NAVIGANT

Energy Efficiency
ComEd Plan Year 4
Nicor Gas Plan Year 1
(6/1/2011-5/31/2012)

Evaluation Report:
Home Energy Savings Program

Final

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Commonwealth Edison Company and
Nicor Gas Company

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E. Executive Summary

This document presents the Evaluation Report of the Home Energy Savings (HES) program that was managed jointly by Nicor Gas and Commonwealth Edison (ComEd) and operated between June 1, 2011 to May 31, 2012 (GPY1, EPY4) [1] period. The HES program provided customers in single family homes a discounted home energy assessment and free or incentivized direct install and weatherization measure recommendations and installations.

E.1 Evaluation Objectives

The objectives of the HES program evaluation in GPY1/EPY4 were to (1) quantify net savings impacts from the program, (2) identify ways in which the program can be improved, and (3) determine process-related program strengths and weaknesses. Evaluation activities will extend across GPY1/EPY4-GPY3/EPY6, with the focus of the GPY1/EPY4 evaluation on high-priority issues, especially those affecting program participation.

E.2 Evaluation Methods

The main focus of the impact evaluation was to validate estimates of gross and net program savings and program tracking information. The process evaluation included a review of the program's administration, delivery, and a combination of trade ally, participant, and non-participant responses to our research questions.

Data collection included:

1. In-depth interviews
    a. Nicor Gas staff
    b. Program administrator
    c. Program implementation contractor staff (including Energy Advisors)
    d. Trade Allies – weatherization contractors
2. Telephone surveys with a random sample of full participants (those receiving both assessment and retrofit services)
3. Telephone surveys with a random sample of non-participants
4. Tracking system review and verification of claimed savings, including project documentation review
    a. Engineering review of the documented algorithms used by the program to calculate energy savings for all measures and the assumptions that feed those algorithms
    b. Cross-check of a sample of program applications with the tracking database
    c. Verification that savings are calculated as documented
    d. Review of other available program information

[1] Gas Program Year 1/Electric Program Year 4

E.3 Key Impact Findings and Recommendations

The evaluation effort succeeded in addressing the key research question posited by the program evaluation plan. Weatherization measure savings are calculated using Conservation Services Group's (CSG) proprietary EnergyMeasure® HOME (EM HOME) software. Navigant performed a desk review of the EM HOME software during GPY1/EPY4. Key findings and recommendations associated with the research questions and evaluation plan are as follows:

- **Finding.** Program verification, due diligence, and tracking system procedures all meet or exceed aspects of national best practices, as documented.

- **Finding.** CSG tracks installation rates during subsequent weatherization or QC activities, but it does not track persistence.
  Recommendation. Improvements in savings estimates may be achieved by tracking direct installation measure persistence as a potential program effectiveness indicator by way of follow-up checks during subsequent weatherization or QC activities.

- **Finding.** The data entry process involves taking field notes on paper and then re-entering the information into *EM HOME* on a computer in the work van, which is an instance of duplicate data entry.
  Recommendation. Explore switching from paper-to-computer based data entry during the energy assessments to using tablet computers equipped with EM HOME software. This will not only remove duplicative data entry and the potential for errors associated with it, but it could also potentially speed up the assessment process, which currently takes an average of 2.5 hours. By speeding up the assessment process, CSG could use the additional time for customer education helpful to the program. Such a software change would also provide the benefit of automatic, real-time accounting for the inter-connectivity of interdependent variables.

- **Finding.** The tracking database extract did not specify whether values were field-specified or default values.
  Recommendation. State whether building characteristics in the tracking system are field-specified or default values (e.g., heating and cooling system efficiencies), to clarify the basis for subsequent savings estimates. CSG stated that this information is visible in the *EM HOME* software suite, but that it would take considerable resources to be made available in the Microsoft Excel format that was used for the data extract submitted to Navigant. This information would be helpful to the evaluation team in determining the accuracy of inputs into the tracking system. This could also be useful as part of energy assessment review and training.

- **Finding.** The *EM HOME* simulation engine does not integrate customer billing data.
  Recommendation. Continue refining the *EM HOME* simulation engine to further improve savings estimates and reduce associated uncertainties. Explore options for improving modeling calibration using customer billing data, to provide an added dimension in estimating savings.

- **Finding.** The tracking system did not track kW savings for electric retrofit measures.
  Recommendation. Provide kW savings for electric retrofit measures to better facilitate cost-effectiveness estimates and various electric resource planning efforts.

Table E- 1 outlines the program's electric and therm savings for GPY1/EPY4.[2] The NTG Framework[3] calls for retroactively applying the NTG ratio for "previously evaluated programs undergoing significant changes — either in the program design or delivery, or changes in the market itself." The evaluation team believes the HES program meets this criterion because the program changed assessment pricing and implementation contractors in GPY1/EPY4. As a result this evaluation uses the NTG ratio calculated from our GPY1/EPY4 research for both the electric and gas components of the program.

Table E- 1. GPY1/EPY4 Savings*

	Energy Savings (MWh)	Peak Demand Savings (kW)	Energy Savings (Therms)
Ex-Ante Gross Savings	527	31	104,505
Ex-Ante Net Savings	358	22	96,105
Realization Rate**	1.09	1.30	1.05
Verified Gross Savings	574	40	109,380
Overall NTG Ratio***	0.82	0.80	0.86
Verified Net Savings	468	32	94,597
Planning Net Savings Goal	438	-	220,729
% Net Goal Achieved	107%	-	43%

Source: Navigant Analysis; Nicor EEP Final – Revision for Compliance Filing 05-27-2011 FINAL; ComEd - PY4 QTR 4 Report
**CFLs, temperature turndown, and thermostats are deemed; showerheads, aerators, pipe insulation are partially deemed; all weatherization measures are not deemed.*
*** Realization rates represent the ratio between verified gross and ex-ante gross savings.*
****Overall NTG is the ratio between verified net and verified gross savings.*

In PY1/PY4 the electric component of the program achieved 107% of planning net savings goals while the gas component of the program achieved 43% of planning net savings goals.

Table E- 2 and Table E- 3 present the measure-specific electric and therm savings for GPY1/EPY4.

[2] The September 14, 2012 final version of the first State of Illinois Energy Efficiency Technical Reference Manual (TRM) (effective as of June 1, 2012) has been agreed to by Illinois Stakeholder Advisory Group (SAG) and the Illinois Commerce Commission in Docket No. 12-0528 as of the date of this report. The verified gross savings shown in Table E-1 are deemed by the TRM for measures outlined in the document. Evaluation research findings for gross savings in GPY1 are provided for reference in the Appendix.
[3] "Proposed Framework for Counting Net Savings in Illinois." Memorandum March 12, 2010 from Philip Mosenthal, OEI, and Susan Hedman, OAG.

Table E- 2. GPY1/EPY4 Measure-Level MWh Savings*

	Measure	Ex-Ante Gross MWh	RR	Verified Gross MWh	NTG	Verified Net MWh
Direct Install Measures	9 Watt CFL	38	1.09	42	0.80	33
	14 Watt CFL	111	1.09	121	0.80	97
	19 Watt CFL	81	1.10	89	0.80	71
	23 Watt CFL	112	1.10	122	0.80	98
	9 Watt Globe CFL	20	1.09	22	0.80	17
	Shower Head	5	1.48	7	0.93	7
	Kitchen Aerator	1	0.46	0	0.99	0
	Bathroom Aerator	2	0.57	1	0.99	1
	Hot Water Temperature Setback	0	-	0	0.88	0
	Pipe Insulation	1	1.54	2	0.93	2
	Programmable Thermostat	0	-	3	0.90	2
	Programmable Thermostat Education	0	-	9	0.90	8
Subtotal		371	1.13	418	0.81	337
Retrofit Measures	Attic Insulation	68	1.00	68	0.81	55
	Wall Insulation	1	1.00	1	0.78	1
	Floor Insulation (Other)	6	1.00	6	0.84	5
	Duct Insulation & Sealing	1	1.00	1	0.80	1
	Air Sealing	80	1.00	80	0.86	69
Subtotal		156	1.00	156	0.84	131
Total Savings		527	1.09	574	0.82	468

Source: Navigant analysis
**CFLs, temperature turndown, and thermostats are deemed; showerheads, aerators, pipe insulation are partially deemed; all weatherization measures are not deemed.*

Table E- 3. GPY1/EPY4 Measure-Level Therms Savings*

	Measure	Ex-Ante Gross Therms	RR	Verified Gross Therms	NTG	Verified Net Therms
Direct Install Measures	9 Watt CFL	0	-	0	0.80	0
	14 Watt CFL	0	-	0	0.80	0
	19 Watt CFL	0	-	0	0.80	0
	23 Watt CFL	0	-	0	0.80	0
	9 Watt Globe CFL	0	-	0	0.80	0
	Shower Head	19,463	0.98	19,157	0.93	17,847
	Kitchen Aerator	426	0.97	412	0.99	409
	Bathroom Aerator	3,574	0.98	3,512	0.99	3,481
	Hot Water Temperature Setback	1,331	0.96	1,274	0.88	1,116
	Pipe Insulation	3,943	0.98	3,855	0.93	3,581
	Programmable Thermostat	3,261	0.90	2,946	0.90	2,651
	Programmable Thermostat Education	0	-	5,718	0.90	5,146
Subtotal		31,998	1.15	36,873	0.93	34,231
Retrofit Measures	Attic Insulation	34,604	1.00	34,604	0.81	28,181
	Wall Insulation	4,316	1.00	4,316	0.78	3,367
	Floor Insulation (Other)	6,496	1.00	6,496	0.84	5,460
	Duct Insulation & Sealing	111	1.00	111	0.80	89
	Air Sealing	26,979	1.00	26,979	0.86	23,270
Subtotal		72,507	1.00	72,507	0.83	60,366
Total Savings		104,505	1.05	109,380	0.86	94,597

Source: Navigant analysis
**CFLs, temperature turndown, and thermostats are deemed; showerheads, aerators, pipe insulation are partially deemed; all weatherization measures are not deemed.*

E.4 Key Process Findings and Recommendations

At this stage in the program's development, Navigant finds that program processes are generally well-planned and executed, and that the program is serving participants very well. However, since the program did not reach its participation goals in GPY1/EPY4, the evaluation team conducted research amongst participants, non-participants, and trade allies to determine marketing outreach effectiveness

and potential barriers to participation. Navigant found that the program is using the most effective means of outreach to customers with its program mailers. The program is also targeting the right customers as many non-participants value energy efficiency, are interested in weatherization work, and are tentatively interested in participating but are not fully persuaded by the program's current marketing. Participants, contractors, and non-participants alike agree that marketing material content could be improved. Many program-aware non-participants that received a spring mailer about the program were unaware of the free direct install measures available through the program and thought that getting an assessment would obligate them to purchase weatherization measures. In addition, a noteworthy portion of participants and non-participants aware of the program showed some uncertainty about the program and the utility intentions of discounting and giving out free measures.

Navigant presents the following key process findings and recommendations:

- **Finding.** Program participants and program partners were very satisfied with the program, incentive levels, and processes. About 97% of participants rated their satisfaction as 8 to 10 on a 0-10 point scale and over half of participants stated they were "very satisfied" (the highest rating).

- **Finding.** The program is using an effective means of outreach to customers. Participants and non-participants agreed that program mailers were the best way to reach them. Participants also noted that word-of-mouth and contractor referrals were other important sources of initial information about the program.

- **Finding.** The program targeted the right market of customers in its marketing mailer. Most mailed non-participants both valued energy efficiency and showed potential for participation in the program. On a four-point scale ("not at all valuable," "somewhat valuable," "very valuable," "extremely valuable"), only 3% of respondents indicated energy efficiency was "not at all valuable" to them, and 60% indicated it was either "very valuable" or "extremely valuable." Furthermore, 25% of non-participants reported that they have plans to make energy efficiency improvements to their home in the near future. When asked to indicate what they would do, the most common response was insulation work (39%). This is a strong indication of potential participants among mailed non-participants.

- **Finding.** A promising proportion of program-knowledgeable non-participants are willing to spend the money necessary to participate in the program's weatherization component. Almost a fifth of program-knowledgeable non-participants (about 5% of all mailed customers) noted that they were willing to spend $750-1,250 on the program if it were to save them money on their energy bills. Another 39% of program-knowledgeable non-participants (about 10% of mailed customers) reported they don't know or are not sure how much they would spend. **Recommendation.** The program could benefit from conducting focus groups to explore how best to remove barriers to participation for these program-knowledgeable non-participants**.**

- **Finding.** Participants, contractors, and non-participants alike agree that marketing material content could be improved. The most common participant recommendation for program improvement was for more informative, persistent, and thorough marketing about the program and its benefits.

Recommendation. The evaluation team suggests a workshop meeting of energy advisors, trade allies, and other program stakeholders to gather feedback on the previous year's program efforts and associated marketing efforts, with the goal of improving the marketing material for future program years. For example, the program may benefit from posting video clips on the program website to clarify program details through a new, information-rich medium. Implementing these recommendations may help identify some sources of participant misunderstandings of program offerings and further strengthen information available to potential participants about the program.

- **Finding.** Many program-aware non-participants were unaware of the free direct install measures available through the program. Furthermore, many non-participants thought that getting an assessment would obligate them to purchase weatherization measures. **Recommendation.** Consider modifying the program marketing collateral to more clearly emphasize that, while strongly encouraged and that there is considerable program support to do so, customers are not obligated to purchase the weatherization measures suggested by the assessment, along with pointing out that direct install measures provide immediate savings benefits that outweigh the cost of getting an assessment. This emphasis may drive more initial participation. Furthermore, the program may attract more participants by more strongly emphasizing that the nature of the assessment is to inform customers about opportunities to save money on energy bills and to make the home more comfortable. Highlighting the low-risk nature of scheduling an assessment may help hesitant participants feel more comfortable about participating since there are no obligations to install recommended measures.

- **Finding.** A noteworthy portion of participants and non-participants aware of the program showed some uncertainty about the program and the utility intentions of discounting and giving out free measures. According to non-participant survey results, if program-aware non-participant skepticism about the program is addressed, it could increase the amount of customers that ultimately consider participation from the current 28% that reported thinking about participating upon receiving a program mailer to up to as much as 50%. **Recommendation.** The program may benefit from addressing these concerns in its marketing and outreach materials in order to tip hesitant but interested potential participants into scheduling an assessment. Given the very high levels of participant satisfaction with the program, the program may consider providing customers summary information from real-world case studies and testimonials that address common misconceptions about the program. These could be presented on the program website, in mailers, and other marketing and outreach material. Issues to address should include why the utilities are willing to incentivize energy efficiency improvements, and the mutually-beneficial nature of the programs for customers and the utilities. Implementing this recommendation may increase the conversion rate for the program mailer.

- **Finding.** Nearly a third of mailed non-participants did not know what "weatherization" means. **Recommendation.** Marketing material should meet the needs of the layman and use simplified terminology to describe the program offerings.

- **Finding.** Though marketing material could benefit from clarification, the overall program marketing message resonates with participant perceptions of the program's primary benefits. The vast majority of participating customers surveyed saw the primary program benefit to be

reduced energy bills (69%) and receiving a rebate on the cost of installing measures (20%). Nearly half (46%) of participants also cited a variety of other benefits the program provided, including improved comfort, assurance that equipment is running smoothly and safely, environmental benefits, and an improved general awareness and knowledge of what's needed to improve a home's efficiency.[4]

- **Finding.** About 26% of non-participants were aware of the program (mostly through program mailers, word- of-mouth, and contractor referrals), while the remainder were not despite having received mailers. Furthermore, program administrators noted that community outreach was not strong in GPY1/EPY4.
  Recommendation. Though the program mailers are the most important source of program outreach, the program may consider seeking to capitalize on developing additional communication channels such as various social media as an extension of the word-of mouth awareness building that is already starting to be an important source of program awareness. Furthermore, the program may benefit from community outreach at events that attract the target participant demographic. Implementing these recommendations may increase participation levels and provides additional opportunities to address issues related to customer awareness and understanding about the program.

[4] Respondents were allowed multiple responses to the question on program benefits.

1. Introduction to the Program

1.1 Program Description

The Home Energy Savings (HES) program is a joint program of Nicor Gas and Commonwealth Edison (ComEd), with Nicor Gas leading the program implementation. In GPY1/EPY4[5], the HES program was expected to achieve 220,729 therms and 438 MWh of net savings through the implementation of home energy assessments to promote discounted weatherization services and the direct installation of energy efficiency measures in residential Nicor Gas-ComEd single-family home residences. To meet these goals, the implementation contractor, Conservation Services Group (CSG), aimed to conduct approximately 2,100 whole-home assessments which would result in about 630 completed jobs in the first program year that ended May 31, 2012.

1.1.1 Implementation Strategy

The HES program provides discounted whole-home assessments (e.g., energy assessments) to customers to identify opportunities for installing energy efficiency measures and weatherizing the home. Program activities are implemented through CSG staff and contracted weatherization providers. During the assessment, free CFLs, showerheads, aerators, hot water temperature setback, programmable thermostat setting, and pipe insulation were directly installed for instant energy savings. A programmable thermostat was also offered at a reduced price for interested participants.

CSG's dedicated assessment staff conducted the energy assessments using proprietary whole-home assessment software. The energy advisors generated custom retrofit recommendation reports by entering home characteristic details gathered during the assessment into the implementation contractor's proprietary program. The customer report outlines recommended measures, potential savings, payback periods, and the amount of incentives available for recommended work. Customers are able to choose which projects they would like to pursue. A program-eligible contractor is then assigned to perform the work and discounts are offered instantaneously. The contractor is responsible for submitting paperwork to CSG to receive rebate funds.

Customers who pursue weatherization projects in PY1 were eligible to receive incentives of 50% of retrofit cost for performing recommended weatherization upgrades to their home, which is capped at a maximum of $1,250 per home.

1.1.2 Program Marketing and Outreach

The Home Energy Savings program utilizes an integrated marketing plan that includes website content, direct mail promotions to residents, and some community events along with direct promotion by weatherization contractors. The marketing message stresses the importance of homeowners' need to care for their home investment and energy performance. Messaging focuses on getting customers to take advantage of the program's key benefits, savings and comfort. The top three messages conveyed to participants about the benefits of participating are:

[5] Gas Program Year 1/Electric Program Year 4

1. Savings & comfort;
2. Simplicity of participating and the potential to save money on home energy use as a result; and
3. Saving money and insuring one's home against rising energy prices.

Trade allies also benefit from the program by having credibility established through participating with the utilities. Furthermore, the program provides program-related administrative and technical training, and standardizes high-quality practices in the market through a quality assurance and control (QA/QC) process.

1.2 Evaluation Questions

The GPY1/EPY4 evaluation addressed the following key research questions:

1.2.1 Impact Questions

1. What is the level of gross annual energy (therm, kWh) and demand (kW) savings induced by the program?
2. What are the net impacts from the program?
3. What is the level of free ridership associated with this program and how can it be reduced?
4. What is the level of spillover associated with this program?
5. Did the program meet its energy savings goals? If not, why not?
6. Are the assumptions and calculations for the direct install measures in compliance with the statewide TRM, and reflective of sound engineering judgment? If not, what changes are required?

