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Multi-Family Home Energy Savings Program
GPY2 Evaluation Report

Final

Energy Efficiency Plan:
Gas Plan Year 2
(6/1/2012-5/31/2013)

Presented to
Peoples Gas and North Shore Gas

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E. Executive Summary

This report presents a summary of the findings and results from the Impact Evaluation of the Peoples Gas and North Shore Gas Multi-Family Home Energy Savings (MFHES) program.[1] The MFHES program is in the second year of jointly implemented program delivery with Commonwealth Edison Company (ComEd), which is ComEd electric program year 5 (EPY5) and Peoples Gas and North Shore Gas program year 2 (GPY2).[2] The MFHES program achieves natural gas energy savings for Peoples Gas and North Shore Gas customers and electric energy savings to ComEd customers. The program is designed to secure energy savings through direct installation of low-cost efficiency measures, such as CFLs, water efficient showerheads, faucet aerators, programmable thermostats, hot water pipe and steam pipe insulation measures at eligible multifamily residences. A secondary objective of the program is to identify energy saving opportunities in the common areas of multifamily buildings through a visual inspection of common area lighting and/or central plant locations to channel customers to other programs offered by the utilities. Primary target markets for the program include property management firms, trade and professional organizations, building owners, and contractors who service multifamily buildings. During EPY5/GPY2, the MFHES program expanded its scope to offer direct installation measures in common areas of eligible multifamily properties. The program added assisted living, senior housing and public housing market segments to eligible properties. Franklin Energy Services, LLC (Franklin Energy) implements the program for customers served by ComEd, Peoples Gas and North Shore Gas.

E.1. Program Savings

Table E-1 summarizes natural gas savings from the Multi-Family program.

[1] In GPY3, the program expanded its scope and changed its name to the Multi-Family Comprehensive Energy Efficiency Program. For purposes of this evaluation report, the program is referred to as the Multi-Family Home Energy Savings program.

[2] The GPY2 program year began June 1, 2012 and ended May 31, 2013.

Table E- 1. Peoples Gas and North Shore Gas GPY2 Program Savings

Savings Category	Peoples Gas	North Shore Gas
Ex-Ante Gross Savings (Therms)	1,826,787	158,112
Verified Gross Realization Rate[3]	100% ‡	98% ‡
Verified Gross Savings (Therms)	1,826,567	154,640
Net to Gross Ratio (NTGR)	0.90†	0.90†
Verified Net Savings (Therms)	1,643,910	139,176

Source: Navigant analysis of GPY2 Multifamily program tracking data (July 26, 2013 data extract).
† A deemed value. Source: Document provided by PGL-NSG to the SAG summarizing the SAG-approved NTGR for PGL-NSG for GPY1-GPY3 through a consensus process in March-August 2013. Distributed in the SAG meeting on August 5-6, 2013. http://ilsagfiles.org/SAG_files/Meeting_Materials/2013/August 5-6, 2013 Meeting/ Peoples Gas and North Shore Gas GPY1-GPY3 and Phase II Plan.xls
‡ Based on evaluation research findings.

E.2. Program Savings by Equipment End-Use Type

Table E- 2 summarizes GPY2 Peoples Gas Multi-Family Home Energy Savings Program energy savings results by measure or equipment end-use type. Hot water pipe insulation measures and boiler pipe insulation measures installed in building common areas were the largest category of savings in the Peoples Gas program, followed by water efficiency measures.

[3] Navigant calculated verified gross savings at the therms level to achieve the closest precision estimate, using more than two decimal places. The verified gross realization rate in the report (verified gross savings/ex ante gross savings) is rounded to 2 digits, so direct application to get verified gross savings may produce rounding differences.

Table E- 2. GPY2 Peoples Gas Program Savings by Equipment End-Use Type

	Sample	Energy Savings (Therms)	90/10 Significance?
Water Efficiency Measures			
Ex-Ante GPY2 Gross Savings	NA†	799,698	NA†
Verified Gross Realization Rate‡		100%	
Verified Gross Savings		799,698	
Net-to-Gross Ratio (NTGR) †		0.90	
Verified Net Savings		719,728	
Thermostats			
Ex-Ante GPY2 Gross Savings	NA†	4,701	NA†
Verified Gross Realization Rate‡		95%	
Verified Gross Savings		4,481	
Net-to-Gross Ratio (NTGR) †		0.90	
Verified Net Savings		4,033	
Hot Water or Steam Pipe Wrap Insulation Measures			
Ex-Ante GPY2 Gross Savings	NA†	1,022,388	NA†
Verified Gross Realization Rate‡		100%	
Verified Gross Savings		1,022,388	
Net-to-Gross Ratio (NTGR) †		0.90	
Verified Net Savings		920,149	
Peoples Gas GPY2 Total			
Ex-Ante GPY2 Gross Savings	NA†	1,826,787	NA†
Verified Gross Realization Rate‡		100%	
Verified Gross Savings		1,826,567	
Net-to-Gross Ratio (NTGR) †		0.90	
Verified Net Savings		1,643,910	

Source: Navigant analysis of GPY2 Multifamily program tracking data (July 26, 2013 data extract).
† Results based on deemed values.
‡ Based on evaluation research findings.

The GPY2 North Shore Gas Multi-Family Home Energy Savings Program energy savings results by measure or equipment end-use type, as shown in Table E- 3 below. The North Shore Gas program installed a greater number of thermostats than the Peoples Gas program, contributing the second most energy savings measure category behind water efficiency measures. Due to limited opportunities based on the building stock in its service area, the North Shore Gas program did not install steam pipe insulation measures.

Table E- 3. GPY2 North Shore Gas Program Savings by Equipment End-Use Type

	Sample	Energy Savings (Therms)	90/10 Significance?
Water Efficiency Measures			
Ex-Ante GPY2 Gross Savings	NA†	82,324	NA†
Verified Gross Realization Rate‡		100%	
Verified Gross Savings		82,324	
Net-to-Gross Ratio (NTGR) †		0.90	
Verified Net Savings		74,092	
Thermostats			
Ex-Ante GPY2 Gross Savings	NA†	74,218	NA†
Verified Gross Realization Rate‡		95%	
Verified Gross Savings		70,747	
Net-to-Gross Ratio (NTGR) †		0.90	
Verified Net Savings		63,672	
Hot Water Pipe Wrap Insulation Measures			
Ex-Ante GPY2 Gross Savings	NA†	1,569	NA†
Verified Gross Realization Rate‡		100%	
Verified Gross Savings		1,569	
Net-to-Gross Ratio (NTGR) †		0.90	
Verified Net Savings		1,413	
North Shore Gas GPY2 Total			
Ex-Ante GPY2 Gross Savings	NA†	158,112	NA†
Verified Gross Realization Rate‡		98%	
Verified Gross Savings		154,640	
Net-to-Gross Ratio (NTGR) †		0.90	
Verified Net Savings		139,176	

Source: Navigant analysis of GPY2 Multifamily program tracking data (July 26, 2013 data extract).
† *Results based on deemed values.*
‡ *Based on evaluation research findings.*

E.3. Impact Estimate Parameters

In the course of estimating verified gross and net savings, the evaluation team used a variety of parameters in its calculations. Some of those parameters were deemed for this program year and others were adjusted based on evaluation research. The key parameters and data sources used in the analysis are shown in Table E- 4.

Table E- 4. Verified Gross and Net Savings Parameter Data Sources

Parameter	Data Source	Deemed or Evaluated?
NTGR	Illinois Stakeholder Advisory Group Process †	Deemed
Realization Rate	Evaluation research	Evaluated
Number of measures installed	Program tracking system	Evaluated
Direct Install Showerhead Savings	Illinois TRM, version 1.0, section 5.4.5.‡	Deemed
Direct Install Bathroom and Kitchen Aerator Savings	Illinois TRM, version 1.0, section 5.4.4.‡	Deemed
Direct Install Programmable Thermostat Savings	Illinois TRM, version 1.0, section 5.3.10.‡	Deemed
Direct Install Hot Water Pipe Wrap Insulation Savings	Illinois TRM, version 1.0, section 5.4.1.‡	Deemed
Hot Water Pipe & Steam Pipe Wrap Insulation Measure Savings	Integrys_Master_Measure_Document 010213 & Evaluation Research	Evaluated

† Document provided by PGL-NSG to the SAG summarizing the SAG-approved NTGR for PGL-NSG for GPY1-GPY3 through a consensus process in March-August 2013. Distributed in the SAG meeting on August 5-6, 2013. http://ilsagfiles.org/SAG_files/Meeting_Materials/2013/August 5-6, 2013 Meeting/ Peoples Gas and North Shore Gas GPY1-GPY3 and Phase II Plan.xls

‡ Source: Integrys_Master_Measure_Document 010213; State of Illinois Technical Reference Manual. Final as of September 14, 2012, effective June 1, 2012. http://ilsagfiles.org/SAG_files/Technical Reference Manual/Illinois Statewide_TRM_Version_1.0.pdf

E.4. Impact Estimate Parameters For Future Use

Navigant conducted evaluation research into two measures that may assist the Illinois TRM Technical Advisory Committee annual updating process. Additional details are included in Section 7.2 of this evaluation report.

E.5. Participation Information

In GPY2, the Peoples Gas program installed a total of 170,087 measures at 27,178 residential dwelling units, an increase of 58% from GPY1's total of 17,188 residential dwelling units. The GPY2 North Shore Gas program installed 11,727 measures at 4,745 residential dwelling units, an increase of 67% from GPY1's total of 2,844 residential dwelling units. Program participation totals are shown in Table E- 5.

Table E- 5. GPY2 Primary Participation Detail

Participation	Peoples Gas	North Shore Gas
Participants (residential dwelling units)	27,148	4,745
Total Measures	170,087	11,727

Source: Navigant analysis of GPY2 Multifamily program tracking data (July 26, 2013 data extract).

E.6. Conclusions and Recommendations

The GPY2 Peoples Gas and North Shore Gas programs each delivered energy savings above the previous program year, although the programs saw lower residential dwelling unit participation than planned. Energy savings from steam pipe insulation common-area measures installed in Peoples Gas service area accounted for a significant source of savings that delivered program savings above planned levels. The programs' tracking system is accurately recording measure counts and, with some minor exceptions as detailed in this report, measure savings, contributing to gross realization rates at or near one-hundred percent. In GPY2, the program-level Net-to-Gross Ratio (NTGR) of 0.90 was used to calculate the verified net savings and was deemed through a consensus process by the Illinois Stakeholder Advisory Group (SAG)[4] based on GPY1 evaluation research.

