Appliance Recycling Net Savings Update (MA20X03-E-ARNTG)

Final Report

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SUBMITTED TO:
Massachusetts Electric Program Administrators

SUBMITTED BY:
NMR Group, Inc.

MA Appliance Recycling NTG Study

Evaluating the NTGRs from an Appliance Recycling Program

NMR conducted a study to estimate retrospective and prospective net-to-gross ratios (NTGRs) for dehumidifiers, freezers, and refrigerators recycled through the Mass Save Appliance Recycling Program. The Massachusetts Program Administrators (PAs) currently sponsor this two-track program. In the first track, the program collects unwanted refrigerators and freezers and pays an incentive of $75 to customers who recycle their appliances through the program. In the second track, the program collects unwanted dehumidifiers at recycling turn-in events. Participants receive a rebate of $30 per unit. Dehumidifier participants could also apply for rebates for purchasing new dehumidifiers through Mass Save.

Study Objectives

Estimate retrospective and prospective NTGRs for dehumidifiers, freezers, and refrigerators recycled through the Program to inform planning for the 2022 to 2024 program cycle

Explore possible effects on NTGRs of synergies created by the availability of incentives for both recycling dehumidifiers and purchasing new ENERGY STAR®-qualified dehumidifiers

Key Findings

Retrospective 2019 & Prospective Recommended NTGRs

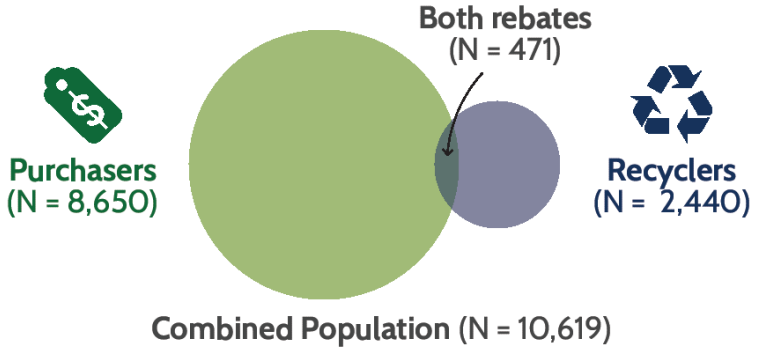
REFRIGERATORS **46%**

FREEZERS **50%**

DEHUMIDIFIERS **41%**

Dehumidifier Dual Rebate Impact on Early Retirement

Nineteen percent of dehumidifier recyclers used rebates for recycling old and purchasing new dehumidifiers. The survey responses indicated that the new unit rebate motivated 22% of dual rebate users to recycle their old dehumidifiers early, translating to only 4% of recyclers. NMR does not recommend adjusting the NTGR to account for early retirement.



Recommendations

NMR recommends that the PAs use the retrospective NTGR for 2019 to plan for the 2022 to 2024 program cycle.

NMR recommends that the PAs adopt the NTGRs prospectively starting in 2022 and continue using them until results of future research or other information suggests changing them.

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Acronyms and Key Terms Used in this Report

Acronym	Definition
ARCA	Appliance Recycling Centers of America, program implementation contractor
BCR	Benefit-Cost Ratio
EEAC	Energy Efficiency Advisory Council
MA19X03-B-RSRNTG	Massachusetts 2020 Consistent Methodology for Self-Reported Net-to-Gross Methodology study
MA19R17-B-TRM	Comprehensive TRM Review
MA20X04-E-PRODNTG	MA20X04 Products NTG Study
MA21R33-E-ARI	Appliance Recycling Impact Update
NPS	Net Promoter Score
NTG / NTGR	Net-to-Gross / Net-to-Gross Ratio; ratio of net savings to gross savings
PA	Program Administrators
Part-use Factor	Portion of the year unit was used prior to recycling; equivalent to the realization rate for appliance recycling programs
RECS	Residential Energy Consumption Survey
RLPNC 18-1	RLPNC 18-1 Appliance Recycling Study
TRM	Technical Reference Manual
UEC	Unit Energy Consumption
UMP	Uniform Methods Project

Executive Summary

The Massachusetts Program Administrators (PAs) currently sponsor a two-track recycling program (the Program) through the Mass Save® Residential Consumer Products Core Initiative. In the first track, the program collects unwanted refrigerators and freezers and pays an incentive of $75 to customers who recycle their appliances through the program. The implementer will also pick up a dehumidifier if already there to get a freezer or refrigerator. In the second track, the program collects unwanted dehumidifiers at recycling turn-in events. Participants receive a rebate of $30 per unit. In 2019, the program provided appliance recycling rebates for 18,333 refrigerators, 3,121 freezers, and 2,002 dehumidifiers. These reflect post-data cleaning counts as calculated by the *MA21R33-E-ARI Appliance Recycling Impact* team.

Study Objectives

The PA asked NMR Group, Inc., (NMR) to achieve the following objectives:

- Estimate retrospective and prospective net-to-gross ratios (NTGRs) for dehumidifiers, freezers, and refrigerators recycled through the Appliance Recycling Program to inform planning for the 2022 to 2024 program cycle.
- Explore possible effects of synergies created by the availability of incentives for both recycling dehumidifiers and purchasing new ENERGY STAR®-qualified dehumidifiers on NTGRs, including whether the PAs should adopt separate early retirement and replace on failure dehumidifier NTGRs.

Study Approach

NMR conducted a web-based survey of 345 participants in the Appliance Recycling Program: 96 refrigerator recyclers, 75 freezer recyclers, and 174 dehumidifier recyclers. Respondents answered questions designed to determine what they believe they would have done with the recycled appliance had they not taken part in the program. The survey also asked participants about their likelihood of recommending the program, and about the influence of incentives for both recycling dehumidifiers and purchasing new ENERGY STAR-qualified dehumidifiers on participation decisions.[1]

As described in more detail in Section 2.3.1, NMR used an approach adapted from the Uniform Methods Project (UMP) to guide the estimation of retrospective net energy savings and NTGRs for appliances recycled by the program in 2019.[2] Net energy savings considers what would have happened to the unit had it not been recycled through the program. The UMP approach assigns

[1] The survey also included questions that informed the *MA21R33-E-ARI Appliance Recycling Impact* study being conducted by Guidehouse and Illume (forthcoming).

[2] Keeling, J.; Bruchs, D. 2017. "Chapter 7: Refrigerator Recycling Evaluation Protocol." *The Uniform Methods Project: Methods for Determining Energy-Efficiency Savings for Specific Measures.* Golden, CO; National Renewable Energy Laboratory. NREL/SR-7A40-68563. http://www.nrel.gov/docs/fy17osti/68563.pdf.

a portion of adjusted gross savings[3] to each unit recycled by the program by accounting for free-ridership (the units would have been removed from service), transferred use (someone other than the participant or their acquaintance would have used the unit), and non-free-ridership (the participant would have kept the unit or given it to an acquaintance). The NTGR equals the average net savings divided by the average adjusted gross savings.

KEY FINDINGS, RECOMMENDATIONS, AND CONSIDERATIONS

Table 1 presents the key study findings related to NTGRs. The table reports the Benefit-cost Ratio Model identification numbers (BCR ID), the current BCR NTGR, the retrospective 2019 NTGR, and the recommended prospective NTGR. The recommendations below acknowledge the recent regulatory decision to unlock the three-year prospective NTGRs but also that the market for recycling appliances appears to move slowly.

- **NMR recommends that the PAs use the retrospective NTGR for 2019 to plan for the 2022 to 2024 program cycle.**
- **NMR recommends that the PAs adopt the NTGRs prospectively starting in 2022 and continue using them until results of future research or other information suggest changing them.**
- **The market for recycled appliances appears to move slowly, resulting in stable NTGRs over time. Therefore, the PAs should consider updating NTGRs for recycled appliances later in the next program cycle, pending the results of any forthcoming coordinated NTG planning.**

Table 1: Recommended NTGRs for 2020 to 2024

Savings Type	BCR IDs	Current BCR	Retrospective 2019 NTGR[1]	Prospective Recommended
Refrigerator	E19A2c066	44%	46% (38%, 54%)	46%
Freezers	E19A2c052	56%	50% (41%, 59%)	50%
Dehumidifier[2]	E19A2c076	50%	41% (35%, 47%)	41%

[1] Confidence interval in parentheses
[2] Although this study conducted primary research only on turn-in dehumidifiers, the recommendation applies to both turn-in and pick-up dehumidifiers. This recommendation reflects the PAs' practice of using the NTGR from the most similar measure in the absence of primary research for a particular measure.

The study found evidence that the availability of rebates for recycling old and buying new dehumidifiers induced about 4% of appliance recyclers to retire their unit early. NMR concludes that this percentage is too small to warrant an adjustment to the dehumidifier NTGR to account for early retirement.

[3] Gross savings adjusted by a realization rate. The realization rate for recycling programs is the portion of the year prior to recycling that the household used the unit.

The survey results also indicate that almost every participant would recommend the program to others. The program has a net promoter score (NPS) of 90% or higher for all three appliances. (The score can range from a low of -100 to a high of +100.)

LIMITATIONS AND SOURCES OF UNCERTAINTY

NMR has identified three potential sources of uncertainty in this study.

1. The results of this study are based on the application of data obtained through participant web surveys and program tracking data to the UMP algorithm. The addition of non-participant and secondary market research would have strengthened the study design. The study did not pursue these methods as the expected program savings did not justify their cost.[4]
2. Although the surveys targeted customers who participated in the program in 2019, NMR conducted the surveys in early 2021, during the pandemic. The amount of time between participation and being surveyed, coupled with the unusual situation, may have biased answers to some of the survey questions in unknown ways.
3. NMR received about 10% of the recruitment letters back in the mail (161 returned of 1,625 sent). NMR sent about 18% of the advance letters to participants from the Cape Light Compact service territory, which is proportionate to their share of all program participants. However, nearly one-half (74) of the returned letters came from Cape Light participant addresses. Since NMR verified that the addresses on the returned letters matched those in the data provided by DNV and Appliance Recycling Centers of America (ARCA), other factors (the health crisis, the strong housing market, etc.) must underlie this high return rate. We suspect that the letter return rate stems from the large number of vacation properties in the Cape Light service territory. Properties may have been sold, and summer residents may not have forwarded their Cape mail to their winter addresses.

NMR believes that the realization rate / part-use factor developed from the MA20X03-E-ARNTG survey data but analyzed by the Appliance Recycling Impact team (MA21R33-E-ARI) is most at risk of being biased. While we have no direct evidence of the impact, NMR suspects that any bias would serve to overstate the portion of the year the appliances were used, assuming seasonal residents unplug the appliances when the homes are vacant.

[4] Expected program savings were 4.6% of electric savings for the 2019 to 2021 cycle.

