



New Commercial Foodservice Measure Prioritization

Final Report

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Executive Summary

The Commercial Foodservice Measure Prioritization Project has developed a database to help investor-owned utilities prioritize energy-efficiency measure development for electric commercial food service programs. This was achieved through extensive assessments of non-incentivized commercial food service equipment including developing preliminary savings estimates, estimating measure costs and sales volumes, identifying equipment testing needs and fuel-substitution potential, and discussions with market actors to help determine market trends and efficiency efforts. This data was gathered to help maximize the impact of limited measure development funds by identifying which technologies provide the most savings and cost-effective opportunities in the energy-efficiency programs like the California Foodservice Instant Rebates Program.

Abbreviations and Acronyms

Acronym	Meaning
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASTM	American Society for Testing and Materials
CA	California
CA eTRM	California Electronic Technical Reference Manual
CFS	Commercial food service
CPUC	California Public Utility Commission
EE	Energy efficiency
ET	Emerging technology
HECU	High-efficiency condensing unit
HEEU	High-efficiency evaporative units
IOU	Investor-owned utility
kWh	Kilowatt-hour
NAFEM	North American Foodservice Equipment Manufacturers
NTG	Net-to-gross
POS	Point-of-sale

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Introduction

The existing commercial foodservice (CFS) measures offered in California incentive programs are the most common pieces of equipment for this industry. Many of the most impactful measures in the energy-efficiency programs will be considered for appliance code standards in the coming years or removed from programs due to the California Public Utilities Commission's (CPUC) gas incentive phase-out Decision 23-04-035 (CPUC 2023)¹. This will leave the foodservice market, which has the highest energy use intensity in the commercial sector, with fewer opportunities to push savings, despite a wide selection of energy-intensive products used in this market. Currently, there is limited aggregated data to determine which measures would provide the largest impact on the investor-owned utilities (IOU) energy-efficiency (EE) portfolio. This project developed a database of criteria for potential new electric CFS measures to help prioritize measure development to replace the measures that will be phased out from the IOU EE programs.

Background

Energy Solutions implements the California Foodservice Instant Rebates Program on behalf of the state IOUs, and the program scope includes new measure development to continue to build out the EE portfolio for CFS measures. Recent measure development has resulted in some measures having lower per-unit savings, less market engagement, or less cost-effectiveness than originally estimated. This project intends to maximize the impacts of new measure development through concerted market research and data analysis to vet the savings, market engagement, and cost-effectiveness of new measures chosen for development in the California Electronic Technical Reference Manual (CA eTRM).

Objectives

The project aimed to thoroughly assess non-incentivized CFS equipment by developing preliminary savings estimates, estimating measure costs and sales volumes, identifying equipment testing needs and fuel-substitution potential, and engaging with market actors to understand market trends and efficiency efforts. The collective data helped facilitate the prioritization of electric CFS measure development and led to the discovery of the most impactful and cost-effective measures for development for EE programs.

Methodology and Approach

Energy Solutions partnered with Frontier Energy, which operates the Food Service Technology Center, (a CFS equipment research and testing laboratory) to leverage our combined energy modeling skills, market relationships, and measure package development expertise to successfully collect key data

¹ Decision 23-04-035: <https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M505/K808/505808197.PDF>

points on potential measures, assess potential impacts, and create a prioritized list of opportunities for measure development using a measure prioritization scoring system. Energy Solutions and Frontier Energy, hereafter referred to as the “team” or “project team,” completed the following efforts for this project.

Data Collection

Measure List Development – The project team created a comprehensive list of CFS equipment commonly found in foodservice establishments by leveraging existing industry experience, reviewing retail CFS websites, and conducting interviews with market stakeholders. The list includes individual pieces of equipment, components of larger systems such as mechanical equipment for walk-in refrigeration, and accessory foodservice measures such as exhaust hood fans and fryer oil filtration systems.

Test Data – Frontier Energy reviewed their database of equipment test results collected from internal tests and the California IOU foodservice labs to count the number of field and lab test data sets collected on the equipment in the measure list. This data helped the project team understand the efforts required to develop a measure package for the CA eTRM and estimate a savings value for each measure.

Savings Values – Frontier Energy compiled per-unit savings values through energy models based on laboratory testing, estimates from field testing, previous studies, or, when existing energy data was not available through estimates, based on standardized calculations using averaged input, duty cycle values, and standardized savings percentages.

The project team used the market analysis and the per-unit savings values together to estimate the annual savings potential for each measure in the California Instant Rebates Program. The program annual savings estimates used a net-to-gross (NTG) factor of 0.6 to calculate a net savings amount. New measures typically use an NTG of 0.7 to calculate net savings for the first two years of the measure, but the default greater than two-year NTG of 0.6 was used to calculate the long-term net savings and cost-effectiveness potential.

