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Energy Efficiency Plan:
Plan Year 1 (6/1/2011-5/31/2012)

Evaluation Report:
Residential Single Family Direct Install Program

FINAL

Presented to
Peoples Gas

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NAVIGANT

Table of Contents

NAVIGANT

List of Figures and Tables

Tables:

NAVIGANT

E. Executive Summary

This report presents a summary of the findings and results from the evaluation of the Peoples Gas Residential Single Family Direct Install (SFDI) Program in Program Year 1 (GPY1), which launched in March 2012. The main goal of this residential direct install program is to secure energy savings through direct installation of low-cost efficiency measures, such as water efficient showerheads and faucet aerators, and pipe insulation, at eligible single family residences. A second objective of this program is to perform a brief assessment of major retrofit opportunities (e.g., furnace, boiler, air conditioning, insulation and air sealing) and bring heightened awareness to the homeowners about the updated Peoples Gas (PG, in GPY1 through GPY3)[1] and North Shore Gas (NSG, in GPY2 and GPY3)[2] Residential Prescriptive programs.

E.1 Evaluation Objectives

The primary objective of the GPY1 impact evaluation is to estimate gross and net energy savings for the Peoples Gas SFDI Program. These results will be used to validate program-claimed savings and to adjust estimates of savings to improve their accuracy. The primary objective of the process evaluation effort in GPY1 is to assess the early program implementation strategy and provide recommendations to enhance effectiveness.

E.2 Evaluation Methods

Navigant performed a verification and due diligence and tracking system review, and the corresponding memo report is included in the Appendix. The basis for gross impact evaluation was the review of tracking data and deemed savings assumptions, and a verification check on 20 project files. Regarding net impacts, Navigant used net to gross ratios from several previously approved sources to calculate net savings, per Option 4 in the March 10, 2010 memo, "Proposed Framework for Counting Net Savings in Illinois".[3] Our approach is further described in Section 3.3.2, Verified Net Energy Savings Evaluation Methods.

The basis for process evaluation was implementation contractor interviews and review of available program materials. Participant surveys were not conducted in GPY1 because the program start-up occurred in March, however we will conduct participant surveys in GPY2 along with program staff interviews and review of additional program documentation. Table E-1 provides a summary of the data collection activities conducted as part of the GPY1 SFDI Program evaluation.

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[1] Peoples Gas Program year dates are: GPY1 begins June 1, 2011 and ends May 31, 2012; GPY2 begins June 1, 2012 and ends May 31, 2013; GPY3 begins June 1, 2013 and ends May 31, 2014.

[2] North Shore Gas Program year dates are parallel to Peoples Gas: GPY2 begins June 1, 2012 and ends May 31, 2013; GPY3 begins June 1, 2013 and ends May 31, 2014.

[3] "Proposed Framework for Counting Net Savings in Illinois," March 10, 2010 memo to Stakeholder Advisory Group from Philip Mosenthal, OEI and Susan Hedman, OAG Under option #4: "Deeming a NTG ratio prospectively, may be appropriate if: the program design and market are understood well enough to reasonably accurately estimate an initial NTG (e.g., based on evaluated programs elsewhere); or it is determined that the savings and benefits of the program are not sufficient to devote the evaluation resources necessary to better estimate a NTG ratio."

Table E-1. GPY1 Data Collection Activities

Collection Method	Targeted Population	Sample Size	Gross Impacts	Net Impacts	Process
Tracking Data	Program Participants	All	X	X	
Deemed Savings Review	Deemed Savings Estimate	All	X	X	
In-depth interviews	Implementation Contractor Staff	3			X
Engineering Desk Review	Installation Forms and Tracking Database	20	X		X

Source: Navigant Evaluation Team

E.3. Key Impact Findings and Recommendations

Since the program only was in operation for three months of the program year, the verified net savings (14,949 therms) was less than 10% of the filed program net savings goal for GPY1 (182,450 therms). This amount of savings is commensurate with a new program that requires time to contact potential customers and schedule installations, as well as performing installations.

Navigant received clarifications and concurrences from the implementation contractor on the verification due diligence and tracking system review and recommendations. The following list summarizes the key impact findings and recommendations from the GPY1 SFDI Program evaluation which incorporate the implementation contactor's planned responses:

Finding. Tracking information did not contain some data elements that would facilitate evaluation, including baseline efficiency on existing equipment where available, whether referrals were made to prescriptive programs, responses from customers, and post-installation inspection activities, making it difficult to assess trends, review inspection results and follow-up with customers regarding prescriptive program opportunities. The tracking system does not record rated baseline gallons per minute (GPM) stamped on showerheads and aerators.

- **Recommendation.** Navigant recommends adding fields to the installation summary form to allow additional tracking information in the program tracking system to provide more detail – this information should include visually inspected water flow ratings of existing plumbing fixtures where available in order to verify measure eligibility, referrals to the other Peoples Gas residential programs for the purposes of following-up with the customer, responses from customer satisfaction surveys, and post-installation inspection activity in order to ensure compliance with quality control procedures.

