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ComEd Upstream Commercial Food Service Equipment Pilot Impact Evaluation Report

Energy Efficiency/Demand Response Plan: Program Year 2021 (CY2021) (1/1/2021-12/31/2021)

Prepared for:

ComEd

FINAL

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1. Introduction

This report presents the results of the impact evaluation of the CY2021 Upstream Commercial Food Service Equipment (UCFSE) Pilot.

It summarizes the total energy and demand impacts for the pilot broken out by relevant measure and pilot structure details. The appendices provide the impact analysis methodology and details of the total resource cost (TRC) analysis inputs. CY2021 covers January 1, 2021 through December 31, 2021.

2. Pilot Description

The UCFSE Pilot incentivizes energy efficient commercial food service equipment for food service operators through an upstream approach. GTI and Frontier Energy implement this pilot on behalf of ComEd, Nicor Gas, Peoples Gas, and North Shore Gas. The UCFSE Pilot launched in September 2019, and CY2021 represents the UCFSE Pilot's second full year.

The implementers work with manufacturers and distributors by offering point-of-sale customer rebates, upstream incentives, and a simplified administrative process for cooking, refrigeration, sanitizing and ventilation measures. The pilot's goal is to help reduce barriers for using energy efficient equipment by food service operators, reducing electric and gas usage in the commercial food service sector. All the gas savings associated with measures are captured in the separate gas utilities' CY2021 impact evaluation reports.

In October 2020, on behalf of the Midwest Market Transformation Collaborative, Resource Innovations (RI) and the Midwest Energy Efficiency Alliance (MEEA) recommended to the Illinois Stakeholders Advisory Group (SAG) Market Transformation Saving Working Group that the UCFSE Pilot not be offered as a market transformation program for Northern Illinois. RI and MEEA recommended the pilot remain an upstream offering.[1]

In CY2021, 64 ComEd customers received instant rebates on 90 electric measures, as shown in Table 2-1.

Table 2-1. Number of Participants and Projects

Participation	Total
Participants	64
Projects	66
Installed Measures	90
Research Measure Types	8

Source: ComEd tracking data and evaluation team analysis

[1] RI and MEEA, "Commercial Food Service Natural Market Baseline Report and Recommendation," October 19, 2020. **https://ilsag.s3.amazonaws.com/CFS-Baseline_MT-Recs_10.19.2020_IL-SAG-MT.pdf**

The pilot included the measures shown in Table 2-2 and Figure 2-1.

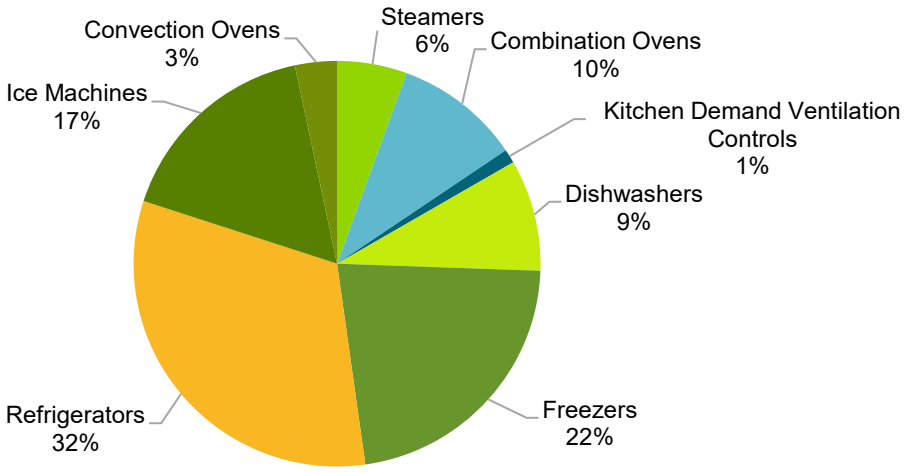
Table 2-2. Number of Measures by Type

Research Category	Quantity	Unit
Steamers	5	Each
Combination Ovens	9	Each
Kitchen Demand Ventilation Controls	1	Each
Dishwashers*	8	Each
Freezers	20	Each
Refrigerators	29	Each
Ice Machines	15	Each
Convection Ovens	3	Each
Total	**90**	

*In CY2021, the category of dishwashers included one multi-tank conveyor unit, three stationary single tank door units, and four under counter units.

Source: ComEd tracking data and evaluation team analysis

Figure 2-1. Share of Measures Installed



Source: ComEd tracking data and evaluation team analysis

3. Pilot Savings Detail

Table 3-1 summarizes the incremental energy and demand savings the UCFSE Pilot achieved in CY2021. The gas utilities are claiming all gas savings for this pilot.

Table 3-1. Total Annual Incremental Electric Savings

Savings Category	Units	Ex Ante Gross Savings	Pilot Gross Realization Rate	Verified Gross Savings	Pilot Net-to-Gross Ratio (NTG)	CY2019 Net Carryover Savings	CY2020 Net Carryover Savings	Verified Net Savings†
Electric Energy Savings - Direct	kWh	309,399	1.13	349,653	0.80	N/A	N/A	279,722
Electric Energy Savings - Converted from Gas	kWh	0	N/A	0	N/A	N/A	N/A	0
Total Electric Energy Savings	kWh	309,399	1.13	349,653	0.80	N/A	N/A	279,722
Summer Peak* Demand Savings	kW	39.61	1.13	44.90	0.80	N/A	N/A	35.92

N/A = not applicable (refers to a piece of data that cannot be produced or does not apply).

† The "Verified Net Savings" in row one (Electric Energy Savings – Direct) include primary kWh savings as a result of measure implementation, as well as secondary kWh savings from wastewater treatment. It does not include carryover savings from CY2019 and CY2020 or electric heating penalties as those do not apply to this program.

* The coincident summer peak period is defined as 1:00-5:00 p.m. Central Prevailing Time on non-holiday weekdays, June through August.

Source: ComEd tracking data and evaluation team analysis

4. Cumulative Persisting Annual Savings

Table 4-1 and Figure 4-1 show the measure-specific and total verified gross savings for the UCFSE Pilot and the cumulative persisting annual savings (CPAS) for the measures installed in CY2021. The electric CPAS across all measures installed in 2021 is shown in Table 4-1. The historic rows in Table 4-1 are the CPAS contribution back to CY2020. The Pilot Total Electric CPAS is the sum of the CY2021 contribution and the historic contribution. Figure 4-1 shows the savings across the effective useful life (EUL) of the measures.

The gas utilities are claiming all gas savings for this pilot, so electric CPAS is equivalent to total CPAS.

