. A combination oven can be operated in one of three modes: convection, steam, and combination mode. A combination oven is also known as a "combi oven." A combination oven uses either gas burner(s) or electric heating element(s) to provide heat for cooking. For purposes of this Article, commercial combination ovens include:

(1) Full-size and half-size gas combination ovens with a pan capacity of at least three and no more than fifty.

(2) Full-size and half-size electric combination ovens with a pan capacity of at least three and no more than fifty.

(3) 2/3-size electric combination ovens with a pan capacity of at least three and no more than eight.

"Commercial convection oven" means an appliance that is not a consumer product and that is designed for cooking food by forcing hot air over it using a fan in a closed cavity. This term applies to units manufactured before January 1, 2029.

"Commercial convection oven" means a commercial oven that is a general-purpose oven that cooks food by forcing hot, dry air over the surfaces of the food products. A convection oven is equipped with one or more fans to improve hot air circulation and achieve even temperature distribution inside the cooking chamber. Commercial convection ovens do not include ovens that can heat the cavity with saturated or superheated steam. However, a convection oven may have moisture injection capabilities. A convection oven uses either gas burner(s) or

electric heating element(s) to provide heat for cooking. For purposes of this Article, commercial convection ovens include:

(1) Full-size gas and electric convection ovens.

(2) Half-size electric convection ovens.

This term applies to units manufactured on or after January 1, 2029.

"Commercial conveyor oven" means a commercial oven that uses a moving belt to transport food products into and through a heated chamber for cooking. A conveyor oven uses either gas burner(s) or electric heating element(s) to provide heat for cooking.

"Commercial deck oven" means a commercial oven that cooks food products directly on the floor of a heated chamber. The bottom of each compartment is called a deck and can be made of metal, stone, brick, ceramic tiles, or a combination of these materials, but is not limited to these materials. Heat is supplied by burners or heating elements located beneath the deck and/or above the ceiling. The oven ceiling, floor, and walls are designed to absorb heat quickly and radiate that heat back slowly and evenly. A deck oven uses either gas burner(s) or electric heating element(s) to provide heat for cooking.

"Commercial food service equipment" means a commercial hot-food holding cabinet, a commercial oven, or a commercial range top.

"Commercial high-speed oven" or "commercial rapid cook oven" means a commercial oven that utilizes one or more heat transfer technologies to cook food within a chamber and that cooks the food product significantly faster than is possible using solely radiant oven or convection oven technologies. Heat transfer technologies that may be employed include convection, radiation, microwave, quartz halogen, and high-velocity hot-air impingement. High-speed ovens do not include microwave ovens.

…[skipping "Commercial hot food holding cabinet"]

"Commercial oven" means a cooking appliance that is not a consumer product and is designed for high-volume cooking and baking in professional kitchens such as restaurants, bakeries, catering businesses, and other food service establishments. Commercial ovens typically feature a high capacity, powerful heating, durable construction, even heat distribution, and advanced cooking controls. Commercial ovens include commercial convection ovens, commercial combination ovens, commercial rack ovens, commercial high-speed ovens, commercial deck ovens, and commercial conveyor ovens. Depending on the energy source, commercial ovens can be categorized as gas ovens, including ovens using either natural gas or propane, and electric ovens.

"Commercial rack oven" means a commercial oven that uses a removable or fixed-rack system to hold multiple baking pans. It is equipped with a motor-driven mechanism for rotating the racks within the oven cavity. A rack oven uses either gas burner(s) or electric heating element(s) to provide heat for cooking. For purposes of this Article, commercial rack oven includes:

(1) Single-rack and double-rack gas ovens.

(2) Single-rack and double-rack electric ovens.

…[skipping "Commercial range top" through "Convection oven"]

"Cooking energy efficiency" means the ratio of the quantity of energy imparted to the specified load to the total energy consumed by the oven during the cooking process. Cooking energy efficiency is expressed in percentage (%).