Finding. During the evaluation Due Diligence review completed in August 2012, we observed that the project information from the installation forms is manually inputted into the tracking system. Handwriting on a number of resident installation summary forms was difficult to read, leading to the

possibility of data entry errors. In winter 2012, the implementer initiated a procedure of random checks on 2.5 percent of projects to ensure accuracy and indicated they are moving toward the evaluation recommendation of up to 5 percent.

- **Recommendation.** To the extent possible, the program should attempt to minimize hand-written data entry. For example, hand-held tablets (*if feasible from a cost perspective)* could facilitate and improve on-site data collection and document survey findings.

Finding. Baseline equipment information was not documented on the installation forms; therefore, the post-installation inspection process cannot include a verification that customer was eligible for SFDI measure installation.

- **Recommendation.** The Operations Manual should identify the minimum rating for baseline GPM required to be eligible for the direct installation of showerheads and aerators, and the Peoples Gas Single Family Direct Install Program form should record values of "rated" GPMs that are stamped on the existing plumbing fixtures, if visible.

Finding. The evaluation due diligence review found that the installation form information was not easily accessible for verification purposes. After the due diligence review memo, the implementer reported that they began scanning each week's paperwork and uploading into the tracking database, and are considering using the BenLink system.

Finding. Of the 20 projects that were desk reviewed by an engineer for the Due Diligence review, 17 installation summary forms stated 1.0 GPM bath faucet aerator whereas the tracking database stated 1.5 GPM bath faucet aerator. The program implementer confirmed all the measures installed are 1.0 GPM aerators that were misnamed in the tracking system. The tracking system has been fixed.

Table E-2 below provides the GPY1 ex ante and verified gross and net energy savings.

Table E-2. GPY1 Verified Savings Estimates

Savings Estimate	Ex Ante Gross Energy Savings (Therms)	Ex Ante Net Energy Savings (Therms)	Evaluation Verified Gross Energy Savings (Therms)	Evaluation Verified Net Energy Savings (Therms)
SF-Showerheads	10,507	9,772	10,507	9,772
SF-Kitchen Aerators	796	748	796	748
SF-Bathroom Aerators	1,543	1,450	1,543	1,450
SF-DHW Pipe Wrap	3,917	2,624	3,917	2,624
SF-Boiler Pipe Wrap	573	384	530	355
Total	17,336	14,978	17,293	14,949

Source: Evaluation Team analysis of Integrys Tracking database

E.4. Key Process Findings and Recommendations

Since the program launched in March 2012, it only operated for three months in GPY1 with significant changes to operation for GPY2 including marketing materials, adding North Shore Gas participants and adding programmable thermostats to the installed measures. For the GPY1 process evaluation, Navigant sought to understand the early implementation mechanisms for the program by conducting interviews with three staff members of the implementation contractor, and reviewing available program materials including the installation form and customer "leave-behind" information sheet. The marketing materials were still in development as of June 1, 2012. Navigant will conduct a more thorough process evaluation in GPY2 which will answer the following process evaluation questions via the results from participant surveys, interviews with program and implementation contractor staff, and reviews of marketing materials, operations manual and tracking system input protocols:

1. How did customers become aware of the program? What marketing strategies could be used to boost program awareness?

2. Has the program effectively channeled customers to other programs sponsored by Peoples and North Shore Gas to implement additional efficiency measures as identified by the energy assessments? What are the main barriers to and motivation for customers to implement additional recommended measures?

The following is a summary of the key process-related findings and recommendations from the GPY1 verification and due diligence and tracking system review, which have been concurred with by the implementation contractor.

Finding. In several of the project files, the person who authorized entry and installations was not the owner and the relationship to the owner was not described on the form.

- **Recommendation.** Navigant recommends that installers should clearly verify that the authorized signer at the home is indeed the authorized person that is granting entry and installations.

Finding: The inspection process was not fully developed in GPY1, and it was unclear how many inspections had been conducted and the results of any inspections that had been conducted.

- **Recommendation.** The program should conduct inspections on a randomly selected sample of up to 5% of the installations and report any discrepancies.

Finding: There was no process in place to check that the program coordinator entered the installation data correctly since the inventory sheets from installers were not cross-checked with the database.

- **Recommendation.** Cross-check information from inventory sheets with the information entered by the program coordinator from the installation summary forms.

1. Introduction to the Program

1.1 Program Description

The Single Family Direct Install (SFDI) Program's primary objective is to secure energy savings through direct installation of low-cost efficiency measures, such as water efficient showerheads and faucet aerators and domestic hot water (DHW) and boiler pipe insulation, at eligible single family residences. A second objective of this program is to perform a brief assessment of major retrofit opportunities (furnace, boiler, air conditioning, insulation and air sealing) and bring heightened awareness to the homeowners about the updated Peoples Gas (PG, in GPY1 through GPY3) and North Shore Gas (NSG, in GPY2 and GPY3) Residential Prescriptive programs. Peoples Gas and North Shore Gas are natural gas distribution utilities of the Integrys Energy Group (Integrys).

