

NEW YORK STATE ELECTRIC & GAS CORPORATION

AND

ROCHESTER GAS & ELECTRIC CORPORATION

RESIDENTIAL GAS HVAC PROGRAM EVALUATION PLAN

May 7, 2009

Residential Efficient Gas Equipment Program Evaluation Plan

1.1 Evaluation Management, Procurement and Reporting

The evaluation plans presented by the Companies have been written to conform to the requirements of the June 23rd, 2008 Order in Case 07-M-0548 “Order Establishing Energy Efficiency Portfolio Standard and Approving Programs.”

These plans also follow guidelines issued by Staff on August 7, 2008 in “Evaluation Plan Guidance for EEPS (Energy Efficiency Portfolio Standard) Program Administrators” and incorporate critical elements highlighted in the “New York Evaluation Plan Review Scoring Criteria,” also issued by Staff. The evaluation plans address the comments of, and follow guidance from, Staff and the EEPS Evaluation Advisory Group.

The Companies anticipate that their efforts in the evaluation of energy efficiency programs will continue to be informed on an on-going basis by Staff and the Evaluation Advisory Group, and by collaboration with other NY utilities implementing similar programs.

Principles underlying the Companies’ evaluation plan include:

- Document the energy savings for gas programs and the energy and demand savings for electric programs,
- Maintain the independence of evaluation from the program implementation function,
- Consider program evaluation early in the program design process to identify evaluation data collection requirements, priorities and budgets,
- Provide enhanced evaluation for programs or measures with the greatest savings, largest performance uncertainties or significant impacts on program cost,
- Use industry standard approaches and protocols, such as the International Performance Measurement and Verification Protocols (IPMVP), for transparency and reproducibility, and
- Provide ongoing, systematic feedback on program performance.

1.1.1 Management

The Companies understand the importance of and are committed to independent and transparent program evaluations. Independence is achieved through our internal structure and the use of external contractors to conduct evaluations.

To achieve independence internally the Companies have assigned full-time responsibility for evaluation of all programs to an internal Evaluation Manager. The Evaluation Manager is responsible for overseeing all evaluation activities and coordinating between external program evaluators and program implementers. The Evaluation Manager also serves as the Companies' representative on the Evaluation Advisory Group. The Evaluation Manager is in a different physical location from program implementation personnel, and interaction with implementation staff is limited to what is necessary to plan and conduct thorough evaluations. The Evaluation Manager reports to the Companies' manager of the Energy Efficiency project team.

In order to insure transparency of the evaluation process, Staff will be kept up-to-date on evaluation activities each month through the Companies' monthly scorecard reports.

1.1.2 Procurement

Both detailed evaluation planning and in-field EM&V activities will be performed by independent evaluation contractors retained through competitive RFP processes. Management and oversight of these independent evaluation contractors is the direct responsibility of the Evaluation Manager. Further review and oversight of the Companies' evaluation plans and reports is provided by the Evaluation Advisory Group and PSC staff.

KEMA was selected through a competitive RFP process to provide initial evaluation plans for the Companies' programs. KEMA's contract was extended to include the evaluation of the gas program, due to the "fast track" timeline of the program. The RFP selection of evaluation contractors to conduct evaluations of other of the Companies' programs will be completed after PSC approval of the Companies' program plans. The Companies may work with other Program Administrators, through a competitive RFP process, to select and retain a single evaluation contractor to conduct evaluations of similar programs.

The approved budget and measures contained in the Commission's April 7th Order require careful planning and execution of program evaluation. The evaluation budget, set at 5 percent of a reduced program budget, is small relative to potential evaluation needs.

1.1.3 Reporting

Data collection, tracking and reporting will be as described in the Companies' previous filings. Data will be submitted using standard naming conventions and protocols, as determined by PSC Staff and the Evaluation Advisory Group.