Tiered measures like hot food holding cabinets and adaptive refrigeration controls were further adjusted to reflect actual additional savings in the EE programs. Tiered measures take existing measures in the eTRM and split them into tiers to encourage purchasing of the highest efficiency products in the measure and prepare the program for potential state appliance standards that would possibly remove or reduce savings potential for the measures. In these instances, claims for the new Tier 2 measures would have previously received standard measure savings. So, the annual next program savings were adjusted to reflect the incremental savings to the program. The estimated gross per-unit savings show the non-adjusted savings. Tier 2 leased dishwasher measure was not adjusted because a Tier 2 offering already exists in the eTRM and the leased market would be a new addition to the program rather than an adjustment from one measure offering to another.

Cost Data – Energy Solutions developed average cost estimates for all potential measures using web-based retailers as well as AutoQuotes to provide current real-world pricing. Since baseline and measure case models have not been identified for most measures, the cost data is an average of all models collected. Energy Solutions also coordinated with the CPUC Viable Electric Alternative Infrastructure Cost Working Group to incorporate electric service modification costs associated with

fuel-substitution measures. However, the group has not produced final cost estimates, so electrical infrastructure costs were not incorporated into the cost data in this project.

Industry Engagement – The project team maintains strong relationships with stakeholders throughout the CFS equipment industry and leveraged these relationships to interview staff at 25 of the top manufacturers to assess the California market size of individual product types, estimate annual sales, collect internal equipment performance test data, assess manufacturer interest and efforts in developing higher-efficiency products, and understand plans for developing more high-efficiency electric equipment. Additionally, Energy Solutions engaged nine manufacturers’ representatives and equipment dealers to help assess sales processes, market drivers, market share, and high sales models for each measure. Interviews followed a standard set of questions but were flexible enough to allow for open conversations. Answers were aggregated to protect proprietary information and provide a balanced estimate of the products’ market size.

Market Analytics – Energy Solutions utilized existing emerging technology (ET) reports, market assessments, industry interviews, and the 2024 North American Association of Food Equipment Manufacturers (NAFEM) Size & Shape of the Industry Study to assess the market size for each equipment type. Energy Solutions leveraged this information to estimate data specific to California using an adjustment coefficient, and we used inflation percentages from 2023 and 2021 to estimate annual sales for 2024.

Program Engagement – Energy Solutions assessed factors such as sales channels, market size, equipment testing opportunities, electrification potential, market penetration of high-efficiency equipment, and measure development complexity to identify measures that are estimated to provide the greatest benefit to the foodservice program and end users.

Prioritization

Energy Solutions developed a ranking system based on five categories: the feasibility of developing a measure based on technical barriers, the program savings potential of the measure, the potential of a measure’s success based on barriers to implementation, and the strategic value to the IOU EE portfolio and Instant Rebates Foodservice Program (bold categories in Table 1). Criteria within each category were given scores, weighted based on the importance to that category and the total score was assigned to the category. Each category was weighted against the other four categories, and a final total score was assigned to each measure. The values in the Share of Total Score column in Table 1 show the percentage of the total score from each category and criterion.

Criteria Descriptions

- **Technical Feasibility**
 - Equipment testing need – a binary score that rates the measure on whether additional lab or field testing is required. Measures with significant data, like those that would create a second, higher-efficiency tier for an existing measure, would not require additional equipment testing.
 - Test procedure status – rates the measure based on the status of test method development. Scores were based on whether a test method is currently active, in development, not required, or does not exist.

- Extent of Lab Testing – score based on a ratio of the number of lab tests conducted to the estimated ideal number of tests required to develop a measure package.
- Extent of Field Testing – score based on a ratio of the number of field tests conducted to the estimated ideal number of tests required to develop a measure package.
- **Energy Impacts**
 - Total annual savings (MMBtu) – total estimated net savings for the EE portfolio based on per-unit savings and estimated participation within the EE programs.
- **Cost-Effectiveness**
 - Rebate-measure cost ratio – ratio of the customer rebate to the average measure cost. This is the percentage of the measure’s cost that the rebate would cover for the end user and indicates how effective a rebate would be in influencing the end user’s purchasing decision.
- **Ease of Implementation**
 - Qualitative complexity – a rating based on the project team’s assessment of the difficulty to develop a measure. This is a more subjective score based on multiple factors including the difficulty and expense of the test method, the expense and potential of acquiring equipment for testing, the difficulty of acquiring baseline data, the difficulty of obtaining field test data, and the number of and complexity of offerings within the measure.
 - Measure category – a binary score based on whether the measure is sold through standard CFS sales channels or would require engagement with dealers and distributors outside the CFS equipment industry.
- **Strategic Value**
 - Electrification opportunity – a binary score based on whether the measure is available in natural gas and, therefore, could be installed as a fuel-substitution measure.
 - Program expansion opportunity – a binary score based on whether the measure could be implemented in programs outside the California Instant Rebates Program.