Section 1 Introduction

The Massachusetts Program Administrators (PAs) currently sponsor a two-track recycling program (the Program) through the Mass Save® Residential Consumer Products Core Initiative. In the first track, the program collects unwanted refrigerators and freezers and pays an incentive of $75 to customers who recycle their appliances through the program. The implementer will also pick up dehumidifiers if the household is recycling a refrigerator or freezer. In the second track, the program collects unwanted dehumidifiers at recycling turn-in events. Participants receive a rebate of $30 per unit. In 2019, the program provided appliance recycling rebates for 18,333 refrigerators, 3,121 freezers, and 2,002 dehumidifiers (through both program delivery methods).[5]

The PAs tasked NMR Group, Inc., (NMR) with estimating retrospective and prospective net-to-gross ratios (NTGR) for dehumidifiers, freezers, and refrigerators recycled through the Appliance Recycling Program. The results will inform planning for the 2022 to 2024 program cycle. The study also explored the possibility of synergies created by the availability of incentives for both recycling dehumidifiers and purchasing new ENERGY STAR®-qualified dehumidifiers that could affect NTGRs.

1.1 Study Objectives

The objectives of this research were as follows:

- Calculate 2019 retrospective net energy savings
- Estimate a 2019 retrospective NTGR and recommend prospective NTGRs for the 2022 to 2024 program cycle
- Explore possible effects on NTGRs created by the availability of both the dual dehumidifier recycling and new dehumidifier rebates, and their treatment in prospective net savings calculations

Research questions included the following:

- What do participants think they would have done with the recycled appliance in the absence of the program?
- Which of these alternative outcomes for units would have resulted in their permanent removal from the grid?
- How do the net energy savings for recycled refrigerators and freezers compare with those reported for the prior Appliance Recycling Study (RLPNC 18-1)?[6]

[5] These counts differ from those listed in the Fourth Quarter 2019 *Key Program Indicators* (KPI) tracking spreadsheet. Specifically, *KPI 2* lists 18,899 refrigerators, 3,318 freezers, and 2,843 dehumidifiers. The count differences reflect the data cleaning efforts of the *MA21R33-E-ARI Appliance Recycling Impact* team.

[6] NMR Group, Inc. 2018. *RLPNC 18-1 Appliance Recycling Report*. Available at https://ma-eeac.org/wp-content/uploads/RLPNC_181_ApplianceRecycleReport_26SEP2018_FINAL.pdf

- Do dual incentives for dehumidifier recycling and new dehumidifier encourage early replacement?
- Would participants recommend the program to others?

Section 2 Research Methodology & Data Analysis Approach

NMR estimated combined 2019 net savings for refrigerators and freezers by replicating the approach used in the 2017 RLPNC 18-1 Appliance Recycling Study, which entails surveys with participating households. This approach is consistent with the recommendations in the Massachusetts 2020 Consistent Methodology for Self-Reported Net-to-Gross Measurement study (MA19X03-B-RSRNTG).[7] Because the RSRNTG study, the UMP, and the Massachusetts Technical Reference Manual (TRM)[8] do not provide guidance on how to estimate NTG for recycled dehumidifiers, we adapted the UMP approach for calculating refrigerator and freezer NTG ratios, with some minor changes. We also conducted a literature review to benchmark the inputs obtained from the participant survey and the resulting NTG ratios.

2.1 Literature Review

For refrigerator and freezer recycling, NMR built onto the literature review of refrigerator and freezer recycling programs for the RLPNC 18-1 Appliance Recycling Study, which covered NTGR studies and TRM assumptions completed through early 2018. We expanded the review to include NTGR studies completed between 2015 and 2020 for dehumidifier recycling. We reviewed 81 different evaluation reports and TRMs from across the nation to identify NTGR for dehumidifier, freezer, and refrigerator recycling. Despite expanding the literature search to a five-year period, we were unable to find any NTGR studies on dehumidifier recycling. Appendix B lists citations and corresponding links for the studies.

2.2 Data Sources

The study relied primarily on program tracking data and responses from a participant survey to estimate the 2019 retrospective NTGR. We incorporated gross savings estimates and realization rates as calculated in the MA21R33-E-ARI study[9] and reported in the Comprehensive TRM Review (MA19R17-B-TRM) study.[10] NMR supplemented these sources with estimates of energy use for newly manufactured freezers and refrigerators (estimated using the ENERGY STAR Appliances Savings Calculator)[11] and data on the prevalence of through-the-door ice for

[7] NMR Group, Inc. and Tetra Tech. 2020. *MA19X03-B-RSRNTG Consistent Methodology for Self-Reported Net-to-Gross Measurement.* Final Report May 28, 2020. https://ma-eeac.org/wp-content/uploads/MA19X03-B-RSRNTG_Residential-SR-NTG-Report_FINAL_2020.5.28.pdf.

[8] Massachusetts Program Administrators. 2020. "1.21 Dehumidifiers." *Electronic Technical Reference Manual*. Available at https://etrm.anbetrack.com/#/workarea/home?token=6d6c45766e692f527044.

[9] NMR collected data on frequency and location of use the year prior to recycling. Guidehouse and Illume analyzed these data and used them as inputs in their impact analysis. The Guidehouse and Illume study is forthcoming, but they shared preliminary results with NMR so that we could meet the PAs' three-year planning deadlines.

[10] The TRM update study provided baseline information for newly purchased dehumidifiers. Guidehouse. 2021. *Comprehensive TRM Review MA19R17-B-TRM.* Available at https://ma-eeac.org/wp-content/uploads/MA19R17-B-TRM_Final_Report_2021-04-12_clean.pdf.

[11] NMR has an archived copy of this calculator, which has been removed from the ENERGY STAR website.

refrigerators (not currently tracked by the program implementer) as reported in the Residential Energy Consumption Surveys (RECS)[12] for 2005, 2009, and 2015.

2.2.1 Program Tracking Data

Appliance Recycling Centers of America (ARCA), the program implementer, provided 2019 program tracking data to NMR. The program tracking data served as the sample frame for the participant survey and provided customer contact information. NMR also used information on recycled unit characteristics to estimate the energy consumption of comparable newly purchased freezers and refrigerators, a component of the NTG algorithm.

2.2.2 Participant Survey

NMR addressed the following topics in a survey of program participants:[13]

- What respondents would have done with the unit in the absence of the program
- How the dehumidifier recycling rebate impacted respondent decisions to purchase new energy-efficient dehumidifiers (including quantity, efficiency, and timing)
- How likely participants would be to recommend the program

To pull the sample for the participant survey, we randomly selected 750 participants from the program tracking that that had recycled a dehumidifier at turn-in events.[14] Likewise, we randomly selected 375 participants that had recycled a freezer and 500 that had recycled a refrigerator through the pick-up program.[15] We verified that the sample accurately reflected the service territories of the population.

NMR sent potential respondents an advance letter with a pre-paid $5 incentive and a link to the web-based survey. The letter explained the purpose of the survey and provided phone numbers and email addresses to contact NMR or the PAs for more information or to take the survey over the phone. NMR sent letters to dehumidifier participants on January 21, 2021. Due to the need to first correct for errors and omissions in the program tracking data, NMR sent letters to refrigerator and freezer participants a week later, on January 28, 2021. Survey fielding for all appliances ended on February 11, 2021, and yielded a total of 345 responses, including 96 refrigerator, 75 freezer, and 174 dehumidifier respondents. The number of responses met or exceeded the study's quotas of 75 freezer respondents and 150 dehumidifier respondents, respectively. Refrigerator responses fell slightly below the desired quota of 100 respondents. Table 2 presents the response rate and the sampling error for both absolute and relative precision, using the 90%

[13] The survey also collected data for the MA21R33-E-ARI study. The impact study provided the gross and adjusted gross savings estimates cited in this report.
[14] We did not survey households who had dehumidifiers picked up, as they could only do this if also recycling a freezer or refrigerator.
[15] NMR worked with DNV and Guidehouse to allocate customers who participated in multiple programs in a manner that ensured that each study had a sample frame that provided adequate and non-biased records from which to draw a sample.

confidence level, and the proportion of respondents identified as free riders through their responses or algorithm decisions.[16,17]

Table 2: Sample Design and Sampling Error

Appliance	Population	Response Rate[1]	Final Sample	Sampling Error	
				Absolute	Relative
Refrigerators	18,333	23%	96	8.4%	16.8%
Freezers	3,121	20%	75	9.4%	20.9%
Dehumidifiers	2,002	27%	174	5.9%	10.6%
Total	**23,456**	**24%**	**345**	**7%**	**13%**

[1] Response Rate = Responded ÷ (Mailed – Returned).

It was common for participants to recycle more than one appliance with the program. In these cases, we randomly assigned respondents to one of the appliances in the survey. The survey named the targeted appliance and its brand and configuration (for refrigerators and freezers) to help respondents differentiate between the units they recycled. Finally, two respondents recalled recycling a different type of appliance than listed in the program tracking database. The survey rerouted the respondents to the survey questions for the appliance they recalled recycling.

2.2.3 Gross Savings Estimates from the Appliance Recycling Impact Evaluation

The participant survey included questions used to estimate gross savings and realization rates for recycled dehumidifiers, freezers, and refrigerators. NMR provided the data from these question to the Illume staff members leading the MA21R33-E-ARI study. Illume and Guidehouse analyzed the data and provided NMR with gross savings and adjusted gross savings estimates for all three appliances. The gross savings equal the average unit energy consumption (UEC) of each appliance, while adjusted gross savings account for how much the unit was used the year prior to recycling (Table 3). It is NMR's understanding that the MA21R33-E-ARI study followed guidance from the UMP in calculating freezer and refrigerator gross savings. The study relied on recently completed primary research on dehumidifiers to estimate savings for that appliance. We refer readers to the forthcoming MA21R33-E-ARI report for additional details.

Table 3: Appliance Recycling Gross Savings Estimates

(Source: MA21R33-E-ARI Study Preliminary Results)

Savings Type	Refrigerator	Freezer	Dehumidifier
Gross (kWh)	1,005	753	1,020
Part-use Factor	90%	83%	NA[1]
Adjusted Gross (kWh)	902	622	1,020

[1] The gross savings algorithm from recently conducted primary impact research accounts for hours of use/year. Therefore, Illume did not apply a part-use factor when calculating gross savings. Refer to the forthcoming MA21R33-E-ARI report for additional details.

[16] See Section 2.3.1 for free-ridership estimates. As that section explains, we entered "don't know" responses into Scenario B of the algorithm. We used this method to calculate sampling error.

[17] NMR typically uses the 90% confidence interval and 50% break in responses for sample design and planning purposes. Using the evaluated results on one of the more important findings presents a more accurate description of sampling error.

2.2.4 ENERGY STAR Appliances Calculator and RECS

As described in Section 2.3.1, the UMP algorithm for net savings requires estimating the energy use of brand-new (i.e., recently manufactured) refrigerators and freezers. NMR turned to the ENERGY STAR Appliances Calculator and RECS to develop this estimate. We first identified the size/capacity (cubic feet for refrigerators and freezers) and configurations (door for refrigerators and upright/chest for freezers) for the most common appliances recycled in the program. These account for 81% of refrigerators and 79% of freezers. We then used the ENERGY STAR Appliances calculator to estimate the energy use of new units with similar configurations, weighting the results by recent shipments of ENERGY STAR and non-ENERGY STAR models.

One difficulty we encountered for refrigerator recycling is that the ENERGY STAR calculator reports different energy usage for through-the-door ice for refrigerators with side-by-side and bottom-mounted freezers, but the program tracking database does not list these characteristics. NMR obtained the percentages of through-the-door ice refrigerators for New England from RECS. We pulled data from 2005, 2009, and 2015 and then weighted the estimated use of new units by the average percentage of values across the three years.