1.2.2 Process Questions

1. Has the program changed since Rider 29/EPY3, and if so, why and how?
2. Is customer awareness of the program and are market effects progressing as the program plan and program theory projected?
3. How aware are customers of the direct install and weatherization measures covered by the program?
4. How effective are the program marketing materials and contractor sales efforts in bringing in participants? Overall how effective is the program outreach?
5. Are the program design and processes proving cost-effective in administering the program, given the target and actual participation and impact levels?
6. Are customers and program partners satisfied with the program?
7. What opportunities for program improvement exist?

2. Evaluation Methods

2.1 *Primary Data Collection*

Table 2-1 below summarizes the surveys, interviews, and other primary data sources that were used to answer the program's gross savings, net savings, and process evaluation questions.

Table 2-1. Evaluation Methods

Method	Subject	Quantity	Gross Impacts	Net Impacts	Process
Telephone Survey	Non-participants: Customers who were contacted but did not sign up for assessments	68	X		X
Telephone Survey	Participants (Full Participants Only[6])	54	X (verify measures)	X	X
In-Depth Telephone Interviews	Program manager and IC staff	6	X (DI measure & weatherization model review)	X[7]	X
In-Depth Telephone Interview	Weatherization subcontractors	4		X[8]	X

Source: Navigant analysis

2.2 *Additional Research*

This evaluation also leveraged additional research materials to perform literature review activities. Navigant compared average participant savings for weatherization measures based on analysis of the CSG tracking database with evaluated weatherization savings from similar programs in other states. The results of the literature review are presented in Appendix 5.2.3.

Navigant also used the current Illinois TRM to inform engineering review activities for all direct install measures offered in the HES program.

[6] The GPY1/EPY4 sample consisted only of full participants and did not include any audit-only participants. The GPY2/EPY5 evaluation will be stratified to also include audit-only participants.
[7] Qualitative perspective to inform participants' NTG self-reports
[8] Qualitative perspective to inform participants' NTG self-reports

Table 2-2. Additional Research Sources

Reference Source	Author	Application	Gross Impacts	Net Impacts	Process
Program Tracking Database	Program Administrator	Impact and Process Evaluation	X		X
Illinois Energy Efficiency Technical Reference Manual	Vermont Energy Investment Corporation (VEIC)	Values for TRM Parameters in Savings Calculations	X		
ComEd PY3 Single Family Evaluation	Navigant	Impact and Process Evaluation	X	X	X

Source: Navigant analysis

2.3 *Impact Evaluation Methods*

This section describes the analytical methods and processes used to evaluate the impacts of the GPY1/EPY4 joint Nicor Gas/ComEd HES program. See Appendix 5.2 for a detailed discussion of impact evaluation methods.

2.3.1 Verification and Due Diligence and Tracking System Review

For the verification and due diligence procedure review, Navigant performed in-depth interviews with CSG and program staff, as well as reviews of program documentation, the tracking system, sample project files, and the implementer's proprietary software. The tracking system was reviewed in order to verify the completeness and accuracy of the tracking system and to identify any important issues that would affect the impact and process evaluation of the HES program. The results of the due diligence and tracking system review are presented in the results section and in Appendix 5.4.

2.3.2 Gross Program Savings Evaluation

Navigant performed a gross savings evaluation for all measures installed through the HES program, including weatherization and direct install measures. In order to complete this task, the evaluation team first performed a summary of the program ex-ante gross impact accomplishments based on an engineering review of the tracking system. CSG provided the original tracking data, and ex-ante updates to direct install measures were provided by WECC[9] throughout the evaluation process. See Appendix 5.2.1 for the details of the ex-ante net savings updates. Navigant also performed a literature review of similar weatherization programs in order to vet the results of CSG's *EM HOME* software. The results of this literature review can be found in Appendix 5.2.3.

2.3.3 Net Program Savings Evaluation

The primary objective of the net savings analysis is to determine each program's net effect on customers' electricity and gas usage. This requires estimating what would have happened in the absence of program

[9] Wisconsin Energy Conservation Corporation

activities and incentives. After gross program impacts are adjusted, net program impacts are derived by estimating a Net-to-Gross (NTG) ratio. The NTG ratio quantifies the percentage of the gross program impacts that are attributable to the program. This includes an adjustment for free ridership (the portion of impact that would have occurred even without the program) and spillover (the portion of impact that occurred outside of the program, but would not have occurred in the absence of the program). A customer self-report method was used to estimate the NTG ratio for this evaluation, using data gathered during participant telephone surveys. Trade ally interview findings were also used to gauge their estimate of overall free-ridership and spillover, to corroborate the participant self-report-based NTG estimates. However, note that the evaluation team did not use the trade ally NTG feedback to inform the participant-determined NTG values used in net impact calculations during this evaluation year, rather noting that feedback for qualitative perspective on the participant self-reports.

The NTG Framework[10] calls for retroactively applying the NTG ratio for "previously evaluated programs undergoing significant changes — either in the program design or delivery, or changes in the market itself." The HES program meets this criterion, and so this evaluation uses the NTG ratio calculated from our GPY1/EPY4 research. The program design was substantially unchanged other than a change in assessment pricing and implementation contractors in GPY1/EPY4, which could affect free ridership and spillover trends. Details of the measure-specific free ridership and spillover calculation methods can be found in Appendices 5.2.4 and 5.2.5.

2.4 Process Evaluation Methods

The purpose of the process evaluation was to determine barriers to program participation and ways to improve the program. As such, the evaluation team conducted interviews across the chain of actors in the program including Nicor Gas program staff, implementation contractor staff, and trade allies. The evaluation team also conducted surveys of full participants to determine program satisfaction and to explore demographic trends among participants in relation to non-participants. The team also conducted a non-participant survey to help establish reasons for non-participation and general awareness of the program and interest in energy efficiency. Finally, the evaluation team reviewed program tracking information, marketing and outreach material, and compared these to industry best practices to identify opportunities for program improvement.[11]

2.4.1 Data Collection Methods and Sampling Plan

Data collection included the following:

1. All program plans and reports;
2. All tracking files and documentation;
3. A random sample of 50 project documents;
4. A demo of the implementation contractor's proprietary assessment software

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

[11] Industry best practices were determined by referencing the Best Practices Self-Benchmarking Tool developed for the Energy Efficiency Best Practices Project: http://www.eebestpractices.com/benchmarking.asp

5. In-depth interviews:
    a. Nicor Gas staff
    b. Program administrator (First Tracks Consulting)
    c. Program implementation contractor (CSG)
6. Telephone surveys for a random stratified sample of full program participants; and
7. Telephone surveys for a random sample of non-participants that were contacted by the program but did not participate.

Navigant conducted in-depth interviews by telephone and email with staff from Nicor Gas, First Tracks, and CSG to clarify program processes, administration, marketing, delivery, tracking systems, and QA/QC procedures. These discussions were driven by questions arising from program details that were not fully described in the program documentation. Furthermore, the evaluation team cross-checked a sample of participant rebate applications against the program tracking system.

Telephone surveys were conducted with 54 randomly selected and stratified full participants. Full participants (direct install and retrofit) were favored over assessment-only (direct install only) participants in order to efficiently gather the most information possible about both direct install and retrofit measures in the program. With this sample size, Navigant achieved a 90% confidence interval and a relative precision of +/- 10%. Without an assessment-only survey sample, it was not possible to determine whether the full-participant direct-install survey provided a statistically reliable understanding of what assessment-only direct-installation dynamics were for the entire program (both full participants and assessment-only participants). The next evaluation cycle will address the assessment-only segment specifically via a telephone survey.

For the non-participant telephone survey, a non-stratified randomly selected sample of 68 completed surveys was targeted to achieve a 90% confidence interval and a relative precision of +/-10%. The sample source was a mailing list Nicor Gas used to promote the program, with assessment participants removed so that only those who were contacted but did not sign up for energy assessments were in the respondent pool.

3. Evaluation Results

3.1 *Impact Evaluation Results*

This section presents the impact evaluation results for the HES program. This section is separated into four parts that trace Navigant's impact evaluation steps. They are:

- A review of the program's verification and due diligence procedures and tracking system;
- A summary of the program-reported ex-ante gross savings estimates;
- A summary of installation and persistence rates applied to ex-ante gross savings to arrive at verified gross savings; and
- A summary of adjustments to verified gross savings for free ridership and spillover to estimate verified net savings.

3.1.1 Review of Verification and Due Diligence Procedures and Tracking System

Navigant performed in-depth interviews with CSG and Nicor Gas program staff to verify the operating procedures used in the HES program. In addition, the evaluation team based its findings on reviews of program documentation, the tracking system, sample project files, and a demo of the implementer's proprietary software. In its due diligence verification analysis, Navigant found that CSG has program processes that reflect national best practices.[12] A full report of the verification and due diligence review, as well as a full listing of observations and recommendations, can be found in Appendix 5.4.

Upon request, CSG provided the evaluation team with a tracking data extract from their proprietary *EnergyMeasure® HUB* and *EnergyMeasure® HOME* (*EM HOME*) software suites. CSG also provided Navigant with a "data dictionary" that specifies the data variables, to assist in understanding the tracking data structure and contents and performed a thorough demonstration of the software for the evaluation team. Navigant found the organization of the tracking system intuitive and was able to navigate the data with ease. CSG tracks nearly all of the information dictated by national best practice standards. CSG uses a proprietary software suite to track participation information and assessment information. Navigant offers specific recommendations regarding CSG's tracking system for the Nicor Gas and ComEd joint HES program in the full Verification of Due Diligence and Tracking System Review memo found in Appendix 5.4.

3.1.2 Ex-ante Gross Savings

This section summarizes the ex-ante savings and participation reported in the program tracking database obtained from CSG. For GPY1/EPY4, the HES program set net impact goals of 438 MWh and 220,729 therms, with participation goals of 2,100 assessments and 630 weatherization jobs. After review of the tracking system and updated ex-ante claimed savings, Navigant reports participation in the HES program in GPY1/EPY4 of 1,080 assessments and 320 weatherization jobs, and ex-ante gross savings of 527 MWh and 104,505 therms. HES program goals and achievements are shown in Table 3-1. The program achieved about half of its participation goals for both assessments and weatherization work.

[12] Industry best practices were determined by referencing the Best Practices Self-Benchmarking Tool developed for the Energy Efficiency Best Practices Project: http://www.eebestpractices.com/benchmarking.asp

Table 3-1. GPY1/EPY4 HES Participation Goals and Achievements

Participation Goal	Achieved Participation	% Goal Met
2,100 Assessments	1,080 Assessments	51%
630 Weatherization Jobs	320 Weatherization Jobs	51%

Source: Navigant analysis of program tracking data

Table 3-2 below shows the ex-ante energy and demand savings claimed for the HES program for GPY1/EPY4, including both direct install and weatherization measures. The number of participants and the number of installed units are also included for each measure.

In order to better understand measure installation patterns, the evaluation team looked at the amount of homes that installed each measure as a percentage of total homes that received an assessment. Table 3-3 below shows the percentage of assessed homes that installed each measure offered in the HES program. In GPY1/EPY4, 1,080 participants received an assessment and excluding CFLs, pipe insulation and bathroom aerators were the most common direct install measures, while attic insulation and air sealing were the most common retrofit measures. The least common direct install measure was the programmable thermostat, and the least common weatherization measures were wall insulation and duct insulation and sealing. Overall, GPY1/EPY4 retrofit measure penetration approximates that of ComEd's PY3 Single Family Retrofit Pilot results.

Table 3-2. GPY1/EPY4 Ex-Ante Gross Impact, by Measure

	Measure	Participants	Installed Units	Therms	MWh	kW (peak)
Direct Install Measures	9 Watt CFL	355	1,305	0	38.0	3.3
	14 Watt CFL	627	2,564	0	110.8	9.5
	19 Watt CFL	479	1,546	0	81.2	7.0
	23 Watt CFL	506	1,546	0	111.6	9.6
	9 Watt Globe CFL	129	680	0	19.8	1.7
	Low Flow Shower Head	475/7^	744/13^	19,463	4.9	0
	Kitchen Aerator	133/5^	151/5^	426	0.7	0
	Bathroom Aerator	567/10^	1270/21^	3,574	2.4	0
	Hot Water Temperature Setback	199/0^	208/0^	1,331	0	0
	Pipe Insulation	572/11^	1260/29^**	3,943	1.3	0
	Programmable Thermostat	56	62	3,261	0	0
	Programmable Thermostat Education*	314	317	0*	0*	0*
Subtotal				31,998	370.6	31.0
Retrofit Measures	Attic Insulation	309	-	34,604	68.1	0
	Wall Insulation	25	-	4,316	0.8	0
	Floor Insulation (Other)	209	-	6,496	6.2	0
	Duct Insulation & Sealing	15	-	111	0.9	0
	Air Sealing	313	-	26,979	80.2	0
Subtotal				72,507	156.2	0
Total Savings				104,505	526.8	31.0

Source: Navigant analysis of program tracking data
^Participants and installed units broken out for participants with gas and electric hot water heaters. The first number represents the participants or installed units for gas water heaters, and the second number is for electric water heaters.
**Nicor Gas/ComEd did not claim savings for programmable thermostat education in GPY1/EPY4. Navigant estimated savings for the measure as discussed in appendix 5.2.2.*
***Installed units for pipe insulation is reported in 3 ft. segments*

Table 3-3. Percent of Participating Homes Installing Each Program Measure Type, GPY1/EPY4

	Measure	Participants	GPY1/EPY4 Percent of Participating Homes Installing Measure	ComEd EPY3 Retrofit Pilot Percent of Participating Homes Installing Measure
Direct Install Measures	Assessment Fee	1,080	100%	-
	All CFL Types	940	87%	82%
	Low Flow Shower Head	482	45%	-
	Kitchen Aerator	138	13%	-
	Bathroom Aerator	577	53%	-
	Hot Water Temperature Setback	199	18%	-
	Pipe Insulation	600	56%	-
	Programmable Thermostat	56	5%	-
	Programmable Thermostat Education	314	29%	-
Retrofit Measures	Attic Insulation	309	29%	25%
	Wall Insulation	25	2%	2%
	Floor Insulation (Other)	209	19%	10%
	Duct Insulation & Sealing	15	1%	3%
	Air Sealing	313	29%	29%

Source: Navigant analysis of program tracking data; ComEd Energy Efficiency/Demand Response Plan: Plan Year 3 (6/1/2010-5/31/2011) Evaluation Report: Single Family Programs

3.1.3 Verified Gross Program Savings

Navigant performed a gross savings evaluation for all measures installed through the HES program in order to verify ex-ante savings assumptions and to adjust weatherization measures for survey-determined installation and persistence rates.

Review of Ex-Ante Gross Impacts

The evaluation team first performed a summary of the program ex-ante gross impact accomplishments based on an engineering review of the tracking system. CSG provided the original tracking data, and updates to direct install measures were provided by WECC[13] throughout the evaluation process. Navigant performed a detailed engineering review of the ex-ante savings assumptions provided by CSG

[13] Wisconsin Energy Conservation Corporation

and WECC and developed verified gross savings values for all of the direct install and weatherization measures. Adjustments to ex-ante savings values were based on updated assumptions and algorithms in the IL TRM, as well as engineering judgment. Further detail on TRM gross savings methodology and updates can be found in Appendix 5.2.3.

The evaluation team further reviewed the software used by CSG to determine ex-ante program impacts in GPY1/EPY4. As stated in the GPY1/EPY4 Evaluation Plan, Navigant chose to conduct a desk review of CSG's *EM HOME* software. As part of the desk review, Navigant performed a literature review to compare evaluated savings values for projects with similar weatherization offerings as the HES program. This was done in order to "vet" the ex-ante savings for weatherization measures in the HES program. Navigant planned to do an expanded evaluation of weatherization measures in future program years if any issues are identified with CSG's weatherization calculation methods. However, Navigant found no issues with the weatherization calculation methods and based on the literature review performed in GPY1/EPY4, Navigant has accepted the ex-ante weatherization savings reported by CSG. Appendix 5.2.3 has a detailed discussion of the literature review findings.

Installation and Persistence Rates

The installation rate is a ratio of customer-reported measure installations to those contained in the program tracking database. The persistence rate is used to reflect the removal of program measures, which can be thrown away, given away, sold, or put into storage. Unlike the installation rate, which can be gauged immediately after a contractor completes work, gauging persistence requires factoring in a period of time after installation before it can be properly measured. Multiplying an installation rate and a persistence rate results in an in-service rate for a measure, which signifies the percentage of a measure reported in the tracking system that is currently verified installed. Thus the in-service rate is multiplied against tracking system ex-ante data to determine verified gross savings.

Navigant used TRM-prescribed in-service rates to calculate verified gross savings for direct install measures; however, since the IL TRM does not outline impact parameter estimates for weatherization measures, the evaluation team conducted a participant survey to determine estimates for these measures. The survey gauged installation rates for measures the tracking system reported installed for each survey participant. Following the installation rate question battery, all respondents were asked a two-part persistence question to identify 1) participants that reported uninstalling one of the measures installed in the program, and 2) which measures were uninstalled by each participant that reported uninstalling something. For a full discussion and outline of measure parameter estimates, see Appendix 5.2.

Table 3-4 shows the installation and persistence rate results for direct install and weatherization measures from Navigant's participant survey alongside the in-service rates deemed in the Illinois TRM for direct install measures.

Table 3-4. GPY1/EPY4 Survey-Determined Direct Install and Weatherization Measure Installation and Persistence Rates Compared to TRM In-Service Rates

	Measure	Survey Installation Rate	n=	Survey Persistence Rate	n=	TRM In-Service Rate[14]
Direct Install Measures	All CFL Types	0.98*	45	0.96	45	0.97
	Low Flow Shower Head	1.00	29	0.90	50	0.98
	Kitchen Aerator	0.94*	32	0.90	50	0.95
	Bathroom Aerator	0.94*	32	0.90	50	0.95
	Hot Water Temperature Setback	0.92*	13	0.92	50	1.00
	Pipe Insulation	0.88*	32	1.00	50	1.00
	Programmable Thermostat	1.00**	NA	1.00	50	1.00
	Programmable Thermostat Education	0.35^	17	1.00	50	-
Retrofit Measures	Attic Insulation	0.96*	54	1.00***	NA	-
	Wall Insulation	1.00	7	1.00***	NA	-
	Floor Insulation (Other)	0.71*	38	1.00***	NA	-
	Duct Insulation & Sealing	1.00**	NA	1.00***	NA	-
	Air Sealing	0.94*	54	1.00***	NA	-

Source: Navigant participant survey
**Navigant reports an installation rate of 1 for these measures as noted in CSG's QAQC findings.*
***Navigant did not collect data for the programmable thermostat and duct insulation and sealing categories because of the relatively small amount of participating homes for these measures. Therefore, Navigant reports an installation rate of 1 for these measures.*
****Navigant assumed participants would not uninstall retrofit measures and assigned a persistence rate of 1.*
^This low installation rate may be due to participant recollection error, especially since this involved programming a household's existing thermostat rather than installing a new energy efficiency device. However, since this is a behavioral measure where an individual might reset the programming, there is precedent to expect relapse and an in-service rate of less than 1. Since the TRM does not provide an estimate for this measure, the evaluation team will continue to use this value to estimate a survey-determined in-service rate to for gross savings calculations.