Program Savings Goals Attainment

Finding 1. The Peoples Gas GPY2 program achieved evaluation verified net savings of 1,643,910 therms, achieving 162 percent of the program's net savings goal of 1,014,441 therms. Compared to GPY1, the Peoples Gas program increased energy savings by 257 percent. The North Shore Gas GPY2 program achieved evaluation verified net savings of 139,176 therms, achieving 78 percent of the program's net savings goal of 179,019 therms. Compared to GPY1, the North Shore Gas program increased energy savings by 76 percent.

Recommendation 1. As already planned in GPY3, the implementation contractor should continue to identify common area and whole-building measure energy savings opportunities for participants. In particular, the implementation contractor should continue to identify opportunities to install steam pipe insulation measures in Peoples Gas service territory. As applicable, the implementation contractor should install steam pipe insulation measures at buildings in North Shore Gas service area, although opportunities may be limited due to the building stock in that area.

Verified Gross Realization Rates

Finding 2. The program is accurately tracking measure counts. Appropriate quality control and quality assurance procedures are in place. The GPY2 Peoples Gas program verified gross realization rate was 100 percent. The GPY2 North Shore Gas program verified gross realization rate was 98 percent. Navigant calculated verified gross savings at the therms

[4] Document provided by PGL-NSG to the SAG summarizing the SAG-approved NTGR for PGL-NSG for GPY1-GPY3 through a consensus process in March-August 2013. Distributed in the SAG meeting on August 5-6, 2013. http://ilsagfiles.org/SAG_files/Meeting_Materials/2013/August 5-6, 2013 Meeting/ Peoples Gas and North Shore Gas GPY1-GPY3 and Phase II Plan.xls

level to achieve the closest precision estimate, using more than two decimal places. The verified gross realization rate in the report (verified gross savings/ex ante gross savings) is rounded to 2 digits, so direct application to get verified gross savings may produce rounding differences.

Savings Estimates

Finding 3. Over half of energy savings from the Peoples Gas program (920,149 verified net therms) were from hot water pipe insulation measures or steam pipe insulation measures installed in building common areas. The implementation contractor's steam pipe insulation measure savings estimates, while reasonable and not requiring an adjustment at this time, stand to benefit from additional engineering research into applicable heat loss correction factors (i.e. heat lost through the insulation system of conditioned space into unconditioned space), which is a required value for engineering software (i.e. 3E Plus) model outputs.

Recommendation 3. The implementation contractor should conduct research to validate engineering assumptions for the heat loss correction factor used in estimating ex-ante savings values for hot water pipe insulation measures or steam pipe insulation measures installed in building common areas. The implementation contractor should communicate the results of its research with Navigant for verification.

Finding 4. With a minor exception below, the program tracking system is accurately recording measure savings estimates based on deemed or partially deemed values from the Illinois TRM. Navigant made a minor adjustment to an ex-ante gross parameter for programmable thermostats to correspond to the Illinois TRM. The Illinois TRM uses a value of 6.2% reduction in heating energy consumption. The ex-ante savings calculation used a value of 6.5% reduction in heating energy consumption. The evaluators applied the value of 6.2% to obtain evaluation verified savings for programmable thermostats. The difference between the ex-ante value of 6.5% and the TRM value of 6.2% was the only adjustment between ex-ante gross and evaluation verified gross savings.

Recommendation 4. The implementation contractor should update ex-ante values for programmable thermostat measures. Specifically, the implementation contractor should update the heating energy consumption gross impact parameter to 6.2% to correspond with the Illinois TRM.

1. Introduction

1.1 Program Description

The Multi-Family Home Energy Savings (MFHES) program is in the second year of jointly implemented program delivery with Commonwealth Edison Company (ComEd), which is ComEd electric program year 5 (EPY5) and Peoples Gas and North Shore Gas program year 2 (GPY2).[5] The MFHES program achieves natural gas energy savings for Peoples Gas and North Shore Gas customers and electric energy savings to ComEd customers. The EPY5/GPY2 MFHES program is designed to secure energy savings through direct installation of low-cost efficiency measures, such as CFLs, water efficient showerheads, faucet aerators, programmable thermostats, hot water pipe and steam pipe insulation measures at eligible multifamily residences. A secondary objective of the program is to identify energy saving opportunities in the common areas of multifamily buildings through a visual inspection of common area lighting and/or central plant locations to channel customers to other programs offered by the utilities. Primary target markets for the program include property management firms, trade and professional organizations, building owners and contractors who service multifamily buildings. During EPY5/GPY2, the MFHES program expanded its scope to offer direct installation measures in common areas of eligible multifamily properties. The program added assisted living, senior housing and public housing market segments to eligible properties. Franklin Energy Services, LLC (Franklin Energy) implemented the program for customers served by ComEd, Peoples Gas and North Shore Gas.

1.2 Evaluation Objectives

Navigant conducted a limited verified gross impact evaluation in GPY2 because most of the GPY2 MFHES program's savings were derived based on the Illinois TRM and Navigant reviewed the savings calculations for this program in the EPY4/GPY1 program year.

The Evaluation Team identified the following key researchable questions for GPY2:

1.2.1 Impact Questions

1. What is the status of the implementation of Navigant's recommendations detailed in the team's Verification, Due Diligence and Tracking System Review memo dated May 21, 2012 (revised November 2, 2012) for ComEd/PGL-NSG?[6]
2. What is the MFHES program's verified net and gross savings?
3. Are TRM algorithms appropriately applied and are the programs' tracking system correctly calculating and tracking deemed measure values?
4. What are the energy savings associated with new program measures, such as shower-start devices?

[5] The GPY2 program year began June 1, 2012 and ended May 31, 2013.

[6] Navigant received a memorandum from Franklin Energy with detailed responses to our findings and recommendations memo on July 18, 2012.

1.2.2 Process Questions

In GPY2, process questions were limited to interviews with program staff and the implementation contractor staff to verify information about the MFHES program's measures and tracking system. The program evaluation plan did not include new research into program processes.

2. Evaluation Approach

Navigant conducted a verified gross impact evaluation in GPY2 through an engineering review of per unit savings parameters and the program tracking system and data. Navigant interviewed utility program staff, consultants, and implementation contractors to verify information about the program and review the tracking system. In GPY2, the Net-to-Gross Ratio (NTGR) estimates used to calculate the Net Verified Savings were deemed through a consensus process by the Illinois Stakeholder Advisory Group (SAG)[7] based on GPY1 evaluation research. Navigant applied the deemed program NTGR to obtain verified net savings.

2.1 Primary Data Collection

2.1.1 Overview of Data Collection Activities

The core data collection activity was reviewing the programs' tracking system to verify that all fields are appropriately populated, as shown in the Table 2-1.

Table 2-1. Core Data Collection Activities

N	What	Who	Target Completes	Completes Achieved	When	Comments
Impact Assessment						
1	Measure Savings Review	Program Tracking System	All	all	July-August 2013	Source of information for verified gross analysis
Process Assessment						
2	Interviews	Program Managers/Implementer Staff	4	4	July 2013	Includes interviews with staff from ComEd and Franklin Energy

Source: Navigant

2.1.2 Verified Savings Parameters

Navigant estimated verified per unit savings for each program measure using impact algorithm sources found in the Illinois TRM for deemed measures, and evaluation research for evaluated measures. Table 2-2 below presents the sources for parameters that were used in verified gross savings analysis indicating which were examined through GPY2 evaluation research and which were deemed. For measures not included in the Illinois TRM, Navigant reviewed ex-ante values and

[7] Document provided by PGL-NSG to the SAG summarizing the SAG-approved NTGR for PGL-NSG for GPY1-GPY3 through a consensus process in March-August 2013. Distributed in the SAG meeting on August 5-6, 2013. http://ilsagfiles.org/SAG_files/Meeting_Materials/2013/August 5-6, 2013 Meeting/ Peoples Gas and North Shore Gas GPY1-GPY3 and Phase II Plan.xls

engineering assumptions provided by the implementation contractor, including hot water pipe and steam pipe insulation measures in building common areas.

Table 2-2. Verified Gross and Net Savings Parameter Data Sources

Parameter	Data Source	Deemed or Evaluated?
NTGR	Illinois Stakeholder Advisory Group Process †	Deemed
Realization Rate	Evaluation research	Evaluated
Number of measures installed	Program tracking system	Evaluated
Direct Install Showerhead Savings	Illinois TRM, version 1.0, section 5.4.5.‡	Deemed
Direct Install Bathroom and Kitchen Aerator Savings	Illinois TRM, version 1.0, section 5.4.4.‡	Deemed
Direct Install Programmable Thermostat Savings	Illinois TRM, version 1.0, section 5.3.10.‡	Deemed
Direct Install Hot Water Pipe Wrap Insulation Savings	Illinois TRM, version 1.0, section 5.4.1.‡	Deemed
Hot Water Pipe& Steam Pipe Wrap Insulation Measure Savings	Integrys_Master_Measure_Document 010213 & Evaluation Research	Evaluated

† Document provided by PGL-NSG to the SAG summarizing the SAG-approved NTGR for PGL-NSG for GPY1-GPY3 through a consensus process in March-August 2013. Distributed in the SAG meeting on August 5-6, 2013. http://ilsagfiles.org/SAG_files/Meeting_Materials/2013/August 5-6, 2013 Meeting/ Peoples Gas and North Shore Gas GPY1-GPY3 and Phase II Plan.xls

‡ Integrys_Master_Measure_Document 010213; State of Illinois Technical Reference Manual. Final as of September 14, 2012, effective June 1, 2012. http://ilsagfiles.org/SAG_files/Technical Reference Manual/Illinois Statewide_TRM_Version_1.0.pdf

2.1.3 Verified Gross Program Savings Analysis Approach

Navigant reviewed the programs' tracking systems and procedures to verify that the program accurately reported measure counts. The majority of program savings were derived based on deemed values and algorithms from the State of Illinois Energy Efficiency Technical Reference Manual (Illinois TRM v1.0).[8] For Peoples Gas and North Shore Gas, the Illinois TRM provides the per unit savings for gas measures, with some exceptions for measures that were not included in the applicable TRM version. For measures not included in the Illinois TRM, Navigant reviewed ex-ante values and engineering assumptions provided by the implementation contractor, including steam pipe insulation measures. Verified per unit savings reflect evaluation adjustments to per unit savings values based on Navigant measure review. The verified gross savings are the product of verified per unit savings and verified measure quantities. Navigant calculated verified gross savings at the therms

[8] State of Illinois Technical Reference Manual. Final as of September 14, 2012, effective June 1, 2012. http://ilsagfiles.org/SAG_files/Technical Reference Manual/Illinois Statewide_TRM_Version_1.0.pdf

level to achieve the closest precision estimate, using more than two decimal places. The verified gross realization rate in the report (verified gross savings/ex ante gross savings) is rounded to 2 digits, so direct application to get verified gross savings may produce rounding differences.