1.2 Program Summary – Description and Theory

This program is designed to increase the market penetration of high efficiency space heating and water heating equipment in NYSEG and RGE ('the Companies') service territories. The program provides rebates to customers for the purchase of high efficiency space and water heating equipment to reduce the higher first cost of the energy efficient equipment. To achieve this goal, customers will be eligible for rebates for equipment and measures as established in the "Order Approving 'Fast Track' Utility Administered Gas Energy Efficiency Programs with Modifications" issued on April 7th, 2009 (Table 1). Heating and plumbing contractors will be eligible for marketing materials and training to further encourage participation. To be eligible for rebates customers must purchase a central heating system or indirect water heater that meets or exceeds minimum requirements. Participants are also eligible for boiler reset controls, duct sealing and programmable thermostats. (see Table 1)

**Table 1
Gas Equipment Incentives**

Equipment	Minimum Efficiency (AFUE)	Rebate (\$)
Furnace	≥ 90	200
Furnace	≥ 92	200
Furnace with ECM	≥ 92	400
Furnace with ECM	≥ 94	600
Furnace with ECM	≥ 95	600
Water Boiler	≥ 85	500
Water Boiler	≥ 90	1,000
Steam Boiler	≥ 82	500
Boiler Reset Control*	NA	100
Indirect Water Heater **	NA	300
Programmable Thermostats**	NA	25
Duct Sealing**		600

* Installed in conjunction with a program eligible boiler.

** Installed by contractor at the time of furnace or boiler replacement. New construction is not eligible for duct sealing.

The Companies will promote the programs by using a three tiered approach. The first and second tiers will be broad based marketing concerning all NYSEG-RGE efficiency programs. The third, program specific, tier is expected to include bill inserts, direct mail campaigns, community outreach, and advertising, as well as materials for use by trade allies. Periodic trade ally meetings and training sessions will maintain awareness of the program and any future changes. Following a competitive, interview based procurement process, the Companies contracted with CSG and EFI to implement aspects of the program including: call centers, rebate fulfillment, database maintenance and marketing management.

The Companies plan to begin offering this program to customers on July 1, 2009. Evaluation reporting will be as described in Section 1.6, Table 8.

1.3 Overview of Evaluation Plan

The proposed plan includes evaluation activities to address key process and impact evaluation issues. The planned evaluation budget is \$37,278 for each utility in each year for a total of \$186,390 for the 2 ½ year period of the approved program. This represents 5 percent of total program costs.

This plan has been designed to incorporate steps to mitigate threats to data reliability. To reduce random error we plan for sufficiently large sample sizes. To reduce systematic error we will use sampling and data collection approaches to minimize non-response or non-inclusion of specific populations. All surveys and interviews will include a balanced set of questions and balanced survey wording to minimize potential bias. Careful selection of the generalized billing analysis model and model parameters will also reduce systematic error. Reports will include estimates of reliability for quantitative results. Discussion of findings will include any potential limitations or bias to the results, if we believe they exist.

The evaluation plan is based on prioritizing the evaluation needs for this program within the context of a very limited evaluation budget. It balances the need for both process and impact evaluation activities to improve program delivery and maximize savings.

The primary objective of the impact evaluation is the identification of net program impacts. To meet this objective the impact evaluation for this program will address:

- Energy savings:
 - Average use (annual full-load equivalent operating hours) of furnaces and boilers, and therm savings resulting from the program.
 - Engineering review of program savings calculations, with particular attention to duct sealing and other measures for which billing analysis does not provide sufficient estimates.
- Net savings issues
 - Free Ridership: The impact of the program and participants decision to install equipment (or obtain duct sealing) at that time and efficiency level (space and water heating equipment).
 - Spillover: The impact of the program on purchases outside the program.
 - Takeback: The impact of the program on customer actions that increase energy use.

Key *process* evaluation issues we will address are:

- Participant and contractor understanding of the program.
- Participant and contractor satisfaction with the program and key components.
- Effect of program on contractor sales of high efficiency equipment.
- Database design and implementation to meet program and evaluation needs.

Table 2 below summarizes the key evaluation activities and shows the timing of each activity.

