Guidehouse
Outwit *Complexity*

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Re: ComEd Retail Online Program, Appliance Rebate Component Net-to-Gross Research Results - Final

1. Executive Summary

This memo presents findings from the net-to-gross (NTG) study of the ComEd Retail Online Program, Appliance Rebate Component. This program component's NTG values are derived from free ridership (FR) and spillover (SO) research gathered via web surveys with Appliance Rebate participants who purchased qualifying appliances in the last quarter of 2021, 2022, or the first quarter of 2023. The survey was designed in accordance with Illinois Technical Reference Manual version 10.0.

The NTG values were derived separately for nine measures sold through the program component (Table 1). These results will inform Guidehouse's September 2023 recommendations to the Stakeholder Advisory Group (SAG) of NTG values to be used for this program component in CY2024.

Table 1 summarizes the Appliance Rebate Component's FR, SO, and NTG findings based on participant feedback. Table 2 provides the historical context for NTG for the Appliance Rebate Program back to PY8.

Table 1. Net-to-Gross Research Results for Appliance Rebates CY2023

Measure	Savings Type	Free Ridership	Participant Spillover	NTG Ratio
Advanced Power Strip	kWh	0.24	0.06	0.82
Air Purifier	kWh	0.23	0.06	0.83
Clothes Washer	kWh	0.51	0.06	0.55
Dehumidifier	kWh	0.41	0.06	0.65
Electric Clothes Dryer	kWh	0.50	0.06	0.56
Refrigerator	kWh	0.51	0.06	0.55
Smart Thermostat	kWh	0.14	0.06	0.92
Ventilation Fan	kWh	0.40	0.06	0.66
Water Dispenser*	kWh	0.37	0.06	0.69

*Water Dispenser survey respondent numbers were too low (n=4) to accurately assess FR; the evaluators recommend using the free ridership value from PY8 research and the spillover value from the current research.

Source: Evaluation team analysis

Table 2. Historical Net to Gross Estimates for Appliance Rebates Measures

Measure*	CY2024	CY2019-CY2023	CY2018	PY9	PY8
Advanced Power Strip	0.82	0.76	0.86	0.86	
Air Purifier	0.83	0.79	0.74	0.78	0.78
Clothes Washer	0.55	0.63	0.58	0.68	0.68
Dehumidifier	0.65	0.67	0.78	0.78	
Electric Clothes Dryer	0.56	0.67	0.62	0.68	0.68
Refrigerator	0.55	0.65	0.57	0.86	0.86
Smart Thermostat	0.92	0.80 cooling 0.90 heating			
Ventilation Fan	0.66	0.66	0.66	0.80	
Water Dispenser	0.69	0.67	0.83	0.80	

*Only current Appliance Rebates measures are displayed for comparison.

Source: Evaluation team analysis

2. Free Ridership and Spillover Survey Disposition

The evaluation team used a Qualtrics web survey to collect data. Two distinct and personalized surveys were administered to participants depending on when they purchased and received a rebate for a qualifying Appliance Rebate measure. SO surveys were sent to Appliance Rebate participants who made a purchase during the last quarter of 2021 and first half of 2022 and FR surveys were sent to customers who participated during the last half of 2022 and first quarter of 2023. If an individual participated during both time periods, they were only included in the SO survey sample to avoid causing survey fatigue and customer dissatisfaction. SO surveys were

administered in a single wave with one reminder email sent to participants who had not started or completed the survey. FR surveys were sent in two waves, one wave encompassing participants from the last half of 2022 and the second wave for those who participated in the first quarter of 2023. Two reminder emails were sent to both FR waves to increase participation in the survey.

Across the two FR waves, 57,355 FR surveys were distributed to participating customers, however 1,162 surveys bounced due to an undeliverable email address. Of the 56,193 FR surveys delivered, 3,009 customers responded and provided complete data for at least one measure that could be used in the FR analysis. In addition, 118 surveys were started but were dropped as either the customer did not recall receiving the rebate (n=13) or were incomplete (n=715). This resulted in a response rate (all survey responses) of 7% and a final completion rate (analyzed completes) of 5%. Table 3 summarizes the FR survey disposition data for individual respondents.

