



ComEd

Fridge & Freezer Recycling Program Evaluation Report

FINAL

**Energy Efficiency / Demand Response Plan:
Plan Year 8 (PY8)
(6/1/2015-5/31/2016)**

**Presented to
Commonwealth Edison Company**

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Prepared by:

Jennifer Fagan
Jeremy Eddy
Caroline Binkley
Itron



www.navigant.com

Submitted to:

ComEd
Three Lincoln Centre
Oakbrook Terrace, IL 60181

Submitted by:

Navigant
30 S. Wacker Drive, Suite 3100
Chicago, IL 60606

Contact:

Randy Gunn, Managing Director
312.583.5714
Randy.Gunn@Navigant.com

Jeff Erickson, Director
608.497.2322
Jeff.Erickson@Navigant.com

Patricia Plympton, Associate Dir.
202.481.7397
Patricia.Plympton@Navigant.com

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TABLE OF CONTENTS

E. Executive Summary	1
E.1. Program Savings.....	1
E.2. Program Savings by Measure Type.....	1
E.3. Program Savings by Implementation Firm.....	2
E.4. Impact Estimate Parameters for Future Use.....	2
E.5. Program Volumetric Detail.....	2
E.6. Results Summary.....	3
E.7. Findings and Recommendations.....	4
1. Introduction	6
1.1 Program Description.....	6
1.2 Evaluation Objectives.....	6
1.2.1 Impact Questions.....	6
2. Evaluation Approach	7
2.1 Overview of Data Collection Activities.....	7
2.2 Verified Savings Parameters.....	7
2.2.1 Refrigerator and Freezer Energy Savings.....	8
2.2.2 Refrigerator and Freezer Summer Coincident Peak Demand Savings.....	9
2.2.3 Room Air Conditioner Energy Savings.....	9
2.2.4 Room Air Conditioner Summer Coincident Peak Demand Savings.....	10
2.2.5 Content.....	10
2.2.6 Verified Gross Program Savings Analysis Approach.....	10
2.2.7 Verified Net Program Savings Analysis Approach.....	11
2.3 Process Evaluation.....	11
3. Gross Impact Evaluation	12
3.1 Tracking System Review.....	12
3.2 Program Volumetric Findings.....	12
3.3 Gross Program Impact Parameter Estimates.....	13
3.4 Verified Gross Program Impact Results.....	14
4. Net Impact Evaluation	16
5. Process Evaluation	19
6. Findings and Recommendations	20

LIST OF TABLES AND FIGURES

Figure 3-1. Number Of Measures Installed by Type	13
Table E-1. PY8 Total Program Electric Savings	1
Table E-2. PY8 Program Results by Measure Type	2
Table E-3. Program Activity Breakdown by Implementation Firm	2
Table E-4. PY8 Volumetric Findings Detail	3
Table E-5. PY8 Results Summary	3
Table 2-1. Primary Data Collection Activities	7
Table 2-2. Additional Resources	7
Table 2-3. Energy Savings for Refrigerators	8
Table 2-4. Energy Savings for Freezers	8
Table 2-5. Verified Savings Parameter Data Sources	10
Table 3-1. PY8 Volumetric Findings Detail	13
Table 3-2. Verified Gross Savings Parameters	14
Table 3-3. PY8 Verified Gross Impact Savings Estimates by Measure Type	15
Table 3-4. Program Activity Breakdown by Implementation Firm	15
Table 4-1. Calculation of Weighted Average NTG Values based on PY6 Results	16
Table 4-2. PY8 Verified Net Impact Savings Estimates by Measure Type	17
Table 4-3. Program Activity Breakdown by Contractor	18

E. EXECUTIVE SUMMARY

This report presents a summary of the findings and results from the evaluation of the PY8¹ Fridge & Freezer Recycling (FFR) program. The FFR program is designed to achieve energy savings through the retirement and recycling of older, inefficient refrigerators, freezers, and room air conditioners (A/Cs). The primary objectives of the program are to decrease the retention of high energy-use refrigerators and freezers and to deliver long-term energy savings. A secondary objective is to dispose of these older units in an environmentally safe manner.

During PY8, the program experienced some significant changes. The program implementer, JACO, shuttered its business in late November 2015, and the program suspended operation. A new implementer, Reclim, was hired and the program resumed operation in April 2016. Further, the largest of the three participating retailers is no longer participating in the program starting in PY8, in an effort by ComEd to reduce free ridership and increase program influence.

E.1. Program Savings

Table E-1 summarizes the electricity savings from the PY8 Fridge & Freezer Recycling program. The verified ex post gross savings and ex ante gross savings estimates are nearly identical. Any differences between the ex ante and verified ex post gross savings estimates are solely due to minor corrections in the tracking data. Both the evaluation team and program implementers used the same procedures to quantify savings - both sets of values were computed using the regression specified in the Illinois Technical Reference Manual Version 4.0 (TRM v4.0).² In addition, since a phone survey was not done this year, both verified gross savings and reported savings use the proportion of appliances located in conditioned space based on documentation of space conditioning in the program tracking data.

Table E-1. PY8 Total Program Electric Savings

Savings Category	Energy Savings (MWh)	Demand Savings (MW)	Peak Demand Savings (MW)
Ex Ante Gross Savings	26,029	2.61	2.61
Verified Gross Savings	26,185	2.63	2.63
Verified Net Savings	14,221	1.42	1.42

Source: ComEd tracking data and Navigant team analysis.