Working through defined and trusted community groups, this program serves single family residential customers who live in the PG territory beginning in March of GPY1, and in both PG and NSG territory beginning in GPY2. This SFDI Program is intended to balance the residential portfolio incentive budget (e.g., $/therm saved) and increase therm savings from residential service customers. In addition, the program intends to build a base of eligible customers for future program participation in Residential Prescriptive and Whole House retrofit (if the program launches). Also, the program plans to be responsive to recent input from HVAC distributors about the need for more homeowner awareness.

The initial program implementation period is three years, which commenced with GPY1 – the program did not begin in earnest until March 2012.[4] The total filed energy savings goal for all of GPY1 was to achieve net gas savings of 182,450 therms. Key metrics include the number of participating single family customers, measures installed and corresponding deemed energy savings, as well as documenting the age and type of existing heating and air conditioning equipment. Customer leads are documented within the implementation contractor's (Franklin Energy Services) tracking system and will serve as the basis for targeted marketing of programs in GPY2 and GPY3.

1.2 Evaluation Questions

The evaluation sought to answer the following key researchable questions.

1.2.1 Impact Questions

The primary objective of the impact evaluation is to estimate gross savings for the SFDI Program in all years and provide one estimate of the net-to-gross ratio. Since the launch date of the Single Family Direct Install program was March 2012, additional information will be gleaned from participant surveys conducted in GPY2 when there is sufficient program participation (e.g., realization rates and net-to-gross ratio). The results from GPY2 will be used to validate program-claimed savings and to improve their accuracy for GPY2 and GPY3. Research questions include:

1. What are the gross impacts from this program?

[4] Program year date ranges are as stated in Footnotes 1 and 2.

2. What are the net impacts from this program?

3. Did the program meet its energy saving goals?

4. Are the deemed savings values reasonable for the program participants?

1.2.2 Process Questions

The primary objective of the limited process evaluation effort in GPY1 was to help program designers, managers and implementers structure their programs to achieve cost-effective savings while maintaining high levels of customer satisfaction. Through interviews with implementation contractor staff, we learned that the program was undergoing significant further development for GPY2 including marketing materials approval, a redesigned installation summary form, and finalizing an operations manual.

Navigant will conduct a more thorough process evaluation in GPY2 and GPY3 focusing on the following areas:

1.2.3 Marketing and Participation

1. For GPY2, how did customers become aware of the program? What marketing strategies could be used to boost program awareness?

2. For GPY2, are the program marketing plans and program promotional materials aligned with program benefits? Do they clearly communicate program benefits?

3. In GPY2, has the program effectively targeted and engaged with community organizations to promote the program to customers?

4. In GPY2, has the program effectively channeled customers to other programs sponsored by Peoples and North Shore Gas to implement additional efficiency measures as identified by the energy assessments? What are the main barriers to and motivation for customers to implement additional recommended measures?

1.2.4 Program Characteristics and Barriers

1. In GPY2, what areas could the program improve to create a more effective program for customers and help increase the energy impacts (information provided in written reports and adequate follow-up information provided)?

2. In GPY2, does the application/enrollment process present any barriers to program participation?

3. In GPY2, are customers satisfied with the aspects of program implementation in which they have been involved?

1.2.5 Administration and Delivery

1. Are program administrative and delivery processes effective for delivering efficient scheduling and installation of measures?
    a. Program tracking and information management systems
    b. Internal and external program communications
    c. Targeting and engaging with community organizations to promote the program effectively
    d. Program delivery organization and staffing
    e. Skill levels needed to implement the program

2. Are there changes to the administrative and delivery process that would improve the program?

3. In GPY2, are customers satisfied with participation in the program and customer service experiences? Are customer surveys completed and reviewed by the program?

4. In GPY2, what are the inspection procedures for the program? Have they been implemented in a manner consistent with design? Do they present a barrier to participation or perceived undue burden on customers?

2. Evaluation Methods

In GPY1, the analytical methods used for the evaluation of the SFDI Program were driven to a large extent by the data available for the program's early stage of development. In addition, we used the Illinois Technical Reference Manual (TRM)[5] for all the measures to verify gross savings calculations (with the exception of boiler pipe insulation which applied an industry standard calculation because it is not in the TRM).

2.1 Primary Data Collection

The data collected for the evaluation of the GPY1 SFDI Program was gathered via the Integrys tracking data analysis, and a deemed savings review. Table 2-1 below provides a summary of the data collection activities.

Table 2-1. GPY1 Data Collection Activities

Collection Method	Targeted Population	Sample Size	Gross Impacts	Net Impacts	Process
Tracking Data	Program Participants	All	X	X	
Deemed Savings Review	Deemed Savings Estimate	All	X	X	
In-depth interviews	Implementation Contractor Staff	3			X
Engineering Desk Review	Installation Forms and Tracking Database	20	X		X

[5] The final version of the first State of Illinois Energy Efficiency Technical Reference Manual (TRM) (Version 1.0 dated September 14, 2012, effective as of June 1, 2012) was approved on January 9, 2013 by the Illinois Commerce Commission in Docket No. 12-0528. The verified gross savings shown in Table E-2 recognizes that gas measures covered by the TRM are deemed for evaluation purposes in GPY1. Since the TRM was not final until after the end of GPY1, the TRM is applicable for evaluation purposes, but not GPY1 implementation. For the Single Family Direct Install Program, evaluation research findings for gross savings that do not assume deemed status of TRM measures in GPY1 were identical to verified gross savings with deeming.