2.1.4 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 GPY2, the NTGR estimate used to calculate the Net Verified Savings was deemed through a consensus process by the Illinois Stakeholder Advisory Group (SAG)[9] based on GPY1 evaluation research.

2.1.4.1 Free-Ridership

The GPY2 free-ridership estimate used to calculate the NTGR was deemed through a consensus process by the Illinois Stakeholder Advisory Group (SAG) based on GPY1 evaluation research. The program evaluation plan did not include new free-ridership research during the GPY2 program year.

2.1.4.2 Spillover

The GPY2 spillover estimate used to calculate the NTGR was deemed through a consensus process by the Illinois Stakeholder Advisory Group (SAG) based on GPY1 evaluation research. The program evaluation plan did not include new spillover research during the GPY2 program year.

2.1.5 Process Evaluation

The GPY2 process evaluation was limited to interviews with program staff and the implementation contractor staff to verify information about the program's measures and tracking system. The program evaluation plan did not include new research into program processes.

[9] Document provided by PGL-NSG to the SAG summarizing the SAG-approved NTGR for PGL-NSG for GPY1-GPY3 through a consensus process in March-August 2013. Distributed in the SAG meeting on August 5-6, 2013. http://ilsagfiles.org/SAG_files/Meeting_Materials/2013/August 5-6, 2013 Meeting/ Peoples Gas and North Shore Gas GPY1-GPY3 and Phase II Plan.xls

3. Gross Impact Evaluation

Navigant determined that the GPY2 Peoples Gas program achieved verified gross savings of 1,826,567 therms and a 100% verified gross realization rate. The GPY2 North Shore Gas program achieved verified gross savings of 154,640 therms and a 98% verified gross realization rate. As noted previously, Navigant calculated verified gross savings at the therms level to achieve the closest precision estimate, using more than two decimal places. The verified gross realization rate in the report (verified gross savings/ex ante gross savings) is rounded to 2 digits, so direct application to get verified gross savings may produce rounding differences.

3.1.1 Tracking System Review

For this evaluation, Navigant verified that the Peoples Gas and North Shore Gas program tracking system (using the Bensight Data Management platform) continued to capture relevant data required to track the program's actions for reporting and evaluation activities. Navigant found that the programs had implemented quality assurance and quality control procedures to minimize the likelihood of data entry errors and that the programs continued to maintain or improve upon these procedures.

Over the course of the GPY2 program year, Navigant and the program implementation contractor maintained close contact regarding program tracking system updates to follow up from previous program evaluation recommendations. The implementation contractor granted Navigant direct access to the program tracking system, enabling Navigant to obtain real-time information from the tracking system. Navigant verified that the program tracking system was accurately recording measure counts. Except for a minor adjustment for programmable thermostats savings values, Navigant verified that measure savings values were accurately recorded in the tracking system. Navigant's previous evaluation of the jointly implemented multifamily programs included a detailed review of the programs' tracking system.[10]

3.1.2 Program Volumetric Findings

As shown in Table 3-1 below, the Peoples Gas GPY2 program installed a verified total of 170,087 direct install measures at 27,148 dwelling units. The North Shore Gas GPY2 program installed a verified total of 11,727 direct install measures at 4,745 dwelling units, as shown in Table 3-2. Direct install measures included water efficiency measures, programmable thermostats, hot water pipe and steam pipe insulation measures. Hot water pipe and steam pipe insulation measure totals are included in linear feet. The North Shore Gas GPY2 program did not install steam pipe wrap insulation, elbows, fittings or valve measures due to limited opportunities based on the building stock in this area.

[10] Navigant, *EPY4-GPY1 ComEd, Peoples Gas and North Shore Gas Multi-Family Home Energy Savings Program Evaluation Report FINAL* (June 4, 2013).

Table 3-1. Peoples Gas Ex-Ante and Verified Measure Count

Measure	Unit	Ex-Ante Measure Count	Verified Measure Count
Showerheads	Unit	25,283	25,283
Kitchen Aerators	Unit	22,413	22,413
Bathroom Aerators	Unit	26,636	26,636
Programmable Thermostat	Unit	121	121
Programmable Thermostat Setback	Unit	10	10
Hot Water Pipe Wrap Insulation	Linear Ft	488	488
Large HW Pipe Wrap - common area	Linear Ft	1,517	1,517
Medium HW Pipe Wrap - common area	Linear Ft	4,894	4,894
Small HW Pipe Wrap - common area	Linear Ft	6,290	6,290
Steam Pipe Elbows & Fittings - XLarge	Linear Ft	64	64
Steam Pipe Elbows & Fittings - Large	Linear Ft	896	896
Steam Pipe Elbows & Fittings - Medium	Linear Ft	9,934	9,934
Steam Pipe Elbows & Fittings - Return Line	Linear Ft	396	396
Steam Pipe Elbows & Fittings - Small	Linear Ft	4,494	4,494
Steam Pipe Valves - Large	Linear Ft	4	4
Steam Pipe Valves - Medium	Linear Ft	6	6
Steam Pipe Valves - Return Line	Linear Ft	3	3
Steam Pipe Valves - Small	Linear Ft	4	4
Steam Pipe Wrap- XLarge	Linear Ft	414	414
Steam Pipe Wrap- Large	Linear Ft	8,670	8,670
Steam Pipe Wrap- Medium	Linear Ft	44,583	44,583
Steam Pipe Wrap- Small	Linear Ft	11,145	11,145
Steam Pipe Wrap- RL Small	Linear Ft	1,823	1,823
GPY2 Peoples Gas Total		**170,087**	**170,087**

Source: Navigant analysis of GPY2 Multifamily program tracking data (July 26, 2013 data extract)

Table 3-2 North Shore Gas Ex-Ante and Verified Measure Count

Measure	Unit	Ex-Ante Measure Count	Verified Measure Count
Showerheads	Unit	2,529	2,529
Kitchen Aerators	Unit	2,284	2,284
Bathroom Aerators	Unit	3,401	3,401
Programmable Thermostat	Unit	269	269
Programmable Thermostat Setback	Unit	1,799	1,799
Hot Water Pipe Wrap Insulation	Linear Ft	1,018	1,018
Medium HW Pipe Wrap - common area	Linear Ft	118	118
Small HW Pipe Wrap - common area	Linear Ft	309	309
GPY2 North Shore Gas Total		**11,727**	**11,727**

Source: Navigant analysis of GPY2 Multifamily program tracking data (July 26, 2013 data extract).

3.1.3 Gross Program Impact Parameter Estimates

As described in Section 2, Navigant calculated verified gross energy savings (therms) using Illinois TRM methodology and algorithms for deemed measures. With a minor exception for programmable thermostats, Navigant verified that ex-ante measure savings were accurately recorded in the tracking system. Navigant made an adjustment to an ex-ante gross parameter for programmable thermostats to correspond to the Illinois TRM. The Illinois TRM uses a value of 6.2% reduction in heating energy consumption. The ex-ante savings calculation used a value of 6.5% reduction in heating energy consumption. The evaluators applied the value of 6.2% to obtain evaluation verified savings for programmable thermostats .

Navigant conducted research to validate engineering assumptions for parameter values not specified in the Illinois TRM, including hot water pipe and steam pipe insulation measures in building common areas, which were supplied by the program's implementation contractor.[11] Navigant reviewed the implementation contractor's engineering input assumptions and determined that these engineering assumptions were reasonable. While Navigant made no adjustments to ex-ante savings for hot water pipe and steam pipe insulation measures in building common areas, Navigant recommends further research to validate engineering assumptions, as documented in this report's findings and recommendations. Additional evaluation research is included in Section 7.2.1.1.

Navigant's research indicates that installing a thermostatically initiated shower restriction valve (i.e. Showerstart™ device) on a showerhead can potentially save an additional 4.2 therms/yr in multifamily homes, although additional research is required. Additional evaluation research is included in Section 7.2.1.2.

Navigant calculated verified gross energy savings (therms) using measure savings values as identified in Table 3-3 below.

[11] Integrys_Master_Measure_Document 010213 (see spreadsheet Tab 31: MF Common Area Pipe Wrap).

Table 3-3. Verified Gross Savings Parameters

Measure	Verified Gross Savings (Therms/Unit)	Method	Source (IL-TRM)
Showerheads	26.21	Deemed	v1.0 sections 5.4.4 and 5.4.5
Kitchen Aerators	2.52	Deemed	
Bathroom Aerators	3.02	Deemed	
Programmable Thermostat	34.21	Deemed	v1.0 section 5.3.10
Hot Water Pipe Wrap Insulation	0.91	Deemed	v1.0 section 5.4.1
Large HW Pipe Wrap - common area	4.49	Evaluated	Inputs from implementation contractor
Medium HW Pipe Wrap - common area	2.56	Evaluated	
Small HW Pipe Wrap - common area	1.11	Evaluated	
Steam Pipe Elbows & Fittings - XLarge	43.33	Evaluated	
Steam Pipe Elbows & Fittings - Large	28.00	Evaluated	
Steam Pipe Elbows & Fittings - Medium	14.11	Evaluated	
Steam Pipe Elbows & Fittings - Return Line	3.36	Evaluated	
Steam Pipe Elbows & Fittings - Small	5.68	Evaluated	
Steam Pipe Valves - Large	70.00	Evaluated	
Steam Pipe Valves - Medium	35.11	Evaluated	
Steam Pipe Valves - Return Line	8.39	Evaluated	
Steam Pipe Valves - Small	14.22	Evaluated	
Steam Pipe Wrap- XLarge	36.11	Evaluated	
Steam Pipe Wrap- Large	23.33	Evaluated	
Steam Pipe Wrap- Medium	11.78	Evaluated	
Steam Pipe Wrap- Small	4.73	Evaluated	
Steam Pipe Wrap- RL Small	2.80	Evaluated	

‡ Source: Integrys_Master_Measure_Document 010213; State of Illinois Technical Reference Manual. Final as of September 14, 2012, effective June 1, 2012. http://ilsagfiles.org/SAG_files/Technical Reference Manual/Illinois Statewide_TRM_Version_1.0.pdf

Key findings include:

1. The programs' tracking system captures relevant data, including accurate measure counts. Appropriate program quality assurance and quality control procedures are in place.
2. With a minor exception for programmable thermostats, Navigant verified that ex-ante measure savings were accurately recorded in the tracking system.