Table 4-1. Cumulative Persisting Annual Savings – Electric

End Use Type	Research Category	EUL	CY2021 Verified Gross Savings (kWh)	NTG*	Lifetime Net Savings (kWh)†	Verified Net kWh Savings 2018	2019	2020	2021	2022	2023	2024	2025	2026
Food Service Equipment	Steamers	12.0	186,357	0.80	1,789,025				149,085	149,085	149,085	149,085	149,085	149,085
Food Service Equipment	Combination Ovens	12.0	53,574	0.80	514,311				42,859	42,859	42,859	42,859	42,859	42,859
Food Service Equipment	Kitchen Demand Ventilation Controls	20.0	38,487	0.80	615,784				30,789	30,789	30,789	30,789	30,789	30,789
Food Service Equipment	Dishwashers||	16.4	25,915	0.80	340,015				20,732	20,732	20,732	20,732	20,732	20,732
Food Service Equipment	Freezers	12.0	16,705	0.80	160,367				13,364	13,364	13,364	13,364	13,364	13,364
Food Service Equipment	Refrigerators	12.0	13,101	0.80	125,773				10,481	10,481	10,481	10,481	10,481	10,481
Food Service Equipment	Ice Machines	9.0	9,313	0.80	67,055				7,451	7,451	7,451	7,451	7,451	7,451
Food Service Equipment	Convection Ovens	12.0	6,200	0.80	59,523				4,960	4,960	4,960	4,960	4,960	4,960
CY2021 Pilot Total Electric Contribution to CPAS			**349,653**		**3,671,853**				**279,722**	**279,722**	**279,722**	**279,722**	**279,722**	**279,722**
Historic Pilot Total Electric Contribution to CPAS‡								**67,304**	**67,304**	**67,304**	**67,304**	**67,304**	**67,304**	**67,304**
Pilot Total Electric CPAS						-	-	**67,304**	**347,026**	**347,026**	**347,026**	**347,026**	**347,026**	**347,026**
CY2021 Pilot Incremental Expiring Electric Savings§										-	-	-	-	-
Historic Pilot Incremental Expiring Electric Savings									-	-	-	-	-	-
Pilot Total Incremental Expiring Electric Savings									-	-	-	-	-	-

End Use Type	Research Category	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Food Service Equipment	Steamers	149,085	149,085	149,085	149,085	149,085	149,085						
Food Service Equipment	Combination Ovens	42,859	42,859	42,859	42,859	42,859	42,859						
Food Service Equipment	Kitchen Demand Ventilation Controls	30,789	30,789	30,789	30,789	30,789	30,789	30,789	30,789	30,789	30,789	30,789	30,789
Food Service Equipment	Dishwashers||	20,732	20,732	20,732	20,732	17,327	17,327	17,327	17,327	17,327	9,212	9,212	9,212
Food Service Equipment	Freezers	13,364	13,364	13,364	13,364	13,364	13,364						
Food Service Equipment	Refrigerators	10,481	10,481	10,481	10,481	10,481	10,481						
Food Service Equipment	Ice Machines	7,451	7,451	7,451									
Food Service Equipment	Convection Ovens	4,960	4,960	4,960	4,960	4,960	4,960						
CY2021 Pilot Total Electric Contribution to CPAS		**279,722**	**279,722**	**279,722**	**272,271**	**268,866**	**268,866**	**48,116**	**48,116**	**48,116**	**40,001**	**40,001**	**40,001**
Historic Pilot Total Electric Contribution to CPAS‡		**67,304**	**67,304**	**63,631**	**61,436**	**61,436**							
Pilot Total Electric CPAS		**347,026**	**347,026**	**343,353**	**333,707**	**330,301**	**268,866**	**48,116**	**48,116**	**48,116**	**40,001**	**40,001**	**40,001**
CY2021 Pilot Incremental Expiring Electric Savings§		**-**	**-**	**-**	**7,451**	**3,406**	**-**	**220,750**	**-**	**-**	**8,115**	**-**	**-**
Historic Pilot Incremental Expiring Electric Savings		**-**	**-**	**3,673**	**2,195**	**-**	**61,436**	**-**	**-**	**-**	**-**	**-**	**-**
Pilot Total Incremental Expiring Electric Savings		**-**	**-**	**3,673**	**9,646**	**3,406**	**61,436**	**220,750**	**-**	**-**	**8,115**	**-**	**-**

End Use Type	Research Category	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Food Service Equipment	Steamers												
Food Service Equipment	Combination Ovens												
Food Service Equipment	Kitchen Demand Ventilation Controls	30,789	30,789										
Food Service Equipment	Dishwashers||	9,212	9,212										
Food Service Equipment	Freezers												
Food Service Equipment	Refrigerators												
Food Service Equipment	Ice Machines												
Food Service Equipment	Convection Ovens												
CY2021 Pilot Total Electric Contribution to CPAS		**40,001**	**40,001**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Historic Pilot Total Electric Contribution to CPAS‡													
Pilot Total Electric CPAS		**40,001**	**40,001**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CY2021 Pilot Incremental Expiring Electric Savings§		**-**	**-**	**40,001**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Historic Pilot Incremental Expiring Electric Savings		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Pilot Total Incremental Expiring Electric Savings		**-**	**-**	**40,001**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Note: The green highlighted cell shows pilot total first-year electric savings. The gray cells are blank, indicating values irrelevant to the CY2021 contribution to CPAS.

* A deemed value. Source: Illinois SAG website: **https://ilsag.s3.amazonaws.com/ComEd-CFSE-NTG-research-memo-2020-12-10.pdf**

† Lifetime savings are the sum of CPAS savings through the EUL.

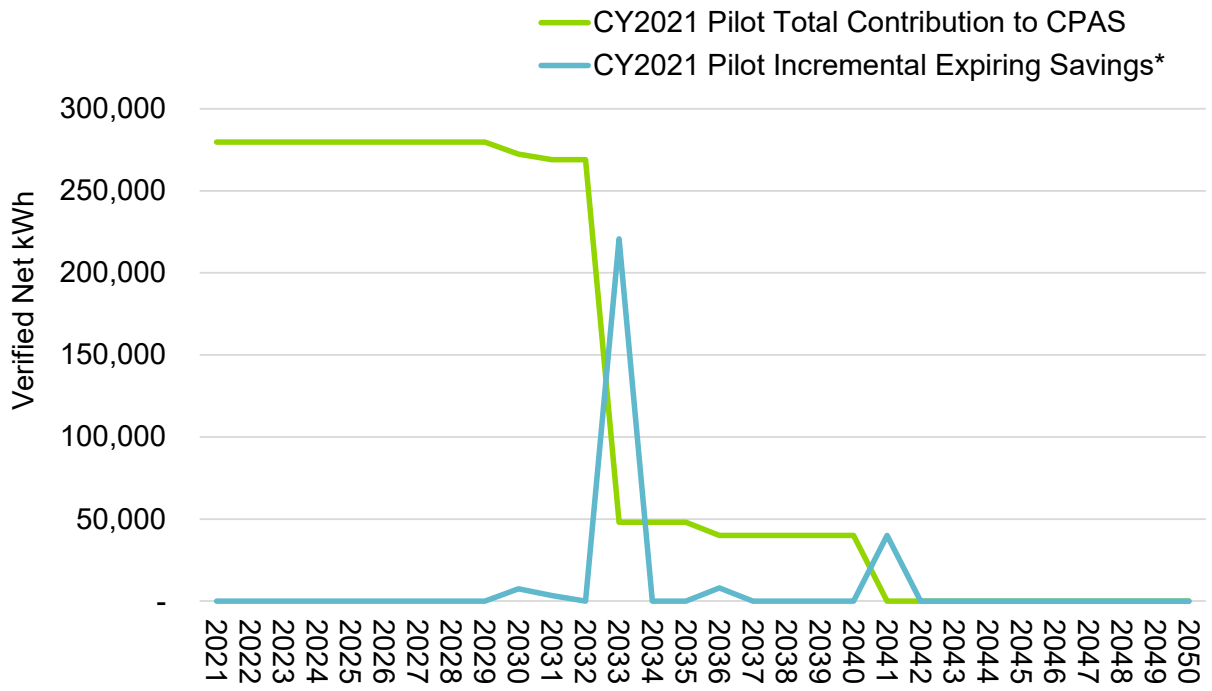
‡ Historic savings go back to CY2020.

