



Residential Program Evaluation Report

Home Energy Rebates

FINAL

**Energy Efficiency Plan:
Gas Plan Year 5
(6/1/2015-5/31/2016)**

**Presented to
Peoples Gas and North Shore Gas**

February 10, 2017

Prepared by:

**Katherine Wolf
Navigant Consulting, Inc.**

**Chelsea Lamar
Navigant Consulting, Inc.**

www.navigant.com

**Submitted to:**

Peoples Gas
North Shore Gas
200 East Randolph Street
Chicago, IL 60601

Submitted by:

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

Contact:

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

Kevin Grabner, Associate Director
608.497.2323
kevin.grabner@navigant.com

Robert Neumann, Associate Director
312.583.2176
rob.neumann@navigant.com

Disclaimer: This report was prepared by Navigant Consulting, Inc. ("Navigant") for Peoples Gas Light and Coke Company ("PGL") and North Shore Gas ("NSG") based upon information provided by PGL and NSG and from other sources. Use of this report by any other party for whatever purpose should not, and does not, absolve such party from using due diligence in verifying the report's contents. Neither Navigant nor any of its subsidiaries or affiliates assumes any liability or duty of care to such parties, and hereby disclaims any such liability.

TABLE OF CONTENTS

E. Executive Summary	1
E.1 Program Savings	1
E.2 Program Savings by Measure	2
E.3 Impact Estimate Parameters for Future Use	3
E.4 Program Volumetric Detail	4
E.5 Findings and Recommendations	5
1. Introduction	6
1.1 Program Description.....	6
1.2 Evaluation Objectives.....	6
1.2.1 Impact Questions.....	6
1.2.2 Process Questions	6
2. Evaluation Approach	7
2.1 Overview of Data Collection Activities.....	7
2.2 Verified Savings Parameters.....	7
2.2.1 Verified Gross Program Savings Analysis Approach	7
2.2.2 Verified Net Program Savings Analysis Approach	8
2.3 Process Evaluation.....	8
3. Gross Impact Evaluation	9
3.1 Program Tracking Data Review	9
3.2 Program Volumetric Findings	9
3.3 Gross Program Impact Parameter Estimates	11
3.4 Verified Gross Program Impact Results.....	12
4. Net Impact Evaluation	14
5. Process Evaluation	16
5.1 Program Awareness.....	16
5.2 Program Satisfaction	16
6. Findings and Recommendations	18
7. Appendix	20
7.1 Free Ridership Research Conducted in GPY5	20
7.1.1 Recommended Free Ridership Calculation Approach	21
7.1.2 Free Ridership Estimates	22
7.1.3 On-Line Survey Instrument.....	24
7.1.4 Navigant's August 23, 2016 Memo on Free Ridership Findings	28

LIST OF FIGURES AND TABLES

Figures

Figure 3-1. Peoples Gas: Number of Measures Installed by Type	10
Figure 3-2. North Shore Gas: Number of Measures Installed by Type	11
Figure 5-1. Source of Initial Program Awareness (n = 116)	16
Figure 5-2. Overall Satisfaction with the Program (n = 93)	17
Figure 7-1. Residential Prescriptive Rebate (With No Audit) Free Ridership	21

Tables

Table E-1. GPY5 Peoples Gas Home Energy Rebate Program Natural Gas Savings	1
Table E-2. GPY5 North Shore Gas Home Energy Rebate Program Natural Gas Savings	1
Table E-3. GPY5 Peoples Gas Home Energy Rebate Program Natural Gas Savings	2
Table E-4. GPY5 North Shore Gas Home Energy Rebate Program Natural Gas Savings	3
Table E-5. GPY5 Peoples Gas Program Primary Participation Detail	4
Table E-6. GPY5 North Shore Gas Home Energy Rebate Program Primary Participation Detail	4
Table 2-1. Primary Data Collection Activities	7
Table 2-2. GPY5 Verified Gross Savings Parameter Data Sources	8
Table 2-3. Net-to-Gross Ratios for Evaluation of the GPY5 Home Energy Rebate Program	8
Table 3-1. GPY5 Peoples Gas Home Energy Rebate Program Primary Participation Detail	9
Table 3-2. GPY5 North Shore Gas Home Energy Rebate Program Primary Participation Detail	10
Table 3-3. GPY5 Home Energy Rebate Program Ex Ante and Verified Gross Savings Parameters	12
Table 3-4. GPY5 Peoples Gas Home Energy Rebate Program Impact Results	13
Table 3-5. GPY5 North Shore Gas Home Energy Rebate Program Impact Results	13
Table 4-1. GPY5 Peoples Gas Home Energy Rebate Program Natural Gas Savings	14
Table 4-2. GPY5 North Shore Gas Home Energy Rebate Program Natural Gas Savings	15
Table 7-1. Primary Data Collection Activities	20
Table 7-2. HER Program Free Ridership Using the Draft TRM v6.0 Algorithm	22
Table 7-3. HER Program Free Ridership Estimates Using the TRM v5.0 Algorithm	23

E. EXECUTIVE SUMMARY

This report presents a summary of the findings and results from the impact and process evaluation of the GPY5¹ Home Energy Rebate program.

E.1 Program Savings

Table E-1 summarizes the natural gas savings from the Peoples Gas Home Energy Rebate Program. As can be seen, the Peoples Gas program achieved a near-perfect verified gross realization rate of 0.99, however the program did not reach the planned program savings goal of 446,220 net therms.

Table E-1. GPY5 Peoples Gas Home Energy Rebate Program Natural Gas Savings

Program/Path	Ex Ante Gross Savings ² (Therms)	Ex Ante Net Savings (Therms)	Verified Gross RR ³	Verified Gross Savings (Therms)	NTGR ⁴	Verified Net Savings ⁵ (Therms)
Home Energy Rebate	391,533	317,142	0.99	388,646	0.81	314,803

Source: Evaluation analysis of GPY5 program tracking data (August 11, 2016 data extract) and Illinois Statewide Technical Reference Manuals.⁶

Table E-2 summarizes the natural gas savings from the GPY5 North Shore Gas Home Energy Rebate Program. As can be seen, North Shore Gas vastly exceeded its planned program savings goal of 103,000 net therms and achieved a realization rate of 1.00.

Table E-2. GPY5 North Shore Gas Home Energy Rebate Program Natural Gas Savings

Program/Path	Ex Ante Gross Savings (Therms)	Ex Ante Net Savings (Therms)	Verified Gross RR	Verified Gross Savings (Therms)	NTGR	Verified Net Savings (Therms)
Home Energy Rebate	698,317	565,637	1.00	698,397	0.81	565,701

Source: Evaluation analysis of GPY5 program tracking data (August 11, 2016 data extract) and Illinois Statewide Technical Reference Manuals.

¹ The GPY5 program year began June 1, 2015 and ended May 31, 2016.

² The term "Ex Ante" refers to the forecasted savings reported by the Program Administrator that have not been independently verified through evaluation. Savings that have been independently verified by the Evaluation Contractor are referred to as "Verified".

³ Verified Gross Realization Rate (RR) = Verified Gross Savings/Ex Ante Gross Savings.

Verified Gross Savings = RR * Ex Ante Gross Savings

⁴ The Net-to-Gross Ratio (NTGR) used for calculating verified net savings is deemed prospectively through a consensus process managed by the Illinois Energy Efficiency Stakeholder Advisory Group (SAG). Deemed NTGRs (as well historical verified gross Realization Rates) are available at:

http://ilsagfiles.org/SAG_files/NTG/2015_NTG_Meetings/Final_2015_Documents/Peoples_Gas_and_North_Shore_Gas_NTG_Summary_GPY1-5_2015-03-01_Final.pdf

⁵ Verified Net Savings = NTGR * Verified Gross Savings

⁶ Illinois Statewide Technical Reference Manual for Energy Efficiency (TRM). The effective TRM for GPY5 is Version 4.0, available from the Illinois Energy Efficiency Stakeholder Advisory Group web site: http://www.ilsag.info/il_trm_version_4.html. The list of TRM Version 4.0 errata in effect for GPY5 is provided in TRM Version 5.0, available at: http://www.ilsag.info/il_trm_version_5.html

E.2 Program Savings by Measure

Table E-3 summarizes the natural gas savings from the Peoples Gas Home Energy Rebate Program by measure.

Table E-3. GPY5 Peoples Gas Home Energy Rebate Program Natural Gas Savings

Measure	Ex Ante Gross Savings (Therms)	Ex Ante Net Savings (Therms)	Verified Gross RR	Verified Gross Savings (Therms)	NTGR	Verified Net Savings (Therms)
Air Sealing	51,096	41,388	0.95	48,473	0.81	39,263
Attic Insulation	23,515	19,047	1.00	23,515	0.81	19,047
Boiler - DHW Two-in-one	1,639	1,328	0.99	1,630	0.81	1,320
Boiler - Hot Water	4,512	3,655	0.93	4,179	0.81	3,385
Boiler - Steam	106	86	1.00	106	0.81	86
Duct Sealing	2,937	2,379	1.00	2,941	0.81	2,382
Furnace	254,130	205,845	1.00	254,263	0.81	205,953
Indirect Water Heater	97	79	1.00	97	0.81	79
Programmable Thermostat	51,526	41,736	1.00	51,538	0.81	41,746
Tankless Water Heater	1,975	1,600	1.00	1,974	0.81	1,599
Total	391,533	317,142	0.99	388,646	0.81	314,803

Source: Evaluation analysis of GPY5 program tracking data (August 11, 2016 data extract).

Table E-4 summarizes the natural gas savings from the GPY5 North Shore Gas Home Energy Rebate Program by measure. The large savings from duct sealing contributed significantly to the program exceeding its gas savings goals. The duct sealing savings are primarily attributed to one trade ally, who focuses on duct sealing. That trade ally has been conducting targeted and direct marketing to potential weatherization customers, leading to high production for those measures. Because the one trade ally has been responsible for so much of the weatherization savings, the program has assigned a specific Trade Ally liaison to the contractor, and is conducting targeted quality assurance to ensure that along with the high level of savings, that all program standards with regards to customer satisfaction and the quality of work performed are being met.