…[skipping "Convertible cooking appliance" through "Drawer warmer"]

"Double-rack oven" means a floor-model commercial rack oven that can accommodate two removable single racks or one double rack of full-size sheet pans measuring approximately 18 x 26 x 1 inches.

~~"Food service equipment" means a commercial hot food holding cabinet, a commercial convection oven, or a commercial range top.~~

…[skipping "Forced convection"]

"Full-size combination oven" means a commercial combination oven that can accommodate two full-size steam pans or Gastronorm (GN) 1/1 pans measuring approximately 12.8 x 20.9 x 2.5 inches per rack position, loaded from front to back or lengthwise.

"Full-size convection oven" means a commercial convection oven that can accommodate one full-size sheet pan measuring approximately 18 x 26 x 1 inches or two half-size sheet pans measuring approximately 18 x 13 x 1 inches per rack position.

…[skipping "Heated glass merchandising cabinet"]

"Half-size combination oven" means a commercial combination oven that can accommodate one full-size steam pan or Gastronorm (GN) 1/1 pan measuring approximately 12.8 x 20.9 x 2.5 inches per rack position, loaded from front to back or lengthwise.

"Half-size convection oven" means a commercial convection oven that can accommodate one half-size sheet pan measuring approximately 18 x 13 x 1 inches per rack position.

"Idle energy rate" of a commercial oven means the rate of oven energy consumption while it is maintaining or holding at a stabilized operating condition or temperature. It is also called standby energy rate and expressed in Btu/hr or kW.

…[skipping "Major cooking component" through "Other cooking products"]

"Pan capacity" of a commercial oven means the number of pans the oven can accommodate when fully loaded. The pans shall be loaded front to back or lengthwise on the racks and shall not be stacked with one another. If the oven has more than one cavity, pan capacity means the maximum number of pans that can be accommodated in all cavities. The size of the pans used to determine the pan capacity varies with commercial oven type and size:

(1) For 2/3-size combination ovens, pan capacity means the maximum number of Gastronorm (GN) 2/3 steam pans measuring 12.8 x 13.8 x 2.5 inches that the oven can accommodate when fully loaded.

(2) For full-size or half-size combination ovens, pan capacity means the maximum number of Gastronorm (GN) 1/1 steam pans measuring 12.8 x 20.9 x 2.5 inches that the oven can accommodate when fully loaded.

(3) For full-size convection ovens, pan capacity means the maximum number of full-size sheet pans measuring 18 x 26 x 1 inches that the oven can accommodate when fully loaded.

(4) For half-size convection ovens, pan capacity means the maximum number of half-size sheet pans measuring 18 x 13 x 1 inches that the oven can accommodate when fully loaded.

"Single-rack oven" means a floor-model commercial rack oven that can accommodate one removable single rack of full-size sheet pans measuring approximately 18 x 26 x 1 inches.

"Water consumption rate" of a commercial combination oven means the water consumed during idle and heavy-load cooking periods in either steam or convection mode. It is expressed as gallons per hour per steam pan (gal/hr/pan) during idle, and gallons per steam pan (gal/pan) during cooking. Gallons per hour per pan and gallons per pan are based on Gastronorm (GN) 1/1 steam pans for full-size and half-size combination ovens and Gastronorm (GN) 2/3 pans for 2/3-size combination ovens.

"Water consumption rate" of a commercial convection oven means the water consumed during the steam injection mode (if applicable). It is expressed as gallons per minute (gal/min).

"Water consumption rate" of a rack oven means the water consumed during the steam injection mode (if applicable) for commercial rack ovens. It is expressed as gallons per minute (gal/min).

…[skipping through the end of section 1602]

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

§ 1602.1. Rules of Construction.

[no changes]

§ 1603. Testing All Appliances.

[no changes]

§ 1604. Test Methods for Specific Appliances.

…[skipping (a) through (q)]

(r) Cooking Products and Commercial Food Service Equipment.

The test methods for cooking products and food service equipment are shown in Table R-1.