The scoring weights were adjusted several times to create a prioritization system that would factor in all the categories and create a prioritized list of measures that makes sense in terms of energy benefits and program implementation. Energy savings and cost effectiveness were determined to be the most important factors that would validate EE program efforts in terms of energy savings and indicate the potential for a measure to move the market towards more efficient options. Early versions gave too much weight to technical feasibility and ease of implementation so measures that could be created without any lab or field testing, but showed low savings were ranking high on the list. Tier 2 hot food holding cabinets and booster heaters are examples that fall into this category. There is an argument for implementing these measures because they could be created and brought into the program much quicker and with less effort, but they still need to also provide sufficient energy savings to validate even light efforts. Ultimately, the energy savings weight was increased, and the feasibility and implementation weight were reduced enough to affect the scoring but not outweigh savings. The scoring system was built to be very flexible so as additional information such

as test data, market insight or new measures are added to the list, it can be adjusted to adapt to market changes or additional information as it becomes available.

Table 1 Measure score weighting

	Criteria	Share of Total Score
1	Technical Feasibility	20%
	Equipment testing need	5%
	Test procedure status	5%
	Extent of Lab Testing	5%
	Extent of Field Testing	5%
2	Energy Impacts	40%
	Total annual savings (MMBtu)	40%
3	Cost-Effectiveness	20%
	Rebate-measure cost ratio	20%
4	Ease of Implementation	13%
	Qualitative complexity	5%
	Measure category	8%
5	Strategic Value	7%
	Electrification opportunity	5%
	Program expansion opportunity	2%

Results

All data noted below can be found in the attached CFS Measure Opportunities List spreadsheet.

Measure List Development

The project team conducted a thorough review of market data, retail CFS websites, and stakeholder engagement to build out the potential measure list. There are currently 62 items included on the list. It is not an exhaustive list of all energy-consuming equipment used in commercial kitchens; however, it is considered a comprehensive list of the most common and most energy-intensive equipment. It was reviewed by all three IOU equipment testing labs who provided feedback on data availability, current testing or measure development efforts, market insights and recommendations on how to categorize measures. Seventy-nine percent of the list is comprised of commercial cooking, warming, and cooling equipment, but the list also includes other equipment found in foodservice sites that are not directly used to prepare food, e.g., exhaust hoods, walk-in refrigeration components, and vending

machine controllers. Food preparation equipment such as slicers and mixers were considered, but the operational hours of these equipment types are too low to provide sufficient savings for measure development. A concise description of each measure was included in the database to facilitate readers' understanding of the underlying principles associated with a measure and its operational purpose.

The models found on retail websites for each measure were analyzed to assess the potential size or feature offerings that would be developed in a measure package. For example, steam kettles range in size from a few gallons to 200 gallons. A steam kettle measure would include several size offerings in a measure package in the CA eTRM to account for the large size variance. Additionally, size metrics were analyzed to determine whether savings modeling would require normalization and how the measure would be incentivized: per unit or another metric like per linear foot. Equipment such as heat strips, which range from 12 inches to 72 inches, would be normalized per foot. Products with a broad range of size offerings make it more difficult to develop a measure package that includes test data and qualifications for the entire size range, as several baseline- and high-efficiency models need to be tested for each category. Therefore, these measures required identifying the primary models sold in the market to focus on the sizes that would provide the most impact. The team found limited data in the existing literature, so this effort required input from the manufacturers and dealers. This input was also used to assess and rate the complexity of developing the measures.

Savings, Measure Cost, and Incentives

Data was collected to estimate the per-unit savings, average equipment cost, and equipment price range. These data points were used to estimate potential customer rebates and incentives paid to dealers, annual potential savings for the EE programs, and to calculate a measure of cost-effectiveness value.

Savings Estimates

The equipment test and field monitoring data compiled by Frontier Energy showed that 34 of the 62 measures on the list had just one or no data points available. Excluding outliers, the average measure has just 1.5 lab tests and 1.6 field monitoring data sets available. A typical measure will need around nine lab tests and six field tests completed for verifiable data. A lack of test data required estimating savings based on inputs and assumptions, as noted in the Data Collection section above. These calculations provided more uncertain savings estimates for many equipment types and highlighted the need to conduct additional testing on a broad range of equipment types.

Savings values show a wide range of savings potential, which highlights both the measures that will bring the highest per-unit energy impacts and the measures that are unlikely to be beneficial for standard measure development due to low savings or small markets.