3. Energy savings from steam pipe insulation measures installed in Peoples Gas service area accounted for a significant source of energy savings. While Navigant made no adjustments to ex-ante savings for hot water pipe and steam pipe insulation measures in building common areas, Navigant recommends further research to validate engineering assumptions regarding heat loss estimates, as documented in this report's findings and recommendations.

3.1.4 Development of the Verified Gross Realization Rate

The verified gross realization rate is the ratio of verified gross savings to ex-ante gross savings from the program tracking system. Navigant calculated verified gross energy savings (therms) using Illinois TRM methodology and algorithms and engineering analysis. Navigant calculated verified gross savings at the therms level to achieve the closest precision estimate, using more than two decimal places. The verified gross realization rate in the report (verified gross savings/ex ante gross savings) is rounded to 2 digits, so direct application to get verified gross savings may produce rounding differences. Navigant applied per unit measure savings values as displayed in Table 3-3 to verified measure quantities found in the program tracking systems to calculate verified gross savings.

As shown in the tables below, GPY2 evaluation verified gross energy savings were nearly equal to ex-ante gross energy savings reported in the program tracking system, resulting in realization rates of 100 percent for Peoples Gas and 98 percent for North Shore Gas.[12] Verified gross savings were the same as ex-ante gross savings with the exception of programmable thermostats, described in Section 3.1.3. The North Shore Gas program included a larger number of programmable thermostats installed by the program, which accounted for the entire difference between the programs' evaluation verified gross savings and the program's ex-ante gross savings.

Navigant used the verified per unit savings values shown in Table 3-3 and the verified measure counts in Table 3-1. to calculate verified gross savings for the Peoples Gas GPY2 program. Table 3-4 below includes ex-ante and verified gross savings for the Peoples Gas GPY2 program. The Peoples Gas GPY2 program achieved verified gross savings of 1,826,567 therms and a verified gross realization rate of 100 percent.[13]

[12] Realization rate = verified gross / ex-ante gross from the tracking system.

[13] The value of 100 percent is rounded.

Table 3-4. GPY2 Peoples Gas Ex-Ante and Verified Gross Savings

Measure	Ex-Ante Gross Savings (therms)	Verified Gross Savings (therms)	Verified Gross Realization Rate
Showerheads	662,667	662,667	100%
Kitchen Aerators	56,531	56,531	100%
Bathroom Aerators	80,500	80,500	100%
Programmable Thermostat	4,343	4,139	95%
Programmable Thermostat Setback	359	342	95%
Hot Water Pipe Wrap Insulation	444	444	100%
Large HW Pipe Wrap - common area	6,810	6,810	100%
Medium HW Pipe Wrap - common area	12,506	12,506	100%
Small HW Pipe Wrap - common area	6,974	6,974	100%
Steam Pipe Elbows & Fittings - XLarge	2,773	2,773	100%
Steam Pipe Elbows & Fittings - Large	25,088	25,088	100%
Steam Pipe Elbows & Fittings - Medium	140,180	140,180	100%
Steam Pipe Elbows & Fittings - Return Line	1,329	1,329	100%
Steam Pipe Elbows & Fittings - Small	25,516	25,516	100%
Steam Pipe Valves - Large	280	280	100%
Steam Pipe Valves - Medium	211	211	100%
Steam Pipe Valves - Return Line	25	25	100%
Steam Pipe Valves - Small	57	57	100%
Steam Pipe Wrap- XLarge	14,950	14,950	100%
Steam Pipe Wrap- Large	202,300	202,300	100%
Steam Pipe Wrap- Medium	525,089	525,089	100%
Steam Pipe Wrap- Small	52,753	52,753	100%
Steam Pipe Wrap- RL Small	5,104	5,104	100%
TOTALS	**1,826,787**	**1,826,567**	**100%**

Source: Navigant analysis of GPY2 Multifamily program tracking data (July 26, 2013 data extract).

Navigant used the verified per unit savings values shown in Table 3-3 and the verified measure counts in Table 3-2 to calculate verified gross savings for the North Shore Gas GPY2 program. Table 3-5 below includes ex-ante and verified gross savings for the North Shore Gas GPY2 program. The North Shore Gas program achieved verified gross savings of 154,640 therms and a 98% verified gross realization rate. As indicated above, the North Shore Gas program included a larger number of programmable thermostats installed by the program, which accounted for the entire difference between the programs' evaluation verified gross savings and the program's ex-ante gross savings.

Table 3-5. GPY2 North Shore Gas Ex-Ante and Verified Gross Savings

Measure	Ex-Ante Gross Savings (therms)	Verified Gross Savings (therms)	Verified Gross Realization Rate
Showerheads	66,285	66,285	100%
Kitchen Aerators	5,761	5,761	100%
Bathroom Aerators	10,279	10,279	100%
Programmable Thermostat	9,654	9,202	95%
Programmable Thermostat Setback	64,564	61,544	95%
Hot Water Pipe Wrap Insulation	925	925	100%
Medium HW Pipe Wrap - common area	302	302	100%
Small HW Pipe Wrap - common area	343	343	100%
TOTALS	**158,112**	**154,640**	**98%**

Source: Navigant analysis of GPY2 Multifamily program tracking data (July 26, 2013 data extract).

3.1.5 Verified Gross Program Impact Results

Table 3-6 below illustrates that the Peoples Gas GPY2 Multi-Family Home Energy Savings Program reported ex-ante gross energy savings of 1,826,787 therms. Evaluation adjustments described in the sections above resulted in evaluation verified gross energy savings of 1,826,567 therms. The overall Peoples Gas program verified gross energy savings realization rate was 100 percent.[14]

[14] The value of 100 percent is rounded.

Table 3-6. Peoples Gas GPY2 Verified Gross Impact Savings Estimates by End-Use

	Sample	Gross Energy Savings (Therms)	90/10 Significance?
Water Efficiency Measures			
Ex-Ante GPY2 Gross Savings	NA†	799,698	NA†
Verified Gross Realization Rate‡		100%	
Verified Gross Savings		799,698	
Thermostats			
Ex-Ante GPY2 Gross Savings	NA†	4,701	NA†
Verified Gross Realization Rate‡		95%	
Verified Gross Savings		4,481	
Hot Water or Steam Pipe Wrap Insulation Measures			
Ex-Ante GPY2 Gross Savings	NA†	1,022,388	NA†
Verified Gross Realization Rate‡		100%	
Verified Gross Savings		1,022,388	
Peoples Gas GPY2 Total			
Ex-Ante GPY2 Gross Savings	NA†	1,826,787	NA†
Verified Gross Realization Rate		100%	
Verified Gross Savings		1,826,567	

Source: Navigant analysis of GPY2 Multifamily program tracking data (July 26, 2013 data extract).
†NA when the TRM determines the gross savings.
‡ *Based on evaluation research findings.*

The North Shore Gas GPY2 Multi-Family Home Energy Savings Program reported ex-ante gross energy savings of 158,112 therms. Evaluation adjustments described in the sections above resulted in evaluation verified gross energy savings of 154,640 therms. Table 3-7 below illustrates that the overall North Shore Gas program verified gross energy savings realization rate was 98 percent.

Table 3-7. North Shore Gas GPY2 Verified Gross Impact Savings Estimates by End-Use

	Sample	Gross Energy Savings (Therms)	90/10 Significance?
Water Efficiency Measures			
Ex-Ante GPY2 Gross Savings	NA†	82,324	NA†
Verified Gross Realization Rate‡		100%	
Verified Gross Savings		82,324	
Thermostats			
Ex-Ante GPY2 Gross Savings	NA†	74,218	NA†
Verified Gross Realization Rate‡		95%	
Verified Gross Savings		70,747	
Hot Water Pipe Wrap Insulation Measures			
Ex-Ante GPY2 Gross Savings	NA†	1,569	NA†
Verified Gross Realization Rate‡		100%	
Verified Gross Savings		1,569	
North Shore Gas GPY2 Total			
Ex-Ante GPY2 Gross Savings	NA†	158,112	NA†
Verified Gross Realization Rate		98%	
Verified Gross Savings		154,640	

Source: Navigant analysis of GPY2 Multifamily program tracking data (July 26, 2013 data extract).
†NA when the TRM determines the gross savings.
‡ Based on evaluation research findings.

4. Net Impact Evaluation

In GPY2, Navigant calculated verified net savings of 1,643,910 therms for the Peoples Gas program and 139,176 therms for the North Shore Gas program. The program level NTGR estimate of 0.90 used to calculate the verified net savings was deemed through a consensus process by the Illinois Stakeholder Advisory Group (SAG)[15] based on GPY1 evaluation research. As noted in Section 2.1.4, the GPY2 evaluation plan did not include new free-ridership or spillover research.

Navigant calculated verified net savings of 1,643,910 therms for the GPY2 Peoples Gas Multifamily program, as shown in Table 4-1 below. As indicated in the table below, measure savings are derived from the Illinois TRM and engineering analysis of program population-level data, so sample size and statistical significance are not applicable. The table presents savings at the measure group level including groups where the NTGR estimate is not statistically significant at the 90/10 level.

