



Memo to:

Massachusetts Program Administrators
Massachusetts EEAC Consultants

Prepared by:

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Date:

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RE: Massachusetts Commercial Food Service Equipment ISP Recommendation

1 EXECUTIVE SUMMARY

This memo details the findings of an industry standard practice (ISP) study undertaken as a part of the ongoing Massachusetts Baseline Repository maintenance and updates. This study characterizes the ISP in Massachusetts for commercial kitchen equipment by incorporating the 2022 Massachusetts Appliance Standards¹ and the prevalence of used equipment in the marketplace. The high-rigor study included background research, a roundtable with PA representatives, interviews with market actors, and a survey of end users. The primary focus of this study, as determined by proportion of savings, included fryers, ovens, steam cookers, and dishwashers.

The Appliance Energy Efficiency Standard was signed into law on March 26, 2021. The statute specifically exempts new appliances or lamps manufactured in Massachusetts and sold outside Massachusetts; new appliances or lamps manufactured outside Massachusetts and sold at wholesale inside Massachusetts for final retail sale and installation outside Massachusetts. Beginning January 1, 2022, manufacturers must certify products to Department of Energy Resources (DOER). Covered products may not be shipped for sale in Massachusetts unless they have been certified to DOER as meeting the required standards. Covered Manufacturers must certify Covered Products to DOER in the Northeast Energy Efficiency Partnerships State Appliance Standards Database (SASD). Beginning on January 1, 2023, sellers may only offer Covered Products for sale or installation in Massachusetts that are certified as compliant with the Appliance Efficiency Standards in the SASD database. For this study, DNV assumed that there is 100% compliance with this statute.

For Program Year (PY) 2022, the baseline assumptions that were used (and detailed in the 2022-2024 Plan TRM)² were generally an average of the previous year baseline efficiency and the new Massachusetts Appliance Standard. These assumptions were intended to be an unbiased reflection of the effects of this 2022 sell-through period. This study effort was intended to provide new baseline recommendations to be applied prospectively to PY2023 and beyond. The key research question for this effort was to understand the extent to which used equipment is sold in the market and should therefore be reflected into the baseline assumptions. In the absence of used equipment in the market, the minimum baseline should be equal to the 2022 Massachusetts Appliance Standards. In cases where there is clearly used equipment sold in the market, the baseline may be adjusted to reflect lesser efficiencies.

The results of the primary research indicated that the most common type of used equipment purchased in the marketplace was commercial ovens. 28% of end user respondents purchased used ovens in the last five years. Of these used ovens, approximately 50% were ENERGY STAR (ES) rated and the others were not. Based on these results DNV estimated an ISP baseline for ovens by developing a blended baseline using the following weighting: 72% new, 14% used ES rated, 14% used non-ES rate. For all other equipment types, used equipment were not considered part of the baseline. For all equipment types, the 2022 MA appliance efficiency standards were applied to the baseline. Table 1-1 summarizes the ISP baseline for new construction commercial kitchen equipment, and Table 1-2 summarizes the deemed savings.

¹ <https://www.mass.gov/service-details/appliance-energy-efficiency-standards>

² <https://www.masssavedata.com/Public/TechnicalReferenceLibrary>

Table 1-1. Recommended key baseline assumptions

TRM Chapter	Equipment Type	Recommended Baseline	Updated Baseline Parameters	Previous Parameters
Food Service-Electric Fryer	Standard Vat	ENERGY STAR for Commercial Fryers, Version 2.0	Cooking efficiency: 80% Idle energy rate: 1.0 kW	Cooking efficiency: 78% Idle energy rate: 1.1 kW
	Large Vat	ENERGY STAR for Commercial Fryers, Version 2.0	Cooking efficiency: 80% Idle energy rate: 1.1 kW	Cooking efficiency: 78% Idle energy rate: 1.1 kW
Food Service-Electric Oven	Full Size Convection Oven	MA ISP - Blended Used/ENERGY STAR Ovens V2.2	Cooking efficiency: 70% Idle energy rate: 1.66 kW	Cooking efficiency: 68% Idle energy rate: 1.8
	Combination Oven - Convection Mode	MA ISP - Blended Used/ENERGY STAR Ovens V2.2	Cooking efficiency: 74% Idle energy rate: 2.3	Cooking efficiency: 74% Idle energy rate: 1.3
	Combination Oven - Steam Mode	MA ISP - Blended Used/ENERGY STAR Ovens V2.2	Cooking efficiency: 53% Idle energy rate: 4.6	Cooking efficiency: 45% Idle energy rate: 8.0
Food Service-Electric Steam Cooker		ENERGY STAR Commercial Steam Cooker Version 1.2	Cooking efficiency: 50% Idle energy rate: 0.4 kW	Cooking efficiency: 38% Idle energy rate: 0.84
Food Service – High Temperature Commercial Dishwasher	Under Counter	ENERGY STAR Commercial Dishwashers Version 2.0	Idle energy rate: 0.5 kW Water Consumption 0.86 GPR	Idle energy rate: 0.63 kW Water Consumption 0.98 GPR
	Door Type	ENERGY STAR Commercial Dishwashers Version 2.0	Idle energy rate: 0.7 kW Water Consumption 0.89 GPR	Idle energy rate: 0.79 kW Water Consumption 1.09 GPR
	Single Tank Conveyor	ENERGY STAR Commercial Dishwashers Version 2.0	Idle energy rate: 1.5 kW Water Consumption 0.7 GPR	Idle energy rate: 1.72 kW Water Consumption 0.79 GPR
	Multi Tank Conveyor	ENERGY STAR Commercial Dishwashers Version 2.0	Idle energy rate: 2.25 kW Water Consumption 0.54 GPR	Idle energy rate: 2.42 Water Consumption 0.76 GPR
	Pot, Pan and Utensil	ENERGY STAR Commercial Dishwashers Version 2.0	Idle energy rate: 1.2 kW Water Consumption 0.58 GPR	Idle energy rate: 1.2 kW Water Consumption 0.64 GPR
Food Service – Low Temperature Commercial Dishwasher	Under Counter	ENERGY STAR Commercial Dishwashers Version 2.0	Idle energy rate: 0.5 kW Water Consumption 1.19 GPR	Idle energy rate: 0.5 kW Water Consumption 1.46 GPR
	Door Type	ENERGY STAR Commercial Dishwashers Version 2.0	Idle energy rate: 0.6 kW Water Consumption 1.18 GPR	Idle energy rate: 0.6 kW Water Consumption 1.64 GPR
	Single Tank Conveyor	ENERGY STAR Commercial Dishwashers Version 2.0	Idle energy rate: 1.5 kW Water Consumption 0.79 GPR	Idle energy rate: 1.55 kW Water Consumption 1.05 GPR
	Multi Tank Conveyor	ENERGY STAR Commercial Dishwashers Version 2.0	Idle energy rate: 2.0 kW Water Consumption 0.54 GPR	Idle energy rate: 2.0 kW Water Consumption 0.79 GPR
Food Service-Gas Fryer	Standard Vat	ENERGY STAR for Commercial Fryers, Version 2.0	Cooking efficiency: 50% Idle energy rate: 9,000 Btu/hr	Cooking efficiency: 42.5% Idle energy rate: 11,500 Btu/hr
	Large Vat	ENERGY STAR for Commercial Fryers, Version 2.0	Cooking efficiency: 50% Idle energy rate: 12,000 Btu/hr	Cooking efficiency: 42.5% Idle energy rate: 12,000 Btu/hr
Food Service-Gas Oven	Convection Oven	MA ISP - Blended Used/ENERGY STAR Ovens V2.2	Cooking efficiency: 44% Idle energy rate: 12,420 Btu/hr	Cooking efficiency: 38% Idle energy rate: 15,000 Btu/hr
	Combination Oven - Convection Mode	MA ISP - Blended Used/ENERGY STAR Ovens V2.2	Cooking efficiency: 53% Idle energy rate: 8,590	Cooking efficiency: 54% Idle energy rate: 9,607 Btu/hr
	Combination Oven - Steam Mode	MA ISP - Blended Used/ENERGY STAR Ovens V2.2	Cooking efficiency: 38% Idle energy rate: 11,175 Btu/hr	Cooking efficiency: 38% Idle energy rate: 15,256 Btu/hr
	Rack Oven - Single Rack	ENERGY STAR Ovens V2.2	Cooking efficiency: 48% Idle energy rate: 25,000 Btu/hr	Cooking efficiency: 30% Idle energy rate: 43,000 Btu/hr
	Rack Oven - Double Rack	ENERGY STAR Ovens V2.2	Cooking efficiency: 52% Idle energy rate: 30,000 Btu/hr	Cooking efficiency: 30% Idle energy rate: 65,000 Btu/hr
Food Service-Gas Steamer		ENERGY STAR Commercial Steam Cooker Version 1.2	Cooking efficiency: 38% Idle energy rate: 12,500 Btu/hr	Cooking efficiency: 26.5% Idle energy rate: 13,750 Btu/hr