One difficulty electric equipment faces from a rebate program standpoint is that it is already highly efficient compared to gas equipment, so there is a smaller variance between standard- and high-efficiency models. Therefore, the savings potential can be quite small, which limits the ability to provide rebates large enough to cost-effectively transform purchases in the market. Taking the existing fryer measure as an example, the measure package in the CA eTRM assumes 37 percent and 52 percent efficiency for gas-base-case and measure-case units, respectively. In comparison,

the measure uses 84 percent and 86 percent efficiency for electric units. The gas fryer has a total resource cost of 3.83 while the electric measure is 0.9. Because of the cost-effectiveness, gas fryer rebates can cover 20 percent of the measure cost, while electric fryer rebates cover only 2 percent. Many of the measures analyzed in this project face similar hurdles for a midstream EE program but could offer better savings opportunities through fuel-substitution measures. At issue are the fuel-substitution hurdles in the CFS industry, described in the Electrification Potential section below.

Cost Estimates

The team used web scraping of major online retailers to collect a diverse set of models and pricing to calculate an average cost of each measure. These values were adjusted based on additional market and model share findings from stakeholder engagement. Since most equipment on the list does not have efficiency classifications set, incremental measure cost, which is used to set rebate amounts, could not be calculated. Instead, the team used the 20th and 80th percentiles of the pricing data to estimate a standardized price range for each measure, which provided insight into the breadth of the product costs and, therefore, potential incremental costs. The cost data and savings estimates were then used to calculate a potential rebate and dealer spiff that would meet the cost-effectiveness range for an EE program. The estimated customer incentive was then divided by the average measure cost to understand the percentage of the total cost that would be covered by the rebate. This ratio was used in the final prioritization score.

Market Info

Data for each measure was collected to estimate the number of units sold in California annually, the existing inventory of measures in the state, and the market penetration of high-efficiency units.

The California market sizes vary significantly, ranging from a few thousand dollars for equipment like electric underfired broilers to several million for soft serve machines, heated merchandisers, rapid cook ovens, and conveyor ovens. While the market size alone does not necessarily drive potential savings, it provides much more opportunity for a productive program measure.

An initial estimate of the California market size for each measure was calculated using the NAFEM 2024 Size & Shape study with a ratio of the number of restaurants in California to national restaurant counts. The NAFEM report provides annual national sales data for categories of equipment but does not separate annual sales data between electric and gas equipment or provide numbers for specific niche products. The project team adjusted NAFEM sales numbers based on market intel from stakeholders and industry reports to estimate the market size for electric equipment and specific equipment types under larger categories. For example, teppan griddles, a subcategory included in the NAFEM griddle category, required an understanding of the market share of teppan griddles to the entire griddle market to estimate their market size. The NAFEM sales numbers are reflective of manufacturer's pricing, and retailers often markup retail prices. The average markup rate is unknown and varies, so it was not included.

Much of the market sales data was from 2023. Where the data from 2023 was determined to be inaccurate compared to previous years or seemed incomplete, data from 2021 was used. The team then applied a factor of inflation from 2023 and 2021 respectively through 2024; this was done to estimate the most accurate and up-to-date market cost and to adjust for recent volatile markets. The California annual sales data was then divided by the average measure cost to estimate the number

of units sold in California in 2024 for each measure. A market-penetration estimate was applied to determine the number of units that would be claimed annually by the efficiency program. This value was based on the team's finding that measure packages typically qualify the top 20 to 30 percent of the market in terms of efficiency. We then adjusted the values on a case-by-case basis to estimate real-world market penetration, and we added a 10 percent market transformation from incentives. Alternative estimates were used on some measures that would have lower penetration rates due to low rebate-to-measure cost ratios, presumed measure availability, or low market adoption.

Finally, the annual units claimed estimate was multiplied by the estimated savings per unit and a net-to-gross ratio of 0.60 to produce an estimated amount of claimable annual savings. MMBtu was used for the measure prioritization score to factor in gas savings for measures such as Tier 2 leased dish machines that offer savings on both fuels.

Market Engagement

Table 8 in the Appendix provides the directory of the top two or three manufacturers for each item on the measure list, which Energy Solutions used to focus market outreach efforts. In some cases, manufacturers produce multiple pieces of equipment noted in the measure list and these names were aggregated to identify a prioritized list of manufacturers to contact regarding the listed products they produce. Energy Solutions developed a standardized list of questions in three categories to ask each manufacturer about each listed product. Additionally, the team drafted a set of questions specifically for dealers, manufacturers' representatives, and distributors. These questions focused more on the sales process to understand what products would benefit the most from rebates. All questions are listed in the Appendix.