[15] Document provided by PGL-NSG to the SAG summarizing the SAG-approved NTGR for PGL-NSG for GPY1-GPY3 through a consensus process in March-August 2013. Distributed in the SAG meeting on August 5-6, 2013. http://ilsagfiles.org/SAG_files/Meeting_Materials/2013/August 5-6, 2013 Meeting/ Peoples Gas and North Shore Gas GPY1-GPY3 and Phase II Plan.xls

Table 4-1. Peoples Gas GPY2 Verified Net Impact Savings Estimates by End-Use

	Sample	Net Energy Savings (Therms)	90/10 Significance?
Water Efficiency Measures			
Ex-Ante GPY2 Gross Savings	NA†	799,698	NA†
Verified Gross Realization Rate‡		100%	
Verified Gross Savings		799,698	
Net-to-Gross Ratio (NTGR)*		0.90	
Verified Net Savings		719,728	
Thermostats			
Ex-Ante GPY2 Gross Savings	NA†	4,701	NA†
Verified Gross Realization Rate‡		95%	
Verified Gross Savings		4,481	
Net-to-Gross Ratio (NTGR) *		0.90	
Verified Net Savings		4,033	
Hot Water or Steam Pipe Wrap Insulation Measures			
Ex-Ante GPY2 Gross Savings	NA†	1,022,388	NA†
Verified Gross Realization Rate‡		100%	
Verified Gross Savings		1,022,388	
Net-to-Gross Ratio (NTGR) *		0.90	
Verified Net Savings		920,149	
Peoples Gas GPY2 Total			
Ex-Ante GPY2 Gross Savings	NA†	1,826,787	NA†
Verified Gross Realization Rate‡		100%	
Verified Gross Savings		1,826,567	
Net-to-Gross Ratio (NTGR) *		0.90	
Verified Net Savings		1,643,910	

Source: Navigant analysis of GPY2 Multifamily program tracking data (July 26, 2013 data extract).
†NA when the TRM determines the gross savings.
‡ Based on evaluation research findings.
** Deemed value.*

Navigant calculated verified net savings for the North Shore Gas GPY2 Multifamily program of 139,176 therms as shown in Table 4-2 below. As indicated in the table below, measure savings are

derived from the Illinois TRM and engineering analysis of program population-level data, so sample size and statistical significance are not applicable. The table presents savings at the measure group level including groups where the NTGR estimate is not statistically significant at the 90/10 level.

Table 4-2. North Shore Gas GPY2 Verified Net Savings by End-Use

	Sample	Net Energy Savings (Therms)	90/10 Significance?
Water Efficiency Measures			
Ex-Ante GPY2 Gross Savings	NA†	82,324	NA†
Verified Gross Realization Rate‡		100%	
Verified Gross Savings		82,324	
Net-to-Gross Ratio (NTGR) *		0.90	
Verified Net Savings		74,092	
Thermostats			
Ex-Ante GPY2 Gross Savings	NA†	74,218	NA†
Verified Gross Realization Rate‡		95%	
Verified Gross Savings		70,747	
Net-to-Gross Ratio (NTGR) *		0.90	
Verified Net Savings		63,672	
Hot Water Pipe Wrap Insulation Measures			
Ex-Ante GPY2 Gross Savings	NA†	1,569	NA†
Verified Gross Realization Rate‡		100%	
Verified Gross Savings		1,569	
Net-to-Gross Ratio (NTGR) *		0.90	
Verified Net Savings		1,413	
North Shore Gas GPY2 Total			
Ex-Ante GPY2 Gross Savings	NA†	158,112	NA†
Verified Gross Realization Rate‡		98%	
Verified Gross Savings		154,640	
Net-to-Gross Ratio (NTGR) *		0.90	
Verified Net Savings		139,176	

Source: Navigant analysis of GPY2 Multifamily program tracking data (July 26, 2013 data extract).
†NA when the TRM determines the gross savings.
‡ Based on evaluation research findings.
** Deemed value.*

4.1.1 Program Planned and Actual Accomplishments

As shown in below Table 4-3, the GPY2 Peoples Gas program installed measures at 27,178 residential dwelling units, an increase of 58 percent from GPY1's total of 17,188 residential dwelling units. While

participation increased from the previous year, the program installed measures at fewer residential dwelling units than planned, accomplishing 71 percent of GPY2's planned participation of 38,250 residential dwelling units. However, the program exceeded planned GPY2 net energy savings targets by 62 percent, due to the significant uptake of steam and hot water pipe insulation for common areas.

Table 4-3. GPY2 Peoples Gas Planned and Actual Accomplishments

Detail	GPY2 Planned	GPY2 Actual	Planned v. Actual
Participants (residential dwelling units)	38,250	27,148	71%
Verified Net Savings (therms)	1,014,441	1,643,910	162%

Source: 2013 PGL NSG ComEd Multifamily Ops Manual_v7 2_4_5_2013_ACCEPTED_CHANGES.1; Navigant analysis of GPY2 Multifamily program tracking data (July 26, 2013 data extract)

Table 4-4 below includes a comparison of GPY2 Peoples Gas program detail against GPY1 Peoples Gas program detail.

Table 4-4. Peoples Gas Program Yearly Comparison

Detail	GPY1	GPY2	Year over Year Difference
Participants (residential dwelling units)	17,188	27,148	58%
Total Measures	47,760	170,087	257%
Verified Net Savings (therms)	461,026	1,643,910	257%

Source: Navigant analysis of GPY2 Multifamily program tracking data (July 26, 2013 data extract); Navigant EPY4-GPY1 ComEd, Peoples Gas and North Shore Gas Multi-Family Home Energy Savings Program Evaluation Report FINAL (June 4, 2013)

As shown in Table 4-5 below, the GPY2 North Shore Gas program installed measures at 4,745 residential dwelling units, an increase of 67 percent from GPY1's total of 2,844 residential dwelling units. While participation increased from the previous year, the program installed measures at fewer residential dwelling units than planned, accomplishing 70 percent of GPY2's planned participation of 6,750 residential dwelling units. The GPY2 program increased energy savings by 76 percent over the previous year, but fell short of GPY2 planned energy savings targets.

Table 4-5. GPY2 North Shore Gas Planned and Actual Accomplishments

Detail	GPY2 Planned	GPY2 Actual	Planned v. Actual
Participants (residential dwelling units)	6,750	4,745	70%
Verified Net Savings (therms)	179,019	139,176	78%

Source: 2013 PGL NSG ComEd Multifamily Ops Manual_v7 2_4_5_2013_ACCEPTED_CHANGES.1; Navigant analysis of GPY2 Multifamily program tracking data (July 26, 2013 data extract)

Table 4-6 includes a comparison of GPY2 North Shore Gas program detail against GPY1 North Shore Gas program detail.

Table 4-6. North Shore Gas Program Yearly Comparison

Detail	GPY1	GPY2	Year over Year Difference
Participants (residential dwelling units)	2,844	4,745	67%
Total Measures	8,942	11,727	31%
Verified Net Savings (therms)	79,268	139,176	76%

Source: Navigant analysis of GPY2 Multifamily program tracking data (July 26, 2013 data extract); Navigant EPY4-GPY1 ComEd, Peoples Gas and North Shore Gas Multi-Family Home Energy Savings Program Evaluation Report FINAL (June 4, 2013)

5. Process Evaluation

The GPY2 process evaluation was limited to interviews with program staff and the implementation contractor staff to verify information about the program's measures, tracking system, and quality assurance/quality control procedures. The program evaluation plan did not include new research into program processes.

6. Conclusions and Recommendations

Overall, the GPY2 Peoples Gas and North Shore Gas Multi-Family Home Energy Savings programs built on a solid foundation from GPY1 to expand their reach, more than doubling their combined energy savings compared to GPY1. Although they reached fewer residential dwelling units than originally planned, the programs increased participation year over year and Peoples Gas exceeded planned energy savings targets. In GPY2, energy savings from steam pipe insulation measures installed in Peoples Gas service area enabled the program to exceed planned energy savings targets despite lower residential dwelling unit participation than originally planned. The programs' tracking system is accurately recording measure counts and, with some minor exceptions as detailed in this report, measure savings, contributing to gross realization rates at or near one-hundred percent. In GPY2, program-level Net-to-Gross Ratio of 0.90 used to calculate the Net Verified Savings was deemed through a consensus process by the Illinois Stakeholder Advisory Group (SAG)[16] based on GPY1 evaluation research.

Program Savings Goals Attainment

Finding 1.[17] The Peoples Gas GPY2 program achieved evaluation verified net savings of 1,643,910 therms, achieving 162 percent of the program's net savings goal of 1,014,441 therms. Compared to GPY1, the Peoples Gas program increased energy savings by 257 percent. The North Shore Gas GPY2 program achieved evaluation verified net savings of 139,176 therms, achieving 78 percent of the program's net savings goal of 179,019 therms. Compared to GPY1, the North Shore Gas program increased energy savings by 76 percent.

Recommendation 1. As already planned in GPY3, the implementation contractor should continue to identify common area and whole-building measure energy savings opportunities for participants. In particular, the implementation contractor should continue to identify opportunities to install steam pipe insulation measures in Peoples Gas service territory. As applicable, the implementation contractor should install steam pipe insulation measures at buildings in North Shore Gas service area, although opportunities may be limited due to the building stock in that area.

Verified Gross Realization Rates

Finding 2. The program is accurately tracking measure counts. Appropriate quality control and quality assurance procedures are in place. The GPY2 Peoples Gas program verified gross realization rate was 100 percent. The GPY2 North Shore Gas program verified gross realization rate was 98 percent. Navigant calculated verified gross savings at the therms level to achieve the closest precision estimate, using more than two decimal places. The verified gross realization rate in the report (verified gross savings/ex ante gross savings)

[16] Document provided by PGL-NSG to the SAG summarizing the SAG-approved NTGR for PGL-NSG for GPY1-GPY3 through a consensus process in March-August 2013. Distributed in the SAG meeting on August 5-6, 2013. http://ilsagfiles.org/SAG_files/Meeting_Materials/2013/August 5-6, 2013 Meeting/ Peoples Gas and North Shore Gas GPY1-GPY3 and Phase II Plan.xls

[17] Findings and Recommendations numbered 1, 2, 3 and 4 appear in the Executive Summary.

is rounded to 2 digits, so direct application to get verified gross savings may produce rounding differences.

Savings Estimates

Finding 3. Over half of energy savings from the Peoples Gas program (920,149 verified net therms) were from hot water pipe or steam pipe insulation measures installed in building common areas. The implementation contractor's steam pipe insulation measure savings estimates, while reasonable and not requiring an adjustment at this time, stand to benefit from additional engineering research into applicable heat loss correction factors (i.e. heat lost through the insulation system of conditioned space into unconditioned space), which is a required value for engineering software (i.e. 3E Plus) model outputs.

Recommendation 3. The implementation contractor should conduct research to validate engineering assumptions for the heat loss correction factor used in estimating ex-ante savings values for hot water pipe or steam pipe insulation measures installed in building common areas. The implementation contractor should communicate the results of its research with Navigant for verification.

Finding 4. With a minor exception below, the program tracking system is accurately recording measure savings estimates based on deemed or partially deemed values from the Illinois TRM. Navigant made a minor adjustment to an ex-ante gross parameter for programmable thermostats to correspond to the Illinois TRM. The Illinois TRM uses a value of 6.2% reduction in heating energy consumption. The ex-ante savings calculation used a value of 6.5% reduction in heating energy consumption. The evaluators applied the value of 6.2% to obtain evaluation verified savings for programmable thermostats. The difference between the ex-ante value of 6.5% and the TRM value of 6.2% was the only adjustment between ex-ante gross and evaluation verified gross savings.

