STATE OF NEW YORK DEPARTMENT OF PUBLIC SERVICE

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December 17, 2008

Secretary Jaclyn Brilling
N.Y.S. Public Service Commission
Three Empire State Plaza
Albany, New York 12223-1350

Re: Case 08-G-1008 - Petition of Consolidated Edison Company of New York, Inc. for Approval of an Energy Efficiency Portfolio Standard (EEPS) "Fast Track" Utility- Administered Gas Energy Efficiency Program

Dear Secretary Brilling:

On behalf of the Staff of the Department of Public Service, enclosed for filing are the original and five copies of *Staff's Comments* in the above-referenced proceeding.

Copies have been served via electronic mail to parties on the Active Party List.

Sincerely,

Anthony Belsito
Assistant Counsel

Encl.

cc: All Parties on the Active Party List

STATE OF NEW YORK
PUBLIC SERVICE COMMISSION

CASE 08-G-1008 – Petition of Consolidated Edison Company of New York, Inc. for Approval of an Energy Efficiency Portfolio Standard (EEPS) "Fast Track" Utility- Administered Gas Energy Efficiency Program

STAFF'S COMMENTS

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Dated: Albany, New York
December 17, 2008

STATE OF NEW YORK
PUBLIC SERVICE COMMISSION

CASE 08-G-1008 - Petition of Consolidated Edison Company of New York, Inc. for Approval of an Energy Efficiency Portfolio Standard (EEPS) "Fast Track" Utility- Administered Gas Energy Efficiency Program

Staff's Comments

Background

On June 23, 2008, the Public Service Commission (Commission), in Case 07-M-0548, issued an order (EEPS Order) that among other things, allowed electric utilities and certain gas utilities to submit program proposals to implement two "Fast Track" electric utility programs and one "Fast Track" gas utility program.[1] The electric Fast Track Programs consist of a Small Business Direct Installation (Small Business) program and a Residential Energy Star electric heating, ventilation and air conditioning (Residential HVAC) program. The Fast Track Gas program consists of a residential efficient gas equipment program. The EEPS order also authorized collection of specified funding amounts and provided for an expedited process for the utility programs.

The EEPS order required that the program proposals include detailed benefit/cost estimates using the Total Resource Cost methodology and that they demonstrate the occurrence of collaborative discussions between the utilities, NYSERDA, and other interested parties to establish uniformity. Although the Commission recognized that certain parameters may vary between

[1] Case 07-M-0548, Proceeding on Motion of the Commission Regarding an Energy Efficiency Portfolio Standard, Order Establishing Energy Efficiency Portfolio Standard and Approving Programs (issued June 23, 2008).

utility programs, it was particularly concerned with uniformity of eligible equipment and rebate levels.

On August 22, 2008, Consolidated Edison Company of New York Inc. (Con Ed) submitted its Fast Track proposal. Thereafter, the Department of Public Service Staff (Staff) commenced discovery concerning the Company's proposal. These comments reflect Staff's analysis of Con Ed's Gas Fast Track proposal and its responses to Staff interrogatories.

In developing its comments concerning the utility proposals, Staff evaluated ten parameters of the proposals:

1. Compliance with the EEPS order concerning budget and energy savings;
2. Compliance with the program descriptions and data contained in Appendix 2 of the EEPS order;
3. Conformity of proposed evaluation plans with the Evaluation Guidelines issued by Staff in consultation with the Evaluation Advisory Group. Here the focus is on the level of evaluation rigor (e.g., statistical reliability), comprehensiveness (e.g., process and impact evaluation, multi-year strategy) and evaluation administration (e.g. budget priorities, functional separation of program and evaluation staff);
4. Level of documentation supporting energy savings estimates by program and by measure;
5. Level of documentation provided for cost data;
6. Contractor training and program orientation plan;
7. Quality Assurance plan;
8. Marketing plan and coordination with other parties;
9. Delineation of operational coordination between utilities and NYSERDA;
10. Cost-effective shown in a benefit cost analysis incorporating methodology and input values supported by DPS Staff for accuracy and standardization/comparability across companies.

Upon evaluating each individual utility proposal and the proposals as a whole, Staff has concluded that while it

generally recommends that the Commission approve the majority of programs,[2] it also recommends specific changes to individual programs. Further, Staff recommends various minimum procedures and standards that should apply to all of the Gas Fast Track programs. Recommendations specific to Con Edison's programs are stated within the "Major Program Parameters" section. Those recommendations that apply to all Gas Fast Track programs are found in the "General Comments" section.

Staff would also like to reiterate a concern raised previously in its comments relating to the electric Fast Track programs. The utilities are requesting SBC surcharge recovery of many internal costs, in addition to many seeking recovery of service company or other affiliates' costs related to the energy efficiency programs. The utilities are seeking recovery of these internal costs under the premise that the costs are incremental to those being recovered in base rates. However, determining whether any internal costs charged to a utility's energy efficiency program are truly incremental to the base rate expense allowances, and thus recoverable through a separate SBC surcharge, is very difficult, to prove. Although Staff raises the issue here, ensuring that energy efficiency costs are not being "double counted" as part of base rates is better accomplished in utility rate cases.

Major Program Parameters

1. Compliance with the EEPS Order concerning budget and energy savings.

Staff compared Con Edison's proposed Gas Fast Track program cumulative budgets and MMBTU savings goals through 2011

[2] Because of the low TRC calculated by Staff for O&R's proposed Fast Track program, Staff cannot recommend approval of the program until O&R can demonstrate a higher likelihood that its program will be cost effective (See Case 08-G-1004, Staff Comments, filed concurrently with these comments on December 17, 2008.

with the program budgets and goals determined from the EEPS Order.[3] The results are shown in the following table:

Cumulative Budget and MBTU Savings Goals through 2011 – Gas Fast Track Program					
EEPS Order		Company Proposal		Percent Difference	
Budget	MMBTU	Budget	MMBTU	Budget	MMBTU
$13,886,207	1,050,137	$14,074,686	344,116	+1.4%	-66%

The Commission's EEPS Order listed the 2008-2011 total budget for Con Edison's Gas Fast Track program as $13,886,207. Con Edison proposes a 2009-2011 (three years) total budget of $12,998,463 for its Gas Fast Track Program, which comports to a $14,074,686 budget for 3.25 years. This budget is slightly more than 1 percent higher than the Commission target.

Con Edison proposes a total 2009-2011 annual savings of 344,463 MMBTU, which comports to a 363,701 MMBTU savings for 3.25 years. Using the information contained in "Revised Table 18", issued as part of the July 3, 2008 Errata Notice, Staff calculated an individual company program prorated savings target of 1,050,137 MMBTU -- a difference of 686,436 MMBTU -- for Con Edison's Gas Fast Track program. (See Appendix A). All of the utility proposed programs contained large discrepancies between proposed savings and those implicit in the EEPS Order.

Staff notes that Con Edison projects the same number of participants and energy savings for each year of the program. Staff believes a more realistic projection would depict an increased number of participants and associated energy savings as the program ramps up each year.

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[3] Individual program savings targets and budgets are derived from Staff's disaggregation of the information provided in Revised Table 18 issued in the July 3, 2008 Errata Notice, Appendix 1.

2. Compliance with the program descriptions and data contained in Appendix 2 of the EEPS Order.

Con Edison's Gas Fast Track program description generally comports to the EEPS Order. Con Edison proposes to combine the electric Residential HVAC and Gas Fast Track programs into one program called the "Residential HVAC Program." The Gas Fast Track portion of the program would provide incentives to customers installing new or replacement gas heating and/or gas domestic water heating systems that exceed current efficiency levels. Con Edison also proposes offering Oil-to-Gas Conversion customers (conversion customers) rebates for installing high efficiency when they convert from oil to natural gas. Staff addresses this particular proposal in detail below in the "Customer Eligibility for Incentive Payments" section of the General Comments.

Con Edison's energy efficiency staff will provide overall strategic direction and program management, and will be supported by program contractors to conduct certain delivery and administrative functions such as contractor training and development of a quality assurance program. The Company proposes that customers receive the incentives in rebate form rather than providing incentives upstream to distributors and manufacturers. Con Edison's proposed eligible equipment and corresponding rebate levels are listed below[4]:

Equipment	Minimum Efficiency	Prescriptive Rebate
Furnace (forced hot air)	≥90% AFUE	$100
Furnace (forced hot air	≥92% AFUE	$225

[4] Con Edison filed this information on November 17, 2008 to replace Table 15 (pg 36) of Con Edison's original Fast Track submission filed on August 21, 2008.

with electronically commutated motors or ECM)		
Boilers (forced hot water/steam)	≥85% AFUE	$450
Boilers (forced hot water/steam	≥90% AFUE or greater	$900
Indirect Water Heater - natural gas forced hot water boiler	ENERGY STAR rated	$150
Tankless Water Heater (with electric ignition)	≥.82 EF	$250
Solar water heating equipment	SRCC requirements	50% of installed costs after tax rebate
Programmable thermostat	ENERGY STAR	50% of installed cost
Outdoor boiler reset control	N/A	50% of installed cost
Drain water heat exchange	N/A	50% of installed cost

The proposed program does not include clothes washers but provides rebates for the purchase of Energy Star rated programmable thermostats. The EEPS Order did not require that programmable thermostats be part of the Gas Fast Track program but did state that clothes washers should be. In addition, Con Edison proposes to provide Energy Efficiency Kits to customers who participate in the Gas Fast Track Program. The kits contain a range of low-cost natural gas savings measures that can be installed by the customer (i.e., low flow showerheads, faucet aerators, window insulation kits and weather strips). The Company is unable to support its savings estimates for these kits, therefore, Staff is not in a position to recommend their inclusion in the Gas Fast Track Program.

Staff agrees with the Company that customer incentives would be a more effective approach than upstream incentives at the outset of a new residential program.

As explained in more detail in the "General Comments" section, the eligible equipment, efficiency standards and incentive levels proposed by the utilities vary greatly (See Appendix B). Generally, the utilities have not provided sufficient data or justification to support these stark incentive payment differences, nor have they offered any compelling argument that such wide variation across the State is helpful to the Commission's energy efficiency goals. Because of the potential confusion that such differences could engender among utility customers and the apparent lack a compelling argument to the contrary, Staff recommends that the Commission modify Con Edison's proposal to include eligible equipment, measure efficiency standards, and incentives levels that conform to common statewide measures until such time the Company can demonstrate any program changes are cost effective and in the interest of all ratepayers (see the Eligible Measures and Customer Incentive section of the General Comments for further details).

Staff also has concerns regarding the Company's proposal to combine the gas and electric programs into one program for marketing purposes. The concerns revolve around possible customer and trade ally confusion. Although, Staff feels that it does not have sufficient information to fully support this portion of the proposal, Staff is willing to monitor how the combined program implementation performs and, therefore, does not oppose it.

3. Conformity of proposed evaluation plans with the Evaluation Guidelines issued by Staff in consultation with the Evaluation Advisory Group.

Staff recommends implementation of a monthly "scorecard report" to provide a summary of key program

achievements (e.g., number of measures installed and customers served, dollars spent, progress toward goals). The report should be due 14 days after the conclusion of the month. The exact requirements and format of these reports should be considered by the EAG with recommendations transmitted to Staff for approval by the Director of the Office of Energy Efficiency and the Environment. Staff also recommends that, in addition to the monthly, quarterly and annually reporting, all program evaluation reports should be easily accessible to the public through the Internet and other convenient formats.

Staff recommends requiring additional detail before it fully approves the Company's evaluation plan. Specifically, Con Edison should provide additional detail on each of the plan components discussed above including the evaluation methodologies, logic model and how the administrative structure will promote a transparent and objective evaluation process.

Con Edison's filing demonstrates an overall understanding of the elements of a strong evaluation program. However, Staff lacks detailed information concerning certain aspects of the Company's evaluation plan. These details should be included in a detailed Implementation Plan submitted after the Commission has approved the Fast Track Programs.[5] The filing adheres generally to the Evaluation Guidelines and includes a good description of its program and the evaluation approach methods it will use. The Company proposes evaluating the Gas Fast Track Program together with Company's Residential ENERGY STAR HVAC program as a single residential program. Con Edison plans to submit more detailed evaluation plans upon program

[5] As explained fully in Staff's General Comments, Staff recommends that the Commission, as part of an order approving utility Gas Fast Track proposals, require each utility to submit a detailed program Implementation Plan. Many utilities have expressed an intention to provide such a plan once the program proposals have been approved.

approval.

The Company focuses on the key elements of a comprehensive evaluation plan. The process evaluation includes interviews with participants, non-participants, and key market actors. Sampling precision is set at a 90/10 confidence level. The Company will implement surveys twice over the life of the program to allow it to measure progress and make modifications to the program as necessary. Participant surveys will include free rider and spillover measurement; non-participant surveys will include a measure adoption module. Further, the Company proposes to develop a logic model but has not provided enough detail to determine whether such an approach would be effective.

Impact evaluation of the Gas Fast Track program will focus on development and analysis of the program data and will begin in the first quarter of 2009 and continue through 2011. The Company's proposal to conduct "waves" of evaluation will allow it to make mid-course corrections to programs and monitor results more closely. The Company will conduct a pre/post longitudinal analysis of actual consumption to determine energy savings and will augment that calculation with engineering-based methods. Electric and gas programs are offered under a unified framework to provide for economies of scale. The Company intends to hire an outside contractor for impact evaluation and the final methodology will be determined when the contractor is selected. Staff requires more detail on the impact methodologies, including specifics of how the Company will measure free ridership and spillover, before supporting the evaluation plan.

The Company will begin process evaluation soon after program launch in 2009 and again in 2010. This approach will allow the Company to make adjustments to its program based on evaluation results. The Company identified its sampling

approach, statistical standards, and outlined its approach to net-to-gross calculations. However, Staff requires detailed information on key research issues (e.g., potential barriers to program participation, what program processes are working and/or not working, and improvements to the process) that Con Edison expects to explore as part of its process evaluation.

Program administrators must always ensure that *administration* efforts are separate from program *evaluation* efforts. To meet this goal, the Con Edison established a new Monitoring, Verification and Evaluation (MV&E) section within its Energy Efficiency Programs Department to oversee evaluation. The manager of the MV&E section will report to the Energy Efficiency Programs' Director. The section will have a separate staff that will not work on program implementation and the MV&E staff's performance will be measured by indicators unrelated to program implementation. However, the outside evaluation contractor is expected to work closely with program implementation staff, thus the potential exists for compromised results. Further details that demonstrate how Con Edison will be able to ensure that an arms-length relation is maintained should be provided in its detailed Implementation Plan.

The Company proposes to allocate five percent of its total budget to evaluation and market research. In its response to Staff interrogatories, the company states that "the majority" of the five percent will go toward evaluation. However, Staff is concerned that the marketing activities Con Edison proposes are very ambitious and may easily consume a large portion of the evaluation budget. As part of its detailed implementation program, Con Edison should submit more details on its evaluation program budget in order to demonstrate that its marketing research efforts do not detract from its evaluation efforts. The Company should also indicate if it plans to collaborate with

other utilities in its evaluation efforts.