§ Incremental expiring savings are equal to CPAS Y_{n-1} - CPAS Y_n.

|| The dishwasher EUL value is a weighted average measure life (WAML) based on verified gross savings (kWh); CPAS extends to the full life of each measure.

Source: Evaluation team analysis

Figure 4-1. Cumulative Persisting Annual Savings



* Expiring savings are equal to CPAS Y_{n-1} - CPAS Y_n.

Source: Evaluation team analysis

5. Pilot Savings by Measure

In CY2021, ComEd UCFSE Pilot customers received rebates for eight electric measure types,[2] as shown in the following figures and tables. Steamers contributed the most savings (see Figure 5-1).

Table 5-1. Number of Measures by Type

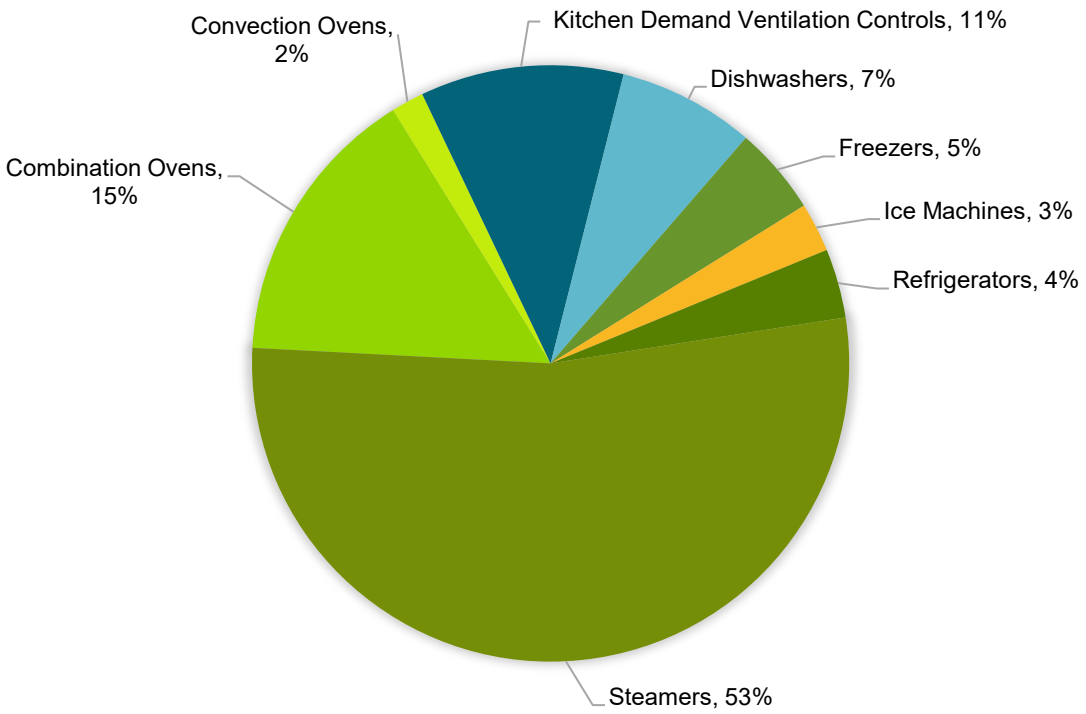
Research Category	Quantity	Unit
Steamers	5	Each
Combination Ovens	9	Each
Kitchen Demand Ventilation Controls	1	Each
Dishwashers*	8	Each
Freezers	20	Each
Refrigerators	29	Each
Ice Machines	15	Each
Convection Ovens	3	Each
Total	**90**	

*In CY2021, the category of dishwashers included one multi-tank conveyor unit, three stationary single tank door units, and four under counter units.

Source: ComEd tracking data and evaluation team analysis

[2] The pilot includes 11 electric measure types: combination ovens, convection ovens, freezers, fryers, griddles, hand wrap machines, dishwashers, ice machines, refrigerators, ventilation controls, and steam cookers. In CY2021, ComEd customers received rebates in eight of the 11 electric measure types.

Figure 5-1. Verified Net Savings by Measure – Electric



Source: ComEd tracking data and evaluation team analysis

Measure-level energy and demand savings are provided in the following tables.

Table 5-2. Energy Savings by Measure – Electric

Research Category	Ex Ante Gross Savings (kWh)	Verified Gross Realization Rate	Verified Gross Savings (kWh)	NTG*	Verified Net Savings (kWh)	EUL (years)
Steamers	132,350	1.41	186,357	0.80	149,085	12.0
Combination Ovens	73,815	0.73	53,574	0.80	42,859	12.0
Kitchen Demand Ventilation Controls	38,487	1.00	38,487	0.80	30,789	20.0
Dishwashers	26,204	0.99	25,915	0.80	20,732	16.4
Freezers	18,307	0.91	16,705	0.80	13,364	12.0
Refrigerators	12,369	1.06	13,101	0.80	10,481	12.0
Ice Machines	4,193	2.22	9,313	0.80	7,451	9.0
Convection Ovens	3,674	1.69	6,200	0.80	4,960	12.0
Total	**309,399**	**1.13**	**349,653**		**279,722**	

Note: The savings in this table include secondary electric energy (kWh) savings from water supply and wastewater treatment plants for measures claimed by ComEd.
* A deemed value. Source: Illinois SAG website: **https://ilsag.s3.amazonaws.com/ComEd-CFSE-NTG-research-memo-2020-12-10.pdf**

Source: ComEd tracking data and evaluation team analysis

Table 5-3. Summer Peak Demand Savings by Measure

Research Category	Ex Ante Gross Peak Demand Reduction (kW)	Verified Gross Realization Rate	Verified Gross Peak Demand Reduction (kW)	NTG*	Verified Net Peak Demand Reduction (kW)
Steamers	20.89	1.24	25.89	0.80	20.71
Combination Ovens	7.49	0.74	5.51	0.80	4.40
Kitchen Demand Ventilation Controls	5.27	1.00	5.27	0.80	4.22
Dishwashers	1.26	2.13	2.68	0.80	2.15
Freezers	1.96	0.91	1.79	0.80	1.43
Refrigerators	1.32	1.06	1.40	0.80	1.12
Ice Machines	0.79	2.22	1.75	0.80	1.40
Convection Ovens	0.63	0.98	0.62	0.80	0.50
Total	**39.61**	**1.13**	**44.90**		**35.92**

* A deemed value. Source: Illinois SAG website: **https://ilsag.s3.amazonaws.com/ComEd-CFSE-NTG-research-memo-2020-12-10.pdf**

Source: ComEd tracking data and evaluation team analysis

The UCFSE Pilot includes measures that save water. That reduction in water produces secondary kWh savings from water supply and wastewater treatment. Table 5-4 shows the secondary measure-level savings. The savings in this table are included in the electricity savings in the previous tables in this section. The steamer and dishwasher measures are the only measures in this pilot that have attributable secondary savings.