2.3 ANALYSIS

2.3.1 Net Energy Savings

NMR applied results of the participant survey and the gross energy savings inputs from the MA21R33-E-ARI study to the UMP algorithm for calculating free-ridership and NTGRs.[18] The UMP algorithm for estimating free-ridership for recycling programs focuses on what would have happened to the recycled unit had it not been recycled through the program. NMR asked respondents to explain what they would have done with the appliance in the absence of the program. There are three possible scenarios:

1. The household would have kept the unit or given it directly to a close acquaintance.
2. The unit would have been transferred directly or indirectly to another customer (other than a close acquaintance) for continued use.
3. The unit would have been discarded by a method that would lead to its permanent removal from service.

The last scenario signifies program free-ridership. Permanent removal from service may occur through municipal recycling programs or because the unit is too old to be offered in the secondary market. The 2011 study found that retailers consider a freezer or refrigerator to be too old for resale if it is older than ten years. Therefore, the current study also uses ten years as the criteria for likely resale for these two appliances. The recent TRM update set dehumidifier measure life

[18] The nature of recycling programs – that someone gets rid of an appliance rather than adding a measure to the home – means they are unlikely to induce the participant spillover associated with traditional rebate or direct install programs.

to 17 years.[19] The PAs, EEAC, and evaluation team agreed to use eight years as the resale age criteria. However, none of the survey respondents said that they would have sold their units to a used appliance dealer in the absence of the program. Therefore, we did not need to apply the resale age criteria.

As the UMP notes, participant intentions may not always match reality. For example, a participant may say they would have sold their old secondary refrigerator on the Internet, but they may not have succeeded in selling it had they tried. In fact, the RLPNC 18-1 Appliance Recycling Study found that about three-quarters of respondents had not tried to get rid of their unit in any other way before turning to the Mass Save recycling program. While the UMP notes that the survey could probe more deeply (e.g., What would you have done if you could not sell it?), the protocol also suggests finding a balance between additional probing and respondent fatigue. For this reason, we propose the scheme detailed in Table 4.

Table 4: Free Rider Scheme

Self-reported Disposition in the Absence of the Program	Refrigerator or Freezer Decision	Dehumidifier Decision	Credited Proportion of Adjusted Gross Savings
Kept by the household	Not a free rider	Not a free rider	100%
Given away for free to an acquaintance	Not a free rider	Not a free rider	100%
Sold/given to charity, classified ads, internet, etc.	See algorithm below	See algorithm below	0% to 50%
Provided to retailer (new or used)	If older than ten years, free rider	If older than eight years, free rider	0%
	If ten years or younger, see algorithm discussion below	If eight years or younger, see algorithm discussion below	0% to 50%
Surrendered to municipality / hired a hauler	Free rider	Free rider	0%
Other dispositions	Treated on case-by-case basis, per survey responses	Treated on case-by-case basis, per survey responses	Varies

For participants who said that, without the program, they would have sold or given the unit to a new appliance retailer (typically upon delivery of a new unit) or a used appliance retailer, NMR followed the algorithm in Figure 1, which we developed based on UMP guidance. For those participants who said that they would have sold or given the unit away directly (e.g., through online classified ads or to a friend) and those who would have provided younger units to retailers, we assigned full savings to one-half of the units[20] and free riders to one-quarter of the units.[21] We

[T] Guidehouse *ibid.*
[20] That is, the unit would have successfully been transferred and put into service elsewhere.
[21] That is, the unit would not have been successfully transferred and would have been removed from service.

assigned the remaining quarter the difference in savings between the original unit and an average new model.[22,23,24]

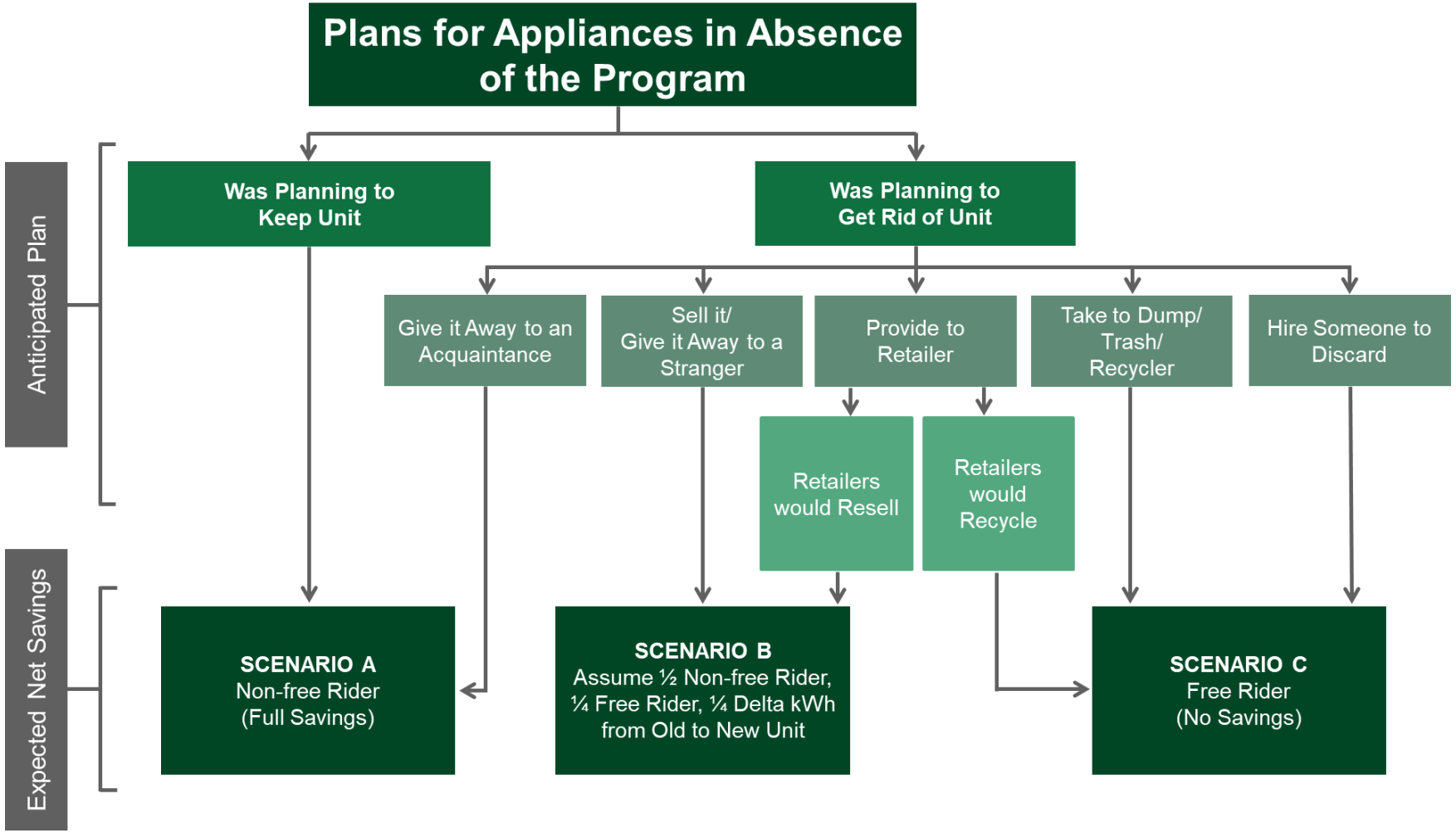
After determining the free-ridership status of each participant, we assigned a portion of adjusted gross savings to the percentage of free rider, non-free rider, and transferred units according to the scheme described in Table 4 and calculated the weighted average net savings. We divided the net savings by the adjusted gross savings to obtain the NTGR.

NMR has one methodological note for all three appliances: the survey instruments for the RLPNC 18-1 Appliance Recycling Study and this current MA20X03-E-ARNTG Study differed somewhat. The RLPNC 18-1 Appliance Recycling Study respondents who did not know if they would have kept or gotten rid of the appliance outside of the program were asked contextual questions to determine if they had tried to recycle their appliance before participating in the Program and why they ultimately decided to recycle with Mass Save. The PA and EEAC representatives had NMR drop this series from the MA20X03-E-ARNTG survey because the questions did not directly factor into the NTG algorithm. In the RLPNC 18-1 Appliance Recycling Study, NMR used these contextual questions to assign program alternatives for some of the "don't know" respondents. If we could not assign an alternative, we removed the respondents from the NTG estimation. Lacking these contextual questions for MA20X03, we entered the "don't know" respondents into Scenario B in the algorithm (Figure 1) with other ambiguous alternative outcomes for recycled units. Additional information on the algorithm can be found in Appendix A.1.

In developing prospective NTGRs to recommend for planning the 2022 to 2024 program cycle, we compared the resulting NTGRs to those from the RLPNC 18-1 Appliance Recycling Study, as well as NTGR and market information gathered from the literature review.

[22] That is, the unit would not have been successfully transferred and a would-be purchaser bought a newly manufactured unit instead.
[23] NMR estimated the UEC of newly obtained products using our saved version of the 2016 ENERGY STAR Appliance Calculator and data from the RECS for 2005, 2009, and 2015 on the proportion of ENERGY STAR refrigerators with through-the-door ice (characteristics not currently tracked by the program implementer). See Appendix A.1 for more details.
[24] NMR calculated the consumption of a new refrigerator by taking the weighted average consumption of a conventional refrigerator and an ENERGY STAR refrigerator. We weighted the average using the national share of ENERGY STAR refrigerators obtained from the ENERGY STAR Shipment Data Report for 2019. The same calculation was applied to freezers.

Figure 1: Free-ridership and Secondary Market Savings Adjustment Algorithm[1,2]



[1] Visual depiction of UMP recommendations provided by Scott Dimetrosky.
[2] Assumes that retailers would resell refrigerators and freezers ten years or younger. Otherwise, the retailer would have recycled the units. The study did not find evidence that dehumidifier recyclers would have sold their units to the secondary market.

2.3.2 Dehumidifier Dual Rebate

Customers who participated in the appliance recycling program could also apply for new dehumidifier rebates through Mass Save. Out of the 2,440 dehumidifier participants[25] who recycled at least one dehumidifier through the program, 471 participants (19%) also received a rebate to purchase a new ENERGY STAR dehumidifier. NMR utilized the participant survey, which included 45 dual rebate users (10% of recyclers), to determine the impact of the dual rebate on the early retirement of dehumidifiers. We also included responses from one dual rebate customer from the in-progress MA20X04 Products NTG study participant survey that the SXC evaluation team conducted at the same time as this study.

[25] This count reflects the population provided to NMR after allocation of cross-program participants for optimal sampling across studies but before the MA21R33-E-ARI team cleaned the program data.

Section 3 Net Savings and NTGR Estimates

NMR estimated NTGRs by applying program tracking data and survey results (including adjusted gross as estimated in the MA21R33-E-ARI study) to the UMP algorithm. We compared the primary NTGRs to those found in a review of recent evaluations of other recycling programs.