The Company proposes an active reporting process by planning to provide quarterly reports on program implementation that will include updates on evaluation. Additional updates will be provided in annual reports.

4. Sufficiency of documentation supporting energy savings estimates by program and by measure.

As explained in more detail in the "General Comments" section, Staff recommends using the TecMarket Manual for calculating the energy savings of each utility proposal at both program and measure level. The utilities, including Con Edison have failed to sufficiently justify their energy savings estimates to the degree needed to enable use of the estimates to measure and report program performance and savings. The TecMarket Manual will provide a well-documented and consistent set of metrics by which to calculate program savings across all of the utility programs. The manual's energy savings calculation methodology and assumptions are used in similar documentation in California and in other jurisdictions. Once New York has results from its own evaluation studies, the manual can be updated as needed.

Con Edison's filing states that energy savings and cost estimates were developed for each measure through detailed research on the proposed measures. In response to Staff's request for source documentation, Con Edison provided extensive excel files from its consultant, The Cadmus Group, Inc. Although the documentation included input files, it did not provide audit trails on formulas, or source references on how basic inputs such as savings calculations were derived. These were provided in later documentation that showed they were from obtained from secondary references.

5. Sufficiency of documentation provided relating to cost data.

Con Edison provided a modest level of detailed supporting documentation describing how each budget category amount was determined. In the files provided by the consultant, budgets were allocated across five categories - Program Planning and Administration, Program Marketing and Trade Ally, Customer Incentives, Program Implementation, and Evaluation & Market Research. However, the supporting documentation did not provide sufficient information detailing the method for determining and allocating the five category budget amounts.

6. Contractor training and program orientation plan.

Staff recommends that a more detailed contractor training and program orientation plan be submitted as part of Con Edison's detailed Implementation Plan discussed in the General Comments section.

Con Edison states that it will provide training for all relevant staff and contractors with respect to necessary business processes, administrative procedures, roles and responsibilities, quality assurance protocols, budgets and timelines. It will recruit and pre-qualify HVAC contractors to deliver high-efficiency equipment installation services. Contractors that participate will be required to complete an application and pre-screening process and will be trained in the use of industry-accepted quality installation procedures. Further, Con Edison will require that all of its approved HVAC installation contractors be trained to install equipment according to original equipment manufacturer (OEM) product guidelines. In response to a Staff interrogatory, Con Edison states that contractors will be asked to demonstrate proficiency

in these standards or will be required to participate in Company-provided training. Con Edison also states that contractor quality installation training will address the key components of proper equipment installation, including equipment sizing, airflow, and duct sealing.

In response to Staff issued interrogatories, the Company stated that intends to work with equipment manufacturers to provide hands on technical training to contractors for the installation and maintenance of high efficiency products. The Company also stated that it will require all contractors that participate in the program to be licensed to work as an HVAC contractor by the municipal authorities having jurisdiction. Con Edison further proposes to reach out to trade allies, equipment dealers, retail outlets, builder and realtor associations and other professional group with direct mail, meetings and seminars to inform them about the Company's programs and how to participate.

7. Quality Assurance plan.

Staff finds that Con Edison's approach is generally adequate. However, Staff feels that the Company should be required to submit more detail concerning how the program will handle identified installation problems. Staff recommends that a proposed quality assurance plan be included in a program Implementation Plan.

A detailed quality assurance plan was not provided in the filing. The Company did state that quality assurance for this program will include screening and pre-qualification of installation contractors and a post installation inspection of an appropriately-sized random sample of all sites.

According to Con Edison's response to a Staff interrogatory, the Company plans to use a minimum sample size of

68 to produce a 90% level of confidence and a 10% margin of error. Further, the Company states that for some measures it may use a larger sample size (i.e., if the technology is new, or if energy savings are dependent on the quality of the installation of the equipment.) Staff is concerned that while the sample size may be adequate for a total participant population perspective, it may not be able to capture poor performance by contractors which is a major objective of a quality assurance plan. Therefore, Staff finds that other approaches may also need to be utilized by the Company.

In a discovery response, the Company stated that it expects an outside contractor to conduct the inspections and that the Con Edison will ride along on a certain percentage. In addition, the Company indicated that it plans to inspect all major retrofit installations to ensure proper installation and functioning of equipment.

In response to an information request, Con Edison states that the implementation contractor will be responsible for Quality Assurance as part of terms and conditions established during contract negotiations. However, the Company will make reasonable efforts to resolve problems by working directly with the customer, the contractor, or both. Con Edison states that it may implement similar protections and oversight that it employs in the Oil-to-Gas Conversion Program.

8. Marketing plan and sufficiency of coordination with other parties.

Staff requests that a more detailed description concerning Con Edison's plans to coordinate its marketing with surrounding utilities and NYSERDA be included in the Company's Implementation Plan.

The Company's filing states that Con Edison has good

working relationships with other utilities, NYPA, the City of New York, NYSERDA, and various other stakeholders. The filing delineates a series of meetings with various parties that discuss coordination issues, including uniformity and balance among programs, eligible equipment and rebates, collaboration regarding multi-family energy efficiency initiatives, potential for joint programs, etc.

The Company intends to work with National Grid and NYSEG to integrate all energy efficiency programs and to educate customers on programs and benefits available from the various programs. Marketing materials in overlapping service territories will be designed to educate the customers on all available programs in their respective service area. In addition, qualified Con Edison vendors will be provided with the details of all programs available in a geographic area, including, NYSERDA, NYSEG and National Grid.

Con Edison will leverage its experience and existing marketing channels for program promotion. Con Edison plans to proactively market its new energy efficiency programs by leveraging existing relationships and customer data to direct target promotional materials to areas with the greatest potential for efficiency gains. Additionally, the Company is conducting a market potential study of its service territory that will enhance Con Edison's ability to tailor outreach efforts to specific geographic areas, customer classes, market sectors and individual customers.

A general marketing plan was outlined in the filing. Marketing will be approached through, print media, direct media. Internet, radio advertisements, service calls, customer newsletters, on-bill messaging, and speaking engagements. The Gas Fast Track marketing budget was allocated at 15% or, at a cost of approximately $48 per participant.

9. Delineation of operational coordination between utilities and NYSERDA.

Staff recommends that Con Edison and NYSERA continue to work on implementing a process for coordinating energy efficiency programs to ensure that customers are not receiving two rebates for the same measure, and that energy savings are not double counted. Further, Staff recommends that Con Edison describe in detail in its Implementation Plan how it will coordinate program delivery with other entities to make customers aware of all programs for which they may be eligible, and to avoid double counting of energy savings, and avoid issuing a double payment for incentives.

The Company's filing states that Con Edison has had, and maintains, a good working relationship with NYSERDA. According to Con Edison's response to a Staff interrogatory, Con Edison plans to coordinate with NYSERDA in the same manner that it does for the Targeted DSM and NYSERDA's System Wide programs. The Company states it has a process in place to coordinate participation between Con Edison and NYSERDA programs to ensure customers participate in only one of those programs. Further, the Company states that this process has worked well and it expects NYSERDA's cooperation to continue. Con Edison proposes expanding this process to include the Gas Fast Track program.

In addition, Con Edison currently operates an existing gas efficiency program which is administered by NYSERDA and funded at $14 million per year, with an additional $400,000 annually for enhanced measurement and verification.[6] NYSERDA was authorized to administer this program until September 30, 2009. Con Edison must file on or before March 2, 2009 a program plan

[6] Case 06-G-1332, Order Continuing Gas Energy Efficiency Programs, issued and effective September 18, 2008

for Commission approval to implement a comprehensive portfolio of gas energy efficiency programs for Rate year 3 (October 1, 2009 through September 30, 2010) with an annual budget of $24 million. These funds are collected through the Monthly Rate Adjustment and the funding is provided to NYSERDA through a contractual agreement.

10. Cost-effectiveness shown in a benefit cost analysis incorporating methodology and input values supported by Staff for accuracy and standardization/comparability across companies.

Staff's current estimate of the program's benefit/cost TRC ratio is 1.47. While this estimate suggests that Con Edison's program is cost-effective, the ratio is still preliminary, at least in part, because Staff has had difficulty getting sufficiently documented sources for Con Edison estimates for measure cost and measure energy savings.

In its 60 Day Filing, Con Edison claimed a TRC ratio of 1.88 for its Gas Fast Track program which Staff preliminarily adjusted down to a ratio of 1.47 by using its own newer estimates of long run avoided costs, applying the avoided costs annual instead of seasonally, and adjusting measure costs for inflation. The 1.47 TRC ratio is only a preliminary estimate because it is based on the Company's inputs on measure costs and savings, which are under review.

Con Edison proposes to offer rebates for the purchase of solar domestic hot water heaters. Using its October estimates of gas avoided costs, Staff modeled this technology individually, using all of the Company's measure inputs with no fixed administrative or marketing costs or free riders. The result was a TRC ratio of 0.34 for this measure by itself. Staff recommends consideration of dropping this measure,

possibly thereby improving the program's overall cost-effectiveness. The Company, however, may choose to provide its own benefit cost analysis in a supplemental filing to demonstrate that solar DHW is cost effective.

Con Edison estimated different avoided costs by sector and for space heating and domestic hot water heating attempting to reflect seasonal use patterns. While this may be appropriate, Staff has not generated or confirmed such distinctions and is using regional annual averages for avoided costs. Further, the Company's avoided cost estimates were based on Staff's Downstate estimates underlying the benefit cost ratio cited in the EEPS Order. The avoided cost estimates in the EEPS Order were largely based on December 2007 forecasts by the United States Department of Energy, Energy Information Administration. Staff is now applying estimates based on October 2008 forecasts and provided by the econometric consulting firm ICF to NYSERDA for the State Energy Plan process. These October 2008 avoided cost estimates are about 5% lower than those used for the EEPS Order.

Con Edison's estimates of avoided costs for space heating, however, are about 32% above Staff's October 2008 Downstate annual averages because of Con Edison's use of the seasonal adjustments. As space heating accounts for almost 83% of Con Edison's claimed gas savings, avoided costs explain most of the difference between the TRC ratios of 1.88 to 1.47.

A secondary factor is that Con Edison assumed that unit measure costs would not increase with inflation between 2009 and 2011. Staff applied the inflation assumption of 2.1% for consistency with Con Edison's nominal avoided costs streams reflecting inflation.

General Comments

1. Eligible Measures and Customer Incentives Residential HVAC Program

The EEPS Order requires utilities to collaborate with NYSERDA and other interested parties to establish uniformity in eligible measures and customer rebate amounts for the Gas Fast Track program.[7] While the utilities have stated that they did collaborate, they nevertheless proposed a wide range of eligible measures, rebate amounts, and rebate structures, as shown in Appendix B. To address this problem, Staff recommends that the same program attributes be offered by each utility statewide for the Gas Fast Track program. Although every program would be administered separately, efficiency measures and eligibility levels would be effectively the same (see table below) thereby minimizing customer and trade ally confusion. Further, Staff recommends that the rebates be a fixed dollar amount rather than being based on a percentage of the installed cost experienced by each individual program participant.

The utilities propose their own unique programs in their EEPS filings with little regard to the programs proposed by neighboring utilities with similar service demands, territories, and customer profiles. Programs vary in the type of eligible measures included, the acceptable qualifying efficiency levels for those measures, and the proposed incentive levels for each measure. Staff is concerned of the possible confusion created by such variation between service territories. Additionally, having to carry an inventory to support differing program requirements across the state is a costly for wholesale equipment distributors and manufacturers, and could possibly limit the availability of some equipment.

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[7] Case 07-M-0548, supra, Order Establishing Energy Efficiency Portfolio Standard and Approving Programs, p. 41.

Many states with leading energy efficiency programs have recognized this problem (frequently after several years of market confusion) and have directed their regulated utilities to coordinate their efforts to assure that the same, or very similar, programs are offered statewide. For example, this approach has been used in California, Connecticut and Massachusetts as well as in those states with a single statewide program operator such as Oregon, Wisconsin, and Vermont and, up until recently, New York.

Staff strongly supports the use of common efficiency measures, eligibility levels and incentives throughout the various utility programs. However, if the utilities are able to provide a compelling reason for varying any of these parameters between programs, than Staff is willing to revisit the issue.

There are several benefits to offering common energy efficiency measures across multiple service territories. First, it reduces the potential for customer and contractor confusion that can be caused by customer exposure to marketing materials from several programs or installation contractors operating in more than one utility service territory. Secondly, the use of common measures and efficiency requirements concentrates product demand for equipment manufacturers and wholesale distributors which increases the likelihood of ample available product by reducing their inventory costs. Common program requirements also make it possible to conduct joint program evaluation across multiple service territories and reduce evaluation costs.

In order to help develop such a statewide program, Staff has retained a consultant, the American Council for an Energy Efficient Economy (ACEEE), to examine the eligible measures and rebate amounts that are currently in place among successful programs around the United States and compare them

with those proposed by the utilities.[8] Staff has developed its recommendations for the Gas Fast Track program in New York using the results from ACEEE's review. These recommendations are presented in the table below.

Recommended Residential HVAC Program Measures and Customer Incentives[1]

Measure	Eligibility	Consumer Incentive	Rationales
Furnaces	AFUE ≥ 92	$200	Gas Appliance Manufacturers Assoc. data from 2000 indicate that 32% of furnaces sold in NYS were condensing, with most of these 90% efficiency. Many northern states are now beginning
	AFUE ≥ 95	$400	

[8] California Public Utilities Commission, Decision 07-10-032, October 18, 2007, Interim Opinion on Issues Relating to Future Savings Goals and Program Planning for 2009-2011 Energy Efficiency and Beyond (directing California utilities "...to prepare a single, comprehensive statewide long-term energy efficiency plan" (id. at p. 2). "Many strategies likely will lend themselves to statewide implementation approaches and program delivery, including collaboration with POUs and market stakeholders. Where possible, we encourage even wider regional implementation programs with other western states or even national joint sponsor." (id. at p. 31). "We reaffirm our support for innovative programs, program diversity and program management that takes advantage of industry best practices and economies of scale afforded by state-wide programs." (id. at 83).