Recommendation 4. The implementation contractor should update ex-ante values for programmable thermostat measures. Specifically, the implementation contractor should update the heating energy consumption gross impact parameter to 6.2% to correspond with the Illinois TRM.

Finding 5. Navigant's research indicates that installing a thermostatically initiated shower restriction valve (i.e. Showerstart™ device) on a showerhead can potentially save an additional 4.2 therms/yr in multifamily homes, although additional research is required.

Recommendation 5. Additional evaluation research findings detailed recommendations are included in Section 7.2.1.2.

Program Participation

Finding 6. The Peoples Gas GPY2 program included 27,148 participating dwelling units, achieving 71% of its participation goal of 38,250 dwelling units. The North Shore Gas GPY2 program included 4,745 participating dwelling units, achieving 70% of its participation goal of 6,750 dwelling units.

Recommendation 6. Due to the significant impact of hot water pipe and steam pipe insulation measures installed in building common areas, the program should consider setting additional participation goals and/or tracking additional participation metrics for such common area measures, apart from residential dwelling unit participation.

Examples could include setting a goal for the number of buildings or amount of linear feet of insulation installed by the implementation contractor.

7. Appendix

7.1 Glossary

ComEd, Nicor, Peoples Gas, and North Shore Gas EM&V Reporting Glossary. December 17, 2013

High Level Concepts

Program Year

- EPY1, EPY2, etc. Electric Program Year where EPY1 is June 1, 2008 through May 31, 2009, EPY2 is June 1, 2009 through May 31, 2010, etc.
- GPY1, GPY2, etc. Gas Program Year where GPY1 is June 1, 2011 through May 31, 2012, GPY2 is June 1, 2012 through May 31, 2013.

There are two main tracks for reporting impact evaluation results, called Verified Savings and Impact Evaluation Research Findings.

Verified Savings composed of

- Verified Gross Energy Savings
- Verified Gross Demand Savings
- Verified Net Energy Savings
- Verified Net Demand Savings

These are savings using deemed savings parameters when available and after evaluation adjustments to those parameters that are subject to retrospective adjustment for the purposes of measuring savings that will be compared to the utility's goals. Parameters that are subject to retrospective adjustment will vary by program but typically will include the quantity of measures installed. In EPY5/GPY2 the Illinois TRM was in effect and was the source of most deemed parameters. Some of ComEd's deemed parameters were defined in its filing with the ICC but the TRM takes precedence when parameters were in both documents.
Application: When a program has deemed parameters then the Verified Savings are to be placed in the body of the report. When it does not (e.g., Business Custom, Retrocommissioning), the evaluated impact results will be the Impact Evaluation Research Findings.

Impact Evaluation Research Findings composed of

- Research Findings Gross Energy Savings
- Research Findings Gross Demand Savings
- Research Findings Net Energy Savings
- Research Findings Net Demand Savings

These are savings reflecting evaluation adjustments to any of the savings parameters (when supported by research) regardless of whether the parameter is deemed for the verified savings analysis. Parameters that are adjusted will vary by program and depend on the specifics of the research that was performed during the evaluation effort.
Application: When a program has deemed parameters then the Impact Evaluation Research Findings

are to be placed in an appendix. That Appendix (or group of appendices) should be labeled Impact Evaluation Research Findings and designated as "ER" for short. When a program does not have deemed parameters (e.g., Business Custom, Retrocommissioning), the Research Findings are to be in the body of the report as the only impact findings. (However, impact findings may be summarized in the body of the report and more detailed findings put in an appendix to make the body of the report more concise.)

Program-Level Savings Estimates Terms

N	Term Category	Term to Be Used in Reports‡	Application†	Definition	Otherwise Known As (terms formerly used for this concept)§
1	Gross Savings	Ex-ante gross savings	Verification and Research	Savings as recorded by the program tracking system, unadjusted by realization rates, free ridership, or spillover.	Tracking system gross
2	Gross Savings	Verified gross savings	Verification	Gross program savings after applying adjustments based on evaluation findings for only those items subject to verification review for the Verification Savings analysis	Ex post gross, Evaluation adjusted gross
3	Gross Savings	Verified gross realization rate	Verification	Verified gross / tracking system gross	Realization rate
4	Gross Savings	Research Findings gross savings	Research	Gross program savings after applying adjustments based on all evaluation findings	Evaluation-adjusted ex post gross savings
5	Gross Savings	Research Findings gross realization rate	Research	Research findings gross / ex-ante gross	Realization rate
6	Gross Savings	Evaluation-Adjusted gross savings	Non-Deemed	Gross program savings after applying adjustments based on all evaluation findings	Evaluation-adjusted ex post gross savings
7	Gross Savings	Gross realization rate	Non-Deemed	Evaluation-Adjusted gross / ex-ante gross	Realization rate
1	Net Savings	Net-to-Gross Ratio (NTGR)	Verification and Research	1 – Free Ridership + Spillover	NTG, Attribution
2	Net Savings	Verified net savings	Verification	Verified gross savings times NTGR	Ex post net
3	Net Savings	Research Findings net savings	Research	Research findings gross savings times research NTGR	Ex post net
4	Net Savings	Evaluation Net Savings	Non-Deemed	Evaluation-Adjusted gross savings times NTGR	Ex post net
5	Net Savings	Ex-ante net savings	Verification and Research	Savings as recorded by the program tracking system, after adjusting for realization rates, free ridership, or spillover and any other factors the program may choose to use.	Program-reported net savings

‡ "Energy" and "Demand" may be inserted in the phrase to differentiate between energy (kWh, Therms) and demand (kW) savings.

† **Verification** = Verified Savings; **Research** = Impact Evaluation Research Findings; **Non-Deemed** = impact findings for programs without deemed parameters. We anticipate that any one report will either have the first two terms or the third term, but never all three.
§ Terms in this column are not mutually exclusive and thus can cause confusion. As a result, they should not be used in the reports (unless they appear in the "Terms to be Used in Reports" column).

Individual Values and Subscript Nomenclature

The calculations that compose the larger categories defined above are typically composed of individual parameter values and savings calculation results. Definitions for use in those components, particularly within tables, are as follows:

Deemed Value – a value that has been assumed to be representative of the average condition of an input parameter and documented in the Illinois TRM or ComEd's approved deemed values. Values that are based upon a deemed measure shall use the superscript "D" (e.g., delta watts^{D}, HOU-Residential^{D}).

Non-Deemed Value – a value that has not been assumed to be representative of the average condition of an input parameter and has not been documented in the Illinois TRM or ComEd's approved deemed values. Values that are based upon a non-deemed, researched measure or value shall use the superscript "E" for "evaluated" (e.g., delta watts^{E}, HOU-Residential^{E}).

Default Value – when an input to a prescriptive saving algorithm may take on a range of values, an average value may be provided as well. This value is considered the default input to the algorithm, and should be used when the other alternatives listed for the measure are not applicable. This is designated with the superscript "DV" as in X^{DV} (meaning "Default Value").

Adjusted Value – when a deemed value is available and the utility uses some other value and the evaluation subsequently adjusts this value. This is designated with the superscript "AV" as in X^{AV}

Glossary Incorporated From the TRM

Below is the full Glossary section from the TRM Policy Document as of October 31, 2012[18].

Evaluation: Evaluation is an applied inquiry process for collecting and synthesizing evidence that culminates in conclusions about the state of affairs, accomplishments, value, merit, worth, significance, or quality of a program, product, person, policy, proposal, or plan. Impact evaluation in the energy efficiency arena is an investigation process to determine energy or demand impacts achieved through the program activities, encompassing, but not limited to: *savings verification*, *measure level research*, and *program level research*. Additionally, evaluation may occur outside of the bounds of this TRM structure to assess the design and implementation of the program.

Synonym: **Evaluation, Measurement and Verification (EM&V)**

[18] IL-TRM_Policy_Document_10-31-12_Final.docx

Measure Level Research: An evaluation process that takes a deeper look into measure level savings achieved through program activities driven by the goal of providing Illinois-specific research to facilitate updating measure specific TRM input values or algorithms. The focus of this process will primarily be driven by measures with high savings within Program Administrator portfolios, measures with high uncertainty in TRM input values or algorithms (typically informed by previous savings verification activities or program level research), or measures where the TRM is lacking Illinois-specific, current or relevant data.

Program Level Research: An evaluation process that takes an alternate look into achieved program level savings across multiple measures. This type of research may or may not be specific enough to inform future TRM updates because it is done at the program level rather than measure level. An example of such research would be a program billing analysis.

Savings Verification: An evaluation process that independently verifies program savings achieved through prescriptive measures. This process verifies that the TRM was applied correctly and consistently by the program being investigated, that the measure level inputs to the algorithm were correct, and that the quantity of measures claimed through the program are correct and in place and operating. The results of savings verification may be expressed as a program savings realization rate (verified ex post savings / ex ante savings). Savings verification may also result in recommendations for further evaluation research and/or field (metering) studies to increase the accuracy of the TRM savings estimate going forward.

Measure Type: Measures are categorized into two subcategories: custom and prescriptive.

Custom: Custom measures are not covered by the TRM and a Program Administrator's savings estimates are subject to retrospective evaluation risk (retroactive adjustments to savings based on evaluation findings). Custom measures refer to undefined measures that are site specific and not offered through energy efficiency programs in a prescriptive way with standardized rebates. Custom measures are often processed through a Program Administrator's business custom energy efficiency program. Because any efficiency technology can apply, savings calculations are generally dependent on site-specific conditions.

Prescriptive: The TRM is intended to define all prescriptive measures. Prescriptive measures refer to measures offered through a standard offering within programs. The TRM establishes energy savings algorithm and inputs that are defined within the TRM and may not be changed by the Program Administrator, except as indicated within the TRM. Two main subcategories of prescriptive measures included in the TRM:

Fully Deemed: Measures whose savings are expressed on a per unit basis in the TRM and are not subject to change or choice by the Program Administrator.

Partially Deemed: Measures whose energy savings algorithms are deemed in the TRM, with input values that may be selected to some degree by the Program Administrator, typically based on a customer-specific input.

In addition, a third category is allowed as a deviation from the prescriptive TRM in certain circumstances, as indicated in Section 3.2:

> **Customized basis:** Measures where a prescriptive algorithm exists in the TRM but a Program Administrator chooses to use a customized basis in lieu of the partially or fully deemed inputs. These measures reflect more customized, site-specific calculations (e.g., through a simulation model) to estimate savings, consistent with Section 3.2.