Note that according to the participant survey some installation rates are less than 100%. This may be due to respondent self-report recollection error or weatherization terminology confusion, especially given the variety of work contractors performed. Navigant confirmed that CSG performs adequate QAQC follow-up checks on homes and accepts their reported installation rate of 100% for all measures. Navigant also

[14] In-service rates are a multiple of installation and persistence rates.

assumed a persistence rate of 1 for weatherization measures and did not gauge it in the survey as it is unlikely weatherization measures would be uninstalled. As a result, weatherization measures were all assigned an in-service rate of 1.

Navigant applied the TRM deemed in-service rates to direct install measure ex-ante savings, and an in-service rate of 1 to weatherization measure ex-ante savings to determine verified gross savings.

Summary of Verified Gross Program Impact Estimates

This section details the results of Navigant's verified gross impact analysis for the HES program. Navigant adjusted the ex-ante values with algorithm/assumption improvements and by applying the TRM in-service rates listed in the previous section of this report for direct install measures. Verified gross savings for weatherization measures all use an in-service rate of 1, where CSG's QAQC findings inform the installation rates, and a persistence rate of 1 is assumed since weatherization measure uninstallation is unlikely. Table 3-5 summarizes the verified gross results by measure type.[15]

[15] The evaluation team calculated an alternative savings estimate for the program as a whole in Appendix 5.2.7 which utilizes Navigant's measure-level installation and persistence rate findings for direct install measures rather than the IL TRM. This was done for reference purposes only.

Table 3-5. GPY1/EPY4 HES Program Verified Gross Savings

	Measure	Therms	Therms RR*	MWh	MWh RR*	kW (peak)	kW RR*
Direct Install Measures	9 Watt CFL	0	-	41.6	1.09	4.1	1.27
	14 Watt CFL	0	-	121.1	1.09	12.1	1.27
	19 Watt CFL	0	-	88.9	1.10	8.8	1.27
	23 Watt CFL	0	-	122.3	1.10	12.2	1.27
	9 Watt Globe CFL	0	-	21.7	1.09	2.2	1.27
	Shower Head	19,157	0.98	7.2	1.48	0.5	-
	Kitchen Aerator	412	0.97	0.3	0.46	0.0	-
	Bathroom Aerator	3,512	0.98	1.4	0.57	0.2	-
	Hot Water Temperature Setback	1,274	0.96	0.0	-	0.0	-
	Pipe Insulation	3,855	0.98	2.1	1.54	0.2	-
	Programmable Thermostat	2,946	0.90	2.7	-	0.0	-
	Programmable Thermostat Education	5,718^	-	8.5	-	0.0	-
Subtotal		36,873	1.15†	417.7	1.13	40.2	1.30
Weatherization Measures**	Attic Insulation	34,604	1.00	68.1	1.00	0.0	-
	Wall Insulation	4,316	1.00	0.8	1.00	0.0	-
	Floor Insulation (Other)	6,496	1.00	6.2	1.00	0.0	-
	Duct Insulation & Sealing	111	1.00	0.9	1.00	0.0	-
	Air Sealing	26,979	1.00	80.2	1.00	0.0	-
Subtotal		72,507	1.00	156.2	1.00	0.0	-
Total Savings		109,380	1.05	573.9	1.09	40.2	1.30

Source: Navigant analysis of program tracking data

**RR = Realization Rate. This is the ratio of verified gross to ex-ante gross savings.*

***The TRM does not specify deemed savings values for retrofit measures, thus savings are based on research parameter values*

^To estimate verified gross savings for the programmable thermostat education measure, Navigant applied the TRM deemed savings value for programmable thermostats to all of the measure participants and then adjusted it by the survey-determined in-service rate of 0.35.

†The program did not claim any savings for the programmable thermostat measure which results in an overall realization rate that is above 1.0, even though all individual measures have a realization rate below 1.0.

Low flow showerheads by far accounted for the most direct install therm savings as a percentage of total direct install therm savings, followed by pipe insulation, bathroom aerators, and programmable thermostats. CFLs accounted for the most electric savings in the direct install measure category. Amongst retrofit measures, attic insulation and air sealing accounted for both the most gas and electric savings. Notably, though programmable thermostats were the least installed direct install measure (see Table 3-3), they accounted for almost as much therm savings as bathroom aerators and pipe insulation.

3.1.4 Net-to-Gross Analysis and Verified Net Program Impact Estimates

This section details the results of Navigant's verified net impact analysis for the HES program, which includes adjustments for both free ridership and spillover in the net-to-gross analysis.

The objective of the free-ridership assessment is to estimate the impact of program incented measures that would have been installed even in the absence of the program. This cannot be measured directly due to the inability to observe behavior in the absence of the program. Thus, free ridership is assessed as a probability score for each measure. The evaluation relies on self-reported data collected during participant telephone surveys to assign free ridership probability scores to each measure. The objective of the spillover assessment is to estimate the impact arising from efficient measures installed as a result of the program that were not incented by the program. The evaluation also relies on self-reported data collected during the telephone survey to identify these measures and assess the role of the program in the decision to install. Summing the free ridership and spillover scores and subtracting them from a factor of 1.0 results in a net-to-gross ratio that the evaluation team applied to verified gross savings to estimate verified net program savings.

Net-to-Gross Analysis

Navigant calculated net-to-gross values for each direct install and weatherization measure based on the free ridership and spillover results determined using the participant survey. Detailed equations and methodologies are presented in Appendix 5.2.4 and 5.2.5. Final free ridership, spillover, and NTG values are shown in Table 3-6.

Table 3-6. Verified Net-to-Gross Results by Measures

	Measure	Free Ridership	FR n=	Spillover	SO n=	NTG
Direct-Install Measures	9 Watt CFL	0.24	45	0.04	3	0.80
	14 Watt CFL	0.24	45	0.04	3	0.80
	19 Watt CFL	0.24	45	0.04	3	0.80
	23 Watt CFL	0.24	45	0.04	3	0.80
	9 Watt Globe CFL	0.24	45	0.04	3	0.80
	Low Flow Shower Head	0.07	29	0.00	0	0.93
	Kitchen Aerator	0.01*	0	0.00*	0	0.99*
	Bathroom Aerator	0.01	32	0.00	0	0.99
	Hot Water Temperature Setback	0.12	12	0.00	0	0.88
	Pipe Insulation	0.12	28	0.05	2	0.93
	Programmable Thermostat	-	0	-	0	0.90**
	Programmable Thermostat Education	-	0	-	0	0.90**
Retrofit Measures	Attic Insulation	0.21	51	0.02	1	0.81
	Wall Insulation	0.22	5	0.00	0	0.78
	Floor Insulation (Other)	0.16	33	0.00	0	0.84
	Duct Insulation & Sealing	-	0	-	0	0.80^
	Air Sealing	0.14	52	0.00	0	0.86
Overall Program		0.15	-	0.01	-	0.86

Source: Navigant participant survey

**Navigant did not collect NTG data for the kitchen aerator measures, as it represented less than 5% of ex-ante program savings. Navigant applied the bathroom aerator NTG results to the kitchen aerator measure. It was assumed that these measures were similar in free ridership and spillover.*

***Navigant did not collect NTG data for the programmable thermostat measures, as it represented less than 5% of ex-ante program savings. Navigant referenced NTG values for comparable programs in the Northeast. A NTG value of 0.89 was used in the 2010 Gas Efficiency Annual Report by the Massachusetts Joint Utilities[16] and a NTG value of 0.90 was used in the Efficiency Vermont Year 2010 Savings Claim[17]. Navigant assigned an average NTG value of 0.90 for programmable thermostat and thermostat education measures.*

^Navigant did not collect NTG data for the duct insulation and sealing measure, as it represented less than 5% of ex-ante program savings. Navigant referenced the latest California Energy Commission and California Public Utilities Commissions' 2008 Database for Energy Efficient Resources[18] (DEER Database) to assign a proxy NTG value based on comparable measures and programs. The DEER NTG values are based on assessment and direct install programs in California performed between the years 2003-2005. These include the Southern California Edison In-Home Assessment Program and H&L Energy Savers Programs, which provide assessment and direct install services similar to those of the HES program.

[16] "2010 Gas Energy Efficiency Annual Report", Boston Gas Company, Colonial Gas Company and Essex Gas Company each d/b/a National Grid, August 2011, page 67.

[17] "Year 2010 Savings Claim", Efficiency Vermont, April 1, 2011, page 162.

[18] See the 2008 Database for Energy-Efficient Resources: http://www.deeresources.com/deer0911planning/downloads/DEER2008_NTG_ValuesAndDocumentation_080530

Table 3-7 shows NTG results by energy and measure types. Navigant calculated NTG values by applying the measure-specific NTG values outlined in Table 3-6 to the verified measure-specific gross savings outlined in Table 3-5. Doing so allowed the evaluation team to determine overall measure type gross and net savings by energy type. The overall measure type net and gross savings were then converted to an overall measure type NTG ratio by energy type seen in the table below.

Table 3-7. Verified Net-to-Gross Results by Energy and Measure Types

Measure Type	Energy Type	NTG
Direct Install Measures	MWh	0.81
	Therms	0.93
	Combined*	0.89
Retrofit Measures	MWh	0.84
	Therms	0.83
	Combined*	0.83
Overall Program	MWh	0.82
	Therms	0.86
	Combined*	0.86

Source: Navigant participant survey
**Combined savings converts therms and kWh impacts to the same unit for comparison. Navigant converted therms to kWh with the conversion factor of 29.3 therms per kWh.*

Verified Net Program Impact Results

The NTG Framework[19] calls for retroactively applying the NTG ratio for "previously evaluated programs undergoing significant changes — either in the program design or delivery, or changes in the market itself." The HES program meets this criterion, and so this evaluation uses the NTG ratios calculated from our GPY1/EPY4 participant survey research. The HES program changed assessment pricing and implementation contractors in GPY1/EPY4.

Navigant applied the measure-level net-to-gross (NTG) values determined through its participant survey research to its verified gross savings estimates for each measure to determine program verified net savings. Table 3-8 shows the final evaluated net savings of the Home Energy Savings GPY1/EPY4 program.

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

Table 3-8. GPY1/EPY4 HES Program Verified Net Savings

	Measure	Therms	MWh	kW (peak)
Direct Install Measures	9 Watt CFL	0	33.3	3.3
	14 Watt CFL	0	97.0	9.6
	19 Watt CFL	0	71.2	7.1
	23 Watt CFL	0	97.9	9.7
	9 Watt Globe CFL	0	17.3	1.7
	Shower Head	17,847	6.7	0.4
	Kitchen Aerator	409	0.3	0.0
	Bathroom Aerator	3,481	1.4	0.2
	Hot Water Temperature Setback	1,116	0.0	0.0
	Pipe Insulation	3,581	1.9	0.2
	Programmable Thermostat	2,651	2.4	0.0
	Programmable Thermostat Education	5,146	7.7	0.0
	Subtotal	34,231	337	32.3
Retrofit Measures	Attic Insulation	28,181	55.5	0.0
	Wall Insulation	3,367	0.6	0.0
	Floor Insulation (Other)	5,460	5.2	0.0
	Duct Insulation & Sealing	89	0.7	0.0
	Air Sealing	23,270	69.2	0.0
	Subtotal	60,366	131	0.0
	Total Savings	**94,597**	**468.2**	**32.3**

Source: Navigant analysis

All told, GPY1/EPY4 program net impacts, using evaluated parameters, are 94,597 therms, 468.2 MWh, and 32.3 kW. The combined effect of the gross impact realization rates and net-to-gross ratios on the HES program results in verified net savings that are 91%, 89%, and 104% of ex-ante therms, kWh, and kW savings, respectively. Ultimately, the program achieved 107% of electric net savings goals and 43% of gas net savings goals.

Table 3-9. Net Savings Goal vs. Achieved Verified Net Savings

	Net Savings Goal	Verified Net Savings	% Goal Met
Electric	438 MWh	468 MWh	107%
Gas	220,729 therms	94,597 therms	43%

Source: Navigant Analysis; Nicor EEP Final – Revision for Compliance Filing 05-27-2011 FINAL; ComEd - PY4 QTR 4 Report

3.2 *Process Evaluation Results*

Since the program did not reach its participation goals in GPY1/EPY4, the evaluation team conducted research amongst full participants (bot assessment/direct install and weatherization services), non-participants, and trade allies to determine marketing outreach effectiveness and potential barriers to participation. The evaluation team further researched program satisfaction amongst participants, as well as the program's general effects on the market as related to its overall market transformation goals. The findings are outlined in this section.

3.2.1 Program Changes since Gas Rider 29/EPY3

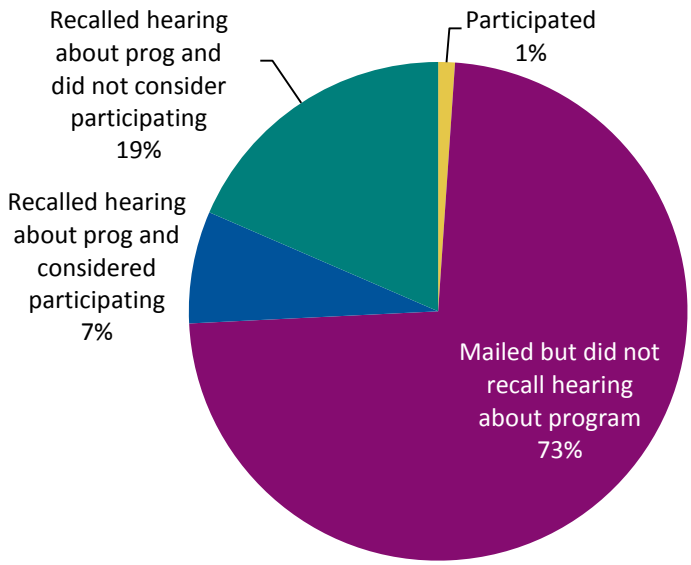
Though the program design is structurally the same since Rider 29, GPY1/EPY4 (Rider 30) has several differences. They include:

- GPY1/EPY4 has a different implementation contractor, assessment pricing has changed, and there are more contractors on board;
- Nicor Gas added weekend assessments;
- Customers were given the option to choose which recommended measures they would like installed rather than the "all or nothing" approach in previous years.

3.2.2 Program Awareness

Customer awareness of the program is progressing as the program plan and program theory projected, even though participation goals were not met. Though the program reports that only 1% of people mailed about the program ended up fully participating, about 26% (n=68) of non-participants that received a program mailer in the spring recalled hearing about the HES program. This finding indicates that a relatively large portion of the population sent a mailer about the program is aware of it. Furthermore, about 28% of non-participants who remembered hearing about the program considered participating in the program, but ultimately did not. This means that out of the nearly 100,000 people mailed about the program, about 28% of the 26% that heard about the program, or about 7,000 individuals, thought about participating in the program but did not (see Figure 3-1).

Figure 3-1. Breakdown of GPY1/EPY4 Spring Mailer Participants and Non-Participants



Source: Non-participant survey and Spring_2012_mailing_list Jim V.xlsx

Though about a quarter of non-participants know about the program in general, their knowledge of program details is more limited. About 78% of program-knowledgeable non-participants didn't know the program offers free direct install measures with a home energy assessment. Furthermore, about 39% of program-knowledgeable non-participants did not know that they are not obligated to follow-through on all of the home-weatherization recommendations if they perform the home assessment.

Notably, about 28% of all mailed non-participants reported not being aware of what "weatherization" means. Thus, a potential barrier to participation is a lack of understanding about what weatherization is and what benefits it may provide. Marketing material might attempt to further address the need to teach the market about the benefits of weatherization and what it involves.

Most non-participants who made energy efficiency changes in their homes with program-eligible measures did not know about utility incentives. About 57% of non-participant respondents had purchased or installed a measure offered in the HES program within the last 12 months. CFLs (25%), weatherization/insulation measures (19%), and showerheads and faucet aerators (18%) were the top three most common measures reported. About 85% obtained those measures from a hardware store and 13% from a contractor. According to the survey respondents, none of the purchases were made through a utility energy efficiency program and only 15% of respondents were aware, at the time of purchasing and installing the equipment, that there was incentive money available from their utilities to help cover the cost of getting those measures (i.e., 85% reported not being aware of utility rebate programs).[20] Some of these non-participants may have been potential participants for the program had they known about

[20] There is a possibility that some survey respondents may have purchased a measure discounted by a utility program, such as CFLs, without knowing it.

the free direct install measures offered for participating in an assessment; a further subset of these could potentially have become retrofit participants.

3.2.3 Marketing and Outreach Effectiveness

The program is using the most effective means of outreach to customers. Though program staff report that only about 1% of people mailed about the program participated, the program mailer was the most effective means of informing participants and non-participants about the program, judging by their reported initial sources for program information. Of the non-participants who remembered hearing about the program, 83% remembered receiving a letter about the program in the mail and 93% of those recalled having opened the letter to read about the program. About 80% of non-participants that read the letter indicate that it was an effective way to communicate about the program and about 61% of non-participants that remembered receiving a letter reported that it was the only way they heard about the program. Accordingly, participants indicated "brochures/fliers through direct mail" (30%) as the primary way they heard about the program. Word of mouth (28%) and contractor "tagged" referrals (15%) were the second and third most common ways heard about the program and a number of miscellaneous other channels were also reported, including television and newspapers. Program administrators note that community outreach was not strong in GPY1.

Program mailers are not only the most effective, but are also the preferred means of outreach among participants and non-participants. Participants and non-participants agreed that program mailers were the best way to reach them. When program-knowledgeable non-participants were asked for the best ways for the utilities to provide them with program information, utility mailings (59%) remained the most popular method, followed by e-mail (17%), and TV and Radio (each 11%). Over half of participants surveyed suggest the program best reach out to customers like them with printed materials sent via mailings, ads/flyers, or with bill inserts. A variety of other methods and media were also suggested, such as online ads and other e-media "blasts" in addition to TV and radio, reflecting the increasingly diverse communications channels available to customers today.

Most (64%) participants who recalled receiving the direct-mail information thought the materials were very useful. Indeed, every participant surveyed who recalled receiving the direct-mail information thought the information was either very useful or at least somewhat useful, and none had immediate thoughts on what might make the materials more useful to them. However, since the program overall did not reach its program intake goal, it suggests a closer look at non-participants' experience with program outreach to find opportunities to increase its effectiveness since customers did not respond to program marketing as expected.

Though the program uses the most effective means of communicating to customers, the content of the marketing material could be improved. The evaluation team found that the program had non-participants who were interested in participating that were deterred due to insufficient understanding of the program and its benefits. Notably, 22% of non-participants who knew about the program but did not participate reported being concerned or skeptical about the trustworthiness of the program and its incentive offers – 11% of whom reported that as their main barrier to participation.[21]

[21] Further barriers to participation are discussed in the Barriers to Participation section.