Table 1-2. Recommended energy and demand savings

TRM Chapter	Equipment Type	Updated Energy Savings	Prior Energy Savings	Updated Demand Savings	Prior Demand Savings
Food Service-Electric Fryer	Standard Vat	Tier 1: 1,131 kWh Tier 2: 1,581 kWh	Tier 1: 1,148 kWh (1,874 in FSC) Tier 2: 2,490 kWh (2,424 in FSC)	Tier 1: 0.27 kW Tier 2: 0.53 kW	Tier 1: 0.26 kW Tier 2: 0.57 kW
	Large Vat	Tier 1: 137 kWh Tier 2: 1,941 kWh	Tier 1: 421 (FSC only) Tier 2: 2,545 kWh (FSC only)	Tier 1: 0.03 kW Tier 2: 0.46 kW	Tier 1: 0.09 kW (FSC only) Tier 2: 0.58 kW (FSC only)
Food Service-Electric Oven	Full Size Convection Oven	Tier 1: 192 kWh Tier 2: 1,111 kWh	Tier 1: 1,025 kWh Tier 2: 2,465 kWh	Tier 1: 0.07 kW Tier 2: 0.41 kW	Tier 1: 0.23 kW Tier 2: 0.5 kW
	Combination Oven - Convection Mode	Tier 1: 6,672 kWh Tier 2: 8,190 kWh	Tier 1: 11,661 kWh Tier 2: 12,943 kWh	Tier 1: 1.6 kW Tier 2: 1.9 kW	Tier 1: 2.66 kW Tier 2: 2.96 kW
	Combination Oven - Steam Mode				
Food Service- Electric Steam Cooker		Tier 1: 1,440 kWh Tier 2: 2,800 kWh	Tier 1: 3,947 kWh Tier 2: 5,306 kWh	Tier 1: 0.51 kW Tier 2: 1.0 kW	Tier 1: 0.9 kW Tier 2: 1.21 kW
Food Service – High Temperature Commercial Dishwasher	Under Counter	Tier 1: 0 kWh Tier 2: 1,132 kWh	Tier 1: 1,585 kWh Tier 2: 2,717 kWh	Tier 1: 0 kW Tier 2: 0.17 kW	Tier 1: 0.36 kW Tier 2: 0.62 kW
	Door Type	Tier 1: 0 kWh Tier 2: 730	Tier 1: 5,932 kWh Tier 2: 6,662 kWh	Tier 1: 0 kW Tier 2: 0.11kW	Tier 1: 1.35 kW Tier 2: 1.52 kW
	Single Tank Conveyor	Tier 1: 0 kWh Tier 2: 1,752	Tier 1: 4,606 kWh Tier 2: 6,358 kWh	Tier 1: 0 kW Tier 2: 0.27 kW	Tier 1: 1.05 kW Tier 2: 1.45 kW
	Multi Tank Conveyor	Tier 1: 0 kWh Tier 2: 2,336	Tier 1: 13,704 kWh Tier 2: 16,040 kWh	Tier 1: 0 kW Tier 2: 0.36	Tier 1: 3.13 kW Tier 2: 3.66 kW
	Pot, Pan and Utensil	Tier 1: 0 kWh Tier 2: 438	Tier 1: 1,655 kWh Tier 2: 2,093 kWh	Tier 1: 0 kW Tier 2: 0.07 kW	Tier 1: 0.38 kW Tier 2: 0.48 kW
Food Service – Low Temperature Commercial Dishwasher	Under Counter	Tier 1: 0 kWh Tier 2: 1,414 kWh	Tier 1: 1,270 kWh Tier 2: 2,684 kWh	Tier 1: 0 kW Tier 2: 0.22 kW	Tier 1: 0.29 kW Tier 2: 0.61 kW
	Door Type	Tier 1: 0 kWh Tier 2: 1,205 kWh	Tier 1: 8,076 kWh Tier 2: 9,281 kWh	Tier 1: 0 kW Tier 2: 0.18 kW	Tier 1: 1.84 kW Tier 2: 2.12 kW
	Single Tank Conveyor	Tier 1: 0 kWh Tier 2: 3,854 kWh	Tier 1: 6,813 kWh Tier 2: 10,668 kWh	Tier 1: 0 kW Tier 2: 0.59 kW	Tier 1: 1.56 kW Tier 2: 2.44 kW
	Multi Tank Conveyor	Tier 1: 0 kWh Tier 2: 5,475 kWh	Tier 1: 9,406 kWh Tier 2: 14,881 kWh	Tier 1: 0 kW Tier 2: 0.83 kW	Tier 1: 2.15 kW Tier 2: 3.40 kW
Food Service-Gas Fryer	Standard Vat	Tier 1: 1.7 MMBTU Tier 2: 13.3 MMBTU	Tier 1: 19.7 MMBTU Tier 2: 33.0 MMBTU	N/A	N/A
	Large Vat	Tier 1: 1.3 MMBTU Tier 2: 17.0 MMBTU	Tier 1: 11.3 MMBTU (FSC only) Tier 2: 29.4 MMBTU (FSC only)	N/A	N/A
Food Service-Gas Oven	Convection Oven	Tier 1: 2.3 MMBTU Tier 2: 15.5 MMBTU	Tier 1: 15.6 MMBTU Tier 2: 33.8 MMBTU	N/A	N/A
	Combination Oven - Convection Mode	Tier 1: 6.6 MMBTU Tier 2: 13.2 MMBTU	Tier 1: 14.8 MMBTU Tier 2: 21.7 MMBTU	N/A	N/A
	Combination Oven - Steam Mode			N/A	N/A
	Rack Oven - Single Rack	20.4 MMBTU	122.8 MMBTU (FSC only - no TRM entry)	N/A	N/A

	Rack Oven - Double Rack	31.9 MMBTU	252.6 MMBTU	N/A	N/A
Food Service-Gas Steamer		Tier 1: 15.6 MMBTU Tier 2: 23.9 MMBTU	Tier 1: 32.0 MMBTU Tier 2: 46.8 MMBTU	N/A	N/A

2 METHODOLOGY

The following sections describe the objectives, approach, and summarize the total interview completes that the study achieved.

2.1 Objectives

The objective of this study was to research and understand what industry standard practice is for commercial kitchen equipment installed in replace on failure (ROF) and new construction (NC) applications. As determined by proportion of savings, the primary focus of this study included fryers, ovens, steam cookers, and commercial dishwashers.³

2.2 Approach overview

The data collection approach used in this ISP study was as follows:

1. **Secondary research and initial PA interviews.** The research team first undertook secondary research on baselines and savings calculations in other jurisdictions. The used kitchen equipment research that was already conducted was used as a jumping-off point, as was a compilation of assumptions and research sources used in the California workpapers that are currently used to calculate TRM savings. The team also requested workbooks and details about project tracking in PA systems and review program eligibility requirements and related applications with PA evaluation staff.
2. **Implementer engagement.** Using the secondary research material, the research team prepared material for an “Implementer’s Webinar” oriented to both internal implementation staff and external implementation contractors that commented on the secondary research and MA program review results to ensure the evaluation team thoroughly understood the nuances of program implementation including program eligibility requirements, tracking limitations, savings assumptions, analysis limitations, and potential changes in program delivery. The group agreed to focus on the efficiency level and idle energy rate of the prioritized measures since those are the main drivers of savings and impacted by the efficiency standards.
3. **Review of interim findings and adjustment of data collection strategies.** After the initial secondary research, interviews with PAs, and the Implementer Webinar were complete, the research team prepared an interim findings presentation as part of the standing BAG/ISP call. The presentation mapped out the data collection that would support the development of new savings calculations and fit into other program requirements. The interim findings were presented to the ISP Task Working Group (TWG) and any other expert stakeholders for input and comment. The goal of this interim presentation was to provide the team with an opportunity to refine the primary research scope to: (1) target the list and quantity of market actors and end users for interviews, (2) inform the survey instrument design, and (3) zero in on the market factors and equipment characterizations that would become the basis of the ISP characterization. Given the need to identify the amount of used equipment in the marketplace and

³ As part of the workplan development process, the team reviewed the tracking data and identified that commercial food service equipment accounts for 4.4% of the tracking therms savings and 2.3% of electric savings (lighting omitted) in the C&I sector for 2019. Within the commercial food service equipment category, the dishwasher, fryer, oven, and steam cooker measure all account for 92% of the electric savings and 98% of gas savings.

the challenges in identify efficiency level of used equipment, DNV presented an approach that shifted some of the primary data collection strategy to focus more on end user surveys and less towards market actor surveys, although the data collection did include both groups.

4. **Primary research** — After receiving feedback on the interim results, the research team undertook primary research and began work on the draft and final ISP study reports. The research team interviewed market actors and end users to collect the information necessary to establish ISP values and understand the magnitude of used equipment market share. The evaluation team synthesized results to key research questions into a composite answer that may be applied to that aspect of the ISP. The results will also be used to develop recommendations on updates to prescriptive commercial food service equipment savings calculations.

2.3 End user web survey

DNV administered a survey to gather information on used commercial kitchen equipment. The total sample included 17,377 contacts; however, only 24% of the sample had email addresses. The DNV team sent the survey to 4,147 sites and used a mixed-use method (phone and email) to complete the survey with sites with and without email addresses. The survey was open for 13 days and received 65 completes, a 1.5% response rate. The findings from this survey are presented in Section 3.1. Appendix A includes the web survey script.