California Public Utilities Commission, Decision 08-09-040 September 18, 2008, Decision Adopting the California Long-Term Energy Efficiency Strategic Plan (including a number of statewide strategies for various programs)

State of Connecticut Department of Public Utility Control (DPUC), Docket No: 03-11-01 PH2, DPUC Review of CL&P and UI Conservation and Load Management Programs, Decision July 28, 2004 at 11: "The Department believes that the programs that have been operated and marketed jointly since that time (May 10, 2000) have shown benefits to Connecticut's ratepayers and that the furtherance of the Department's policy of seamless program implementation is appropriate."

			rebates at 92% and are no longer rebating for 90% (e.g., Massachusetts). We recommend 95% as the higher tier so that utility incentives complement the $150 federal tax incentive being offered for >95% AFUE in 2009. Most of the NYS utilities propose 92%, with a few proposing a higher tier at 94 or 95%. The Staff recommended incentive level is an approximate average offered by utilities surveyed by ACEE.
	ECM	$200	Furnaces containing an ECM would receive additional incentive beyond those listed above. An ECM reduces heating season energy use by more than 50%. National Grid, Con Ed, O&R and NYSEG have proposed incentives for ECM's but these should be offered by all utilities.
Hot water boilers	AFUE ≥ 85%	$500	The lower tier is the Energy Star level, the higher tier is for a condensing unit. Most NYS utilities proposed one or both of these levels. The Staff recommended incentives are derived from ACEEE's survey of other utility programs.
	AFUE ≥ 90%	$1000	
Steam boilers	AFUE > 82 plus electronic ignition	$200	This measure was proposed by most utilities. The Staff recommended eligibility levels and incentives on based on programs offered by other Northeast utilities.
Duct and air sealing	Blower door and duct blaster assisted sealing by certified contractors.	$600	In order to qualify, both measures would need to be performed together and by a BPI certified contractor. The Staff recommended incentive level is designed to cover 60% of the cost of these measures and is consistent with other energy efficiency programs in the Northeast. To qualify for a rebate contractors performing these measures should be BPI certified or equivalent. NiMo proposes incentives for air sealing, O&R for duct sealing. Both should be offered statewide.
Boiler reset controls	Prescriptive	$100	This relatively inexpensive measure can produce a 10% increase in efficiency when installed in an older boiler.

			Eligibility is for installation of the reset controls into existing boilers only. Many new boilers already include this capability and no additional incentive would be offered in addition to those listed above. The Staff recommended incentive level is that proposed by NiMo, Keyspan and NFG.
Energy Star thermostats	Energy Star	$25	This measure is proposed by National Grid (Key Span and Niagara Mohawk), Con Edison, St. Lawrence and Corning. The Staff recommended incentive is equal to that proposed by National Grid, St. Lawrence and Corning.
Indirect water heaters	Insulated separate storage tank, attached to Energy Star boiler	$300	National Grid (Niagara Mohawk and Keyspan), Con Edison, and O&R all propose this measure which saves significant energy relative to a separate boiler and water heater. In addition to the utility incentive, if the C_{EF} (a measure of combined system efficiency) of the installed measure is at least 0.80, a $300 federal tax credit is also available through the 2006 Federal Energy Act. The Staff recommended incentive level is derived from those offered by other utilities in the region.
Instantaneous water heaters	EF $\geq$ .82 plus electronic ignition	$300	All of the utilities included this measure in their proposals. The efficiency level is the Energy Star standard. This EF for the instantaneous water heater is higher the EF for the very high efficiency water heater because the test for the instantaneous water heater tends to exaggerate the efficiency of these units. (testing is conducted with just 6 hot water draws/day and higher number of draws will reduce efficiency). The Staff recommended incentive level is an approximate average of those offered by utilities surveyed by ACEEE.. In addition to this utility incentive, there is also a $300 federal tax credit. Together, these cover the majority of incremental cost.
Very high	EF $\geq$ .80	$300	These are condensing water heaters and

efficiency water heater			have similar savings to indirect and instantaneous water heaters. EF from Energy Star. In addition to this utility incentive, there is also a $300 federal tax credit. Together, these cover majority of incremental cost.

[1] AFUE - Annualized Fuel Utilization Efficiency
ECM - Electronically Commutated Motor
EF - Energy Factor

[2] Blower Door and Duct Blaster assisting sealing are two means of identifying leakages to and from interior conditioned spaces. Qualified contractors target improvements to HVAC system performance by pressurizing or de-pressurizing an HVAC system, or the conditioned interior space, and comparing that with an ambient condition for finding leakages.

Staff generally recommends distinct efficiency-based rebates over cost-based rebates (i.e., a predetermined rebate amount for a particular level efficiency provided by the measure as opposed to a percentage of the incremental cost of installing a more efficient unit) in order to make incentives easy for consumers to understand and to scale the amount of incentives on the basis of energy efficiency performance of measures installed for mass marketed residential equipment. Staff's recommendations for specific performance-based rebate amounts however, are generally based on paying 70% of the incremental cost of installing high efficiency equipment (high enough to attract a lot of interest, but also leaving a significant share of the cost to the customer).

2. Standard Approach for Estimating Energy Savings-Technical Manual

Staff is very concerned about the great variation in energy savings estimates proposed by the utilities. In order to properly compare the various utility savings estimates to each other and to the requirements of the EEPS Order, Staff

recommends a standard approach be used to calculate performance metrics. In order to effectuate this approach, Staff asked TecMarket Works, an independent consultant providing EEPS related evaluation advisory services to Staff, to develop a technical manual illustrating standardized approaches, calculations and assumptions for program administrators to estimate Fast Track program energy savings at the measure level.

The approaches proposed in the technical manual are based primarily on engineering factors, evaluation results from similar programs and general experience. The initial draft of the technical manual covering selected residential and small commercial energy efficiency measures is attached Appendix C.

The use of the technical manual is not a substitute for the comprehensive program evaluation advocated by the Commission. A key limitation to the technical manual is that its methods for estimating efficiency savings are limited to gross energy savings and do not fully account for real world conditions (e.g., poor quality installations and human behavior). However, a standardized approach based on engineering and energy efficiency experience is the best option available at this time. Because the Fast Track programs are new, it will take time to accumulate a full range of evaluation data for each program. Program administrators have indicated that it will be at least a year before they will begin evaluations to directly verify energy saving impacts. The technical manual will provide immediate and consistent methods for estimating energy saving impacts until the calculations and assumptions can be further refined based on actual program evaluation data.

3. Procurement of Program Services and Equipment

As a method of limiting costs, Staff recommends that competitive bidding - rather than sole-source procurement -- be

required as the preferred procurement method for equipment and contracts. Staff further recommends that any proposal for sole-source procurement be submitted to and approved by the Director of the Office of Energy Efficiency and the Environment.

4. Modifications to Approved Programs

Staff recommends that there be an opportunity for Staff review and comments and in certain circumstances Commission approval before any material change is made to any approved energy efficiency program. Some of the utilities propose to be allowed to reallocate funds among program budgets and to make changes to eligible energy efficiency measures and/or customer incentives to adjust to customer responsiveness or changing market conditions during the program. The utilities propose to inform Staff of such program changes after the modifications have been made. While Staff recognizes that changes to approved programs may be justified to improve their performance, Staff would like there be an opportunity to review and comment on proposed changes for several reasons. First, program changes can create inconsistencies among the utility programs that can lead to market confusion and reduce the statewide program effectiveness. Also, it is important to maintain a balance of programs so that all customer sectors have fair opportunity to participate in energy efficiency programs. Finally, requiring review and approval of material changes will prevent utilities from favoring particular programs in a way that maximizes their potential for incentives payments but is not in the best interest of all rate payers.

Accordingly, Staff recommends that any utility proposal for changes to approved program budgets, eligible energy efficiency measures, or customer rebates should be submitted to Staff for review and comment at least 90 days before the proposed implementation date. Proposals that would

result in budget reallocations that would represent a cumulative change of 10% or more from the total approved annual budget should be submitted for Commission approval before implementation.

5. Implementation Plan

Staff recommends that once the Commission approves final program parameters, each utility be required to submit an energy efficiency program Implementation Plan that describes in detail the overall program and how it will operate. The Implementation Plan should be submitted within 60 days of Commission approval of the programs, and reflect all changes and enhancements to the program proposals that are approved by the Commission. An acceptable Implementation Plan would include the following:

- Overall program annual and cumulative budgets and energy savings goals;
- The Gas Fast Track Program shall include:
  - cumulative and annual budgets, energy savings, and customer participation goals;
  - annual budgets by spending category including descriptions of expenditures within each category (budget category definitions to be provided by Staff);
  - descriptions of roles and responsibilities of the utility and all contractors participating in the program;
  - detailed contractor training and program orientation plan;
  - target customer market and detailed marketing plan, including sample customer and trade ally outreach materials;

- training for retail partners;
- eligible measures and associated customers incentives;
- Oil-to-gas conversion program requirements as explained in Summary of Recommendations for all Gas Fast Track programs of all utilities;
- procedures for customer enrollment;
- contact information for customer inquiries and complaints;
- Quality Assurance plan;
- coordination with other New York energy efficiency programs, including plans for how the company will avoid duplication and confusion resulting from overlapping/neighboring programs, ensure no double counting of savings achieved, and ensuring that no more than one incentive payment is provided for an energy efficiency measure.

6. Evaluation, Measurement and Verification Forum (EM&V Forum)

Staff recommends that the Commission require utilities to provide a more detailed evaluation plan as part of the detailed Implementation Plan and prior to final approval of any utilities evaluation plan. Specifically, the utilities should provide additional detail on their evaluation methodologies, proposed logic models, contractor selection processes, and plans for working with other utilities and methods for collecting reliable data. Further, utilities should demonstrate the administrative structure it will implement to ensure a transparent and objective evaluation process.

7. Market Research

Staff recommends that proposals to use evaluation funding for market research be reviewed by the EAG and approved by the Director of the Office of Energy Efficiency and the Environment. Market research, including studies of energy efficiency potential, business and consumer perceptions of energy efficiency, and the market viability of new energy efficiency technologies is a valuable tool for informing the design of energy efficiency programs. The role of market research in assessing the performance of energy programs is less clear. The five percent of energy program budgets that are dedicated to evaluation are earmarked to assess program performance, document impacts, and to enhance accountability. Staff is concerned that if evaluation funds are assigned to market research, targeting program design issues, the quality of the evaluation of specific programs may suffer.

8. Reporting

Accountability is a key objective of the EEPS, making transparent and timely reporting of program progress essential. To ensure that program progress is monitored closely, Staff recommends that all program administrators be required to report program data and evaluation results on both a quarterly and annual basis. Staff further, recommends implementation of a monthly "scorecard report," prepared by all administrators, to provide the Commission and the public with a summary of key program achievements (e.g., number of measures installed and customers served, dollars spent, progress toward goals). Quarterly reports should be due no later than 45 days after the conclusion of the calendar quarter; annual reports should be due no later than 60 days after the conclusion of the calendar year; and monthly scorecard reports should be submitted within 14 days after the end of each month. The exact requirements and format

of these reports should be considered by the EAG with recommendations transmitted to Staff for approval by the Director of the Office of Energy Efficiency and the Environment.

Staff also recommends that all program evaluation reports should be easily accessible to the public through the Internet and other convenient formats.

9. Customer Eligibility for Incentive Payments

Several companies propose to include Oil-to-Gas Conversion customers (conversion customers) in their Fast Track Gas program. Staff notes that several companies also have existing Oil-to-Gas Conversion Marketing plans that provide conversion customers certain benefits without requiring that the conversion customer install higher efficiency equipment. Many conversion customers receive significant incentives/benefits from these existing Oil-to-Gas Conversion marketing plans including low-cost financing, discounted equipment and rebates. Several of the utility marketing plans are currently being funded by existing ratepayers.

Although Staff generally supports the concept of allowing conversion customers the opportunity to participate in the energy efficiency programs, it believes that safeguards must be established to prevent an inequitable amount of energy efficiency funds being spent on conversion customers and thereby, limiting opportunities for existing customers to participate in the Fast Track program.

Therefore, Staff recommends that the utilities be directed to limit or cap the participation of conversion customers as follows:

- Conversion customers should be required to install higher efficiency equipment (i.e., rated at least as Energy Star)

as a prerequisite for a conversion customer's receipt of any financial incentives or other direct benefits provided by a ratepayer funded Oil-to-Gas Marketing program;

- Incentives provided to conversion customers should not exceed 38% of the total incentive amount proposed in each Gas Fast Track program budget;
- The administrative costs associated with providing incentives to conversion customers should not exceed 38% of the total administrative costs of the Gas Fast Track program budgets (e.g., associated administration, marketing, etc.)

Further, in accordance with such limitations Staff recommends that:

- The utilities be placed under a continuing obligation to demonstrate a reasonable and appropriate allocation of incentives between existing customers and conversion customers;
- The utilities justify the reasonableness of this allocation on a going forward basis by
  - o Planning and tracking the individual program expenditures at the measure level
  - o Demonstrate that budget allocations are proportional to the potential number of customers replacing existing equipment vs. the potential number of customers converting;
- The requirements listed above be included in the companies' Implementation Plans.

Staff recognizes the potential for lost opportunities that may arise regarding conversion customers. If a conversion customer does not choose higher efficiency gas equipment at the

time of conversion, this efficiency improvement could be lost for the life of the equipment (e.g., approximately 18 to 20 years for a furnace). However, Staff has serious concerns regarding an unbalanced number of conversion customers participating in the Gas Fast Track program. First, conversion customers who receive conversion incentives, in addition to energy efficiency incentives, will collect a higher level of benefits than that available to existing natural gas customers. This appears unbalanced because the existing natural gas customers are funding both the energy efficiency programs as well as the conversion marketing programs. Further, several of the programs that propose including conversion customers inordinately target the replacement of boilers as compared to the number of participants replacing furnaces. Because energy efficient boilers are more expensive and offer approximately half of the energy savings of an energy efficient furnace, programs that focus resources on conversion customers could be less cost-effective and result in lower overall savings.

In order to illustrate Staff concerns, information from Keyspan LI's proposed Gas Fast Track Program is depicted in the table below.[9]

KEDLI -- Res'l Gas HVAC Year 2

Measures	Est'd # Program Particl pants	% of Particip ants	% of Partici pants	Est'd Annual Savings/ Participant (MMBTU)	Useful Life (Yrs)	Incre mental Cost	Incentive	% Incre mental Cost Paid	Total Incentive $ Paid	% Incentive Budget Paid for this Measure	% Incentiv Budget Paid fo this Measur
High Effic Gas Furnace (AFUE≥92%)	201	7%	17%	21.1	18	$ 654	$ 150	23%	$ 30,150	1%	7%
High Effic Gas Furnace (AFUE≥92%) w/ECM	277	10%		19.6	18	$ 679	$ 400	59%	$ 110,800	5%	
Boilers (Forced Hot Water) 85% + AFUE	360	13%	52%	8.9*	25	$ 984	$ 750	76%	$ 270,000	13%	79%
Boilers (Forced Hot Water) 90% + AFUE	1,120	39%		11.4	25	$1,310	$ 1,200	92%	$1,344,000	66%	
High Effic Gas Steam Boiler	93	3%		12.9	25	$2,186	$ 400	18%	$ 37,200	2%	
Indirect Water Heater	631	22%		7.9	20	$ 300	$ 300	100%	$ 189,300	9%	
Tankless Nat'l Gas Water Heater	165	6%		7.4	20	$ 500	$ 300	60%	$ 49,500	2%	
Total	2,847								$2,030,950	100%	

8.9 => Actual Grid Worksheet listed 11.4 here for KEDLI, but Staff corrected apparent typo to match KEDNY figure for analytical purposes*

[9] Source of information contained in this is the Excel file provided in response to DPS-54, in Case 08-G-1015 (National Grid).