E.2. Program Savings by Measure Type

The table below includes program savings by measure type.

¹ The PY8 program year began June 1, 2015 and ended May 31, 2016.

² Illinois Statewide Technical Reference Manual for Energy Efficiency Version 4.0, available at: <http://www.ilsag.info/technical-reference-manual.html>

Table E-2. PY8 Program Results by Measure Type

Savings Category	Refrigerators	Freezers	Room A/Cs
Ex Ante Gross Savings (MWh)	22,135	3,766	127
Ex Ante Gross Peak Demand Reduction (MW)	2.16	0.28	0.18
Deemed Part-Use Factor	0.79	0.79	1.00
Verified Gross Savings (MWh)	22,292	3,766	127
Verified Gross Peak Demand Reduction (MW)	2.17	0.28	0.18
Verified Gross Realization Rate	1.01	1.00	1.00
Deemed Net to Gross Ratio (NTGR) †	0.58	0.57	0.50
Program Induced Replacement (PIR)‡	-0.04	-0.01	0.00
Final Net to Gross Ratio (NTGR and PIR)‡	0.54	0.56	0.50
Verified Net Savings (MWh)	12,060	2,098	64
Verified Net Demand Reduction (MW)	1.18	0.15	0.09

Source: ComEd tracking data and Navigant team analysis.

† A deemed value. Source: ComEd_NTG_History_and_PY8_Recommendation_2016-02-26_Final_EMV_Recommendations.xlsx which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>

‡ Based on evaluation research findings.

E.3. Program Savings by Implementation Firm

The FFR program’s implementation firm, JACO, suspended operation in late November 2015, and during April 2016, the program resumed operation under a second contractor, Recleim. Table E-3 below summarizes total program activity by each of these contractors, both in terms of the volume of units they collected and recycled, and the associated energy savings.

Table E-3. Program Activity Breakdown by Implementation Firm

Contractor	Total Units Recycled	Ex Ante Gross Savings (kWh)	Ex-Ante Gross Demand Reduction (kW)	Verified Gross Savings (kWh)	Verified Gross Demand Reduction (kW)	Verified Gross kWh Realization Rate	NTGR	Verified Net Savings (kWh)	Verified Net Demand Reduction (kW)
JACO	26,291	21,408	2.14	21,532	2.15	101%	0.54	11,692	1.17
Recleim	5,510	4,621	0.47	4,653	0.48	101%	0.54	2,529	0.26
Total	31,801	26,029	2.61	26,185	2.63	101%	0.54	14,221	1.43

Source: Evaluation team analysis

E.4. Impact Estimate Parameters for Future Use

The PY8 FFR program evaluation did not conduct evaluation research on deemed parameters, and, thus, there are no parameter updates to report.

E.5. Program Volumetric Detail

According to program tracking data, there were 28,599 participants in PY7 contributing a total of 31,801 recycled measures to the program. These volumes are down approximately 25 percent from PY7, where the program recycled a total of 40,946 units, which were contributed by 38,239 participants. The reduced volume is a direct result of the program’s suspension during four months of the program year.

Table E-4. PY8 Volumetric Findings Detail

Participation	Program-Reported Number of Units	Verification Factor	Verified Participation Units	% of Total Units
Number of Participants	28,599	100%	28,599	NA
Units by Measure Type				
Refrigerators (includes Small Units)	26,947	100%	26,947	85%
Freezers	4,311	100%	4,311	13%
Room ACs	543	100%	543	2%
Total Measures	31,801	100%	31,801	100%

Source: ComEd tracking data and Navigant team analysis.

E.6. Results Summary

The following table summarizes results from the PY8 FFR program.

Table E-5. PY8 Results Summary

Participation	Units	PY8
Verified Net Savings	MWh	14,221
Verified Net Demand Reduction	MW	1.42
Verified Gross Savings	MWh	26,185
Verified Gross Demand Reduction	MW	2.63
Program Realization Rate (Gross)	%	101
Deemed Net to Gross Ratio (NTGR) †	#	Refrigerators 0.58
	#	Freezers 0.57
	#	Room A/C 0.50
Program Induced Replacement (PIR) ‡	#	Refrigerators (0.039)
	#	Freezers (0.013)
	#	Room A/C (0.00)
Final Net to Gross Ratio (NTGR and PIR) †	#	Total Program 0.54
	#	Refrigerators 0.54
	#	Freezers 0.56
	#	Room A/C 0.50
Refrigerators (Includes Small Units)	#	26,947
Freezers	#	4,311
AC Units	#	543
Unique customer participants	#	28,599

Source: ComEd tracking data and Navigant team analysis.

† A deemed value. Source: ComEd_NTG_History_and_PY8_Recommendation_2016-02-26_Final_EMV_Recommendations.xlsx, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>

E.7. Findings and Recommendations

Despite being suspended for approximately four months of the program year, the FFR program continues to recycle a high volume of units and provides a reliable source of savings for ComEd.³

Verified Gross Impacts and Realization Rate

Finding 1. The PY8 program ex ante and evaluation-verified ex post gross energy savings were nearly identical. The ex ante gross savings was 26,029 MWh, while evaluation-verified gross savings was 26,185 MWh. Evaluation-verified net savings was 14,221 MWh. Gross peak demand savings was 2.63 MW and net savings was 1.42 MW.