Table 2-1. Summary of survey activity

Sample Group	Sample Frame	Surveys Completed	Response Rate (web)	Approach
MA commercial kitchens ⁴	17,377	65	1.5%	Email and Phone

2.4 Market actor interviews

DNV conducted phone surveys with distributors to better understand the market of commercial food service equipment. Since this study focuses on fryers, dishwashers, steam cookers, and ovens, the perspectives provided are focused on those systems. Appendix B is the interview script. All interviewees stated that they were familiar with the used market of commercial kitchen and food service equipment in Massachusetts. The team reviewed the Massachusetts Point of Sale Commercial Food Service dealer partners list to identify distributors who sold used food service equipment and would be eligible for the survey. Out of the 80 total distributors, 22 distributors were confirmed through online research to sell used equipment. The team contacted these 22 distributors via phone and email and were able to conduct interviews with two distributors. In addition to the market actor interviews, DNV completed an interview with the program manager for the Energy Star commercial food service program manager. This interview helped refine and focus the primary data collection efforts

3 SURVEY RESULTS

The following sections summarize the results of the primary research conducted as part of this study.

⁴ Contact info obtained through <https://restaurantemaillist.com/>

3.1 Used equipment mix

All respondents were asked generally about the equipment purchasing behaviors. 78% of respondents said they at least consider purchasing used equipment. However, when asked how likely it is that they may purchase used equipment in the future, the average rating (on a scale from 1 to 5, with 1 being not at all likely and 5 being extremely likely) was a 3.

Respondents were then asked if they had purchased any kitchen equipment in the last five years. The most common kitchen equipment recently purchased by respondents was ovens, followed by fryers and commercial dishwashers. Respondents were then asked if any of the equipment that they purchased was used equipment at the time of purchase. 28% of respondents (n=11) had purchased used oven equipment in the last five years. There were only 6 respondents that recently purchased a steam cooker, and 0 indicated purchasing any used steam cookers. Table 3-1 presents the number of used equipment purchases by equipment type.

Table 3-1. End user survey respondents who purchased used equipment by type

Equipment Type	Number of Survey Responses	Respondents who Purchased Used Equipment	% Used
Oven	39	11	28%
Fryer	34	1	3%
Commercial Dishwasher	19	2	11%
Steam Cooker	6	0	0%
Total	98	14	14%

Of the 11 respondents who purchased used ovens, 2 noted that the used oven was Energy Star rated, 2 noted that the used oven was not Energy Star rated, and 7 did not know. However, 2 of the 7 who didn't know if their used oven was Energy Star or not, did provide model numbers. Based on model number lookups, DNV identified 1 additional Energy Star oven.

This represents 50% of used oven were Energy Star rated (3 of 6 known).

The average manufacture year of used commercial kitchen equipment varies based on equipment type. Table 3-2 provides a breakdown of used equipment age by type. Only ovens had more than two responses to this question. **The average age of used ovens was 7 years as end users reported the average year of purchased ovens was 2019.**

Table 3-2. Average age of used equipment as reported by end users

Equipment Type	Average year manufactured
Oven	2012
	n=11
Fryer	N/A
	n=1
Commercial Dishwasher	2015
	n=2
Steam Cooker	N/A
	n=0

Both distributors that DNV interviewed sell used kitchen equipment in Massachusetts. The percent of sales that are used vs. new kitchen equipment are detailed in Table 3-3. Respondent 1 sells more used equipment than Respondent 2, but both responses support the presence of used equipment in the marketplace.

Table 3-3. Percent of sales overall by distributor

Technology	Percent of Sales	
	Respondent 1	Respondent 2
New Equipment	30%	80%-90%
Used Equipment	70%	10%-20%

Both distributors indicated that most customers are interested in used equipment, but that sales of used equipment are dependent on inventory. The typical age of used equipment that they sell is 10 years or less. When asked about percent of sales by equipment type, both respondents indicated that they sell more commercial ovens than other types of kitchen equipment. They also categorized which equipment they see frequently being sold in the used market which is detailed in Table 3-2 below.

Table 3-4. Percent of sales by equipment type

Technology	Percent of Sales	
	Respondent 1	Respondent 2
Oven	50% used	Some used
Fryer	<5% used	Typically buy new
Commercial Dishwasher	0% used	0% used
Steam Cooker	2-3 used sales, 0 new sales	Typically buy new

Some individual responses to the market actor surveys are included in the tables below.

Table 3-5. Distributor descriptions of used market for commercial kitchen equipment

Respondent	Question: Can you tell me a little bit about the used market of commercial kitchen and food service equipment? What do you think the overall market is for used equipment vs. new equipment?
1	The used market has become more popular in recent months as the price of new equipment has gone up by 40%-50% on average. Reductions in incentives for fryers and ovens have made purchasing new equipment unattainable for smaller restaurants (large chains are not as affected by this). The used market is tremendously stronger than new right now.
2	For dealers, the used market is not what it used to be 4 or 5 years ago. A lot of equipment is commodity style and new equipment is more affordable than it used to be. The used market is mostly online now, not so much in dealers.

Respondent 1 also indicated that the COVID-19 pandemic may have influenced the reduction of used equipment entering the marketplace as compared to the past. They noted that some restaurant owners are being forced to sell their kitchen

equipment to landlords as back payment for missed rent during lockdowns. This may explain some of the slowing of the used market noted by Respondent 2.

Table 3-6. Distributor descriptions about customer buying practices

Respondent	Question: How many end users typically purchase new vs. used commercial kitchen equipment? Who is typically buying used equipment?
1	It depends on what they have in inventory. People usually ask for used before they ask for new unless they've had issues with used in the past. In that case, they want new for the warranty and the peace of mind.
2	Maybe 7 out of 10 want new equipment, however, most customers are interested in used equipment. Customers don't typically care about Energy Star, but it is a selling feature when they learn about the rebates.

Both respondents indicated that most customers are influenced by the rebates associated with the ENERGY STAR label, but that the energy savings associated with the label is not the first priority when making a purchase.

Table 3-7. Distributor characterization of why customers purchase new or used

Respondent	Question: What is the main reason someone would purchase new vs. old equipment?
1	Warranty and savings on bills. People want the warranty to avoid unexpected repair bills.
2	Warranty and reliability. They don't want to have problems with the equipment.

The warranty and reliability associated with new equipment are the most important factor in buying new equipment. Both respondents indicated that the initial cost is also a large driver of the decision for new vs used equipment.

3.2 Oven Baseline Adjustment

To account for the Massachusetts Appliance Standards, DNV is recommending updates to the baseline efficiency values for each measure type. Due to the evidence suggesting that there is a non-inconsequential amount of used ovens being sold in the marketplace, we are also recommending a blended baseline for ovens to account for the presence of used equipment in the marketplace. This subsection provides details on the blended baselines for gas and electric ovens.

For ovens, DNV assumed 72% of kitchen equipment is brand new, which would be subject to the 2022 MA appliance standard. This standard specifies compliance with ENERGY STAR for Commercial Ovens, Version 2.2. DNV assumed the remaining 28% of purchased equipment would be used. Of the 28% used, half are expected to be ES rated and half are non-ES rated. Used equipment purchasers, on average, purchased ovens that were 7 years old. Therefore, the used equipment efficiency values were based on ES and non-ES (conventional) equipment ratings from 2016, which would be 7 years prior to 2023 when the new baselines will be effective.

Table 3-8. Weighted MA ISP baseline for commercial convection oven – full size electric

	Used (28%)	New (72%)	Weighted
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Convection Oven Electric Full Size	Conventional (50%)	ENERGY STAR v2.2 (50%)	ENERGY STAR v2.2	MA ISP Baseline
Weighting	14%	14%	72%	
Cooking energy efficiency	65%	71%	71%	70%
Idle energy rate	2,000	1,600	1,600	1,656

Table 3-9. Weighed MA ISP baseline for commercial combination oven – electric

Combination Oven Electric	Used (28%)				New (72%)		Weighted ISP Baseline	
	Conventional (50%)		ENERGY STAR v2.2 (50%)		ENERGY STAR v2.2		Conv ec. Mode	Steam Mode
	Convec. Mode	Steam Mode	Convec. Mode	Steam Mode	Convec. Mode	Steam Mode		
Weighting	14%	14%	14%	14%	72%	72%		
Cooking energy efficiency	65%	40%	76%	55%	76%	55%	74%	53%
Idle energy rate	3,750	12,500	2,099	3,300	2,099	3,300	2,330	4,588

Table 3-10. Weighed MA ISP baseline for commercial convection oven – gas

Convection Oven Gas	Used (28%)		ENERGY STAR v2.2 (50%)	New (72%) ENERGY STAR v2.2	Weighted ISP Baseline
	Conventional (50%)	ENERGY STAR v2.2 (50%)			
Weighting	14%	14%	14%	72%	
Cooking energy efficiency	30%	46%	46%	46%	44%
Idle energy rate	15,000	12,000	12,000	12,000	12,420