Table E-4. GPY5 North Shore Gas Home Energy Rebate Program Natural Gas Savings

Measure	Ex Ante Gross Savings (Therms)	Ex Ante Net Savings (Therms)	Verified Gross RR	Verified Gross Savings (Therms)	NTGR	Verified Net Savings (Therms)
Air Sealing	8,253	6,685	0.95	7,853	0.81	6,361
Attic Insulation	4,310	3,491	1.00	4,310	0.81	3,491
Boiler - Hot Water	1,601	1,297	0.93	1,483	0.81	1,201
Duct Sealing	421,240	341,204	1.00	421,834	0.81	341,686
Furnace	242,603	196,508	1.00	242,603	0.81	196,509
Indirect Water Heater	97	79	1.00	97	0.81	79
Programmable Thermostat	19,677	15,939	1.00	19,680	0.81	15,941
Tankless Water Heater	536	434	1.00	536	0.81	434
Total	698,317	565,637	1.00	698,397	0.81	565,701

Source: Evaluation analysis of GPY5 program tracking data (August 11, 2016 data extract).

E.3 Impact Estimate Parameters for Future Use

In fall of 2015, Navigant conducted GPY5 NTG and process evaluation research through an on-line survey with 119 customers that participated in the GPY5 HER Program. The results of this research were used to develop free ridership estimates for future use, and provided feedback on a limited number of process questions. The NTG research methods and results are provided in the Appendix.

E.4 Program Volumetric Detail

Table E-5 and Table E-6 below present GPY5 program participation reported by the Program Administrator Franklin Energy Services (FES) for the Peoples Gas and North Shore Gas programs. Detailed volumetric breakdown of the measure type and savings quantity are provided in the program-level analysis in Section 3.

Table E-5. GPY5 Peoples Gas Program Primary Participation Detail

Measure	Quantity	Units
Air Sealing	246	# projects
Attic Insulation	227	# projects
Boiler - DHW Two-in-one	10	# units
Boiler - Hot Water	31	# units
Boiler - Steam	2	# units
Duct Sealing	5	# projects
Furnace	1,243	# units
Indirect Water Heater	2	# units
Programmable Thermostat	1,477	# units
Tankless Water Heater	69	# units
Total Projects	3,312	

Source: Navigant analysis of GPY5 program tracking data (August 11, 2016 data extract).

Table E-6. GPY5 North Shore Gas Home Energy Rebate Program Primary Participation Detail

Measure	Quantity	Units
Air Sealing	55	# projects
Attic Insulation	34	# projects
Boiler - Hot Water	11	# units
Duct Sealing	669	# projects
Furnace	1,186	# units
Indirect Water Heater	2	# units
Programmable Thermostat	19	# units
Tankless Water Heater	562	# units
Total	2,538	

Source: Navigant analysis of GPY5 program tracking data (August 11, 2016 data extract).

E.5 Findings and Recommendations

The following provides insight into key program findings and recommendations.⁷

Verified Gross Savings and Realization Rate.

Finding 1. There is a seven percent discrepancy between the ex ante gross and verified gross savings for the hot water boiler measure labeled “Boiler - HW <300MBtu, >=88% AFUE (EUL + ER)”. Both Navigant calculations using the TRM and Franklin Energy documentation⁸ indicate per unit savings of 134.8 gross therms (109.2 net therms), while the GPY5 tracking data reports 117.89 net therms implying 145.5 gross therms.

Recommendation 1. Navigant recommends updating the ex ante gross and net savings in the tracking system to match with the master measure Franklin Energy workbook for the boiler measure.

Finding 2. There is a five percent discrepancy between the ex ante and verified gross savings for the Air Sealing measure. Navigant found that the discrepancy can be explained by rounding the unit savings value. Navigant and Franklin Energy calculate unit savings for this measure as 0.1057 therms /CFM50 reduction or 0.0856/CFM50 net savings. The GPY5 program tracking database is using net unit savings of 0.09/CFM50, hence the 0.95 percent realization rate.

Recommendation 2. Navigant recommends that for the air sealing measure, the implementer rounds the database unit savings to an additional significant figure.

Process Evaluation.

Finding 5. Navigant’s on-line survey with program participants provided feedback that the most common way that participants are made aware of the program is through their contractor, followed by People Gas and North Shore Gas bill inserts and advertising. The program is effectively implementing the program plans in terms of program promotion.

Finding 6. Via the on-line survey, participants reported very high levels of satisfaction with the program. The few unsatisfied participants reported frustration with the application process and telephone assistance, and confusion about the status of their application.

Recommendation 4. Ensure that all call center staff at Peoples Gas and North Shore Gas are able to direct program participants to the correct program staff.

⁷ Numbered findings and recommendations in this section are the same as those found in the Findings and Recommendations section of the evaluation report for ease of reference between each section. Therefore, gaps in numbering may occur in the Executive Summary.

⁸ Because the Illinois TRM provides multiple options for selecting input assumptions, Franklin Energy Services produces a “Master Measure Database” spreadsheet that documents their approach to compliance with the Illinois TRM. The spreadsheet is PG&NSG MMDB PY5 - 04122016, produced by Franklin Energy.

1. INTRODUCTION

1.1 Program Description

Under the Home Energy Rebate Program, cash incentives and education were offered to encourage upgrading of water- and space-heating equipment and weatherization among residential customers of Peoples Gas and North Shore Gas. The Home Energy Rebate Program was designed to conserve natural gas and lower its participants' monthly energy bills. Both rental and owner-occupied dwellings are eligible for rebates. Customers must be active residential customers of Peoples Gas or North Shore Gas in order to receive rebates for gas saving measures. The premises must be used for residential purposes in existing buildings

1.2 Evaluation Objectives

The Evaluation Team identified the following key researchable questions for GPY5

1.2.1 Impact Questions

1. What is the program's verified gross savings?
2. What is the program's verified net savings?
3. What updates are recommended for the Illinois Technical Reference Manual (TRM)?
4. What is the researched value for free ridership?

1.2.2 Process Questions

1. How did participating customers first learn about the program rebate?
2. Are customers satisfied with the program?

2. EVALUATION APPROACH

This section provides an overview of the data collection methods, gross and net impact evaluation approaches, and process evaluation approaches that occurred for the GPY5 evaluation.

2.1 Overview of Data Collection Activities

The core data collection activities included a review for the program tracking database, and an on-line participant survey during which free-ridership and process information was collected. The primary data collection activities are shown in the following table.

Table 2-1. Primary Data Collection Activities

What	Who	Completions Achieved	When	Comments
Program Tracking Database	GPY5 Participants	Census	October – November 2016	
On-Line Surveys	GPY5 Participants	133	November 2015 – January 2016	119 completions provided sufficient data to analyze free ridership. Spillover was not researched because the survey was conducted shortly after participating. Spillover research will occur in GPY6.

Source: Navigant.

2.2 Verified Savings Parameters

2.2.1 Verified Gross Program Savings Analysis Approach

Navigant estimated verified per-unit savings for each program measure using impact algorithms and input assumptions defined by the Illinois TRM for deemed measures⁹, and evaluation research for non-deemed measures. Table 2-2 below presents the sources for parameters that were used in verified gross savings analysis, indicating which were examined through GPY5 evaluation research and which were deemed.

⁹ Because the Illinois TRM provides multiple options for selecting input assumptions, Franklin Energy Services produces a “Master Measure Database” spreadsheet that documents their approach to compliance with the Illinois TRM. The spreadsheet is PG&NSG MMDB PY5 - 04122016, produced by Franklin Energy.

Table 2-2. GPY5 Verified Gross Savings Parameter Data Sources

Parameter	Data Source	Deemed or Evaluated?
Measure Quantity Installed	Program tracking system	Evaluated
Verified Gross Realization Rate	Program tracking data, TRM, Navigant	Evaluated
Air Sealing	Illinois TRM v4.0 – Section 5.6.1‡	Deemed
Attic Insulation	Illinois TRM v4.0 – Section 5.6.4‡	Deemed
Boiler - DHW Two-in-one	Illinois TRM v4.0 – Section 5.3.6‡	Deemed
Boiler - Hot Water	Illinois TRM v4.0 – Section 5.3.6‡	Deemed
Boiler - Steam	Illinois TRM v4.0 – Section 5.3.6‡	Deemed
Duct Sealing	Illinois TRM v4.0 – Section 5.3.4‡	Deemed
Furnace	Illinois TRM v4.0 – Section 5.3.7‡	Deemed
Indirect Water Heater	Illinois TRM v4.0 – Section 5.4.2‡	Deemed
Programmable Thermostat	Illinois TRM v4.0 – Section 5.3.11‡	Deemed
Tankless Water Heater	Illinois TRM v4.0 – Section 5.4.2‡	Deemed

Source: Evaluation analysis of programs data and Illinois TRM documents.

‡ Source: State of Illinois Technical Reference Manuals. PG&NSG MMDb PY5 - 04122016, produced by Franklin Energy;

2.2.2 Verified Net Program Savings Analysis Approach

Verified net energy savings were calculated by multiplying the verified gross savings estimates by a deemed net-to-gross ratio (NTGR). In GPY5, the NTGR values used to calculate the verified net savings were based on past evaluation research and approved through a consensus process managed by the Illinois Energy Efficiency Stakeholder Advisory Group (SAG)¹⁰. Table 2-3 presents the deemed NTGR.

Table 2-3. Net-to-Gross Ratios for Evaluation of the GPY5 Home Energy Rebate Program

Program Path/Measure	Utility	GPY5 Deemed NTG Value
Residential Prescription Rebates	PGL and NSG	0.81

Source: Documents available on the Illinois Energy Efficiency Stakeholder Advisory Group web site.

2.3 Process Evaluation

As outlined in the GPY5-6 Home Energy Rebate Evaluation Plan, the majority of the process evaluation is scheduled to take place in GPY6, and will consist of participant and trade ally telephone surveys. For GPY5, the process evaluation was limited to survey questions about program awareness and satisfaction included in the free ridership on-line survey.

¹⁰ Source: Deemed NTGR values are available on the Illinois Energy Efficiency Stakeholder Advisory Group web site.

http://ilsagfiles.org/SAG_files/NTG/2015_NTG_Meetings/Final_2015_Documents/Peoples_Gas_and_North_Shore_Gas_NTG_Summary_GPY1-5_2015-03-01_Final.pdf

3. GROSS IMPACT EVALUATION

The gross impact analysis involved a review of the tracking system and verification of measure savings. The verified savings were calculated by multiplying the quantity of measures installed by the verified measure per unit savings. The programs' verified gross realization rates were determined by the ratio of the verified savings to the ex ante gross savings.