Finding 2. The program gross realization rate is the difference between ex ante gross savings (kWh) and verified gross savings. Given that ex ante and ex post gross savings are nearly the same, the resulting evaluation-verified gross realization rate is 101 percent. Any differences between the ex ante and verified ex post gross savings estimates are solely due to minor corrections in the tracking data. Both the evaluation team and program implementers used the same procedures to quantify savings - both sets of values were computed using the regression specified in the TRM.

Tracking Data Quality

Finding 3. The tracking data is high quality and is generally sufficient to estimate program savings accurately under the current TRM regression specifications. The problems that surfaced were relatively insignificant. A total of 3,000 JACO records excluded the unit's prior location. In addition, for Reclaim data, a total of 11 PY8 small units (SU) are included in the data set. Small units are not targeted by the program. Further, Reclaim data included 98 businesses. While the program does not target business customers, they are allowed to participate if they request an appointment. This has been a long-standing policy. Many small business customers are similar to residential customers in terms of energy use. Additional details are included in Section 3.1.

Program Volumetric Findings

Finding 4. According to program tracking data, there were 28,599 participants in PY7 contributing a total of 31,801 recycled measures to the program. These volumes are down approximately 25 percent from PY7, where the program recycled a total of 40,946 units, which were contributed by 38,239 participants. While the volume of PY8 activity and savings was down from PY7, the key reason for it is unrelated to the effectiveness of program delivery. The decline in volumes is associated with the program not operating during one-third of the program year and its transition to a new implementation firm. The breakdown of units collected by the program was 85 percent refrigerators, 14 percent freezers, and 2 percent room air conditioners. This breakdown is almost identical to the proportions in PY5, PY6, and PY7. Additional details are included in Section 3.2.

Verified Net Impacts

Finding 5. The evaluation re-computed the net-to-gross ratio (NTGR) using deemed values as determined through the SAG process to reflect the fact that ComEd removed one vendor from participation in PY8. The re-computed NTGR found in this evaluation is 0.54 for the total program. It is based on a refrigerator NTGR of 0.54 (based on a weighted average of a customer NTGR of 0.77 and a retailer NTGR of 0.29, and net of a PIR factor of 0.039), a freezer NTGR of 0.56 (based on a weighted average of a customer NTGR of 0.58 and a retailer NTGR of 0.30, and net of a PIR factor of 0.013) and a room A/C NTGR of 0.50. It also includes a term for Program Induced Replacements (PIR), per the TRM. Because a larger

³ The numbering on findings and recommendations in this section is the same as in the Findings and Recommendations section of the evaluation report for ease of reference between each section.

proportion of refrigerator participants said they would have their dealer remove the old unit (39 percent) than freezer participants (3 percent), the retailer NTGR plays a correspondingly larger role driving the final refrigerator NTGR.

Finding 6. In an effort by ComEd to reduce free ridership and improve program influence, ComEd did not extend an offer to the largest of the three participating retailers (Vendor #1) to participate in the program starting in PY8. This single action has increased the NTGR for refrigerators by 5 percentage points.

Recommendation 1. Commendably, ComEd has taken a major step to reduce free ridership in this program by removing a major participating retailer from the program. Theoretically, free ridership could be reduced further by limiting eligibility to those customers who have true secondary units (i.e., those in basements and garages). This would mean that customers who are replacing existing primary units would be ineligible, including those who are remodeling kitchens or simply upgrading to a more modern unit. However, restricting participation in this manner would sharply reduce participation, and therefore, would introduce a considerable trade-off to the program. This option should be carefully considered to assess whether the benefit of reduced free ridership is worth the cost of significantly reduced participation.

1. INTRODUCTION

1.1 Program Description

The Fridge & Freezer Recycling (FFR) program is designed to achieve energy savings through the retirement and recycling of older, inefficient refrigerators, freezers, and room air conditioners (A/Cs). The primary objectives of the program are to decrease the retention of high energy-use refrigerators and freezers and deliver long-term energy savings. A secondary objective is to dispose of these older refrigerators and freezers in an environmentally safe manner. The implementation contractor was JACO Environmental until late 2015, when it shuttered its business and the program operation was suspended. In April 2016, a new implementer, Reclim, was hired and the program resumed operation.

1.2 Evaluation Objectives

The evaluation team identified the following key researchable questions for PY8.

1.2.1 Impact Questions

1. What are the gross impacts from this program?
2. What are the net impacts from this program? What is the level of free ridership with this program?
3. Did the program meet its energy and demand goals? If not, why not?

2. EVALUATION APPROACH

Given the program’s suspension during approximately one-third of the program year, the PY8 evaluation scope was limited to verifying the gross savings from the program using the regression framework and part-use factors specified in the Illinois TRM v4.0, and the SAG-approved net-to-gross values from the PY6 evaluation. A phone survey was not conducted.

2.1 Overview of Data Collection Activities

For the PY8 evaluation, aside from program manager interviews, there was no primary data collection.