Trade allies further reaffirmed the need to improve marketing material content. One contractor notes that CSG-provided marketing material is "too vague" and unclear for the layman, which stifles participation motivation. They recommend driving participants to the website to grab their attention. One trade ally noted customers sometimes questioned the motives of the utilities and their promotion of energy conservation, indicating a limited understanding of the program's merits and financing. As such, the program stands to gain potential participants by more clearly addressing skepticism about the utilities' intentions with the HES program and a lack of understanding about program offerings.

Though nearly a third of non-participants did not know what weatherization is, most non-participants both valued energy efficiency and showed potential for participation. Most non-participants reported seeing value in making their home energy efficient, and the majority reported previously making energy efficiency changes in their homes. On a four-point scale ("not at all valuable," "somewhat valuable," "very valuable," "extremely valuable"), only 3% of respondents indicated energy efficiency was "not at all valuable" to them, and 60% indicated it was either "very valuable" or "extremely valuable." Furthermore, 85% of non-participants indicated they had previously made some or major changes in their home to save energy. Thus non-participants are aware of energy efficiency and they've most likely done something energy efficient in their home in the past.

The evaluation team also gauged whether non-participants had plans for energy efficiency work on their home in the near future. About 25% of non-participants reported that they have plans to make energy efficiency improvements to their home in the near future. When asked to indicate what they would do, the most common response was insulation work (39%). A further 17% indicated wanting to replace their windows, and another 6% noted wanting to install new doors. Thus, over half of non-participants indicated a desire to retrofit their home against the elements. This finding indicates that, although some non-participants report having already done some previous energy efficiency work, there seems to be clear interest in weatherization work among non-participants.

Program-knowledgeable non-participants were asked how much they would be willing to spend to make their home more energy efficient if the average home energy efficiency retrofit job in the program could save hundreds of dollars a year in avoided energy costs. About 44% reported they would spend $0 to less than $250 and 17% (or 5% of all mailed customers) would spend in the range of $750 to $1250 on the program. Thus, nearly a fifth of program knowledgeable non-participants would be willing to spend enough to cover the cost of assessment and retrofits, which is a promising indication of potential assessment participants. Another 29% of program-knowledgeable non-participants (about 10% of mailed customers) reported they don't know or are not sure how much they would spend.

Overall, these findings support the general flow of the program's marketing efforts and show that – including brochures, word-of-mouth, and contractor referrals in particular – the program's marketing strategy is having a positive effect on increasing customer awareness. However, since about 74% of non-participants don't remember hearing about the HES program and a portion of interested non-participants were deterred from the program due to not fully understanding and being skeptical of the program, the program may benefit from 1) expanding to other forms of outreach, and 2) improving its marketing messaging.

3.2.4 Barriers to Participation

The evaluation team supplemented its marketing and outreach effectiveness research with additional research into potential barriers to participation.

Overall, program-knowledgeable non-participants reported the most common reason they did not participate in PY1 was because they couldn't afford it (26%). The latter is reflected in the difference in demographics between participants and non-participants, where program participants were almost twice as likely to be making $100,000 or more than non-participants. Aside from affordability concerns, other barriers noted include:

- A general lack of interest in the program (21%);
- Having already done some work on the home (11%), including one non-participant who participated in a LIHEAP state weatherization program instead;
- Skepticism or mistrust about the program (11%);
- Having switched to an alternative energy provider with cheaper energy costs and thus being ineligible for the program, which is an inaccurate perception;
- Being confident to do the work themselves (someone in construction for over 40 years);
- Having an older home and planning to move away soon due to retirement; and
- Lack of initiative

Trade allies gave two notable barriers for customers already participating in the program:

1) Terminology in the program can be too sophisticated

2) Certain home conditions (including homes that don't fit the program's ideal "cookie cutter" design) may prevent optimal testing and installations.

Though trade allies generally showed agreement with available program energy efficiency measures, a few additional suggestions were made. Suggestions included considering incorporating injection and/or spray foam to be either incented or explored as a value added incentive to the customer, weather-stripping doors and caulking as cost-effective additions.

3.2.5 Participant and Program Partner Satisfaction and Recommendations for Improvement

The vast majority of participating customers surveyed saw the primary program benefit to be reduced energy bills (69%) and receiving a rebate on the cost of installing measures (20%). Nearly half (46%) of the respondents also cited a variety of other benefits the program provided, including improved comfort, assurance that equipment is running smoothly and safely, environmental benefits, and an improved general awareness and knowledge of what's needed to improve a home's efficiency.[22]

About two-thirds of participants surveyed had no concerns or skepticism about the program before they decided to participate, implying a reasonably good understanding that appears to be supported by the positive experience these customers had with the program information. The one-third who did have

[22] Respondents were allowed multiple responses to the question on program benefits.

some concern or skepticism noted several points, including the following (in no particular order of importance):

- A feeling that it's too good to be true;
- The program is somehow giving away something for nothing;
- A belief that green initiatives lose money and are poorly administered;
- Wondering how long the economic payback would be;
- Uncertainty whether the program would work on a very old home;
- Whether the program would act quickly once a customer signs up;
- Not understanding what the outcome would be; and
- Simply, the cost a customer would incur.

Even with such reservations, which the program seems to have addressed for participants (as all those with reservations did indeed sign up and participate), respondents overwhelmingly are satisfied with the program overall. About 97% rated their satisfaction as 8 to 10 on a 0-10 point scale and over half of participants stated they were very satisfied (10 rating). There were no aspects of the program (including participation processes, program staff, contractors, program information and measures installed) where customers gave dissatisfied ratings and nearly all aspects received high ratings (8 or higher). Also, over half those surveyed have recommended direct install measures to others since participating in the program, and few measures have been removed since they were installed. The few reasons participants gave for being somewhat dissatisfied mainly concerned scheduling or information being misplaced or not provided, confusion over what was being recommended, particularly difficult installation circumstances and, in one case, dissatisfaction with the showerhead spray pattern.

Participants were asked what opportunities they saw for program improvement, and 69% of respondents offered suggestions to improve the program – though a number of the "suggestions" actually were compliments paid by respondents who were very pleased with the program. The main suggestions were for more informative, persistent, and thorough marketing (about 25% of recommendations). Figure 3-2 summarizes participant suggestions for program improvement:

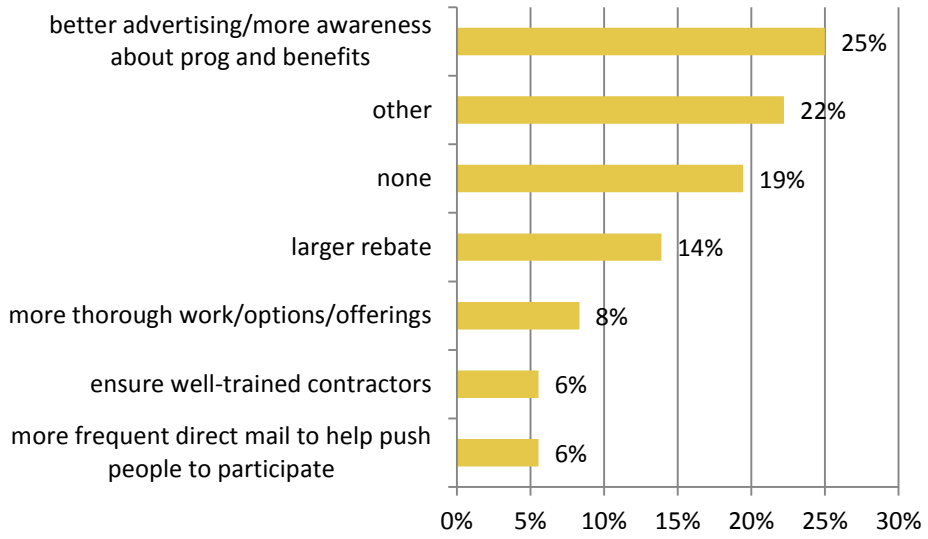
Overall, the suggested marketing and outreach improvements covered a range of possibilities and included the following:

- Marketing showing what the program has done in actual homes
- Simpler, and more marketing
- Testimonials
- Community outreach – town hall or similar organized community events

Most of these suggestions were offered in a positive sense, indicating a need for marginal, not wholesale improvements in the program. In summary, these survey findings show the program has worked very well for those who have participated in it.

Trade allies also agreed that minor adjustments could be made to continue to improve the program. Adjustment suggestions include introducing additional incentivized measures (such as spray foam), making the energy assessments "fit" a wider variety of homes better, as well as implementing additional targeted approaches to the program's marketing strategies, including targeted community outreach.

Figure 3-2. Participant Suggestions for Program Improvement



Source: Navigant participant survey.

3.2.6 Market Effects

Overall, trade ally interview and survey findings show that the program is affecting both the customer and trade ally markets. Trade allies indicate that the program is effective in communicating and raising awareness of energy saving initiatives introduced by the utility. Furthermore, trade allies think participants found the level of incentives appropriate to influence measure adoption that otherwise would not have happened. The average free ridership estimated by energy advisors is 18%. Also, both energy advisors and contractors report there may be spillover occurring due to: 1) the competitive advantage participation in the program creates in the market, which potentially influences other contractors to try to compete with the program[23], and 2) measures that are not incentivized by the program may be pursued by participants with other contractors outside of the program in order to have "complete" home projects. The GPY2/EPY4 evaluation will include more detailed market effects research.

[23] When asked why some contractors may choose not to participate in the program, one weatherization contractor noted that some contractors that may be aware of the program do not participate because they prefer their autonomy rather than following guidelines established by utility programs. Furthermore, contractors are selected to participate by CSG.

4. Findings and Recommendations

4.1 *Key Impact Findings and Recommendations*

- **The program achieved** 468 MWh and 94, 597 therms of verified net savings. The electric overall NTG ratio is 0.82 and the gas NTG ratio is 0.86. Overall, the program achieved 107% of its electric and 43% of its gas goals.

- **Finding.** Program verification, due diligence, and tracking system procedures all meet or exceed aspects of national best practices, as documented.

- **Finding.** CSG tracks installation rates during subsequent weatherization or QC activities, but it does not track persistence.
  Recommendation. Improvements in savings estimates may be achieved by tracking direct installation measure persistence as a potential program effectiveness indicator by way of follow-up checks during subsequent weatherization or QC activities.

- **Finding.** The data entry process involves taking field notes on paper and then re-entering the information into *EM HOME* on a computer in the work van, which is an instance of duplicate data entry.
  Recommendation. Explore switching from paper-to-computer based data entry during the energy assessments to using tablet computers equipped with EM HOME software. This will not only remove duplicative data entry and the potential for errors associated with it, but it could also potentially speed up the assessment process, which currently takes an average of 2.5 hours. By speeding up the assessment process, CSG could use the additional time for customer education helpful to the program. Such a software change would also provide the benefit of automatic, real-time accounting for the inter-connectivity of interdependent variables.

- **Finding.** The tracking database extract did not specify whether values were field-specified or default values.
  Recommendation. State whether building characteristics in the tracking system are field-specified or default values (e.g., heating and cooling system efficiencies), to clarify the basis for subsequent savings estimates. CSG stated that this information is visible in the *EM HOME* software suite, but that it would take considerable resources to be made available in the Microsoft Excel format that was used for the data extract submitted to Navigant. This information would be helpful to the evaluation team in determining the accuracy of inputs into the tracking system. This could also be useful as part of energy assessment review and training.

- **Finding.** The *EM HOME* simulation engine does not integrate customer billing data.
  Recommendation. Continue refining the *EM HOME* simulation engine to further improve savings estimates and reduce associated uncertainties. Explore options for improving modeling calibration using customer billing data, to provide an added dimension in estimating savings.

- **Finding.** The tracking system did not track kW savings for electric retrofit measures.
  Recommendation. Provide kW savings for electric retrofit measures to better facilitate cost-effectiveness estimates and various electric resource planning efforts.

Table 4-1outlines the program's electric and therm savings for GPY1/EPY4.[24] The NTG Framework[25] calls for retroactively applying the NTG ratio for "previously evaluated programs undergoing significant changes — either in the program design or delivery, or changes in the market itself." The evaluation team believes the HES program meets this criterion because the program changed assessment pricing and implementation contractors in GPY1/EPY4. As a result this evaluation uses the NTG ratio calculated from our GPY1/EPY4 research for both the electric and gas components of the program.

Table 4-1. GPY1/EPY4 Savings*

	Energy Savings (MWh)	Peak Demand Savings (kW)	Energy Savings (Therms)
Ex-Ante Gross Savings	527	31	104,505
Ex-Ante Net Savings	358	22	96,105
Realization Rate**	1.09	1.30	1.05
Verified Gross Savings	574	40	109,380
Overall NTG Ratio****	0.82	0.80	0.86
Verified Net Savings	468	32	94,597
Planning Net Savings Goal	438	-	220,729
% Net Goal Achieved	107%	-	43%

Source: Navigant Analysis; Nicor EEP Final – Revision for Compliance Filing 05-27-2011 FINAL; ComEd - PY4 QTR 4 Report
**CFLs, temperature turndown, and thermostats are deemed; showerheads, aerators, pipe insulation are partially deemed; all weatherization measures are not deemed.*
*** Realization rates represent the ratio between verified gross and ex-ante gross savings.*
*****Overall NTG is the ratio between verified net and verified gross savings.*

In PY1/PY4 the electric component of the program achieved 107% of planning net savings goals while the gas component of the program achieved 43% of planning net savings goals.

Table 4-2 and Table 4-3 present the measure-specific electric and therm savings for GPY1/EPY4.

[24] The September 14, 2012 final version of the first State of Illinois Energy Efficiency Technical Reference Manual (TRM) (effective as of June 1, 2012) has been agreed to by Illinois Stakeholder Advisory Group (SAG) and the Illinois Commerce Commission in Docket No. 12-0528 as of the date of this report. The verified gross savings shown in Table E-1 are deemed by the TRM for measures outlined in the document. Evaluation research findings for gross savings in GPY1 are provided for reference in the Appendix.
[25] "Proposed Framework for Counting Net Savings in Illinois." Memorandum March 12, 2010 from Philip Mosenthal, OEI, and Susan Hedman, OAG.

Table 4-2. GPY1/EPY4 Measure-Level MWh Savings*

	Measure	Ex-Ante Gross MWh	RR	Verified Gross MWh	NTG	Verified Net MWh
Direct Install Measures	9 Watt CFL	38	1.09	42	0.80	33
	14 Watt CFL	111	1.09	121	0.80	97
	19 Watt CFL	81	1.10	89	0.80	71
	23 Watt CFL	112	1.10	122	0.80	98
	9 Watt Globe CFL	20	1.09	22	0.80	17
	Shower Head	5	1.48	7	0.93	7
	Kitchen Aerator	1	0.46	0	0.99	0
	Bathroom Aerator	2	0.57	1	0.99	1
	Hot Water Temperature Setback	0	-	0	0.88	0
	Pipe Insulation	1	1.54	2	0.93	2
	Programmable Thermostat	0	-	3	0.90	2
	Programmable Thermostat Education	0	-	9	0.90	8
Subtotal		371	1.13	418	0.81	337
Retrofit Measures	Attic Insulation	68	1.00	68	0.81	55
	Wall Insulation	1	1.00	1	0.78	1
	Floor Insulation (Other)	6	1.00	6	0.84	5
	Duct Insulation & Sealing	1	1.00	1	0.80	1
	Air Sealing	80	1.00	80	0.86	69
Subtotal		156	1.00	156	0.84	131
Total Savings		527	1.09	574	0.82	468

Source: Navigant analysis
**CFLs, temperature turndown, and thermostats are deemed; showerheads, aerators, pipe insulation are partially deemed; all weatherization measures are not deemed.*

Table 4-3. GPY1/EPY4 Measure-Level Therms Savings*

	Measure	Ex-Ante Gross Therms	RR	Verified Gross Therms	NTG	Verified Net Therms
Direct Install Measures	9 Watt CFL	0	-	0	0.80	0
	14 Watt CFL	0	-	0	0.80	0
	19 Watt CFL	0	-	0	0.80	0
	23 Watt CFL	0	-	0	0.80	0
	9 Watt Globe CFL	0	-	0	0.80	0
	Shower Head	19,463	0.98	19,157	0.93	17,847
	Kitchen Aerator	426	0.97	412	0.99	409
	Bathroom Aerator	3,574	0.98	3,512	0.99	3,481
	Hot Water Temperature Setback	1,331	0.96	1,274	0.88	1,116
	Pipe Insulation	3,943	0.98	3,855	0.93	3,581
	Programmable Thermostat	3,261	0.90	2,946	0.90	2,651
	Programmable Thermostat Education	0	-	5,718	0.90	5,146
Subtotal		31,998	1.15	36,873	0.93	34,231
Retrofit Measures	Attic Insulation	34,604	1.00	34,604	0.81	28,181
	Wall Insulation	4,316	1.00	4,316	0.78	3,367
	Floor Insulation (Other)	6,496	1.00	6,496	0.84	5,460
	Duct Insulation & Sealing	111	1.00	111	0.80	89
	Air Sealing	26,979	1.00	26,979	0.86	23,270
Subtotal		72,507	1.00	72,507	0.83	60,366
Total Savings		104,505	1.05	109,380	0.86	94,597

Source: Navigant analysis
**CFLs, temperature turndown, and thermostats are deemed; showerheads, aerators, pipe insulation are partially deemed; all weatherization measures are not deemed.*

4.2 *Key Process Findings and Recommendations*

At this stage in the program's development, Navigant finds that program processes are generally well-planned and executed, and that the program is serving participants very well. However, since the program did not reach its participation goals in GPY1/EPY4, the evaluation team conducted research amongst participants, non-participants, and trade allies to determine marketing outreach effectiveness and potential barriers to participation. Navigant found that the program is using the most effective

means of outreach to customers with its program mailers. The program is also targeting the right customers as many non-participants value energy efficiency, are interested in weatherization work, and are tentatively interested in participating but are not fully persuaded by the program's current marketing. Participants, contractors, and non-participants alike agree that marketing material content could be improved. Many mailed program-aware non-participants were unaware of the free direct install measures available through the program and thought that getting an assessment would obligate them to purchase weatherization measures. In addition, a noteworthy portion of participants and non-participants aware of the program showed some uncertainty about the program and the utility intentions of discounting and giving out free measures.

Navigant presents the following key process findings and recommendations:

- **Finding.** Program participants and program partners were very satisfied with the program, incentive levels, and processes. About 97% of participants rated their satisfaction as 8 to 10 on a 0-10 point scale and over half of participants stated they were "very satisfied" (the highest rating).

- **Finding.** The program is using an effective means of outreach to customers. Participants and non-participants agreed that program mailers were the best way to reach them. Participants also noted that word-of-mouth and contractor referrals were other important sources of initial information about the program.

- **Finding.** The program targeted the right market of customers in its marketing mailer. Most mailed non-participants both valued energy efficiency and showed potential for participation in the program. On a four-point scale ("not at all valuable," "somewhat valuable," "very valuable," "extremely valuable"), only 3% of respondents indicated energy efficiency was "not at all valuable" to them, and 60% indicated it was either "very valuable" or "extremely valuable." Furthermore, 25% of non-participants reported that they have plans to make energy efficiency improvements to their home in the near future. When asked to indicate what they would do, the most common response was insulation work (39%). This is a strong indication of potential participants among mailed non-participants.