3.1 Program Tracking Data Review

Navigant used the data extracts from the program's tracking system to verify the program's GPY5 ex ante inputs, including the measure counts and ex ante savings. In addition to the tracking database, Franklin Energy updated and provided to Navigant a spreadsheet of the measure savings (PG&NSG MMDB PY5) that were derived either from the Illinois TRM (Ver. 4.0) for the deemed measures, or from other engineering estimates for measures not included in the Illinois TRM.

3.2 Program Volumetric Findings

As shown in Table 3-1 and Table 3-2, the Peoples Gas Home Energy Rebate Program reported 3,312 total units/projects incented. The North Shore Gas Home Energy Rebate Program reported 2,538 total units/projects incented.

Table 3-1. GPY5 Peoples Gas Home Energy Rebate Program Primary Participation Detail

Measure	Quantity	Units
Air Sealing	246	# projects
Attic Insulation	227	# projects
Boiler - DHW Two-in-one	10	# units
Boiler - Hot Water	31	# units
Boiler - Steam	2	# units
Duct Sealing	5	# projects
Furnace	1,243	# units
Indirect Water Heater	2	# units
Programmable Thermostat	1,477	# units
Tankless Water Heater	69	# units
Total	3,312	

Source: Navigant analysis of GPY5 program tracking data (August 11, 2016 data extract).

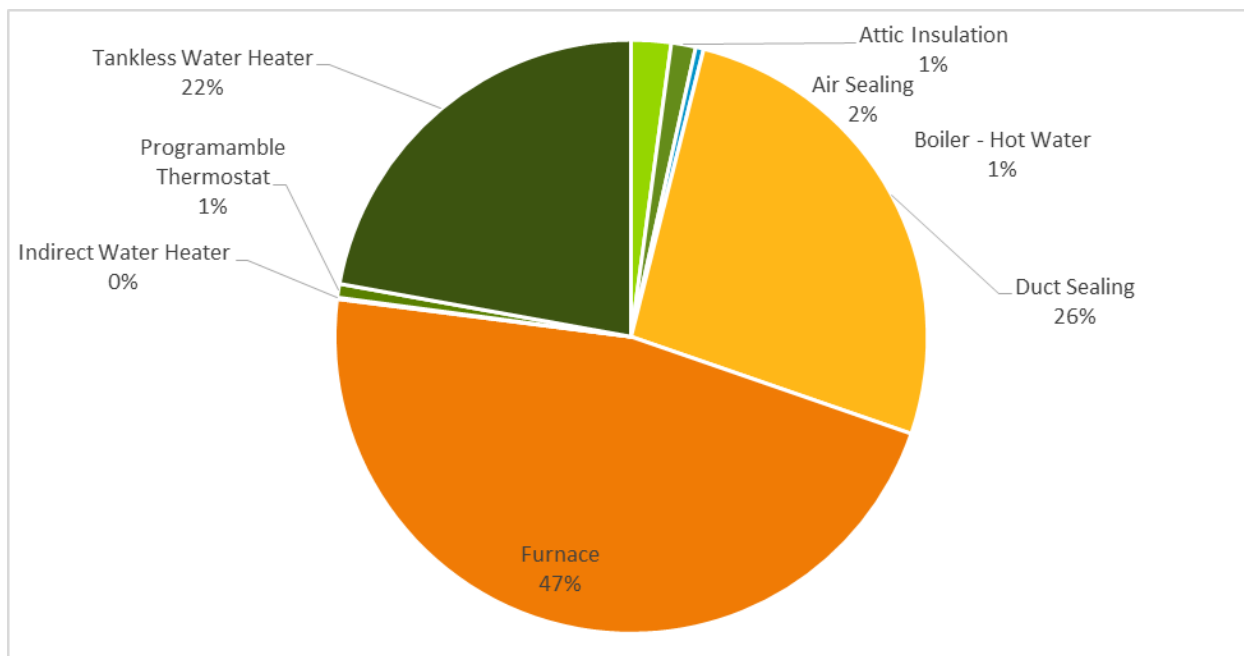
Table 3-2. GPY5 North Shore Gas Home Energy Rebate Program Primary Participation Detail

Measure	Quantity	Units
Air Sealing	55	# projects
Attic Insulation	34	# projects
Boiler - Hot Water	11	# units
Duct Sealing	669	# projects
Furnace	1,186	# units
Indirect Water Heater	2	# units
Programmable Thermostat	19	# units
Tankless Water Heater	562	# units
Total	2,538	

Source: Navigant analysis of GPY5 program tracking data (August 11, 2016 data extract).

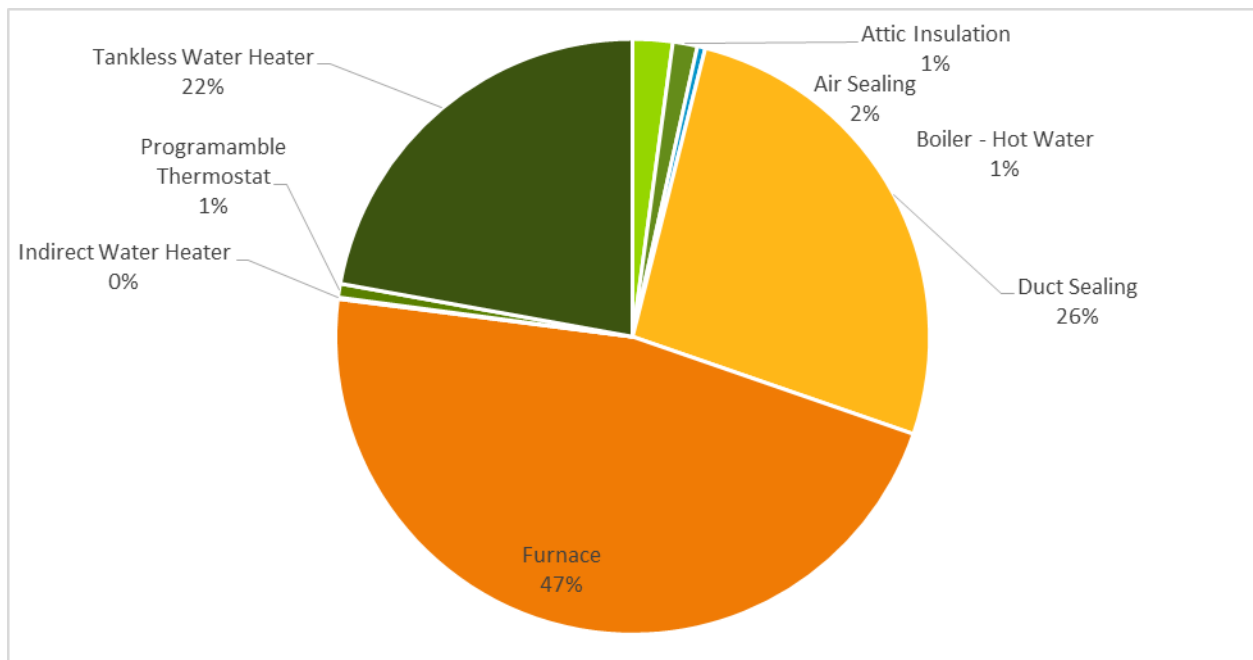
Figure 3-1 and Figure 3-2 disaggregate the measure mix by type. For Peoples Gas overall, weatherization measures contributed 14 percent of the measure quantity in GPY5, and equipment measures (including hot water efficiency measures and thermostats) contributed the remaining 86 percent. For North Shore Gas, weatherization measures contributed 30 percent of the measure quantity in GPY5, and equipment measures (including hot water efficiency measures and thermostats) contributed the remaining 70 percent.

Figure 3-1. Peoples Gas: Number of Measures Installed by Type



Source: Navigant Analysis

Figure 3-2. North Shore Gas: Number of Measures Installed by Type



Source: Navigant Analysis

3.3 Gross Program Impact Parameter Estimates

As described in Section 2, Navigant estimated verified per unit savings for each program measure using impact algorithms and input assumptions defined in the Illinois TRM and documentation of TRM compliance provided by Franklin Energy Services. Table 3-3 presents the key parameters and the references used in the verified gross savings calculations.

Table 3-3. GPY5 Home Energy Rebate Program Ex Ante and Verified Gross Savings Parameters

Measure	Ex Ante Gross Savings (Therms/Unit)	Verified Gross Savings (Therms/Unit)	Method	Data Source†
Air Sealing	Varies	Varies	Deemed	Illinois TRM v4.0 – Section 5.6.1
Attic Insulation	Varies	Varies	Deemed	Illinois TRM v4.0 – Section 5.6.4
Boiler - DHW Two-in-one	163.9	163.0	Deemed	Illinois TRM v4.0 – Section 5.3.6
Boiler - Hot Water	145.5	134.8	Deemed	Illinois TRM v4.0 – Section 5.3.6
Boiler - Steam	53.2	53.2	Deemed	Illinois TRM v4.0 – Section 5.3.6
Duct Sealing	1.5	1.5	Deemed	Illinois TRM v4.0 – Section 5.3.4
Furnace	204.4	204.5	Deemed	Illinois TRM v4.0 – Section 5.3.7
Indirect Water Heater	48.7	48.7	Deemed	Illinois TRM v4.0 – Section 5.4.2
Programmable Thermostat	34.9	34.9	Deemed	Illinois TRM v4.0 – Section 5.3.11
Tankless Water Heater	28.2	28.2	Deemed	Illinois TRM v4.0 – Section 5.4.2

Source: Navigant analysis of program tracking data and Franklin Energy Services documents.

†The effective TRM for GPY5 is Version 4.0, available from the Illinois Energy Efficiency Stakeholder Advisory Group web site: http://www.ilsag.info/il_trm_version_4.html. The list of TRM Version 4.0 errata in effect for GPY5 is provided in TRM Version 5.0, available at: http://www.ilsag.info/il_trm_version_5.html

There is a seven percent discrepancy between the ex ante gross and verified gross savings for the hot water boiler measure labeled “Boiler - HW <300MBtu, ≥88% AFUE (EUL + ER)”. Both Navigant calculations using the TRM and Franklin Energy documentation¹¹ indicate per unit savings of 134.8 gross therms (109.2 net therms), while the GPY5 tracking data reports 117.89 net therms implying 145.5 gross therms. The result is a 93 percent realization rate for the hot water boiler measure.