Table 2
Gas Equipment Evaluation Activities and Timing

Evaluation Activity	Overall Purpose	Timing
Tracking database system review	Ensure appropriate data are collected and accessible for analysis	Fall, 2009
Program staff and implementation contractor interviews (~8 completes)	Understand program operations and issues	Fall, 2009
Supply chain interviews <ul style="list-style-type: none"> Participant and non-participating contractors (~ 25 completes) 	Understand pre-program markets, and initial interactions with program	Spring, 2010
Participating customer telephone surveys (~ 550 completes)	Confirm equipment installation. Explore program interactions, takeback and free ridership. Collect characteristics for use in billing analysis	Spring, 2011
Billing (consumption data) analysis combined with engineering analysis	Determine gross savings associated with high-efficiency equipment	Summer, 2011
Analysis and reporting	Estimate program net savings factors and prepare final report with all process and impact findings and program recommendations.	Fall, 2011

Table 3 below summarizes the key evaluation activities and the contribution that each activity makes to specific analyses. We provide more specific information in the impact and process evaluation sub-sections below.

Table 3
Evaluation Activities and Issues Addressed

	Effect on Market	Installation	Gross savings	Net Savings	Free ridership	Satisfaction/Awareness	Data Availability	Objectives	Processes
Participating contractor interviews (supply chain)	✓			✓	✓	✓			✓
Non-participating contractor interviews (supply chain)	✓			✓	✓	✓			
Consumption (billing) data analysis		✓	✓	✓					
Engineering review of savings estimation			✓						
Participating customer surveys		✓	✓	✓	✓	✓			✓
NYSEG/RG&E staff interviews							✓	✓	✓
Implementation staff interviews (sub-contractors)							✓	✓	✓
Tracking database review			✓				✓		

1.4 Impact evaluation

The impact analysis will determine the energy saved as a result of the program. Several of the evaluation activities will contribute to the analysis of gross and net program savings. These include the supply chain interviews, participant telephone surveys, engineering review and consumption (billing) analysis.

Supply chain interviews: We plan to conduct interviews with up to 25 participating and non-participating contractors who sell or install equipment or services offered through the Program. This would include heating contractors who install furnaces, boilers, or who conduct duct sealing on existing homes, as well as heating or plumbing contractors who install indirect water heaters. Participating contractors are defined as those who installed equipment (or conducted duct sealing) for which the program issued a rebate. Non-participating contractors are those that install equipment of the type eligible (residential furnaces or boilers) but have not installed equipment for which the program issued a rebate. The sample will be selected to include contractors of different sizes, but with disproportionately more large contractors (who represent a greater share of sales). The sample will be selected from either a utility maintained list of contractors, Dunn and Bradstreet records, or a combination of the two.

Table 4 below outlines the *impact* issues we will address with the contractor groups.

**Table 4
Supply Chain Interviews –Impact Issues Addressed**

	Participant	Non-Participant
Sales trend information		
High efficiency equipment prior to program	✓	✓
High efficiency equipment rebated through program	✓	
High efficiency equipment overall	✓	✓
Duct sealing pre and during program	✓	✓
Perception of impact on market for program equipment and measures*	✓	✓

* If aware of program and question is applicable

Participating customer telephone surveys will confirm that rebated equipment was installed, and collect information on the influence of the contractor and the program on the decision to install efficient equipment. These interviews will also collect information on any changes to heated space or water heating use (floor space heated, insulation levels, or hot water usage) in conjunction with installation of the new equipment. (see

Table 5 for a list of issues addressed in the participant surveys.) Information on sampling and survey procedures is provided in the process evaluation sub-section.

**Table 5
Participant Surveys –Process and Impact Issues Addressed**

	Impact	Process
Verification		
Equipment	✓	✓
Timing	✓	✓
Receipt of rebate		✓
Household Information		
Changes in space heating temperature as result of program rebated equipment	✓	✓
Changes in hot water temperature or usage as result of program rebated equipment	✓	✓
Other program induced changes that affect gas consumption.	✓	✓
Other EE equipment purchases or changes	✓	
Changes not induced by the program that affect gas consumption	✓	
Program Attribution		
Timing	✓	✓
Efficiency level	✓	✓
Satisfaction with program		
Processes and communication		✓
Forms and program requirements		✓
Equipment installed		✓
Timing of rebate payment		✓
Demographics		✓

* If missing in participant database

Engineering review: The engineering review will first test for compliance with the required approach, as specified in the technical manual, “New York Standard Approach for Estimating Energy Savings from Energy Efficiency Programs, Selected Residential and Small Commercial Gas Measures”, March 25, 2009. Next, the review will include some secondary research to confirm (or suggest modification) to the manual’s approach or assumptions. For furnaces (and boilers, if sufficient participation) the assumptions regarding Equivalent Full Load Hours (EFLH) will be assessed in the billing data analysis as discussed below.