- **Finding.** A promising proportion of program-knowledgeable non-participants are willing to spend the money necessary to participate in the program's weatherization component. Almost a fifth of program-knowledgeable non-participants (about 5% of all mailed customers) noted that they were willing to spend $750-1,250 on the program if it were to save them money on their energy bills. Another 39% of program-knowledgeable non-participants (about 10% of mailed customers) reported they don't know or are not sure how much they would spend.
  Recommendation. The program could benefit from conducting focus groups to explore how best to remove barriers to participation for these program-knowledgeable non-participants**.**

- **Finding.** Participants, contractors, and non-participants alike agree that marketing material content could be improved. The most common participant recommendation for program improvement was for more informative, persistent, and thorough marketing about the program and its benefits.
  Recommendation. The evaluation team suggests a workshop meeting of energy advisors, trade allies, and other program stakeholders to gather feedback on the previous year's program efforts

and associated marketing efforts, with the goal of improving the marketing material for future program years. For example, the program may benefit from posting video clips on the program website to clarify program details through a new, information-rich medium. Implementing these recommendations may help identify some sources of participant misunderstandings of program offerings and further strengthen information available to potential participants about the program.

- **Finding.** Many program-aware non-participants were unaware of the free direct install measures available through the program. Furthermore, many non-participants thought that getting an assessment would obligate them to purchase weatherization measures.
  Recommendation. Consider modifying the program marketing collateral to more clearly emphasize that, while strongly encouraged and that there is considerable program support to do so, customers are not obligated to purchase the weatherization measures suggested by the assessment, along with pointing out that direct install measures provide immediate savings benefits that outweigh the cost of getting an assessment. This emphasis may drive more initial participation. Furthermore, the program may attract more participants by more strongly emphasizing that the nature of the assessment is to inform customers about opportunities to save money on energy bills and to make the home more comfortable. Highlighting the low-risk nature of scheduling an assessment may help hesitant participants feel more comfortable about participating since there are no obligations to install recommended measures.

- **Finding.** A noteworthy portion of participants and non-participants aware of the program showed some uncertainty about the program and the utility intentions of discounting and giving out free measures. According to non-participant survey results, if program-aware non-participant skepticism about the program is addressed, it could increase the amount of customers that ultimately consider participation from the current 28% that reported thinking about participating upon receiving a program mailer to up to as much as 50% based on non-participant survey results.
  Recommendation. The program may benefit from addressing these concerns in its marketing and outreach materials in order to tip hesitant but interested potential participants into scheduling an assessment. Given the very high levels of participant satisfaction with the program, the program may consider providing customers summary information from real-world case studies and testimonials that address common misconceptions about the program. These could be presented on the program website, in mailers, and other marketing and outreach material. Issues to address should include why the utilities are willing to incentivize energy efficiency improvements, and the mutually-beneficial nature of the programs for customers and the utilities. Implementing this recommendation may increase the conversion rate for the program mailer.

- **Finding.** Nearly a third of mailed non-participants did not know what "weatherization" means.
  Recommendation. Marketing material should meet the needs of the layman and use simplified terminology to describe the program offerings.

- **Finding.** Though marketing material could benefit from clarification, the overall program marketing message resonates with participant perceptions of the program's primary benefits. The vast majority of participating customers surveyed saw the primary program benefit to be reduced energy bills (69%) and receiving a rebate on the cost of installing measures (20%).

Nearly half (46%) of participants also cited a variety of other benefits the program provided, including improved comfort, assurance that equipment is running smoothly and safely, environmental benefits, and an improved general awareness and knowledge of what's needed to improve a home's efficiency.[26]

- **Finding.** About 26% of non-participants were aware of the program (mostly through program mailers, word- of-mouth, and contractor referrals), while the remainder were not despite having received mailers. Furthermore, program administrators noted that community outreach was not strong in GPY1/EPY4.
  Recommendation. Though the program mailers are the most important source of program outreach, the program may consider seeking to capitalize on developing additional communication channels such as various social media as an extension of the word-of mouth awareness building that is already starting to be an important source of program awareness. Furthermore, the program may benefit from community outreach at events that attract the target participant demographic. Implementing these recommendations may increase participation levels and provides additional opportunities to address issues related to customer awareness and understanding about the program.

[26] Respondents were allowed multiple responses to the question on program benefits.

5. Appendix

5.1 Glossary

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, 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 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, Nicor Gas 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, Nicor Gas 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[27].

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)**

> **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

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

(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 *Detailed Impact Evaluation Methods and Results*

5.2.1 Ex-ante Gross Savings Adjustments

Navigant performed a gross savings evaluation for all measures installed through the HES program, including weatherization and direct install measures. In order to complete this task, the evaluation team first performed a summary of the program ex-ante gross impact accomplishments based on an engineering review of the program's tracking system. Conservation Services Group (CSG) provided the original tracking data, and updates to direct install measures were provided by Wisconsin Energy Conservation Corporation (WECC) throughout the evaluation process. The details of the ex-ante savings updates are:

- WECC provided updated gas (therm) savings values for all of the HES direct install measures. These updates were based on algorithms and assumptions provided in the latest TRM. WECC applied these changes retroactively to the installed measures reported by CSG. This update affected the kitchen/bathroom aerator measures, as well as low-flow showerheads, hot water temperature setback, pipe insulation, and programmable thermostat measures. Navigant did not receive updated electric (kWh) savings values for direct install measures.

CSG provided the remainder of the ex-ante energy and demand savings values for electric and gas use, which includes all retrofit measures and electric savings for direct install measures.

5.2.2 Direct Install Verified Gross Savings Adjustments

Navigant performed a detailed engineering review of the ex-ante savings assumptions provided by CSG and WECC and developed verified gross savings values for all of the direct install measures. Adjustments to ex-ante savings values were based on updated assumptions and algorithms in the TRM, as well as engineering judgment. Updates to direct install formulas and assumptions are as follows:

- Navigant updated CSG's ex-ante kWh and kW savings for CFL measures in order to comply with the TRM assumptions and algorithms. The TRM states 1,000 annual hours of use and a waste heat factor of 1.06 for energy. The TRM also states a deemed waste heat factor of 1.11 for demand and a coincidence factor of 0.095, which the evaluation team applied in the verified savings estimates.
- WECC provided Navigant with updated gas savings for direct install measures based on the TRM. Navigant performed a review of the updated savings claimed, and found them to coincide with the assumptions provided in the TRM. However, participants with electric hot water heating were not differentiated in the WECC data, so Navigant modified the ex-ante gas savings to account for electric savings. The evaluation team also used the equations and assumptions in the TRM to modify CSG's ex-ante kW savings. Navigant also applied this methodology to bathroom/kitchen aerators and pipe insulation.
- For programmable thermostats and hot water temperature setback, Navigant allowed a maximum of one deemed savings amount per household. Navigant noted four households (7% of total) claiming more than one programmable thermostat deemed savings value in the ex-ante assumptions, as well as nine households (5% of total) claiming multiple deemed savings for hot water temperature setback.
- For the programmable thermostat education measure, Navigant applied the full TRM deemed savings for programmable thermostat education for each participant, and then adjusted the

savings using the participant survey self-reported in-service rate of 0.35. Navigant used the TRM to inform the calculations of the verified kW savings values. CSG did not originally claim ex-ante kW savings for non-CFL direct install measures.

- Navigant used the in-service rates provided in the TRM for all direct install measures.

5.2.3 Weatherization Measures Literature Review

Navigant performed a literature review to compare evaluated savings values for projects with similar weatherization offerings as the HES program. This was done in order to 'vet' the ex-ante savings for weatherization measures in the HES program. Table 5-1 shows the average gas (therm) savings for participants broken out by the top two savings measures: attic insulation and air sealing. Together, these two weatherization measures accounted for 85% of ex-ante claimed weatherization gas savings, with 48% and 37% from attic insulation and air sealing, respectively. Evaluated savings from four similar programs are also provided in the table below.

Table 5-1. Literature Review of Savings for Similar Weatherization Programs

Attic Insulation (therms/ participant)	Air Sealing (therms/ participant)	Program	Year	State	Type of Analysis
152	52	MassSAVE Final Summary QA/QC and Impact Study Report – Appendix B	2008	MA	Billing analysis
78	67	New Hampshire Weatherization Program Impact Evaluation Report	2007	NH	Regression analysis
109	83	Ohio Home Weatherization Assistance Program Impact Evaluation	2006	OH	Billing and regression analysis
84	28	Wisconsin Weatherization Assistance – Evaluation of Program Savings, Fiscal Years 2007-2009	2011	WI	Billing and regression analysis
106	58	Average Literature Review Net Savings			
78-152	28-83	Range Literature Review Net Savings			
112	86	HES Program Average Ex-ante Savings			
91	74	HES Program Average Verified Net Savings*			

Source: Navigant analysis
**Analysis of verified net savings is presented in Section 3.1.6*

Based on the tracking data provided by CSG, Navigant calculated the average ex-ante gas savings for attic insulation and air sealing participants at 112 and 86 therms per participant, respectively. Verified net savings are 91 and 74 therms per participant for attic insulation and air sealing. Literature review findings showed an average net gas savings of 106 therms and a range of savings between 78 and 152 therms for attic insulation projects in similar climates. For air sealing projects, the literature review found an average net gas savings of 58 therms and a range between 28 and 83 therms per participant.

Based on the findings from the literature review, Navigant has determined that the savings values from CSG's EM Home model compares favorably with evaluated savings for similar programs and climates. It is important to note that:

- The majority of the literature review studies used a billing analysis approach to determine evaluated gas savings. Billing analysis, by design, attempts to correct for NTG impacts on claimed savings values. This in turn lowers the savings associated with those measures.
- Homes in the Illinois program are larger on average than those in the majority of the literature review programs. The average conditioned area of homes that installed attic insulation and performed air sealing is approximately 3400 sq. feet in Illinois. Larger homes typically have higher heating and cooling loads than smaller homes, and would therefore realize greater savings from home weatherization measures.
- Navigant also reviewed CSG's document, *EnergyMeasure® HOME* - Algorithm Description, and found that the model uses reasonable and respectable assumptions and equations from ASHRAE and the DOE.

Navigant plans to do an expanded evaluation of weatherization measures in future program years. This could entail billing analysis or calibrated simulation efforts, or both approaches as needed to effectively triangulate impact estimates.

5.2.4 Net Program Impact Evaluation Methods

The primary objective of the net savings analysis is to determine each program's net effect on customers' electricity and gas usage. This requires estimating what would have happened in the absence of program activities and incentives. After gross program impacts are adjusted, net program impacts are derived by estimating a Net-to-Gross (NTG) ratio. The NTG ratio quantifies the percentage of the gross program impacts that are attributable to the program. This includes an adjustment for free ridership (the portion of impact that would have occurred even without the program) and spillover (the portion of impact that occurred outside of the program, but would not have occurred in the absence of the program). A customer self-report method was used to estimate the NTG ratio for this evaluation, using data gathered during participant telephone surveys. Trade ally interview findings were also used to gauge their estimate of overall free-ridership and spillover, to corroborate the participant self-report-based NTG estimates.

Free Ridership

Free ridership cannot be measured directly due to absent empirical data regarding the counterfactual situation. Thus, free ridership is assessed as a probability score for each measure. The evaluation relies on self-reported data collected during participant telephone surveys to assign free ridership probability scores to each measure. More specifically, for each measure, the following questions were posed to each measure recipient:

FR1. Had the participant heard about the program before or after they thought about installing the program measure?
FR2. Had the participant already begun researching or collecting information about the measure?
FR3. Had the participant already selected which measure to purchase?
FR4. Had the participant already selected where they were planning to purchase the measure/a contractor to work with (whichever is more applicable to the measure type)?
FR5. Did the participant have specific plans to install the measure before learning about the program? (PLANS, y/n)
FR6. How likely was the participant to install the measure if they had not installed it through the program? (LIKELIHOOD, 0-10)
FR7. How critical was the program in the decision to install the measure? (IMPORTANCE, 0-10)
FR8. Would the participant have installed the same measure within a year of when they did if the program didn't exist? (TIMING, 0-10)

Free Ridership Scoring

The free ridership data was assembled into a probability score in a step-by-step fashion, applying the following logic:

If the customer had not considered the measure prior to participating in the program then the probability of free ridership is estimated to be zero (based on FR1 above). Similarly, if the customer had not begun researching or collecting information about the measure, and the self-reported probability of installing the measure was less than or equal to 3 (on a 0-10 scale), then the probability of free ridership is estimated to be zero (based on FR2 and FR6). If neither of the above criteria holds, then responses to questions FR6, FR7 and FR8 are used to calculate the probability of free ridership.

The program includes both directly installed and weatherization components, where the customer demonstrates very little initiative to install the measures as the actual purchase, recommendation, and installation activities are performed by program staff. For this reason, participant self-reported intentions to install these measures even without the program [FR6 and FR8] are discounted relative to the self-reported importance of the program to the installation [FR7]. Thus the weighting of planning to program importance scoring is at a rate of 2 to 1, as the equation below shows. The corresponding formula for calculating free ridership is shown below:

$$[(FR6+FR8)/2 *(1/3) + (FR7)*(2/3)]$$

Note that in the above formula, if FR6 or FR8 are invalid (missing or "don't know") then the first component [(FR6+FR8)/2] relies on the non-missing factor. That is, if FR6 is invalid the formula is: [FR8*(1/3) + (FR7)*2/3]. If FR6 and FR8 are missing then the score is based on FR7 alone.

For CFL free ridership scoring, adjustments are made in a few special cases. In particular, free ridership scores are set to zero for customers who report a CFL spillover adoption, or have a low pre-retrofit CFL saturation rate. Customers who reported the program strongly influenced them to install additional CFLs following their participation (i.e. report spillover adoptions) are assumed not to be free riders. This is to reflect the most improbable event that these customers are highly influenced by the program to purchase more CFLs, yet would have purchased CFLs

without the program in any case. Customers who reported that prior to participating in the program less than 10% of their sockets were already retrofit with CFLs are also assumed not to be free riders. In light of the direct installation delivery approach, this adjustment reflects the empirical evidence of the customer's low propensity to install CFLs independently. Furthermore, a bulb count weight is applied in calculating the overall result for CFL free ridership, while other measure free ridership scores are aggregated using an equal weight, in accordance with the assignment of ex-ante impact.

The approach described above is generally consistent with the approach applied in previous ComEd evaluations of the predecessor Single Family program, including in PY3. However, while the calculations remain identical, the free ridership questions in this program year were expanded to more clearly specify having "specific plans" to mean a participant actually started collecting information about the program prior to their participation [FR2].

Program Spillover

The objective of the spillover assessment is to estimate the impact arising from efficient measures installed as a result of the program that were not incented by the program. The evaluation relies on self-reported data collected during the telephone survey to identify these measures and assess the role of the program in the decision to install. Data from interviews with trade allies where spillover was gauged also are referenced.

For each measure installed through the program, the following questions are posed to each measure recipient:

SP1. Have you installed any additional measures since receiving the ones through the program?
SP2. How many additional measures did you install?
SP3. How influential was the program in encouraging you to install these additional measures? (0-10 scale)

Spillover Scoring

The survey data was assembled into an assessment of spillover impact through application of the following method:

If the customer installed additional units of the measure following their participation, and the program was highly influential in the decision to install those measures, the adoption is considered to be potentially program spillover:

[If SP1=1 and SP3 is greater than or equal to 8, then adoption is spillover]

Any savings associated with spillover were weighted against the total savings of the participant sample for the particular measure to establish a measure-specific spillover rate.

Considerations and Measure-Specific Adjustments to Spillover

Compact Fluorescent Bulbs

The impact credit granted for CFL spillover adoptions must avoid double counting impact credit accrued already through the ComEd midstream residential lighting program. We continue to use the

approach established in the PY3 evaluation that assumes that 1) the market share of program bulbs is not a readily available number, and 2) the residential lighting program PY3 evaluation results indicated a substantial amount of free ridership (41%), and there is no reason that one program's free ridership cannot be another program's net impact. Thus, it is not necessary that bulbs be un-incented for them to legitimately qualify for credit under the Single Family Program.[28] Due to the uncertainty in this area, we take the conservative approach used in the PY3 evaluation and assume that only 50% of the impact arising from CFL spillover adoptions is creditable to the program. Again, even if these customers purchased a discounted bulb, the purchase decision was either influenced by both programs (making the 50% assumption reasonable) or influenced by only the HES program (making the 50% assumption conservative).

Pipe Insulation, Attic Insulation and Air Sealing
In the case of pipe insulation, the ex-ante impact is based on the installation of up to nine linear feet. Customers that report the installation of additional pipe insulation up to a total of nine linear feet outside of the program and that give the program an influence score of 8 or more qualified as spillover. Similarly, participants in the HES program that reported spillover adoptions of insulation and air sealing measures were credited an impact equivalent to the average verified impact over all the participants as a fraction of the total participant sample's savings for the particular measure.

Net-to-Gross Ratio (NTG)
The final net-to-gross ratios (NTG) for each measure are calculated as:

$$NTG = 1 - [Free\ Ridership] + [Spillover]$$

Where,
Free ridership is the energy savings that would have occurred even in the absence of program activities and sponsorship, expressed as a percent of gross impact.

And,

Spillover is the energy savings that occurred as a result of program activities and sponsorships, but was not included in the gross impact accounting, expressed as a percent of gross impact.

5.2.5 Net Program Impact Parameter Estimate Results

This section details the results of Navigant's verified net impact analysis for the HES program, which includes adjustments for both free ridership and spillover.

[28] There is some available evidence regarding the CFL market share of residential lighting program bulbs. The PY3 residential lighting general population survey revealed that 87% of CFLs are purchased at stores participating in the ComEd lighting program. Among program stores, the shelf space dedicated to ComEd program CFL bulbs is 53% of the overall shelf space dedicated to CFLs (for standard bulbs), and 62% for specialty bulbs. If we assume shelf space relates directly to sales share, than 46% of standard CFLs and 54% of specialty bulbs are Residential Lighting program bulbs.

Free Ridership

The objective of the free-ridership assessment is to estimate the impact of program incented measures that would have been installed even in the absence of the program. This cannot be measured directly due to the inability to observe behavior in the absence of the program. Thus, free ridership is assessed as a probability score for each measure. The evaluation relies on self-reported data collected during participant telephone surveys to assign free ridership probability scores to each measure. Furthermore, trade allies were interviewed to gauge their overall sense of free ridership in the weatherization component of the program to help cross-check the participant self-report results. Details on the free ridership telephone survey battery and scoring methods are presented within Section 2.3.3 (page 10). The participant survey in GPY1/EPY4 gauged the level of free ridership for all measures accounting for greater than 5% of ex-ante savings. For measures with less than 5% of program savings, NTG values were estimated based on literature reviews due to survey limitations.