Energy Solutions conducted interviews with 34 stakeholders to date representing over 32 of the products on the measure list. For equipment outside the standard CFS sales channels, such as synchronous motors and food waste digesters, it was more difficult to collect useful data and connect to market stakeholders, as we have no connections to those industries. The interviews provided useful information such as the market split between natural gas and electric equipment, which helped refine the market size and market penetration data. They also provided insight into the industry's development of high efficiency equipment. In general, the manufacturers have little to no data on energy consumption of their products outside of what has been tested for ENERGY STAR, federal codes or through the CA IOU test labs. Additionally, many products discussed have never been redesigned or evaluated for potential efficiencies in energy consumption. Some still use the same design as when the product was created decades ago. This provides an opportunity for improving the efficiency of the equipment, but consumption data will need to be collected before the extent of the opportunity can be fully understood. The lack of effort in improving the design of equipment also proves to be a hurdle to improving efficiency as most manufacturers did not express interest in putting resources into redesigning or improving the efficiency of products. Many of the products on the measure list are not the primary revenue sources for the manufacturers so their interest in dedicating resources to these products is limited. Rebates would help create incentives for manufacturers to reevaluate equipment design, but additional manufacturer engagement may be needed to encourage improvements in equipment efficiency.

Electrification Potential

In alignment with the California EE and CalNEXT program goals, the team studied each measure's electrification potential, which is defined as an electric product's ability to replace a similar gas product. Since CFS cooking is dominated by gas equipment, there is a significant opportunity for electrification, and many measures are on the list that could provide electrification opportunities. However, the industry faces several barriers to implementation of electric cooking equipment. Some equipment, such as tandoori ovens, currently has very limited electric options. Other equipment, such as woks, do not have electric options that can meet the needs of a high-production kitchen. The market also faces hurdles to the implementation of electric cooking equipment, including industry skepticism and prohibitive costs for electrical infrastructure upgrades. Regardless of the hurdles, the measures were given a binary score for their electrification potential, which was factored into the overall prioritization score. Table 2 lists the measures that provide electrification potential, which represents 39 percent of the measures analyzed. About 70 percent of these measures are dominated by gas equipment in the existing market. The remaining 30 percent are more evenly split or primarily electric equipment with gas model options. The electric-dominated equipment includes two-thirds-sized combi ovens, booster heaters, proofer ovens, rethermalizers, and some specialty fryers.

Table 2 Potential electrification measures

Measure	
Booster heaters	Rethermalizer - water bath
Braising pans/tilt skillets	Rice cookers
Cheese melter	Rotisserie
Combination oven – two-thirds-sized	Salamander
Conveyor broilers	Smokers/smoke ovens
Conveyor impingement oven	Specialty fryers (countertop, doughnut, stovetop, etc.)
Conveyor ovens	Steam-jacketed kettles
Gyro broiler	Stock pot range
Pasta cooker	Teppanyaki griddle
Plancha griddle	Underfired broilers
Proofer oven	Upright broiler
Rack oven	Wok ranges

Market Findings:

The team observed the following key insights from our market research:

Manufacturer Interest: Manufacturers have an overall interest in rebates for their products but may not be willing to budget resources for improving the efficiency of their smaller-market products. Rethermalizer ovens, braising pans/tilt skillets, panini grills, and hot dog roller grills were all noted by manufacturers as preferable equipment for rebates.

Lack of Equipment Testing: Product engineering teams noted a lack of equipment energy performance testing for many technologies. Unless there are market drivers such as incentives or significant customer interest in energy efficient equipment, many products are developed without energy efficiency in mind.

High Product Costs: High product costs would hinder the success of some measures in an incentive program. Products like blast chillers and conveyor dishwashers average \$35,000 to \$40,000 per unit. Energy savings for these units would have to be very substantial to provide a rebate that would influence sales in the market.

High Savings Potential Measures: Products like high-efficiency evaporator units and high-efficiency condensing units could provide significant savings to the IOU EE portfolios through multiple program delivery models.

American Society for Testing and Materials (ASTM) Test Methods: ASTM and American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) energy-performance test methods set the procedures to calculate the consumption and efficiency of CFS equipment and are the foundation for developing a measure's efficiency qualifications for most equipment. There are enough existing ASTM test methods developed to provide a pipeline for developing new measures for several years. These measures are presented in Table 3. New test methods will need to be developed to continue measure development beyond the existing test methods or to accommodate measures that identify large savings potentials. ASTM test-method development adds at least a year to the timeline to develop a measure. The prioritization system placed measures without test methods lower on the list, but there are measures without test methods that have considerable savings opportunities. These measures may just be harder to develop or implement successfully. Table 6 provides a list of measures that do not currently have an active energy performance test method, along with the annual kWh savings.