Keyspan LI's proposed program appears to heavily target forced hot water boilers which provide the least amount of energy savings per heating unit installed. Staff notes that the Company proposes to pay a very high percentage of the incremental costs for these boilers -- 76%-92% in comparison with: 1) its proposed incentives for other equipment, and 2) other utilities' proposed incentives for boilers. Staff further notes that proposed incentives for boilers in year 2 comprise 79% of the incentive budget for Year 2. Moreover, Keyspan LI's proposal to pay 92% of the incremental cost of the 90%+ efficiency forced hot water boiler results in a payback period of less than one year (to the customer).

In addition, Keyspan LI has an existing Oil-to-Gas Conversion Marketing Program that offers conversion customers significant incentives including financing, discounted equipment and rebates that are funded by ratepayers. In response to a Staff request for information, Keyspan LI stated that the Company does not plan or track program expenditures at a measure level. Nor does the Company propose any limit on the number of conversion customers that may be eligible to receive rebates for installing high efficiency equipment.

Keyspan LI's Conversion Marketing Department budget is summarized in the table below.

Oil-to-Gas Conversion Marketing Program		
Customer Contributions	$0	Defined as "upcharge" – the amount the customer pays for gas heating equipment[10]
Incentive Programs (Financing Program)	$8,000	Covers the costs related to administering a financing program that the customer may participate in to finance the costs of converting their heating equipment (both equipment and installation costs)
Incentive Programs (Equipment)	$800,621	The amount that the Company pays for the equipment which is offset by the upcharge. Under the discounted equipment program, customers are able to purchase gas heating equipment (replacing non-gas heating equipment only) at a discounted price. Various gas heating equipment types are covered (e.g., steam boilers, hot water boilers, hot air furnaces – **both <u>standard</u> and high efficiency**)
Incentive Programs (Other)	$25,000	Funds rebates for customers
Rebates – A/P	$15,000	No explanation provided
Total	**$848,621**	

Further, Staff notes that conversion customers are not required to upgrade to high efficiency equipment. Plus, Keyspan LI has a large backlog of conversion customers at this time.[11] By letter dated August 28, 2008, gas utilities were asked to provide, on a monthly basis, the number of pending conversion requests. KeySpan LI indicated on September 22, 2008, that a total of 2,580 residential customers were scheduled for conversion, with another 23,396 having made inquiries but not yet scheduled for

[10] These upcharges vary based on the type of equipment that is selected. In general, the upcharge for standard efficiency equipment ranges from $399 to $899. The upcharge for high efficiency equipment ranges from $799 to $2,899.

[11] KEYSPAN LI has submitted a petition to the Commission requesting that it be allowed to accept conversion customers as participants in the Interim energy efficiency program.

conversion.

Because Keyspan LI does not propose to limit the number of conversion customers who receive energy efficiency rebates, it is possible that conversion customers could receive all of the energy efficiency rebates while existing customers (who funded both incentive programs) are left without an opportunity to participate in the Gas Fast Track program. (Staff notes that this becomes a greater issue when the Gas Fast Track Program is fully subscribed). For example, KeySpan LI projects a total of 1,951 participants in year 1 of its Fast Track program. However, as noted above, KeySpan LI has a current backlog of 2,580 conversion customers. The lost opportunity may be that of current gas customers paying the SBC, who lose the opportunity to participate in the Gas Fast Track program.

Staff developed its recommended limits, delineated above by reviewing US Census data for New York State.[12] There are approximately 3.7 million natural gas heating customers in New York State and about 2.3 million heating customers that use fuel oil. Homes heated by all other fuels, or no fuel, total approximately 1 million households. Of the households heated by either oil or natural gas, oil represents about 38% of the total. Therefore, Staff proposes that incentive payments for installation of high efficiency furnaces or boilers to customers converting from fuel oil be limited to 38% of the total budget for any utility program.

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[12] Link to source data: http://factfinder.census.gov/servlet/ADPTable?_bm=y&-geo_id=04000US36&-qr_name=ACS_2007_1YR_G00_DP4&-context=adp&-ds_name=&-tree_id=307&-_lang=en&-redoLog=false&-format=

Conclusions

Summary of Recommendations for the Con Edison Program

Staff recommends that the Commission approve Con Edison's Gas Fast Track Program with certain conditions and/or modifications.

- Con Edison's program should include the uniform eligible equipment, rebate levels and proposed estimated savings proposed by Staff on pages 22-25.
- Con Edison should provide a supplemental filing containing its own cost benefit analysis of solar domestic hot water heaters to demonstrate that solar how water heaters are cost effective.
- Energy savings estimates should be calculated using the technical manual attached as Appendix C.
- Con Edison should be required to provide a detailed Implementation Plan within 60 days of Commission Approval of the Gas Fast Track program. The plan should describe exactly how the Company proposes to implement all aspects of its Gas Fast Program including the specific information recommended below (for further details see "Implementation Plan" section of Staffs General Comments).
- Con Edison should explain in its Implementation Plan how it will ensure that joint marketing of the electric and gas HVAC programs together under one Residential HVAC Program will not cause customer and contractor confusion.
- Con Edison should provide a complete and detailed evaluation plan as part of it Implementation Plan. Specifically, the Company should provide additional detail on methodologies, logic model, and how the administrative structure will promote a transparent and objective evaluation process.

- At this time and until it can be replaced by actual program evaluation findings, the Con Edison should apply the technical manual recommended by Staff in the General Comments section for determining the amount of energy savings achieved by measure and by program.
- Con Edison, as part of its Implementation Plan should provide documentation to support the specific functions and corresponding spending in each of the five budget categories for the Residential Gas HVAC program.
- Con Edison did not file plans for any contractor program orientation. The Company should be required to file a detailed contractor training and program orientation plan as part of its Implementation Plan.
- Con Edison should submit a detailed plan for Quality Assurance as part of its Implementation Plan. The Quality Assurance Plan should include the process for remediation for the identified problems with measure installations
- Con Edison's proposed plans of the coordination of marketing plans with NYSERDA and neighboring utilities should be described in the program Implementation Plan.
- Competitive bidding should be the preferred procurement practice for all equipment purchases and service contracts The Company should be required to submit a proposal to use sole-source procurement to the Director of the Office of Energy Efficiency and the Environment for review and approval.
- Any utility proposed changes to approved program budgets, eligible energy efficiency measures, or customer rebates should be submitted to Staff for review and comments 90 days before the proposed implementation date. Proposals that would result in budget reallocations that represent a

cumulative change of 10% or more from the total approved annual budget should be submitted for Commission approval before implementation.

2008 - 2011 Gas Utility Expedited Programs

Cumulative Budgets, Participation, Annual MMBTU Savings, and B/C Ratios

Residential Efficient Gas Equipment

	note 1 and note 2 BUDGET			note 2 SAVINGS in MMBTU			note 3 B/C Ratio			note 4
	Filed	Order x 3.25 years	Filed as % of Order	Per 8/22/08 Filing	Implicit in Order	Filed as % of Order	Filed	Staff Dec 18		per Order
Central Hudson	$ 949,931	$ 999,378	95.1%	10,404	75,577	13.8%	2.16	**0.99**		3.40
Con Edison	14,074,686	13,886,207	101.4%	363,701	1,050,137	34.6%	1.88	**1.47**		3.40
Corning	487,500	483,103	100.9%	12,132	36,534	33.2%		**1.18**	1.21 sp ht only	3.40
NYSEG	3,813,521	3,390,787	112.5%	72,745	256,426	28.4%	1.77	**1.31**		3.40
Niagara Mohawk	6,368,145	6,369,386	100.0%	77,057	481,681	16.0%	1.56	**1.22**		3.40
O&R	1,357,000	1,517,812	89.4%	16,645	114,784	14.5%	1.20	**0.85**		3.40
RG&E	3,830,949	3,251,755	117.8%	72,745	245,912	29.6%	1.63	**1.31**		3.40
KEDLI	7,530,000	7,508,085	100.3%	88,451	567,795	15.6%	1.72	**1.29**		3.40
KEDNY	11,145,000	11,181,056	99.7%	120,090	845,561	14.2%	1.31	**0.99**		3.40
NFG		0								
St. Lawrence	337,240	337,240	100.0%	5,532	25,504	21.7%		**1.46**	1.49 sp ht only	3.40
Total Filings	$ 49,893,972	$ 48,924,808		839,502	3,699,912	22.7%				

Notes:

1 Commission Order: amount is for 3.25 year period 4th Quarter 2008 through 2011
Revised Table 18 - "Annual Collections" $ 15,053,787 3.25 = 48,924,808 excluding NFG

2 KEDNY and KEDLI filed budgets listed as existing Interim program budgets with Fast Track additional annual collections

3 Staff's preliminary analysis used companies' estimates of measure savings and costs.

4 Commission Order, Appendix 2, page 1 - "Residential Efficient Gas Equipment shows Projected TRC ratio of 3.4

Comparison of Residential Gas Fast Track Program Financial Incentives to Participating Customers

Program measures:	Central Hudson	Con Ed	Corning	NYSEG / RG&E	Niagara Mohawk Oct. '08 - May '09	Niagara Mohawk Oct. '08 - May '09 w/BPI	Niagara Mohawk June '09 - Dec. '11	Niagara Mohawk June '09 - Dec. '11 w/BPI	Orange & Rockland	KEDLI / KEDNY	KEDLI / KEDNY w/BPI	St. Lawrence
Furnace AFUE ≥ 90		$100	$400						$100			$400
Furnace AFUE ≥ 92	$200			$400	$400	$500	$150	$200		$150	$200	
Furnace AFUE ≥ 92 w ECM		$225			$500	$700	$400	$600	$200	$400	$600	
Furnace AFUE ≥ 94				$500								
Furnace AFUE ≥ 95	$500											
Water Boiler AFUE ≥ 85	$400	$450	$400		$750	$850	$750	$850	$500	$750	$850	$400
Water Boiler AFUE ≥ 90	$800	$900		$500	$1,200	$1,400	$1,200	$1,400		$1,200	$1,400	
Steam Boiler AFUE ≥ 82	$200				$400	$500	$400	$500		$400	$500	
Water Heating Storage tank EF≥0.62	$50											
Water Heating Storage tank EF≥0.64				$75								
Water Heating Storage tank Energy Star			$150									
Water Heating tankless EF ≥ .82	$300	$250	$400		$500	$600	$300	$400	$300	$300	$400	$500
Water Heating tankless EF ≥ .84				$600								
Indirect water heater		$150			$300	$400	$300	$400		$300	$400	
Solar assist water heating	$2,000	note										
Drain water heat exchanger		note										
Clothes washer	$75											
Boiler reset control		note			$100	$100	$100	$100		$100	$100	
Programmable Thermostats		note	$25		$25	$25	$25	$25		$25	$25	$25
Low flow shower heads	$10											
Low flow faucets	$10											
Heating system cleaning & tune-up					$50	$50	$50	$50				
Replacement Windows					$10	$10						

Note: Incentive - 50% of installed cost, solar incentive is 50% installed cost after rebates

New York Standard Approach for Estimating Energy Savings from Energy Efficiency Programs

Selected Residential & Small Commercial Gas Measures

December 17, 2008

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TECMARKET Works

Table of Contents

Introduction

This document presents the measure-specific energy savings estimation approaches to be used by organizations delivering natural gas energy efficiency programs to the citizens of New York that are funded via the Systems Benefits Charge.

This document is provided for public review and comment. Comments are requested on the recommended approaches presented in this document. This document is the first in a series of similar documents covering different measures across different market sectors. These documents will be released over the next few months to allow public comment on the recommended approaches. Once comments are received by the DPS, the recommended approaches will be revised and potentially modified to reflect the comments received. The documents will then be accumulated to a single document to present the approaches for estimating savings to be used by program planners and implementers. The approaches in these documents will become the prescribed approaches for estimating savings for the types of measures covered.

As evaluations are conducted the approaches and engineering parameters used within each approach will be revised and up-dated so that they move toward higher levels of estimation accuracy.

This first document covers a limited set of residential and small commercial measures.

Reviewers are requested to review this document and provide comments on the following components of the document.

approach. If a change is recommended please indicate what approach you would suggest, an example of that approach, with references that support the estimation approach if available.

2. Parameters used in the methods. At this time New York specific data is [illegible] relevant data that can be incorporated into the methodologies.

commercial measure, and if desired, suggest other measures that you think should be added to the group of measures for the specific market sector.

Please note that we have started with a limited set of measures and we realize that other measures need to be added. We would like to hear comments on what reviewers think those measures should be.

Net to Gross Adjustments

The savings approaches presented in this manual provide gross energy saving estimates and specify the approaches for obtaining those estimates. The New York Department of Public Service definition specifies that savings projections used for predicting energy savings will be net savings. To arrive at net savings the gross estimates presented in this manual must be adjusted to account for freeriders and spillover. Freerider adjustments act to erode the gross savings estimate by subtracting out the savings that would have occurred without the program's incentive or influence. Spillover adjustments act to increase savings by counting the additional savings that occur as a result of two possible conditions. First, participants can replicate that same action (participant spillover) outside of the program participation process providing additional savings. Second, the program can influence the way non-participants make energy saving decisions that result in additional savings not associated with a specific participation event. Together, the subtraction of savings for freeriders, plus the addition of savings for spillover tend to offset each other to a significant degree. As a result, for the purposes of estimating program impacts, the savings estimates presented in this manual, or the savings produced using the calculation approaches described in this manual, must be multiplied by 0.90 to arrive at an estimated net energy savings for each measure.

As program evaluations are completed this factor will be adjusted up or down as appropriate by program, for each measure included in this manual. Over time the adjustment factor will evolve to be more accurate and will be focused on specific types of programs and delivery approaches. However, at the current time, to standardize the net

Single Family Residential Measures

CLOTHES WASHERS

Measure Description

Residential clothes washers whose water is heated by natural gas, meeting the minimum qualifying efficiency standards establishes under the Energy Star Program.

Savings Estimation Approach[1]

A description of how to calculate lifetime savings using these data is presented in the lifetime savings section below.

Annual Energy Savings

The table below shows, for new clothes washer units and for early retirement units, the savings in natural gas resulting from the installation of energy efficient clothes washers that meet Energy Star and CEE Tier 3 standards, in comparison to a minimum federal standard clothes washer. The gas savings are the associated with the gas-fired hot water heater which is needed less to heat the efficiency clothes washer than the standard unit. The more efficient clothes washer also yields reduced use of electricity and water in the clothes washer itself, and these too are in the table below. The savings presented are taken directly from the CL&P and UI document noted above, some of which are derived directly from the EPA savings calculator[2]. The number of wash cycles per year is 392, and is used to interpolate the results from the EPA savings calculator to derive the Energy Star unit savings.