Table 2-1. Primary Data Collection Activities

What	Who	Target Completes	Completes Achieved	When
Program Tracking Database	Participants			
In Depth Interviews	Program Manager/Implementer Staff	1	1	July 2016

Table 2-2. Additional Resources

Reference Source	Author	Gross Impacts
Illinois Technical Reference Manual	VEIC	X

2.2 Verified Savings Parameters

The PY8 ex ante and evaluation verified gross energy savings were calculated directly using procedures specified in the Illinois Technical Reference Manual (TRM) version 4.0.⁴ These procedures call for energy savings to be computed using the regression equations specified below. These were revised from TRM version 3.0 to eliminate the single-door variable and resulting negative savings associated with very small single door units. Note that all of the factors in the regression equations below are derived from pooled data from metering studies conducted by several Midwestern utilities, including one done by ComEd in PY4.

Since the PY8 evaluation is limited to verifying savings estimates using procedures and assumptions specified in the Illinois TRM v. 4.0 and the SAG-approved net-to-gross values from the PY6 evaluation, there are no future applications of the resulting data.

The final TRM version 4.0 regression specifications for refrigerators, freezers, and room air conditioners, respectively are below:

⁴ Source: <http://www.ilsag.info/technical-reference-manual.html>

2.2.1 Refrigerator and Freezer Energy Savings

Table 2-3. Energy Savings for Refrigerators

Independent Variable	Coefficient	Source
Intercept	83.324	TRMv.4.0
Age (years)	3.678	TRMv.4.0
Pre-1990	485.037	TRMv.4.0
Size (Cubic Feet)	27.149	TRMv.4.0
Side-by-side	406.779	TRMv.4.0
Primary Unit	161.857	TRMv.4.0
Unconditioned Space X CDD	15.366	TRMv.4.0
Unconditioned Space X HDD	-11.067	TRMv.4.0
Part Use Factor	0.79	PY6 evaluation

$$\Delta kWh = [83.32 + (Age * 3.68) + (Pre-1990 * 485.04) + (Size * 27.15) + (Side-by-side * 406.78) + (Proportion of Primary Appliances * 161.86) + (CDD/365.25 * unconditioned * 15.37) + (HDD/365.25 * unconditioned * -11.07)] * Part Use Factor$$

Where:

Age = Age of retired unit

Pre-1990 = Pre-1990 dummy (=1 if manufactured pre-1990, else 0)

Size = Capacity (cubic feet) of retired unit

Side-by-side = Side-by-side dummy (= 1 if side-by-side, else 0)

Single-Door = Single-Door dummy (= 1 if Single-Door, else 0)

Primary Usage = Primary Usage Type (in absence of the program) dummy (= 1 if Primary, else 0)

Interaction: Located in Unconditioned Space x CDD/365.25 (=1 * CDD/365.25 if in unconditioned space)

CDD = Cooling Degree Days⁵

Interaction: Located in Unconditioned Space x HDD/365.25 (=1 * HDD/365.25 if in unconditioned space)

HDD = Heating Degree Days⁶

Part Use Factor = To account for those units that are not running throughout the entire year.

Table 2-4. Energy Savings for Freezers

Independent Variable	Coefficient	Source
Intercept	132.12	TRM v. 4.0
Age (years)	12.13	TRM v. 4.0
Pre-1990	156.18	TRM v. 4.0
Size (cubic feet)	31.84	TRM v. 4.0
Chest	-19.71	TRM v. 4.0
Unconditioned Space X CDD	-12.76	TRM v. 4.0
Unconditioned Space X HDD	9.78	TRM v. 4.0
Part-use factor	0.79	PY6 evaluation

⁵ Dependent on geographic location.

⁶ Dependent on geographic location.

$$\Delta kWh = [132.12 + (Age * 12.13) + (Pre-1990 * 156.18) + (Size * 31.84) + (Chest * -19.71) + (CDDs * unconditioned * -12.76) + (HDDs * unconditioned * 9.78)] * Part Use Factor$$

Total kWh saved = $\Delta kWh * \text{Number of Units} * \text{Installation Rate}$

Where:

- Age = Age of retired unit
- Pre-1990 = Pre-1990 dummy (=1 if manufactured pre-1990, else 0)
- Size = Capacity (cubic feet) of retired unit
- Side-by-side = Side-by-side dummy (= 1 if side-by-side, else 0)
- Single-Door = Single-Door dummy (= 1 if Single-Door, else 0)
- Chest = Chest freezer dummy (=1 if chest freezer, else 0)
- Primary Usage = Primary Usage Type (in absence of the program) dummy (= 1 if Primary, else 0)
- Interaction: Located in Unconditioned Space x CDDs = Proportion of units in unconditioned spaces interacted with CDDs
- Interaction: Located in Unconditioned Space x HDDs = Proportion of units in unconditioned spaces interacted with HDDs
- Part Use Factor = To account for those units that are not running throughout the entire year.

After energy savings based on full load hours have been computed, a part-use factor is then applied. This factor is based on the value from the most recent part-use factor participant survey results available at the start of the PY8 program year, in this case, the PY6 evaluation.