Table R-1
Cooking Products and Commercial Food Service Equipment Test Methods

Appliance	*Test Method*
Microwave ovens	10 C.F.R. section 430.23(i) (Appendix I to subpart B of part 430) (January 19, 2025)
Conventional cooktops and combined cooking products	10 C.F.R. section 430.23(i) (Appendix I1 to subpart B of part 430) (January 19, 2025)
Commercial hot food holding cabinets	ANSI/ASTM F2140-01 (Test for idle energy rate-dry test) and US EPA's Energy Star Guidelines, "Measuring Interior Volume" (Test for interior volume)
Commercial convection ovens	ANSI/ASTM F1496-99 for units manufactured before January 1, 2029 (Test for energy input rate and idle energy consumption only) ANSI/ASTM F1496-13 (2019) for units manufactured on or after January 1, 2029 (Test for energy input rate, preheat energy, idle energy rate, cooking energy efficiency, and water consumption rate during steam injection) [2,3]
Commercial combination ovens [1,3]	ANSI/ASTM F2861-24 (Test for energy input rate, preheat energy, idle energy rate, cooking energy efficiency, and water consumption rate during idle and cooking)
Commercial rack ovens [1,3]	ANSI/ATSM F2093-18 (2023) (Test for energy input rate, preheat energy, idle energy rate, cooking energy efficiency, and water consumption rate during steam injection mode)
Commercial conveyor ovens [1,3]	ANSI/ATSM F1817-17 (2022) (Test for energy input rate, preheat energy, idle energy rate, and cooking energy efficiency)
Commercial deck ovens [1,3]	ANSI/ATSM F1965-17 (2022) (Test for energy input rate, preheat energy, idle energy rate, and cooking energy efficiency)
Commercial high-speed ovens [1,3]	ANSI/ATSM F2238-20 (Test for energy input rate, preheat energy, idle energy rate, and cooking energy efficiency)
Commercial range tops	ANSI/ASTM F1521-96 (Test for cooking energy efficiency only)

[1] Testing required for units manufactured on and after January 1, 2029.

[2] For commercial convection ovens, if an oven model has multiple door-type configurations, the least energy-efficient configuration must be tested.

[3] If a gas commercial oven model has both natural gas and propane configurations, the natural gas configuration must be tested. The natural gas configuration test results can be used to certify both the natural gas configuration and the propane configuration.

…[skipping the rest of (r) through (x)]

The following documents are incorporated by reference in section 1604.

…[skipping to ASTM INTERNATIONAL]

ASTM INTERNATIONAL

ANSI/ASTM F1496-99	Standard Test Method for Performance of Convection Ovens
ANSI/ASTM F1496-13 (2019) (for units manufactured on or after January 1, 2029)	Standard Test Method for Performance of Convection Ovens
ANSI/ASTM F2861-24	Standard Test Method for Performance of Combination Ovens
ANSI/ASTM F2093-18 (2023)	Standard Test Method for Performance of Rack Ovens
ANSI/ASTM F1817-17 (2022)	Standard Test Method for Performance of Conveyor Ovens
ANSI/ASTM F1965-17 (2022)	Standard Test Method for Performance of Deck Ovens
ANSI/ASTM F2238-20	Standard Test Method for Performance of Rapid Cook Ovens
ANSI/ASTM F1521-96	Standard Test Methods for Performance of Range Tops
ANSI/ASTM F2140-01 Holding	Standard Test Method for the Performance of Hot Food Cabinets
ANSI/ASTM F2143-01 Buffet and	Standard Test Method for the Performance of Refrigerated Preparation Tables
ASTM F2644-07	Standard Test Method for Performance of Commercial Patio Heaters

Copies available from: ASTM
100 Barr Harbor Drive
West Conshohocken, PA 19428-2959
www.astm.org
Phone: 1-877-909-2786

…[skipping through the end of section 1604]

§ 1605. Energy Performance, Energy Design, Water Performance, and Water Design Standards: In General.

[no changes]

§ 1605.1 Federal and State Standards for Federally Regulated Appliances.

…[skipping (a) through (q)]

(r) Cooking Products and <u>Commercial</u> Food Service Equipment.