3.1 Primary NTGRs – Participant Survey Results

The net savings algorithm, described in Section 2.3.1, classifies each recycled appliance as a free rider, non-free rider, or transferred unit. Appendix A.3.1 provides additional details on survey responses and free rider classification by appliance. We followed the UMP guidance to treat one-half of transferred units (those being sold or given to retailers or strangers) as non-free riders and one-quarter as free riders. The remaining one-quarter of transferred units were assigned energy savings equal to the difference (delta) between units recycled through the program in 2019 and similar newly manufactured units. NMR used the adjusted gross energy savings of recycled units provided by the MA21R33-E-AR study (Table 5).

Table 5: MA21R33-E-ARI Annual Average Consumption by Measure

	Refrigerators	Freezers	Dehumidifiers
Recycled unit usage (kWh)	902	622	1,020
New unit usage (kWh)	445	359	543
Delta Watts (kWh)	457	263	477

Table 6 summarizes the application of this algorithm for refrigerators, while Table 7 presents the freezer results. The calculation method yielded a NTGR of 46% for refrigerators and 50% for freezers. In comparison, the RLPNC 18-1 Appliance Recycling Study found – and the current TRM and BRC assume – a NTGR of 44% for refrigerators and 56% for freezers. See Section 3.2 for a comparison of the current results and those from the prior study.

Table 6: Refrigerator Net Savings Calculations[1]

(Base = Refrigerator Respondents; n = 96)

Net Savings Assignment	Col A Per Unit Net Savings (kWh)	Col B % of Refrigerators	Col A x Col B Weighted Savings (kWh)
Free Riders	0	42%	0
Transfer Free Riders	0	8%	0
Non-free Riders	902	26%	235
Transfer Non-free Riders	902	16%	146
Transfer Other (Partial Free Riders)	457	8%	37
Net Savings			417
Adjusted Gross Savings			902
NTG (Net/Gross)			**46% (38%, 54%)**

[1] Results subject to rounding error.

Table 7: Freezer Net Savings Calculations[1]

(Base = Freezer Respondents; n = 75)

Net Savings Assignment	Col A Per Unit Net Savings (kWh)	Col B % of Freezers	Col A x Col B Weighted Savings (kWh)
Free Riders	0	36%	0
Transfer Free Riders	0	9%	0
Non-free Riders	622	29%	182
Transfer Non-free Riders	622	17%	108
Transfer Other (Partial Free Riders)	263	9%	23
Net Savings			313
Adjusted Gross Savings			622
NTG (Net/Gross)			**50%** **(41%, 59%)**

[1] Results subject to rounding error.

The MA21R33-E-ARI study set the recycled dehumidifier adjusted gross savings to 1,020 kWh. Dehumidifiers exhibited a lower NTGR than both refrigerators and freezers due to a larger share of respondents indicating they would have taken the unit to a dump or put it out with the trash without the program. Table 8 shows the method yielded a NTGR of 41%.

Table 8: Dehumidifier Net Savings Calculations[1]

(Base = Dehumidifier Respondents; n = 174)

Net Savings Assignment	Col A Per Unit Net Savings (kWh)	Col B % of Dehumidifiers	Col A x Col B Weighted Savings (kWh)
Free Riders	0	51%	0
Transfer Free Riders	0	5%	0
Non-free Riders	1,020	29%	299
Transfer Non-free Riders	1,020	10%	100
Transfer Other (Partial Free Riders)	477	5%	23
Net Savings			422
Adjusted Gross Savings			1,020
NTG (Net/Gross)			**41%** **(35%, 47%)**

[1] Results subject to rounding error.

3.2 COMPARISON OF NTGR ESTIMATES

NMR also conducted a literature review of 81 studies, of which 15 reported NTGRs for recycling programs. The studies spanned from 2018 to 2020 and included the RLPNC 18-1 Appliance Recycling Study. Table 9 compares the current study results with NTGRs assumed in the 2019 to 2021 BCR and found in the literature. For refrigerator and freezer recycling, the median NTGR found in the literature tends to be slightly higher than, but within the confidence intervals of, the current study results. The Massachusetts NTGRs and current BCR values do tend to fall on the lower side of the ranges observed in the literature review.

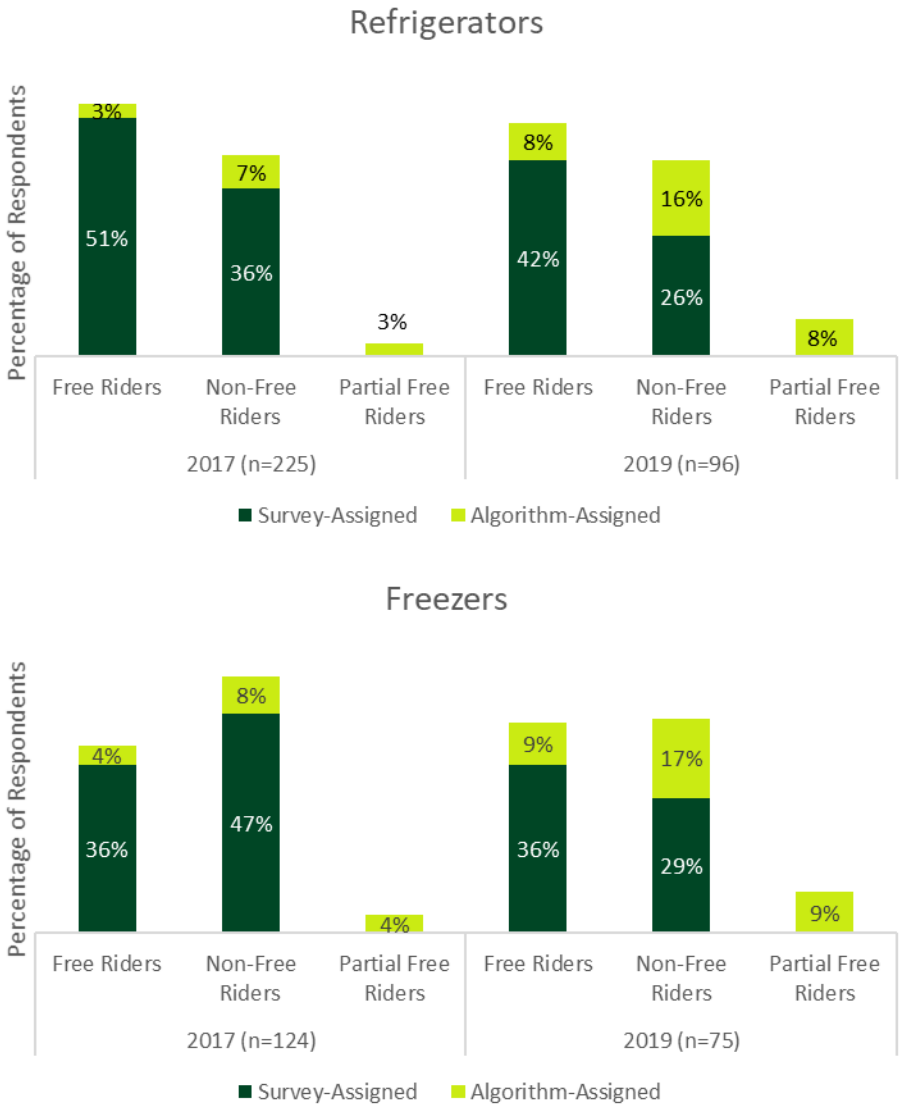
Table 9: NTGR Comparison

Appliance Type (Sample Size)	MA Primary Research NTGR[1]	Current BCR NTGR	Literature Review		
			NTGR Range	Median	Study Count[1]
Refrigerator recycling (n=96)	46% (38%, 54%)	44%	40-71%	51%	18
Freezer recycling (n=75)	50% (41%, 59%)	56%	47-65%	57%	9
Dehumidifier recycling (n=174)	41% (35%, 47%)	50%	N/A	N/A	0

[1] Confidence interval in parentheses.

Figure 2 compares how free-ridership assignment of respondents in the current study to that of the RLPNC 18-1 Appliance Recycling Study. For both freezers and refrigerators, participants' responses suggested the same or lower percentage of *survey-assigned* (free-ridership status assigned based on survey responses) free riders and non-free riders across the two studies. However, the 2019 study had a greater proportion of *algorithm-assigned* respondents where free-ridership status was assigned based on the UMP algorithm (Figure 1). This reflects a change in the survey questionnaire. As we explained in more detail in Section 2.3.1, respondents in 2017 provided additional information about the alternative outcomes for the recycled appliances, and NMR used this information to assign free-ridership status for many respondents who said that they "did not know" what they would have done with the unit in the absence of the program. The 2019 questionnaire removed these questions, as they did not directly feed into the UMP algorithm. NMR assigned to the algorithm all 2019 respondents who did not know the alternative outcome for their unit.

Figure 2: Free-ridership Assignment 2017 vs. 2019



Section 4 Additional Analysis

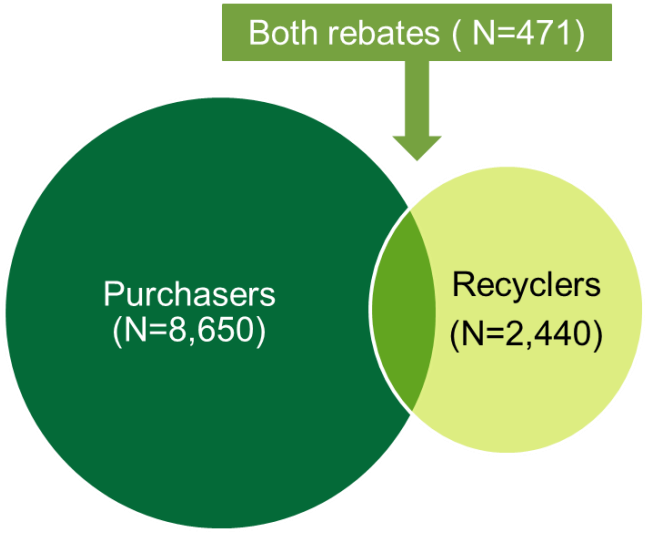
This section summarizes research on two additional topics addressed in the surveys:

1. The impact on participant decision-making of rebates for both recycling old and buying new dehumidifiers
2. The net promoter score (NPS), determined by participants' likelihood to recommend the program

4.1 Dehumidifier Dual Rebate Impact on Early Retirement

In 2019, the PAs offered rebates both for recycling old dehumidifiers and buying new ENERGY STAR-qualified dehumidifiers. The survey included questions to gauge how the availability of both rebates influenced respondents' participation decisions.[26] NMR refers to participants who used both rebates as *dual rebate users.* There were 471 dual rebate users among the 11,090 customers who either recycled or bought a dehumidifier through PA programs in 2019 (Figure 3).[27] Dual rebate users represent 4% of the combined population of recyclers and purchasers, or 19% of recyclers and 5% of purchasers in that period.

Figure 3: Population Incidence of Dual Rebate Users



[26] The MA20X04-E-PRODNTG study also addressed the impact of the dual rebates, but only one respondent in that study had also recycled a dehumidifier through the program.
[27] The population sizes exclude participants for whom rebate status could not be verified or who had been assigned to Residential Coordinated Delivery studies (to ensure the efficient allocation of sample across evaluations). The recycling population reflects counts prior to cleaning by the MA21R33-E-ARI team.