Billing (consumption) data analysis: The billing data analysis will determine the gross savings associated with the installation of the high-efficiency equipment. It will include

billing and survey data for customers participating in the program through June, 2010. Including participants from this time frame will;

- capture most participants in the first year of program implementation,
- provide a minimum 12 months post installation billing data, and
- allow for final reporting within the program period.

We assume that billing data will be available for all participants. We will select a sample of participants for survey data collection. The survey sample will be stratified by utility, and may be further stratified to include a disproportionate number of participants in subgroups of interest. We will develop the final sampling strategy based on participation levels. KEMA will complete a minimum of 271 surveys per utility, or attempt a census of the population if participation levels are insufficient to obtain that number of completes. (For small populations, fewer surveys are needed to obtain the confidence level/precision of 90/10 required for this evaluation.)

The billing analysis will rely on post consumption data to estimate participant equivalent full load operating hours (EFLH). This estimate, combined with equipment size and efficiency information (from the program tracking database) provides sufficient information to do an engineering estimation of gross savings. This estimate is then combined with attribution and take-back estimates based on participant self-reports to calculate a net savings.

$$Y_{jt} = \mu_j + \tau_t + \gamma_H HDD_{jt} + \varepsilon_{jt}$$

where

Y_{jt} = therms per day for participant j during billing period t ,

μ_j = participant j constant or fixed effect (=1 if participant j and =0 otherwise);

τ_t = billing period t constant or fixed effect (=1 if billing period t and =0 otherwise);

γ_H = coefficients estimated by the regression;

HDD_{jt} = heating degree-days per day for the days included in billing period t for participant j and the weather station assigned to participant j ;

ε_{jt} = random error for participant j during billing period t .

In this model, the fixed effect term μ_j controls for characteristics that are specific to participant j across all billing periods. The fixed effect term τ_t controls for conditions affecting billing period t across all participants. The model is run multiple times using heating degree days calculated using a range of degree day bases. The model with the best fit (R-square) is used.

In this model formulation the coefficient γ_H is interpreted as the average heating usage per degree day. Normal year heating usage is calculated by applying this coefficient to degree days calculated from an accepted normal weather series and the chosen degree day base.

$$\bar{U} = \gamma_H HDD_{norm}$$

Where

\bar{U} = Average annual normal heating usage, therms / year

HDD_{norm} = Annual degree days from normal weather using chosen degree day base

Equivalent full load hours is calculated using the following equation:

$$EFLH_H = \bar{U} * \left(\frac{100,000 Btu}{1 therm} \right) * \left(\frac{AFUE_Q}{CAPY_Q} \right)$$

Where

$EFLH_H$ = equivalent full load hours for program participants;

$AFUE_Q, CAPY_Q$ = are program qualified unit efficiency (%) and capacity (Btu/hr.)

This equation provides the updated estimate of program participant EFLH for use in the program savings equation.

The billing analysis for the participants will be conducted after the second full winter of program implementation, with all program participants through June, 2010. Waiting until after the second full winter of program implementation has two benefits. First, it maximizes the overall number of participants so that there may be sufficient data to achieve a confidence interval of ± 10 percent at the 90 percent confidence level. (If there is insufficient participation to achieve this level of precision it is still important to do impact analysis at this time to assess program effectiveness.) Second, for the heating analysis it increases the number of participants for which there is at least one full heating season of post installation data.