Table 3. Free Ridership Decision Maker Survey Disposition

Measure Type	Survey Sample	Survey Responses	Analyzed Responses	Response Rate
Advanced Power Strip	629	57	45	9%
Air Purifier	6,979	629	461	9%
Clothes Washer	10,118	616	473	6%
Dehumidifier	2,658	279	231	10%
Electric Clothes Dryer	688	71	53	10%
Refrigerator	10,263	744	561	7%
Smart Thermostat	30,615	1,566	1,327	5%
Ventilation Fan	392	43	37	11%
Water Dispenser	73	5	4	7%
FR – Overall Program	**56,193***	**3,737**	**3,009**	**7%**

*Some individuals had up to three measures that they were surveyed on, so this number represents the number of discrete individuals contacted and is not the sum of people contacted for each measure.
Source: Evaluation team research

A total of 36,532 SO surveys were distributed to participating customers, however 1,050 surveys bounced due to an undeliverable email address. Of the 35,482 delivered SO surveys, 1,882 customers responded and provided complete data that could be used in the SO analysis. In addition, 122 surveys were started but were dropped as either the respondent reported they had not received the rebate (n=5) or the data they provided to the survey were incomplete (n=117). This resulted in a SO survey response rate (all survey responses) of 6% and a completion rate (analyzed completes) of 5%.

Table 4 summarizes SO survey disposition data for individual respondents. The measures shown in the table below are the measures incentivized through the program component, not the SO measures.

Table 4. Spillover Decision Maker Survey Disposition

Measure Type	Survey Sample	Survey Responses	Analyzed Responses	Response Rate
Advanced Power Strip	498	58	53	12%
Air Purifier	1,677	113	103	7%
Clothes Washer	8,967	420	388	5%
Dehumidifier	2,475	225	219	9%
Electric Clothes Dryer	530	32	31	6%
Refrigerator	9,327	550	515	6%
Smart Thermostat	15,108	704	667	5%
Ventilation Fan	394	22	20	6%
Water Dispenser	62	8	8	13%
SO - Overall Program	**35,482***	**2,004**	**1,882**	**6%**

*Some individuals had up to three measures that they were surveyed on, so this number represents the number of discrete individuals contacted and is not the sum of people contacted for each measure.

Source: Evaluation team analysis.

As some individuals purchased more than one measure, or more than one of the same measures, Table 5 summarizes the survey disposition data for each measure analyzed, not the individual purchaser (as is shown in Table 3 above).

Table 5. Free Ridership Measure Survey Disposition

Measure Type	Measure Population	Survey Sample	Survey Responses	Analyzed Responses	Share of Program Measures Represented by Analyzed Responses
Advanced Power Strip	58,753	988	58	46	0.1%
Air Purifier	16,042	10,037	835	640	4%
Clothes Washer	12,070	10,212	587	475	4%
Dehumidifier	10,766	2,771	292	242	2%
Electric Clothes Dryer	811	690	70	53	7%
Refrigerator	12,425	10,353	722	565	5%
Smart Thermostat	41,937	32,245	1,577	1,375	3%
Ventilation Fan	5,396	454	50	43	0.8%
Water Dispenser	198	73	5	4	2%
FR – Overall Program	**158,398**	**67,823**	**4,196**	**3,443**	**2%**

*Source: Evaluation team analysis*

3. Free Ridership and Spillover Protocols

The evaluation team applied the relevant free ridership and spillover protocols from Illinois TRM version 11.

## 3.1 Participant Free Ridership Estimation

The FR algorithm for smart thermostats is outlined in Figure 1; the algorithm for all other measures is in Figure 2. As the measures rebated through the Appliance Rebate Component are primarily single quantity purchases, the quantity score was not included in the no program score calculation.