NMR asked dual rebate users modified versions of the timing and efficiency free-ridership questions from the Consistent Methodology for Self-Reported Residential Net-to-Gross Measurement study (MA19X03-B-RSRNTG).[28] As explained in Appendix A.2, their responses indicated that the rebate for the new unit induced 22% of the dual rebate survey participants to recycle their unit. However, dual rebate users only represent 19% of recyclers. Therefore, participants only retired 4% of the recycled dehumidifiers early due to the availability of the rebate for the new unit. NMR concludes that this percentage is too small to warrant adjusting the dehumidifier NTGR to account for early retirement.

4.2 Likelihood of Recommending Appliance Recycling Program

The web survey asked respondents how likely they would be to recommend the appliance recycling program to a friend, using a scale of zero to ten, where zero is "extremely unlikely" and ten is "extremely likely."[29] The survey also asked respondents to explain the reasoning behind their responses. NMR used the likelihood scale responses to calculate the NPS, a well-established measure of customer loyalty. To create this score, NMR groups respondents as promoters (score 9-10), passives (7-8), and detractors (0-6). The NPS is calculated by subtracting the percentage of detractors from the percentage of promoters. The resulting score can range from a low of -100 to a high of +100.

As Table 10 shows, the NPSs for all appliance types were very high, at 93% for both refrigerators and freezers and 91% for dehumidifiers.

Refrigerator and freezer respondents found to be promoters (i.e., with ratings of nine or ten) cited the rebate, the ease and convenience of the program, the environmental benefit, and the removal of the unit among the major factors for recommending the program. Dehumidifier promoters most frequently indicated they would recommend the program because recycling the unit is environmentally responsible, they wanted the rebate, and the program made it easy and convenient to recycle.

Of the few respondents who would not recommend the Appliance Recycling Program (indicated by ratings of zero to two), one refrigerator recycler said that they would not recommend the program because the contractor never came to pick up their unit. One dehumidifier recycler said they never received their rebate.

[28] NMR Group, Inc., and Tetra Tech. 2021. *Consistent Methodology for Self-Reported Residential Net-to-Gross Measurement.* (MA19X03-B-RSRNTG). https://ma-eeac.org/wp-content/uploads/MA19X03-B-RSRNTG_Residential-SR-NTG-Report_FINAL_2020.5.28.pdf.

[29] *Using a scale of 0 to 10, where 0 is "extremely unlikely" and 10 is "extremely likely," how likely are you to recommend the Mass Save Appliance Recycling Program to a friend?*

Table 10: Likelihood of Recommending Product[1]

(Base = respondents not indicating don't know / refusal to answer)

Recommendation Likelihood	Refrigerators	Freezers	Dehumidifiers
Number of respondents	96	73	173
9 to 10 (Promoters)	94%	93%	93%
7 to 8 (Passives)	5%	7%	5%
0 to 6 (Detractors)	1%	0%	2%
NPS	93%	93%	91%

[1] Results subject to rounding error.

Appendix A Additional Methods and Results

This section provides additional details on study methods and results.

A.1 Net Energy Savings – UMP Algorithm Additional Methods

For one-quarter of the transferred units, the UMP algorithm requires calculating the delta in usage between a new unit and the recycled one (see Scenario B in Figure 1). NMR took the following steps to estimate the energy use of new units, which fed into the calculation of the delta watts between newly manufactured and recycled units:

1. Identified the most common refrigerator and freezer configurations and sizes recycled through the program. These accounted for 81% of refrigerators and 79% of freezers.
2. Used the ENERGY STAR Appliances Calculator to extract the energy use of new units (both conventional and ENERGY STAR-qualified models), including estimates for refrigerators with and without through-the-door ice and freezers with manual or automatic defrost.
3. Estimated the proportion of refrigerators with through-the-door ice for side-by-side and bottom-mounted models, using the average of their prevalence as reported in RECS for 2005, 2009, and 2015.[30] The program tracking database does not note whether recycled units had through-the-door ice, but this feature greatly affects energy use.
4. For both conventional and ENERGY STAR qualified new appliances, weighted the average energy use for each new appliance type by the total number of units of similar sizes and configuration recycled through the program, or assumed from RECS data.
5. Calculated a single weighted average energy use for new refrigerators and freezers using national market share of ENERGY STAR qualified refrigerators and freezers (43% and 30%, respectively).[31]

The final delta used to estimate net energy savings equals the difference between the adjusted gross energy use for appliances recycled in the program in 2019 and the new unit energy use.

[30] As noted earlier, we rely on the average for three years because of the uncertainty regarding whether prospective purchasers would buy units that match those recycled through the program or that reflect the general purchase of new units in the broader market.

[31] ENERGY STAR. 2019. ENERGY STAR Unit Shipment and Market Penetration Report Calendar Year 2019 Summary.https://www.energystar.gov/partner_resources/products_partner_resources/brand_owner_resources/unit_shipment_data

A.2 DEHUMIDIFIER DUAL REBATE IMPACT ADDITIONAL RESULTS

NMR asked dual rebate users modified versions of the timing and efficiency free-ridership questions from the MA19X03-B-RSRNTG.[32] Across the two types of rebates, 26 respondents *consistently* scored as free-riders, while seven respondents *consistently* scored as non-free-riders.

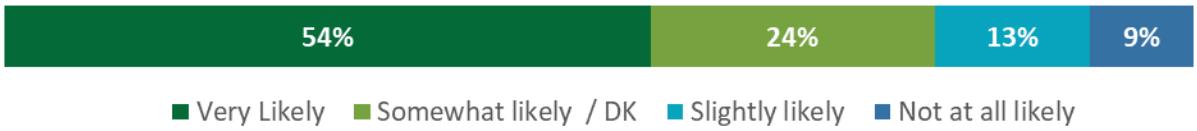
The new unit rebate only induced 22% of the dual rebate survey participants to recycle their unit. The availability of rebates for recycling old and buying new dehumidifiers induced about 4% of appliance recyclers to retire their unit early.[33] NMR concluded that this percentage is too small to warrant an adjustment to the dehumidifier NTGR to account for early retirement. Over four-fifths of respondents (83%) indicated they *would have purchased the new dehumidifier within one year had the recycling rebate not been available* (Figure 4). Applying MA19X03-B-RSRNTG scoring to the responses yielded a 77% free-ridership rate for this question. Respondents varied more in their *likelihood to purchase new units at the same efficiency level without the recycling rebate*. Figure 5 shows that over one-half of respondents were "very likely," one-quarter "somewhat likely," and a little over one-tenth (13%) were "slightly likely" to purchase the same efficiency unit without the recycling rebate. The corresponding free-ridership rate was 70% for this question.

Figure 4: Influence of Recycling Rebate on New Unit Purchase: Timing (n=46)

(If there had been no rebate available for recycling your old dehumidifier, when do you think you would have purchased a new dehumidifier?)

Figure 5: Influence of Recycling Rebate on New Unit Purchase: Efficiency (n=46)

(If there had been no rebate available for recycling your old dehumidifier, how likely is it that you would have purchased any type of new dehumidifier at the same time?)



[32] NMR Group, Inc., and Tetra Tech. 2021. *Consistent Methodology for Self-Reported Residential Net-to-Gross Measurement.* (MA19X03-B-RSRNTG). https://ma-eeac.org/wp-content/uploads/MA19X03-B-RSRNTG_Residential-SR-NTG-Report_FINAL_2020.5.28.pdf.

The survey also asked when the participant would have recycled their old dehumidifier had the rebate for the new unit not been available. Over three-fourths of respondents (78%) said they would have gotten rid of their dehumidifier within one year (Figure 6). Applying the MA19X03-B-RSRNTG method scoring produces a free-ridership rate of 71% for the inducement of the new rebate on recycling.[34] *Only 22% of dual rebate users said that the new unit rebate induced them to recycle the old unit early*. This translates into 4% of all dehumidifier recyclers as only 19% of recyclers also used a rebate to buy a new dehumidifier.

Figure 6: Influence of New Unit Rebate on Recycling: Timing (n=46)

(If there had been no rebate available to buy a new dehumidifier, when do you think you would have gotten rid of your old dehumidifier?)

Overall, with free-ridership rates at 70% or higher and very few respondents indicating that the dual rebates changed their behavior, NMR concluded that the dual rebate model does not induce substantial changes in customer decisions about recycling or buying dehumidifiers. The existence of individual rebates appears to be the greater motivator.

A.3 Web Survey Frequency Tables

A.3.1 Free Rider Scheme

The surveys asked respondents what they would have done with their appliance had the Appliance Recycling Program not been available to them. For respondents who said they would have 'gotten rid' of the appliance, the surveys asked how they would have gotten rid of it. Table 11 shows the responses to the questions as well as the assigned free rider decision based on the free-ridership scheme proposed in Table 4 in Section 2.3.1. Figure 7 shows over one-half of dehumidifier respondents (51%) were assigned as pure free riders compared to 42% of refrigerator respondents and 36% of freezer respondents.

[34] The NTG methodology for dual rebate users uses the MA self-report method, whereas the methodology for appliance recyclers follows the UMP's appliance recycling algorithm. The application of different methodologies means that the free-ridership rates are not comparable; therefore, we only compared free-ridership rates for new purchasers.

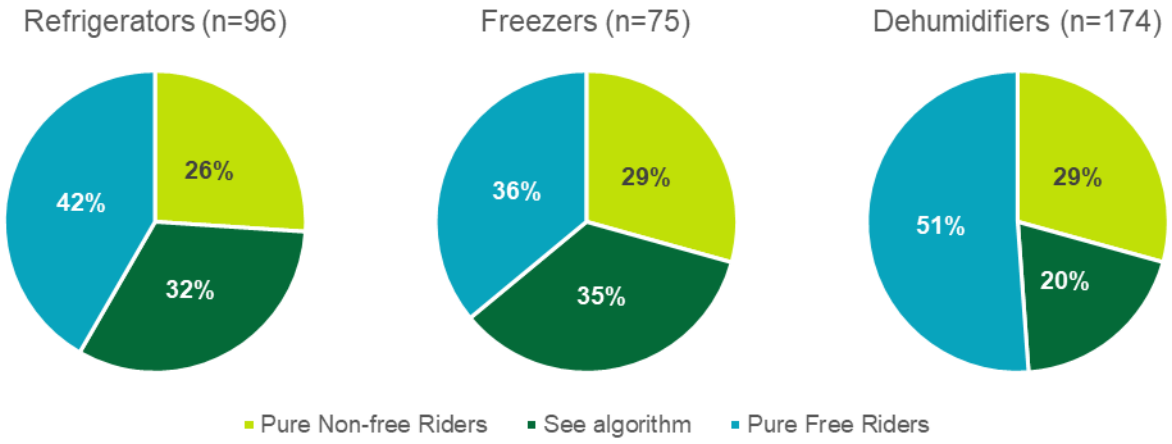
Table 11: Actions in the Absence of the Program and Free Rider Decision Shares by Appliance

(If the Mass Save Appliance Recycling Program had not been available to you, what would you most likely have done with your appliance?)