Table 5-4. Secondary Energy Savings from Water Reduction by Measure – Electric

Research Category	Ex Ante Annual Water Savings (gallons)	Ex Ante Gross Savings (kWh)	Verified Gross Realization Rate (RR_{water})	Verified Gross Savings (kWh)	NTG*	Verified Net Savings (kWh)
Steamers	NR	NR	N/A	1,342	0.80	1,074
Combination Ovens	NR	NR	N/A	0	0.80	0
Kitchen Demand Ventilation Controls	NR	NR	N/A	0	0.80	0
Dishwashers	NR	NR	N/A	809	0.80	648
Freezers	NR	NR	N/A	0	0.80	0
Refrigerators	NR	NR	N/A	0	0.80	0
Ice Machines	NR	NR	N/A	0	0.80	0
Convection Ovens	NR	NR	N/A	0	0.80	0
Total	**NR**	**NR**	**N/A**	**2,151**		**1,721**

NR = Not reported (refers a piece of data that was not reported in the data)
N/A = Not applicable (refers to a piece of data that cannot be produced or does not apply)
Note: The savings in this table reflect only secondary electric energy (kWh) savings from water supply and wastewater treatment plants for measures claimed by ComEd, not those claimed by gas utilities.
* A deemed value. Source: Illinois SAG website: **https://ilsag.s3.amazonaws.com/ComEd-CFSE-NTG-research-memo-2020-12-10.pdf**

Source: ComEd tracking data and evaluation team analysis

6. Impact Analysis Findings and Recommendations

The evaluation team developed several recommendations for ComEd and the implementer based on findings from the CY2021 evaluation. Many findings and recommendations in this report are the same as those in the CY2020 evaluation and in the CY2021 Wave 1 Memo. The following findings and recommendations directly impacted the savings and realization rates of the installed measures. Table 6-1 lists the measure-level realization rates and their percentage of the pilot's verified net savings.

Table 6-1. Measure-Level Savings and Realization Rates

Research Category	Verified Gross Realization Rate	Percentage of Verified Net Savings
Steamers	1.41	53%
Combination Ovens	0.73	15%
Kitchen Demand Ventilation Controls	1.00	11%
Dishwashers	0.99	7%
Freezers	0.91	5%
Refrigerators	1.06	4%
Ice Machines	2.22	3%
Convection Ovens	1.69	2%
Total	**1.13**	

Source: ComEd tracking data and evaluation team analysis

6.1 Daily Operating Hours and Days per Year

Finding 1 (also found in CY2020). Guidehouse found that the ex ante savings calculations used IL-TRM default values for annual days of operation and daily operating hours for all measures installed. Steamers, combination ovens, convection ovens, and dishwashers are provided the option in the IL-TRM to use an actual or custom value when available. The tracking data provided the business address, so Guidehouse used supplemental research to gather the actual schedules. The schedules allowed the evaluation team to use the business' actual daily hours and annual days of operation in the savings calculation in place of the default values. Table 6-2 lists the installed measures' custom values by project ID. Any project IDs not listed used the IL-TRM deemed values.

> **Recommendation 1.** Collect information on the business' actual operating hours and days per year. For dishwashers specifically, this will be the hours and days of dishwasher operation, which might differ slightly from regular business hours. Capturing this data will allow for more accurate savings calculations. Also, consider adding this information request to the project application form.

Table 6-2. Actual Daily Hours and Annual Days of Operation

Measure	Project ID	Hrs/Day	Custom Days/Year
Steamers	160	10.17	313.07
	173	6.00	260.89
	213	13.29	365.25
Combination Ovens	44	16.71	365.00
	200	11.50	312.86
	244	15.57	365.00
	287	6.00	260.71
	343	6.00	180.00
Dishwashers	44	16.71	365.25
	222	6.00	180.00
	140	8.00	365.25
	127	6.00	180.00
	291	18.00	313.07
	141	9.50	313.07
Convection Oven	159	8.00	260.89
	262	13.00	365.25
	333	13.57	365.25

Source: ComEd tracking data and evaluation team analysis

6.2 Coincidence Factor

Finding 2 (also found in CY2020). Guidehouse found that some building types reported in the tracking data incorrectly aligned with the options in the IL-TRM. Therefore, incorrect coincidence factor (CF) values were used in some of the demand savings calculations. This applied to combination oven and dishwasher measures. For example, project ID 44 contains combination ovens and dishwashers. It was listed in the tracking data as a Hotel/Motel, which is not a building type option in the IL-TRM section of either measure. Guidehouse researched the business to match it with a listed IL-TRM business type and to find the right CF value to use in the verified savings calculation. Details on these updates can be seen in Table 6-3.

> **Recommendation 2.** Record the business type for each project in accordance with the IL-TRM, which is then used to determine the correct CF value for the ex ante savings calculations.

Table 6-3. Actual CF Values

Measure	Project ID	CF
Combination Ovens	44	0.51
	200	0.36
	244	0.36
	287	0.51
	343	0.39
Dishwashers	44	0.51
	127	0.39
	140	0.36
	141	0.36
	222	0.39
	291	0.36

Source: ComEd tracking data and evaluation team analysis

6.3 Secondary Water Savings

Finding 3 (also found in CY2020). Guidehouse found that secondary kilowatt-hour (kWh) savings from water supply and wastewater treatment were not reported separately from primary energy savings in the tracking data.

> **Recommendation 3.** Document the primary and secondary energy savings separately. This applies to the steamer and dishwasher measures.

6.4 ENERGY STAR Qualified Products List

Finding 4 (also found in CY2020). Guidehouse found many measures provided in the tracking data that were not included in the most recent ENERGY STAR Qualified Products List (QPL). The evaluation team could not confirm the matching model number for one freezer, one combination oven, one refrigerator, eight ice machines, and five dishwashers.

> **Recommendation 4.** Provide more detail on the rationale for including these measures in the tracking data.