7.2 Detailed Impact Research Findings and Approaches

Navigant conducted evaluation research into two measure categories: 1) hot water pipe and steam pipe insulation measures, and 2) a thermostatically initiated shower restriction valve on a showerhead.

7.2.1 Gross Impact Results

7.2.1.1 Hot Water Pipe and Steam Pipe Insulation Measures

As written in Section 3.1.3, Navigant conducted research to validate engineering assumptions for parameter values not specified in the Illinois TRM for hot water pipe and steam pipe insulation measures in building common areas, which were supplied by the program's implementation contractor.[19] Navigant used the algorithm presented in Figure 7-1 below to calculate verified gross savings for steam pipe insulation measures.

Figure 7-1. Verified Gross Savings Algorithm – Steam Pipe Insulation

$$\textit{Verified Gross Annual Therm Savings per Foot} = ((Qbase - Qeff) * HOURS) / (100{,}000 * \eta Boiler)) * CF$$

Where:

- Q_{base} = Heat Loss from Bare Pipe (Btu/hr/ft).
- Q_{eff} = Heat Loss from Insulated Pipe (Btu/hr/ft).
- Hours = Annual operating hours (actual or defaults by piping use and building type)
- 100,000 = conversion factor (1 Therm = 100,000 Btu)
- ηBoiler = Efficiency of the boiler being used to generate the hot water or steam in the pipe (=80.7% for steam boilers)
- CF = Heat loss correction factor of 0.67

Navigant reviewed steam and hot water pipe insulation measure savings inputs from the program implementation contractor. The implementation contractor developed heat loss estimates (Qbase and Qeff) using the 3E Plus v4.0 software program[20]. The energy savings analysis is based on engineering assumptions using an average of 1.5-inch insulation around bare pipe. Details of the input parameters to 3E plus used to develop savings estimates are shown in Table 7-1 below.

[19] Integrys_Master_Measure_Document 010213 (see spreadsheet Tab 31: MF Common Area Pipe Wrap).

[20] 3E Plus is a heat loss calculation software provided by the NAIMA (North American Insulation Manufacturer Association).

Table 7-1. Steam Pipe Insulation Savings Parameters

Parameter	Value	Data Source
R value of pipe insulation	5.0 (1.5 inches of insulation with K of 0.27)	IECC 2009
DI-R value of pipe insulation	3.0 (1.5 inches of insulation with K of 0.28)	IECC 2009
Linear feet of pipe	1	Standard value
Pipe temperature	225 F	Engineering assumption
Ambient temperature	75F	Engineering assumption
Combustion Efficiency	80.7%	Engineering assumption
Nominal Pipe Size	Varies	Engineering assumption
BTU loss/hr, uninsulated	Varies	Calculation using 3E Plus
BTU loss/hr, insulated	Varies	Using 3E Plus
BTU loss/hr, savings	Varies	Using 3E Plus
Hours of Operation/year	4,963	TMY3 Weather Data from O'Hare Int'l Airport
Heat Loss Correction Factor	0.67	Engineering Assumption
BTU/therm Conversion Factor	100,000	Standard value
Therms/year saved	Varies	Calculation
DI-Therms/year saved	Varies	Calculation
Nominal Therms/year saved	Varies (Average of all pipe sizes)	Calculation
DI-Nominal Therms/year saved	Varies (Average of all pipe sizes)	Calculation

Source: Navigant analysis of Integrys_Master_Measure_Document 010213

Navigant's engineering review concluded the assumptions, algorithms and per unit savings results for steam and hot water pipe insulation measures were reasonable. The assumption for Heat Loss Correction Factor (0.67) is not supported by documentation from the implementation contractor, however, Navigant was not able to cite research to suggest a different value.

7.2.1.2 Thermostatically Initiated Shower Restriction Valve

As requested by Peoples Gas and North Shore Gas, Navigant conducted research to identify possible energy savings associated with installing a thermostatically initiated shower restriction valve on a showerhead.[21] The specific device with shower restriction valve technology available in the retail market is under the trademarked name "ShowerStart™." Navigant's research indicates that

[21] Navigant's evaluation research was included in a separate memorandum dated September 6, 2013. The memorandum is replicated in this section.

installing ShowerStart devices can potentially save an additional 4.2 therms/yr in multifamily homes. Presuming that the installation of a 1.5 GPM water efficient showerhead provides a baseline case for the ShowerStart device, Navigant's estimates in the table below do not include water/energy savings from installing a 1.5 GPM water efficient showerhead at the water source.

To: **Interested Parties in Illinois**
From: **Multifamily Program Evaluation Team**
Date: **September 6, 2013**
Subject: **Research Energy Savings From Thermostatic Shower Restriction Valves**

Executive Summary

The purpose of this memo is to present research on potential energy and water savings from installing a thermostatically initiated shower restriction valve on a showerhead. Navigant's research focused on a unique and patented shower restriction valve technology available in the retail market called ShowerStart™ [1]. This device has been tested to provide energy and water savings in other jurisdictions, and thus serves as a basis for preliminary research on the device's operation and potential savings for Illinois utility energy efficiency programs.

The Table 7-2 below presents a summary of potential savings from installing ShowerStart on a previously installed 1.5 gallons per minute (GPM) water efficient showerhead. Presuming that the installation of a 1.5 GPM water efficient showerhead provides a baseline case for the ShowerStart device, Navigant's estimates in the table below do not include water/energy savings from installing a 1.5 GPM water efficient showerhead at the water source. Navigant's research indicates that installing ShowerStart devices can potentially save an additional 3.2 therms/yr or 75 kWh/yr in single family homes and 4.2 therms/yr or 84 kWh/yr in multifamily homes. These additional savings can result in a 2.3 year simple payback for electric water heat and a 4.6 year simple payback for gas water heat in multifamily homes.

Table 7-2. Potential Savings from Installing ShowerStart on 1.5 GPM Showerhead

ShowerStart Savings Calculations	Single Family	Multi-Family
Water savings (gallons/yr/ShowerStart)	588	664
Electric Energy Savings (kWh/yr/ShowerStart)	75	84
Peak Demand savings (kW/yr/ShowerStart)	0.005	0.007
Gas energy savings (therms/yr/ShowerStart)	3.2	4.2
Simple Payback Period	2.3 years electric water heater 4.6 years gas water heater	

Source: Navigant

ShowerStart™ Technology Description

As illustrated in Figure 2 below, the ShowerStart device is described by the manufacturer as a "compact, thermostatic valve that automatically pauses a shower's water flow once it reaches bathing temperature" [2]. The thermostatic valve can be installed in-between the shower arm and existing showerhead, and it is expected to detect when near-bathing-temperature water (95F/35C) arrives at the shower head.

Figure 2. Depiction of ShowerStart Device

(Source: www.showerstart.com)

Once installed and operational, the device is expected to automatically reduce the showerhead's flow to a trickle, and as a result prevent hot water from unintentionally running down the drain while the user is away. When ready to begin showering, the user can pull the thermostatic valve's fob to resume normal showerhead flow [3].

Water Savings Potential and Calculation

The potential to reduce hot water waste and produce energy savings from a shower restriction device depends primarily on accurate estimation of the time hot water arrives at the shower and the time an individual enters the shower. Limited information exists on how much hot water is avoided or wasted before a user gets into the shower after installing the device, and accordingly how long the wasted hot water is left to run. From a few available surveys and research studies on the functions of shower restriction devices, we can estimate the total time that passes between turning on the shower and entering the shower (pre-retrofit warm up wait time out of the shower spent on bathroom activities), and how much time it takes before the hot water arrives at the shower (cold water warm-up time). The difference between these two estimates represents the hot water wait time that could be prevented due to installation of the shower restriction device.

Table 7-3 below provides average estimates of the hot water wait time deduced from residential shower behavior studies. ShowerStart LLC estimates that total warm-up wait activities will take about 106 seconds to complete, while it takes 46 seconds for warm water to arrive at the shower, resulting in 60 seconds of hot water waste time that could have been prevented with the use of the

ShowerStart device. Based on the results from a pilot study conducted by California's City of San Diego Water Department, an average of 52 seconds of hot water waste time can be deduced [4]. The Pacific Gas and Electric Company (PG&E) relied on what they considered to be a conservative value of 34 seconds hot water waste time to calculate the potential savings from shower restriction devices in their service territory [5].

Table 7-3. Estimates of Avoided Shower Hot Water Waste Time

Study Type	Hot Water Waste Time (sec)	Sources (See reference section for study reports)
Survey	60	ShowerStart LLC
Survey	52	City of San Diego Water Department
Research Studies	34	Pacific Gas and Electric Company (PG&E)

Sources: see reference section

ShowerStart LLC estimated each ShowerStart installed in a typical single family home with 3 persons could yield up to 2700 gallons of water savings annually (assuming a 2.5 GPM showerhead). The City of San Diego estimated 2400 gallons annual savings for a similar household size. The PG&E conducted a more in depth analysis and came up with estimates for low flow 1.6 GPM showerheads, and estimated 296 gallons annual water savings for single family homes, and 435 gallons for multifamily homes.

It is important to note that it is possible the ShowerStart device may not realize any savings. A typical example would be a situation where an individual has a habit of opening the bath faucet during the warm up time, such that the showerhead is used immediately when the water temperature is deemed warm enough to start shower.

Engineering Estimate of Water Savings from Using ShowerStart

Using the Illinois TRM section 5.4.5, Navigant applied savings assumptions and algorithm for the showerhead replacement measure to estimate potential water and energy savings from installing a ShowerStart device. Savings estimates have been provided for both 2.67 GPM base flow showerheads and 1.5 GPM low flow efficient showerheads in single family and multifamily homes [6].

Table 7-4. Potential Water Savings for ShowerStart Device in Illinois

Water Savings Calculations	Single Family	Multi-Family
Water savings from installing ShowerStart on 2.67 GPM base showerhead (gallons/yr/ShowerStart)	1,046	1,182
Water savings from installing ShowerStart on 1.5 GPM low flow showerhead (gallons/yr/ShowerStart)	588	664
Percent increase in water savings on a 1.5 GPM low flow showerhead retrofit	16%	17%

Source: Navigant

Energy Savings Potential and Calculation

Navigant estimated energy savings potential for both 2.67 GPM base flow showerheads and 1.5 GPM low flow showerheads installed with a ShowerStart device in a single family and multifamily homes.