Response	Refrigerators	Freezers	Dehumidifiers
Number of respondents	96	75	174
Pure Free Riders			
Taken it to a garbage dump or put out as trash	19%	12%	30%
Recycled it	6%	7%	14%
Hired a hauler to take it away	9%	8%	3%
Had a retail store come and pick it up (>10 yrs)	7%	8%	0%
Something else[1]	0%	1%	3%
See Algorithm			
Given it away for free to a stranger	9%	7%	6%
Had a retail store come and pick it up (≤10 yrs)	5%	1%	0%
Sold it	2%	4%	1%
Gotten rid of it but don't know how	1%	1%	1%
Something else[1]	2%	3%	1%
Don't know[1]	13%	19%	11%
Pure Non-free Rider			
Kept it	20%	27%	29%
Given it away for free to an acquaintance	6%	3%	1%

[1] Status was assigned based on review of open-ended responses.

Figure 7: Free Rider Decision Shares by Appliance



A.3.2 Economic and Demographic Characteristics

The surveys asked respondents about the type of home they live in, whether they own or rent it their home, their age, their level of education, the size of their household, and their income level. Table 12 through Table 17 show the responses to the economic/demographic questions. We provide thoughts below on three of the indicators: type of home, respondent age, and household size. We provide the question wording in the sub-caption above each table.

Thirteen percent of refrigerator recyclers live in duplexes, townhomes, or triple decker homes. The presence of stairs in these types of buildings can make it difficult to remove a heavy appliance, and the program offers the participant a convenient way to do so.

Table 12: Type of House

(What type of home do you live in? Please select one.)

	Refrigerators	Freezers	Dehumidifiers
Number of respondents	96	75	174
Single-family	82%	93%	97%
Apartment/condo in a 2–4-unit building	4%	3%	2%
Apartment/condo in a 5+ unit building	0%	3%	0%
Duplex	8%	0%	<1%
Townhouse	3%	1%	1%
Triple decker	2%	0%	0%
Mobile home	1%	0%	0%

Table 13: Whether the Respondent Owns or Rents

(Do you own or rent this residence?)

	Refrigerators	Freezers	Dehumidifiers
Number of respondents	96	75	174
Own	96%	96%	99%
Rent	4%	1%	1%
Other	0%	3%	0%

Table 14: Respondent Age

(Which of the following best describes your age?)

	Refrigerators	Freezers	Dehumidifiers
Number of respondents	91	68	163
18-24	0%	0%	0%
25-29	2%	0%	0%
30-39	14%	6%	3%
40-49	12%	10%	13%
50-59	21%	25%	22%
60-69	29%	35%	31%
70-79	20%	16%	27%
80-89	2%	8%	3%
90 years or older	0%	0%	1%

Table 15: Respondent Level of Education

(What is the highest level of education that you have completed so far?)

	Refrigerators	Freezers	Dehumidifiers
Number of respondents	63	75	166
Ninth to twelfth grade, no diploma	1%	0%	0%
High school graduate	8%	6%	5%
Some college, no degree	12%	14%	7%
Associate's degree	13%	9%	11%
Bachelor's degree	36%	34%	36%
Graduate or professional degree	30%	37%	41%

Table 16: Household Size

(Counting yourself, how many individuals typically occupy this home?)

	Refrigerators	Freezers	Dehumidifiers
Number of respondents	96%	75	174
One	15%	17%	18%
Two	36%	51%	48%
Three	20%	20%	15%
Four	23%	8%	14%
Five	2%	3%	3%
Six or more	4%	1%	2%

Table 17: Income

(Which of these categories best describes your total household income in 2019 before taxes – counting everyone living in your house?)

	Refrigerators	Freezers	Dehumidifiers
Number of respondents	94	48	121
Above 60% of state median	86%	90%	92%
Below 60% of state median	14%	10%	8%

Appendix B Literature Review Bibliography

NMR reviewed 81 reports; 15 of them included findings on NTGRs. Table 18 and Table 19 list the sources and values derived from each source for free-ridership, where available, and NTG rates. Many of these sources require an ESource DSM Library login to access, but they may be publicly available from other websites. Note that NMR verified that all links worked prior to delivering this report, but hosts may remove or change study locations in the future.

Table 18: NTGR Values and Literature Review Sources – Refrigerators

Year Publ.	Year Eval.	State or Prov.	Title	Free-ridership	NTGR
2018	2017-2018	PA	(FE) Final Annual Report to the Pennsylvania Public Utility Commission Phase III of Act 129 Program Year 9 (June 1, 2017 – May 31, 2018)	0.55	0.45
2018	2017-2018	PA	(FE) Final Annual Report to the Pennsylvania Public Utility Commission Phase III of Act 129 Program Year 9 (June 1, 2017 – May 31, 2018)	0.42	0.58
2018	2017-2018	PA	(FE) Final Annual Report to the Pennsylvania Public Utility Commission Phase III of Act 129 Program Year 9 (June 1, 2017 – May 31, 2018)	0.49	0.51
2018	2017	GA	Evaluation of Georgia Power Company's 2017 DSM Programs – Volume I		0.64
2018	2017	WI	Focus on Energy Calendar Year 2017 Evaluation Report Volume II		0.51
2018	2017	NM	Evaluation of the 2017 Public Service Company of New Mexico Energy Efficiency and Demand Response Programs		0.68
2019	2018	MI	DTE Electric Company's PY 2018 Evaluation Report	0.43	0.57
2019	2018-2019	PA	PPL Electric Utilities Annual Report to the Pennsylvania Public Utility Commission PHASE IIIOF ACT 129PY10ANNUAL REPORT		0.61
2019	2018-2019	PA	(FE) Final Annual Report to the Pennsylvania Public Utility Commission Phase III of Act 129 Program Year 10 (June 1, 2018 – May 31, 2019)	0.53	0.47
2019	2018-2019	PA	(FE) Final Annual Report to the Pennsylvania Public Utility Commission Phase III of Act 129 Program Year 10 (June 1, 2018 – May 31, 2019)	0.49	0.51
2019	2018-2019	PA	(FE) Final Annual Report to the Pennsylvania Public Utility Commission Phase III of Act 129 Program Year 10 (June 1, 2018 – May 31, 2019)	0.52	0.48
2019	2018	IN	2018 Vectren Demand-Side Management Portfolio Process and Electric Impacts Evaluation	0.32	0.68
2019	2018	IL	NTG Memo: ComEd Fridge & Freezer Recycling Program CY2018		0.40
2019	2018	IL	NTG Memo: Appliance Recycling Initiative Participant Survey Results – 2019 and 2020 (Ameren IL)	0.29	0.71
2019	2018	NS	2018 DSM EVALUATION REPORTS EFFICIENCY NOVA SCOTIA		0.57
2020	2019	MI	DTE PY 2019 Evaluation Report	0.57	0.43
2020	2019	WI	Focus on Energy Calendar Year 2019 Evaluation Report VOLUME II PROGRAM EVALUATIONS	0.58	0.42
2020	2019	IL	NTG Memo: Appliance Recycling Initiative Participant Survey Results – 2019 and 2020 (Ameren IL)	0.53	0.47

Table 19: NTGR Values and Literature Review Sources – Freezers

Year Publ.	Year Eval.	State or Prov.	Title	Free-ridership	NTGR
2018	2017	WI	Focus on Energy Calendar Year 2017Evaluation Report Volume II		0.64
2018	2017	GA	Evaluation of Georgia Power Company's 2017 DSM Programs – Volume I		0.57
2019	2018	IL	NTG Memo: ComEd Fridge & Freezer Recycling Program CY2018		0.52
2019	2018	IL	NTG Memo: Appliance Recycling Initiative Participant Survey Results – 2019 and 2020 (Ameren IL)	0.36	0.64
2019	2018	NS	2018 DSM Evaluation Reports Efficiency Nova Scotia		0.48
2019	2018	IN	2018 Vectren Demand-Side Management Portfolio Process and Electric Impacts Evaluation	0.38	0.62
2019	2018-2019	PA	PPL Electric Utilities Annual Report to the Pennsylvania Public Utility Commission PHASE III OF ACT 129PY10ANNUAL REPORT		0.65
2020	2019	WI	Focus on Energy Calendar Year 2019Evaluation Report VOLUME II PROGRAM EVALUATIONS	0.53	0.47
2020	2019	IL	NTG Memo: Appliance Recycling Initiative Participant Survey Results – 2019 and 2020 (Ameren IL)	0.46	0.54

Appendix C Appliance Recycling Participant Web Survey

MA20X03 ARNTG Appliance Recycling Participant Web Survey

Topic	Questions
Screening and verifying product counts and types	V1 to V3
Impact Factors	RF, FZ, DH Series
Free-ridership	RFR, FFR, DFR Series
Program Information and Satisfaction	P1 Series
Demographics	D Series

KEY

[ ] = Instructions for programmer

Introduction

[NOTE TO PROGRAMMER: WE NEED AT LEAST 100 REFRIGERATOR RESPONDERS, 75 FREEZER RESPONDERS, AND 150 DEHUMIDIFIER RESPONDERS. WE CAN ACCEPT COMPLETIONS BEYOND THOSE QUOTAS]

Thank you for taking the time to complete this survey for the sponsors of Mass Save®. Berkshire Gas, Cape Light Compact, Eversource, Liberty Utilities, National Grid and Unitil work together as Mass Save® to help residents and businesses across Massachusetts save money and energy, providing energy efficiency programs and services while simultaneously leading the state to a clean and energy efficient future.

This survey asks questions about your household's participation in the Mass Save Appliance Recycling Program. We are contacting customers who recycled refrigerators, freezers, and dehumidifiers through Mass Save in 2019. Please have the person who made the decision to participate in this program complete the survey. Answer the questions to the best of your ability. All your responses will remain confidential. The survey should take about 5-10 minutes to complete.

The sponsors of Mass Save have partnered with NMR Group to administer this survey. If you have any technical questions about the survey, or you wish to receive the survey link at a different email address, please contact Shirley Pon at (617) 544-6230 ext. 2032 or spon@nmrgroupinc.com. If you have questions about validity of the survey, please contact Michael Strom of National Grid at michael.strom@nationalgrid.com.

Verification and Recall

V1. Just to confirm, are you the person who made the decision to recycle the appliance(s)?

1. Yes **[GO TO V2]**
2. No **[TERMINATE]**

98. Don't know **[TERMINATE]**

V2. Our records indicate that your household recycled an appliance through Mass Save.

[IF MODE=PICK-UP] Someone would have come to your home and picked up your old refrigerator or freezer to recycle it**.** They may also have removed an old dehumidifier. You would have received a rebate for each appliance you recycled.

[IF MODE=TURN-IN] You dropped off your old dehumidifier at a turn-in event. You would have received a rebate for each unit you recycled.

Our records indicate that you recycled:

[READ IN NUM.RF] refrigerator(s)

[READ IN NUM.FZ] freezer(s)

[READ IN NUM.DH] dehumidifier(s)

Is this correct?

1. Yes **[IF APPTYPE1 = REFRIGERATOR, GO TO RF SERIES; IF APPTYPE1 = FREEZER GO TO FZ SERIES; IF APPTYPE1 = DEHUMIDIFIER, GO TO DH SERIES]**
2. No, do not recall participating **[THANK AND TERMINATE]**
3. No, different quantities or appliances **[GO TO V3]**

98. Don't know **[THANK AND TERMINATE]**

V3. **[IF V2 = 3 AND MODE=PICK-UP]** Thinking only about any appliances that were picked up through the Appliance Recycling program, please enter the number of refrigerators, freezers, and dehumidifiers you recycled. Enter zero if you did not recycle the appliance.