2.2.2 Refrigerator and Freezer Summer Coincident Peak Demand Savings

$$\Delta kW = kWh/8760 * CF$$

Where:

- kWh = Savings provided in algorithm above
- CF = Coincident factor defined as summer kW/average kW
- = 1.081 for Refrigerators
- = 1.028 for Freezers

2.2.3 Room Air Conditioner Energy Savings

Room AC gross energy savings will be estimated using the algorithm specified in TRM version 4.0 and shown below.

$$\Delta kWh = ((FLH_{RoomAC} * BtuH * (1/EER_{exist}))/1000)$$

Where:

- FLH_{RoomAC} = Full Load Hours of room air conditioning unit
- = dependent on location, see below

Climate Zone (City based upon)	FLH _{RoomAC}
1 (Rockford)	220
2 (Chicago)	210
3 (Springfield)	319
4 (Belleville)	428
5 (Marion)	374
Weighted Average	248

BtuH = unit capacity [BTU/h] is a nameplate value
 = Size of retired unit
 = Actual. If unknown assume 8500 Btu/hr

EER_{exist} = unit efficiency [EER] of the recycled unit
 = Efficiency of existing unit
 = 7.7

2.2.4 Room Air Conditioner Summer Coincident Peak Demand Savings

Room AC gross summer coincident peak demand (kW) savings is estimated using the algorithm specified in TRM version 4.0 and shown below.

$$\Delta kW = (BtuH * 1/EER_{exist})/1000 * CF$$

Where:

CF = Summer Peak Coincidence Factor for measure
 = 0.3

2.2.5 Content

For the PY8 evaluation, the program tracking database and the TRM version 4.0 provide all the inputs needed to calculate verified gross savings. The source of the part-use factor is the PY6 evaluation.

Table 2-5. Verified Savings Parameter Data Sources

Gross Savings Input Parameters	Data Source	Deemed † or Evaluated?
Unit Energy Consumption	IL TRM v 4.0	Deemed
Unit Energy Demand	IL TRM v 4.0	Deemed
Net-to-gross ratio	Illinois Stakeholder Advisory Group (SAG)† PY6 Participant surveys	Deemed (SAG consensus) Deemed (Program Induced Replacement Factor)
Part-Use Factor	PY6 Participant surveys	Deemed
Verification Factor	N/A	Deemed at 1.0

Source: Evaluation team

† A deemed value. Source: ComEd_NTG_History_and_PY8_Recommendation_2016-02-26_Final_EMV_Recommendations.xlsx, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>

2.2.6 Verified Gross Program Savings Analysis Approach

Savings estimates were developed for the full population of units collected in PY8 to estimate PY8 Unit Energy Consumption (UECs). The ex post savings estimates of energy (kWh) savings rely on regression equations as specified in the TRM version 4.0. Gross energy savings are expressed in terms of full-year

UECs. UEC estimates were made using a regression-based approach that models full-year energy savings as a function of unit characteristics (i.e., age, size, configuration, defrost mode, and unit location prior to being recycled).

Gross peak demand (kW) savings were also calculated according to the algorithm specified in the TRM version 4.0. The coincidence factors in the TRM version 4.0 were calculated using the regression equations to predict consumption on summer peak days.

Both energy (kWh) and peak demand (kW) savings estimates were made based on the characteristics of the population of units collected by the program during PY8. In addition, gross energy savings estimates were adjusted for part-use, by applying part-use factors from the PY6 evaluation.

2.2.7 Verified Net Program Savings Analysis Approach

Verified net energy and demand (coincident peak and overall) savings were calculated by multiplying the verified gross savings estimates by a net-to-gross ratio (NTGR). In PY8, the NTGR estimates used to calculate the net verified savings were based on past evaluation research and approved through the Illinois Stakeholder Advisory Group consensus process.⁷ With regard to the NTG ratio, there were two issues with direct application of the PY8 SAG approved values (based on the PY6 evaluation results):

1. None of the NTGR values in the SAG spreadsheet include the Program-Induced Replacement factor, required by the TRM.
2. A change to the program in PY8 required re-calculation of the weighted average NTGRs for refrigerators and freezers using the SAG approved values that exclude Vendor #1. This is because Vendor #1 is no longer participating in the program starting in PY8.

After correcting for these issues, the final NTGRs for refrigerators and freezers were recomputed and applied to gross savings.

2.3 Process Evaluation

The PY8 Fridge & Freezer Recycling program evaluation did not include a process evaluation.

⁷ A deemed value. Source: ComEd_NTG_History_and_PY8_Recommendation_2016-02-26_Final_EMV_Recommendations.xlsx, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>

3. GROSS IMPACT EVALUATION

The PY8 program recycled nearly 32,000 units and achieved verified savings of 25,185 Gross MWh and 14,221 Net MWh. These volumes are down approximately 25 percent from PY7 and this can be attributed to the suspension period when the program was shut down. The PY8 verified gross MWh savings is 101 percent of PY7 verified gross MWh savings.

3.1 Tracking System Review

A detailed review by the evaluation team of both sets of tracking system data, for JACO and Reclim, surfaced some minor issues that should be addressed going forward.

Key findings are:

1. The tracking data is high quality and is generally sufficient to estimate program savings accurately under the current TRM regression specifications.
2. Problems surfaced were relatively insignificant.
 - a. For JACO data:
 - i. Prior location, unit usage, unit season, and unit replaced are missing in approximately 3,000 records mostly due to the retail partners not collecting those data elements. *This has been a recurring problem, but fortunately, the volume of units affected is down significantly from PY7 when more than 9,000 units were missing this information.*
 - b. For Reclim data:
 - i. A total of 11 PY8 small units (SU) are included in the data set. SUs are units under 10 cubic feet. Of these, 3 units are shown as having a size of zero cu ft. *Although small units are not targeted by the program, if the crew encounters a small unit at the time of pickup, there has been a long-standing policy to offer a courtesy pickup to the customer if the crew encounters a small unit at the time of pickup. The customer does not receive an incentive in these cases, but is assured that the unit will be properly recycled. It should be noted that small units cannot be scheduled for pickup.*
 - ii. Ninety-eight records are Business customers and represent a variety of building/business types including multifamily buildings, schools, churches, and other retail businesses. *While the program does not target business customers, they are allowed to participate if they request an appointment. This has been a long-standing policy. Many small business customers are similar to residential customers in terms of energy use.*