Table 1 – Annual Energy and Resource Savings

Clothes Washer Specifications[3]		Savings from Hot Water Heater	Savings from Clothes Washer	
	MEF	Natural Gas (Ccf)	Electric (kWh)	Water (Gallons)
Base Line	1.0	-	-	-
Energy Star	1.72	2.16	15	6,993
CEE Tier 3	2.0	2.52	17	8,157
Early Retirement				
Energy Star	1.72	9.36	50	9,932

Lifetime Energy Savings

[1] This methodology is derived from CL&P and UI Program Savings Documentation for 2008 Program Year, pp. 155-156.
[2] See http://www.energystar.gov/ia/partners/manuf_res/downloads/2007CW_SavingsCalculator.pdf
[3] See http://www.cee1.org/resid/seha/rwsh/reswash_specs.pdf

Lifetime savings are shown in Table 2. For a new clothes washer (not replacing an existing operating unit), the measure life is 14 years, reported in the CL&P and UI document and in other sources.[4] Lifetime natural gas, electricity, and water savings are the product of the savings shown in the upper portion of Table 1 and the measure life, 14 years.

For early retirement of operating but older units, the measure life of the new clothes washer remains 14 years. However, the savings for the first four years are calculated based against the resource use of the old, replaced washer (under the assumption that the old washer would have been used another 4 years) and for the remaining 10 years the savings are calculated against the resource use of the federal standard clothes washer.

Table 2 - Lifetime Energy and Resource Savings

Clothes Washers Specifications		Savings from Hot Water Heater	Savings from Clothes Washer	
	MEF	Natural Gas (Ccf)	Electric (kWh)	Water (Gallons)
Savings - New Units				
Base Line	1.26	0	0	0
Energy Star	1.72	30.2	210	97,902
CEE Tier 3	2.2	56.4	314	103,558
Savings - Early Retirement				
Typical washer	-	0	0	0
[illegible]	[illegible]	85.2	454	115,311

Demand Savings

Gas – none

[illegible]

[illegible] coincidence factors to the energy savings.

Coincidence factors for electric use:

[illegible]

[illegible] data from the Efficiency Vermont TRM, CF = .00

[4] See, for example, the Northwest Power & Conservation Council, www.nwcouncil.org/energy/rtf/supportingdata/CRDiscountCalc.xls

[5] Technical Reference User Manual (TRM) No. 4-19, Efficiency Vermont, 9/5/2003

HIGH EFFICIENCY GAS FURNACES

Description of Measure

High efficiency condensing gas furnaces with AFUE > 90%.

Method for Calculating Energy Savings

$$\Delta therms = units \times \frac{kBtuh}{unit} \times RLF_{heat} \times \left(\frac{1}{\bar{\eta}_{base} \times \bar{\eta}_{duct,base}} - \frac{1}{\bar{\eta}_{ee} \times \bar{\eta}_{duct,ee}} \right) \times \frac{HLH}{100}$$

where:

Δtherms	= gross annual gas savings
units	= number of furnaces installed
kBtuh/unit	= the nominal rating of the heating capacity of the furnace in kBtu/hr
$\bar{\eta}$	= average heating season efficiency of furnace
$\bar{\eta}_{duct}$	= average seasonal duct system efficiency
HLH	= heating load hours
RLF_{heat}	= heating mode rated load factor
100	= conversion factor (kBtuh/therm)

The *rated load factor* is the ratio of the peak heating load imposed on the heating equipment to the total rated nominal capacity. This factor [illegible] the furnace.

$$RLF = \frac{peak\ heating\ load}{nameplate\ heating\ capacity}$$

[illegible] for the rated load factor is 0.8

The AFUE [illegible]

should use the manufacturers' rated AFUE until data can be developed that are more appropriate for NY climates.

The *duct system efficiency* accounts for losses from duct systems due to leakage and inadequate insulation. See section on duct leakage sealing and insulation for more information.

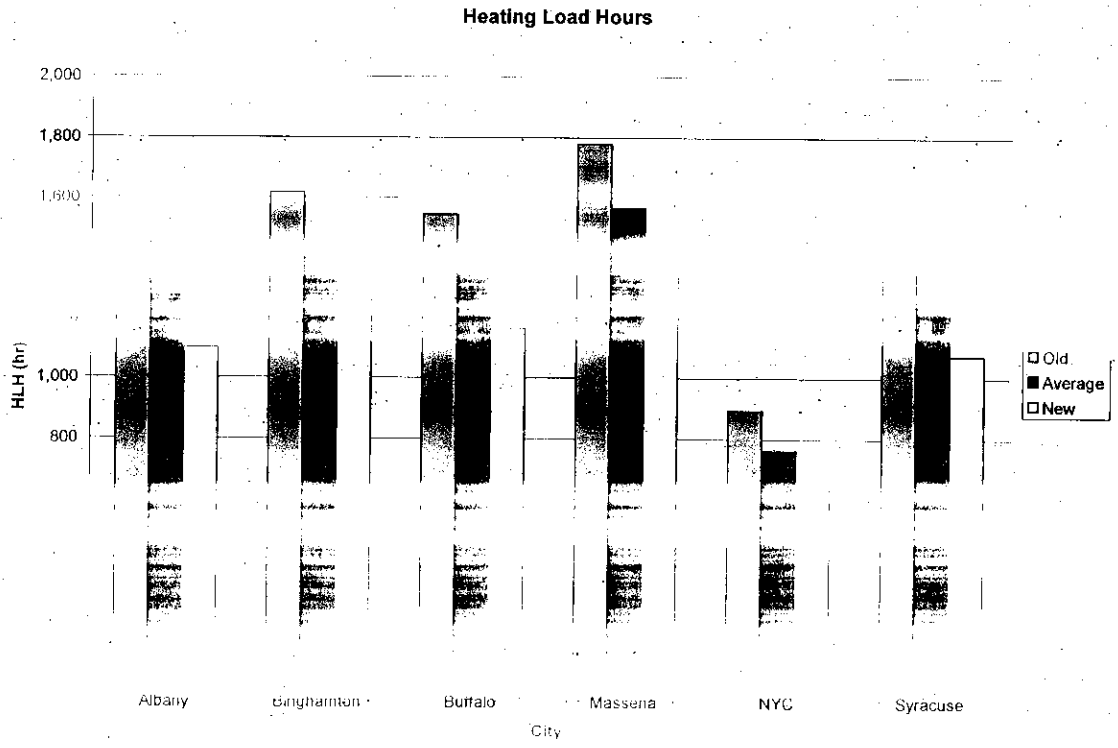
Heating load hours are defined as the ratio of the annual building heating load to the peak building heating load:

$$HLH = \frac{\text{Annual Heating Load (Btu)}}{\text{Peak Heating Load (Btu/hr)}}$$

Heating load hours for residential buildings were calculated from a DOE-2.2 simulation of prototypical residential buildings. The prototype building characteristics are described in Appendix A. The HLH for three building vintages and six different cities in NY are shown below:

City	Old	Average	New
Albany	1,450	1,275	1,100
Binghamton	1,618	1,410	1,261
Buffalo	1,544	1,354	1,166
Massena	1,780	1,566	1,414
NYC	893	763	635
Syracuse	1,436	1,265	1,075

These data are also shown in the following Figure:



Baseline Efficiencies from which savings are calculated

New construction and replacement baseline minimum AFUE for new gas furnaces per NAECA is 78%. Common practice generally leads code, but there are no New York specific baseline data on baseline furnace efficiency available at this time.

Compliance Efficiency from which incentives are calculated

ACEEE recommends two tiers: > 92% and > 95% AFUE

Operating Hours

Heating load hours calculated from building energy simulation models described in Appendix A and summarized above.

Incremental Cost

Non-Gas Benefits - Annual Electric Savings

EC motors included with high efficiency gas furnaces may provide electricity savings benefits. However, studies in Wisconsin indicate that homeowners are more likely to operate their furnace fans continuously after installing a furnace with an EC motor, potentially reducing or eliminating these savings.

Notes & References

1. Typical value for rated load factor (RLF) taken from Engineering Methods for Estimating the Impacts of Demand-Side Management Programs. Volume 2: Fundamental Equations for Residential and Commercial End-Uses. TR-100984S Vol 2. Electric Power Research Institute, Palo Alto, CA August, 1993.
2. [illegible] Seol. "Variable Speed Furnace Fan Time of Use: Wisconsin Perspective." Novem[illegible] December 2004. Energy Center of Wisconsin. Madison, WI. *www.ecw.org/download.php?producturl=/prod/articles/art1_furn.pdf*

Revision Number
0

DUCT INSULATION AND LEAKAGE SEALING

Description of Measure

Improvements to duct systems made in conjunction with high efficiency furnace installation.

Method for Calculating Energy Savings

$$\Delta\text{therms} = \text{units} \times \frac{\text{kBtuh}}{\text{unit}} \times \text{RLF}_{\text{heat}} \times \left(\frac{1}{\bar{\eta}_{base} \times \bar{\eta}_{duct,base}} - \frac{1}{\bar{\eta}_{ee} \times \bar{\eta}_{duct,ee}} \right) \times \frac{\text{HLH}}{100}$$

where:

Δtherms	= gross annual gas savings
units	= number of furnaces installed
kBtuh/unit	= the nominal rating of the heating capacity of the furnace in kBtu/hr
$\bar{\eta}$	= average heating season efficiency of furnace
$\bar{\eta}_{duct}$	= duct system average seasonal efficiency
HLH	= heating load hours
RLF_{heat}	= heating mode rated load factor
100	= conversion factor (kBtuh/therm)

Duct system efficiencies were calculated utilizing the building energy simulation model described in Appendix A. The heating season average distribution efficiencies for duct systems located in unconditioned basements in across the six New York cities are summarized below:

Duct Leakage (Qn)	Duct Value (supply and	Albany	Binghamton	Buffalo	Syracuse	NYC	Syracuse
20%	Uninsulated	0.936	0.931	0.932	0.933	0.939	0.934
8%	R-6	0.980	0.979	0.978	0.978	0.980	0.979
15%	R-6	0.968	0.967	0.967	0.967	0.969	0.967
25%	R-6	0.953	0.952	0.952	0.951	0.954	0.951
30%	R-6	0.946	0.944	0.944	0.944	0.946	0.944

Baseline Efficiencies from which savings are calculated

The US EPA estimates total duct leakage for typical residential construction at 20% of system air flow.

Compliance Efficiency from which incentives are calculated

The Air Conditioning Contractors of America (ACCA) Quality Installation (QI) Standard recommends sealing duct systems to the following total leakage specifications:

Construction type	Duct location	Total Leakage (%)
New	Inside thermal envelope	10%
New	Outside thermal envelope	6%
Existing	All	20% or 50% reduction (which ever is greater)

Operating Hours

Heating load hours calculated from building energy simulation models described in Appendix A and summarized in previous section.

Incremental Cost

Duct sealing [illegible] conditioning systems in homes with central AC utilizing the same duct system.

Notes & References

[illegible] Estimating the Impacts of Demand-Side Management Programs. Volume 2: Fundamental Equations for Residential and Commercial End-Uses. TR-1009845 [illegible]

Quality Installation Specification. Air Conditioning Contractors of America, Arlington, VA. www.acca.org

included in ANSI/ASHRAE Standard 152 – 2004, Method of Test for Determining the Design and Seasonal Efficiencies of Residential Thermal Distribution Systems. American Society of Heating, Refrigeration and Air Conditioning Engineers, Atlanta, GA. www.ashrae.org

Revision Number

0

BOILERS

Description of Measure

High efficiency condensing and non-condensing hot water and steam boilers

Method for Calculating Energy Savings

$$\Delta\text{therms} = \text{units} \times \frac{\text{kBtuh}}{\text{unit}} \times \text{RLF}_{\text{heat}} \times \left(\frac{1}{\bar{\eta}_{base} \times \bar{\eta}_{dist,base}} - \frac{1}{\bar{\eta}_{ee} \times \bar{\eta}_{dist,ee}} \right) \times \frac{\text{HLH}}{100}$$

where:

Δtherms	= gross annual gas savings
units	= number of furnaces installed
kBtuh/unit	= the nominal rating of the heating capacity of the boiler in kBtu/hr
$\bar{\eta}$	= average heating season efficiency of boiler
$\bar{\eta}_{dist}$	= average heating season distribution system efficiency
HLH	= heating load hours
RLF_{heat}	= heating mode rated load factor
100	= conversion factor (kBtuh/therm)

The *rated load factor* is the ratio of the peak heating load in Btu/hr to the input rating of the equipment in Btu/hr rated heating capacity. This factor compensates for oversizing of the boiler.

$$\text{RLF} = \frac{peak\ heating\ load}{nameplate\ heating\ capacity}$$

Recommended value for the rated load factor is 0.8.

should use the manufacturers' rated AFUE until data can be developed that are more appropriate for NY climates.