[IF V2 = 3 AND MODE=TURN-IN] Thinking only about the dehumidifiers you dropped off at a turn-in event, please enter the number of dehumidifiers you recycled. Enter zero if you did not recycle a dehumidifier.

1. **[IF V2=3 AND MODE=PICK-UP]** Refrigerators **[ENTER QUANTITY, MUST BE ZERO OR GREATER]**
2. **[IF V2=3 AND MODE=PICK-UP]** Freezers **[ENTER QUANTITY, MUST BE ZERO OR GREATER]**
3. Dehumidifiers **[ENTER QUANTITY, MUST BE ZERO OR GREATER]**

[IF V3.1=0 AND V3.2=0 AND V3.3=0, TERMINATE]

[REASSIGNMENT APPLIES TO MODE=PICK-UP ONLY]

[IF V3.2 > 0, REASSIGN APPTYPE1 = FREEZER]

[IF V3.1 > 0 AND V3.2 = 0 AND V3.3=0, REASSIGN APPTYPE1 = REFRIGERATOR]

[IF V3.1 = 0 AND V3.2 = 0 AND V3.3 >0, REASSIGN APPTYPE1 = DEHUMIDIFIER]

[IF V3.1 AND V3.2 > 0, REASSIGN APPTYPE1 = FREEZER]

[IF APPTYPE1 = REFRIGERATOR, GO TO RF SERIES; IF APPTYPE1 = FREEZER GO TO FZ SERIES; IF APPTYPE1 = DEHUMIDIFIER, GO TO DH SERIES]

Refrigerators (RF SERIES)

[IF V2 = 1 AND NUM.RF = 1 OR IF V3.1 = 1] This next set of questions will ask about the old **refrigerator** that you had removed by the Mass Save Appliance Recycling Program.

[IF V2 = 1 AND NUM.RF > 1 OR IF V3.1>1] We are aware that you had more than one **refrigerator** removed by Mass Save.

For purposes of this survey, please think about the **[IF UNIT.BRAND1<>" " Unit.Brand1]]** refrigerator with **[Configuration1]** configuration**.** Please keep only that one refrigerator clearly in your mind as you answer the next few questions.

RF1. Which of the following best describes the condition of your recycled refrigerator?

1. It was working with no need of repair
2. It was working with need of minor repair
3. It was working with need of major repair
4. It was no longer working

98. Don’t know

RF2. Thinking about the 12 months before you recycled it, was the refrigerator plugged in… **[ALLOW ONLY ONE RESPONSE]**

1. All of the time **[GO TO RF4]**
2. Some of the time
3. Never **[GO TO RF4]**

98. Don't know **[GO TO RF4]**

RF3. **[ASK IF RF1 = 2]** How many months was the refrigerator plugged in the year before you recycled it? **[ALLOW WHOLE NUMBER BETWEEN 0 AND 12]**

RF4. Where in the house was the refrigerator located? **[RANDOMIZE 1-6; ALLOW ONLY ONE RESPONSE]**

1. Kitchen
2. Basement
3. Garage
4. Porch/Patio
5. Laundry room
6. Yard

97. Some other place, please specify: **[OPEN END]**

98. Don't know

RF5. **[IF RF4≠1]** Is the space where the refrigerator was located heated by your heating system in the winter?

1. Yes
2. No

98. Don't know

RF6. Is the space where the refrigerator was located cooled with air conditioning in the summer?

1. Yes
2. No

98. Don't know

Refrigerator Free-Ridership (RFR Series)

[DISPLAY IF NUM.RF > 1 OR IF V3.1>1] Please continue thinking about just that one refrigerator for the next set of questions.

RFR1. Before you heard about the Mass Save Appliance Recycling Program, had you considered getting rid of the refrigerator? Meaning, did you already have plans to get the appliance out of your home by selling it, giving it away, having someone pick it up, or taking it to the dump or a recycling center yourself? **[ALLOW ONLY ONE RESPONSE]**

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

RFR2. If the Mass Save Appliance Recycling Program had not been available to you, what would you most likely have done with your refrigerator? **[ALLOW ONLY ONE RESPONSE]**

1. Gotten rid of it
2. Kept it [**GO TO P1]**
98. Don't know [**GO TO P1]**

RFR3. **[ASK IF RFR2 = 1]** If the Mass Save Appliance Recycling Program had not been available to you, what would you most likely have done to get rid of the refrigerator? **[RANDOMIZE 1-6, ALLOW ONLY ONE RESPONSE]**

1. Sold it **[GO TO RFR4]**
2. Given it away for free **[GO TO RFR5]**
3. Recycled it **[GO TO RFR6]**
4. Taken it to a garbage dump or put it out as trash **[GO TO P1]**
5. Hired a hauler to take it away **[GO TO P1]**
6. Had a retail store come and pick it up **[GO TO P1]**
97. Something else, please specify: **[OPEN END] [GO TO P1]**
98. Don't know **[GO TO P1]**

RFR4. **[ASK IF RFR3=1]** Would you have sold the refrigerator to: **[RANDOMIZE 1-3, ALLOW ONLY ONE RESPONSE]**

1. Acquaintance, friend, or family member
2. Stranger (e.g., through an online ad)
3. Used appliance dealer

97. Someone else, please specify: **[OPEN END]**
98. Don't know

RFR5. **[ASK IF RFR3=2]** If you had given the refrigerator away for free, who would you have given it to? **[RANDOMIZE 1 TO 6, ALLOW ONLY ONE RESPONSE]**

1. Given to an acquaintance, friend, or family member
2. Given to a charity, such as Goodwill Industries or a church
3. Put it on the curb
4. Posted it online for free
5. Taken it to a swap shop or community swap day

97. Given it away some other way, please specify: **[OPEN END]**
98. Don't know

RFR6. **[ASK IF RFR7=3]** How would you have recycled the refrigerator? **[RANDOMIZE 1 TO 3, ALLOW ONLY ONE RESPONSE]**

1. Taken it to a recycling center
2. Put it out for pick-up
3. Hired someone to take it

97. Done something else, please specify: **[OPEN END]**
98. Don't know

[GO TO P1]

Freezers (FZ SERIES)

[ASK IF APPTYPE 1 = FREEZER]

[IF V2 = 1 AND NUM.FREEZERS = 1 OR V3.2 =1] This next set of questions will ask about the old **stand-alone freezer** you had removed through the program.

[IF V2 = 1 AND NUM.FREEZERS > 1 OR V3.2 >1] We are aware you had more than **one stand-alone freezer** removed through the program.

For purposes of this survey, please think about the **[IF UNIT.BRAND1<>" " Unit.Brand1]]** freezer with **[Configuration1]** configuration**.** Please keep only that one freezer clearly in your mind as you answer the next few questions.

FZ1. Which of the following best describes the condition of your recycled freezer?

1. It was working with no need of repair
2. It was working with need of minor repair
3. It was working with need of major repair
4. It was no longer working

98. Don't know

FZ2. Thinking about the 12 months before you recycled it, was the freezer plugged in… **[ALLOW ONLY ONE RESPONSE]**

1. All of the time **[GO TO FZ4]**
2. Some of the time
3. Never **[GO TO FZ4]**

98. Don't know **[GO TO FZ4]**

FZ3. **[ASK IF FZ2 = 2]** How many months was the freezer plugged in the year before you recycled it? **[ALLOW WHOLE NUMBER BETWEEN 0 AND 12]**

FZ4. Where in your house was the freezer located? **[RANDOMIZE 1-6; ALLOW ONLY ONE RESPONSE]**

1. Kitchen
2. Basement
3. Garage
4. Porch/Patio
5. Laundry room
6. Yard

97. Some other place **[OPEN END]**

98. Don't know

FZ5. **[IF FZ4≠1]** Is the space where the freezer was located heated by your heating system in the winter? **[ALLOW ONLY ONE RESPONSE]**

1. Yes
2. No

98. Don't know

FZ6. Is the space where the freezer was located cooled with air conditioning in the summer? **[ALLOW ONLY ONE RESPONSE]**

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

Freezer Free-Ridership (FFR Series)

[DISPLAY IF NUM.FREEZERS > 1] Please continue thinking about just that one freezer for the next set of questions.

FFR1. Before you heard about the Mass Save Appliance Recycling Program, had you considered getting rid of the freezer? Meaning, did you already have plans to get the appliance out of your home by selling it, giving it away, having someone pick it up, or taking it to the dump or a recycling center yourself? **[ALLOW ONLY ONE RESPONSE]**

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

FFR2. If the Mass Save Appliance Recycling Program had not been available to you, what would you most likely have done with your freezer? **[ALLOW ONLY ONE RESPONSE]**

1. Gotten rid of it
2. Kept it [**GO TO P1]**
98. Don't know [**GO TO P1]**

FFR3. **[ASK IF FFR2 = 1]** If the Mass Save Appliance Recycling Program had not been available to you, what would you most likely have done to get rid of the freezer? **[RANDOMIZE 1-6, ALLOW ONLY ONE RESPONSE]**

1. Sold it **[GO TO FFR4]**
2. Given it away for free **[GO TO FFR5]**
3. Recycled it [**GO TO FFR6]**
4. Taken it to a garbage dump or put it out as trash **[GO TO P1]**
5. Hired a hauler to take it away **[GO TO P1]**
6. Had a retail store come and pick it up **[GO TO P1]**

97. Something else, please specify: **[OPEN END] [GO TO P1]**
98. Don't know **[GO TO P1]**

FFR4. **[ASK IF FFR3=1]** Would you have sold the freezer to: **[RANDOMIZE 1-3, ALLOW ONLY ONE RESPONSE]**

1. Acquaintance, friend, or family member
2. Stranger (e.g., through an online ad)
3. Used appliance dealer
97. Someone else, please specify: **[OPEN END]**
98. Don't know

FFR5. **[ASK IF FFR3=2]** If you had given the freezer away for free, who would you have given it to? **[RANDOMIZE 1-5, ALLOW ONLY ONE RESPONSE]**

1. Given to an acquaintance, friend, or family member
2. Given to a charity, such as Goodwill Industries or a church
3. Put it on the curb
4. Posted it online for free
5. Taken it to a swap shop or community swap day
97. Given it away some other way, please specify: **[OPEN END]**
98. Don't know

FFR6. **[ASK IF FFR3=3]** How would you have recycled the freezer? **[RANDOMIZE 1-3, ALLOW ONLY ONE RESPONSE]**

1. Take it to a recycling center
2. Put it out for pick-up
3. Hired someone to take it
97. Done something else, please specify: **[OPEN END]**
98. Don't know

[GO TO P1]

Dehumidifiers (DH SERIES)

[ASK IF APPTYPE 1 = DEHUMIDIFIER]

[IF V2 = 1 AND NUM.DH = 1 OR V3.2 =1] This next set of questions will ask about the old **dehumidifier** you recycled through the program.

[IF V2 = 1 AND NUM. DH > 1 OR V3.2 >1] We are aware you recycled more than one **dehumidifier** through the program.