3.2 Program Volumetric Findings

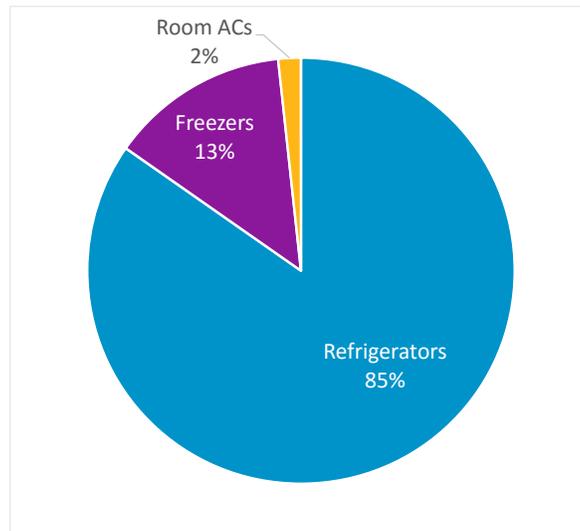
According to program tracking data, the program had 28,599 participants, contributing a total of 31,801 units to the program. A verification rate of 100 percent was assumed for each appliance type, since a phone survey was not completed this year. The volume of units processed through the program is down significantly from PY7, when 40,946 units were verified as being recycled through the program; however, all of this decline is associated with the program's implementation contractor transition between late November 2015 and April 2016. The breakdown of units is 85 percent refrigerators, 14 percent freezers, and 2 percent room air conditioners, which is a similar proportion from previous years.

Table 3-1. PY8 Volumetric Findings Detail

Participation	Program-Reported Number of Units	Verification Factor	Verified Participation Units	% of Total Units
Number of Participants	28,599	100%	28,599	
Units by Measure Type				
Refrigerators (includes Small Units)	26,947	100%		85%
Freezers	4,311	100%		13%
Room ACs	543	100%		2%
Total Measures	31,801	100%	31,801	100%

Source: ComEd tracking data and Navigant team analysis.

Figure 3-1. Number Of Measures Installed by Type



Source: Evaluation Analysis

3.3 Gross Program Impact Parameter Estimates

As described in Section 2, energy and demand savings for refrigerators and freezers are estimated using a detailed set of regression equations specified in the TRM. In addition, the TRM procedure includes a separate formula for developing engineering-based estimates of room A/C savings.

For the parameters not specified in the TRM, findings from the PY6 evaluation were used. These findings include the part-use factor. In addition, a 100 percent verification rate was assumed since surveys were not conducted this year.

Table 3-2. Verified Gross Savings Parameters

Gross Savings Input Parameters	Data Source	Deemed † or Evaluated?
Unit Energy Consumption	IL TRM v 4.0	Deemed
Unit Energy Demand	IL TRM v 4.0	Deemed
Net-to-gross ratio	Illinois Stakeholder Advisory Group (SAG)† PY6 Participant surveys	Deemed (SAG consensus) Deemed (Program Induced Replacement Factor)
Part-Use Factor	PY6 Participant surveys	Deemed
Verification Factor	N/A	Deemed at 1.0

Source: Evaluation team

† A deemed value. Source: ComEd_NTG_History_and_PY8_Recommendation_2016-02-26_Final_EMV_Recommendations.xlsx, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>

3.4 Verified Gross Program Impact Results

The resulting total program verified gross savings is 26,185 MWh and 2.63 MW as shown in Table 3-3. The table presents savings at the measure group level. Verified gross savings excluding the part-use factor, are virtually identical to ex ante gross savings. Any differences between the ex ante and verified ex post gross savings estimates are solely due to minor corrections in the tracking data. Both the evaluation team and program implementers used the same procedures to quantify savings - both sets of values were computed using the regression specified in the TRM. In addition, since a phone survey was not done this year, both verified gross savings and reported savings use the proportion of appliances located in conditioned space based on documentation of space conditioning in the program tracking data.

Final verified gross savings include the part-use factor since it is an element of the gross savings calculation. Gross realization rates based on savings adjusted for the part-use factor are shown in Table 3-3 below.

Table 3-3. PY8 Verified Gross Impact Savings Estimates by Measure Type

	Gross Energy Savings (MWh)	Gross Peak Demand Savings (MW)
Refrigerators		
Verification Factor	100%	100%
Gross Realization Rate based on savings including Part-Use Factor	101%	101%
Part Use Factor	0.79	0.79
Verified Gross Savings	22,292	2.17
Freezers		
Verification Factor	100%	100%
Gross Realization Rate based on savings including Part-Use Factor	100%	100%
Part Use Factor	0.79	0.79
Verified Gross Savings	3,766	0.28
Room ACs		
Verification Factor	100%	100%
Gross Realization Rate	100%	100%
Part Use Factor	1.00	1.00
Verified Gross Savings	127	0.18
Total		
Ex ante PY7 Gross Savings	26,029	2.61
Verified Gross Realization Rate	101%	101%
Gross Realization Rate based on savings including Part-Use Factor	101%	101%
Verified Gross Savings	26,185	2.63

Source: ComEd tracking data and Navigant team analysis.