Figure 1. Alternative Smart Thermostat Free Ridership Overview
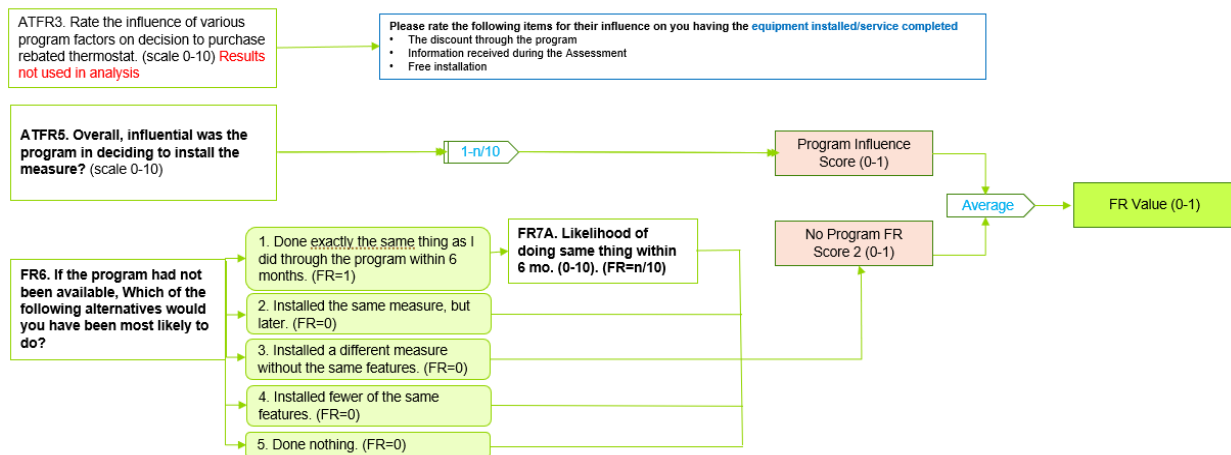
Source: Informed by SAG NTG Working Group Core Non-Residential "Redline" Algorithm, Winter 2023

Figure 2. Residential Prescriptive Rebate (With No Audit) Free Ridership
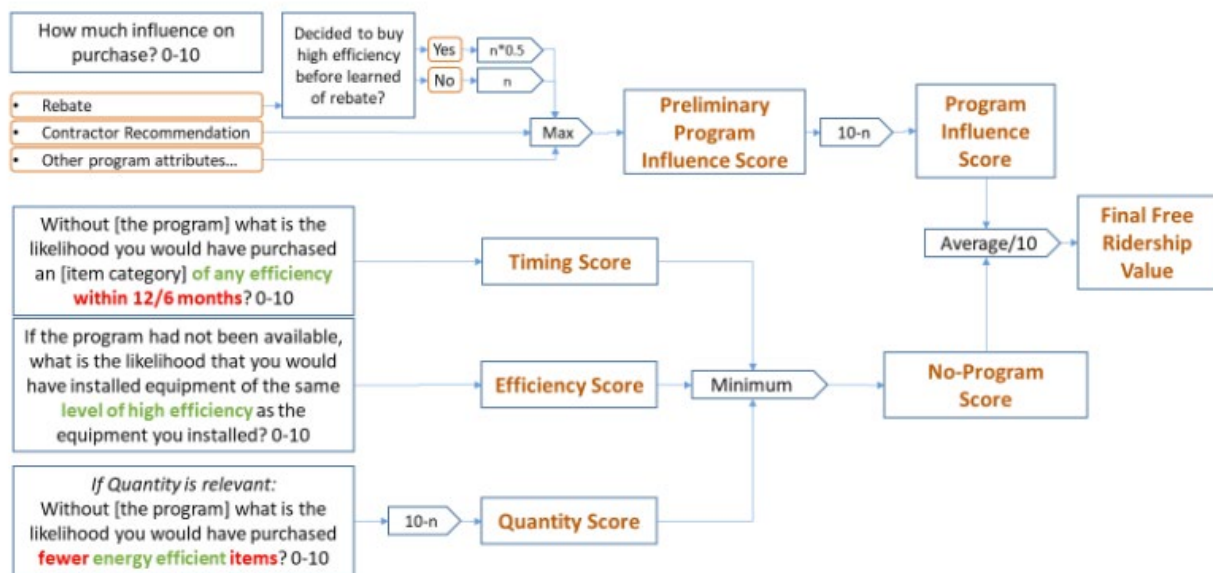
Source: Illinois Statewide Technical Reference Manual for Energy Efficiency, Version 10.0