Finding 5. For several measures whose model numbers were included in the ENERGY STAR QPL, Guidehouse found key savings input parameters did not align with the values specified for those measures. The evaluation team corrected all misaligned savings input parameters to match the ENERGY STAR QPL prior to calculating verified gross savings. More detail on adjusted parameters for specific measures is contained in Appendix B, Table B-1 through Table B-4. This applies to steamers, combination ovens, refrigerators, freezers, and electric convection ovens. In addition, Guidehouse found that project ID 185 incorrectly recorded the installed measure as a glass door. The ENERGY STAR QPL specified the measure as a solid door. The evaluation team made this correction, which impacted the savings calculation inputs and methodology.

> **Recommendation 5**: Ensure tracking data values align with the QPL and apply aligned input parameters when calculating ex ante savings.

Finding 6. Guidehouse found some savings input information was left blank in the tracking data. Guidehouse used the ENERGY STAR QPL to fill in the missing information. This included efficiency standard information for the ice maker measure in project ID 117, combination oven data fields for project ID 44 seen in Table B-2, and Consortium of Energy Efficiency (CEE) Tier information for steamers. One steamer measure in project ID 173 was also missing Production Capacity information.

> **Recommendation 6.** Provide all measure input information used in ex ante savings calculations in the tracking data. If information is not collected, the ENERGY STAR QPL should be sourced to fill in the missing data.

6.5 Blank or Misreported Efficiency Tier

Finding 7. For two ice makers in project IDs 123 and 163, Guidehouse found the Efficiency Standard information was provided in the incorrect tracking data field. This Efficiency Standard information was provided in the Equipment Type field, which then rendered the measures' Equipment Type information blank. The evaluation team used supplemental research to fill in this missing information.

> **Recommendation 7**: Ensure tracking data information is consistently reported in the correct field for each measure.

6.6 Reported Measures with Zero Claimed Savings

Finding 8. Guidehouse found six of the 90 measures with zero reported ex ante electric energy savings (kWh) and zero reported ex ante demand savings (kW). These included five ice makers and one steamer: project IDs 123, 117, 163, 226, 277, and 173. It was not clear in the pilot data why there were zero ex ante savings reported for these measures. The evaluation team calculated verified kWh and kW savings for all six measures since they were included in the final CY2021 tracking data and met efficiency standards. These measures accounted for 6.5% of total verified gross savings.

> **Recommendation 8.** If measures with zero savings were cancelled, they should be removed from the pilot's final tracking data. If they were not cancelled, the tracking system should provide an explanation for the zero savings estimates for these measures.

6.7 Kitchen Demand Ventilation Controls

Finding 9. Guidehouse found that ex ante savings for the single installed kitchen demand ventilation control did not report the controlled fan's horsepower in the tracking data. The evaluation team used a deemed value for $Horsepower_{Fan}$ from Section 4.2.16 of the IL-TRM, which was 7.75.

> **Recommendation 9.** Record the actual horsepower of fans with installed kitchen demand ventilation controls and report it as part of the pilot's database.

Finding 10. Guidehouse found the EUL for the single kitchen demand ventilation control was reported as 15 years in the tracking data. The evaluation team referenced the IL-TRM EUL of 20 years and made adjustments accordingly.

Recommendation 10. Report EUL values for each measure installed that align with guidance in the applicable version of the IL-TRM.

6.8 Dishwashers

Finding 11. The evaluation team found that reported energy savings matched the deemed savings for the IL-TRM "Natural Gas Building and Electric Booster Water Heating" water heating combination. However, the tracking data did not contain the data necessary for the evaluation team to confirm this accurately represents the water heating of the building where the measure was installed. The ex ante reported savings indicated a possible match with the "Natural Gas Building and Electric Booster Water Heating" IL-TRM deemed savings values, therefore the evaluation team used "Natural Gas Building and Electric Booster Water Heating" for calculating verified savings of dishwasher measures, as well.

Recommendation 11. (also found in CY2020). Confirm that ex ante savings used the "Natural Gas Building and Electric Booster Water Heating" assumption. In addition, collect information on the pilot application form on the fuel used for building and booster water heating. This will help the evaluation team confirm the appropriate savings values in the future.

Finding 12. The tracking data did not define the county where each measure was installed. This affects the secondary water savings value for the dishwasher measures via the TRM's Illinois Total Water Energy Factor ($E_{WaterTotal}$). Ex ante savings calculations used the deemed Cook County value for every dishwasher measure. The evaluation team identified the county for each dishwasher measure using the ZIP codes provided in the tracking data and found the measure in project ID 127 is in McHenry County. Verified savings calculated secondary energy savings values using the appropriate energy factor.

Recommendation 12. Include a tracking data field to define the project's county or use the reported ZIP codes to determine the project's county. In addition, use the appropriate $E_{WaterTotal}$ according to the county where each measure was installed.

6.9 Ice Machines

Finding 13. Guidehouse found that the pilot used the IL-TRM deemed values for kWhEE in the ex ante savings for ice machines rather than the efficient energy consumption values provided in the tracking data. (The savings calculations for the refrigerators and freezers measures correctly used the reported efficient energy consumption value). The IL-TRM deemed calculations represent the maximum efficient value, so the savings calculation should use the reported specific value when available. The evaluation team used the reported values from the tracking data in its calculations.

Recommendation 13. Consistently use the reported efficient values in ex ante savings.

Appendix A. Impact Analysis Methodology

The evaluation team determined verified gross savings for each pilot measure by:

- Reviewing the savings algorithm inputs in the measure workbook for agreement with the IL-TRM and IL-TRM Errata.
- Verifying measure specifications with the ENERGY STAR website and QPL and adjusting any values that were incorrect in the reported data.
- Determining custom hours of operation for locations where the IL-TRM allowed the measure to have custom hours per day and days per year savings inputs.
- Validating savings algorithms were applied correctly.
- Cross-checking per-unit savings values in the tracking data with the verified values in the team's calculations if the workbook did not agree with the IL-TRM.
- Checking model numbers against the ENERGY STAR QPL to observe if the individual measures are still qualified.
- Multiplying the verified per-unit savings value by the quantity reported in the tracking data.

The team calculated verified net energy and demand (coincident peak and overall) savings by multiplying the verified gross savings estimates by a NTG ratio of 0.8. For CY2021, the UCFSE Pilot's NTG estimate was determined in a memo to ComEd.[3]

The evaluation team estimated the lifetime energy and demand savings by multiplying the verified savings by the EUL for each measure.

A.1 Commercial Steam Cookers

The evaluation followed the methodology provided in the IL-TRM. The evaluation team conducted research to validate the parameters that were not specified in the IL-TRM and to confirm values provided in the tracking data. Table A-1. shows the steamer savings parameters.