There is a five percent discrepancy between the ex ante and verified gross savings for the Air Sealing measure. Navigant found that the discrepancy can be explained by rounding the unit savings value. Navigant and Franklin Energy calculate unit savings for this measure as 0.1057 therms /CFM50 reduction or 0.0856/CFM50 net savings. The GPY5 program tracking database is using net unit savings of 0.09/CFM50, hence a 0.95 percent realization rate.

There are small discrepancies in the furnace and Boiler DHW Two-in-one measure unit savings that Navigant attributes to trivial rounding differences.

3.4 Verified Gross Program Impact Results

As shown in Table 3-4, the GPY5 Peoples Gas Home Energy Rebate Program reported ex ante gross energy savings of 391,533 therms. Evaluation adjustments resulted in verified gross energy savings of 388,646 therms, reflecting the program’s gross realization rate of 99%.

¹¹ Because the Illinois TRM provides multiple options for selecting input assumptions, Franklin Energy Services produces a “Master Measure Database” spreadsheet that documents their approach to compliance with the Illinois TRM. The spreadsheet is PG&NSG MMDB PY5 - 04122016, produced by Franklin Energy.

Table 3-4. GPY5 Peoples Gas Home Energy Rebate Program Impact Results

Measure Category	Quantity Unit	Verified Measure Quantity	Ex Ante Gross Savings (therms)	Verified Gross Realization Rate	Verified Gross Savings (therms)
Air Sealing	50 CFM	458,452	51,096	0.95	48,473
Attic Insulation	Square footage	23,514	23,515	1.00	23,515
Boiler - DHW Two-in-one	Each	10	1,639	0.99	1,630
Boiler - Hot Water	Each	31	4,512	0.93	4,179
Boiler - Steam	Each	2	106	1.00	106
Duct Sealing	25 CFM	1,966	2,937	1.00	2,941
Furnace	Each	1,243	254,130	1.00	254,191
Indirect Water Heater	Each	2	97	1.00	97
Programmable Thermostat	Each	1,477	51,526	1.00	51,538
Tankless Water Heater	Each	70	1,975	1.00	1,974
Total			391,533	0.99	388,646

Source: Program tracking data and Navigant analysis

As shown in Table 3-5, the GPY5 North Shore Gas Home Energy Rebate Program reported ex ante gross energy savings of 698,317 therms. Evaluation adjustments resulted in verified gross energy savings of 698,367 therms, reflecting the program's gross realization rate of 100%.

Table 3-5. GPY5 North Shore Gas Home Energy Rebate Program Impact Results

Measure Category	Quantity Unit	Verified Measure Quantity	Ex Ante Gross Savings (therms)	Verified Gross Realization Rate	Verified Gross Savings (therms)
Air Sealing	50 CFM	74,275	8,253	0.95	7,853
Attic Insulation	Square footage	4,310	4,310	1.00	4,310
Boiler - Hot Water	Each	11	1,601	0.93	1,483
Duct Sealing	25 CFM	281,987	421,240	1.00	421,834
Furnace	Each	1,186	242,603	1.00	242,603
Indirect Water Heater	Each	2	97	1.00	97
Programmable Thermostat	Each	564	19,677	1.00	19,680
Tankless Water Heater	Each	19	536	1.00	536
Total			698,317	1.00	698,397

Source: Program tracking data and Navigant analysis

4. NET IMPACT EVALUATION

Verified net energy savings were calculated by multiplying the verified gross savings estimates by a net-to-gross ratio. As noted in Section 2, the NTGR used to calculate the net verified savings for the GPY5 Home Energy Rebate Program was deemed through a consensus process managed by the Illinois SAG.

Table 4-1 summarizes the natural gas savings from the GPY5 Peoples Gas Home Energy Rebate Program by measure. The program did not reach the GPY5 planned savings goal of 446,220 net therms.

Table 4-1. GPY5 Peoples Gas Home Energy Rebate Program Natural Gas Savings

Measure	Ex Ante Gross Savings (Therms)	Ex Ante Net Savings (Therms)	Verified Gross RR	Verified Gross Savings (Therms)	NTGR	Verified Net Savings (Therms)
Air Sealing	51,096	41,388	0.95	48,473	0.81	39,263
Attic Insulation	23,515	19,047	1.00	23,515	0.81	19,047
Boiler - DHW Two-in-one	1,639	1,328	0.99	1,630	0.81	1,320
Boiler - Hot Water	4,512	3,655	0.93	4,179	0.81	3,385
Boiler - Steam	106	86	1.00	106	0.81	86
Duct Sealing	2,937	2,379	1.00	2,941	0.81	2,382
Furnace	254,130	205,845	1.00	254,263	0.81	205,953
Indirect Water Heater	97	79	1.00	97	0.81	79
Programmable Thermostat	51,526	41,736	1.00	51,538	0.81	41,746
Tankless Water Heater	1,975	1,600	1.00	1,974	0.81	1,599
Total	391,533	317,142	0.99	388,646	0.81	314,803

Source: Evaluation analysis of GPY5 program tracking data (August 11, 2016 data extract).

Table 4-2 summarizes the natural gas savings from the GPY5 North Shore Gas Home Energy Rebate Program by measure. The program significantly exceeded the planned GPY5 savings goal of 103,000 net therms. The furnace rebates achieved high volume, resulting in 196,509 verified net therms, nearly double the savings goal. The largest measure savings were achieved in duct sealing, with 341,686 verified net therms, about 60 percent of the verified net savings for the program. The duct sealing savings are primarily attributed to one trade ally, who focuses on duct sealing. That trade ally has been conducting targeted and direct marketing to potential weatherization customers, leading to high production for those measures. Because the one trade ally has been responsible for so much of the weatherization savings, the program has assigned a specific Trade Ally liaison to the contractor, and is conducting targeted quality assurance to ensure that along with the high level of savings, that all program standards with regards to customer satisfaction and the quality of work performed are being met.

Table 4-2. GPY5 North Shore Gas Home Energy Rebate Program Natural Gas Savings

Measure	Ex Ante Gross Savings (Therms)	Ex Ante Net Savings (Therms)	Verified Gross RR	Verified Gross Savings (Therms)	NTGR	Verified Net Savings (Therms)
Air Sealing	8,253	6,685	0.95	7,853	0.81	6,361
Attic Insulation	4,310	3,491	1.00	4,310	0.81	3,491
Boiler - Hot Water	1,601	1,297	0.93	1,483	0.81	1,201
Duct Sealing	421,240	341,204	1.00	421,834	0.81	341,686
Furnace	242,603	196,508	1.00	242,603	0.81	196,509
Indirect Water Heater	97	79	1.00	97	0.81	79
Programmable Thermostat	19,677	15,939	1.00	19,680	0.81	15,941
Tankless Water Heater	536	434	1.00	536	0.81	434
Total	698,317	565,637	1.00	698,397	0.81	565,701

Source: Evaluation analysis of GPY5 program tracking data (August 11, 2016 data extract).

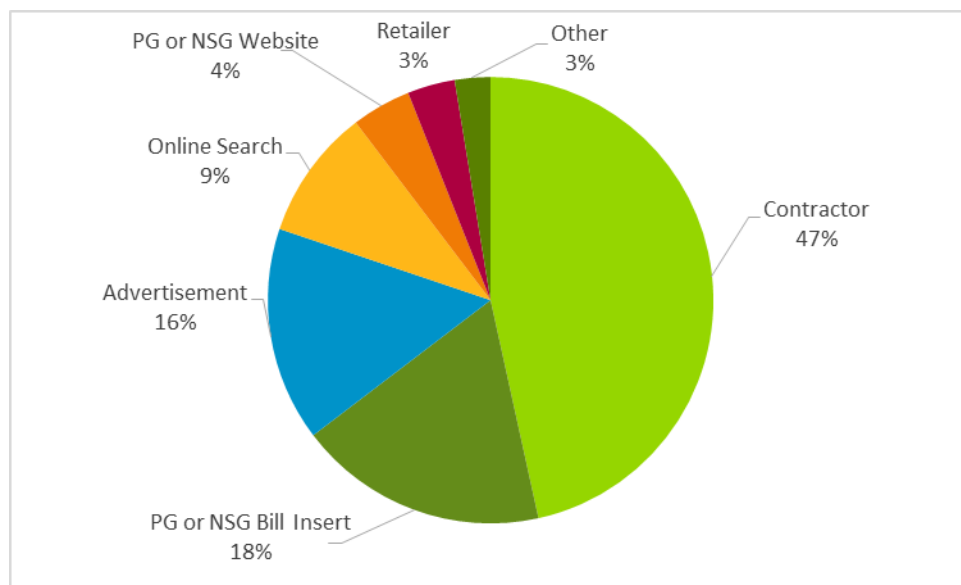
5. PROCESS EVALUATION

The process evaluation consisted of the participant internet-based survey, and focused on two areas: program awareness and overall program satisfaction. Participants were asked questions about how they first became aware of the program, and if they had any comments on the program or suggestions for improvement.

5.1 Program Awareness

The survey participants were asked to name the method by which they first became aware of the Home Energy Rebate Program. The most common response given was that the participant first learned about the program from their contractor, which is consistent with the program implementation team's program plans. The next most common method of learning about the program was through a Peoples Gas or North Shore Gas bill insert, followed by a Peoples Gas or North Shore Gas advertisement. This is consistent with the program plan, and demonstrates that the program staff is implementing their marketing plan effectively. More participants reported using an on-line search engine, such as Google, to find out information about the availability of rebates than reported using the Peoples Gas or North Shore Gas website. The methods of program awareness are presented in Figure 5-1. The "Other" methods of learning about the program were not specified.