Participants were administered the free-ridership battery in order of the magnitude of savings estimated per measure for each participant. In order to shorten the survey length and prevent participant response bias due to survey length fatigue, we asked participants if they had the same plans and sentiments about program influence for their secondary measures as for their first measure (for direct install and weatherization respectively). If an individual indicated that they had different plans and program influence for their other installed measures, the free ridership battery was repeated for each measure that they had installed and in order of savings generated. Otherwise, they would be skipped to the next section. At the time of analysis, the evaluation team found that the survey instrument had a CATI coding error for the weatherization battery, whereby participants that reported no previous plans to install their first measure (a zero free ridership) were not asked free ridership questions for the remainder of their weatherization measures. This amounted to 17 of 54 participants. Since our best estimate for omitted participant secondary measure free ridership is their zero free ridership response for their first measure, we assigned free ridership values of zero to their secondary measures as well.

The results of the program free-ridership estimates are shown in Table 5-2. The self-report free ridership results for weatherization measures are slightly less than the range specified by trade allies interviewed during the evaluation. Whereas weatherization measure participant self-report free ridership ranged from 14-22%, with an overall average of 18%, the seven trade allies[29] interviewed roughly estimated free ridership between 10-45%, with an average rating of 39%. Given that energy advisors are in contact with customers during the installation decision-making process more than trade allies, their reported free ridership scores are more likely accurate. Looking at their estimates alone, they report that free ridership is between 10-25%, with an average of 18%. The latter matches the participants' self-reported overall weatherization measures free ridership average of 18%. [30]

[29] Three CSG energy assessors, and four weatherization contractors

[30] Note that the trade ally free ridership estimates were not used to modify the participant survey-determined estimates and are only presented for additional reference.

Table 5-2. Participant Self-Report Free Ridership Results by Measure

Direct Install Measure	Average Free Ridership	n=
Showerhead	7%	29
Bathroom Aerator	1%	32
Pipe Insulation	12%	28
Hot Water Temp Setback	12%	12
CFL	24%	45
Overall DI*	12%	146
Retrofit Measure	**Average Free Ridership**	**n=**
Air Sealing	14%	52
Attic Insulation	21%	51
Wall insulation	22%	5
Other Insulation	16%	33
Overall Weatherization*	18%	141

Source: Navigant participant survey
**Overall DI and weatherization free ridership is calculated by applying the measure specific free ridership values to the verified gross savings values, and calculating the ratio of free ridership energy savings to total gross energy savings. Navigant converted electric and therm savings to a consistent energy value for purposes of calculating overall free ridership.*

Free Ridership and Participant Stratification and Contractor Referrals

The evaluation team also looked at free ridership results by survey savings stratification tier and by whether a participant was referred to the program by a contractor ("tagged") or not. In both cases, the splitting of the participant sample led to a sample too small to establish separate quantitative free ridership values to use for net impact estimates. However, some qualitative observations can be made that could be tested with a larger or targeted participant survey sample in the future.

Overall, participants in the top savings tier (meaning they had the most savings per project than other tiers), were more likely to be free riders for both direct install and weatherization measures than the second and third highest savings tiers. This may be an indication that participants that pursue more projects are more likely to have had plans to install the measures before and the program was less influential in their decisions to install those measures.

The evaluation team also compared free ridership for participants that were referred to the program by a contractor (and thus "tagged") to those that applied to the program on their own initiative. The results indicate that participants that were tagged generally had lower free ridership scores for direct install measures than those that contacted the program for an assessment on their own initiative. However, they had higher free ridership scores for weatherization measures. This seems expected, as contractor-referred participants were already looking for weatherization work, and the free direct install measures

were an additional, unintended benefit to participating. On the other hand, the non-tagged participants may initially be drawn to try the program in order to get free direct install measures they would have gotten otherwise, while also exploring potential weatherization work that they ultimately agreed to complete.

Program Spillover

The objective of the spillover assessment is to estimate the impact arising from efficient measures installed as a result of the program that were not incented by the program. The evaluation relies on self-reported data collected during the telephone survey to identify these measures and assess the role of the program in the decision to install. Net Program Impact Evaluation Methods are presented within Section 2.3.1.4. Spillover estimates, using this approach and expressed as a percent of measure ex-ante impact, are shown in Table 5-3 below.

Table 5-3. Spillover Results by Measures

DI Measure	Spillover	n=
Showerhead	-	-
Bathroom Aerator	-	-
Pipe Insulation	5%	2
Hot Water Temp Setback	-	-
CFL	4%	3
Retrofit Measure	**Spillover**	**n=**
Air Sealing	-	-
Attic Insulation	2%	1
Wall insulation	-	-
Other Insulation	-	-

Source: Navigant participant survey

Mailed Non-participant Spillover

In analyzing the non-participant survey, the evaluation team identified a qualitative non-program spillover amongst 5.2% of customers mailed about the program that did not participate. Of the 69 surveyed non-participants, 57% reported installing an energy efficient measure in the last year. Of those 10.3% (four people) knew about utility programs including the HES program. Of those four people, a further two (or 50%) said the program was very influential in their decision to install energy efficient measures, and they reported installing weatherization/insulation measures and pipe insulation. Thus, about 5.2% of all mailed non-participants surveyed knew about the program, installed energy efficient measures, and considered the HES program very influential in their installations.

Extrapolating that percentage to the overall population of non-participating customers mailed about the program indicates that 5,200 individuals out of the 100,000 that were mailed may have installed an energy efficient measure in the last year and considered the program influential in that action. Unfortunately, the sample size of non-program spillover customers in the survey was too small to quantify impacts. Quantifying non-program spillover impacts would require a substantially larger non-

participant sample size to capture a statistically significant representation of average savings per spillover incident.

5.2.6 Survey-Determined Installation and Persistence Rates for Direct Install Measures (For Reference)

Though TRM values were used to calculate verified gross savings estimates for direct install measures, the following Navigant survey research-determined in-service rates are listed for reference purposes. The evaluation team gauged in-service rates for direct install measures in the participant. We outline them alongside persistence rates for program direct install measures in Table 5-4. The installation rate is a ratio of customer-reported measure installations to those contained in the program tracking database. The persistence rate is used to reflect the removal of program measures, which can be thrown away, given away, sold, put into storage, or altered in some other way as to end their function. Installation rates of less than 1.00 may be due to participant self-report recollection error. CSG reports an installation rate of 100% from their QAQC follow-up visits.

Table 5-4. GPY1/EPY4 Direct Install Measure Installation and Persistence Rate Results – Survey Determined

(For Reference - Not Used in Verified Gross Calculations)

Measure	Installation Rate**	Persistence Rate
9 Watt CFL	0.98	0.96
14 Watt CFL	0.98	0.96
19 Watt CFL	0.98	0.96
23 Watt CFL	0.98	0.96
9 Watt Globe CFL	0.98	0.96
Shower Head	1.00	0.90
Kitchen Aerator	1.00*	0.95*
Bathroom Aerator	0.94	0.90
Hot Water Temperature Setback	0.92	0.92
Pipe Insulation	0.88	1.00
Programmable Thermostat	1.00^	1.00^
Programmable Thermostat Education	0.35	1.00

Source: Navigant participant survey
**Navigant did not collect data for the kitchen aerator measure, and has assigned the persistence rate as 0.95, according to the in-service rate defined in the TRM.*
***Installation rates of less than 1.00 may be due to participant self-report recollection error. CSG reports an installation rate of 100% from their QAQC follow-up visits.*
^Navigant did not collect data for the programmable thermostat measure, and has assigned an installation and persistence rate of 1.

5.2.7 Overall Program Research Findings Gross and Net Savings (For Reference)

This section presents the evaluated HES Program gross and net savings based on the evaluation team's research findings for direct install and weatherization measures for reference purposes (whereas the verified gross savings in the body of the report were based on TRM-prescribed gross parameter estimates for direct install measures). These savings values include the installation rates, persistence rates, and net-to-gross values determined utilizing the participant survey. Table 5-5 presents the gross program savings and realization rates based on research findings.

Table 5-5. GPY1/EPY4 HES Program Research Findings Gross Savings

	Measure	Therms	Therms RR*	MWh	MWh RR*	kW (peak)	kW RR*
Direct Install Measures	9 Watt CFL	0	-	41.0	1.08	4.1	1.25
	14 Watt CFL	0	-	119.5	1.08	11.9	1.25
	19 Watt CFL	0	-	87.7	1.08	8.7	1.25
	23 Watt CFL	0	-	120.6	1.08	12.0	1.25
	9 Watt Globe CFL	0	-	21.4	1.08	2.1	1.25
	Shower Head	17,526	0.90	6.6	1.36	0.4	-
	Kitchen Aerator	391	0.92	0.3	0.44	0.0	-
	Bathroom Aerator	3,328	0.93	1.3	0.54	0.1	-
	Hot Water Temperature Setback	1,167	0.88	0.0	-	0.0	-
	Pipe Insulation	3,855	0.98	2.1	1.54	0.2	-
	Programmable Thermostat	2,946	0.90	2.7	-	0.0	-
	Programmable Thermostat Education	2,018	-	3.0	-	0.0	-
Subtotal		31,230	0.98	406.0	1.10	39.6	1.28
Retrofit Measures	Attic Insulation	34,604	1.00	68.1	1.00	0.0	-
	Wall Insulation	4,316	1.00	0.8	1.00	0.0	-
	Floor Insulation (Other)	6,496	1.00	6.2	1.00	0.0	-
	Duct Insulation & Sealing	111	1.00	0.9	1.00	0.0	-
	Air Sealing	26,979	1.00	80.2	1.00	0.0	-
Subtotal		72,507	1.00	156.2	1.00	0.0	-
Total Savings		103,736	0.99	562.2	1.07	39.6	1.28

Source: Navigant analysis
**RR = Realization Rate. This is the ratio of research findings gross to ex-ante gross savings.*

Table 5-6 presents the net program savings and realization rates based on researching findings.

Table 5-6. GPY1/EPY4 HES Program Research Findings Net Savings

	Measure	Therms	MWh	kW (peak)
Direct Install Measures	9 Watt CFL	0	32.8	3.3
	14 Watt CFL	0	95.6	9.5
	19 Watt CFL	0	70.2	7.0
	23 Watt CFL	0	96.5	9.6
	9 Watt Globe CFL	0	17.1	1.7
	Shower Head	16,327	6.1	0.4
	Kitchen Aerator	387	0.3	0.0
	Bathroom Aerator	3,298	1.3	0.1
	Hot Water Temperature Setback	1,023	0.0	0.0
	Pipe Insulation	3,581	1.9	0.2
	Programmable Thermostat	2,651	2.4	0.0
	Programmable Thermostat Education	1,816	2.7	0.0
Subtotal		29,084	327.1	31.9
Retrofit Measures	Attic Insulation	28,181	55.5	0.0
	Wall Insulation	3,367	0.6	0.0
	Floor Insulation (Other)	5,460	5.2	0.0
	Duct Insulation & Sealing	89	0.7	0.0
	Air Sealing	23,270	69.2	0.0
Subtotal		60,366	131.2	0.0
Total Savings		89,450	458.2	31.9

Source: Navigant analysis

Table 5-7 shows the overall program ex-ante and researching findings gross and net savings.

Table 5-7. GPY1/EPY4 Overall HES Program Research Findings Savings*

	Energy Savings (MWh)	Peak Demand Savings (kW)	Energy Savings (Therms)
Ex-Ante Gross	527	31	104,505
Ex-Ante Net	358	22	96,105
Research Findings Realization Rate**	1.07	1.28	0.99
Research Findings Gross	562	40	103,736
NTG Ratio****	0.82	0.80	0.86
Research Findings Net	458	32	89,450
Planning Net Savings Goal	438	-	220,729
% Net Goal Achieved	105%	-	41%

Source: Navigant analysis
**CFLs, temperature turndown, and thermostats are deemed; showerheads, aerators, pipe insulation are partially deemed; all weatherization measures are not deemed.*
***Research findings realization rate represent the ratio between research findings gross and ex-ante gross savings.*
****Overall NTG is the ratio between verified/research net and gross savings.*

5.3 *Additional Process Evaluation Results*

This section summarizes additional results from the telephone surveys with participants and non-participants, as well as interviews with trade allies. The surveys and interviews were conducted in October, 2012.

5.3.1 Participant Demographics

Customers surveyed are mostly in the 31-60 year old age range (72%), all own their homes, over 2/3 of households (69%) earn over $75,000 annually, and over half (58%) had made at least some previous changes in their home to save energy.

5.3.2 Non-Participant Demographics, Attitudes, and Buying Behavior

The HES program targeted its spring mailer to areas with high-use households that have good potential for cost effective energy efficiency retrofits. All non-participants that responded reported living in a single family home, and 90% of non-participants own the home. Their households generally consist of 1 to 4 family members (82%) and most homes are between 1,000 and 2,599 square feet (63%). About 45% reported an annual income of $75,000 or more, compared to 69% of participants. Furthermore, while 29% of non-participants made $100,000 or more, program participants were almost twice as likely to be making $100,000 or more (50%).

Most non-participants reported seeing value in making their home energy efficient, and the majority reported previously making energy efficiency changes in their homes. On a four-point scale ("not at all valuable," "somewhat valuable," "very valuable," "extremely valuable"), only 3% of respondents indicated energy efficiency was "not at all valuable" to them, and 60% indicated it was either "very valuable" or "extremely valuable." Furthermore, 85% (n=68) indicated they had previously made some or major changes in their home to save energy. This may be an indication that many non-participants feel that they have already done something to make their home energy efficient and that they don't need to do more, largely because energy is still relatively affordable.

5.3.3 Trade Ally Reporting on Program Awareness and Marketing and Outreach Effectiveness

Weatherization contractors were asked a series of questions to understand their program marketing including about their program-specific marketing, marketing effectiveness, and suggested changes. Contractors generally indicate that they relied on CSG's marketing efforts for "priming" of customers more than on their own direct marketing efforts outside of referrals. However, they do make use of the flyers they are given by the implementation contractor and find them helpful. Two respondents indicated having distributed supplied marketing material to their customer base and one indicated having done an e-mail blast about the program. Furthermore, another contractor reported putting the program banner on their website provided by CSG and "steering" of customers to the program if they felt it was appropriate. All respondents thought the participation in the program was seasonal, and all marketing efforts should be targeted throughout the winter, late summer, early fall, and spring.

Though the contractors are satisfied with marketing overall, there were several suggestions for marketing improvements:

- One contractor notes that CSG-provided marketing material is "too vague" and unclear for the layman, which stifles participation motivation. They recommend driving participants to the website to grab their attention.

- A contractor noted customers sometimes questioned the motives of the utilities and their promotion of energy conservation, indicating a limited understanding of the program's merits and reasoning for providing customers incentives.
- One contractor recognized CSG's need for targeting their marketing to program-eligible participants despite having newspaper, radio, and TV advertisements that apply to the broader Chicago area. This contractor recommended continuing to distribute mailers and further recommended sending personnel from the utility or energy assessment firm to summer festivals, community outreach events (especially those related to conservation, like Earth Day), and trade shows, in which a greater number of potential participants might be concentrated.

The program may benefit from including contractors in the outreach material development, as they have experience directly addressing misunderstandings and questions with customers.

5.3.4 Trade Ally Reporting on Customer Participation Motives and Barriers to Participation

Customer Participation:
Trade Allies provided multiple responses for the reasons customers participated in the program. These included:

- Making the home more comfortable (3 of 7 Trade Allies),
- Improving the performance of their home (2 of 7),
- Taking advantage of the incentive and reducing energy costs (3 of 7), and
- Wanting to move towards a "greener" home (1 of 7).

The energy advisors had a more detailed understanding of the effect of the cost of the assessment than weatherization contractors because they work directly with customers in promoting measure recommendations. The energy advisors reported that customers are happy with the price. They also generally believed that the $99 assessment brought more serious participants with a higher likelihood of following through on weatherization work than the $49 assessment price, though the latter increased the number of assessments being performed. It also appears that there may be some additional strain and logistical issues in scheduling for energy advisors as the number of assessments increases.

Energy advisors and contractors agree that participants generally understand the participation process, and they make apparent effort to clarify participation details for them. Furthermore, there appear to be no issues for participants in understanding assessment reports and follow-up processes. In fact, one contractor noted that with the change of implementation contractors, they have noticed a drop in the number of follow-up calls from participants asking for clarification about the program. Thus it appears the implementation contractor's energy advisors are doing a better job of communicating about the program with customers.

Generally, trade allies believe that there are no major barriers to participation. Instead, customer cost concerns, skepticism with utility motives, and a lack of awareness were reported as broad participation barriers. However, trade allies gave two notable barriers for customers already participating in the program: 1) the terminology in the program can be too sophisticated; and 2) certain home conditions (including homes that don't fit the program's ideal "cookie cutter" design) may prevent optimal testing and installations. Though trade allies generally showed agreement with available program energy efficiency measures, a few additional suggestions were made. Suggestions included considering incorporating injection and/or spray foam to be either incented or explored as a value added incentive to

the customer, weather-stripping doors and caulking as cost-effective additions, and additional measures that might help cater to specific types of homes.

Incentives Levels:
All respondents favored the level of incentives in the program. They noted that participants were generally satisfied with the level of incentives offered; furthermore, respondents to the question said that without the program incentives, customers would generally have pursued less comprehensive projects or none at all. Below are excerpts of trade ally feedback regarding their opinions on whether participants would have done the same projects if they did not receive program incentives:

- "Not to the same extent, they'd do some of the work and do it more cheaply, doing it themselves or getting less qualified tradespeople."
- "…No, they'd not do the same/as much."
- "Yes, people still would still install the same products, but not correctly to maximize their savings and only if they could afford it. Probably not to this level. Giving them the knowledge of what would happen without it makes them satisfied."
- "Many wouldn't install anything"

Program Influence:
In order to gauge program influence, the evaluation team asked contractors what energy efficiency actions customers asked about in GYP1/EPY4 compared to what might have occurred without the program. Two contractors stated that it was difficult to speculate on customer behavior, although it was likely the program was getting customers to ask more questions than had the program not existed. However, the two other respondents said that there was no difference. Of these two, one respondent claimed that participants were more likely to participate if the program money saving potential was promoted rather than the more abstract concept of energy saving.

Three respondents indicated that their sales of weatherization measures have increased "somewhat" since the introduction of the program. Not all respondents provided an estimated percentage of sales; however, they did indicate that the program had helped in the sale of this equipment.

Trade allies were also asked to gauge what percent of people are conducting weatherization work on their own, also known as "do-it-yourselfers." Two respondents made similar percentage estimates of at around 20-25%. The other respondents could not provide a rough estimate, but they believed a small percentage were installing weatherization measures themselves.

5.3.5 Trade Ally Reporting on Market Baseline, Free Ridership, and Spillover

Baseline:
Weatherization contractors were asked a series of quantitative and qualitative questions to gauge baseline market conditions, free ridership, and spillover. Prior to their involvement in the program, three weatherization contractors reported that they made the same measure recommendations to customers as they did during the program in GPY1/EPY4. Prior to participation, contractors indicate that about 30-80% of their customers implemented their recommendations. One contractor reported changing the measures their business recommend since joining the program, and they indicate the program was only somewhat influential in making that decision (3 on a scale from 0 to 10).