For purposes of this survey, please think about the **[IF UNIT.BRAND1<>" " Unit.Brand1]]** dehumidifier. Please keep only that one dehumidifier clearly in your mind as you answer the next few questions.

DH1. Which of the following best describes the condition of your recycled dehumidifier?

1. It was working with no need of repair
2. It was working with need of minor repair
3. It was working with need of major repair
4. It was no longer working **[**

98. Don't know

Source: GE Appliances

Source: Ivation Products

DH2. When you used the recycled dehumidifier, was there a hose that drained the system (picture on the right), or did you have to empty the recovered water bucket (picture on the left)? **[ALLOW ONLY ONE RESPONSE]**

1. A hose drained the system
2. Needed to empty the recovered water bucket

98. Don't know

DH3. Thinking about the 12 months before you recycled it, was the dehumidifier plugged in… **[ALLOW ONLY ONE RESPONSE]**

1. All of the time **[GO TO DH5]**
2. Some of the time
3. Never **[GO TO DH5]**

98. Don't know **[GO TO DH5]**

DH4. **[ASK IF DH3 = 2]** How many months in the year was the dehumidifier plugged in before you recycled it? **[ALLOW WHOLE NUMBER BETWEEN 0 AND 12]**

DH5. When it was plugged in, how many hours in the day was the dehumidifier turned on before you recycled it? **[ALLOW WHOLE NUMBER BETWEEN 0 AND 24]**

DH6. When it was plugged in, was your old dehumidifier that you recycled on all the time, or did you set controls to shut it off when the humidity dropped below a certain level? **[ALLOW ONLY ONE RESPONSE]**

1. It was on all the time
2. It was set to shut off when humidity dropped below a certain level

98. Don't know

Dehumidifier Free-Ridership (DFR Series)

[DISPLAY IF NUM.DEHUMIDIFIER > 1] Please continue thinking about just that one dehumidifier for the next set of questions.

DFR1. Before you heard about the Mass Save Appliance Recycling Program, had you considered getting rid of the dehumidifier? Meaning, did you already have plans to get the appliance out of your home by selling it, giving it away, having someone pick it up, or taking it to the dump or a recycling center yourself? **[ALLOW ONLY ONE RESPONSE]**

1. Yes
2. No

98. Don't know

DFR2. If the Mass Save Appliance Recycling Program had not been available to you, what would you most likely have done with your dehumidifier? **[ALLOW ONLY ONE RESPONSE]**

1. Gotten rid of it

2. Kept it **[GO TO INSTRUCTIONS BEFORE DFR7]**

98. Don't know **[GO TO INSTRUCTIONS BEFORE DFR7]**

DFR3. **[ASK IF DFR2 =1]** If the Mass Save Appliance Recycling Program had not been available to you, what would you most likely have done to get rid of the dehumidifier? **[RANDOMIZE 1-6, ALLOW ONLY ONE RESPONSE]**

1. Sold it **[GO TO DFR4]**
2. Given it away for free **[GO TO DFR5]**
3. Recycled it [**GO TO DFR6]**
4. Taken it to a garbage dump or put it out as trash **[GO TO P1]**
5. Hired a hauler to take it away **[GO TO P1]**

97. Something else, please specify: **[OPEN END] [GO TO P1]**

98. Don't know **[GO TO P1]**

DFR4. **[ASK IF DFR3=1]** Would you have sold the dehumidifier to: **[RANDOMIZE 1-3, ALLOW ONLY ONE RESPONSE]**

1. Acquaintance, friend, or family member
2. Stranger (e.g., through an online ad)
3. Used appliance dealer

97. Someone else, please specify: **[OPEN END]**

98. Don't know

DFR5. **[ASK IF DFR3=2]** If you had given the dehumidifier away for free, who would you have given it to? **[RANDOMIZE 1-5, ALLOW ONLY ONE RESPONSE]**

1. Given to an acquaintance, friend, or family member
2. Given to a charity, such as Goodwill Industries or a church
3. Put it on the curb
4. Posted it online for free
5. Taken to a swap shop
6. Given it to a retail store

97. Given it away some other way, please specify: **[OPEN END]**

98. Don't know

DFR6. **[ASK IF DFR3=3]** How would you have recycled the dehumidifier? **[RANDOMIZE 1-3, ALLOW ONLY ONE RESPONSE]**

1. Take it to a recycling center
2. Put it out for pick-up
3. Hired someone to take it

97. Something else, please specify: **[OPEN END]**

98. Don't know

[IF NEWDH = 0, GO TO P1]

DFR7. **[ASK IF NEWDH = 1]** Our records indicate that you also received at least one $30 rebate from Mass Save to buy a new dehumidifier. Do you recall using a rebate to buy a new dehumidifier? **[ALLOW ONLY ONE RESPONSE]**

1. Yes
2. No **[GO TO P1]**

98. Don't know **[GO TO P1]**

DFR8. **[ASK IF DFR7 = 1]** If there had been no rebate available for recycling your old dehumidifier, how likely is it that you would have purchased any type of new dehumidifier at the same time? **[ALLOW ONLY ONE RESPONSE]**

1. Not at all likely
2. Slightly likely **[GO TO DFR9]**
3. Somewhat likely **[GO TO DFR9]**
4. Very likely

98. Don't know

DFR9. **[ASK IF DFR8= 2 OR 3]** If there had been no rebate available for recycling your old dehumidifier, when do you think you would have purchased a new dehumidifier? Would you say… **[ALLOW ONLY ONE RESPONSE]**

1. Not at all likely
2. Slightly likely
3. Somewhat likely
4. Very likely

98. Don't know

DFR10. **[ASK IF DFR7 = 1]** If there had been no rebate available to buy a new dehumidifier, how likely is it that you would have recycled your old dehumidifier at the same time? **[ALLOW ONLY ONE RESPONSE]**

1. Not at all likely
2. Slightly likely **[GO TO DFR11]**
3. Somewhat likely **[GO TO DFR11]**
4. Very likely

98. Don't know

DFR11. **[ASK IF DFR10 = 2 OR 3]** If there had been no rebate available to buy a new dehumidifier, when do you think you would have gotten rid of your old dehumidifier? Would you say … **[ALLOW ONLY ONE RESPONSE]**

1. Within 6 months of when you did
2. Between 6 months and 12 months of when you did
3. More than 1 year after when you did

98. Don't know **[GO TO P1]**

DFR12. **[ASK IF DFR7 = 1]** If there had been no rebate available for recycling your old dehumidifier, how likely is it that you would have purchased the dehumidifier with the exact same high-efficiency level? **[ALLOW ONLY ONE RESPONSE]**

1. Not at all likely
2. Slightly likely
3. Somewhat likely
4. Very likely

98. Don't know

Program Satisfaction

P1. Using a scale of 0 to *10*, where 0 is "extremely unlikely" and 10 is "extremely likely," how likely are you to recommend the Mass Save Appliance Recycling Program to a friend? **[RECORD A WHOLE # 0-10; Don't know = 98; Refused = 99.]**

P2. **[IF P1 < 3]** Why would you be unlikely to recommend the Appliance Recycling Program? **[OPEN END]**

P3. **[IF P1 > 8]** Why would you be likely to recommend the Appliance Recycling Program? **[OPEN END]**

Demographics

We just have a few more questions for you. Please keep your primary address in mind while answering the remaining survey questions.

D1. What type of home do you live in? Please select one.

1. Single-family
2. Duplex
3. Triple decker (e.g. three-story house with each floor being a separate unit)
4. Apartment/condo in a 2-4 unit building
5. Apartment/condo in a 5+ unit building
6. Townhouse or row house (adjacent walls to another house)
7. Mobile home or trailer

97. Other, please specify: **[OPEN END]**

D2. Do you own or rent this residence?

1. Own
2. Rent

97. Other, please specify: **[OPEN END]**

D3. Counting yourself, how many individuals typically occupy this home? Enter zero if not occupied for at least six months.

Occupant Type	**Number**
Adults, 18 and older	**[OPEN END; NUMERIC]**
Children, under 18	**[OPEN END; NUMERIC]**

D4. What is the highest level of education that you have completed so far?

1. Less than ninth grade
2. Ninth to twelfth grade, no diploma
3. High school graduate (includes GED)
4. Some college, no degree
5. Associates degree
6. Bachelor's degree
7. Graduate or professional degree

99. Prefer not to answer

D5. Which of the following best describes your age?

1. 18-24
2. 25-29
3. 30-39
4. 40-49
5. 50-59
6. 60-69
7. 70-79
8. 80-89
9. 90 years or older

99. Prefer not to answer

D6. **[IF D3 SUM OF ADULTS AND CHILDREN =1]** Which of these categories best describes your total household income in 2019 before taxes—counting everyone living in your house?

1. Less than $35,510 **[GO TO CLOSING]**
2. $35,510 or more **[GO TO CLOSING]**

99. Prefer not to answer **[GO TO CLOSING]**

D7. **[IF D3 SUM OF ADULTS AND CHILDREN =2]** Which of these categories best describes your total household income in 2019 before taxes—counting everyone living in your house?

1. Less than $46,437 **[GO TO CLOSING]**
2. $46,437 or more **[GO TO CLOSING]**

99. Prefer not to answer **[GO TO CLOSING]**

D8. **[IF D3 SUM OF ADULTS AND CHILDREN =3]** Which of these categories best describes your total household income in 2019 before taxes—counting everyone living in your house?

1. Less than $57,363 **[GO TO CLOSING]**
2. $57,363 or more **[GO TO CLOSING]**
99. Prefer not to answer **[GO TO CLOSING]**

D9. **[IF D3 SUM OF ADULTS AND CHILDREN =4]** Which of these categories best describes your total household income in 2019 before taxes—counting everyone living in your house?

1. Less than $68,289 **[GO TO CLOSING]**
2. $68,289 or more **[GO TO CLOSING]**
99. Prefer not to answer **[GO TO CLOSING]**

D10. **[IF D3 SUM OF ADULTS AND CHILDREN =5]** Which of these categories best describes your total household income in 2019 before taxes—counting everyone living in your house?

1. Less than $79,215 **[GO TO CLOSING]**
2. $79,215 or more **[GO TO CLOSING]**
99. Prefer not to answer **[GO TO CLOSING]**

D11. **[IF D3 SUM OF ADULTS AND CHILDREN =6]** Which of these categories best describes your total household income in 2019 before taxes—counting everyone living in your house?

1. Less than $90,141 **[GO TO CLOSING]**
2. $90,141 or more **[GO TO CLOSING]**
99. Prefer not to answer **[GO TO CLOSING]**

D12. **[IF D3 SUM OF ADULTS AND CHILDREN =7]** Which of these categories best describes your total household income in 2019 before taxes—counting everyone living in your house?

1. Less than $92,190 **[GO TO CLOSING]**
2. $92,190 or more **[GO TO CLOSING]**
99. Prefer not to answer **[GO TO CLOSING]**

D13. **[IF D3 SUM OF ADULTS AND CHILDREN =8]** Which of these categories best describes your total household income in 2019 before taxes—counting everyone living in your house?

1. Less than $94,239 **[GO TO CLOSING]**
2. $94,239 or more **[GO TO CLOSING]**

99. Prefer not to answer **[GO TO CLOSING]**

[CLOSING] Thank you very much for taking the time to complete this important survey.