(1) **Energy Design Standard for Gas Cooking Products.**

(A) **Gas Cooking Products Equipped With an Electrical Supply Cord.** Gas cooking products that are consumer products and that are equipped with an electrical supply cord shall not be equipped with a constant burning pilot light.

(B) **Gas Cooking Products Not Equipped With an Electrical Supply Cord.** Gas cooking products that are consumer products manufactured on or after April 9, 2012, and that are not equipped with an electrical supply cord shall not be equipped with a constant burning pilot light.

(2) **Microwave Ovens.**

Microwave-only ovens, countertop convection microwave ovens, built-in microwave ovens, and over-the-range convection microwave ovens manufactured on or after the effective dates shown shall not exceed the average standby power rating (watts) shown in Table R-2 and Table R-3.

Table R-2
Standards for Microwave Ovens Manufactured on or After June 17, 2016, but Before June 22, 2026

Appliance	*Maximum Standby Power (Watts)*
Microwave-only oven	1.0
Countertop convection microwave oven	1.0
Built-in microwave oven	2.2
Over-the-range convection microwave oven	2.2

Table R-3

Standards for Microwave Ovens Manufactured On or After June 22, 2026

Appliance	*Maximum Standby Power (Watts)*
Microwave-only oven	0.6
Countertop convection microwave oven	0.6
Built-in microwave oven	1.0
Over-the-range convection microwave oven	1.0

(3) **Hot Food Holding Cabinets.** See section 1605.3(r) of this Article for energy efficiency standards for commercial hot food holding cabinets.

(4) **Commercial Ovens.** See section 1605.3(r) of this Article for energy and water efficiency standards for commercial ovens.

~~(4)~~(5) **Other Cooking Products and Commercial Food Service Equipment.** There is no energy efficiency standard or energy design standard for other cooking products or ~~for~~ commercial food service equipment.

…[skipping through the end of section 1605.1]

§ 1605.2 State Standards for Federally Regulated Appliances.

…[skipping (a) through (q)]

(r) Cooking Products and Commercial Food Service Equipment.

(1) **Hot Food Holding Cabinets.** See section 1605.3(r) of this Article for energy efficiency standards for commercial hot food holding cabinets.

(2) **Cooking Products.** See section 1605.1(r) of this Article for energy efficiency standards and energy design standards for cooking products that are federally regulated consumer products.

(3) **Commercial Ovens.** See section 1605.3(r) of this Article for energy and water efficiency standards for commercial ovens.

~~(3)~~(4) **Other Cooking Products and Commercial Food Service Equipment.** There is no energy efficiency standard for other cooking products or commercial food service equipment.

…[skipping through the end of section 1605.2]

§ 1605.3 State Standards for Non-Federally Regulated Appliances.

…[skipping (a) through (q)]

(r) Cooking Products and Commercial Food Service Equipment

~~(1) **Energy Standards for Food Service Equipment.** There is no energy efficiency standard or energy design standard for food service equipment other than commercial hot food holding cabinets.~~

~~(2)~~(1) ~~**Energy Efficiency Standards for**~~ **Commercial Hot Food Holding Cabinets.** The idle energy rate of commercial hot food holding cabinets manufactured on or after January 1, 2006, shall be no greater than 40 watts per ft^3 of measured interior volume.

(2) **Commercial Ovens.**

(A) **Commercial Convection, Combination, and Rack Ovens.** The cooking energy efficiency, idle energy rate, and water consumption rate of commercial convection ovens, commercial combination ovens, and commercial rack ovens manufactured on or after January 1, 2029, shall meet the applicable energy and water efficiency standards shown in Table R-4.