Contractors have been somewhat influenced by the program to recommend new measures, but it appears that the program has been more influential in getting participants to install measures they would otherwise not have implemented. Since participating in the program, two contractors indicate about 30% of their customers follow through on their recommendations, and about 50% of those are program participants. All contractors that responded also indicate that they likely would have been recommending the same weatherization measures without the program (scores of 8 to 10 on a 10 point scale). However, three of four contractors indicated customers would be not at all likely to somewhat likely to implement the measures without the program; only one contractor indicated his customers would have been extremely likely to implement the same measures without the program.

Free Ridership:
Trade allies and energy advisors assert that they are extremely influential in influencing participant project implementation when they are the ones consulting participants. Unless participants are referred to the program by a contractor ("tagged"), energy advisors are usually the actors making measure recommendations to participants. Furthermore, all respondents claimed that the program is very influential on customers' decisions to install weatherization measures (scores of 8-10 on a 10 point scale). The average free-ridership score reported by the energy advisors and contractors is about 37% though most indicated that this is a difficult number to estimate. Since energy advisors are more in touch with customers in the decision-making process, their estimates are more likely accurate. The average energy advisor free ridership estimate is 18%.

Program Spillover:
Half the interviewed contractors claimed that their experiences with the program influenced their recommendations for additional energy efficiency measures with their customers. The two respondents specifically mentioned injection and/or spray foam used primarily for certain insulation applications. These respondents could not provide an accurate estimate of the additional savings these measures may have provided. One of the two contractors estimated that probably about 30% of the program-influenced un-incented measures were installed, an estimate based on their closing rate for in-program projects.

Non-Participant Spillover:
There is some sense by contractors that non-participant trade allies are at a disadvantage if they don't participate in this program. When asked why these businesses may not be participating, two contractors indicated that other contractors may like being independent or they don't want to go through the requirements stipulated by the program in order to qualify. Another contractor believes they may not be participating because they haven't heard about the program.

Contractors were also asked what effect they think the program is having on the market for energy efficiency measures in the Chicago area and their responses were varied. One contractor reported that overall the program is having a significant impact on the contractor market due to the competitive advantage of the rebate, and another contractor speculated that the program is possibly building awareness in the market for customers (which may indirectly influence contractors those customers interact with), rather than contractors directly. In accordance with the latter, one energy advisor reports that the program may be causing non-participant spillover when the program doesn't cover a measure (such as dense packing a cathedral ceiling), causing the participant to reach out to other local contractors. The advisor also estimates that 65-70% of participants have had quotes from other contractors who give lower quotes, but that with rebates the program is still more competitive. On the other hand, another

energy advisor reported that the program is probably having little influence on the contractor market because not many contractors are aware of the program.

Overall, the interview results indicate that the program is effective in communicating and raising awareness of energy saving initiatives introduced by the utility. As well, trade allies think participants found the level of incentives appropriate to influence measure adoption that otherwise would not have happened. The average free ridership estimated by energy advisors is 18% and both energy advisors and contractors report there may be spillover occurring due to: 1) the competitive advantage participation in the program creates in the market, which potentially influences other contractors to try to compete with the program, and 2) measures that are not incentivized by the program may be pursued by participants with other contractors outside of the program in order to have "complete" home projects. The participants agreed that minor adjustments could be made to continue to improve the program. Adjustment suggestions include introducing additional incentivized measures (such as spray foam), making the energy assessments "fit" a wider variety of homes better, as well as implementing additional targeted approaches to the program's marketing strategies, including targeted community outreach.

5.4 VDDTSR Memo-Final Version

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Confidential Memorandum

To: **Jim Jerozal, Dan Rourke, Scott Dimetrosky, Ted Weaver, Julie Hollensbe**

Copy: **James Vanderploeg, Jennifer Hinman, David Brightwell**

From: **Randy Gunn, Mark Thornsjo, Miroslav Lysyuk, Ryan Powanda, Laura Tabor**

Date: **August 28, 2012**

Re: Verification, Due Diligence and Tracking System Review of Nicor's Home Energy Savings Program

This document provides the results from our due diligence review of the quality assurance, program tracking, and savings verification procedures of the Nicor Home Energy Savings (HES) program. The Verification, Due Diligence, and Tracking System Review (VDDTSR) recommendations are based on findings from in-depth interviews with the program staff and the implementation team (Conservation Services Group), as well as reviews of program documentation, the tracking system, sample project files, and the implementer's proprietary audit software. The primary areas of inquiry were to determine:

- Whether appropriate eligibility criteria have been properly adhered to and applications are appropriately completed and backed with supporting documentation
- Whether the QA/QC activities are adequate and unbiased (e.g., are samples statistical, is there incorrect sampling that may skew results, etc.)
- Whether project information is entered in an accurate and timely manner in the tracking system and savings were calculated correctly

This memo is based in part on information disclosed by Conservation Services Group to Navigant that is confidential.

Overview of Findings

Verification and Due Diligence

Conservation Services Group (CSG) has a comprehensive procedure for verification and due diligence which meets or exceeds most aspects of national best practices. The program manual clearly outlines screening procedures for customers which the evaluation team verified for thoroughness. Furthermore, the program operations manual also outlines CSG's Quality Assurance & Quality Control (QA/QC) procedures for verifying rebate applications and for conducting contractor field inspections. All participating contractors are pre-screened and required to be Building Performance

Institute (BPI) certified to ensure their qualifications allow them to best provide whole-home weatherization services. Each Home Energy audit goes through an administrative review process that reviews all assessment documentation. In addition, 15 percent of completed Energy Advisor audits are field inspected and CSG post-inspects the first five installations for new contractors, 25 percent of the next twenty, and a continuing random sample of 5 percent of work afterwards. Overall, three modes of inspection are conducted on assessment work in order to assure that program services meet the performance metrics set forth in the program implementation contract. All participants that undergo an audit are administered a customer satisfaction survey, and customers that give ratings of four or lower on a ten point scale are followed-up with to ensure proper resolution of any outstanding issues. Customer satisfaction and inspection QA/QC scores are compiled for all contractors and Energy Advisors to generate overall score cards that are used as a quality control and market training tool. CSG also keeps a detailed log of customer issues and resolution steps.

Reporting and Tracking

CSG tracks nearly all of the information dictated by national best practice standards. CSG uses a proprietary software suite to track participation information and audit information. All information entered into the system is automatically synchronized using the internet. Furthermore, the auditing software, *EnergyMeasure® HOME (EM HOME),* incorporates data validation routines that help guide data entry, generally increasing both the speed and accuracy of data entry. Navigant finds that CSG goes through adequate quality control screenings for data entry. At least 15 percent of Energy Advisor work is post-assessment inspected by a supervisor who reviews data inputs and corrects them in the tracking database as necessary. The data tracking system includes a data dictionary that fully documents each data field to enable one to understand and review the tracking system.

Summary of Recommendations

Overall, CSG does a thorough job of tracking program information. Based on reviews of the program tracking system, *EM HOME*, and related documentation, Navigant recommends additionally increasing the flexibility of *EM HOME* data extracts and reporting, so as to expand upon the system's current analysis and tracking capabilities. Specific examples include:

- Include estimated pre and post whole-home energy consumption values at the project level in addition to incremental savings at the measure level. This would assist in QA/QC of claimed savings using *EM HOME*, including billing analysis and calibrated model review.
- Provide a breakdown of incentive amounts that have been paid by each utility, so that program cost-effectiveness can be analyzed more flexibly.
- Include additional QC information in the tracking system that would be helpful in estimating savings accurately in addition to the QC blower door measurement. As an example, it would be helpful for understanding direct-install measure persistence if, during the weatherization phase activities, there could be a check for discrepancies in installation of direct install (DI) measures to see if any have been uninstalled since the initial home assessment and direct-install visit.
- Provide kW savings for retrofit measures as well as kWh, to help educate customers about demand savings as well as energy savings. State whether building characteristics in the tracking system are field-specified or default values. CSG stated that this information is

visible in the *EM* software suite, but that it would take considerable resources to be made available in the Microsoft Excel format that was used for the data extract submitted to Navigant. However, this information would be helpful to the evaluation team in determining the accuracy of inputs into the tracking system. This could also be useful as part of energy auditor review and training.

- Record the total number of fixtures that were eligible for DI measure installation in addition to the total number installed. This will assist in determining penetration of DI measures and remaining market potential. CSG has stated plans to incorporate this information for PY2.
- Record previous project statuses and dates when status type is changed so that full project progress may be more accurately mapped and tracked and to ensure fully up-to-date information for customer status communications is analyzed.
- Record all heating and cooling systems present in the house, not just the ones with the highest loads, to round out the energy profile of the home and to better inform market potential studies. This will assist in accurate energy and gas savings estimations.
- Provide data gathered in *EnergyMeasure® HUB (EM HUB)*, the administrative software counterpart to *EM HOME*, on program marketing as part of the tracking system extract to better assist future process evaluation efforts.

Navigant also makes the following general recommendations:

- CSG should explore switching from paper-to-computer based data entry during the energy audits to using tablet computers equipped with *EM HOME* software. This will not only remove duplicative data entry and the potential for errors associated with it, but it could also potentially speed up the audit process, which currently takes on average 2.5 hours. By speeding up the audit process, CSG could use the additional time for additional data gathering that may be helpful to the program. Furthermore, paper-based data tracking fails to take into account the inter-connectivity between variables that real-time use of software on a tablet computer during audit would allow.
- Though CSG is tracking KPIs, we suggest also tracking direct install measure persistence as a potential program effectiveness indicator by way of follow-up checks during subsequent weatherization activities.
- CSG should consider explicitly tracking two additional indicators of program success: 1) the percent of project proposals actually installed and 2) the percent of potential recommended savings achieved by participating customers against the full potential savings proposed. Looking at these indicators against other data about customers such as the amount of incentives given, types of measures installed, and other participant data may help shed light on optimal ways of increasing the magnitude of program participation.
- CSG thoroughly tracks Energy Auditor and Contractor QAQC performance. However, score cards and detailed customer complaint logs are kept in separate files. Currently the score cards only indicate numeric scores, while the complaint logs track detailed customer interaction information associated with specific contractors and Energy Advisors. CSG may consider pulling in complaint log information into QAQC score cards in order to allow for easier tracking of customer issue patterns specific to Energy Advisors and contractors along with detailed customer interaction information.

Data Collection

CSG provided the evaluation team with a tracking data extract from their proprietary *EnergyMeasure® HOME* and *EnergyMeasure® HUB* software suites in Microsoft Office Excel format. The due diligence and tracking system review looks at this data extract as well as information gathered from in-depth interviews with program and implementation staff, their descriptions of program processes and the tracking system, and a live demonstration of the tracking data gathering software. We also reviewed project documentation for a sample of fifty PY1 projects to compare against the tracking system. To conduct the best practices benchmarking assessment, we consulted the *Best Practices Self-Benchmarking Tool* from the *National Energy Efficiency Best Practices Study*.

The results of the above due diligence and tracking system review tasks are presented below. Navigant's findings are followed by the results of the evaluation team's national best practices benchmarking assessment of the program.

Review of Program Operating Procedures and Tracking System

We examined the operating procedures and tracking system used by Nicor's program implementer, CSG, to intake participants, to gather data about audited homes, to generate project recommendations, and to process rebate forms for the HES program. The CSG program manual provides an outline of the following steps in the participation and rebate processes:

- Individual contacts Nicor/ComEd/CSG to participate in the program and is screened for eligibility
- CSG schedules approved participants for a whole-home audit by a CSG Energy Advisor, CSG's dedicated and trained audit staff for the program
- Energy Advisors conduct a comprehensive home audit, enter data in proprietary software, and generate an audit report on-site with direct install and weatherization recommendations
- During the audit, Energy Advisors also direct install a series of recommended direct install savings measures free of charge
- Upon signed approval from the participant, a follow-up visit is scheduled by a BPI certified contractor to install weatherization measures
- Contractors give participants instant rebates on the cost of weatherization jobs and receive reimbursement from CSG upon submitting proper documentation
- A post-inspection is conducted by CSG in select homes to insure both Energy Advisor and contractor work is meeting quality expectations

Below is our assessment of the participation screening process, QA/QC procedures, and the data tracking system.

Process Due Diligence Verification

<u>Participant Eligibility Screening</u>

The program operations manual thoroughly outlines screening processes for both accepting participants and approving contractors into the program, and based upon interviews with program

staff, CSG appears to be following the manual's procedures diligently. Interested participants can call or email CSG at a dedicated number and email address to schedule a Home Energy assessment. Misdirected calls to the utility or another utility program are redirected to CSG's HES program toll-free number. Upon contacting CSG, customers are screened to determine their eligibility in the program. Screening criteria include verifying 1) that the primary heating source is gas or electric, 2) that the building has less than five living units, and 3) that the customer has both Nicor and ComEd accounts. Ineligible callers that are eligible for other Nicor or ComEd programs are referred to those instead, thus helping to fulfill the cross-marketing objectives of Nicor's and ComEd's portfolios.

Program-eligible customers answer a series of preliminary questions over the telephone while scheduling an audit that CSG call center staff enter into *EnergyMeasure® Hub (EM HUB)*, CSG's proprietary customer application system that compliments *EnergyMeasure® Home (EM HOME)*, the auditing software.[1] Information entered in *EM HUB* is synchronized with information used and entered in *EM HOME* during audits. These data are stored jointly in one place and were made available to us in the data extract. Interviews with the implementation contractor found no problems reported with the customer intake process.

Contractor Eligibility Screening

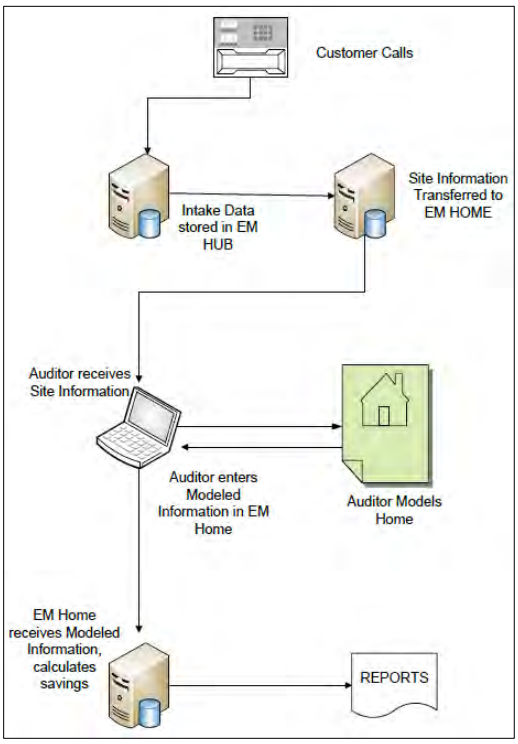
Participating contractor firms are also screened for approval to participate in the HES program. Eligibility criteria require that the contracting firm 1) demonstrate the capacity to conduct business successfully (proper business certification and licensing), 2) that participating staff undergo a background check and pass a drug test, and 3) that they must show at least BPI Building Envelope Certification for each individual employed who will be acting as the supervisor on crews performing work through the program.

Audit, Retrofit, and QA/QC Procedures

Upon customer verification of eligibility to participate in the program, the audit and measure installation processes are as follows (see Figure 1):

[1] Both *EnergyMeasure® Hub and EnergyMeasure® Home* are reviewed in greater detail below.

Figure 1. CSG Audit Process



Source: CSG

Site Scheduling

CSG initiates an HES project when a customer calls a dedicated CSG number to participate in the HES program, requesting a site visit. The CSG phone staff schedule a time for the audit and input customer information into *EM HUB*, including preliminary details about the house such as the year it was built, contact information, site visit scheduling, and records of how the customer learned about the program. *EM HUB* then automatically transfers applicable customer information to *EM HOME* for the in-home audit visit. Preliminary customer information is thus automatically uploaded and ready for the Energy Advisor in *EM HOME* at the time of audit.

In-home Audit

Upon arrival at the site, the auditor gathers data about the customer site using a dedicated paper-based form before entering the data into *EM HOME* on a computer in the work vehicle. In the process, auditors verify and update some of the preliminary building information that was entered into *EM HUB* during the initial customer call. During the audit, auditors record the baseline characteristics of the house such as building structure dimensions, envelope (including insulation), infiltration, HVAC equipment, appliances, lighting, and water fixtures. Over 1,000 data points are available for manipulation through *EM HOME.*

EM HOME attempts to simplify the audit process by providing intelligent default values for the

home based on the age of the building and other key data as it is entered. The default values must be "clicked through" to actively accept them to prevent abuse of the default value option. CSG trains Energy Advisors to override the default values with field-specified values whenever possible. All data entered into the system is validated and error messages and clearly visible alerts are used to notify the user of outstanding data entry issues.

Calculation of Savings, Recommendation of Measures, and Installation

After the auditor enters data into *EM HOME*, the software uses proprietary algorithms to construct packages of retrofit and DI measure installations with varying levels of complexity, costs, and associated payback periods. In recommending attic insulation, for example, the software and Energy Advisor aim for a target R-value of at least 49 and determine how much additional insulation is required to meet it. Furthermore, CSG's algorithms incorporate interactive effects among various measures. As an example, efficient lighting DI measures will decrease cooling electricity use while increasing heating energy use. In the final output, the software aims to provide the customer with a package of retrofit and DI measures with maximum energy savings and reasonable payback periods.

At the end of the audit, the software automatically generates a printable report with custom measure "scenarios" with descriptions of proposed projects, costs, incentives, savings, and payback periods. The report and a proposal contract are given to the customer at the time of the audit. The Energy Advisor explains the audit report to the customer with a focus on the costs and savings involved, health and safety concerns, and non-energy benefits. The customer has 30 days to decide to implement the package, to modify it, or to decline the recommendations and proposal. Upon customer approval, CSG will provide them with an approved list of contractors to install the measures. Since customers can choose to modify the package of measures that will be installed or contractors may need to change program scope, CSG updates the *EM HOME* database after the audit if changes are requested, based on the actual installed measures performed by the contractor. Contractors can request these changes through a change order process with CSG.

Quality Control Processes

CSG conducts QA/QC inspections on Energy Advisor audit and participating contractor weatherization work. Each Home Energy audit goes through an administrative review process that reviews all assessment documentation. In addition, 15 percent of completed Energy Advisor audits are field inspected, and the first five installations for new contractors, 25 percent of the next twenty, and a random sample of 5 percent of continuing work thereafter is post-inspected. Overall, three modes of inspection are conducted on assessment work: 1) Assessment Observation ride-along (especially for newer staff); 2) Post-Assessment Inspection; and 3) Post-Installation Inspection (combining inspections of Energy Advisor assessment and contractor work). Energy Advisors that exhibit a pattern of failure on field inspections or response to customer issues are subject to corrective actions and, if the correction process fails, termination. Table 1 below lists the specific criteria that are reviewed in the assessment observations and post-assessment inspections. CSG has paper forms for inspectors to use during these assessments.