3.2 Participant Spillover Estimation

Verdant calculated SO based on the methodology outlined in IL TRM v11. For a purchase to be considered spillover it must meet the following criteria:

1. Be a high efficiency measure

2. Not rebated by ComEd

3. Purchase decision must have been strongly influenced (spillover score > 5) by the Appliance Rebate component of the Retail/Online Program

If these three criteria were met, participant spillover was calculated as dictated in the IL TRM using the following steps:

1. Calculate spillover savings for each surveyed participant installing an efficient measure not rebated through the program where the Spillover Score is greater than 5.

2. Calculate the total program savings for the surveyed participant population (regardless of whether they reported any spillover purchases).

3. Calculate the spillover percentage estimate as: Spillover Percentage Estimate = Sum of Spillover kWh savings / Sample Evaluated Program kWh savings.

4. Detailed NTG Results

The following section details NTG calculations and results for the Appliance Rebate Component.

4.1 Free Ridership Component Scores

FR, program influence score (PI) and no program influence score (NP) were calculated in alignment with IL TRM v11 (Figure 1, Figure 2 above). FR was calculated for each measure by combining the results from both survey waves weighted by kWh savings for each wave time period. To calculate average PI and average NP, the average PI and NP for each measure were calculated for each wave and then combined using kWh savings for weighting. Table 6 outlines the average PI, NP, and FR for each of the nine measures researched as part of the Appliance Rebate Component.

Table 6. Free Ridership Component Scores

Measure	Average Program Influence Score*	Average No Program Score	Free Ridership
Advanced Power Strip	8.9	3.7	0.24
Air Purifier	8.7	3.4	0.23
Clothes Washer	6.4	6.5	0.51
Dehumidifier	7.7	5.9	0.41
Electric Clothes Dryer	6.2	6.2	0.50
Refrigerator	6.5	6.6	0.51

Measure	Average Program Influence Score*	Average No Program Score	Free Ridership
Smart Thermostat**	8.7	1.9	0.14
Ventilation Fan	7.5	5.8	0.40
Water Dispenser	8.2	7.0	0.37

*The inverse of this score (10-PI) is used to calculate FR

**These scores have been multiplied by 10 so they are on the same scale as the other measure scores

Source: Evaluation team research

4.2 Spillover Estimation

Table 7 displays the additional energy efficiency improvements that respondents made due to the influence of the program. SO rates were calculated following IL TRM v11 which states to divide the spillover savings (kWh) by the Appliance Rebate Component savings (kWh). Analysis of the survey response data found 72 respondents that made SO qualifying improvements (defined as high efficiency purchases that were not incentivized and were influenced by the ComEd program). To ensure the SO respondent data accurately reflects the population of Appliance Rebate participants, SO values were weighted by the ratio of the quantity of program measures purchased by all survey respondents to the quantity of program measures sold through the program during the SO time period. If a survey respondent purchased more than one program measure, the program measure with the higher unit energy savings (UES) was used to weight the respondent (this was necessary since SO was estimated on a program basis rather than on a measure-by-measure basis). Table 7 shows the 138 spillover measures purchased by the 72 survey respondents who were determined to have made a non-incentivized high efficiency purchase that was influenced by the program. As shown in Table 7 the sum of the savings from these 138 measures was 802,578 kWh. Dividing these spillover savings by the program savings for the entire surveyed population resulted in a participant spillover rate of 0.06.