Engineering Estimate of Electric Energy Savings from ShowerStart

As shown in Table 7-5 below, a ShowerStart device installed on a 2.67 GPM base flow showerhead could save an additional 133 kWh annually in a typical single family home and 150 kWh annually in a multifamily home in Illinois. A ShowerStart device installed on a 1.5 GPM low flow showerhead could save an additional 75 kWh annually in a typical single family home and 84 kWh annually in a multifamily home in Illinois. These savings represent additional 16% and 16% increase respectively, given that the TRM estimated annual energy savings for installing a 1.5 GPM low flow showerhead is 468 kWh for single family, and 528 kWh for a multifamily home.

Calculations:

Annual Electric Energy Savings from ShowerStart = Avoided annual electrical energy use from showerhead

Avoided electrical energy savings for 1.5 GPM low flow showerhead installed with ShowerStart = [%ElectricDHW * (GPM_low_SS * L_showerstart) * Household * SPCD * 365.25 / SPH) * EPG_electric]*ISR_ss

Where:
%ElectricDHW = proportion of water heating supplied by electric resistance heating (100%)
EPG_electric = Energy per gallon of hot water supplied by electric (0.127 kWh/gallon)
Other variables as defined above.

Table 7-5. Potential Electric Energy Savings for ShowerStart Device in Illinois

Electric Energy Savings Calculations	Single Family	Multi-Family
Electric Water Heater savings from installing ShowerStart on 2.67 GPM base showerhead (kWh/yr/ShowerStart))	133	150
Electric Water Heater savings from installing ShowerStart on 1.5 GPM low flow showerhead (kWh/yr/ShowerStart)	75	84
Percent increase in electrical energy savings on a 1.5 GPM low flow showerhead retrofit	16%	16%

Source: Navigant

Engineering Estimate of Electrical Demand Savings

As shown in Table 7-6 below, annual peak demand savings for ShowerStart device installed on a 2.67 GPM base flow showerhead could be 0.009 KW in a typical single family home and 0.012 KW in a multifamily home in Illinois. Annual peak demand savings for ShowerStart device installed on a 1.5 GPM low flow showerhead could be 0.005 KW in a typical single family home and 0.007 KW in a multifamily home in Illinois.

Calculations:

Annual Peak Demand Savings from ShowerStart = Avoided annual peak demand from showerhead

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

Where:

ΔkWh = calculated kWh value in Table-3 above

Hours = Annual electric DHW recovery hours for showerhead use (431 for SF DI; 354 for MF DI)

CF = Coincidence Factor for electric load reduction (=0.0278)

Table 7-6. Potential Demand Savings for ShowerStart Device in Illinois

Electric Demand Savings Calculations	Single Family	Multi-Family
Electric Water Heater savings from installing Peak Demand savings from installing ShowerStart on 2.67GPM base showerhead (KW/yr/ShowerStart)	0.009	0.012
Peak Demand savings from installing ShowerStart on 1.5GPM low flow showerhead (KW/yr/ShowerStart)	0.005	0.007

Source: Navigant research

Engineering Estimate of Natural Gas Energy Savings

As shown in Table 7-7 below, a ShowerStart device installed on a 2.67 GPM base flow showerhead could save an additional 5.6 therms annually in a typical single family home and 7.4 therms annually in a multifamily home in Illinois. A ShowerStart device installed on a 1.5 GPM low flow showerhead

could save an additional 3.2 therms annually in a typical single family home and 4.2 therms annually in a multifamily home in Illinois. These savings represent additional 16% and 17% increase respectively, given that the TRM estimated annual energy savings for installing a 1.5 GPM low flow showerhead is 19.9 therms for single family, and 24.9 therms for a multifamily home.

Calculations:

Natural gas energy savings from ShowerStart = Avoided annual therms energy use from showerhead

Avoided therms energy savings for 1.5gpm low flow showerhead installed with ShowerStart =%FossilDHW * ((GPM_low_SS * L_showerstart) * Household * SPCD * 365.25 / SPH) * EPG_gas * IRS_ss

Where:
%FossilDHW = *proportion of water heating supplied by natural gas heating (100%)*
EPG_gas = Energy per gallon of hot water supplied by gas (0.0054 therm/gal SF, 0.0063 Therm/gal MF)
Other variables as defined above.

Table 7-7. Potential Gas Therms Savings for ShowerStart Device in Illinois

Gas Therm Savings Calculations	Single Family	Multi-Family
Natural gas energy savings from installing ShowerStart on 2.67 GPM base showerhead (therms/yr/ShowerStart)	5.6	7.4
Natural gas energy savings from installing ShowerStart on 1.5 GPM low flow showerhead (therms/yr/ShowerStart	3.2	4.2
Percent increase in natural gas therms savings on a 1.5 GPM low flow showerhead retrofit	16%	17%

Source: Navigant

Cost Savings

As shown in Table 7-8 below, the national average cost of water is approximately $0.002/gallon, according to the United States Environmental Protection Agency [7]. The average cost to heat water from a standard gas water heater is estimated as $0.008/gallon, and $0.017 for an electric water heater [8]. Assuming that users typically turn their mixing valve all the way to the hot position in the warm-up process, and the average hot water cost savings for an electric water heater is $0.02/gallon, gas water heating is $0.01 per gallon, and the unit cost of ShowerStart is $29.95, we can estimate the net savings in utility bills for each ShowerStart installed. Table-7 and Table-8 below illustrate potential cost savings for installing thermostatic shower restriction valves in multifamily and single family residences.

Table 7-8. Potential Cost Savings from Installed ShowerStart device (Multifamily)

Cost Savings for Multifamily	ShowerStart with 2.67 GPM base showerhead	ShowerStart with 1.5 GPM low flow showerhead
Water Savings (gallons/yr/ShowerStart)	1,182 gallons	664 gallons
Utility Bill Savings ($/yr/ShowerStart)	$23.64 Electric WH $11.82 Gas WH	$13.28 Electric WH $6.64 Gas WH
Net Savings (bill savings - unit cost)	($6.31) Electric WH ($18.13) Gas WH	($16.67) Electric WH ($23.31) Gas WH
Payback Period	1.3 years (Elec.) 2.6 years (Gas)	2.3 years (Elec.) 4.6 years (Gas)

Source: Navigant

Table 7-9. Potential Cost Savings from Installed ShowerStart device (Multifamily)

Cost Savings for Multifamily	ShowerStart with 2.67 GPM base showerhead	ShowerStart with 1.5 GPM low flow showerhead
Water Savings (gallons/yr/ShowerStart)	1,046 gallons	588 gallons
Utility Bill Savings ($/yr/ShowerStart)	$20.92 Electric WH $10.46 Gas WH	$11.76 Electric WH $5.88 Gas WH
Net Savings (bill savings - unit cost)	($9.03) Electric WH ($19.49) Gas WH	($18.19) Electric WH ($24.07) Gas WH
Payback Period	1.4 years (Elec.) 2.9 years (Gas)	2.5 years (Elec.) 5.1 years (Gas)

Source: Navigant

Conclusion

As discussed above, additional 16 percent of water and energy savings may be realized from installing a ShowerStart device on a 1.5 GPM efficient showerhead. Additional cost savings ranging from an estimated $6.00 to $24.00 may be accrued from installing a ShowerStart device in single family and multifamily homes.

Suggested Additional Research

- Further studies are required to understand users' shower behavior, and to enable accurate determination of the pre-shower hot water wait time in the State of Illinois.
- Further research is necessary to investigate the showerhead flow rate during trickling due to operation of the shower restriction valve.
- Further research is necessary to investigate how much hot water is wasted before a user enters into the shower when a shower restriction valve is installed, and how long this wasted hot water is left to run.

- Further studies could focus on investigating whether shower restriction valves interfere with the flow rate and consequently affect the energy savings from a low flow showerhead, causing savings estimates to be revised for one or both devices.
- Research on shower behaviors should include the impact of situations where users normally open the faucet tap during the warm up time. Such discussion was lacking in the reference materials, but the possibility could render the thermostatic restriction valve virtually non-operational, and thus produce zero savings. Alternatively, if the pre-retrofit scenario involved hot water waste through the faucet and post-retrofit behavior changed to using the showerhead for warm up time, savings could be greater.

References

[1] ShowerStart LLC (www.showerstart.com)
[2] "Simply & Cost Effectively Reducing Shower Based Warm-Up Waste: Increasing Convenience & Conservation by Attaching ShowerStart to Existing Showerheads" (ShowerStart LLC, 2008).
[3] "Identifying, Quantifying and Reducing Behavioral Waste in the Shower: Exploring the Savings Potential of ShowerStart" (ShowerStart LLC, May 2013).
[4] "Water Conservation Program: ShowerStart Pilot Project White Paper", (City of San Diego, CA, August 2008).
[5] Pacific Gas and Electric Company (Work Paper PGECODHW113, Low Flow Showerhead and Thermostatic Shower Restriction Valve, Revision # 4, August 2012).
[6] Illinois Statewide Technical Reference Manual for Energy Efficiency (June 2013, Version 2.0, section 5.4.5).
[7] www.epa.gov/safewater, "Water on Tap, What You Need to Know", 2009.
[8] Smart Energy Design Assistance Center, University of Illinois, Urbana, Champaign; Newsletter Vol. 6, No. 6, June 2010, (www.sedac.org).

7.2.2 Net Program Impact Results

Verified net energy savings were calculated by multiplying the Verified Gross Savings estimates by a deemed Net-to-Gross Ratio (NTGR). In GPY2, the NTGR estimate used to calculate the Net Verified Savings was deemed through a consensus process by the Illinois Stakeholder Advisory Group (SAG)[22] based on GPY1 evaluation research. The program evaluation plan did not include new free-ridership research or spillover research during the GPY2 program year.

7.3 Detailed Process Results

The GPY2 process evaluation was limited to interviews with program staff and the implementation contractor staff to verify information about the program's measures and tracking system. The program evaluation plan did not include new research into program processes.

[22] Document provided by PGL-NSG to the SAG summarizing the SAG-approved NTGR for PGL-NSG for GPY1-GPY3 through a consensus process in March-August 2013. Distributed in the SAG meeting on August 5-6, 2013. http://ilsagfiles.org/SAG_files/Meeting_Materials/2013/August 5-6, 2013 Meeting/ Peoples Gas and North Shore Gas GPY1-GPY3 and Phase II Plan.xls

7.4 Data Collection Instruments

The GPY2 evaluation plan did not include developing new data collection instruments for this program evaluation.