Figure 5-1. Source of Initial Program Awareness (n = 116)



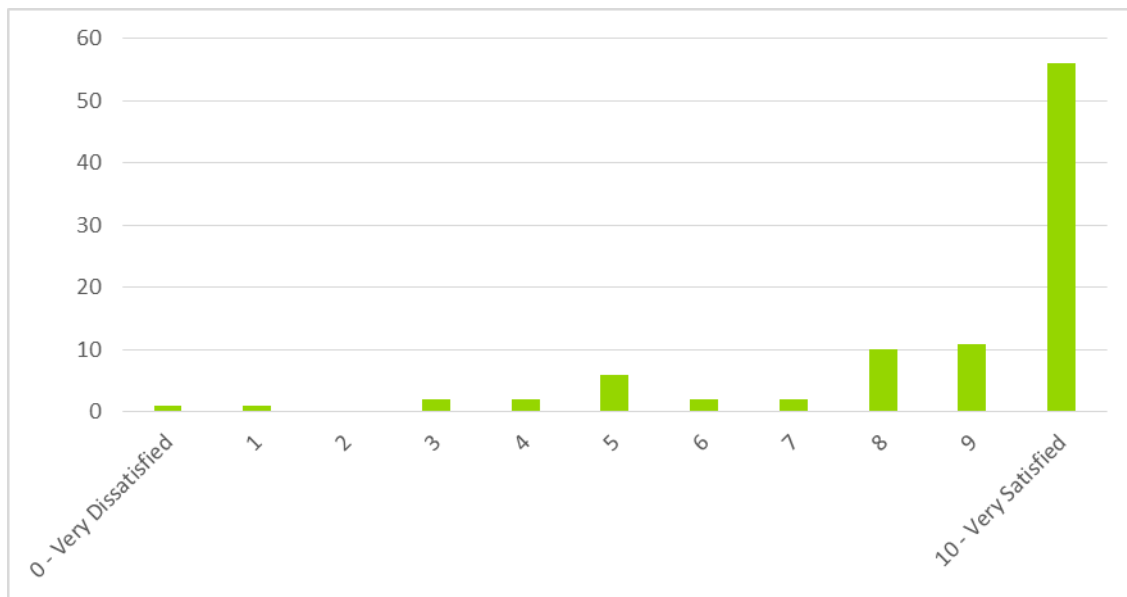
Source: Navigant Analysis

5.2 Program Satisfaction

Overall, the program participants reported a positive experience with their participation in the program. The participants were asked to rate their level of satisfaction on a zero to ten point scale, with zero meaning "very dissatisfied" and ten meaning "very satisfied". The average score given was an 8.7. The distribution of satisfaction scores is presented in Figure 5-2. As can be seen, the majority (60 percent) of

the participants reported that they were “very satisfied” with their experience with the program, only six percent of participants rated the program at a less than 5 on the satisfaction scale. The participants who were not satisfied with the program reported a several reasons why they were not satisfied, mostly centered around general frustration with the application process and confusion about the status of their application. Three individual participants reported that they had difficulty getting ahold of a program representative who could answer their questions about the status of their rebate application. It is not clear whom they attempted to contact, but Navigant suggests that all call center staff at Peoples Gas and North Shore Gas be able to direct program participants to the correct program staff.

Figure 5-2. Overall Satisfaction with the Program (n = 93)



Source: Navigant Analysis

6. FINDINGS AND RECOMMENDATIONS

This section summarizes the key impact and process findings and recommendations.

Verified Gross Savings and Realization Rate.

Finding 1. There is a seven percent discrepancy between the ex ante gross and verified gross savings for the hot water boiler measure labeled “Boiler - HW <300MBtu, >=88% AFUE (EUL + ER)”. Both Navigant calculations using the TRM and Franklin Energy documentation¹² indicate per unit savings of 134.8 gross therms (109.2 net therms), while the GPY5 tracking data reports 117.89 net therms implying 145.5 gross therms.

Recommendation 1. Navigant recommends updating the ex ante gross and net savings in the tracking system to match with the master measure Franklin Energy workbook for the boiler measure.

Finding 2. There is a five percent discrepancy between the ex ante and verified gross savings for the Air Sealing measure. Navigant found that the discrepancy can be explained by rounding the unit savings value. Navigant and Franklin Energy calculate unit savings for this measure as 0.1057 therms /CFM50 reduction or 0.0856/CFM50 net savings. The GPY5 program tracking database is using net unit savings of 0.09/CFM50, hence the 0.95 percent realization rate.

Recommendation 2. Navigant recommends that for the air sealing measure, the implementer rounds the database unit savings to an additional significant figure.

Program Volumetric Findings.

Finding 3. The program incented 3,312 Peoples Gas measures and 2,538 North Shore Gas measures. For Peoples Gas overall, weatherization measures contributed 14 percent of the measure quantity in GPY5, and equipment measures (including hot water efficiency measures and thermostats) contributed the remaining 86 percent. For North Shore Gas, weatherization measures contributed 30 percent of the measure quantity in GPY5, and equipment measures (including hot water efficiency measures and thermostats) contributed the remaining 70 percent.

Finding 4. The Peoples Gas program achieved 314,803 verified net therms, short of the GPY5 planned savings goal of 446,220 net therms. Furnaces accounted for 65 percent of verified net therms for PGL, followed by programmable thermostats (13 percent) and air sealing (12 percent). Duct sealing was only one percent of verified net therms for PGL (2,382 therms).

The NSG program significantly exceeded the planned GPY5 savings goal of 103,000 net therms with 565,701 verified net therms. The largest measure savings were achieved in duct sealing with 341,686 verified net therms – about 60 percent of the verified net savings for the program – followed by furnaces (35 percent of verified net therms). The duct sealing savings are primarily attributed to one trade ally that has been conducting targeted and direct marketing to potential weatherization customers. Because the one trade ally has been responsible for so much of the weatherization savings, the NSG program has assigned a specific Trade Ally liaison to the contractor.

¹² Because the Illinois TRM provides multiple options for selecting input assumptions, Franklin Energy Services produces a “Master Measure Database” spreadsheet that documents their approach to compliance with the Illinois TRM. The spreadsheet is PG&NSG MMDB PY5 - 04122016, produced by Franklin Energy.

Recommendation 3: The Peoples Gas program should consider developing a small trade ally network for duct sealing to generate additional therm savings, if needed to meet the portfolio savings goal.

Process Evaluation.

Finding 5. Navigant's on-line survey with program participants provided feedback that the most common way that participants are made aware of the program is through their contractor, followed by People Gas and North Shore Gas bill inserts and advertising. The program is effectively implementing the program plans in terms of program promotion.

Finding 6. Via the on-line survey, participants reported very high levels of satisfaction with the program. The few unsatisfied participants reported frustration with the application process and telephone assistance, and confusion about the status of their application.

Recommendation 4. Ensure that all call center staff at Peoples Gas and North Shore Gas are able to direct program participants to the correct program staff.

7. APPENDIX

7.1 Free Ridership Research Conducted in GPY5

This section presents results from Navigant's GPY5 residential free ridership evaluation research activity. Our free ridership research will support our recommendation of Net-to-Gross (NTG) values for deeming in GPY7 and beyond for the Home Energy Rebate Program (HER). Participant spillover, free ridership, and process research are planned for GPY6. Participating trade ally NTG research is also planned for GPY6.

Table 7-1 below summarizes the primary data source that Navigant used to estimate the free ridership rate for the program. An on-line survey was conducted in November 2015 with GPY5 participants from June 2015 through October 2015 that was designed to capture free ridership soon after the purchase transaction. The survey instrument is provided in Section 7.1.3.

Table 7-1. Primary Data Collection Activities

What	Who	Completions Achieved	When	Comments
On-Line Surveys	GPY5 HER Participants	133	November 2015 – January 2016	119 completions provided sufficient data to analyze free ridership. Spillover was not researched because the survey was conducted shortly after participating. Spillover research will occur in GPY6.

Source: Navigant.

Navigant sent a memo on August 23, 2016¹³ that reported free ridership based on applying the Illinois TRM version 5.0¹⁴ methodologies to participant survey responses, including a sensitivity analysis for the algorithm. Navigant described our concerns with the TRM v5.0 algorithm and offered an alternative approach in our August 23 memo. The Illinois Residential NTG Working Group reviewed the TRM v5.0 algorithm in fall 2016, and recommended changes to the approach. Our alternative approach was not adopted for TRM v6.0, but the approach that did make it into the draft TRM v6.0 addresses what we believed were weaknesses of TRM v5.0 and produces results similar to our August recommended alternative.

Sections 7.1.1 and 7.1.2¹⁵ present our results using the draft Illinois TRM version 6.0¹⁶ free ridership algorithm to estimate free ridership for the HER Program, using the GPY5 on-line survey participant responses and applying professional judgment to match our response data with the draft TRM v6.0 methodology. Navigant recommends the algorithm in the draft TRM v6.0 over the algorithm in TRM v5.0 to estimate free ridership for residential prescriptive rebate programs.

¹³ The August 23, 2016 memo is provided in Section 7.1.4.

¹⁴ Illinois Statewide Technical Reference Manual for Energy Efficiency (TRM) Version 5.0 (effective 6/1/2016). Available here: <http://www.ilsag.info/technical-reference-manual.html>. See *Volume 4: Cross-Cutting Measures and Attachment*.

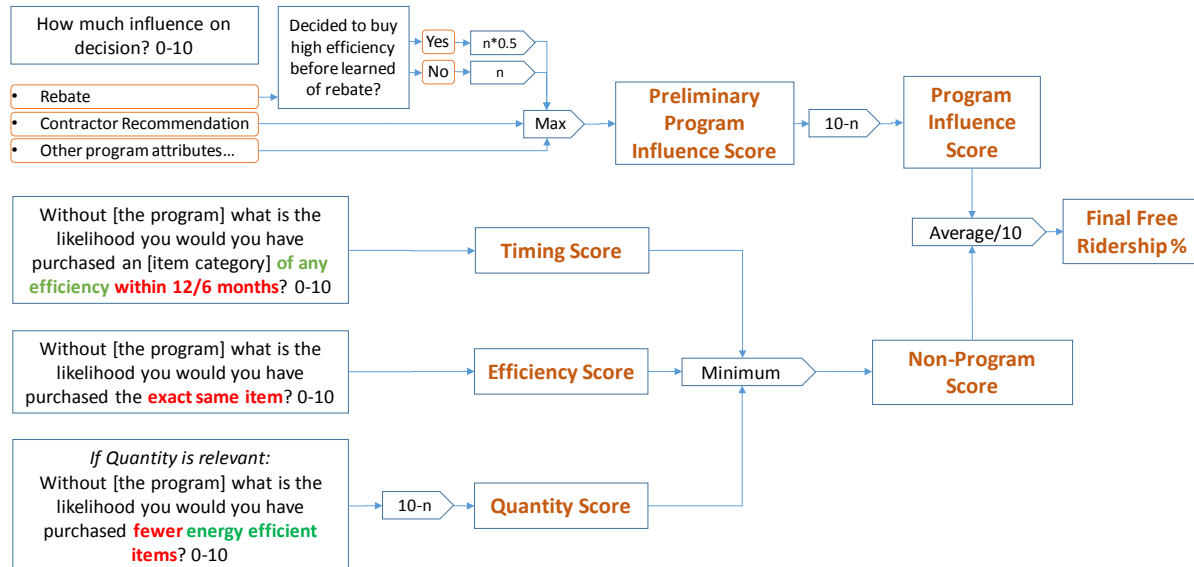
¹⁵ The material presented in Sections 7.1.1 and 7.1.2 was sent out in a Navigant memo dated December 30, 2016.