Table 3-11. Weighed MA ISP baseline for commercial combination oven – gas

	Used (28%)				New (72%)		Weighted ISP Baseline	
	Conventional (50%)		ENERGY STAR v2.2 (50%)		ENERGY STAR v2.2		Conv ec. Mode	Steam Mode
	Convec. Mode	Steam Mode	Convec. Mode	Steam Mode	Convec. Mode	Steam Mode		
Weighting	14%	14%	14%	14%	72%	72%		
Cooking energy efficiency	35%	20%	56%	41%	56%	41%	53%	38%
Idle energy rate	9,607	15,256	8,425	10,511	8,425	10,511	8,590	11,175

Table 3-12. Weighed MA ISP baseline for commercial single rack oven – gas

Convection Oven Gas	Used (28%)		ENERGY STAR v2.2 (50%)	New (72%) ENERGY STAR v2.2	Weighted ISP Baseline
	Conventional (50%)	ENERGY STAR v2.2 (50%)			
Weighting	14%	14%	14%	72%	
Cooking energy efficiency	30%	48%	48%	48%	45%
Idle energy rate	43,000	25,000	25,000	25,000	27,520

Table 3-13. Weighed MA ISP baseline for commercial double rack oven – gas

Convection Oven Gas	Used (28%)		New (72%)	Weighted ISP Baseline
	Conventional (50%)	ENERGY STAR v2.2 (50%)	ENERGY STAR v2.2	
Weighting	14%	14%	72%	
Cooking energy efficiency	30%	52%	52%	49%
Idle energy rate	65,000	30,000	30,000	34,900

3.3 Awareness of Appliance Standards

To better understand any possible future changes to the market after the Massachusetts appliance standards take full effect, the DNV team asked respondents, both end users and distributors, about their current level of awareness regarding the appliance standards. End users were asked, on a scale from 1 to 5, with 1 being not at all familiar and 5 being extremely familiar, how familiar they are with Massachusetts new Appliance Energy Efficiency Standards. The average response was 2.0 (n = 59). Both distributors also indicated that they were mostly unfamiliar with the standards. One distributor noted that he had heard about the standards but has been hearing conflicting information. He is concerned that the qualifying equipment could be significantly more expensive than the non-Energy Star equipment. He is also concerned that online sales will be able to bypass the standards more easily threatening the profitability of the brick-and-mortar stores. The other distributor noted that the current rebates are very advantageous for both the end users and the dealers. He noted that if those rebates were to disappear, it's likely that the percent of used equipment sold in the marketplace would increase. While these responses do not provide enough evidence to make changes to the updated baselines, they do indicate that there could be potential changes to the market over time in response to the new standards and the percent of used equipment in the marketplace could increase in the future.

4 SAVINGS ANALYSIS

DNV recalculated deemed electric and gas energy savings for each targeted measure using the current version of the Savings Calculator for ENERGY STAR Commercial Food Service (CFS) Products last updated in March 2021. Inputs to the tool used a mix of CA DEER workpaper sources, ENERGY STAR standards, Massachusetts appliance standards, and findings from this research effort. The following sections present the specific inputs and proposed savings values for each equipment type.

4.1 Electric Ovens

Table 4-1. Calculator inputs and savings for commercial ovens – electric

TRM Chapter	Food Service-Electric Oven		
Equipment Type	Full Size Convection Oven	Combination Oven - Convection Mode	Combination Oven - Steam Mode
Notes	Baseline is 28% used and 72% new equipment. Used is 50% conventional and 50% Energy Star V2.2.	Baseline is 28% used and 72% new equipment. Used is 50% conventional and 50% Energy Star V2.2. Error in Energy Star calculator corrected to ensure total daily energy includes preheat energy.*	
Recommended Baseline	MA ISP - Blended Used/ENERGY STAR Ovens V2.2		
Updated Baseline Parameters	Cooking efficiency: 70% Idle energy rate: 1.66 kW	Cooking efficiency: 74% Idle energy rate: 2.3	Cooking efficiency: 53% Idle energy rate: 4.6



Previous Parameters	Cooking efficiency: 68% Idle energy rate: 1.8	Cooking efficiency: 74% Idle energy rate: 1.3	Cooking efficiency: 45% Idle energy rate: 8.0
Updated Energy Savings	Tier 1: 192 kWh Tier 2: 1,111 kWh		Tier 1: 6,672 kWh Tier 2: 7,643 kWh
Prior Energy Savings	Tier 1: 1,025 kWh Tier 2: 2,465 kWh		Tier 1: 11,661 kWh Tier 2: 12,943 kWh
Updated Demand Savings	Tier 1: 0.07 kW Tier 2: 0.41 kW		Tier 1: 1.5 kW Tier 2: 1.7 kW
Prior Demand Savings	Tier 1: 0.23 kW Tier 2: 0.5 kW		Tier 1: 2.66 kW Tier 2: 2.96 kW
Additional Updates	Production Capacity (lbs/hr): Baseline - 88, Efficient - 93 Operating Hours/Day: 9.9 Operating Days/Year: 270 Pounds of Food Cooked per Day: 122	Production Capacity (lbs/hr): Baseline - 100, Efficient - 125 Pounds of Food Cooked per Day: 250 Number of Pans: 20	Production Capacity (lbs/hr): Baseline - 150, Efficient - 200 Pounds of Food Cooked per Day: 250 Number of Pans: 20

*The Energy Star Calculator algorithm was not capturing the preheat energy in the total daily energy calculation for combination ovens for either the baseline or the efficient technology. DNV corrected this in the calculator and the savings also reflect this change.



4.2 Gas Ovens

Table 4-2. Calculator inputs and savings for commercial ovens – gas

TRM Chapter	Food Service-Gas Oven			
Equipment Type	Convection Oven	Combination Oven - Convection Mode	Combination Oven - Steam Mode	Rack Oven
Notes	Baseline is 28% used and 72% new equipment. Used is 50% conventional and 50% Energy Star V2.2.	Baseline is 28% used and 72% new equipment. Used is 50% conventional and 50% Energy Star V2.2.	Baseline is 28% used and 72% new equipment. Used is 50% conventional and 50% Energy Star V2.2.	Rack oven represented by double rack assumptions.
Recommended Baseline	MA ISP - Blended Used/ENERGY STAR Ovens V2.2			
Updated Baseline Parameters	Cooking efficiency: 44% Idle energy rate: 12,420 Btu/hour	Cooking efficiency: 53% Idle energy rate: 8,590	Cooking efficiency: 38% Idle energy rate: 11,175 Btu/hour	Cooking efficiency: 49% Idle energy rate: 34,909 Btu/hour
Previous Parameters	Cooking efficiency: 38% Idle energy rate: 15,000 Btu/hour	Cooking efficiency: 54% Idle energy rate: 9,607 Btu/hour	Cooking efficiency: 38% Idle energy rate: 15,256 Btu/hour	Cooking efficiency: 30% Idle energy rate: 65,000 Btu/hour
Updated Energy Savings	Tier 1: 2.3 MMBTU Tier 2: 15.5 MMBTU	Tier 1: 6.6 MMBTU Tier 2: 13.2 MMBTU		31.9 MMBTU
Prior Energy Savings	Tier 1: 15.8 MMBTU Tier 2: 33.8 MMBTU	Tier 1: 14.8 MMBTU Tier 2: 21.7 MMBTU		252.6 MMBTU
Additional Updates	Production Capacity (lbs/hr): Baseline - 88, Efficient - 93 Operating Hours/Day: 9.9 Operating Days/Year: 270 Pounds of Food Cooked per Day: 122	Production Capacity (lbs/hr): Baseline - 100, Efficient - 125 Pounds of Food Cooked per Day: 250 Number of Pans: 20	Production Capacity (lbs/hr): Baseline - 150, Efficient - 200 Pounds of Food Cooked per Day: 250 Number of Pans: 20	

4.3 Electric Fryers

Table 4-3. Calculator inputs and savings for commercial fryer – electric

TRM Chapter			
Food Service-Electric Fryer			
Equipment Type	Standard Vat	Large Vat	Weighted Average*
Notes	Prior energy savings in TRM don't align with FSTC calculator. Table reflects prior assumptions	TRM does not currently list a Large Vat option. Prior results based on FSC only.	
Recommended Baseline	ENERGY STAR for Commercial Fryers, Version 2.0		
Updated Baseline Parameters	Cooking efficiency: 80% Idle energy rate: 1.0 kW	Cooking efficiency: 80% Idle energy rate: 1.1 kW	
Previous Parameters	Cooking efficiency: 78% Idle energy rate: 1.1 kW	Cooking efficiency: 78% Idle energy rate: 1.1 kW	
Updated Energy Savings	Tier 1: 1,131 kWh Tier 2: 1,581 kWh	Tier 1: 137 kWh Tier 2: 1,941 kWh	<i>Tier 1: 1,121 kWh Tier 2: 1,585 kWh</i>
Prior Energy Savings	Tier 1: 1,148 kWh (1,874 in FSC) Tier 2: 2,490 kWh (2,424 in FSC)	Tier 1: 421 (FSC only) Tier 2: 2,545 kWh (FSC only)	
Updated Demand Savings	Tier 1: 0.27 kW Tier 2: 0.53 kW	Tier 1: 0.03 kW Tier 2: 0.46 kW	<i>Tier 1: 0.27 kW Tier 2: 0.53 kW</i>
Prior Demand Savings	Tier 1: 0.26 kW Tier 2: 0.57 kW	Tier 1: 0.09 kW (FSC only) Tier 2: 0.58 kW (FSC only)	
Additional Updates	Preheat Time (min): Baseline - 9.45, Efficient - 8.93 Preheat Energy (kWh): Baseline 1.75, Efficient - 1.56 Production Capacity (lbs/hr): Baseline - 69.4, Efficient - 62.1 Operating Days/Year: 351 Pounds of Food Cooked per Day: 111		

* Current TRM only has standard vat measures listed. Based on confirmation of recent sales, large vat measures do exist but make up less than 1% of sales. Recommend using the weighted average savings values (99% standard, 1% large).