Table R-4
Standards for State-Regulated Commercial Convection, Combination, and Rack Ovens Manufactured on or After January 1, 2029

Oven Type	Oven Class	Maximum Idle Energy Rate (Btu/hr or kW)	Minimum Cooking Energy Efficiency (%)	Maximum Water Consumption Rate
Commercial Convection Ovens	Full-Size Gas	9,500	49	N/A
	Full-Size Electric (Pan Capacity ≥ 5)	1.40	76	
	Full-Size Electric (Pan Capacity < 5)	1.00		
	Half-Size Electric	1.00	71	
Commercial Combination Ovens[1]	Gas (3 ≤ Pan Capacity ≤ 50) – Steam Mode	200P + 6,511	41	When Idling = N/A. When Cooking = 0.5 gal/pan for steam mode and 0.4 gal/pan for convection mode.
	Gas (3 ≤ Pan Capacity ≤ 50) – Convection Mode	140P+3,800	57	
	Electric (5 ≤ Pan Capacity ≤ 50) – Steam Mode	0.133P+0.6400	55	
	Electric (5 ≤ Pan Capacity ≤ 50) – Convection Mode	0.083P + 0.35	78	
	Electric (3 - 4 Pan Capacity) and 2/3-Size Electric (3 ≤ Pan Capacity ≤ 8) – Steam Mode	0.060P	51	
	Electric (3 - 4 Pan Capacity) and 2/3-Size Electric (3 ≤ Pan Capacity ≤ 8) – Convection Mode	0.05P + 0.55	70	
Commercial Rack Ovens	Single-Rack Gas	25,000	48	N/A
	Double-Rack Gas	30,000	52	

[1]: For commercial combination ovens, P is the pan capacity as defined in section 1602(r) of this Article.

(B) **Commercial Conveyor, Deck, High-Speed Ovens, and Electric Rack Ovens.** There are no energy efficiency or design standards for commercial conveyor, deck, high-speed, and electric rack ovens.

(3) **Cooking Products.** See section 1605.1(r) of this Article for energy efficiency standards and energy design standards for cooking products that are federally regulated consumer products.

(4) **Other Commercial Food Service Equipment.** There are no energy efficiency standards or energy design standards for commercial food service equipment other than commercial hot food holding cabinets and commercial ovens listed in section 1605.3(r) of this Article.

…[skipping through the end of section 1605.3]

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

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

(a) Filing of Statements.

Each manufacturer shall electronically file with the Executive Director through the MAEDbS a statement for each appliance that is sold or offered for sale in California. The statement shall contain all of the information described in paragraphs (2) through (4) of this subsection and shall meet all of the requirements of paragraph (1) of this subsection and all other applicable requirements in this Article.

The effective dates of this section shall be the same as the effective dates shown in section 1605.1, 1605.2 or 1605.3 of this Article for appliances for which there is an energy efficiency, energy consumption, energy design, water efficiency, water consumption, or water design standard in section 1605.1, 1605.2, or 1605.3 of this Article. For appliances with no energy efficiency, energy consumption, energy design, water efficiency, water consumption, or water design standard in section 1605.1, 1605.2, or 1605.3 of this Article, the effective date of this section shall be one year after they are added to section 1601 of this Article, unless a different effective date is specified.

…[skipping EXCEPTIONS]

(1) **General Rules.**

(A) **Format and Categories.** Each statement shall be in a format (including but not limited to computer formats) and in categories specified by the Executive Director.

(B) **When Different Statements are Required.** The Executive Director may establish, modify, and enforce schedules for the submittal of statements where it is reasonably necessary for orderly processing of submittals, for example when manufacturers or third parties often submit many statements simultaneously.

(C) **Asterisks in Model Numbers.** In filing any statement, the manufacturer may use asterisks as a substitute for letters, numbers, blanks, or other characters in the model number, provided that an asterisk (i) shall be used only for a part of the model number that does not indicate energy consumption, energy efficiency, water consumption, or water efficiency, or a design or feature affecting such efficiency or consumption; (ii) shall represent a single letter, number, blank, or other character at the asterisk's location in the model number; and (iii) shall not be used for any of the first four letters, numbers, blanks, or other characters in the model number.

(D) **Different Functions.** Except as provided in section 1606(a)(1)(G) of this Article, if the same appliance is sold or offered for sale as more than one type of appliance shown in Table X (for example, if the appliance can serve both water heating and pool heating functions), the manufacturer shall submit a separate statement for each model of that appliance type. Each appliance type for which a statement is submitted must match all the common identifiers shown in Table X.