Table A-1. Commercial Steam Cooker Savings Parameters

Gross Savings Input Parameters	Value	Units	Deemed or Evaluated?	Source *
Quantity	Varies	No. of measures	Evaluated	Tracking Data
Net-to-Gross (NTG)	0.80	%	Deemed	Illinois Energy Efficiency (EE) Policy Manual†
Measure Type and Eligibility			Evaluated	ENERGY STAR Qualified Products List (QPL)
$CSM_{\%Baseline}$	0.9	%	Deemed	IL-TRM – Section 4.2.3
$CSM_{\%ENERGYSTAR}$	0	%	Deemed	IL-TRM – Section 4.2.3

[3] **https://ilsag.s3.amazonaws.com/ComEd-CFSE-NTG-research-memo-2020-12-10.pdf**

Gross Savings Input Parameters	Value	Units	Deemed or Evaluated?	Source *
$IDLE_{BASE}$	Varies	kW	Evaluated	Tracking Data, IL-TRM – Section 4.2.3
$IDLE_{ENERGYSTAR}$	Varies	kW	Evaluated	Tracking Data, IL-TRM – Section 4.2.3
PC_{BASE}	Varies	Lbs/hr	Evaluated	Tracking Data, IL-TRM – Section 4.2.3
PC_{ENERGY}	Varies	Lbs/hr	Evaluated	Tracking Data, IL-TRM – Section 4.2.3
E_{FOOD}	0.0308	kW/lb	Deemed	IL-TRM – Section 4.2.3
EFF_{BASE}	0.26	%	Deemed	IL-TRM – Section 4.2.3
$EFF_{ENERGYSTAR®}$	0.5	%	Deemed	IL-TRM – Section 4.2.3
F	100	Lbs/day	Deemed	IL-TRM – Section 4.2.3
PRE_{number}	1	No. per day	Deemed	IL-TRM – Section 4.2.3
Pre_{heat}	0.5	kWh/preheat	Deemed	IL-TRM – Section 4.2.3
$HOURS_{day}$	Varies	Hours	Evaluated	Tracking Data, IL-TRM – Section 4.2.3
$Days_{Year}$	Varies	Days/year	Evaluated	Tracking Data
Coincidence Factor (CF)	Varies	-	Evaluated	Tracking Data, IL-TRM – Section 4.2.3
W_{BASE}	40	Gal/hr	Deemed	IL-TRM – Section 4.2.3
$W_{ENERGYSTAR®}$	Varies	Gal/hr	Evaluated	Tracking Data, IL-TRM – Section 4.2.3
$E_{water\ supply}$	2,571	kWh/mil. Gal	Deemed	IL-TRM – Section 4.2.3
EUL	12	Years	Mixture	IL-TRM – Section 4.2.3

*IL-TRM is the Illinois Technical Reference Manual version 9.0 from **http://www.ilsag.info/technical-reference-manual.html.**

† **https://ilsag.s3.amazonaws.com/ComEd-CFSE-NTG-research-memo-2020-12-10.pdf**

Source: Evaluation team analysis

A.2 Combination Ovens

The evaluation followed the methodology provided in the IL-TRM. The evaluation team conducted research to validate the parameters that were not specified in the IL-TRM and to confirm values provided in the tracking data. Table A-2 shows the combination oven savings parameters.

Table A-2. Combination Oven Savings Parameters

Gross Savings Input Parameters	Value	Units	Deemed or Evaluated?	Source *
Quantity	Varies	No. of measures	Evaluated	Tracking Data
NTG	0.80	%	Deemed	Guidehouse Memo to ComEd†
Measure Type and Eligibility			Evaluated	ENERGY STAR QPL
LB_{Elec}	Varies	Lbs/day	Evaluated	Tracking Data, IL-TRM – Section 4.2.1
$EFOOD_{ConvElec}$	73.2	Wh/lb	Deemed	IL-TRM – Section 4.2.1
$ElecEFF_{ConvBase}$	0.72	%	Deemed	IL-TRM – Section 4.2.1
$ElecEFF_{ConvEE}$	Varies	%	Evaluated	Tracking Data, IL-TRM – Section 4.2.1
$\%_{Conv}$	0.5	%	Deemed	IL-TRM – Section 4.2.1
$EFOOD_{SteamElec}$	30.8	Wh/lb	Deemed	IL-TRM – Section 4.2.1
$ElecEFF_{SteamBase}$	0.49	%	Deemed	IL-TRM – Section 4.2.1
$ElecEFF_{SteamEE}$	Varies	%	Evaluated	Tracking Data, IL-TRM – Section 4.2.1
$\%_{Steam}$	0.5	%	Deemed	IL-TRM – Section 4.2.1
$ElecIDLE_{ConvBase}$	Varies	W	Evaluated	Tracking Data, IL-TRM – Section 4.2.1
$ElecIDLE_{ConvEE}$	Varies	W	Deemed	IL-TRM – Section 4.2.1
$ElecPC_{ConvBase}$	Varies	Lbs/hr	Evaluated	Tracking Data, IL-TRM – Section 4.2.1
$ElecPC_{ConvEE}$	Varies	Lbs/hr	Evaluated	Tracking Data, IL-TRM – Section 4.2.1
$ElecIDLE_{SteamBase}$	Varies	W	Evaluated	Tracking Data, IL-TRM – Section 4.2.1
$ElecIDLE_{SteamEE}$	Varies	W	Evaluated	Tracking Data, IL-TRM – Section 4.2.1
$ElecPC_{SteamBase}$	Varies	Lbs/hr	Evaluated	Tracking Data, IL-TRM – Section 4.2.1
$ElecPC_{SteamEE}$	Varies	Lbs/hr	Evaluated	Tracking Data, IL-TRM – Section 4.2.1
CF	Varies	-	Evaluated	Tracking Data, IL-TRM – Section 4.2.1
HOURS	Varies	Hours/day	Evaluated	Tracking Data
DAYS	Varies	Days/yr	Evaluated	Tracking Data
EUL	12	Years	Mixture	IL-TRM – Section 4.2.1

*IL-TRM is the Illinois Technical Reference Manual version 9.0 from **http://www.ilsag.info/technical-reference-manual.html**.

† **https://ilsag.s3.amazonaws.com/ComEd-CFSE-NTG-research-memo-2020-12-10.pdf**

Source: Evaluation team analysis

A.3 Kitchen Demand Ventilation Controls

The evaluation followed the methodology provided in the IL-TRM. The evaluation team conducted research to validate the parameters that were not specified in the IL-TRM and to confirm values provided in the tracking data, when possible. Table A-3 shows the kitchen demand ventilation controls savings parameters.

Table A-3. Kitchen Demand Ventilation Controls Savings Parameters

Gross Savings Input Parameters	Value	Units	Deemed or Evaluated?	Source *
Quantity	Varies	No. of measures	Evaluated	Tracking Data
NTG	0.80	%	Deemed	Guidehouse Memo to ComEd†
$Horsepower_{Fan}$	7.75	HP	Deemed, if unknown	IL-TRM – Section 4.2.16
EUL	20	Years	Mixture	IL-TRM – Section 4.2.16

*IL-TRM is the Illinois Technical Reference Manual version 9.0 from **http://www.ilsag.info/technical-reference-manual.html**.