4.4 Gas Fryers

Table 4-4. Calculator inputs and savings for commercial fryer – gas

TRM Chapter	Food Service-Gas Fryer		
Equipment Type	Standard Vat	Large Vat	Weighted Average*
Notes		Large vat not currently broken out in TRM	
Recommended Baseline	ENERGY STAR for Commercial Fryers, Version 2.0	ENERGY STAR for Commercial Fryers, Version 2.0	
Updated Baseline Parameters	Cooking efficiency: 50% Idle energy rate: 9,000 Btu/hour	Cooking efficiency: 50% Idle energy rate: 12,000 Btu/hour	
Previous Parameters	Cooking efficiency: 42.5% Idle energy rate: 11,500 Btu/hour	Cooking efficiency: 42.5% Idle energy rate: 12,000 Btu/hour	
Updated Energy Savings	Tier 1: 1.7 MMBTU Tier 2: 13.3 MMBTU	Tier 1: 1.3 MMBTU Tier 2: 17.0 MMBTU	<i>Tier 1: 1.7 MMBTU Tier 2: 13.4 MMBTU</i>
Prior Energy Savings	Tier 1: 19.7 MMBTU Tier 2: 33.0 MMBTU	Tier 1: 11.3 MMBTU (FSC only) Tier 2: 29.4 MMBTU (FSC only)	
Additional Updates	Preheat Time (min): 7 Preheat Energy (Btu): Baseline 16,609, Efficient - 9,730 Production Capacity (lbs/hr): Baseline - 58.0 Efficient - 65.7 Operating Days/Year: 351 Pounds of Food Cooked per Day: 111		

* Current TRM only has standard vat measures listed. Based on confirmation of recent sales, large vat measures do exist but make up less than 1% of sales. Recommend using the weighted average savings values (99% standard, 1% large).

4.5 Electric Steam Cookers

Table 4-5. Calculator inputs and savings for commercial steam cooker – electric

TRM Chapter	Food Service-Electric Steam Cooker
Equipment Type	Electric Steam Cooker
Notes	
Recommended Baseline	ENERGY STAR Commercial Steam Cooker Version 1.2
MA Baseline Parameters	Cooking efficiency: 50% Idle energy rate: 0.4 kW
MA Previous Parameters	Cooking efficiency: 38% Idle energy rate: 0.84
Energy Savings	Tier 1: 1,440 kWh Tier 2: 2,800 kWh
Prior Energy Savings	Tier 1: 3,947 kWh Tier 2: 5,306 kWh
Demand Savings	Tier 1: 0.51 kW Tier 2: 1.0 kW
Prior Demand Savings	Tier 1: 0.9 kW Tier 2: 1.21 kW
Additional Updates	

4.6 Gas Steam Cookers

Table 4-6. Calculator inputs and savings for commercial steam cooker – gas

TRM Chapter	Food Service-Gas Steamer
Equipment Type	Gas Steamer
Notes	
Recommended Baseline	ENERGY STAR Commercial Steam Cooker Version 1.2
MA Baseline Parameters	Cooking efficiency: 38% Idle energy rate: 12,500 Btu/hour
MA Previous Parameters	Cooking efficiency: 26.5% Idle energy rate: 13,750 Btu/hour
Energy Savings	Tier 1: 15.6 MMBTU Tier 2: 23.9 MMBTU
Prior Energy Savings	Tier 1: 32.0 MMBTU Tier 2: 46.8 MMBTU
Additional Updates	

4.7 Dishwashers

The baseline for dishwashers does not include used equipment. End users indicated that 11% (2 of 19) of recently purchased equipment was used equipment, and the two distributor respondents both indicated that 0% of their commercial dishwasher sales included used equipment. During a stakeholder group meeting that included PA representatives and EEAC consultants, we decided to not apply any used equipment to the baseline due to the lack of sufficient evidence.

Table 4-7. Calculator inputs and savings for high temperature commercial dishwashers

TRM Chapter	Food Service – High Temperature Commercial Dishwasher				
Equipment Type	Under Counter	Door Type	Single Tank Conveyor	Multi Tank Conveyor	Pot, Pan and Utensil
Notes					
Recommended Baseline	ENERGY STAR Commercial Dishwashers Version 2.0	ENERGY STAR Commercial Dishwashers Version 2.0	ENERGY STAR Commercial Dishwashers Version 2.0	ENERGY STAR Commercial Dishwashers Version 2.0	ENERGY STAR Commercial Dishwashers Version 2.0
MA Baseline Parameters	Idle energy rate: 0.5 kW Water Consumption 0.86 GPR	Idle energy rate: 0.7 kW Water Consumption 0.89 GPR	Idle energy rate: 1.5 kW Water Consumption 0.7 GPR	Idle energy rate: 2.25 kW Water Consumption 0.54 GPR	Idle energy rate: 1.2 kW Water Consumption 0.58 GPR
MA Previous Parameters	Idle energy rate: 0.63 kW Water Consumption 0.98 GPR	Idle energy rate: 0.79 kW Water Consumption 1.09 GPR	Idle energy rate: 1.72 kW Water Consumption 0.79 GPR	Idle energy rate: 2.42 Water Consumption 0.76 GPR	Idle energy rate: 1.2 kW Water Consumption 0.64 GPR
Energy Savings	Tier 1: 0 kWh Tier 2: 1,132 kWh	Tier 1: 0 kWh Tier 2: 730	Tier 1: 0 kWh Tier 2: 1,752	Tier 1: 0 kWh Tier 2: 2,336	Tier 1: 0 kWh Tier 2: 438
Prior Energy Savings	Tier 1: 1,585 kWh Tier 2: 2,717 kWh	Tier 1: 5,932 kWh Tier 2: 6,662 kWh	Tier 1: 4,606 kWh Tier 2: 6,358 kWh	Tier 1: 13,704 kWh Tier 2: 16,040 kWh	Tier 1: 1,655 kWh Tier 2: 2,093 kWh
Demand Savings	Tier 1: 0 kW Tier 2: 0.17 kW	Tier 1: 0 kW Tier 2: 0.11kW	Tier 1: 0 kW Tier 2: 0.27 kW	Tier 1: 0 kW Tier 2: 0.36	Tier 1: 0 kW Tier 2: 0.07 kW
Prior Demand Savings	Tier 1: 0.36 kW Tier 2: 0.62 kW	Tier 1: 1.35 kW Tier 2: 1.52 kW	Tier 1: 1.05 kW Tier 2: 1.45 kW	Tier 1: 3.13 kW Tier 2: 3.66 kW	Tier 1: 0.38 kW Tier 2: 0.48 kW
Additional Updates					



Table 4-8. Calculator inputs and savings for low temperature commercial dishwashers

TRM Chapter		Food Service – Low Temperature Commercial Dishwasher		
Equipment Type	Under Counter	Door Type	Single Tank Conveyor	Multi Tank Conveyor
Notes				
Recommended Baseline	ENERGY STAR Commercial Dishwashers Version 2.0	ENERGY STAR Commercial Dishwashers Version 2.0	ENERGY STAR Commercial Dishwashers Version 2.0	ENERGY STAR Commercial Dishwashers Version 2.0
MA Baseline Parameters	Idle energy rate: 0.5 kW Water Consumption 1.19 GPR	Idle energy rate: 0.6 kW Water Consumption 1.18 GPR	Idle energy rate: 1.5 kW Water Consumption 0.79 GPR	Idle energy rate: 2.0 kW Water Consumption 0.54 GPR
MA Previous Parameters	Idle energy rate: 0.5 kW Water Consumption 1.46 GPR	Idle energy rate: 0.6 kW Water Consumption 1.64 GPR	Idle energy rate: 1.55 kW Water Consumption 1.05 GPR	Idle energy rate: 2.0 kW Water Consumption 0.79 GPR
Energy Savings	Tier 1: 0 kWh Tier 2: 1,414 kWh	Tier 1: 0 kWh Tier 2: 1,205 kWh	Tier 1: 0 kWh Tier 2: 3,854 kWh	Tier 1: 0 kWh Tier 2: 5,475 kWh
Prior Energy Savings	Tier 1: 1,270 kWh Tier 2: 2,684 kWh	Tier 1: 8,076 kWh Tier 2: 9,281 kWh	Tier 1: 6,813 kWh Tier 2: 10,668 kWh	Tier 1: 9,406 kWh Tier 2: 14,881 kWh
Demand Savings	Tier 1: 0 kW Tier 2: 0.22 kW	Tier 1: 0 kW Tier 2: 0.18 kW	Tier 1: 0 kW Tier 2: 0.59 kW	Tier 1: 0 kW Tier 2: 0.83 kW
Prior Demand Savings	Tier 1: 0.29 kW Tier 2: 0.61 kW	Tier 1: 1.84 kW Tier 2: 2.21 kW	Tier 1: 1.56 kW Tier 2: 2.44 kW	Tier 1: 2.15 kW Tier 2: 3.40 kW
Additional Updates				