Table 3 Measures with active test methods

Measure	Test Procedure Status
Blast chillers	In progress or proposed
Booster heaters	Active
Braising pans/tilt skillets	Active
Cheese melter	In progress or proposed
Coffee brewers	Active

Measure	Test Procedure Status
Combination oven – two-thirds-sized	Active
Conveyor broilers	Active
Conveyor dish machine	Active
Conveyor impingement oven	Active
Conveyor ovens	Active
Convection oven – one-quarter-sized	Active
Drawer warmer	Active
Espresso machine	In progress or proposed
Frozen drink machine	Active
Ice cream freezer/cabinet	Active
Lab-grade refrigerator or freezer	Active
Leased ice machines	Active
Open refrigerated grab-and-go case	Active
Panini grills	In progress or proposed
Pasta cooker	Active
Plancha griddle	In progress or proposed
Rack ovens	Active
Rapid cook oven - microwave	Active
Rapid cook oven - non-microwave	Active
Refrigerated merchandisers	Active
Rethermalizer - oven	Active
Rethermalizer - water bath	Active
Rice cookers	In progress or proposed
Rotisserie	Active
Salamander	In progress or proposed
Small and large ULT freezers	Active
Soft-Serve ice cream / gelato / custard / yogurt machine	Active
Steam-jacketed kettle	Active
Strip heaters/warmer	In progress or proposed

Measure	Test Procedure Status
Teppan griddle	In progress or proposed
Tier 2 HFHC	Active
Tier 2 leased door-type dish machine	Active
Tier 2 R/F (adaptive controls)	Active
Underfired broiler	Active
Upright broiler	Active
Wok range	Active

Technology-Based Eligibility: Another category of potential measures includes equipment that would be qualified based on technology or features and, therefore, would not require a test method, rather than an efficiency rating based on test methods. These products have shown energy savings through other studies and testing; however, they may require additional testing for eTRM measure development. This category includes the products presented in Table 4, and possibly other measures that would be identified during product testing.

Table 4 Measures qualified by product features

Measure
HECU
HEEU
Synchronous motor
Tier 2 refrigerator or freezers (adaptive controls)
Vending machine controller

Natural Gas Dominance in the Market: Natural gas dominance in the CFS equipment sector creates a market where electric equipment has a very small market share – sometimes five to ten percent of the market for that product, which severely limits the savings opportunity in incentive programs.

Accessory Equipment: Accessory CFS equipment like air curtains, synchronous motors, and oil filtration systems have large sales volume potential which could provide savings opportunities across various programs and building types outside of foodservice. Unfortunately, there is little to no energy consumption data for these products, and they will need further research to understand the full opportunity for these measures.

Leased Equipment: Leased dishwashers and ice machines are an untapped market for efficiency programs and have a low initial cost which could lead to a rebate being more substantial to the

lessor and drive the market towards more efficient models. Initial research indicates the ice machine rental industry's standard practice is to use ENERGY STAR® units, while the dishwasher rental market uses a mix of baseline and ENERGY STAR units. The dishwasher's saving opportunities is almost entirely from natural gas savings, which would put it among the top measures. However, for this exercise, only electric savings were included. The ice machine's market penetration percentage was adjusted to reflect only the potential market transformation, as full market penetration would be near 100 percent for the rental market.

Recommendations

The following recommendations were developed during the project:

Additional equipment metering and testing – Due to a lack of energy consumption data, it is recommended that additional equipment testing be conducted on equipment that shows potential based on the market size and initial savings estimates. Measures with existing test methods should have laboratory tests conducted, and measures without test methods should have additional field metering conducted to understand the operational use and energy consumption.

Leverage IOU foodservice labs for equipment testing – The Energy Resource Center run by SoCalGas, the Foodservice Technology Center run by SoCal Edison, and the Food Service Technology Center contracted by PG&E, should be given funding to conduct testing on equipment noted in the prioritized list and those where little-to-no energy consumption data exists.

Work with manufacturers on improving equipment efficiency – Interviews with market actors highlighted a lack of effort in improving the efficiency of CFS equipment due to the products small market share, lack of bandwidth at the manufacturers or perceived value. The IOUs should investigate opportunities to work with CFS manufacturers on improving the efficiency of all the products they manufacture. This could include upstream type program designs or collaboration with the IOU test labs to help manufacturers test and improve the efficiency of their product lines.

Develop test methods – Several measures without standardized test methods show good potential for program savings, but most will require a test method to move forward through measure development. It is recommended that the IOUs and EE programs leverage the CFS labs to develop test methods for these measures shown in Table 6.

Leverage IOU resources, emerging tech (ET), and EE programs for measure development – ET programs like CalNEXT and the Gas ET program offer funding opportunities to develop measures through third parties that can provide the needed lab and field equipment testing, deep market analysis, and measure development to create measure packages for the eTRM. Additionally, IOU engineering resources and the California Instant Rebates Program offer avenues that should be used for the IOUs to collaborate and select measures prioritized in this report for future testing and development.