Table 7. Spillover Research Results by Measure

Measure	Spillover Measures	Spillover kWh (UES)
Advanced Power Strip	25	73
Air Sealing – Door Sealing	5	36
Air Sealing – Door Sweep	3	36
Air Sealing – Duct Sealing	2	22
Air Sealing – Window Sealing	6	4
Central Air Conditioning	10	255
Clothes Washer	12	59
Dishwasher	14	12
Electric Clothes Dryer	15	162
Faucet Aerators	2	35
Freezer	2	32
Heat Pump	1	1,995
Insulation – Attic	8	657

Measure	Spillover Measures	Spillover kWh (UES)
Insulation – Basement	1	315
Insulation – Crawlspace	2	181
Insulation – Walls	4	81
Refrigerator	9	57
Room Air Conditioner	3	97
Showerheads	2	21
Smart Thermostats	12	194
Total Weighted Spillover		**802,578**
Total Weighted Program Savings		**13,430,110**
Spillover Rate		**0.06**

Note: The most common additional energy efficiency improvement respondents shared was LED lighting. However, as this is an upstream program offered by ComEd, we could not verify that respondents had received non-rebated LED lighting. For this reason, LED bulbs and fixtures were removed from SO analyses.

Source: Evaluation team research

4.3 Free Ridership and Spillover to Create Program Net-to-Gross Ratio

Table 8 summarizes Guidehouse's draft recommendations for the Appliance Rebate Component to be used in 2024 based on research presented in this memo. NTG was calculated as 1 – FR + SO.

Table 8. Appliance Rebate Free Ridership and Participant Spillover Recommendations

Measure	Free Ridership	Relative Precision	Participant Spillover	NTG
Advanced Power Strips	0.24	0.23	0.06	0.82
Air Purifier	0.23	0.07	0.06	0.83
Clothes Washer	0.51	0.04	0.06	0.55
Dehumidifier	0.41	0.06	0.06	0.65
Electric Clothes Dryer	0.50	0.12	0.06	0.56
Refrigerator	0.51	0.03	0.06	0.55
Smart Thermostat[†]	0.14	0.07	N/A	0.93
Ventilation Fan	0.40	0.17	0.06	0.66
Water Dispenser*	0.37	0.24	0.06	0.69

*Water Dispenser FR values come from PY8 as sample size was too low (n=4) to ascertain FR values for this cycle

[†] By formula: 1 – (current research free ridership * 0.5) + nonparticipant spillover

Source: Evaluation team research

4.3.1 *Free Ridership Sources*

As presented in section 3.1 of this memo, FR is based on a survey of Appliance Rebate Component Purchasers from the second half of 2022 and first quarter of 2023.

Responses for water dispensers were too few to use the results from the FR survey (n=4). For this reason, we used a FR value of 0.37 from Navigant survey research on participants from CY2018.

Table 9. Appliance Rebate Program NTG History

	Energy Star Rebate (Appliances)
EPY8	**Clothes Washer** = 0.68 based upon ComEd PY5 Evaluation Report **Refrigerator** = 0.86 based upon MA 2012 Home Energy Services Evaluation **Air Purifier** = 0.78 based upon Ameren IL Residential EE Product s PY5 **Learning Thermostats** = 0.90 Navigant researched value for Residential Programs **Freezers** = 0.86 based upon MA 2012 Home Energy Services Evaluation for refrigerators **Heat Pump Water Heater** = 0.86 based upon Ameren IL Res EE Products PY5 **Clothes Dryer** = 0.68 based upon ComEd Clothes Washer PY5 Evaluation Report
EPY9	**Clothes Washer = 0.68** – based upon ComEd PY5 Evaluation Report **Refrigerator = 0.86** – based upon MA 2012 Home Energy Services Evaluation **Air Purifier = 0.78** – based upon Ameren IL Residential EE Products PY5 **Learning Thermostats** = 0.90 – Navigant researched value for Residential Programs **Freezers = 0.86** – based upon MA 2012 Home Energy Services Evaluation for refrigerators. **Heat Pump Water Heater = 0.86** – based upon Ameren IL Res EE Products PY5 **Clothes Dryer = 0.68** – based upon ComEd Clothes Washer PY5 Evaluation Report **Dehumidifier = 0.78** – based upon Ameren PY4 researched value of 0.78 **Advanced Power Strips = 0.86** – Ameren primary research in PY4 **Dishwasher = 0.92** – based upon recent CO study; will be provided to SAG once it is public **Pool Pump = 1.00** – based upon recent CO study; will be provided to SAG once it is public **Bathroom Exhaust Fan = 0.80** – default value (secondary research didn't support a recommendation) **Water Cooler = 0.80** – default value (secondary research didn't support a recommendation) **Window AC = 0.80** – default value (secondary research didn't support a recommendation) NTG Source: Based upon EPY8 Recommendations for existing measures and secondary research for new measures.