Table 1: HES Program Energy Auditor Home Energy Assessment and Post-Assessment QA/QC Procedures

Assessment Observations	Post-Assessment Inspection
Assessor appearance	Complete exterior visual inspection
Assessor professionalism	Complete interior inspection
General inspection of home	Complete basement inspection
Air sealing and insulation specific inspection	Complete building shell inspections
HVAC inspection	Complete appliance and lighting inspections
Combustion testing	Ensure all measures in report are appropriate and that none were missed
Direct installations	-
Report quality	-
Customer debrief	-
Proposal	-
Request for water data	-

Source: Navigant

The requirements for contractor post-assessment inspections are shown in Table 2:

Table 2: HES Program Contractor Post-Installation QA/QC Criteria

QA/QC Criteria Reviewed
Exterior Inspection
Interior Inspection
Combustion Safety Testing
Worst Case Setup
Interior Combustion Appliance Testing Inspection
Installation Inspection
Diagnostic Testing
Customer Service Survey
Discrepancies

Source: Navigant

Both Energy Advisors and contractors that exhibit a pattern of failure on field inspections or in their responses to customer issues are subject to corrective actions or termination from the program. During interviews, CSG noted that contractors receive mostly positive reviews from customers. The sample of contractor scorecards provided to the evaluation team by CSG confirms this. Furthermore, the QC process is clearly documented in the program tracking database, including sites that were selected for QC and the accompanying QC blower door measurement values. Furthermore, a detailed customer complaint and resolution process log is kept.

In reviewing contractor performance score cards and complaint and resolution logs in detail, Navigant found no significant outstanding issues or patterns for concern. Contractors were rated on

three criteria: Work Quality, Customer Service, and Documentation Quality. On a ten point scale, no contractor scored below a 7 in the sample of files provided to the evaluation team. Though the complaint and resolution log noted two instances of Energy Advisors forgetting to turn a customer's furnace on/off switch back on after inspection (causing participants to call out contractors for repairs), CSG took action to make Energy Advisors aware of the potential oversight and recommended a means for them to remember to turn furnaces back on.

Tracking System Review: CSG EnergyMeasure® HOME and EnergyMeasure® HUB

As discussed above, all of the current program tracking is managed by CSG's proprietary *EnergyMeasure® HUB* and *EnergyMeasure® HOME* software. *EM HUB* is a program management tool used to track customer information prior to audits, and *EM HOME* is the audit software tool used to track home characteristics and develop retrofit recommendations. The tracking system appears to adequately track program participation data to a reasonably high level of quality given the resources available to the program.

Upon request, CSG provided Navigant with a 'data dictionary' to assist in understanding the tracking data structure and contents. The tracking data is organized into four distinct levels. Together, these four levels provide the necessary information for evaluation purposes. An overview of data organization is as follows:

- Level 1 – Completed building energy audit data
- Level 2 – Summary of proposed retrofit contracts
- Level 3 – Detailed measure-level data on proposed retrofit contracts
- Level 4 – Measure-level data for all completed installations, both retrofit and direct install

The common linking variable between these levels is the 'Project ID' field. The Project ID serves as the unique identifier for each HES Program project. As an example, projects that have completed an audit with an accompanying proposed retrofit and installed measures will appear in the tracking data on Levels 1-4. Direct install and building retrofit/weatherization measures are clearly separated and receive separate line item entries in the tracking system. Navigant found the organization of the tracking system intuitive and was able to navigate the four levels with ease.

Below we discuss in detail the Retrofit and Direct Install measures tracked in the data extract.

<u>Retrofit Measures</u>

The HES program offered a variety of retrofit measures during Program Year 1 (PY 1). These measures increased the weatherization of the residence through added insulation, air and duct sealing, and attic ventilation. Upon processing data entered during the audit process, *EM HOME* provides insulation and weatherization recommendations (including depth of insulation required) that auditors incorporate into energy savings packages personalized for each residence.

EM HOME calculates energy and demand savings for retrofit measures with proprietary algorithms

based upon sound engineering principles[2] and using building data obtained during the audit process. The audit software's savings outputs for each project are provided in the tracking system for both proposed and installed measures. The tracking system also provides additional data for retrofit projects including:

- Heating and cooling system size, efficiency, and age (also included for projects that only installed DI measures)
- Pre and post R-values for proposed and recommended insulation measures
- Pre, post, and QC blower door measurement values
- Measure costs to the customer, ComEd, and Nicor. This includes audit and program fees, measure rebates, and customer costs (also included for projects that only installed DI measures)

Direct Install Measures

The HES program provided 12 direct install (DI) measures to customers during PY1. The savings for these measures are determined using deemed savings values and measure quantities, which are clearly tracked in the tracking system. Navigant will perform a literature review of technical documents for related programs to verify CSG's current deemed savings value assumptions in the final evaluation report, shown below in Table 3. CSG plans to use the latest Illinois TRM deemed value assumptions in PY2. Not included in the table below is the thermostat education measure, which does not have associated deemed savings.

[2] Based on evaluation team review of CSG provided document: *EnergyMeasure® HOME* - Algorithm Description. Algorithms and assumptions cite methods developed by ASHRAE, DOE, and other respected sources.

Table 3. CSG Deemed Savings Values for Direct Install Measures

Product	Therms	kWh
Programmable Thermostats	26	0.0
CFL's (40 Watt Equivalent)	0	29.1
CFL's (60 Watt Equivalent)	0	43.2
CFL's (75 Watt Equivalent)	0	52.5
CFL's (100 Watt Equivalent)	0	72.2
CFL's (9W Globe)	0	29.1
Water Heater Turndown	11	188.0
Water Heater Pipe Insulation (systems)	34	122.0
Low Flow Showerheads	27	693.1
Low Flow Kitchen Aerators	5	137.0
Low Flow Bathroom Aerators	5	239.6

Source: Navigant

Tracking System Data Output Findings

Navigant examined the HES tracking system data output provided by CSG for signs of systematic input error, outliers, missing values, and missing variables. After a thorough review, Navigant did not find systematic errors which would significantly affect program savings. Select observations are detailed below:

- Navigant noted one instance of an anomalous "Fkw" entry in the tracking system measure list
- There appeared to be two outlier values for the Annual Fuel Utilization Efficiency (AFUE) input – Project numbers P00000001418 and P00000001418 have recorded AFUE values of 3.1 and 2.5, respectively. All other AFUE values are between 60 and 100. Project P00000001418 installed retrofit and DI measures. P00000001579 only installed DI measures, whose savings would not be affected by an anomalous AFUE value.
- Two project entries (P00000001484 and P00000001018) have negative quantity values for proposed insulation measures.
- Some of the recommended R-values are lower than the base R-values for added insulation measures. As an example, Project P00000001177 has an 'attic floor open blow cellulose 4"' installed measure with a base R-value of 38.2 and a recommended R-value of 13.6. However, claimed kWh and therm savings values for this measure appear to be within normal ranges compared to similar projects.
- Project P00000001215 has a base R-value of 992.6 and a recommended R-value of 989.8, which appear to be outliers. However, this project does not seem to have abnormal savings values compared to similar projects.
- kW savings values are not provided for retrofit measures, only direct install measures.

Since program inception using *EM HOME*, there have been no changes in the basic algorithm approach described in the operations manual. Furthermore, there are no plans to change the underlying algorithms; however, CSG reports that it continually evaluates the software to make improvements and to fix bugs.

QA/QC Project Documentation Review

Navigant requested a sample of project documentation files in order to evaluate the accuracy of data being entered into the program tracking system and to identify whether there are any issues that could affect program savings. Navigant requested project documentation from three participant groups: participants who have received an audit and implemented recommended retrofit measures (15), participants who received an audit and only implemented direct install measures (10), and a sample of project documents for sites that have undergone the QC process implemented by CSG (25). Navigant selected the three program sample groups to ensure adequate coverage of different participation types in case there may be participant-type specific issues. The QC'd group was included and sampled most in order to identify whether there are any patterns in CSG's QC findings. The QA/QC project documents CSG provided Navigant included project work order agreements, inspection forms, combustion safety forms, building detail forms, quality control inspection forms, surveys, and additional miscellaneous documentation related to the building projects, including handwritten notes. All of this documentation was used by CSG for building assessment, data entry, work orders, contractor work, and surveys.

Upon review of the provided documentation, Navigant found that nearly all data were entered accurately from the project forms into the program tracking system. Navigant noted some minor instances of inconsistent and incorrect data entry, including fields for the number of occupants, SEER values, and QC blower door measurements. Only 4 of the projects reviewed, all from the QC sample group, showed data entry error, however, and no systematic errors were identified. Specific QA/QC activity findings are detailed below:

- Navigant notes a lack of detailed HVAC information in the project documentation. It appears that AFUE and SEER efficiency values have been defaulted for a majority of projects, without an even distribution of values among participants. Analysis shows that the assigned AFUE and SEER values are bimodal for both metrics (80 and 90 for AFUE, 11 and 13 for SEER). Navigant will follow up with CSG in the impact evaluation task to discuss this finding and possible implications for estimating program impacts.
- Navigant notes inconsistency among several project documents regarding the QC blower door measurement value. For example, Project P00000001051 (Site 1050) lists the QC blower door measurement in the tracking database as the pre-work value (2643 CFM50), while the QC Post Job Inspection Form provided lists the CFM50 value as 2986. The QC Inspection Forms sampled do not provide additional clarification or indication of remedial actions taken if the post-work and QC blower door measurement values are not in close agreement, or if the QC value is above the pre-work value for projects which have completed air sealing measures. CSG has stated that QC blower door measurement values are used for final calculation of project savings, which was a concern in Nicor's previous Rider 29 program.

Benchmarking

To conduct the best practices benchmarking assessments, we compared CSG's practices (shown as a bullet list) with the *Best Practices Self-Benchmarking Tool*[3] from the *National Energy Efficiency Best Practices Study (numbered items in italic font)*. The benchmarking categories used were Quality Control and Verification and Reporting and Tracking.

Table 4. Benchmarking Scores

Program Management: Quality Control and Verification	Score
Develop inspection and verification procedures during the program design phase	Meets best practice
Verify accuracy of rebates, coupons, invoices to ensure the reporting system is recording actual product installations by target market	Meets best practice
Provide quick and timely feedback to applicants	Meets best practice
Ensure that inspectors have adequate training in identifying and explaining reasons for failure	Meets best practice
Use the inspection and verification function as a training tool for the market, especially in market transformation programs	Meets best practice
Assess customer satisfaction with the product through evaluation	Meets best practice
Build in statistical features to the sampling protocol to allow reduction in required inspections based on observed performance and demonstrated quality work	Meets best practice
Reporting and Tracking	**Score**
Define and identify the key information needed to track and report early in the program development process	Meets best practice
Clearly articulate the data requirements to measure success	Needs some improvement
Minimize duplicative data entry by linking databases to exchange information dynamically	Meets best practice
Conduct regular checks of tracking reports to assess program performance	Meets best practice
Develop accurate algorithms and assumptions on which to base estimates of savings	Meets best practice
Use the Internet to facilitate data entry and reporting; build in real-time data validation systems that perform routine data quality functions	Meets best practice
Automate routine functions such as monthly reports	Meets best

[3] See the Best Practices Self-Benchmarking Tool developed for the Energy Efficiency Best Practices Project: http://www.eebestpractices.com/benchmarking.asp.

	practice
Build in rigorous quality control screens for data entry	Meets best practice
Carefully document the tracking system and provide manuals for all users	Meets best practice
* Scores are based on the metric definitions contained in the tool.	

Source: Navigant

Quality Control and Verification

1. *Develop inspection and verification procedures during the program design phase*
    - Meets best practice
    - CSG has clearly articulated inspection and contractor verification procedures outlined in the program operations manual. Both Energy advisors and contractor data entry into *EM HOME* and work (respectively) are reviewed, and corrective and disciplinary measures are outlined. Furthermore, contractor eligibility requirements are well developed and ensure quality and knowledgeable work standards.

2. *Verify accuracy of rebates, coupons, invoices to ensure the reporting system is recording actual product installations by target market*
    - Meets best practice
    - All project recommendations, including direct install and retrofit, are recommended upon the basis of the implementer's proprietary software; thus rebates and invoices are dependent on the accuracy of data entry and recommendations made by the software. As such, the proprietary auditing software is setup to help promote accurate data entry. When possible, the system helps guide data entry by limiting the need for avoidable data entry and selection processes depending on other data that is entered during the audit (e.g. if a home is identified as built in 1892, insulation options are modified to reflect reasonable assumptions for that build period). The software also suggests default values when possible. Furthermore, the software and interface are setup to notify auditors if necessary data is not entered before a final project recommendation report is created.

    - The software validation checks are complimented by ride-along supervision for new Energy Advisors; furthermore, subsets of all projects are selected for additional QA/QC checks to ensure audits and data entry are accurate and reasonable.

3. *Provide quick and timely feedback to applicants*
    - Meets best practice
    - The implementer's proprietary software generates a custom measure recommendation report immediately at the time of audit which the Energy Advisor explains to the customer. The report includes possible measure installations, energy and money savings potential, payback periods, and information about what projects would entail and next steps. Navigant's document review verified the thoroughness

of the information. Subsequent participant surveys during Navigant's process review of the program will gauge customer satisfaction with timeliness and quality of information provided by the program.

4. *Ensure that inspectors have adequate training in identifying and explaining reasons for failure*
    - Meets best practice
    - Energy Advisors that perform program audits are trained to properly conduct the audits and enter data in an informed manner into the auditing software. Furthermore, in order to be eligible to participate in the program, contractors are required to be Building Performance Institute (BPI) Building Envelope certified, trained, and quality control tracked by the implementer to insure that deficiencies are prevented, noted, and corrected when necessary. If a contractor is put on probation for a significant work lapse, they are required to write a summary of the issue, why it occurred, and what steps the contractor will take to prevent it in the future. The contractor's performance then continues to be reviewed to ensure full compliance with program operating rules and procedures.

5. *Use the inspection and verification function as a training tool for the market, especially in market transformation programs*
    - Meets best practice
    - Navigant was able to review QA/QC project files, issue and resolution logs, Energy Advisor and Contractor grading forms, and a sample delinquency notice letter, and finds that the inspection and verification function is clearly structured to function as a training tool for the market in this program. CSG's combination of Assessment Observation Ride-Alongs, Post-Assessment Inspections, and Post-Installation Inspections are used to train new Energy Advisors, and ensure that their work and the follow-up installation contractor work meets program requirements and standards, and that customers are satisfied. All new Energy Advisors have close oversight by a superior in their first week of work and then as needed. Furthermore, at least 15 percent of Energy Advisor and contractor work is follow-up inspected. Energy Advisors and Contractors with patterns of program failure or customer issues may have more of their work field-inspected, and corrective measures are pursued in all cases of failure.

6. *Ensure inspectors have plenty of hands-on-construction practice*
    - Meets best practice
    - Energy Advisors are required to have Building Performance Institute (BPI) certification to participate in the program to ensure a "whole house" building science approach to the program. In order to get BPI certified, people are recommended to have previous hands-on experience. Furthermore, all staff undergo training specific to the program to update their skills.

7. *Assess customer satisfaction with the product through evaluation*
    - Meets best practice
    - CSG administers a customer satisfaction survey of customers that have had an

assessment done that measure their satisfaction with the assessment and any follow up work done by participating contractors. The data is used in establishing performance score cards for individual Energy Advisors and contracting companies.

8. *Build in statistical features to the sampling protocol to allow a reduction in the number of required inspections based on observed performance & demonstrated quality of work. Use a "good" random sample.*
    - Meets best practice
    - At least 15 percent of Energy Advisor work is assessed in a post-assessment QA/QC field review. The first five installations for new contractors, 25 percent of the next twenty, and a random sample of 5 percent of continuing work thereafter is post inspected. Additional assessments are scheduled as needed based on observed performance and demonstrated quality of work.

Reporting and Tracking Benchmarking

1. *Define and identify the key information needed to track and report early in the program development process*
    - Meets best practice
    - CSG's development and use of its proprietary *EnergyMeasure® HOME* and *EnergyMeasure® HUB* software suite for the program precluded the need for a high degree of planning to ensure proper functioning of the audit software prior to the program. Furthermore, key performance indicators and other information were identified for regular reporting purposes for the client. Thus Navigant finds that key information tracking was developed early in the program process.

2. *Clearly articulate the data requirements to measure success*
    - Needs some improvement
    - CSG's operations manual outlines six key performance indicators: participation rate (jobs per assessment), CFL installs per assessment, Customer Satisfaction Response Rate, Customer Satisfaction Evaluation Score, Safety Incidents, and Responsible Auto Accidents. Navigant recommends also tracking direct install measure persistence, and the percent of recommended measures installed and/or the percent of potential recommended savings achieved by participating customers.

3. *Minimize duplicative data entry by linking databases to exchange information dynamically*
    - Meets best practice
    - CSG's *EnergyMeasure®* software suite is linked via the internet to exchange key information between the call center administrative data entry and data that is gathered on-site during the energy audit and measure installation components of the program. However, Navigant recommends researching switching from using a paper-based form during the audit that is then used to enter data into the audit software to a tablet-based system (augmented as needed with paper-based notations

and sketches). This will minimize manual data recording and an extra step in the data entry process.

4. *Conduct regular checks of tracking reports to assess program performance*
    - Meets best practice
    - CSG generates weekly and monthly reports for the client on all program related work. These reports detail mailings, sources of participation, weekly production, savings, QA/QC, scheduled pipeline events, KPI, and contractor details. Furthermore, the financial and administrative manager makes sure that time charged to the program is accurate, complete, and in accordance with the contract on a weekly basis.

5. *Develop accurate algorithms and assumptions on which to base estimates of savings*
    - Meets best practice
    - Navigant's review of the algorithm descriptions in the operations manual found them satisfactory and consistent with proper engineering principles. Further reviews will be conducted in the evaluation team's Impact Review for the final evaluation report.

6. *Use the Internet to facilitate data entry and reporting; build in real-time data validation systems that perform routine data quality functions*
    - Meets best practice
    - CSG's *EnergyMeasure®* software suite is linked via the internet to exchange key information between the call center administrative data entry in *EM HUB* and data that is gathered on-site in *EM HOME* during the energy audit and measure installation components of the program. *EM HOME* uses real-time data validation during the data entry phase of home audits to speed up data entry and to limit data entry errors.

7. *Automate routine functions such as monthly reports*
    - Meets best practice
    - CSG generates weekly and monthly reports for Nicor using data pulled from its tracking database. Data includes mailing, marketing, savings, contractor detail, QA/QC, and KPI information.

8. *Build in rigorous quality control screens for data entry*
    - Meets best practice
    - The *EM HOME* software used in the program has real-time data validation that adjusts data entry options depending on previous data points. At least 15 percent of Energy Advisor work goes through a post-assessment inspection where their data is reviewed by a supervisor and adjusted in the system for mistakes as necessary.

9. *Carefully document the tracking system and provide manuals for all users*
    - Meets best practice
    - CSG provided Navigant with a data dictionary that assisted the evaluation team in

understanding the tracking system extract from the *EM* software suite. Finally, the algorithms behind the *EM HOME* software are sufficiently explained in the tracking system for desk review purposes.

5.5 Program Theory Logic Model Review