Net-to-gross analysis. Analysis of the participant survey data will determine the fraction of participating customers who were influenced by the program to install higher efficiency equipment or have their ducts sealed and insulated. It will also identify any additional energy efficiency actions taken by participants as a result of program influence, but not

subsidized or required by the program (participant spillover). The participant survey data will determine changes in customer behavior because of the program that may reduce energy savings (takeback). Finally, the survey will determine the fraction of participating customers that implemented other energy efficiency actions unrelated to the program that would affect gas usages.

Analysis of participating supply chain actor interviews will assess the changes in equipment offered as a result of the program. This information will provide an estimate of the total effect of the program on adoption by participating customers, or its complement, free ridership. The supply chain interviews may also indicate any effect of the program on high-efficiency equipment sales to nonparticipating customers (free drivership or non-participant spillover). The final net-to-gross estimates will provide separate estimates of free ridership, and free drivership. Free-ridership and take-back estimates will be based on participant self reports, quantified and combined with the gross saving estimates for an overall realization rate. Spillover and market effects results will most likely be qualitative and very small.

Until a more accurate measure is determined through the evaluation, the Company will use a 90 percent net factor for the combined effects of freeridership and spillover. This estimate assumes that free-ridership is partially offset by program spillover effects. Thus, 90 percent of program gross savings is attributable to the program.

1.5 Process Evaluation

The process evaluation will focus on contractor and customer understanding of the program, satisfaction with the program, and program database tracking. We will address some additional process issues in staff and implementation interviews.

Several of the evaluation activities will contribute to process evaluation results. These include:

- NYSEG/RG&E program and implementation contractor staff interviews,
- tracking database review,.
- supply chain interviews, and
- participant telephone surveys.

The process evaluation report will deliver actionable recommendations for program changes that can be expected to increase the effectiveness of the program.

Utility program staff interviews. Senior staff on the evaluation team will complete in-depth interviews with utility program staff early in the program implementation. We will

interview key staff to obtain more details on program operations, as well as insight into internal communications, understanding of objectives, and alignment of individual and program goals.

Implementation contractor interviews. CSG and EFI were both hired to implement the program. Senior staff on the evaluation team will complete in-depth interviews with key program implementation staff early in the program implementation. Interviews with these contractors will address the same issues as the utility staff interviews, with more focus on processes and communication than on overall goals.

Table 6 shows the topics for discussion in these interviews. We have planned for up to eight in-depth interviews with utility and sub-contractor program staff.

**Table 6
Utility and Implementation Staff Interview Topics**

Topic	Utility	CSG & EFI
Program staffing		
Staffing level	✓	✓
Roles and responsibilities	✓	✓
Respondent background.	✓	✓
Program goals and objectives		
Communication and processes	✓	✓
Internal to organization	✓	✓
Utility to implementation contractor	✓	✓
Utility to customers and to suppliers	✓	✓
Implementation contractor to customers and to suppliers	✓	✓
Perception of program impact on market and participant decisions	✓	✓*
Perception of customer and supplier program satisfaction		✓*
Program challenges and weaknesses		✓*
Program strengths		✓*
Recommendations for program changes		✓

*Does not apply to EFI

Tracking system review. The evaluation will include an initial evaluation of the tracking system layouts and contents to assure that key information is tracked. The review will address the adequacy of the targeted data elements to support program operations and

evaluation, as well as the consistency and completeness of data entry. This review will assess and report on three essential elements of the database:

1. Are the necessary data being collected?
2. Are the data collected in a way that can be analyzed? This includes looking at the structure of the database to assure that equipment is tied to a participant and to the data to assess savings. It also includes looking at the data to make sure that units are consistent, categories are mutually exclusive, and data are limited to appropriate ranges.
3. Does the database contain the data? In other words, are the data fields populated?

Supply chain interviews will provide information on the effectiveness of program outreach to contractors. They will provide supply chain perceptions of customer responses, how supply chain actors use the program to sell higher efficiency products, and how the program has affected their markets. We plan to conduct interviews with up to 25 participating and non-participating contractors who sell or install equipment or services offered through the Program.

The evaluator will use trained energy analysts to administer the questionnaires. Trade allies are more challenging to both reach and to engage in the study, and the use of professional staff increases participation. These surveys will be structured, but are likely to contain more open-ended questions and require a bit more probing to elicit useful responses. We will limit the number of interviewers (two or fewer for any sub-group) to maintain consistency throughout.