¹⁶ Draft Illinois Statewide Technical Reference Manual for Energy Efficiency (TRM) Version 6.0, December 9, 2016 draft *Volume 4: Cross-Cutting Measures and Attachments*.

7.1.1 Recommended Free Ridership Calculation Approach

The following diagram describes the draft TRM v6.0 free ridership algorithms for residential rebate programs.

Figure 7-1. Residential Prescriptive Rebate (With No Audit) Free Ridership



Source: Illinois TRM Version 6 December 9, 2016 draft Volume 4.

7.1.2 Free Ridership Estimates

Free Ridership Using the Draft TRM v6.0 Algorithm

Navigant applied the algorithm indicated by the TRM version 6.0 draft flow diagram to the data we collected from 119 GPY5 HER participants, using professional judgment to match responses with the draft TRM v6.0 approach where some questions were worded differently. Table 7-2 presents the resulting estimates of free ridership.

Table 7-2. HER Program Free Ridership Using the Draft TRM v6.0 Algorithm

Measure Category	Average FR	Responses
Furnace >95 AFUE ††	0.48	67
Boiler	†	1
Programmable Thermostat‡	0.64	38
Tankless Water Heater	†	9
Weatherization	†	4
Overall HER Program#	0.49	119

Source: Navigant analysis of data from an on-line survey conducted by Navigant in GPY5 with 119 GPY5 HER Program participants.

† Free ridership results are not statistically significant due to the small number of responses.

†† The GPY5 PGL and NSG program offered rebates for one category of furnaces that are 95.0% AFUE and above.

‡ Programmable thermostats include basic programmable and advanced programmable types.

Overall HER Program result uses GPY5 HER Program verified gross savings to weight measure category free ridership.

For context, the deemed NTG ratio (NTGR) and component values for the GPY6 HER Program are NTGR (0.81); Free ridership (0.30); Participant Spillover (0.00); and Non-Participant Spillover (0.11).

Free Ridership Using the TRM v5.0 Algorithm

For comparison, the results we reported in the August 23, 2016 memo using TRM version 5.0 are presented below.

Table 7-3. HER Program Free Ridership Estimates Using the TRM v5.0 Algorithm

Measure††	Free Ridership TRM v5.0 Methodology	N
Furnace – 95% AFUE	0.62	58
Furnace – 97% AFUE	†	9
Boiler	†	1
Programmable Thermostat‡	0.70	38
Tankless Water Heater	†	9
Weatherization	†	4

Source: Navigant analysis

† Free ridership results for the Boiler, Tankless Water Heater, Weatherization, and 97% AFUE furnace are not statistically significant due to the small number of responses.

†† The GPY5 PGL and NSG program offered rebates for one category of furnaces that are 95.0% AFUE and above. For the sensitivity analyses, Navigant separated the furnace category into a single category of efficiency equal to or greater than 95.0% AFUE and less than 97.0% AFUE. This 95% to 97% AFUE category matches the Nicor Gas “95% AFUE” category for comparison. If PGL and NSG retain the single rebate category of 95% AFUE and above, Navigant will estimate free ridership results on the same basis.

‡ Programmable thermostats include basic programmable and advanced programmable types.

Navigant concludes there were not sufficient data points available to report a free ridership estimate for measures other than furnaces, programmable thermostats, and equipment hardware measures in the overall HER Program. Weatherization and duct sealing measures were significant contributors to program savings in GPY5 for Peoples Gas and North Shore Gas, but they were not well represented in the survey response data. Navigant recommends that the overall HER Program free ridership result of 0.49 shown in Table 7-2 not be applied to weatherization or duct sealing. When participant surveys are conducted in GPY6, Navigant will over-sample weatherization and duct sealing participants in order to present significant measure-level results, given the large proportion of program savings for those measures.

Given the high free ridership value for programmable thermostats, Navigant recommends that during future program planning activities, People Gas and North Shore Gas consider either removing the programmable thermostat measure from the program, or only offering rebates on the “smart thermostats”.

7.1.3 On-Line Survey Instrument

Peoples Gas and North Shore Gas Home Energy Rebate Program Fast-Feedback Survey Draft (August 7, 2015)

Intro. Please click [here](#) to complete a brief survey about the HVAC and Water Heating/Weatherization Rebates. Your responses will help <Peoples Gas/North Shore Gas> better serve you, and you will be entered in a drawing for a chance to win a \$XX gift card, or one of ten \$XX gift cards.

[HVAC and WH REBATES]

HVAC0. How did you first learn about the Home Energy Rebate program <measure> rebate?

1. From a contractor
2. From a Peoples Gas or North Shore Gas bill insert
3. From an advertisement
4. Other [open ended response box]

HVAC1. When did you first learn about the Home Energy Rebate program <measure> rebate?

1. Before I decided to buy a new <measure>
2. After I decided to buy a new <measure>, but before I purchased it
3. After I purchased the <measure>
4. Don't remember

The <measure> you bought is energy efficient. [ADD DESCRIPTION OF HIGH EFFICIENCY MEASURE]

HVAC2. Before you learned about the rebate from the Home Energy Rebate program, were you already planning to purchase a *high efficiency* <measure>?

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

HVAC3. How **influential** was the *rebate* from the Home Energy Rebate program on your decision to purchase a *high efficiency* <measure> instead of a *less efficient* <measure>? [THIS QUESTION WILL BE PRESENTED AS A 0-10 SLIDING WIDGET, WITH 0 AND 10 DEFINED AS BELOW.]

- 0 - Not at all influential
10 - Very influential

HVAC4. How **influential** was the *recommendation from your contractor* on your decision to purchase a *high efficiency* <measure> instead of a *less efficient* <measure>? [THIS QUESTION WILL BE PRESENTED AS A 0-10 SLIDING WIDGET, WITH 0 AND 10 DEFINED AS BELOW.]

- 0 - Not at all influential
10 - Very influential

How would you rate your knowledge about all the options that were available to you?

HVAC5. Without the Home Energy Rebate Program, what is the **likelihood** that you would have purchased a <measure> with the *exact same* high efficiency level? [THIS QUESTION WILL BE PRESENTED AS A 0-10 SLIDING WIDGET, WITH 0 AND 10 DEFINED AS BELOW.]

0 - Not at all likely

10 - Very likely

HVAC6. Without the Home Energy Rebate Program, what is the **likelihood** that you would have purchased the high efficiency <measure> *within one year* of your original purchase date? [THIS QUESTION WILL BE PRESENTED AS A 0-10 SLIDING WIDGET, WITH 0 AND 10 DEFINED AS BELOW.]

0 - Not at all likely

10 - Very likely

HC7. In your own words, how did the Home Energy Rebate program affect your decision to purchase the high efficiency <measure> that you received a rebate for?

OPEN ENDED RESPONSE

[WEATHERIZATION REBATES]

You installed weatherization measures through the program. Weatherization includes attic and wall installation and air and duct sealing.

W0. How did you first learn about the Home Energy Rebate Program Weatherization rebate?

1. From a contractor
2. From a Peoples Gas or North Shore Gas bill insert
3. From an advertisement
4. Other [open ended response box]

W1. When did you first learn about the Weatherization rebate available from the Home Energy Rebate program?

1. Before I decided to have weatherization done
2. After I decided to have weatherization done
3. After the weatherization was done
4. Don't remember

W2. Before you learned about the Home Energy Rebate program, were you *already planning* to have weatherization done?

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

W2a. Did you participate in the Home Energy Jumpstart program?

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

W2a. How **influential** was the Home Energy Jumpstart program on your decision to have weatherization done?

- 0 - Not at all influential
- 10 - Very influential

W3. How **influential** was the weatherization **rebate** on your decision to have weatherization done? [THIS QUESTION WILL BE PRESENTED AS A 0-10 SLIDING WIDGET, WITH 0 AND 10 DEFINED AS BELOW.]

- 0 - Not at all influential
- 10 - Very influential

W5. Without the Home Energy Rebate Program weatherization rebate, what is the **likelihood** that you would have had the *exact same* weatherization done? [THIS QUESTION WILL BE PRESENTED AS A 0-10 SLIDING WIDGET, WITH 0 AND 10 DEFINED AS BELOW.]

- 0 - Not at all likely
- 10 - Very likely

W6. Without the Home Energy Rebate Program weatherization rebate, what is the **likelihood** that you would have had the weatherization done *within one year* of your original date? [THIS QUESTION WILL BE PRESENTED AS A 0-10 SLIDING WIDGET, WITH 0 AND 10 DEFINED AS BELOW.]

- 0 - Not at all likely
- 10 - Very likely

W7. Without the Home Energy Rebate Program weatherization rebate, what is the **likelihood** that you would have had *less* weatherization done? (For example, only had attic insulation installed but not foundation insulation.) [THIS QUESTION WILL BE PRESENTED AS A 0-10 SLIDING WIDGET, WITH 0 AND 10 DEFINED AS BELOW.]

- 0 - Not at all likely
- 10 - Very likely

W8. In your own words, how did the Home Energy Rebate Program affect your decision to have the weatherization that you received a rebate for done?

OPEN ENDED RESPONSE

[ASK ALL]

OE1. Overall, how satisfied are you with the Home Energy Rebate Program? [THIS QUESTION WILL BE PRESENTED AS A 0-10 SLIDING WIDGET, WITH 0 AND 10 DEFINED AS BELOW.]

0 – Very Dissatisfied

10 - Very Satisfied

OE2. Do you have any comments about the Home Energy Rebate program?