(E) **Multiple Statements.** A manufacturer may electronically file statements through the MAEDbS for more than one appliance in a single submittal to the Executive Director. If a submittal contains statements for more than one appliance, there shall be only one statement for each appliance, except as provided in sections 1606(a)(1)(D) and 1606(a)(1)(G) of this Article. The Executive Director shall allow multiple statements to be submitted in the same electronic file under conditions they determine are reasonably necessary to ensure accuracy and compatibility with the MAEDbS.

…[skipping rest of (1)]

(2) **Manufacturer Information.**

(A) The name, address, telephone number, e-mail address, and, if available, fax number and URL (web site) address of the manufacturer; provided, however, that if a parent entity is filing on behalf of a subsidiary entity, if a subsidiary entity is filing on behalf of a parent entity, or if an affiliate entity is filing on behalf of an affiliate entity, then each entity shall be clearly identified and the information shall be provided for both entities.

(B) The name, address, telephone number, e-mail address, and, if available, fax number of the individual to contact concerning the statement pursuant to section 1606(a)(4) of this Article. There shall be only one individual to contact for each category (box) in the "Appliance" column of Table X, except that the individual may, during their absence, delegate their duties in this regard.

(C) The name, address, telephone number, e-mail address, and, if available, fax number of the person signing the declaration pursuant to section 1606(a)(4) of this Article.

(3) **Testing and Performance Information.**

(A) A statement that the appliance has been tested in accordance with all applicable requirements of sections 1603 and 1604 of this Article. If section 1604 of this Article provides more than one test method that may be used, the manufacturer shall identify which method was used.

…[skipping EXCEPTIONS]

(B) The name and address and, if available, telephone number, fax number, URL (web site) address, and e-mail address of the laboratory or other institution where the testing required by sections 1603 and 1604 of this Article was performed.

(C) The applicable information listed in Table X; provided, however, that submittal of information marked with "1" is voluntary for federally regulated appliances, and that submittal of information marked with "2" is voluntary for state-regulated appliances. Where there is text in the "Permissible Answers" column, the information provided must be one of the answers shown. If the text in the "Permissible Answers" column states "other (specify)," the information provided must be a specific response for the "Required Information" category (e.g., a response of "other" is not acceptable).

…[skipping EXCEPTIONS]

(D) How Tested Data Must Be Reported.

1. For any numerical value required by Table X that is produced by a test specified in section 1604 of this Article, the reported value shall be no higher for the value for which the consumer would prefer a high number, and no lower for the value for which the consumer would prefer a low number, than the values obtained by testing; unless different specific instructions are specified in the test method specified in section 1604 of this Article.

2. For any numerical value required by Table X that is produced by calculation from measured numerical test results, the reported value shall be no higher for the values where the consumer would prefer a high number than the exact result of the calculation, and no lower than the exact result of the calculation where the consumer would prefer a low number, than the values obtained by calculating, unless different specific instructions are specified in the test method specified in section 1604 of this Article.

3. Manufacturers may report:

a. numbers higher than tested values, where the consumer would, all other things being equal, prefer lower values (or is indifferent); and

b. numbers lower than tested values, where the consumer would, all other things being equal, prefer higher values (or is indifferent).

…[skipping Example]

Table X
Data Submittal Requirements

	Appliance	*Required Information*	*Possible Answers*
	All Appliances	* Manufacturer's Name	
		* Brand Name	
		* Model Number	
		Date model to be displayed	
		Regulatory Status	Federally regulated consumer product, federally regulated commercial and industrial equipment, non-federally regulated, other

…[skipping section A through section Q]