†NA when the TRM determines the gross savings.

The FFR program’s implementation firm, JACO, suspended operation in late November 2015, and during April 2016, the program resumed operation under a second contractor, Recleim. Table 3-4 below summarizes total program activity by each of these contractors, both in terms of the volume of units they collected and recycled, and the associated energy savings.

Table 3-4. Program Activity Breakdown by Implementation Firm

Contractor	Total Units Recycled	Ex Ante Gross Savings (kWh)	Ex-Ante Gross Demand Reduction (kW)	Verified Gross Savings (kWh)	Verified Gross Demand Reduction (kW)	Verified Gross kWh Realization Rate	NTGR	Verified Net Savings (kWh)	Verified Net Demand Reduction (kW)
JACO	26,291	21,408	2.14	21,532	2.15	101%	0.54	11,692	1.17
Recleim	5,510	4,621	0.47	4,653	0.48	101%	0.54	2,529	0.26
Total	31,801	26,029	2.61	26,185	2.63	101%	0.54	14,221	1.43

Source: Evaluation team analysis

4. NET IMPACT EVALUATION

The SAG determined⁸ that the NTG values for this program should be deemed prospectively and used to calculate verified net savings. The table below shows the deemed NTG values and the PY8 verified net savings.

The SAG consensus process determined that the NTG values for each of the measures recycled through this program should be deemed prospectively and used to calculate verified net savings. The TRM, Version 4.0 procedure for Refrigerator and Freezer Recycling that was adopted subsequent to this determination requires that the NTG value also include a term for Program Induced Replacements (PIR)⁹. These are replacements of refrigerators or freezers that are directly attributable to the incentive provided by the program.

Thus, the NTG ratio is calculated from three elements: the free ridership values, spillover values and the PIR. All three elements were calculated from findings from the PY6 evaluation.

In addition to incorporating the PIR into the NTG value, the free ridership component of the PIR also needed to be re-computed using the SAG approved values that exclude Vendor #1.¹⁰ This was necessary because Vendor #1 was eliminated from participation in the program starting in PY8.

The final NTGRs for refrigerators and freezers, are based on the values in the SAG table excluding Vendor #1 and on other PY6 research, are shown in Table 4-1 below.

Table 4-1. Calculation of Weighted Average NTG Values based on PY6 Results

Appliance Type		NTGR	Weight	Weighted NTGR by component
Refrigerators	Retailer component	0.29	39%	0.11
	Nonretailer component	0.77	61%	0.47
	<i>NTGR excluding PIR</i>			0.58
	PIR			-0.039
	<i>NTGR including PIR</i>			0.54
Freezers	Retailer component	0.30	3%	0.01
	Nonretailer component	0.58	97%	0.56
	<i>NTGR excluding PIR</i>			0.57
	PIR			-0.013
	<i>NTGR including PIR</i>			0.56

Source: ComEd tracking data and Navigant team analysis.

⁸ Source: A deemed value. Source: ComEd_NTG_History_and_PY8_Recommendation_2016-02-26_Final_EMV_Recommendations.xlsx, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>

⁹ The PIR factor is calculated across all units, not just those that were replaced. This makes the value lower (i.e., less negative) than if it were if it were based only on the replaced units.

¹⁰ Note that the weighted average NTGRs in the SAG spreadsheet for refrigerators (row 29) and freezers (row 30) include Vendor #1. These are relevant to the PY6 program, but no longer apply to the PY8 program, since it excludes Vendor #1.

Table 4-2. PY8 Verified Net Impact Savings Estimates by Measure Type

	Energy Savings (MWh)	Coincident Peak Demand Savings (MW)
Refrigerators		
Verification Factor	100%	100%
Gross Realization Rate including part use factor	101%	101%
Verified Gross Savings	22,292	2.17
Part Use Factor	0.79	0.79
Free Ridership + PIR factor	0.46	0.46
Spillover	0.00	0.00
NTG	0.54	0.54
Verified Net Savings	12,060	1.18
Freezers		
Verification Factor	100%	100%
Gross Realization Rate including part use factor	100%	100%
Verified Gross Savings	3,766	0.28
Part Use Factor	0.79	0.79
Free Ridership + PIR factor	0.44	0.44
Spillover	0.00	0.00
NTG	0.56	0.56
Verified Net Savings	2,098	0.15
Room ACs		
Verification Factor	100%	100%
Gross Realization Rate	100%	100%
Verified Gross Savings	127	0.18
Part Use Factor	1.00	1.00
Free Ridership	0.50	0.50
Spillover	0.00	0.00
NTG	0.50	0.50
Verified Net Savings	64	0.09
Total		
Ex ante Gross Savings	26,029	2.61
Verification Factor	100%	100%
Gross Realization Rate including part use factor	101%	101%
Verified Gross Savings	26,185	2.63
Part Use Factor	0.79	0.79
Free Ridership + PIR factor	0.46	0.46
Spillover	0.00	0.00
NTG	0.54	0.54
Verified Net Savings	14,221	1.42

Source: ComEd tracking data and Navigant team analysis.

The FFR program’s implementation contractor, JACO, suspended operation in late 2015. During April 2016, a second contractor, Reclim, was hired and the program resumed operation. Table 4-3 below summarizes total program activity by each of these contractors, both in terms of the volume of units they collected and recycled, and the associated energy savings.