Energy Star Rebate (Appliances)	
CY2018	**Clothes Washer = 0.58** **Refrigerator = 0.57** **Air Purifier = 0.74** **Freezers = 0.54** **Heat Pump Water Heater = 0.74** **Clothes Dryer = 0.62** **Bathroom Exhaust Fan = 0.66** **Water Cooler = 0.83** **Window AC = 0.63** **Dehumidifier = 0.78** – based upon Ameren PY4 researched value of 0.78 **Advanced Power Strips = 0.86** – Ameren primary research in PY4 **Dishwasher = 0.80** – default value **Pool Pump = 0.80** – default value **Learning Thermostats =** NA. The savings value in the IL TRM is based on regression analysis on consumption data and thus is a net savings number. NTG Source: Based upon EPY8 participant self-report survey unless noted otherwise.
CY2019-CY2023	**NTG Clothes Washer:** 0.62, FR 0.42 **NTG Refrigerator:** 0.61, FR 0.43 **NTG Air Purifier:** 0.78, FR 0.26 **NTG Freezers:** 0.58, FR 0.46 **NTG Heat Pump Water Heater:** 0.78, FR 0.26 **NTG Clothes Dryer:** 0.66, FR 0.38 **NTG Bathroom Exhaust Fan:** 0.70, FR 0.34 **NTG Water Cooler:** 0.87, FR 0.17 **NTG Window AC:** 0.67, FR 0.37 **Dehumidifier = 0.78** – based upon Ameren PY4 researched value of 0.78 **Advanced Power Strips = 0.86** – Ameren primary research in PY4 **Dishwasher = 0.80** – default value **Pool Pump = 0.80** – default value **Advanced Thermostats =** NA. The savings value in the IL TRM is based on regression analysis on consumption data and thus is a net savings number. SO: 0.04 (clothes washer, refrigerator, air purifier, freezers, heat pump water heater, clothes dryer, bathroom exhaust fan, water cooler, window AC) NTG Source: SO based upon EPY8 participant self-report survey; FR based upon EPY8 unless noted otherwise.

Energy Star Rebate (Appliances)	
CY2024	**NTG Advanced Power Strips:** 0.82, Free Ridership: 0.24, Spillover: 0.06
	NTG Air Purifiers: 0.83, Free Ridership: 0.23, Spillover: 0.06
	NTG Clothes Washers: 0.55, Free Ridership: 0.51, Spillover: 0.06
	NTG Dehumidifiers: 0.65, Free Ridership: 0.41, Spillover: 0.06
	NTG Electric Clothes Dryers: 0.56, Free Ridership: 0.50, Spillover: 0.06
	NTG Refrigerators: 0.55, Free Ridership: 0.51, Spillover: 0.06
	NTG Smart Thermostat: 0.92, Free Ridership: 0.14, Spillover: 0.06
	NTG Ventilation Fan: 0.66, Free Ridership: 0.40, Spillover: 0.06
	NTG Water Dispenser: 0.69, Free Ridership: 0.37, Spillover: 0.06

Source: *https://www.ilsag.info/wp-content/uploads/ComEd-NTG-CY2023-Recommendations-Final-2022-09-30.xlsx and current research*