5 CONCLUSIONS, RECOMMENDATIONS, AND CONSIDERATIONS

DNV conducted primary research using end user surveys as well as market actor interviews. Based on the research objectives, DNV pivoted more towards relying on end users over market actors to better understand and quantify the used market. While the quantity of market actor interviews was lower than initially targeted, all market actor interviews were conducted with credible sources who were able to provide good insights that could be used with the end user surveys to formulate conclusions and recommendations for food service equipment in MA. The DNV team has the following conclusions and recommendations based on our research.

5.1 Conclusions

DNV has the following conclusions based on our primary and secondary research.

Used equipment. Based on the end user surveys as well as the market actor interviews, used equipment does play a role in the commercial food service industry. How much varied by equipment type, with both survey sources citing ovens as the market where purchasing used equipment is the most prevalent, indicating that on average 28% of the ovens purchased were used. Of the used equipment it averaged between 6 and 7 years old when purchased. Out of the other three categories researched, dishwashers was the next highest at 11%.

Replace on failure vs. new construction. DNV did not find any difference between commercial food service equipment installed as a replace on failure versus a true new construction project.

5.2 Recommendations

Based on our research and conclusions DNV has the following recommendations relating to commercial food service equipment.

- 1. Adopt the baselines outlined in this document.** The baselines outlined by equipment type use a variety of information, including the new food service equipment standards and our primary research. The oven category is the most notable, as DNV has included used equipment efficiencies in the baseline efficiency calculation. In the rest of the categories, DNV recommends adopting the baseline efficiency that aligns with the new food service equipment standards starting in 2023.
- 2. Focus program offerings on Tier 2 measures.** With the new equipment standards coming into play, the program should focus on providing incentives for Tier 2 measures only. With the increased baselines, the savings for Tier 1 are negligible or drastically reduced leading to a very low or zero benefit cost ratio.
- 3. Update TRM with new savings values.** DNV recommends adopting the updated savings shown in this document that use the ISP baselines along with the newly recommended qualifying efficiencies. DNV also recommends listing all relevant savings parameters in the TRM. Currently, only the idle energy rate and efficiency level are listed in the TRM.

5.3 Considerations

Based on our research and conclusions DNV has the following considerations relating to commercial food service equipment.

- 1. Continue to monitor possible changes in the used equipment marketplace** in response to the Massachusetts appliance standards. The two distributors interviewed had low familiarity with the new standards but indicated that changes to the types of products available could lead to increases in the used equipment market.



6 APPENDIX A: END USER SURVEY GUIDE

Introduction

[IF SURVEY IS TAKEN ONLINE, begin at INTRO1. Alternative text will be provided where applicable with the programming instructions stating, "IF SURVEY IS TAKEN OVER THE PHONE" with alternative text after "IF SURVEY IS TAKEN ONLINE".]

[IF SURVEY IS TAKEN ON THE PHONE]

Intro1. Hello, my name is <INTERVIEWER NAME> from DNV, calling on behalf of the Mass Save program. Today we're conducting an important study on the energy needs and perceptions of restaurants like yours. We are specifically interested in how your company thinks about and manages their kitchen equipment purchasing. The survey should take less than 15 minutes and at no time will we try to sell you anything. Do you have time to talk for a few minutes about your purchasing decisions? If eligible and when you complete the survey, we will email you a \$25 Amazon Gift Card within 7 days.

[IF NEEDED] Your input will allow the Program Administrators to build and maintain better energy savings offerings for customers like you. This survey is authorized by the Mass Save® program. Mass Save® is a collaborative of Massachusetts' natural gas and electric utilities and energy efficiency service providers including Berkshire Gas, Cape Light Compact, Eversource, Liberty Utilities, National Grid, and Unitil. The goal of the program is to empower residents, businesses, and communities to make energy efficient upgrades by offering a wide range of services, rebates, incentives, trainings, and information.

1	Yes	PERSON1
2	Make Appointment=APPT	APPT
88	Refused	Thank & Terminate

[If Intro1 = 2]

APPT.

77	Record day of the week, time of day and date to call back. Record phone number and contact name if needed.	Call contact and repeat intro process at designated time
88	Refused	Thank & Terminate
99	Don't know	Thank & Terminate

[IF SURVEY IS TAKEN ONLINE]

Intro1. Thank you for participating in our survey. Prior to starting, we need to ask you a few questions to determine if you are eligible to take this survey. If **eligible** and **once we receive your completed survey**, we will email you a \$25 Amazon Gift Card within 7 days.

All of your responses will be confidential to the extent permitted by law, and any analyses will not identify individuals.

Click the arrow to continue.

PERSON1

[IF SURVEY IS TAKEN ON THE PHONE]

We need to speak with someone who is knowledgeable about the purchase of kitchen equipment for your restaurant. Would that be you?

1	Yes	SCRN_Part1
2	Yes, need to make an appointment	APPT



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3	No, but I will give you the name	Person2
4	No one knows about the kitchen equipment	Thank and Terminate (T1)

[IF SURVEY IS TAKEN ONLINE]

We need to speak with someone who is knowledgeable about the purchasing practices of kitchen equipment for your restaurant or food service company. Would that be you?

1	Yes	SCRN_Part1
3	No, but I will give you the name and email of the person who is familiar with this purchase	Person2
4	No one knows about the purchase of new kitchen equipment	Thank and Terminate (T1)

T1. Thank you for your response. Unfortunately, you do not qualify to take the survey. We are only seeking input from respondents that are familiar with the purchase of new commercial kitchen equipment. We appreciate your willingness to participate in this study. Have a great day.

Person2

[IF SURVEY IS TAKEN ON THE PHONE]

Who would be the person most familiar with your restaurant's kitchen equipment?

77	Record Name, as <CONTACT>	MAY_I
88	Refused	Thank & Terminate (T1)
99	Don't know	Thank & Terminate (T1)

MAY_I May I speak with him/her?

1	Yes	INTRO1
2	Yes, need to make an appointment	APPT
88	Refused	Thank & Terminate (T1)

[IF SURVEY IS TAKEN ONLINE]

Please provide the name and email for who would be the person most familiar with your restaurant's kitchen equipment.

[Enter New Contact Name and move on]

77	Record Name, as <CONTACT>	Thank & Terminate (T2)
78	Record Email, as <EMAIL>	Thank & Terminate (T2)
88	Refused	Thank & Terminate (T1)
99	Don't know	Thank & Terminate (T1)

T2 Thank you for your response. We will reach out to the person you mentioned in the last question to learn about the kitchen equipment your restaurant installed. Have a great day.

Screener

SCRN_Part1. What is the ownership structure of your restaurant? [Select one]

1. Chain
2. Franchise
3. Individually owned
4. Partnership
5. Cooperative
6. Other [Record response]



SCRN_Part2. Which best describes your restaurant? [\[Select one\]](#)

1. Quick service (drive through, fast food, outlet within retail store, etc.)
2. Limited service (Order through cashier, no wait service)
3. Full restaurant service
4. Catering and banqueting
5. Drinking establishments (bars, pubs, etc.)
6. Commercial cafeteria
7. Other [Record response]

SCRN_Part3. Have you purchased any of the following equipment in the past 5 years? Please select all that apply. (Select all that apply)

1. Fryer
2. Oven
3. Steam cooker
4. Commercial dishwasher
5. None of the above [Make answer exclusive]

SCRN_Part3a.

Do you plan to purchase a fryer, oven, steam cooker, or commercial dishwasher in the next 5 years? [\[Select one\]](#)

1. Yes
2. No
3. Don't know
4. Other [Record response]

[IF SCR_N_Part3 = 5 AND SCR_N_PART3a = 2, 3,4]

SCRN_Part3b. Thank you for your response. Unfortunately, you do not qualify to take the survey. We are only seeking input from respondents that have or are considering purchasing commercial kitchen equipment. We appreciate your willingness to participate in this study. Have a great day. [\[END SURVEY\]](#)

Decision Making Practices

DM_A1: Does your company or organization have any regulations or formal requirements about purchasing commercial kitchen equipment? [\[Select one\]](#)

1. Yes [Please explain]
2. No
3. Don't know

DM_A2: When you purchase commercial kitchen equipment, do you ever consider purchasing used equipment? [\[Select one\]](#)

1. Yes
2. No
3. Don't know

[IF DM_A2 = 1]

DM_A3: On a scale from 1 to 5, with 1 being not at all likely and 5 being extremely likely, when you purchase a fryer, oven, steam cooker, or commercial dishwasher in the future, how likely are you to purchase used equipment?