† **https://ilsag.s3.amazonaws.com/ComEd-CFSE-NTG-research-memo-2020-12-10.pdf**

Source: Evaluation team analysis

A.4 Commercial Solid and Glass Door Refrigerators and Freezers

The evaluation followed the methodology provided in the IL-TRM. The evaluation team conducted research to validate the parameters that were not specified in the IL-TRM and to confirm values provided in the tracking data. Table A-4 shows the refrigerator and freezer savings parameters.

Table A-4. Commercial Refrigerators and Freezers Door Savings Parameters

Gross Savings Input Parameters	Value	Units	Deemed or Evaluated?	Source *
Quantity	Varies	No. of measures	Evaluated	Tracking Data
NTG	0.80	%	Evaluated	Guidehouse Memo to ComEd†
Measure Type and Eligibility			Evaluated	ENERGY STAR QPL
kWhbase	Varies	kWh	Evaluated	Tracking Data, IL-TRM – Section 4.2.2
kWhee	Varies	kWh	Evaluated	Tracking Data, IL-TRM – Section 4.2.2
CF	0.937	-	Deemed	IL-TRM – Section 4.2.2
HOURS	8766	Hours/year	Deemed	IL-TRM – Section 4.2.2
EUL	12	Years	Mixture	IL-TRM – Section 4.2.2

*IL-TRM is the Illinois Technical Reference Manual version 9.0 from **http://www.ilsag.info/technical-reference-manual.html**.

† **https://ilsag.s3.amazonaws.com/ComEd-CFSE-NTG-research-memo-2020-12-10.pdf**

Source: Evaluation team analysis

A.5 Ice Makers

The evaluation followed the methodology provided in the IL-TRM. The evaluation team conducted research to validate the parameters that were not specified in the IL-TRM and to confirm values provided in the tracking data. Table A-5 shows the ice machine savings parameters.

Table A-5. Ice Maker Savings Parameters

Gross Savings Input Parameters	Value	Units	Deemed or Evaluated?	Source *
Quantity	Varies	No. of measures	Evaluated	Tracking Data
NTG	0.80	%	Evaluated	Guidehouse Memo to ComEd†
Measure Type and Eligibility			Evaluated	ENERGY STAR QPL
kWh_{base}	Varies	kWh	Evaluated	Tracking Data, IL-TRM – Section 4.2.10
kWh_{ee}	Varies	kWh	Evaluated	Tracking Data, IL-TRM – Section 4.2.10
DC	0.57	-	Deemed	IL-TRM – Section 4.2.10
H	Varies	Lbs ice/day	Evaluated	Tracking Data
CF	0.937	-	Deemed	IL-TRM – Section 4.2.10
HOURS	8766	Hours/year	Deemed	IL-TRM – Section 4.2.10
EUL	9	Years	Mixture	IL-TRM – Section 4.2.10

*IL-TRM is the Illinois Technical Reference Manual version 9.0 from **http://www.ilsag.info/technical-reference-manual.html**.

† **https://ilsag.s3.amazonaws.com/ComEd-CFSE-NTG-research-memo-2020-12-10.pdf**

Source: Evaluation team analysis

A.6 ENERGY STAR Dishwashers

The evaluation followed the methodology provided in the IL-TRM. The evaluation team conducted research to validate the parameters that were not specified in the IL-TRM and to confirm values provided in the tracking data. Table A-6 shows the dishwasher savings parameters.

Table A-6. ENERGY STAR Dishwasher Savings Parameters

Gross Savings Input Parameters	Value	Units	Deemed or Evaluated?	Source *
Quantity	Varies	No. of measures	Evaluated	Tracking Data
NTG	0.80	%	Evaluated	Guidehouse Memo to ComEd†
Measure Type and Eligibility			Evaluated	ENERGY STAR QPL
$WaterUse_{base}$	Varies	gal	Evaluated	Tracking Data, IL-TRM – Section 4.2.6
$WaterUse_{ESTAR}$	Varies	gal	Evaluated	Tracking Data, IL-TRM – Section 4.2.6
RacksWashed	Varies	-	Deemed	IL-TRM – Section 4.2.6
Days	365.25	Days per year	Deemed	IL-TRM – Section 4.2.6
DTin	70	Inlet water temperature °F	Deemed	IL-TRM – Section 4.2.6
Eff_{Heater}	0.98	%	Deemed	IL-TRM – Section 4.2.6
$IdleDraw_{Base}$	Varies	kW	Deemed	IL-TRM – Section 4.2.6
$IdleDraw_{ESTAR}$	Varies	kW	Evaluated	Tracking data, IL-TRM – Section 4.2.6
WashTime	Varies	(min)	Deemed	IL-TRM – Section 4.2.6
CF	Varies	-	Deemed	IL-TRM – Section 4.2.6
HOURS/day	18	Hours/day	Deemed	IL-TRM – Section 4.2.6
EUL	10-20	Years	Deemed	IL-TRM – Section 4.2.6

*IL-TRM is the Illinois Technical Reference Manual version 8.0 from **http://www.ilsag.info/technical-reference-manual.html**.

† **https://ilsag.s3.amazonaws.com/ComEd-CFSE-NTG-research-memo-2020-12-10.pdf**

Source: Evaluation team analysis

A.7 ENERGY STAR Electric Convection Ovens

The evaluation followed the methodology provided in the IL-TRM. The evaluation team conducted research to validate the parameters that were not specified in the IL-TRM and to confirm values provided in the tracking data. Table A-7 shows the convection oven savings parameters.

Table A-7. ENERGY STAR Electric Convection Oven Savings Parameters

Gross Savings Input Parameters	Value	Units	Deemed or Evaluated?	Source *
Quantity	Varies	No. of measures	Evaluated	Tracking Data
NTG	0.80	%	Deemed	Guidehouse Memo to ComEd†
Measure Type and Eligibility			Evaluated	ENERGY STAR QPL
LB	100	Lb/day	Deemed	IL-TRM – Section 4.2.19
E_{FOOD}	0.0732	kWh/lb	Deemed	IL-TRM – Section 4.2.19
EFF_{base}	0.65	%	Deemed	IL-TRM – Section 4.2.19
EFF_{eff}	Varies	%	Evaluated	Tracking Data
$IDLE_{base}$	2	kW	Deemed	IL-TRM – Section 4.2.19
$IDLE_{eff}$	Varies	kW	Evaluated	Tracking Data
PC_{base}	70	Lb/hr	Deemed	IL-TRM – Section 4.2.19
PC_{eff}	79	Lb/hr	Deemed	IL-TRM – Section 4.2.19
PRE_{TIME}	15	Min/day	Deemed	IL-TRM – Section 4.2.19
$PRE_{ENERGY\ Base}$	1.5	kWh	Deemed	IL-TRM – Section 4.2.19
$PRE_{ENERGY\ Eff}$	1	kWh	Deemed	IL-TRM – Section 4.2.19
CF	Varies	-	Evaluated	Tracking Data, IL-TRM – Section 4.2.19
$HOURS_{DAY}$	Varies	Hours/day	Evaluated	Tracking Data
DAYS	Varies	Days/yr	Evaluated	Tracking Data
EUL	12	Years	Mixture	IL-TRM – Section 4.2.19

*IL-TRM is the Illinois Technical Reference Manual version 9.0 from **http://www.ilsag.info/technical-reference-manual.html**.