**Table 7
Supply Chain Interviews -Process Issues Addressed**

	Participant	Non-Participant
Program awareness		
Contractor	✓	✓*
Customers	✓	✓*
Satisfaction with program		
Processes and communication	✓	✓*
Forms and program requirements	✓	✓*
Marketing/Advertising	✓	✓*
Equipment rebated	✓	✓*
Customer Satisfaction	✓	

* If aware of program and question is applicable

Participating customer telephone surveys will collect information on the customers' interactions with the program and their contractor, basic demographics, the influence of the rebate and the supplier on the decision to buy high-efficiency equipment, and satisfaction with the program. These interviews will include free-rider and participant spillover questions. We will complete a minimum of 271 surveys per utility.

The participant surveys will be administered by interviewers using computer-aided telephone interview (CATI) stations. The evaluator will manage the survey data collection procedure to assure high response rates and quality data. We anticipate the following steps:

- Customer service representatives at both utilities are made aware of the study and dates for data collection.
- CATI interviewers and supervisory staff are trained on the specific survey and questions.
- The evaluator provides the CATI interviewers a Frequently Asked Questions (FAQ) sheet that addresses common questions such as “How was I selected?” or “Will my name be used?” They are also provided a utility contact person name and number for respondents who want to verify that the study is legitimate.
- Surveys are pre-tested the week prior to full implementation. The pre-test is conducted with respondents from the sample population by the CATI interviewers and are monitored by evaluation staff. The pre-test is intended to identify any problems with the survey procedures, skip patterns or contact information.
- Numbers are tried a minimum of five times before they are dropped. The call backs occur at different times, on different days, and over a period spanning a minimum of 8 days.
- Phone calls take place in the early evening and on the weekend to maximize the chance of reaching respondents while minimizing their inconvenience. Some day time calling is included to minimize bias due to respondent availability.
- CATI lab supervisors will monitor up to 10 percent of all calls throughout the calling period.

See Table 5 above for the process issues addressed in the participant surveys.

Overlap with NYSERDA programs. NYSERDA's Home Performance with ENERGY STAR Program covers residential space and water heating equipment. This program provides loans to participants for improving the efficiency of a home. The NYSEG/RGE evaluation will clarify the overlap and complementarity of these two programs, via the program staff interviews. The evaluation will also assess any confusion among supply chain actors and consumers, via the interviews with contractors.

The final report will highlight any issues regarding overlap of programs between NYSEG / RG&E and NYSERDA.

1.6 Deliverables

We plan to complete three reports for the evaluation of the residential gas rebate program. Table 8 lists the deliverables for the evaluation and the approximate timing of their completion.

**Table 8
Evaluation Deliverables – Residential Gas Rebate Program**

	Deliverable	Timing
Staff Interviews and Database Review <ul style="list-style-type: none"> • Summary of staff interviews and key issues. • Assessment of tracking database. • Recommended actions or changes 	Memo style report	Fall, 2009
Supply chain interviews <ul style="list-style-type: none"> • Summary of findings in key topic areas. • Key program successes and issues • Recommendations for program change 	Report	Spring/Summer 2010
Final Report <ul style="list-style-type: none"> • Executive Summary • Impact results • Participant Survey Results • Summary and Recommendations • Appendices including sampling, analysis methodology, and survey instruments 	Report	January, 2012

1.7 Budget

Below is an estimated budget for completing the evaluation activities described in this plan. These are high level estimates. Many of the evaluation activities share costs so that eliminating one activity may not reduce the overall budget by the amount of that task. For example, some sampling and reporting costs are shared across activities.

Table 9
Evaluation Budget – Residential Gas Rebate Program

	Estimated Cost (\$1,000)
Planning, Management*	35
Staff Interviews	9
Database Review	17
Supply Chain Surveys	27
Participant Surveys	45
Billing Analysis and Engineering Review	53
Total	\$ 186

*Approximately 10k of this budget has been spent to-date on detailed evaluation plan development.