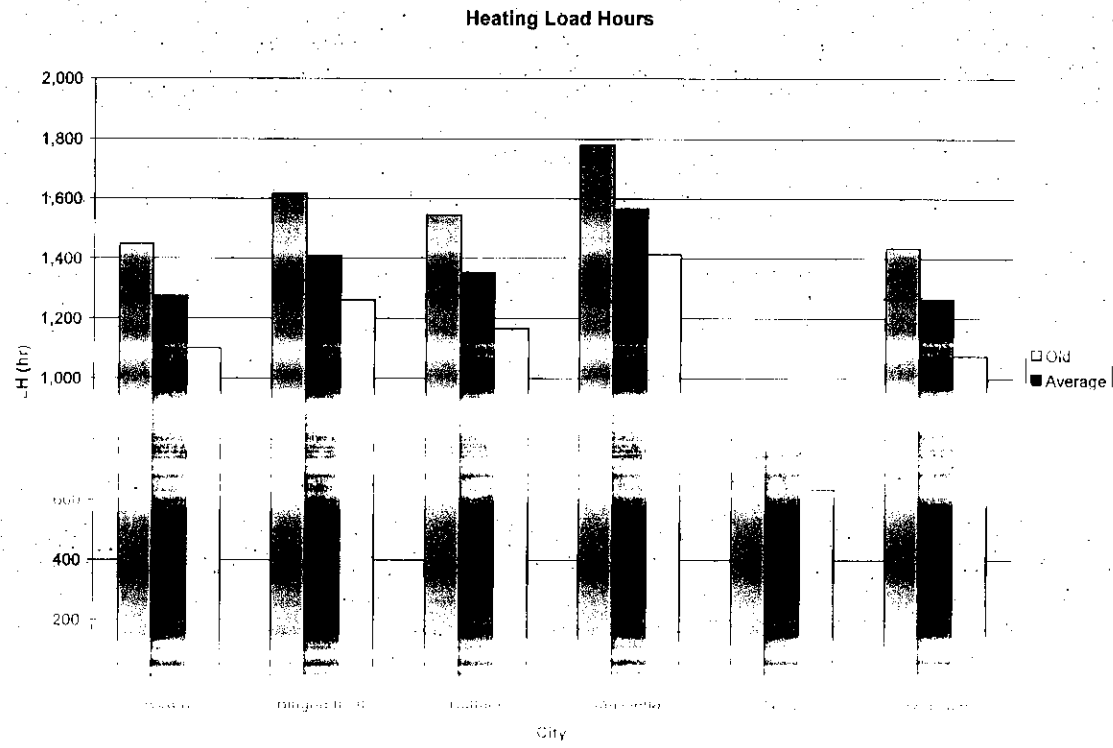
Heating load hours are defined as the ratio of the annual building heating load to the peak building heating load:

$$\text{HLH} = \frac{\text{Annual Heating Load (Btu)}}{\text{Peak Heating Load (Btu/hr)}}$$

Heating load hours for residential buildings were calculated from a DOE-2.2 simulation of prototypical residential buildings. The prototype building characteristics are described in Appendix A. The HLH for three building vintages and six different cities in NY are shown below:

City	Old	Average	New
Albany	1,450	1,275	1,100
Binghamton	1,618	1,410	1,261
Buffalo	1,544	1,354	1,166
Massena	1,780	1,566	1,414
NYC	893	763	635
Syracuse	1,436	1,265	1,075

These data are also shown in the following Figure:



Baseline Efficiencies from which savings are calculated

New construction and replace on failure: minimum AFUE for new boilers per NAECA is 80% for hot water boilers and 75% for steam boilers < 300,000 Btu/hr output.

Compliance Efficiency from which incentives are calculated

ACEEE recommends two tiers for hot water boilers: ≥85% for non-condensing applications and ≥ 90% for condensing applications. Steam boilers ≥ 82% AFUE with electronic ignition.

Operating Hours

Heating load hours calculated from building energy simulation models described in Appendix A and summarized in previous section.

Incremental Cost

Non-Gas Benefits - Annual Electric Savings

None addressed in this procedure.

Notes & References

1. Typical value for rated load factor (RLF) taken from Engineering Methods for Estimating the Impacts of Demand-Side Management Programs. Volume 2: Fundamental Equations for Residential and Commercial End-Uses. TR-100984S Vol 2. Electric Power Research Institute, Palo Alto, CA August, 1993.
2. An alternative source of distribution system efficiency calculation methods is included in ANSI/ASHRAE Standard 152 – 2004. Method of Test for Determining the Design and Seasonal Efficiencies of Residential Thermal Distribution Systems, American Society of Heating, Refrigeration and Air

[illegible]

0

BOILER RESET CONTROLS

Description of Measure

Reset of hot water setpoint in single family residential buildings with zone thermostat control. Applied to existing non-condensing boiler systems.

Method for Calculating Energy Savings

$$\Delta\text{therm} = \text{units} \times \text{kBtuh/unit} \times \text{RLF} \times (1 / \bar{\eta}) \times \text{HLH}/100 \times \text{ESF}$$

where:

Δtherm	= gross annual gas savings
units	= number of boiler reset controls installed
kBtuh/unit	= size of boiler served by each reset controller
100	= conversion factor (therm/kBtuh)
$\bar{\eta}$	= average seasonal efficiency of the boiler system without reset controls
RLF	= rated load factor
HLH	= Heating load hours
ESF	= energy savings factor computed with a building energy simulation model

The *rated load factor* is the ratio of the peak heating load imposed on the boiler equipped with the total rated heating capacity. This factor compensates for oversizing of the boiler.

$$\text{RLF} = \frac{\textit{peak heating load}}{\textit{nameplate heating capacity}}$$

Recommended value for the rated load factor is 0.8.

should use the manufacturers' rated AFUE until data can be developed that are more appropriate for NY climates.

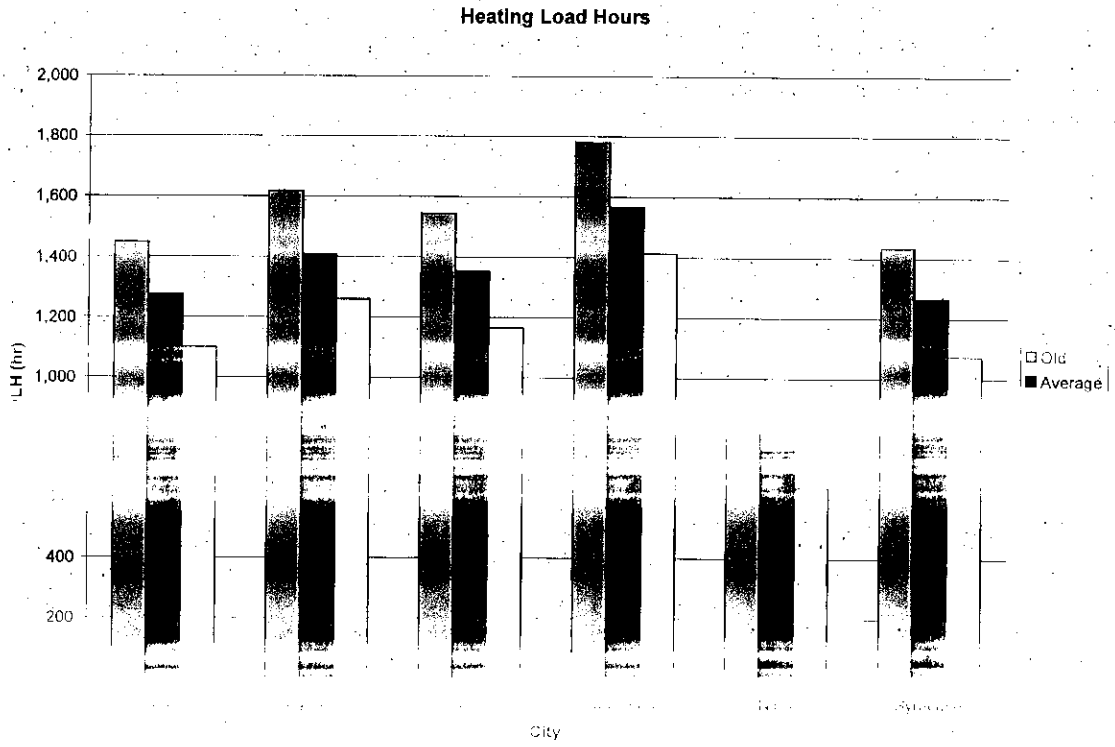
Heating load hours are defined as the ratio of the annual building heating load to the peak building heating load:

$$\text{HLH} = \frac{\textit{Annual Heating Load (Btu)}}{\textit{Peak Heating Load (Btu/hr)}}$$

Heating load hours for residential buildings were calculated from a DOE-2.2 simulation of prototypical residential buildings. The prototype building characteristics are described in Appendix A. The HLH for three building vintages and six different cities in NY are shown below:

City	Old	Average	New
Albany	1,450	1,275	1,100
Binghamton	1,618	1,410	1,261
Buffalo	1,544	1,354	1,166
Massena	1,780	1,566	1,414
NYC	893	763	635
Syracuse	1,436	1,265	1,075

These data are also shown in the following Figure:



Baseline Efficiencies from which savings are calculated

Constant hot water setpoint temperature of 180F

Compliance Efficiency from which incentives are calculated

Reset hot water temperature to 160F

Operating Hours

Heating load hours calculated from building energy simulation models described in Appendix A and summarized in previous section.

Incremental Cost

Non-Gas Benefits - Annual Electric Savings

Lower setpoint temperature may cause hot water circulator to run longer cycles. Minor impact not accounted for in this procedure.

Notes & References

Revision Number

INSTANTANEOUS WATER HEATERS

Description of Measure

Tankless gas water heaters installed in whole-house applications.

Method for Calculating Energy Savings

$$\Delta\text{therm} = units \times \frac{GPD \times 365 \times 8.3 \times \Delta T}{100{,}000} \times \left[\frac{1}{EF_{base}} - \frac{1}{EF_{ee}} \right]$$

where:

Δtherm	= gross annual gas savings
units	= number of high efficiency water heaters installed under the program
GPD	= average daily water consumption (gallons/day)
$\overline{\Delta T}$	= average difference between the cold inlet temperature and the hot water delivery temperature (°F)
EF_{base}	= baseline water heater energy factor
EF_{ee}	= baseline water heater energy factor
8.3	= conversion factor (Btu/gallon-°F)
100,000	= conversion factor (Btu/therm)

Water heating energy consumption is calculated from the hot water use and difference in the water heater delivery temperature and entering cold water temperature. If the supplemental water heater has sufficient capacity to meet the load, hot water will be delivered at the water heater setpoint temperature. Water heater setpoint for residential buildings is usually in the range of 120°F to 140°F. The water heater capacity should be

Cold water entering temperatures vary according to water source and climate. Ground

from water utilities fluctuate seasonally due to the influence of climate on reservoir or

outdoor temperature are shown below:

City	Annual average outdoor temperature (°F)
Albany	48.2
Binghamton	46.9
Buffalo	48.3

City	Annual average outdoor temperature (°F)
Massena	44.7
NYC	49.4
Syracuse	48.6

Hot water use varies by family size. Estimates of hot water use per person as a function of number of people in the home is shown below:

Number of people	Gal/person-day
2	18
3	22
4	16
5 or more	12

Baseline Efficiencies from which savings are calculated

New construction and replace on failure: Instantaneous water heater is assumed to replace a standard efficiency tank-type water heater. Energy Factors (EF) according to NAECA for storage water heaters are calculated as a function of storage volume: 0.62-0.0019V EF, where V is tank volume in gallons.

Compliance Efficiency from which incentives are calculated

ACEEE recommends EF ≥ .82 plus electronic ignition

Water heater assumed to be available at all hours

Incremental Cost

New Gas Benefits - Annual Electric Savings

None

1. Average hot water use per person taken from: Perlman, M., B.B. Mills, and B.T. Parlow: Development of Residential Hot Water Use Patterns; Ontario Hydro
2. Average annual outdoor temperature taken from the National Renewable Energy Laboratory TMY 3 long-term average weather data sets, processed with the DOE-2.2 weather data statistics package. www.nrel.gov

Revision Number

0

SOLAR HOT WATER

Description of Measure

Solar water heaters convert radiant energy from the sun to thermal energy, which is used to meet a portion of the hot water load. Active systems generally use roof mounted flat plate collectors, with water or an antifreeze solution as the collector fluid, and a pump to circulate the collector fluid through a tank-mounted heat exchanger. A separate water heater is generally used as a supplemental heat source for all systems.

Method for Calculating Energy Savings

$$\Delta\text{therm} = units \times \frac{GPD \times 365 \times 8.3 \times \overline{\Delta T}}{EF_{base} \times 100{,}000} \times ESF$$

where:

Δtherm	= gross annual gas savings
units	= number of solar water heaters installed under the program
EF_{base}	= energy factor of supplemental electric water heater
GPD	= average daily water consumption (gallons/day)
$\overline{\Delta T}$	= average difference between the cold inlet temperature and the hot water delivery temperature
ESF	= energy savings factor
100,000	= conversion factor (therm/Btu)
365	= conversion factor (days/yr)
8.3	= conversion factor (Btu/gallon-°F)

The ***energy factor*** is a measure of the overall efficiency of the supplemental water heater. The energy factor applies to storage-type water heaters up to 120 gallons, and is

The ***average daily hot water usage***, expressed in gallons per day varies by family size.

Number of people	Gal/person-day
2	18
3	22
4	16
5 or more	12

The ***energy savings factor*** (ESF) is the fraction of the annual water heating load which is met by solar energy. This factor is also called the ***solar savings fraction***. Residential active solar DHW systems are typically analyzed by a solar water heater sizing program such as the FCHART program.

The ESF for a residential solar DHW system is usually about 0.7. Solar water heater performance is influenced by climate, collector area, water heating load, collector efficiency, heat exchanger performance, pipe heat losses, storage tank heat losses, and storage tank size. The method used to calculate ESF should account for these parameters.

Baseline Efficiencies from which savings are calculated

New construction and replace on failure: Solar water heater is assumed to supplement a standard efficiency tank-type water heater. Energy Factors (EF) according to NAECA for storage water heaters are calculated as a function of storage volume: 0.62-0.0019V EF, where V is tank volume in gallons.

Compliance Efficiency from which incentives are calculated

Operating Hours

The backup water heater is assumed to be available during all hours. The solar water heater operates only when useful solar energy can be collected.

Non-Gas Benefits - Annual Electric Savings

Active solar water heaters require electricity to operate circulating pumps and controls. These impacts are not accounted for in this procedure.

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1. Average hot water use per person taken from: Perlman, M., B.E. Mills, and B.T.

2. Average annual outdoor temperature taken from the National Renewable Energy

3. Solar water heater performance can be estimated using the FCHART method: Beekman, W.A., S.A. Klein, and J.A. Duffie: Solar Heating Design by the FCHART Method. Wiley and Sons, New York, 1977.

Revision Number

0

LOW FLOW SHOWERHEADS

Measure Description

A low flow showerhead is a water saving showerhead rated at 2.5 gallons per minute (gpm) - the federal statutory standard for showerheads – or less. It reduces the amount of water flowing through the showerhead, compared with a standard showerhead, while maintaining similar shower pressure.

Savings Estimation Approach – Method and Results[6]

Annual Energy Savings

Method

The savings estimations were derived through the following steps:
1. Develop estimate of annual gallons of water saved from the measure (Table 1)
2. Calculate the amount of heat required to heat that much water (Table 2)
3. Develop an estimate of the total energy saved based on the efficiency of the hot water heater. (Table 3)

Savings

Table 1 below provides a range of baseline shower flows (the columns), related input assumptions, and the resulting water savings. Two different flows for the new showerhead are included below: 2.2 gallons per minute (gpm) and 1.5 gpm, at the lower end of available products. The duration of the shower used in the calculations is 8 minutes. This is based on reported savings in research conducted in the development of

showerheads

Table 1. Water Savings (Gallons/year)

Water Savings = ((Actual GPM - 2.2 GPM) X (minutes/shower) X (#showers/day) X (days/year))

Actual shower flow in GPM as found	3	4	5	2.5	5
[illegible]					
Duration of use (minutes)	8	8	8	8	8
No. of showers day	2	2	2	2	2

[6] This methodology is derived from CL&P and UI Program Savings Documentation for 2008 Program Year. pp. 155-156.