Not at all likely 1	2	3	4	Extremely Likely 5	Don't know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

DM_A4: On a scale from 1 to 5, with 1 being not at all familiar and 5 being extremely familiar, how familiar are you with Massachusetts new Appliance Energy Efficiency Standards that sets energy efficiency standards for appliances, including commercial kitchen equipment, sold starting in 2023?



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Not at all familiar 1	2	3	4	Extremely Familiar 5	Don't know
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

[If Scrn_Part3 = 1]

Fryer

DM_F1. You indicated that you purchased a fryer in the last five years. Approximately in what year did you purchase that fryer? [\[Select one\]](#)

1. 2022
2. 2021
3. 2020
4. 2019
5. 2018
6. Prior to 2018
7. Don't know

DM_F2. Is this an electric or gas fryer? [\[Select one\]](#)

1. Electric
2. Gas
3. Don't know

DM_F3. Is your fryer standard or deep vat? [\[Select one\]](#)

1. Standard (A fryer with a vat that measures >12 inches and < 18 inches wide, and a shortening capacity > 25 pounds and < 65 pounds)
2. Deep vat (A fryer with a vat that measures > 18 inches and < 24 inches wide, and a shortening capacity > 50 pounds)
3. Don't know

DM_F4. When you purchased your current fryer, was it new or used at the time of purchase? [\[Select one\]](#)

1. New
2. Used
3. Don't know

DM_F5. Is your fryer Energy Star certified? [\[Select one\]](#)

1. Yes
2. No
3. Don't know

[IF DM_F4=1] **DM_F6.** Did you receive any type of energy-efficiency rebate from Mass Save or your electric or gas utility when you purchased this equipment? [\[Select one\]](#)

1. Yes
2. No
3. Don't know

[IF DM_F4=1,3 THEN SKIP TO DM_O1]

[IF DM_F4=2]

DM_F7: What year was your current fryer manufactured?

1. [Record response]
2. Don't know

DM_F8. We would like to confirm the fryer type and efficiency. To do this, we recommend either taking a picture of the nameplate of your fryer and uploading it to the survey in the next question or providing us with the model number and serial number on the nameplate. Please choose below which option is easier for you to do.

1. I can provide the model number of my fryer
2. I can take a picture of the nameplate of my fryer



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3. I cannot provide this information at this time [SKIP to DM_01]

[IF DM_F8 = 1]

DM_F9. Please provide the manufacturer, model number, and serial number of your fryer below.

1. Manufacturer: [Record brand response]
2. Model number: [Record model number response]
3. Serial number: [Record serial number response]

[IF DM_F8 = 2]

DM_F10. Please take a picture of the fryer nameplate and upload it below.

1. [FILE UPLOAD]

[If Scrn_Part3 = 2]

Oven

DM_O1. You indicated that you purchased an oven in the last five years. Approximately in what year did you purchase that oven? [Select one]

1. 2022
2. 2021
3. 2020
4. 2019
5. 2018
6. Prior to 2018
7. Don't know

DM_O2. Is it an electric or gas oven? [Select one]

1. Electric
2. Gas
3. Don't know

DM_O3. What type of oven did you purchase?

1. Convection Oven
2. Combination Oven
3. Rack Oven
4. Don't know

[If DM_O3 = 1]

DM_O3a. Is your convection oven full size or half size?

1. Full size (A convection oven capable of accommodating standard fullsize sheet pans measuring 18 x 26 x 1-inch)
2. Half size (A convection oven capable of accommodating half-size sheet pans measuring 18 x 13 x 1-inch)
3. Don't know
4. Other [Record response]

[If DM_O3 = 2]

DM_O3b. Is your combination oven full size or half size?

1. Full size (A combination oven capable of accommodating two 12.7 x 20.8 x 2.5-inch steam table pans per rack position, loaded from front-to-back or lengthwise)
2. Half size (A combination oven capable of accommodating a single 12.7x 20.8 x 2.5-inch steam table pan per rack position, loaded from front-to-back or lengthwise)
3. Don't know
4. Other [Record response]

[If DM_O3 = 2]

DM_O3c. Does your combination oven use convection mode or steam mode?

1. Convection mode
2. Steam mode
3. Don't know
4. Other [Record response]

[If DM_O3 = 1 OR 2]

DM_O3c. What is the pan capacity of your oven?

1. [Record response]
2. Don't know

[If DM_O3 = 3]

DM_O3d. Is your rack oven a single rack or double rack?

1. Single Rack Oven (A floor-model rack oven that can accommodate one removable single rack of standard sheet pans measuring 18 x 26 x 1-inch Steam mode)
2. Double Rack Oven (A floor-model rack oven that can accommodate two removable single racks of standard sheet pans measuring 18 x 26 x 1-inch or one removable double-width rack)
3. Don't know
4. Other [Record response]

DM_O4. When you purchased your oven, was it new or used at the time of purchase? [Select one]

1. New
2. Used
3. Don't know

DM_O5. Is your oven Energy Star certified? [Select one]

1. Yes
2. No
3. Don't know

[IF DM_O4=1] **DM_O6.** Did you receive any type of energy-efficiency rebate from Mass Save or your electric or gas utility when you purchased this equipment? [Select one]

1. Yes
2. No
3. Don't know

[IF DM_O4=1,3 THEN SKIP TO DM_S1]

[IF DM_O4=2]

DM_F7: What year was your oven manufactured?

1. [Record response]
2. Don't know

DM_O8. We would like to confirm the oven type and efficiency. To do this, we recommend either taking a picture of the nameplate of your oven and uploading it to the survey in the next question or providing us with the model number and serial number on the nameplate. Please choose below which option is easier for you to do.

1. I can provide the model number of my oven
2. I can take a picture of the nameplate of my oven
3. I cannot provide this information at this time [SKIP to DM_S1]

[IF DM_O8 = 1]

DM_O9. Please provide the manufacturer, model number, and serial number of your oven below.

1. Manufacturer: [Record brand response]
2. Model number: [Record model number response]
3. Serial number: [Record serial number response]

[IF DM_O8 = 2]

DM_O10. Please take a picture of the oven nameplate and upload it below.

1. [FILE UPLOAD]

[If Scrn_Part3 = 3]

Steam Cooker



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DM_S1. You indicated that you purchased a steam cooker in the last five years. Approximately in what year did you purchase that steam cooker? [\[Select one\]](#)

1. 2022
2. 2021
3. 2020
4. 2019
5. 2018
6. Prior to 2018
7. Don't know

DM_S2. Is it an electric or gas steam cooker? [\[Select one\]](#)

1. Electric
2. Gas
3. Don't know

DM_S2a. What type of steam cooker did you purchase?

1. Steam generator
2. Boiler based
3. Boilerless
4. Don't know

DM_S3. What is the steam cooker's pan capacity? [\[Select one\]](#)

1. Less than 3-pan
2. 3-pan
3. 4-pan
4. 5-pan
5. 6-pan or larger
6. Don't know
7. Other [Record response]

DM_S4. When you purchased your steam cooker, was it new or used at the time of purchase? [\[Select one\]](#)

1. New
2. Used
3. Don't know

DM_S5. Is your steam cooker Energy Star certified? [\[Select one\]](#)

1. Yes
2. No
3. Don't know

[IF DM_S4=1] DM_S6. Did you receive any type of energy-efficiency rebate from Mass Save or your electric or gas utility when you purchased this equipment? [\[Select one\]](#)

1. Yes
2. No
3. Don't know

[IF DM_S4=1,3 THEN SKIP TO DM_D1]

[IF DM_S4=2]

DM_S7: What year was your steam cooker manufactured?

1. [Record response]
2. Don't know

DM_S8. We would like to confirm the steam cooker type and efficiency. To do this, we recommend either taking a picture of the nameplate of your steam cooker and uploading it to the survey in the next question or providing us with the model number and serial number on the nameplate. Please choose below which option is easier for you to do.

1. I can provide the model number of my steam cooker
2. I can take a picture of the nameplate of my steam cooker
3. I cannot provide this information at this time **[SKIP to DM_S1]**



[IF DM_S8 = 1]

DM_F9. Please provide the manufacturer, model number, and serial number of your steam cooker below.

1. Manufacturer: [\[Record brand response\]](#)
2. Model number: [\[Record model number response\]](#)
3. Serial number: [\[Record serial number response\]](#)

[IF DM_S8 = 2]

DM_F10. Please take a picture of the steam cooker nameplate and upload it below.