OPEN ENDED RESPONSE

7.1.4 Navigant's August 23, 2016 Memo on Free Ridership Findings

To: Pat Michalkiewicz, Koby Bailey, Peoples Gas and North Shore Gas; Sue Nathan, Applied Energy Group; Paige Knutsen, Jim Heffron, Jason Ballew, Franklin Energy Services; Jennifer Morris, David Brightwell, ICC Staff; NTG Working Group; Annette Beitel, Celia Johnson, Future Energy Enterprises/EE SAG

From: Katherine Wolf and Jane Hummer, Navigant

CC: Randy Gunn, Kevin Grabner, Rob Neumann, Jeff Erickson, Navigant

Date: August 23, 2016

Re: Free Ridership Research Results from GPY5 for the Peoples Gas and North Shore Gas Home Energy Rebate Program

This memo presents results from Navigant's GPY5 residential free ridership evaluation activity. Our free ridership research will later support our recommendation of Net-to-Gross (NTG) values for deeming in GPY7 and beyond for the Home Energy Rebate Program (HER). Participant spillover research is planned for GPY5 and trade ally research is planned for GPY6.

NET-TO-GROSS ESTIMATION FOR THE HOME ENERGY REBATE PROGRAM

Peoples Gas (PGL) and North Shore Gas' (NSG) Home Energy Rebate Program provides their customers with rebate incentives for purchasing high-efficiency furnaces, programmable thermostats, building shell improvements, and other energy efficiency measures. Participants may apply for the rebates themselves, or contractors may assist them in the rebate application process. Rebates are processed and submitted to residential customers after installation of qualified measures.

Data Collection for Net-to-Gross Estimates

Table 4 below summarizes primary data sources that Navigant used to estimate the free ridership rate for the program. An on-line survey was conducted in November 2015 with GPY5 participants from June 2015 through October 2015 that was designed to capture free ridership soon after the purchase transaction. Future surveys will cover participant spillover and feedback from trade allies. The results from the spillover calculations and trade ally survey will be presented in separate memos.

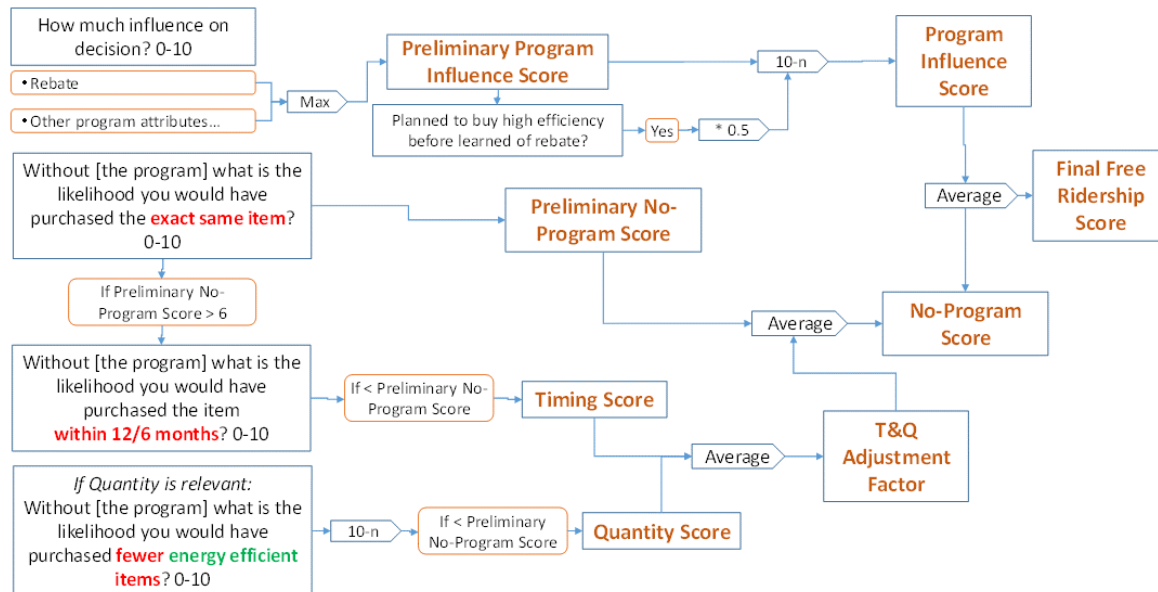
Method	Subject	Target Completes	Actual Completes
Program Participant On-line Survey	GPY5 Participating Customers	100	119

Source: Navigant

Free Ridership Estimates Using Algorithms in the TRM

Initially, Navigant used the Illinois TRM version 5.0¹⁷ free ridership algorithm to estimate free ridership for the program. The following diagrams describe the TRM free ridership algorithms for Replace on Burnout (ROB) and Early Replacement (ER):

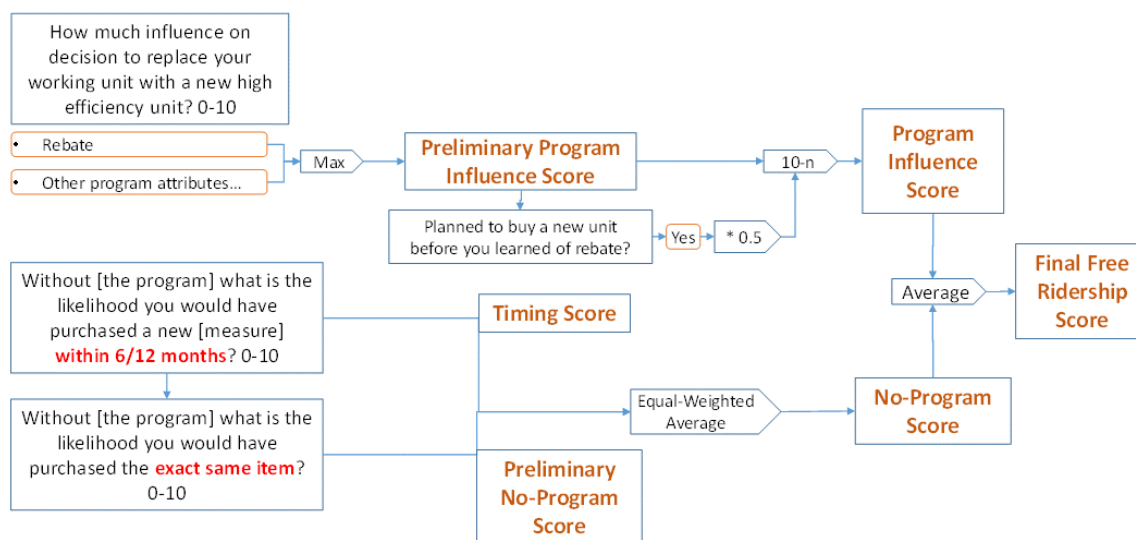
Figure 2. Residential Prescriptive Rebate (With No Audit) Free Ridership (Replace on Burnout)



Source: Illinois TRM Version 5.0

¹⁷ Illinois Statewide Technical Reference Manual for Energy Efficiency (TRM) Version 5.0 (effective 6/1/2016). Available here: <http://www.ilsag.info/technical-reference-manual.html>. See *Volume 4: Cross-Cutting Measures and Attachment*.

Figure 3. Residential Prescriptive Rebate (With No Audit) Free Ridership (Early Replacement)



Source: Illinois TRM Version 5.0

Navigant applied the algorithms indicated by the ROB and ER TRM flow diagrams to the data collected from HER participants. Since the differences between the results using the early replacement and replace-on-burnout algorithms were quite small, Navigant compared the sensitivity analysis results to the replace-on-burnout results in the tables below for simplicity's sake.

Table 5. Program Free Ridership Estimates Using the TRM ROB Algorithm†

Measure††	Free Ridership TRM ROB Methodology	N
Furnace – 95% AFUE	0.62	58
Furnace – 97% AFUE	0.68	9
Boiler	0.78	1
Programmable Thermostat	0.70	38
Tankless Water Heater	0.65	9
Weatherization	0.49	4

Source: Navigant analysis

† Free ridership results for the Boiler, Tankless Water Heater, Weatherization, and 97% AFUE furnace are not statistically significant due to the small number of responses.

†† The GPY5 PGL and NSG program offers rebates for one category of furnaces that are 95.0% AFUE and above. For the sensitivity analyses, Navigant separated the furnace category into a single category of efficiency equal to or greater than 95.0% AFUE and less than 97.0% AFUE. This 95% to 97% AFUE category matches the Nicor Gas “95% AFUE” category for comparison. If PGL and NSG retain the single rebate category of 95% AFUE and above, Navigant will estimate free ridership results on the same basis. Programmable thermostats include basic programmable and advanced programmable types.

For context, the deemed NTG ratio (NTGR) and component values for the GPY6 HER Program are NTGR (0.81); Free ridership (0.30); Participant Spillover (0.00); and Non-Participant Spillover (0.11).

SENSITIVITY ANALYSES

Navigant conducted a number of sensitivity analyses to explore the impacts of adjustments to the TRM algorithm on the free ridership results. The results of the sensitivity analyses are presented only for the two measures with the largest sample sizes: 95% AFUE furnaces and programmable thermostats. For the purposes of the sensitivity analyses, all participants are assumed to have completed replace-on-burnout rather than early replacement projects.

Table 6. PGL and NSG Sensitivity Results from Individual Adjustments to TRM Algorithm

Modification to Algorithm	95% AFUE Furnace (n=58)		Programmable Thermostat (n=38)	
	FR Result	Difference*	FR Result	Difference
TRM Algorithm Unadjusted	62%	n/a	70%	n/a
Using minimum of Timing and Preliminary No-Program as No-Program score (instead of average)	59%	-3%	67%	-3%
Balancing Prior Plans adjustment so a “No” answer reduces Preliminary No-Program score by 50%	60%	-2%	69%	-1%
Balancing Prior Plans adjustment so a “No” answer reduces No-Program score by 50%	60%	-2%	69%	-1%
Removing very inconsistent responses from analysis**	61%	-2%	71%	+1%
Removing Prior Plans adjustment from algorithm	48%	-14%	57%	-13%

Source: Navigant analysis

* The difference is measured from the results in Table 5, assuming that all participants completed replace-on-burnout rather than early replacement projects. A negative number indicates that the adjustment to the TRM algorithm reduced the free ridership estimate; a positive number indicates the adjustment increased the free ridership estimate. Differences may look inconsistent due to rounding.

** “Very inconsistent responses” are defined as respondents who answered that the program had both high program influence (>7) and they had a high likelihood (>7) of installing the same measure without the program, or respondents who indicated very low program influence (<3) and low likelihood (<3). Removal reduces the sample size significantly.

Discussion of Possible Modifications to Algorithm

This section discusses the various modifications to the TRM algorithm which Navigant tested in the sensitivity analyses.