[7] State of Wisconsin Public Service Commission of Wisconsin Focus on Energy Evaluation ACES: Default Deemed Savings Review Final Report June 24, 2008 and Potential Water and Energy Savings from Showerheads, by Peter J. Biermayer, LBNL 58601-Revised, March 17, 2006

Table 2. Energy Savings (MMbtu/year)

Energy Savings =((water savings x (temp to shower-temp to heater) x (8.3BTU per gallon) / (1,000,000))

Gallons of water saved/year	2,920	8,760	14,600	5,840	20,440
Temperature of water to the house (degrees F)	55	55	55	55	55
Temperature of water to the shower (degrees F)	105	105	105	105	105
Change in temperature	50	50	50	50	50
Weight of water (lbs/gallon)	8.3	8.3	8.3	8.3	8.3
BTUs to heat 1 lb of water one degree F	1	1	1	1	1
Gas saved at showerhead (MMBTu/year)	1.212	3.635	6.059	2.424	8.483

Table 3. Natural Gas Savings (Mbtu/year and Therms/year)

Natural Gas Savings = = ((Savings at shower in MMbtu/y) /(0. 6)))

Gas saved at showerhead (MMBTU/year)	1.212	3.635	6.059	2.424	8.483
Estimated efficiency of gas water heater	0.6	0.6	0.6	0.6	0.6
Natural gas saved at water heater in MMBTU/yr	2.020	6.059	10.098	4.039	14.138
Natural gas saved at water heater in Therms/yr	20.20	60.59	100.98	40.39	141.38

Lifetime Energy Savings = Annual savings x measure life

The measure life of showerheads is assumed to be 10 years[8].

Table 4 – Lifetime Natural Gas Savings (Therms)

Natural gas saved at water heater in Therms/yr	20.20	60.59	100.98	40.39	141.38

Demand Savings

There are no demand savings associated with this measure.

Program Costs and Bill Savings Standardization Report Final Report February 1, 2001 (Revised as of March 5, 2001). The effective useful life (EUL) is defined as the median number of years that a measure is in place and operable. See also Measure Life Report Residential and Commercial/Industrial Lighting and HVAC Measures, prepared for

The New England State Program Working Group (SPWG) for use as an Energy Efficiency Measures/Programs

Reference Document for the ISO Forward Capacity Market (FCM) by GDS Associates, Inc., June 2007

FAUCET AERATORS

Measure Description

A faucet aerator is a water saving device that, by federal guidelines that went into effect in 1994, enables no more than 2.2 gallons per minute (gpm) to pass through the faucet. A low flow faucet aerators can reduce water flow to 1.5 gpm while maintaining appropriate water pressure and flow.

Savings Estimation Approach – Method and Results[9]

Annual Energy Savings

Method

The savings estimations were derived through the following steps:

1. Develop estimate of annual gallons of water saved from the measure (Table 1)
2. Calculate the amount of heat required to heat that much water (Table 2)
3. Develop an estimate of the total energy saved based on the efficiency of the hot water heater. (Table 3)

Savings

Table 1 below provides the baseline (standard) and low flow aerator water flows, related input assumptions, and the resulting water savings. Assumptions regarding average duration of use and number of uses per day are also presented. This is based on the CL&P and UI savings document, which itself relied on FEMP assumptions.[10]

Table 1: Water Savings Calculations

Water Savings = ((Standard – low flow aerator GPM) X (duration/use) X (#uses/day) X (days/year))

Standard aerator (GPM)	2.2
Replacement low flow aerator (GPM)	1.5
Savings in GPM	0.7
[illegible]	
[illegible]/day	3.0
Days/year	260

[9] This methodology is derived from CL&P and UI Program Savings Documentation for 2008 Program Year, pp. 157-158.

[10] Federal Energy Management Program "Domestic Water Conservation Technologies" at http://www1.eere.energy.gov/femp/pdfs/22799.pdf and other sources.

Table 2. Energy Savings (MMbtu/year)

Energy Savings =((water savings x (temp faucet-temp to heater) x (8.3BTU per gallon) / (1,000,000))

Gallons of water saved/year	2,730
Temperature of water to the house (degrees F)	55
Temperature of water at faucet (degrees F)	80
Change in temperature (degrees F)	25
Weight of water (lbs/gallon)	8.3
BTUs to heat 1 lb of water one degree F	1
Gas saved at faucet (MMBTU/year)	0.566

Table 3. Natural Gas Savings (Mbtu/year and Therms/year)

Natural Gas Savings = = ((Savings at faucet in MMbtu/y) /(0. 6)))

Gas saved at faucet (MMBTU/year)	0.566
Estimated efficiency of gas water heater	0.6
Natural gas saved at water heater in MMBTU/yr	0.944
Natural gas saved at water heater in Therms/yr	9.44

Lifetime Energy Savings = Annual savings x measure life

The measure life of faucet aerators is assumed to be 10 years[11].

Table 4 – Lifetime Natural Gas Savings (Therms)

Natural gas saved at water heater in Therms	9.44
Measure life	10
Lifetime natural gas savings (therms)	94

Demand Savings

Revision Number

[11] Based on the effective useful life of 10 years in California Joint Utility Low Income Energy Efficiency Program Costs and Bill Savings Standardization Report Final Report February 1, 2001 (Revised as of March 5, 2001). The effective useful life (EUL) is defined as the median number of years that a measure is in place and operable.

HOT WATER TANK WRAPS

Description of Measure

This section covers additional thermal insulation blankets for storage-type gas water heaters. These blankets are intended to reduce standby heat losses through the side of the water heater.

Method for Calculating Energy Savings

$$\Delta therm = units \times \frac{(UA_{base} - UA_{ee}) \times \overline{\Delta T}}{\eta_{waterheater}} \times \frac{8760}{100000}$$

where:

ΔkW	= gross coincident demand savings
ΔkWh	= gross annual energy savings
units	= number of water heaters installed under the program
UA_{base}	= overall heat transfer coefficient of base water heater (Btu/hr-°F)
UA_{ee}	= overall heat transfer coefficient of improved water heater (Btu/hr-°F)
ΔT	= temperature difference between the tank and the ambient air (°F)
CF	coincidence factor
341[illegible]	= conversion factor ([illegible])
8760	= conversion factor (hr/yr)
100000	= conversion factor (Btu/therm)
$\eta_{waterheater}$	= water heater combustion efficiency

[illegible] assuming 1 inch of fiberglass insulation on the existing water heater and an additional 2 inches of fiberglass insulation for the tank wrap. The tank wrap is assumed to cover the [illegible]

Water heater	Gas	
30	4.21	1.76
50	5.13	1.91
60	4.54	2.14
75	5.50	2.52
80+	6.28	2.64

ΔT = 140°F water setpoint temp − 65°F room temp = 75°F

The combustion efficiency of a non-condensing storage type water heater is assumed to be 70%

Baseline Efficiencies from which savings are calculated

The existing water heater is assumed to have 1 inch of fiberglass insulation as the factory standard insulation level.

Compliance Efficiency from which incentives are calculated

Operating Hours

The water heater is assumed to be available during all hours.

Incremental Cost

Non-Gas Benefits - Annual Electric Savings

Notes & References

Revision Number

0

Small Commercial Measures

HIGH EFFICIENCY FURNACES

Description of Measure

High efficiency furnace sections included in rooftop AC systems and furnaces included in split AC systems. Applications in small commercial buildings utilizing residential gas service.

Method for Calculating Energy Savings

$$\Delta\text{therms} = \text{units} \times \frac{\text{kBtuh}}{\text{unit}} \times \text{RLF}_{\text{heat}} \times \left(\frac{1}{\bar{\eta}_{base} \times \eta_{duct,base}} - \frac{1}{\bar{\eta}_{ee} \times \eta_{duct,ee}} \right) \times \frac{\text{HLH}}{100}$$

where:

Δtherms	= gross annual gas savings
units	= number of furnaces installed
kBtuh/unit	= the nominal rating of the heating capacity of the furnace in kBtu/hr
$\bar{\eta}$	= average heating season efficiency of furnace
HLH	= heating load hours
RLF_{heat}	= heating season rated load factor
100	= conversion factor (kBtuh/therm)

The ***rated load factor*** is the ratio of the peak heating load imposed on the heating equipment to the total rated heating capacity. This factor compensates for [illegible]

$$\text{RLF} = \frac{\text{peak heating load}}{\text{[illegible]}}$$

Recommended value for the rated load factor is 0.8.

city. The average efficiency in the equation above is equal to the AFUE. Programs should use the manufacturers' rated AFUE until data can be developed that are more appropriate for NY climates.

The ***duct system efficiency*** accounts for losses from duct systems due to leakage and inadequate insulation. See section on duct leakage sealing and insulation for more information.

Heating load hours are defined as the ratio of the annual building heating load to the peak building heating load:

$$HLH = \frac{Annual\ Heating\ Load\ (Btu)}{Peak\ Heating\ Load\ (Btu/hr)}$$

Heating load hours were calculated from a DOE-2.2 simulation of prototypical small commercial buildings. The prototype building characteristics are described in Appendix A. The HLH for four small commercial building types and six different cities in NY are shown below:

Building	Albany	Binghamton	Buffalo	Massena	NYC	Syracuse
Assembly	1,201	1,257	1,237	1,448	754	1,129
Fast Food Restaurant	1,782	1,907	1,864	2,112	1,016	1,689
Full Service Restaurant	1,878	2,003	1,959	2,182	1,026	1,774
Small Retail	1,230	1,257	1,275	1,417	681	1,211

Baseline Efficiencies from which savings are calculated

New construction and replace on failure: minimum AFUE for new gas furnaces is now

Compliance Efficiency from which incentives are calculated

Operating Hours

Operating hour assumptions for the prototypical buildings are described in

Incremental Cost

Notes & References

1. Typical value for rated load factor (RLF) taken from Engineering Methods for Estimating the Impacts of Demand-Side Management Programs. Volume 2:

Fundamental Equations for Residential and Commercial End-Uses. TR-100984S Vol 2. Electric Power Research Institute, Palo Alto, CA August, 1993.

Revision Number

0

DUCT INSULATION AND LEAKAGE SEALING

Description of Measure

Improvements to duct systems made in conjunction with high efficiency furnace or rooftop system installation. Duct systems are assumed to be located in unconditioned plenum space between finished ceiling and roof surface.

Method for Calculating Energy Savings

$$\Delta\text{therms} = \text{units} \times \frac{\text{kBtuh}}{\text{unit}} \times \text{RLF}_{\text{heat}} \times \left(\frac{1}{\bar{\eta}_{base} \times \eta_{duct,base}} - \frac{1}{\bar{\eta}_{ee} \times \eta_{duct,ee}} \right) \times \frac{\text{HLH}}{100}$$

where:

Δtherms	= gross annual gas savings
units	= number of furnaces installed
kBtuh/unit	= the nominal rating of the heating capacity of the furnace in kBtu/hr
$\bar{\eta}$	= average heating season efficiency of furnace
η_{duct}	= duct system efficiency
HLH	= heating load hours
[illegible]	[illegible]
[illegible]	[illegible]

Duct system efficiencies were calculated for duct systems located in unconditioned plenum space between finished ceiling and roof surface in four small commercial [illegible]

Baseline Efficiencies from which savings are calculated

Compliance Efficiency from which incentives are calculated

Operating Hours

Heating load hours calculated from building energy simulation models described in Appendix A and summarized in previous section.

Incremental Cost

Non-Gas Benefits - Annual Electric Savings

Duct leakage sealing will improve efficiency of air conditioning systems in homes with central AC utilizing the same duct system.

Notes & References

Revision Number

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BOILERS

Description of Measure

High efficiency condensing and non-condensing hot water and steam boilers in small commercial buildings utilizing residential gas service.

Method for Calculating Energy Savings

$$\Delta therms = units \times \frac{kBtuh}{unit} \times RLF_{heat} \times \left(\frac{1}{\overline{\eta}_{base} \times \overline{\eta}_{dist}} - \frac{1}{\overline{\eta}_{ee} \times \overline{\eta}_{dist}} \right) \times \frac{HLH}{100}$$

where:

Δtherms	= gross annual gas savings
units	= number of furnaces installed
kBtuh/unit	= the nominal rating of the heating capacity of the boiler in kBtu/hr
$\overline{\eta}$	= average heating season efficiency of boiler
$\overline{\eta}_{dist}$	= average heating season distribution system efficiency
HLH	= heating load hours
RLF_{heat}	= heating mode rated load factor

The *rated load factor* is the ratio of the peak heating load imposed on the heating equipment to the total rated heating capacity. This factor compensates for oversizing of the boiler.

$$RLF = \frac{peak\ heating\ load}{[illegible]}$$

Recommended value for the rated load factor is 0.8.

city. The average efficiency in the equation above is equal to the AFUE. Programs should use the manufacturers' rated AFUE until data can be developed that are more

Heating load hours are defined as the ratio of the annual building heating load to the peak building heating load:

$$HLH = \frac{Annual\ Heating\ Load\ (Btu)}{Peak\ Heating\ Load\ (Btu/hr)}$$

Heating load hours were calculated from a DOE-2.2 simulation of prototypical small commercial buildings. The prototype building characteristics are described in Appendix A. The HLH for four small commercial building types and six different cities in NY are shown below:

Building	Albany	Binghamton	Buffalo	Massena	NYC	Syracuse
Assembly	1,201	1,257	1,237	1,448	754	1,129
Fast Food Restaurant	1,782	1,907	1,864	2,112	1,016	1,689
Full Service Restaurant	1,878	2,003	1,959	2,182	1,026	1,774
Small Retail	1,230	1,257	1,275	1,417	681	1,211

Distribution efficiencies for hydronic heating systems are currently under Tecmarket Review.

Baseline Efficiencies from which savings are calculated

New construction and replace on failure: minimum AFUE for new boilers per NAECA is 80% for hot water boilers and 75% for steam boilers < 300,000 Btu/hr output.

Compliance Efficiency from which incentives are calculated

ACEEE recommends two tiers for hot water boilers: ≥85% for non-condensing applications and ≥ 90% for condensing applications. Steam boilers ≥ 82% AFUE with electronic ignition

Operating Hours

Heating load hours calculated from building energy simulation models described in Appendix A and summarized in previous section.

[illegible]

Non-Gas Benefits - Annual Electric Savings

[illegible]

0

BOILER RESET CONTROLS

Description of Measure

Reset of hot water setpoint in small commercial buildings with zone thermostat control. Applied to existing non-condensing boiler systems.