1. [\[FILE UPLOAD\]](#)

[If Scrn_Part3 = 3]

Commercial Dishwasher

DM_D1. You indicated that you purchased a dishwasher in the last five years. Approximately in what year did you purchase that steam cooker? [\[Select one\]](#)

1. 2022
2. 2021
3. 2020
4. 2019
5. 2018
6. Prior to 2018
7. Don't know

DM_D2. Is your dishwasher low temp or high temp? [\[Select one\]](#)

1. Low temp (A machine that applies a chemical sanitizing solution to the surfaces of dishes to achieve sanitization)
2. High temp (A machine that applies hot water to the surfaces of dishes to achieve sanitization)
3. Other [\[Record response\]](#)
4. Don't know

[IF DM_D2 = 1]

DM_D3a. What type of low temp dishwasher did you purchase? [\[Select one\]](#)

1. Under counter (A stationary rack machine with an overall height of 38 inches or less, designed to be installed under food preparation workspaces)
2. Stationary Single Tank Door (A stationary rack machine designed to accept a standard 20 inch x 20 inch dish rack which requires the raising of a door to place the rack into the wash/rinse chamber)
3. Single Tank Conveyor (A conveyor machine that includes a tank for wash water followed by a sanitizing rinse)
4. Multi Tank Conveyor (A conveyor type machine that includes one or more tanks for wash water and one or more tanks for pumped rinse water, followed by a sanitizing rinse)
5. Other [\[Record response\]](#)
6. Don't know

[IF DM_D2 = 2]

DM_D3a. What type of high temp dishwasher did you purchase? [\[Select one\]](#)

1. Under counter (A stationary rack machine with an overall height of 38 inches or less, designed to be installed under food preparation workspaces)
2. Stationary Single Tank Door (A stationary rack machine designed to accept a standard 20 inch x 20 inch dish rack which requires the raising of a door to place the rack into the wash/rinse chamber)
3. Pot, Pan, and Utensil (A stationary rack, door type machine designed to clean and sanitize pots, pans, and kitchen utensils)
4. Single Tank Conveyor (A conveyor machine that includes a tank for wash water followed by a sanitizing rinse)
5. Multi Tank Conveyor (A conveyor type machine that includes one or more tanks for wash water and one or more tanks for pumped rinse water, followed by a sanitizing rinse)
6. Other [\[Record response\]](#)
7. Don't know

DM_D4. When you purchased your dishwasher, was it new or used at the time of purchase? [\[Select one\]](#)

1. New



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2. Used
3. Don't know

DM_D5. Is your dishwasher Energy Star certified? [\[Select one\]](#)

1. Yes
2. No
3. Don't know

[IF DM_D4=1] DM_D6. Did you receive any type of energy-efficiency rebate from Mass Save or your electric or gas utility when you purchased this equipment? [\[Select one\]](#)

1. Yes
2. No
3. Don't know

[IF DM_D4=1,3 THEN SKIP TO CL1]

[IF DM_D4=2]

DM_D7: What year was your dishwasher manufactured?

1. [\[Record response\]](#)
2. Don't know

DM_D8. We would like to confirm the dishwasher type and efficiency. To do this, we recommend either taking a picture of the nameplate of your dishwasher and uploading it to the survey in the next question or providing us with the model number and serial number on the nameplate. Please choose below which option is easier for you to do. [\[Select one\]](#)

1. I can provide the model number of my dishwasher
2. I can take a picture of the nameplate of my dishwasher
3. I cannot provide this information at this time [\[SKIP to DM_S1\]](#)

[IF DM_D8 = 1]

DM_D9. Please provide the manufacturer, model number, and serial number of your dishwasher below.

1. Manufacturer: [\[Record brand response\]](#)
2. Model number: [\[Record model number response\]](#)
3. Serial number: [\[Record serial number response\]](#)

[IF DM_D8 = 2]

DM_F10. Please take a picture of the dishwasher nameplate and upload it below.

2. [\[FILE UPLOAD\]](#)

Closing

CL1. Thank you very much for taking the time to provide your feedback! Your feedback is very valuable. If you would like a \$25 gift card from Amazon.com, please enter your email address on the next page.

CL2. Please provide the email address you would like your gift card to be sent to.

1. [\[OPEN-ENDED RESPONSE\]](#)

CL3. Thank you for participating and offering your feedback. Please allow up to 7 days for processing the gift card.



7 APPENDIX B: MARKET ACTOR SURVEY GUIDE

Survey Overview

Objective: The DNV Team will conduct phone surveys with market actors, such as distributors, to learn about the market of commercial equipment and food service equipment.

Anticipated timing (survey length): 15-20 minutes

Method of data collection: Phone-survey

Survey

Email Survey Invitation Letter

Subject: Interview to Discuss Commercial Kitchen Equipment Market

Hi [First Name],

My firm, DNV, is conducting a study on behalf of the sponsors of Mass Save to learn about the market of commercial food service equipment.

To help with this study, I would like to ask you, or someone at [Company name] that is familiar with the commercial kitchen and food service market for new and used equipment in Massachusetts only, specifically market trends regarding fryers, ovens, commercial dishwashers and steam cookers. My questions will take no longer than 15-20 minutes and all your responses will be kept confidential.

I've listed some of my availability below; please let me know which of these times works best for your schedule (All EST):

- Insert time slots here

Please let me know if you have any questions. We appreciate any and all feedback you can provide!

Best,

DNV staff

Introduction Text Prior to Question

[INTERVIEWER NOTE: THE QUESTIONS IN THIS INTERVIEW GUIDE SHOULD NOT NECESSARILY BE READ VERBATIM BUT MAY BE MODIFIED TO SUIT THE INTERVIEW]

Hi, my name is _____, and I am calling from DNV on behalf of the Sponsors of Mass Save® regarding their programs which support the sale and adoption efficient products. We are conducting a study to learn about the market of commercial food service equipment. In this case, our conversation will focus on fryers, ovens, commercial dishwashers, and steam cookers.

We understand that you are a distributor of commercial equipment and food service equipment. I'm estimating our questions will take less than 30 minutes. Is now still a good time to talk? If not, could we schedule another time at your convenience?

It is helpful for me to record the conversation for note-taking purposes, so that I can replay it to myself in case I missed anything. Everything you say today will be kept confidential, meaning that we won't attach your name or any other identifying information to any of our results or findings.

Would it be okay for me to record this conversation? **[IF YES, BEGIN RECORDING]**

Introduction/Screening

Q1. Do you sell commercial kitchen and food service equipment in Massachusetts?



[If NO, end survey]

Q2. Do you sell used kitchen equipment? Specifically, we are interested in fryers, ovens, commercial dishwashers and steam cookers?

[If respondent sells used equipment, ask the next section. If new equipment only, Skip to Q8.]

Used Equipment

Q3. Can you tell me a little bit about the used market of commercial kitchen and food service equipment?

1. How many end-users typically purchase new vs. used commercial kitchen equipment? (Make sure to specify that we are interested in all new – not just new energy star or high efficiency equipment)
2. Who is typically buying used equipment?
3. What is the main reason someone would purchase new vs. old equipment?

Q4. Can you tell me roughly the percent of your sales that are used vs. new kitchen equipment?

Technology	Percent of Sales
New Equipment	
Used Equipment	
Technology	Percent of Sales
Fryers	
Ovens	
Commercial Dishwashers	
Steam cookers	

Q5. What do you think the overall market is for used equipment versus new kitchen equipment?

[INTERVIEWER NOTE: WE ARE INTERESTED IN THE TOTAL MARKET NOT JUST FOR THE ONE DISTRIBUTOR]

Q6. What is the typical age of the used kitchen equipment you sell? (Probe: Number of years or average years the equipment is manufactured). Is this typical for most distributors selling used equipment?

Q7. Is the used equipment you sell typically ENERGY STAR certified?

1. If yes, what percent of your used equipment you sell is ENERGY STAR certified?
2. For equipment that is not ENERGY STAR certified, are you able to identify any information about the efficiency level of your used equipment?



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- Q8. What types of customers typically purchase used equipment? Is there anything fundamentally different about them compared to customers that only purchase new equipment?
- Q9. Are you familiar on any restrictions that might be in place for different end-users to purchase new vs. used commercial kitchen equipment?

New Equipment

- Q10. What is the key factor that influences end-users decision to purchase specific commercial kitchen equipment models? (Probe: price point/first costs, ENERGY STAR label, reliability, operating costs, maintenance, efficiency).
- Q11. How much do you think the ENERGY STAR label influences a customer's decision to purchase equipment? On a scale from 0 to 10 with 0 not being important, and 10 being incredibly important, how important do you see most customers valuing the ENERGY STAR label?

New ENERGY STAR Appliance Standards/COVID-19

- Q12. On a scale from 1 to 5, with 1 being not at all familiar and 5 being extremely familiar, how familiar are you with Massachusetts new Appliance Energy Efficiency Standards that sets energy efficiency standards for appliances, including commercial kitchen equipment, sold starting in 2023?
1. Noting the appliance standards that will be in effect soon, do you think that this would impact purchasing habits of the equipment you sell?
 2. If yes, how do you think it will impact purchasing habits?
- Q13. Did the COVID-19 pandemic have any effect on the used equipment marketplace? (Probe: staff turnover, supply chain issues)

Closing

- Q14. Do you have any other comments or feedback on the market of commercial kitchen equipment that we haven't discussed?
- Q15. Do you have any contacts at other companies that you think might be interested in speaking with me?