Prioritized Measure List

Table 5 provides the 10 measures that ranked the highest in the scoring methodology. These measures scored highest in the five ranked categories but do not necessarily offer the highest

savings opportunities for the EE programs since factors such as measure development complexity and implementation feasibility were factored into the scoring system. For example, sales data for hot dog grills/rollers, which are used extensively in convenience stores, show potential for large annual sales and offer significant savings opportunities to the EE portfolio, but they do not have a test methodology and have no test data available. The lower score for this measure factors in the additional time to implement and the lack of data available to accurately confirm savings estimates.

Overall, each measure has market or measure development aspects beyond what can be ranked and scored, and these should be considered when further evaluating measures for development. With this scoring system, the booster heater ranked just out of the top ten because the measure package could be produced with no testing, significantly reducing the effort and time to implementation, but the savings opportunity is very low, 12,000 kWh/yr. The HEEU and HECU measures offer significant savings opportunities, but they are sold outside the CFS sales channel, which could create program-delivery hurdles. Conveyor dishwashers offer significant gas and electric savings but could be included in Title 20 appliance standards, which would reduce or eliminate the savings opportunity. As such, this list should be used as guidance for measure development rather than a strict sequential list for development. Additional opportunities in the list should be reviewed and considered for further testing and analysis to verify savings opportunities for the IOU EE programs.

Table 5 Top measures for development

Measure	kWh Per Unit	Unit Count	Total Annual kWh
High Efficiency Evaporator Unit (HEEU)	902	1,442	780,712
High Efficiency Condensing Unit (HECU)	4,146	292	726,077
Rapid Cook Oven - Microwave	2,870	328	564,127
Conveyor Dishwasher	7,262	55	239,864
Synchronous Motor / (open cases and walk-ins)	375	1,000	225,000
Pasta Cooker	7,704	9	42,526
Conveyor Impingement Oven	1,985	91	108,596
Conveyor Oven	2,100	40	50,094
Convection Oven - 1/4 Sized	546	338	110,496
Espresso Machine	1,991	113	135,109

Prioritized Measure List with No Test Method

A key component of developing a measure package is having a test method to be able to test and compare equipment models to a standardized test method. For commercial foodservice equipment, ASTM test methods are utilized for standardized test procedures. This is an additional step that requires extensive testing and collaboration with the market to create an ASTM test method that has

been vetted with industry input. This step alone can take well over a year from inception to an approved standard. For this reason, it is important to create a pipeline of approved test methods for new measure development. The top 30 ranked measures have an approved test method or one that is in development, indicating there is not a current need for test method development. Table 6 presents the measures with the highest savings potential that do not have ASTM test methods developed or in development.

Table 6 Top measures for test method development

Measure	kWh Per Unit	Unit Count	Total Annual kWh
Microwave	126	1,507	113,933
Hot dog grills/roller	350	485	101,704
Glasswasher	1,820	68	74,693
Exhaust hood fan	818	132	64,910
Food waste disposer	250	95	14,197

Finally, Table 7 presents a list of measures that likely would not require a test method to develop an measure package because models could be qualified for a program based on the technology itself or integrated features. The high-efficiency recirculation pump and oil-filtration MPs would qualify measures with electronically communicated motors. Synchronous motors and vending machine controllers are high-efficiency technologies and would not require an efficiency rating to qualify. However, these measures would still require field testing to obtain operational hours and calculate energy savings. Despite the large savings potential with the recirculation pumps and synchronous motors, the measures did not rank as top measures because they are products sold outside of the CFS sales channels and would not easily fit into the existing CFS programs offered by the IOUs. However, they could be implemented in other EE HVAC, water heating, or pump programs. The unit count and total annual kWh for oil filtration systems and vending machine controllers could not be estimated due to lack of existing research and data, as well as an inability to collect market sales data from market actors during correspondence or interviews. Oil-filtration systems would fit in with the standard CFS program delivery, but the energy savings are likely very small. The non-energy fryer oil savings that could be achieved from this measure are significant if it could be claimed as a secondary benefit to the measure.

Table 7 Measures not Requiring Test Methods

Measure	kWh Per Unit	Unit Count	Total Annual kWh
Synchronous motor / (open cases and walk-ins)	375	1,000	225,000
Hot water recirculation pump with control	364	756	165,110

Measure	kWh Per Unit	Unit Count	Total Annual kWh
Oil filtration system - electric	-	1,027	-
Vending machine controller - electric	774	-	-
Exhaust hood fan	818	132	64,910

Appendix: Supplemental Information

Manufacturer Interview Questions

Market

- Approximately how big is the existing market size (number of units in the market today)?
- What are the approximate national annual sales of the listed products?
- If you're willing to share, how many units do you sell annually?
- Do you have an estimate of what percentage of the market you maintain?
- What is the percentage split of sales for this product between gas and electric?
- What sizes/models/categories are the most prominent?