2.2 Tracking Data

Navigant performed a review of the program tracking database. The program implementation contractor is in the process of developing a guide for the SFDI Program for the Bensight Data Management system that Navigant will review upon completion. Navigant obtained an extract from the program tracking system (*Access database information extracted on July 19, 2012*) to review information included in the tracking system and compare corresponding entries in project files. The program extract from July 19, 2012 indicated that the program had completed 507 units with realized energy savings, a difference of three units compared to the units reported by Franklin Energy in a telephone conversation on July 31, 2012.

2.3 Verified Savings Evaluation Methods

Overall program savings were estimated by using per unit savings values in the TRM (with the exception of boiler pipe insulation, described below) and the measure quantities in the database extract from August 27, 2012 and revised according to a follow-up email[6] and compared to values calculated by the implementation contractor.

2.3.1 Verified Gross Energy Savings Evaluation Methods

Verified Gross Energy Savings (therms) resulting from the GPY1 SFDI Program were calculated using TRM[7] deemed values for energy savings, except for the boiler pipe insulation, addressed below.

2.3.1.1 Verified Gross Energy Savings – Single Family Direct Install Low Flow Showerheads

Verified Gross Annual Therm Savings = %FossilDHW * ((GPM_base * L_base - GPM_low * L_low) * Household * SPCD * 365.25 / SPH) * EPG_gas * ISR

= 19.9 therms per unit

Where:

- %Fossil DHW = 100% of DHW is heated by natural gas
- GPM_base = SFDI: Baseline showerhead gallons per minute = 2.67
- L_base = Shower length in minutes with baseline showerhead = 8.2
- GPM_low = SFDI: Low flow showerhead gallons per minute = 1.5
- L_low = Shower length in minutes with low flow showerhead = 8.2
- Household = Average number of people per household = 2.56
- SPCD = Showers Per Capita Per Day = 0.75
- SPH = SFDI: Showerheads Per Household so that per-showerhead savings fractions can be determined = 1.79
- EPG_gas = SFDI: Energy per gallon of Hot water supplied by gas = 0.0054 Therm/gal
- ISR = SFDI: In service rate of showerhead = 0.98

[6] E-mail from Jay Boettcher, Franklin Energy Services, to Kevin Grabner, Navigant, "RE: Check of Claimed GPY1 Savings for Single Family Direct Install", September 13, 2012.
[7] Illinois Statewide Energy Efficiency Technical Reference Manual, September 14, 2012.

2.3.1.2 *Verified Gross Energy Savings – Single Family Direct Install Low Flow Kitchen and Bathroom Aerators*

Verified Gross Annual Therm Savings = %FossilDHW * ((GPM_base * L_base - GPM_low * L_low) * Household * DF * 365.25 / FPH) * EPG_gas * ISR

= 1.78 therms per unit (Kitchen)
= 2.14 therms per unit (Bathroom)

Where:

- %Fossil DHW = 100% of DHW is heated by natural gas
- GPM_base = SFDI: Average flow rate, in gallons per minute, of the baseline faucet "as-used" = 1.2
- L_base = Average retrofit length faucet use per capita for all faucets in minutes = 9.85
- GPM_low = SFDI: Average flow rate, in gallons per minute, of the low-flow faucet aerator "as-used"= 0.94
- L_low = Average retrofit length faucet use per capita for all faucets in minutes = 9.85
- Household = Average number of people per household = 2.56
- DF = Drain Factor = 75% for Kitchen and 90% for Bathroom
- FPH = SFDI: Faucets Per Household =1 for Kitchen and 2.83 for Bathroom
- EPG_gas = SFDI: Energy per gallon of Hot water supplied by gas = 0.0040 Therm/gal
- ISR = SFDI: In service rate of faucet aerators = 0.95

2.3.1.3 *Verified Gross Energy Savings – Single Family Direct Install Domestic Hot Water Pipe Insulation*

Verified Gross Annual Therm Savings = ((1/Rexist – 1/Rnew) * (L * C) * ΔT * 8,766) / ηDHW /100,000

= 0.908 therms per unit

Where:

- Rexist = Pipe heat loss coefficient of uninsulated pipe (existing) [(hr-°F-ft)/Btu] = 1.0
- Rnew = Pipe heat loss coefficient of insulated pipe (new) [(hr-°F-ft)/Btu] = Actual (1.0 + R value of insulation) = 3.2
- L = Length of pipe from water heating source covered by pipe wrap (ft) = 1
- C = Circumference of pipe (ft) (Diameter (in) * π/12) = Actual = 0.196
- ΔT = Average temperature difference between supplied water and outside air temperature (°F)= 60
- ηDHW = Recovery efficiency of gas hot water heater = 0.78

2.3.1.4 *Verified Gross Energy Savings – Single Family Direct Install Boiler Pipe Insulation*

Since this measure is not deemed in the Illinois TRM, Navigant verified the calculations performed by the implementation contractor. The implementation contractor used the industry software 3E Plus®[8] to calculate the gross energy savings and Navigant agreed with the input values listed in Table 2-2 with the exception of the estimated hours per year of heating. The implementation contractor's estimate was based upon hours per year when the temperature is below 65F, assuming 70F space temperature with internal loads, and weather data for O'Hare International Airport from TMY3 data (6,309 hours)[9]. This estimate may include hours outside a typical heating season when some boilers will not be in use. Navigant revised the hours of use to represent shut down during the cooling season. We based our estimate of actual usage on an operating strategy of 24 hours a day for the eight months of typical heating (mid-September – mid-May), which is 5,840 hours per year, and no operation during the cooling season. This revises the gross savings to be 3.19 therms per linear foot (from 3.45).