Table 4-3. Program Activity Breakdown by Contractor

Contractor	Total Units Recycled	Ex Ante Gross Savings (kWh)	Ex Ante Gross Demand Reduction (kW)	Verified Gross Savings (kWh)	Verified Gross Demand Reduction (kW)	Verified Gross kWh Realization Rate	NTGR†,††	Verified Net Savings (kWh)	Verified Net Demand Reduction (kW)
JACO	26,291	21,408	2.14	21,532	2.15	101%	0.54	11,692	1.17
Reclim	5,510	4,621	0.47	4,653	0.48	101%	0.54	2,529	0.26
Total	31,801	26,029	2.61	26,185	2.63	101%	0.54	14,221	1.42*

Source: Evaluation team analysis

*Column total doesn't add up due to rounding.

†A deemed value. Source: ComEd_NTG_History_and_PY8_Recommendation_2016-02-26_Final_EMV_Recommendations.xlsx, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>

†† The NTGRs include the effect of the Program-Induced Replacement (PIR) factor, while the SAG-approved values exclude it.

5. PROCESS EVALUATION

The PY8 Fridge & Freezer Recycling program evaluation did not include a process evaluation.

6. FINDINGS AND RECOMMENDATIONS

Despite being suspended for approximately four months of the program year, the FFR program continues to recycle a high volume of units and provides a reliable source of savings for ComEd.

Verified Gross Impacts and Realization Rate

Finding 1. The PY8 program ex ante and evaluation-verified ex post gross energy savings were nearly identical. The ex ante gross savings was 26,029 MWh, while evaluation-verified gross savings was 26,185 MWh. Evaluation-verified net savings was 14,221 MWh. Gross peak demand savings was 2.63 MW and net savings was 1.42 MW.

Finding 2. The program gross realization rate is the difference between ex ante gross savings (kWh) and verified gross savings. Given that ex ante and ex post gross savings are nearly the same, the resulting evaluation-verified gross realization rate is 101 percent. Any differences between the ex ante and verified ex post gross savings estimates are solely due to minor corrections in the tracking data. Both the evaluation team and program implementers used the same procedures to quantify savings - both sets of values were computed using the regression specified in the TRM.

Tracking Data Quality

Finding 3. The tracking data is high quality and is generally sufficient to estimate program savings accurately under the current TRM regression specifications. The problems that surfaced were relatively insignificant. A total of 3,000 JACO records excluded the unit's prior location. In addition, for Reclaim data, a total of 11 PY8 small units (SU) are included in the data set. Small units are not targeted by the program. Further, Reclaim data included 98 businesses. While the program does not target business customers, they are allowed to participate if they request an appointment. This has been a long-standing policy. Many small business customers are similar to residential customers in terms of energy use. Additional details are included in Section 3.1.

Program Volumetric Findings

Finding 4. According to program tracking data, there were 28,599 participants in PY7 contributing a total of 31,801 recycled measures to the program. These volumes are down approximately 25 percent from PY7, where the program recycled a total of 40,946 units, which were contributed by 38,239 participants. While the volume of PY8 activity and savings was down from PY7, the key reason for it is unrelated to the effectiveness of program delivery. The decline in volumes is associated with the program not operating during one-third of the program year and its transition to a new implementation firm. The breakdown of units collected by the program was 85 percent refrigerators, 14 percent freezers, and 2 percent room air conditioners. This breakdown is almost identical to the proportions in PY5, PY6, and PY7. Additional details are included in Section 3.2.

Verified Net Impacts

Finding 5. The evaluation re-computed the net-to-gross ratio (NTGR) using deemed values as determined through the SAG process to reflect the fact that ComEd removed one vendor from participation in PY8. The re-computed NTGR found in this evaluation is 0.54 for the total program. It is based on a refrigerator NTGR of 0.54 (based on a weighted average of a customer NTGR of 0.77 and a retailer NTGR of 0.29, and net of a PIR factor of 0.039), a freezer NTGR of 0.56 (based on a weighted average of a customer NTGR of 0.58 and a retailer NTGR of 0.30, and net of a PIR factor of 0.013) and a room A/C NTGR of 0.50. It also includes a term for Program Induced Replacements (PIR), per the TRM. Because a larger proportion of refrigerator participants said they would have their dealer remove the old unit

(39 percent) than freezer participants (3 percent), the retailer NTGR plays a correspondingly larger role driving the final refrigerator NTGR.

Finding 6. In an effort by ComEd to reduce free ridership and improve program influence, ComEd did not extend an offer to the largest of the three participating retailers (Vendor #1) to participate in the program starting in PY8. This single action has increased the NTGR for refrigerators by 5 percentage points.

Recommendation 1. Commendably, ComEd has taken a major step to reduce free ridership in this program by removing a major participating retailer from the program. Theoretically, free ridership could be reduced further by limiting eligibility to those customers who have true secondary units (i.e., those in basements and garages). This would mean that customers who are replacing existing primary units would be ineligible, including those who are remodeling kitchens or simply upgrading to a more modern unit. However, restricting participation in this manner would sharply reduce participation, and therefore, would introduce a considerable trade-off to the program. This option should be carefully considered to assess whether the benefit of reduced free ridership is worth the cost of significantly reduced participation.