† **https://ilsag.s3.amazonaws.com/ComEd-CFSE-NTG-research-memo-2020-12-10.pdf**

Source: Evaluation team analysis

Appendix B. Adjusted Custom Input Parameters

The savings input values provided in the tracking data for steamer idle energy rate and water usage differed from the values listed in each measure's specifications in the ENERGY STAR QPL. Table B-1 lists the adjusted values.

Table B-1. Steamer Measures with Updated Values

Project ID	Idle Consumption Rate (kW)	Water Use (gal/hr)
160	0.33	0.92
173	0.33	0.92
181	0.33	0.92
213	0.33	0.92

Source: ComEd tracking data and evaluation team analysis

The verified savings calculations used adjusted values from the ENERGY STAR QPL, shown in Table B-2.

Table B-2. Combination Oven Measures with Updated Values

Project ID	Steam Idle Consumption Rate (kW)	Steamer Cooking Efficiency (%)	Steam Production Capacity (lbs/Hr)	Convection Idle Consumption Rate (kW)	Convection Cooking Efficiency (%)	Convection Production Capacity (lbs/Hr)	Hrs/Day	Custom Days/Year	CF
44	1.33	65%	179	1.13	79%	117	16.71	365.00	0.51
200	0.84	58%	217	0.98	82%	117	11.50	312.86	0.36
244	Varies	Varies	Varies	Varies	Varies	Varies	15.57	365.00	0.36
287	0.64	58%	103	0.70	76%	62	6.00	260.71	0.51
343	1.33	65%	179	1.13	79%	117	6.00	180.00	0.39
Deemed TRM Values	Calculated	55%	Deemed	Calculated	76%	Deemed	12	365	Varies

Source: ComEd tracking data and evaluation team analysis

Volume and energy consumption values provided in the tracking data did not always align with what was listed in the ENERGY STAR QPL for each reach-in refrigerator or freezer model number. Table B-3 contains the adjusted values.

Table B-3. Refrigerator and Freezer Measures with Updated Values

Project ID	Measure Type	Volume (cu. ft.)	Energy Consumption (kWh/day)
193	Freezer – Solid Door	43.45	8.85
190	Refrigerator – Solid Door	4.93	0.61
192	Refrigerator – Solid Door	43.26	2.57
204	Refrigerator – Solid Door	42.75	2.22
211	Refrigerator – Solid Door	20.26	1.12
275	Refrigerator – Solid Door	42.69	1.37
276	Refrigerator – Solid Door	41.57	1.95
282	Refrigerator – Solid Door	20.26	1.12
283	Refrigerator – Solid Door	43.26	2.57
290	Refrigerator – Solid Door	43.26	2.57
311	Refrigerator – Solid Door	43.26	2.57
312	Refrigerator – Solid Door	43.26	2.57
317	Refrigerator – Solid Door	20.26	1.12
342	Refrigerator – Solid Door	41.57	1.95
342	Refrigerator – Solid Door	6.18	0.75

Source: ComEd tracking data and evaluation team analysis

Table B-4 shows the adjusted and custom values used in the verified savings calculations for convection ovens.

Table B-4. Convection Oven Measures with Updated Values

Project ID	Idle Consumption Rate (kW)	Cooking Efficiency (%)	Production Capacity (lbs/Hr)	Hrs/Day	Custom Days/Year	CF
159	1.55	75.00	97.43	8.00	260.89	0.41
262	1.55	75.00	97.43	13.00	365.25	0.41
333	1.51	78.00	104.91	13.57	365.25	0.36

Source: ComEd tracking data and evaluation team analysis

Appendix C. Total Resource Cost Detail

Table C-1 shows the TRC cost-effectiveness analysis inputs available at the time of finalizing this impact evaluation report. This table does not include additional required cost data (e.g., measure costs, pilot-level incentives, and non-incentive costs). ComEd will provide this data to the evaluation team later.

Table C-1. Total Resource Cost Savings Summary

End Use Type	Research Category	Units	Quantity	EUL (years)*	ER Flag†	Gross Electric Energy Savings (kWh)	Gross Peak Demand Reduction (kW)	Gross Gas Savings (Therms)	Gross Secondary Savings due to Water Reduction (kWh)	Gross Heating Penalty (kWh)	Gross Heating Penalty (Therms)	NTG (kWh)	NTG (kW)	NTG (Therms)	Net Electric Energy Savings (kWh)	Net Peak Demand Reduction (kW)	Net Gas Savings (Therms)	Net Secondary Savings due to Water Reduction (kWh)	Net Heating Penalty (kWh)	Net Heating Penalty (Therms)
Food Service Equipment	Steamers	Each	5	12.0	NO	185,015	25.89	0	1,342	0	0	0.80	0.80	0.80	148,012	20.7	0	1,074	0	0
Food Service Equipment	Combination Ovens	Each	9	12.0	NO	53,574	5.51	0	0	0	0	0.80	0.80	0.80	42,859	4.4	0	0	0	0
Food Service Equipment	Kitchen Demand Ventilation Controls	Each	1	20.0	NO	38,487	5.27	0	0	0	0	0.80	0.80	0.80	30,789	4.2	0	0	0	0
Food Service Equipment	Dishwashers	Each	8	16.4	NO	25,106	2.68	0	809	0	0	0.80	0.80	0.80	20,085	2.1	0	648	0	0
Food Service Equipment	Freezers	Each	20	12.0	NO	16,705	1.79	0	0	0	0	0.80	0.80	0.80	13,364	1.4	0	0	0	0
Food Service Equipment	Refrigerators	Each	29	12.0	NO	13,101	1.40	0	0	0	0	0.80	0.80	0.80	10,481	1.1	0	0	0	0
Food Service Equipment	Ice Machines	Each	15	9.0	NO	9,313	1.75	0	0	0	0	0.80	0.80	0.80	7,451	1.4	0	0	0	0
Food Service Equipment	Convection Ovens	Each	3	12.0	NO	6,200	0.62	0	0	0	0	0.80	0.80	0.80	4,960	0.5	0	0	0	0
	Total			**13.1**		**347,501**	**44.9**	**0**	**2,151**	**0**	**0**				**278,001**	**35.9**	**0**	**1,721**	**0**	**0**

Note: To avoid double counting, the verified gross kWh and net kWh used in the TRC analysis exclude secondary energy savings from water reduction measures.
* The total of the EUL column is the WAML and is calculated as the sum product of EUL and measure savings divided by total pilot savings.
† Early replacement (ER) measures are flagged as YES, otherwise a NO is indicated in the column.
Source: ComEd tracking data and evaluation team analysis