Table 2-2. SFDI Boiler Pipe Insulation Input Values to 3E Plus and Energy Savings Output Value

Parameter	Value	Units	Notes
R Value of pipe insulation	5.6		1.5 inches of insulation with K of 0.27 or less is required by IECC 2009
Feet of pipe	1	ft	Calculations are per foot
Temp of pipe	160	Degrees F	Assuming 180F boiler water, cools down over boiler loop
Ambient temperature	70	Degrees F	Assumption, conservative value based on assumed average 65F set point
Combustion Eff.	80%		Federally mandated boiler thermal efficiency
NPS (nominal pipe size)	1.5		1.5 inches, assumed
Btu loss/hr, uninsulated	70.2		Using 3E Plus®
Btu loss/hr, insulated	11.85		Using 3E Plus®
Btu loss/hr, savings	58.35		Calculated
Hours/year	5,840	hours	Hours for heating for eight months of the year
CF	0.75		Correction factor, a portion of losses will be useful heat
Btu/therm	100,000		Standard for natural gas delivered to WI
Therms/year saved	3.19	therms	Calculated (Equation)

Source: Navigant Evaluation Team

[8] http://www.pipeinsulation.org Accessed: October 25, 2012. "The 3E Plus® Insulation Thickness Computer Program is an industrial energy management tool developed by the North American Insulation Manufacturers Association (NAIMA) to simplify the task of determining how much insulation is necessary to use less energy, reduce plant emissions and improve system process efficiency."

[9] Email from Jay Boettcher, September 13, 2012.

2.3.2 Verified Net Energy Savings Evaluation Methods

Verified net energy savings resulting from the GPY1 SFDI Program were calculated by multiplying the measure-level evaluation verified gross savings by the measure-level net-to-gross ratios (NTGR) provided as GPY1 planning assumptions from Peoples Gas.[10] Evaluation results from ComEd GPY2 direct installation programs provided the basis for Peoples Gas NTGRs for faucet aerators and showerheads.[11] A net to gross ratio for pipe insulation of 67%[12] was assumed by Peoples Gas for direct hot water pipe insulation.

In accord with the NTG Framework[13], we conclude it is appropriate to use the planned NTG ratios provided by Peoples Gas for GPY1 as final, evaluation verified values for GPY1, on the following basis:

- This program has not been evaluated before and so according to the NTG Framework the NTG is to be applied retroactively. The program falls under the following condition from the NTG Framework: For existing and new programs not yet evaluated, and previously evaluated programs undergoing significant changes — either in the program design or delivery, or changes in the market itself — NTG ratios established through evaluations would be used retroactively, but could also then be used prospectively if the program does not undergo continued significant changes.
- For programs falling under the above requirement, deeming a NTG ratio *prospectively*, may be appropriate if: the program design and market are understood well enough to reasonably accurately estimate an initial NTG *(e.g.,* based on evaluated programs elsewhere); or it is determined that the savings and benefits of the program are not sufficient to devote the evaluation resources necessary to better estimate a NTG ratio

In summary, we believe the program design and market are understood well enough to reasonably accurately estimate an initial NTG for GPY1 based on ComEd evaluation reports for a similar program, and that the limited participation in GPY1 was not sufficient to devote the evaluation resources to conduct a better estimate for GPY1.

[10] Three documents from Peoples Gas were provided through an email from Annette Beitel, EE SAG Facilitator, March 5, 2012: *Low Flow Aerators Single Family DI 022912, Low Flow Showerheads Single Family DI 022912, Residential DHW Pipe Wrap Single Family DI 022912.*

[11] Navigant, *Energy Efficiency / Demand Response Plan: Plan Year 2, Evaluations Report: Summary Report,* Prepared for Commonwealth Edison Company, December 2010.

[12] Peoples Gas reported that the NTG ratio was taken from a past evaluation of this measure under the Wisconsin Focus on Energy program, performed by PA Consulting and KEMA.

[13] "Proposed Framework for Counting Net Savings in Illinois." Memorandum March 12, 2010 from Philip Mosenthal, OEI, and Susan Hedman, OAG.

3. Evaluation Results

3.1 Verified Savings Results

This section presents the Verified Gross and Net Savings results from the GPY1 SFDI Program evaluation, as well as an overview of the Verification and Due Diligence and Tracking System review. Navigant performed a verification and due diligence review of the program tracking and savings verification procedures used in the Peoples Gas Single-Family Direct Install Program (SF DI) during the program's first year (PY1) (See Appendix 5.1). The main components of this review included analysis of program documentation and procedures as well as interviews with the implementation contractor program manager, regional manager, and team leader for the installation teams.