Table X Continued — Data Submittal Requirements

	Appliance	*Required Information*	*Possible Answers*
R	Consumer Product Cooking Products	*Type	Conventional range, conventional cooking top, conventional oven, microwave-only oven, countertop convection microwave oven, built-in microwave oven, over-the-range convection microwave oven, combined cooking products, other (specify)
		*Energy Source	Gas, electric, microwave
		Electrical Supply Cord (for gas models only)	True, False
		Constant Burning Pilot Light	True, False
		Annual Cooking Energy Consumption	
		Clock Power Consumption (for gas conventional ovens only)	
		Pilot Light Consumption (for gas conventional ovens only)	
		Annual Secondary Energy Consumption (for gas conventional ovens only)	
		Average Standby Power (data required for various microwave ovens manufactured on or after June 17, 2016 only)	
		Off Mode Power[1]	
		On Mode Power	
	All Commercial Ovens	Type	Commercial Convection Oven, Commercial Combination Oven, Commercial Rack Oven, Commercial Deck Oven, Commercial Conveyor Oven, Commercial High-Speed Oven
		Heat Energy Source	Gas, Electric
		Energy Input Rate (Btu/hr or kW)	
	Commercial Convection Ovens	Oven Size	Full-Size, Half-Size
		Pan Capacity	
		Preheat Energy (Btu or kWh)	

		~~Energy Input Rate~~	
		Idle Energy ~~Consumption~~ Rate (Btu/hr or kW)	
		Cooking Energy Efficiency (%)	
		Moisture or Steam Injection Capable	Yes, No
		Water Consumption Rate (gal/min) (for units with steam injection capability only)	
		Production Capacity (lbs/hr)	
		Number of Cooking Cavities	1, 2, 3
		Cavity 1 Door Type	Glass, Glass-Solid, Solid
		Cavity 2 Door Type	Glass, Glass-Solid, Solid, N/A
		Cavity 3 Door Type	Glass, Glass-Solid, Solid, N/A
	Commercial Combination Ovens	Oven Size	Full-Size, Half-Size, 2/3-Size
		Pan Capacity	
		Preheat Energy (Btu or kWh)	
		Idle Energy Rate in Steam Mode (Btu/hr or kW)	
		Idle Energy Rate in Convection Mode (Btu/hr or kW)	
		Cooking Energy Efficiency in Steam Mode (%)	
		Cooking Energy Efficiency in Convection Mode (%)	
		Water Consumption Rate in Idle in Steam Mode (gal/hr/pan)	
		Water Consumption Rate in Idle in Convection Mode (gal/hr/pan)	
		Water Consumption Rate in Cooking in Steam Mode (gal/pan)	
		Water Consumption Rate in Cooking in Convection Mode (gal/pan)	
		Production Capacity in Steam Mode (lbs/hr)	

		Production Capacity in Convection Mode (lbs/hr)	
	Commercial Rack Ovens	Oven Size	Single-Rack, Double-Rack
		Preheat Energy (Btu or kWh)	
		Idle Energy Rate (Btu/hr or kW)	
		Cooking Energy Efficiency (%)	
		Moisture or Steam Injection Capable	Yes, No
		Water Consumption Rate (gal/min) (for units with steam injection capability only)	
		Production Capacity (lbs/hr)	
	Commercial Conveyor Ovens and Commercial Deck Ovens	Preheat Energy (Btu or kWh)	
		Idle Energy Rate (Btu/hr or kW)	
		Cooking Energy Efficiency (%)	
		Production Capacity (lbs/hr)	
		Number of Cooking Cavities	
	Commercial High-Speed Ovens	Number of Heat Transfer Technologies	
		Heat Transfer Technology 1	Convection, Radiation, Microwave, Quartz Halogen, High Velocity Air Impingement, Other
		Heat Transfer Technology 2	Convection, Radiation, Microwave, Quartz Halogen, High Velocity Air Impingement, Other, N/A
		Heat Transfer Technology 3	Convection, Radiation, Microwave, Quartz Halogen, High Velocity Air Impingement, Other, N/A
		If "Other" is selected above, please specify	
		Preheat Energy (Btu or kWh)	
		Idle Energy Rate (Btu/hr or kW)	
		Cooking Energy Efficiency (%)	
		Production Capacity (lbs/hr)	

	Commercial Hot Food Holding Cabinets	Measured Interior Volume (ft^3)	
		Energy Input Rate	
		Idle Energy Consumption Rate	
	Commercial Range Tops	Energy Input Rate	
		Cooking Energy Efficiency	
		Test Cooking Vessel Diameter	

* "Identifier" information as described in Section 1602(a) of this Article.