Engineering

- Are there any listed products that you would prioritize for product development if they received rebates?
- Are there any listed products that you have made efforts to increase efficiency?
- Are there any products you're interested in improving its efficiency?
- Are there barriers to improving the efficiency of any of the products listed?
- If there were rebates available, would you be able or willing to put engineering resources into improving the efficiency of your product line?

Energy Use

- Do you have data on the energy use of the products on the list?
- Do you have estimates on the savings potential of the listed products? (Percentage or value)
- Are you interested in supporting testing and analysis of these products? Testing, providing models for FSTC or utility labs to test, providing contacts to sites for field testing?

Dealer Interview Questions

- How are these products typically sold?
- Do you stock these products, or are they special orders?
- Which products do you think would benefit from rebates the most?
- What are the main sales drivers for this equipment?
- What are the high-sales models for each measure?
- What market share do those manufacturers hold?

Manufacturer Outreach

Table 8 Top manufacturers of analyzed measures

Measure	Manufacturer 1	Manufacturer 2	Manufacturer 3
Air curtain	Marsair	Curtron	Berner
Blast chiller	Hurrichill	Traulsen	Electrolux
Booster heater	Hatco	Hubbell	
Braising pan/tilt skillet	Rational	Cleveland	Groen
Cheese melter	Vollrath	Lang	Imperial
Coffee brewer	Curtis	Bunn-O-Matic	Bloomfield
Commercial toaster oven	Hatco	Waring	Prince Castle
Combination oven – two-thirds-sized	Rational	Alto-Shaam	Blodgett
Convection oven – one-quarter sized	Equipex	Nemco	
Conveyor broiler	Marshall Air		
Conveyor dish machine	Hobart	Champion	Jackson
Conveyor impingement oven	Lincoln	XLT	
Conveyor oven	Lincoln	XLT	
Drawer warmer	Hatco	Merco	Wells
Drop-in cold well	Hatco	Vollrath	Wells
Electric conveyor oven	Lincoln	TurboChef	Vollrath
Electric rack oven	Baxter	Doyon	Revent
Espresso machine	La Marzocco	Synesso	Thermoplan AG
Exhaust hood	Halton		
Exhaust hood fan	Greenheck		
Food waste disposer	Salvajor		
Frozen drink machine	Icepro	Spaceman	Frosty Factory
Gyro broiler	Inoksan	Optimal Automatics	
Hot water recirculation pump with controls	Watts	Vevor	
Heated merchandiser (freestanding & countertop)	Nemco	Hatco	

Measure	Manufacturer 1	Manufacturer 2	Manufacturer 3
HECU/HEEU	Heatcraft	HTPG	Trenton
Hot dog grill/roller	Nemco	Star	APW
Ice cream freezer	Delfield	Masterbilt	Omcan
Leased ice machine	Manitowoc	Ice O Matic	Scottsman
Microwave	Amana	Panasonic	
Oil filtration system	Frymaster	Vito Fryfilter	
Panini grill	Star	Equipex	Waring
Pasta cooker	Pitco	Arcobaleno	
Plancha griddle	Woodstone	EVO	
Proofer oven	Duke		
Rack oven	Baxter	Doyon	
Rapid cook oven - microwave	Turbochef	Merrychef	Pratica
Rapid cook oven - non-microwave	Turbochef	Merrychef	Pratica
Rethermalizer - oven	Winston	Alto-Shaam	Cres Cor
Rethermalizer - water bath	Hatco	Hubbell	
Rice cooker	Rinnai	Thunder Group	
Rotisserie	Fri-Jado	Hardt	Rotisol
Salamander	Vulcan	Equipex	
Smokers/smoke oven	Alto-Shaam	Cres Cor	
Soft drink dispenser	Follett	Cornelius	Multiplex
Soft-serve ice cream / gelato / custard / yogurt machine	Taylor	Spaceman	Carpigiani
Specialty fryer (countertop, doughnut, stovetop, etc.)	Pitco	Avalon	Frymaster
Steam-jacketed kettle	Groen	Cleveland	Crown
Stock pot range	Cooktek	Nemco/Dipo	Imperial
Strip heater/warmer	Hatco	Nemco	Vollrath
Synchronous motor (open cases and walk-ins)	Qpower		
Teppan griddle	EVO	Wolf	

Measure	Manufacturer 1	Manufacturer 2	Manufacturer 3
Tier 2 R/F (adaptive controls)	Beverage-Air	Husmann	Victory
Underfired broiler	EmberGlo		
Upright broiler	Southbend		
Vending machine controller	Vending Miser		
Ventless exhaust	EVO		
Waffle iron	Nemco	Equipex	Waring
Wok range	Town	Turbo Air	Moffat