3.1.1 Verification and Due Diligence and Tracking System Review

The program was launched in March of 2012 and made significant progress in GPY1. According to the implementation program manager, an SFDI operations manual is being developed which will describe quality control and quality assurance frameworks as well as outline the program guidelines for eligibility, site assessment, installation of water devices, safety training, customer satisfaction survey and complaint resolution. Quality assurance is still under development and will be addressed in the GPY2 evaluation - this will also include marketing, outreach and comparing program materials against national best practices. We will review the SFDI operations manual once it is complete. Our review in GPY1 found the Single-Family program's tracking system captures the measure information installed on behalf of the program. We observed an inconsistency between the completed residential single family direct install form and the tracking database measure name for bathroom aerators; this was a misnamed measure in tracking system and was fixed by the implementer. Measure quantities and measure savings were reviewed upon receipt of the data extract updated for TRM values (August 27, 2012 extract). The program should consider adding additional fields to capture GPM ratings stamped on the existing equipment that is being replaced.

Summary of Recommendations:

- Have the installer verify that customer (or proxy) information is legibly filled out the on installation form.
- Consider using handheld input devices as opposed to handwritten input, where feasible.
- Consider adding flow ratings of existing plumbing fixtures to the installation form.
- To ensure accuracy of manually entered data, conduct random checks on at least 5% of the entered project data.
- Ensure that all scanned hard copies of project documents are saved and transferred onto the program tracking system for easy access and review.

3.1.2 Ex Ante and Verified Gross Savings Parameter Estimates

Table 3-1 below provides the measure tallies used to calculate the GPY1 Ex Ante and Verified Gross Savings. Navigant used the quantities in the August 27, 2012 data extract provided by the implementation contractor as clarified in a follow-up email on September 13, 2012 in which some of the projects were identified as "rejected" and we removed them from our summary. For GPY1, a total of 502 households participated with a total of 6,176 units installed.

Table 3-1. Ex Ante and Verified Gross Savings Parameter Estimates

Measure	SF-Showerheads	SF-Kitchen Aerators	SF-Bathroom Aerators	SF-DHW Pipe Wrap (ft)	SF-Boiler Pipe Wrap (ft)	Total
Units	528	447	721	4,314	166	6,176

Source: Navigant Evaluation Team Analysis of Tracking Data and Deemed Savings Review

3.1.3 Ex Ante and Verified Gross Savings Estimates

Table 3-2 below provides the GPY1 Ex Ante and Verified Gross Savings estimates. Navigant used the above quantities of measures and the TRM deemed savings approach and calculated the same values for the verified gross savings as the ex-ante values, with the exception of the boiler pipe wrap savings, described in Section 3.3.1.

Table 3-2. Ex Ante and Verified Gross Savings Estimates

Measure	SF-Showerheads	SF-Kitchen Aerators	SF-Bathroom Aerators	SF-DHW Pipe Wrap	SF-Boiler Pipe Wrap	Total Therms
Ex-Ante Gross Energy Savings (Therms)	10,507	796	1,543	3,917	573	17,336
Evaluation Verified Gross Energy Savings (Therms)	10,507	796	1,543	3,917	530	17,293

Source: Navigant Evaluation Team Analysis of Tracking Data and Deemed Savings Review

3.1.4 Net to Gross Ratios for Ex Ante and Verified Net Savings Estimates

Table 3-3 below provides the NTGR values used to calculate the Verified Net Savings. Navigant used the same NTGR as the SF – DHW Pipe Wrap for the SF- Boiler Pipe Wrap.

Table 3-3. Net to Gross Ratios

Measure	SF-Showerheads	SF-Kitchen Aerators	SF-Bathroom Aerators	SF-DHW Pipe Wrap	SF-Boiler Pipe Wrap
NTGR	0.93	0.94	0.94	0.67	0.67

Source: GPY1 planning assumptions from Peoples Gas.

3.1.5 Ex Ante and Verified Net Program Impact Results

Using the net-to-gross ratios from the GPY1 planning assumptions from Peoples Gas, Navigant calculated the net impacts, which were the same as the ex-ante values with the exception of the boiler pipe wrap. Table 3-4 below provides the GPY1 Ex Ante and Verified Net Savings estimates.

Table 3-4. Ex Ante and Verified Net Savings Estimates

Measure	SF-Showerheads	SF-Kitchen Aerators	SF-Bathroom Aerators	SF-DHW Pipe Wrap	SF-Boiler Pipe Wrap	Total Therms
Ex-Ante Net Energy Savings (Therms)	9,772	748	1,450	2,624	384	14,978
Evaluation Verified Net Energy Savings (Therms)	9,772	748	1,450	2,624	355	14,949

Source: Navigant Evaluation Team Analysis of Tracking Data and Deemed Savings Review

3.2 Process Evaluation Results

Navigant process evaluation included in-depth interviews with three members of the implementation contractor's staff (the regional manager, the program manager and the team leader for the installation teams) and a review of available program materials. The process evaluation of the GPY1 SFDI Program assessed the effectiveness of program processes (e.g., the mechanics of how the program was implemented).