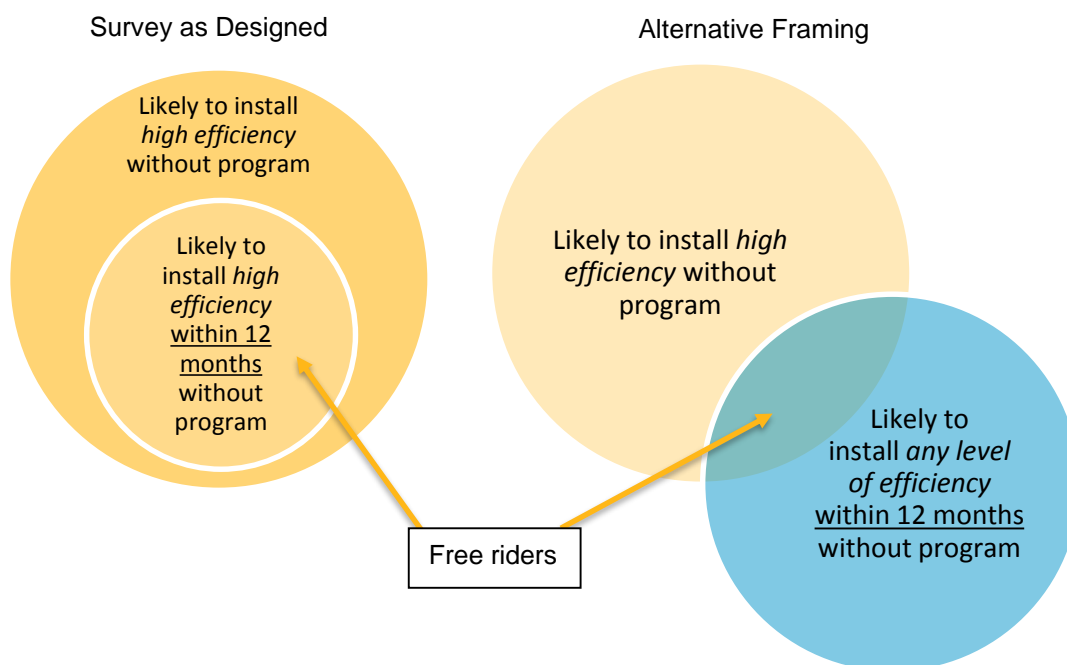
Changes to Treatment of the Timing Question

Navigant identified one potential change to the treatment of the timing question:

1. Using the minimum (rather than average) of the Preliminary No-Program and Timing scores as the No-Program score

One rationale for changing the treatment of the Timing question is that there is a possibility that some participants mistakenly answer the Timing question thinking about the likelihood of purchasing *any* equipment within a year, not necessarily *high efficiency* equipment. In fact, it is likely that some participants are making that mistake; 22 out of 119 PGL/NSG survey respondents gave a higher score for Timing than they did Preliminary No-Program, which should be logically impossible if they understood the question correctly. The Timing score should be less than or equal to the Preliminary No-Program score because the Timing score is a narrower case of the Preliminary No-Program score – both scores refer to purchasing the exact same furnace except the Timing score adds the restriction of making the purchase within 12 months. Figure 4 demonstrates how participants with a high Timing score should be a subset of the population of possible free riders based on the survey as designed in accordance with the TRM (left Venn diagram). The right Venn diagram shows an alternative way to frame the questions (which may be consistent with how some participants interpreted the question). It separates the questions of likely to install high efficiency and likely to install within 12 months without regard to efficiency level.

Figure 4. Relationship between the Preliminary No-Program Score and the Timing Score



Using the minimum, rather than the average, of the Timing and Preliminary No-Program score would reflect the survey's intentions and correct for any participants who mistakenly interpreted the timing question to be asking about purchasing a furnace or other measure of *any* efficiency rather than high efficiency.¹⁸

Free ridership batteries often ask about the timing of an efficiency purchase if the program did not exist because participants have a hard time predicting major purchases far in advance. If a respondent says

¹⁸ Note that the survey instrument does ask participants about their likelihood of purchasing the "exact same" efficiency item.

that they were very likely to install a high efficiency measure at some point (e.g., a Preliminary No-Program score of 7 or higher), but less likely to install the measure within one year (e.g., a lower Timing score), the No-Program score should reflect that lower score because of the uncertainty in participants' ability to predict future purchase decisions under hypothetical circumstances. If a respondent indicated a very low likelihood of making the purchase within one year, it is very difficult for them to accurately predict whether they would have ever made the purchase; personal finances and market conditions can change dramatically within a year.

Changes to Treatment of Prior Planning Question

The TRM algorithm is particularly sensitive to the response to the question about whether participants had planned to purchase high efficiency prior to learning about the program's rebate. A "yes" answer to the prior planning question results in a minimum free ridership score of 25% regardless of the responses to other questions.

Navigant identified three mutually exclusive potential changes to the treatment of the prior planning question:

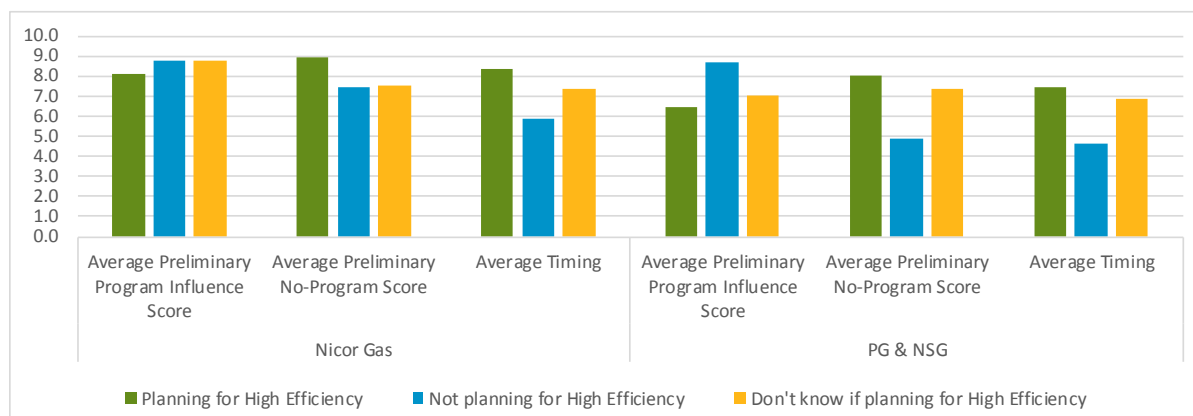
1. Removing Prior Plans adjustment from the algorithm
2. Balancing the Prior Plans adjustment so a "No" answer reduces Preliminary No-Program score by 50%
3. Balancing the Prior Plans adjustment so a "No" answer reduces No-Program score by 50%

One rationale for changing the treatment of the prior planning question is respondents may be assuming that *any* new furnace, boiler, or water heater would be higher efficiency than the one they were replacing.¹⁹ Thus, they could honestly answer "yes, I was planning to buy a high efficiency [measure] before I learned about the rebate" while still being unlikely to have purchased the same high level of efficiency incented through the program. The 50% reduction to the program influence (resulting from a "yes" answer to the prior planning question) as specified in the TRM algorithm has a significant impact on the resulting free ridership estimate; simply removing that adjustment had the biggest impact of all the sensitivity analyses Navigant tried.

Another rationale is that participants themselves may already be accounting for their prior plans when answering the other questions which factor into the algorithm. On average, both Nicor Gas and PGL and NSG participants who said they were planning for high efficiency before they learned about the program gave lower Program Influence scores and higher Preliminary No-Program and Timing scores than participants who said they were not planning for high efficiency prior to learning of the program, as shown in the figure below. Thus, even without the Prior Planning adjustment, participants who said they were planning for high efficiency receive higher free ridership estimates than those who were not. Further adjustment on the basis of prior plans may not be necessary, and may be inconsistent with the principle of allowing participants to speak for themselves without evaluators building arbitrary evaluation constructs into the algorithm. Thus, Navigant tried a sensitivity analysis in which the prior plans question does not factor into the algorithm.

¹⁹ The survey instrument specifically referenced "95% AFUE furnaces", however, it is possible that some customers still mistakenly think of all new furnaces as "high efficiency."

Figure 5. Correlation of Prior Plans with Other Scores



Source: Navigant analysis

If it is believed that prior plans indicate that free ridership is likely *higher* than participants would otherwise describe, it would be logical to believe that the lack of prior plans would similarly indicate *lower* free ridership than participants would otherwise describe. Navigant tried sensitivity analyses in which a “no prior plans” answer resulted in cutting the Preliminary No-Program or the entire No-Program score in half, in parallel to a “yes” answer cutting the Preliminary Program Influence score in half.

Other Sensitivity Analyses and Changes to the TRM Algorithms

There are numerous possible adjustments to the TRM algorithms that may be considered and analyzed through sensitivity tests. The adjustments could be analyzed individually or in combinations. For example, one possible change to the algorithm would remove very inconsistent responses from the analysis to address inconsistencies in participants’ answers. This change could be implemented in any combination with the other adjustments to the treatment of timing and prior plans discussed in the previous sections. Removing very inconsistent responses would have less effect if certain adjustments are made to the timing or prior plans treatments, because those possible changes would serve to reduce the number of inconsistent responses.

Navigant’s Suggested Modification to the TRM Algorithm

One combination of modifications to the algorithm that Navigant believes would be defensible and improve the analysis is:

1. Using the minimum (rather than average) of the Preliminary No-Program and Timing scores as the No-Program score, and
2. Removing the Prior Plans adjustment from the algorithm.

The results of this combination are presented in the table below.

Table 7. PGL/NSG Sensitivity Results from Combined Adjustments to TRM Algorithm

Modifications to Algorithm	95% AFUE Furnace (n=58)		Programmable Thermostat (n=38)	
	FR Result	Difference	FR Result	Difference
TRM Algorithm Unadjusted	62%	n/a	70%	n/a
Using minimum of Timing and Preliminary No-Program scores as No-Program score and removal of the Prior Plans adjustment	46%	-16%	56%	-14%

Source: Navigant analysis

The following figure demonstrates how this change in algorithm affects the distribution of free ridership values for PGL and NSG 95% AFUE furnace participants. The TRM algorithm results in free ridership scores between 10% and 100%, with most results clustered between 50% and 80%. The modified algorithm results in a more normal distribution of scores using the full range of 0% to 100%, and the central tendency is at 40-50% free ridership.

Figure 6. Effect of Treatment of Prior Plans in Algorithm on Free Ridership