1 = Voluntary for federally regulated appliances

…[skipping section S through section X]

(4) **Declaration.**

(A) Each statement shall include a declaration, executed under penalty of perjury of the laws of California, that

1. all the information provided in the statement is true, complete, accurate, and in compliance with all applicable provisions of this Article;
2. the requirements of section 1606(g) of this Article have been and are being complied with;
3. for appliances for which there is an energy efficiency, energy consumption, energy design, water efficiency, water consumption, or water design standard in section 1605.1, 1605.2, or 1605.3 of this Article, that the appliance complies with the applicable standards;
4. the appliance was tested under the applicable test method specified in section 1604 of this Article,

…[skipping through the end of section 1606]

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

§ 1607. Marking of Appliances.

(a) Scope of Section 1607.

Every unit of every appliance within the scope of section 1601 of this Article shall comply with the applicable provisions of this section. The effective dates of this section shall be the same as the effective dates shown in section 1605.1, 1605.2 or 1605.3 of this Article for appliances for which there is an energy efficiency, energy consumption, energy design, water efficiency, water consumption, or water design standard in section 1605.1, 1605.2, or 1605.3 of this Article. For appliances with no energy efficiency, energy consumption, energy design, water efficiency, water consumption, or water design standard in section

1605.1, 1605.2, or 1605.3 of this Article, the effective date of this section shall be January 1, 2006.

(b) Name, Model Number, and Date.

Except as provided in section 1607(c) of this Article, the following information shall be permanently, legibly, and conspicuously displayed on an accessible place on each unit;

(1) manufacturer's name or brand name or trademark (which shall be either the name, brand, or trademark of the listed manufacturer specified pursuant to section 1606(a)(2)(A) of this Article;

(2) model number; and

(3) date of manufacture, indicating (i) year and (ii) month or smaller (e.g. week) increment. If the date is in a code that is not readily understandable to the layperson, the manufacturer shall immediately, on request, provide the code to the Energy Commission.

…[skipping (c)]

(d) Energy Performance Information.

…[skipping (d)(1) through (d)(16)]

(17) **Commercial Ovens**. Each commercial oven, manufactured on or after January 1, 2029, shall be marked, permanently and legibly in an accessible and conspicuous place on the unit, as specified below.

(A) For all commercial ovens, the marking shall include the following information:

1. Energy input rate (Btu/hr or kW).

(B) For commercial convection ovens, the marking shall include the following information:

1. Pan capacity;

2. Idle energy rate (Btu/hr or kW);

3. Cooking energy efficiency (%).

(C) For commercial combination ovens, the marking shall include the following information:

1. Pan capacity;

2. Idle energy rate — steam mode (Btu/hr or kW);

3. Idle energy rate — convection mode (Btu/hr or kW);

4. Cooking energy efficiency — steam mode (%);

5. Cooking energy efficiency — convection mode (%);

6. Water consumption rate — idle in steam mode (gal/min/pan);

7. Water consumption rate — idle in convection mode (gal/min/pan);

8. Water consumption rate — cooking in steam mode (gal/pan);

9. Water consumption rate — cooking in convection mode (gal/pan).

(D) For commercial rack ovens, the marking shall include the following information:

1. Idle energy rate (Btu/hr or kW);

2. Cooking energy efficiency (%).

(E) For commercial conveyor ovens, commercial deck ovens, and commercial high-speed ovens, the marking shall include the following information:

1. Idle energy rate (Btu/hr or kW);

2. Cooking energy efficiency (%).

…[skipping through the end of section 1607]

§ 1608. Compliance, Enforcement, and General Administrative Matters.

[No changes]

§ 1609. Administrative Civil Penalties.

[No changes]