3.2.1 Program Implementation Strategy

The implementation strategy for the GPY1 SFDI Program included contacting the 700+ customers that had indicated interest in the Chicagoland program[14]. The program is undergoing enhancements in early GPY2 and we will document the revisions to implementation strategy in the GPY2 evaluation report. The following describes the implementation strategy from program launch in March 2012 to May 31, 2012.

3.2.1.1 Pre-Installation Protocol

The implementers set forth the following qualifications:

- At the outset of the program, Franklin Energy contacted via telephone the 700+ households that had been put onto a waiting list after the Chicagoland pilot had met its goals.
- After determining that a Peoples Gas customer was interested in the program, the customer service representatives (CSR) asked several qualifying questions to determine if the customer was eligible. If so, the CSR scheduled an installation date.

The pre-installation qualification process was straightforward and captured the necessary information for the installers who would be performing the installations in the qualifying homes.

3.2.1.2 Installation Protocol

The following steps were followed by the implementers during the installation process:

- The Franklin Energy installers (which included two teams of two people) arrive at the home with a carbon copy form "Peoples Gas Residential Single Family Direct Install Program" (See Appendix 5.1) with the Owner's or Occupant's name, billing address, phone number, rate classification and Peoples Gas Utility account number completed during the telephone in–take process. The authorization for this information is tagged in Bensight as "Written" or "Verbal" and the type of authorization for retrieving this data is tracked.
- The installers also ask for a dated authorized signature prior to entering the home.
- The installers verify that the water flow ratings on the existing plumbing devices meet the eligibility criteria and proceed to install the energy efficient devices and/or pipe insulation and note that on the form.
- The installers also note if the space heating is electric or gas and whether the home has a programmable thermostat. In addition, the installers note the name of the utility, square footage and number of refrigerators.
- The installers record the date and time of the installation as well as print and sign the Field Technician's Name.
- The installers then secure an authorized signature, printed name, date, and relationship to owner (if applicable) to verify the installation. A duplicate copy of the installation summary form is left with the participant.

[14] "Single Family Direct Install Final Report," Chicagoland Natural Gas Savings Program and ComEd, prepared by Franklin Energy Services, July 11, 2011.

- In addition, the installers also leave behind for the customer information regarding the installed energy saving products and estimated annual savings that would be seen on the participant's Peoples Gas natural gas bill (See Appendix 5.1).

To ensure that the installers have a Peoples Gas customer's authorization and verification (or the customer's authorized proxy) it is important that the handwriting is legible on the form and the relationship to the Peoples Gas customer (if it is a proxy) is filled out.

Moreover, to the extent feasible, the program should attempt to minimize hand-written data entry. For example, hand held tablets facilitate on-site data collection and document survey findings. Handwriting on some resident reports was difficult to read, leading to the possibility of data entry errors.

Also, noting the water flow ratings of the existing plumbing fixtures on the installation form would serve as a record that the customer did qualify for the direct install measures.

3.2.1.3 Post-Installation Reporting and Invoicing

Post-installation reporting and invoicing is as follows:

- In addition to providing the installation forms, installers file an "On-hand Quantity" inventory report to the inventory specialist every Friday afternoon at end-of-business. This product count is monitored on a weekly basis and assumed install quantities are randomly checked against the database for accuracy. This quality control measure prevents the report of fraudulent inventory amounts.
- A program coordinator manually enters the measures on the completed forms into the Bensight Data Management system.
- Each month, Franklin Energy submits an invoice detailing the products that were installed via the program as well as the number of audits conducted. In addition, Franklin Energy submits a monthly report that contains the status of the program toward meeting its goals and the total savings to date.

In the future, to ensure accuracy of manually entered data, random checks on up to 5% of the entered projects could be performed on a monthly or quarterly basis.[15] The program implementer should also ensure that all scanned hard copies of project documents are saved and transferred onto the program tracking system for easy access and review.[16]

3.2.2 Program Implementation Assessment

Through interviews with implementation staff, Navigant gained an appreciation for the early implementation activities of the SFDI Program. In the first five weeks of the program, the program implementer contacted all 700+ households who were interested in the Chicagoland program but were not served. Over 500 households received installations from the SFDI Program during March - May 2012. According to the program implementer staff interviews, the customers reported a high level of

[15] The implementer reports they are following this recommendation in GPY2.
[16] Ibid.

satisfaction with the installations and the level of customer service and participating customers referred a significant number of new contact leads to the program.

3.2.2.1 Marketing and Installations

The SFDI Program met its goals to contact the 700+ Peoples Gas customers who had not previously participated in the Chicagoland project, and over 500 customers participated in the first three months of the SFDI Program. The implementation contractor contacted the 700+ contacts from the Chicagoland program in the first five weeks of the SFDI Program. The implementation contractor created availability in the installation crews' schedules to allow for flexibility in case there were additional eligible customers that were neighbors of the installations scheduled that day as well as to place door hangers on neighborhood homes about the program. The program added additional installation staff to keep up with the demand, and customers who called to request participation in the program were scheduled for installation the following week if they met eligibility requirements.

3.2.2.2 Customer Satisfaction

Customer satisfaction was reported to be high by the implementation staff and customer referrals became the biggest source of new participants in the second five weeks of the program, also indicating a high satisfaction rate among participants. A customer satisfaction survey "leave behind" is planned for GPY2.

3.2.2.3 Project Inspections and Quality Control

The inspection process was not fully developed in GPY1, and it was unclear how many inspections had been conducted and the results of any inspections that had been conducted. Also, there was not a process in place to check that the program coordinator entered the installation data correctly since the inventory sheets from installers were not cross-checked with the database.

4. Findings and Recommendations

4.1 Key Impact Findings and Recommendations

The following list summarizes the key impact findings from the GPY1 evaluation:

Finding. Tracking information did not contain some data elements that would facilitate evaluation, including baseline efficiency on existing equipment where available, whether referrals were made to prescriptive programs, responses from customers, and post-installation inspection activities, making it difficult to assess trends, review inspection results and follow-up with customers regarding prescriptive program opportunities. The tracking system does not record rated baseline gallons per minute (GPM) stamped on showerheads and aerators.

- **Recommendation.** Navigant recommends adding fields to the installation summary form to allow additional tracking information in the program tracking system to provide more detail – this information should include visually inspected water flow ratings of existing plumbing fixtures where available in order to verify measure eligibility, referrals to the other Peoples Gas residential programs in order to allow follow-up, responses from customer satisfaction surveys, and post-installation inspection activity in order to ensure compliance with quality control procedures.

Finding. During the evaluation Due Diligence review completed in August 2012, we observed that the project information from the installation forms is manually inputted into the tracking system. Handwriting on a number of resident installation summary forms was difficult to read, leading to the possibility of data entry errors. In winter 2012, the implementer initiated a procedure of random checks on 2.5 percent of projects to ensure accuracy and indicated they are moving toward the evaluation recommendation of up to 5 percent.

- **Recommendation.** To the extent possible, the program should attempt to minimize hand-written data entry. For example, hand-held tablets (*if feasible from a cost perspective)* could facilitate and improve on-site data collection and document survey findings.

Finding. Baseline equipment information was not documented on the installation forms; therefore, the post-installation inspection process cannot include a verification that customer was eligible for SFDI measure installation.

- **Recommendation.** The Operations Manual should identify the minimum rating for baseline GPM required to be eligible for the direct installation of showerheads and aerators, and the Peoples Gas Single Family Direct Install Program form should record values of "rated" GPMs that are stamped on the existing plumbing fixtures, if visible.

Finding. The evaluation due diligence review found that **t**he installation form information was not easily accessible for verification purposes. After the due diligence memo, the implementer reported that they began scanning each week's paperwork and uploading into the tracking database, and are considering using the BenLink system.

Finding. Of the 20 projects that were desk reviewed by an engineer for the Due Diligence review, 17 installation summary forms stated 1.0 GPM bath faucet aerator whereas the tracking database stated 1.5 GPM bath faucet aerator. The program implementer confirmed all the measures installed are 1.0 GPM aerators that were misnamed in the tracking system. The tracking system has been fixed.

4.2 Key Process Findings and Recommendations

The following list summarizes the key process findings and recommendations from the interviews:

Finding. In several of the project files the person who authorized entry and installations was not the owner and the relationship to the owner was not described on the form.

- **Recommendation.** Navigant recommends that installers should clearly verify that the authorized signer at the home is indeed the authorized person that is granting entry and installations.

Finding: The inspection process was not fully developed in GPY1, and it was unclear how many inspections had been conducted and the results of any inspections that had been conducted.

- **Recommendation.** The program should conduct inspections on a randomly selected sample of up to 5% of the installations and report any discrepancies.

Finding: There was no process in place to check that the program coordinator entered the installation data correctly since the inventory sheets from installers were not cross-checked with the database.

- **Recommendation.** Cross-check information from inventory sheets with the information entered by the program coordinator from the installation summary forms.

5. Appendix

5.1 Glossary

ComEd, Nicor, Peoples Gas, and North Shore Gas EM&V Reporting Glossary. January 10, 2013

High Level Concepts

Program Year

- EPY1, EPY2, etc. Electric Program Year where EPY1 is June 1, 2008 to May 31, 2009, EPY2 is June 1, 2009 to May 31, 2010, etc.
- GPY1, GPY2, etc. Gas Program Year where GPY1 is June 1, 2011 to May 31, 2012, GPY2 is June 1, 2012 to 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 EPY4/GPY1 ComEd's deemed parameters were defined in its filing with the ICC. The Gas utilities agreed to use the parameters defined in the TRM, which came into official force for EPY5/GPY2.

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, Retro-commissioning), 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, Retro-commissioning), 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 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[17].

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)**

[17] 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.

5.2 *Peoples Gas GPY1 Single-Family Direct Install Program – Verification, Due Diligence and Program Tracking System Review*

Navigant's initial memo on the verification, due diligence and tracking system review is attached below. Franklin Energy reviewed the memo and responded with clarifications and concurrences, and those are reflected in the findings for this evaluation report.

PG Single Family Direct Install Program