Method for Calculating Energy Savings

$\Delta therm = units \times kBtuh/unit \times RLF \times (1 / \eta) \times HLH/100 \times ESF$

where:

Δtherm	= gross annual gas savings
units	= number of boiler reset controls installed
kBtuh/unit	= size of boiler served by each reset controller
100	= conversion factor (therm/kBtuh)
$\bar{\eta}$	= average seasonal efficiency of the boiler system without reset controls
RLF	= rated load factor
HLH	= Heating load hours
ESF	= energy savings factor computed with a building energy simulation model

The *rated load factor* is the ratio of the peak heating load imposed on the heating equipment to the total rated heating capacity. The RLF is used to account for the oversizing of the boiler.

$$RLF = \frac{peak\ heating\ load}{nameplate\ \text{heating}\ capacity}$$

The *AFUE* is an estimate of the seasonal heating energy efficiency for an average US

appropriate for NY climates.

peak building heating load:

$$HLH = \frac{Annual\ \text{Heating Load (Btu)}}{Peak\ \text{Heating Load (Btu/hr)}}$$

Heating load hours were calculated from a DOE-2.2 simulation of prototypical small commercial buildings. The prototype building characteristics are described in Appendix A. The HLH for four small commercial building types and six different cities in NY are shown below:

Building	Albany	Binghamton	Buffalo	Massena	NYC	Syracuse
Assembly	1,201	1,257	1,237	1,448	754	1,129
Fast Food Restaurant	1,782	1,907	1,864	2,112	1,016	1,689
Full Service Restaurant	1,878	2,003	1,959	2,182	1,026	1,774
Small Retail	1,230	1,257	1,275	1,417	681	1,211

Distribution efficiencies for hydronic heating systems and Energy Savings Factors are currently under Tecmarket Review.

Baseline Efficiencies from which savings are calculated

Constant hot water setpoint temperature of 180F

Compliance Efficiency from which incentives are calculated

Reset hot water temperature to 160F

Operating Hours

[illegible] Appendix A and summarized in previous section.

Incremental Cost

Non-Gas Benefits - Annual Electric Savings

[illegible] impact not accounted for in this procedure.

Revision Number

[illegible]

INSTANTANEOUS WATER HEATERS

Description of Measure

Tankless gas water heaters installed in whole-building applications.

Method for Calculating Energy Savings

$$\Delta\text{therm} = units \times \frac{GPD \times 365 \times 8.33 \times \Delta T}{100{,}000} \times \left[\frac{1}{EF_{base}} - \frac{1}{EF_{ee}}\right]$$

where:

Δtherm	= gross annual gas savings
units	= number of high efficiency water heaters installed under the program
GPD	= average daily water consumption (gallons/day)
$\overline{\Delta T}$	= average difference between the cold inlet temperature and the hot water delivery temperature (°F)
EF_{base}	= baseline water heater energy factor
EF_{ee}	= baseline water heater energy factor
8.33	= conversion factor (Btu/gallon-°F)
100,000	= conversion factor (Btu/therm)

Water heating energy consumption is calculated from the daily hot water use and the difference in the water heater delivery temperature and entering cold water temperature. If the supplemental water heater has sufficient capacity to meet the load, hot water will be delivered at the water heater setpoint temperature. Water heater setpoint for residential buildings is usually in the range of 120°F to 140°F. The water heater setpoint should be [illegible] If the supplemental water heater has sufficient capacity to meet the load, the hot water delivery temperature may need to be reduced from the setpoint temperature.

Water temperatures from wells tend to be fairly stable year-round, and are approximately equal to the annual average outdoor temperature. Ground and surface water temperatures storage tank water temperature. Cold water entering temperatures estimated for this manual are shown below:

City	Annual average outdoor temperature (°F)
Albany	48.2
Binghamton	46.9

City	Annual average outdoor temperature (°F)
Buffalo	48.3
Massena	44.7
NYC	49.4
Syracuse	48.6

The ***energy factor*** is a measure of the overall efficiency of the instantaneous and storage water heaters. This factor is based on a standard US Department of Energy test procedure, and is applicable to residential water heater load profiles. The energy factor should be used until better data on average water heater efficiency for commercial applications are developed.

The ***average daily hot water usage***, expressed in gallons per day, normalized for occupancy or restaurant meal volume is shown below:

Building Type	Average gallons per day (ASHRAE)
Office Building	1.0 gal/day per person
Full service restaurant	2.4 gal / day per meal
Fast food restaurant	0.7 gal /day per meal

Baseline Efficiencies from which savings are calculated

New construction and replace on failure: Instantaneous water heater is assumed to replace a standard efficiency tank-type water heater. Energy Factors (EF) according to NAECA for storage water heaters are calculated as a function of storage volume: 0.62-

Compliance Efficiencies from which Incentives are Calculated

ACEEE recommends EF ≥ .82 plus electronic ignition

Operating Hours

Incremental Cost

Non Gas Benefits - Annual Electric Savings

None

Notes & References

1. Average annual outdoor temperature taken from the National Renewable Energy Laboratory TMY 3 long-term average weather data sets, processed with the DOE-2.2 weather data statistics package. www.nrel.gov
2. Average hot water use data taken from the 2007 ASHRAE HVAC Applications Handbook, Chapter 49 – Service Water Heating. American Society of Heating, Refrigeration and Air Conditioning Engineers. Atlanta GA.

Revision Number

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SOLAR HOT WATER

Description of Measure

Solar water heaters convert radiant energy from the sun to thermal energy, which is used to meet a portion of the hot water load. Active systems generally use roof mounted flat plate collectors, with water or an antifreeze solution as the collector fluid, and a pump to circulate the collector fluid through a tank-mounted heat exchanger. A separate water heater is generally used as a supplemental heat source for all systems.

Method for Calculating Energy Savings

$$\Delta\text{therm} = units \times \frac{GPD \times 365 \times 8.33 \times \overline{\Delta T}}{EF_{base} \times 100{,}000} \times ESF$$

where:

Δtherm	= gross annual gas savings
units	= number of solar water heaters installed under the program
EF_{base}	= energy factor of supplemental electric water heater
GPD	= average daily water consumption (gallons/day)
$\overline{\Delta T}$	= average difference between the cold inlet temperature and [illegible]
[illegible]	[illegible]
[illegible]	[illegible]
100,000	= conversion factor (therm/Btu)
365	= conversion factor (days/yr)
8.33	= conversion factor (Btu/gallon-°F)

The *energy factor* is a measure of the overall efficiency of the supplemental water heater. The energy factor applies to storage-type water heaters up to 120 gallons, and is [illegible]

The *average daily hot water usage*, expressed in gallons per day, normalized for [illegible] is shown below:

Building Type	Average gallons per day (ASHRAE)
Office Building	1.0 gal/day per person
Full service restaurant	2.4 gal / day per meal
Fast food restaurant	0.7 gal /day per meal

The ***energy savings factor*** (ESF) is the fraction of the annual water heating load which is met by solar energy. This factor is also called the ***solar savings fraction***. Residential active solar DHW systems are typically analyzed by a solar water heater sizing program such as the FCHART program.

The ESF for a commercial solar DHW system varies widely based on the magnitude of the hot water load and available roof are for solar collectors. Solar water heater performance is influenced by climate, collector area, water heating load, collector efficiency, heat exchanger performance, pipe heat losses, storage tank heat losses, and storage tank size. The method used to calculate ESF should account for these parameters.

Baseline Efficiencies from which savings are calculated

New construction and replace on failure: Solar water heater is assumed to supplement a standard efficiency tank-type water heater. Energy Factors (EF) according to NAECA for storage water heaters are calculated as a function of storage volume: 0.62-0.0019V EF, where V is tank volume in gallons.

Compliance Efficiency from which incentives are calculated

Operating Hours

The backup water heater is assumed to be available during all hours. The solar water heater operates only when useful solar energy can be collected.

Non-Gas Benefits - Annual Electric Savings

Active solar water heaters require electricity to operate circulating pumps and controls. These impacts are not accounted for in this procedure.

Appendix A Prototypical Building Descriptions

SINGLE FAMILY RESIDENTIAL

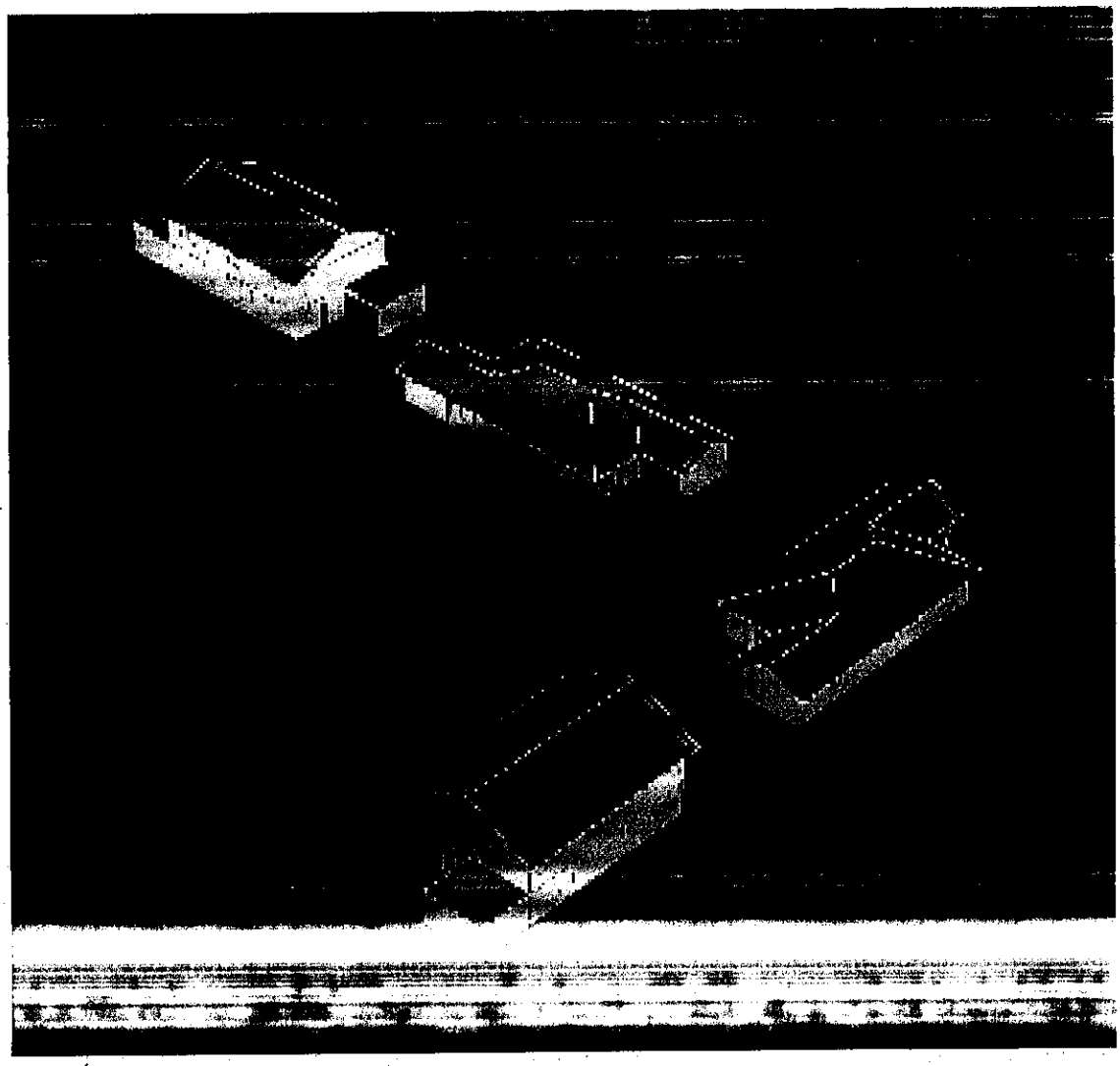
Analysis used to develop parameters for the energy and demand savings calculations are based on DOE-2.2 simulations of a set of prototypical residential buildings. The prototypical simulation models were derived from the residential building prototypes used in the California Database for Energy Efficiency Resources (DEER)[12] study, with adjustments make for local building practices and climate. The prototype "model" in fact contains 4 separate residential buildings; 2 one-story and 2 two-story buildings. Each version of the 1 story and 2 story buildings are identical except for the orientation, which is shifted by 90 degrees. The selection of these 4 buildings is designed to give a reasonable average response of buildings of different design and orientation to the impact of energy efficiency measures.

Three separate models were created to represent general vintages of buildings:

1. Old, poorly insulated building constructed in the 1950s or earlier. This vintage is referred to as the "old" vintage
2. Existing, average insulated building conforming to 1980s era building codes. This vintage is referred to as the "average" vintage.
3. New construction conforming to the NY State energy standards for residential buildings. This vintage is referred to as the "new" vintage.

A sketch of the residential prototype buildings is shown below.

[12] 2004-2005 Database for Energy Efficiency Resources (DEER) Update Study, Final Report, Itron, Inc. Vancouver, WA. December, 2005. Available at http://www.calmac.org/publications/2004-05_DEER_Update_Final_Report-Wo.pdf



Computer rendering of residential building prototypical DOE-2 model.

Residential Building Prototype Description

Vintage	Three vintages simulated – old poorly insulated buildings (existing average insulated buildings and
Conditioned floor area	1 story house: 1400 SF (not including basement); 2 story house: 2930 SF (not including basement)
Wall construction and R-value	Wood frame with siding. R-value varies by vintage
Roof construction and R-value	Wood frame with asphalt shingles. R-value varies by vintage
Glazing type	Average of single and double pane; properties vary by vintage

Characteristic	Value
Lighting and appliance power density	0.51 W/SF average
HVAC system type	Packaged single zone AC or heat pump
HVAC system size	Based on peak load with 20% oversizing
HVAC system efficiency	Baseline SEER = 13
Thermostat setpoints	Heating: 70°F with setback to 60°F Cooling: 75°F with setup to 80°F
Duct location	Buildings without basement: attic Buildings with basement: basement
Duct surface area	Single story house: 390 SF supply, 72 SF return Two story house: 505 SF supply, 290 SF return
Duct insulation	Uninsulated
Duct leakage	20% of fan flow total leakage, evenly split between supply and return.
Natural ventilation	Allowed during cooling season when cooling setpoint exceeded and outdoor temperature < 65°F. 3 air changes per hour

Wall, Floor and Ceiling Insulation Levels

The assumed values for wall and ceiling by vintage are shown in Table 1 through Table 2

Table 1. Wall Insulation R-Value Assumptions by Vintage

Vintage	Assumed R-value of insulated wall	Notes
Older, poorly insulated	7	No insulation in 2 by 4 wall; 3.5 in. air gap resistance only
Existing, average	11	Fiberglass insulation in 2 by 4 wall per MEC
New construction	19	Code

Table 2. Ceiling Insulation R-Value Assumptions by Vintage

Vintage	Assumed R-value of insulated ceiling	Notes
Older, poorly insulated	11	Min
New construction	30 (NYC), 38 (all others)	Code

Vintages are shown in Table 3.

Table 3. Window Property Assumptions by Vintage

Vintage	U-value (Btu/hr-F-SF)	SHGC	Notes
Older, poorly insulated	0.93	0.87	Single pane clear
Existing, average insulation	0.68	0.77	Double pane clear
New construction	0.28	.49	Double low e per code

Infiltration

Infiltration rate assumptions were set by vintage as shown in Table 4.

Table 4. Infiltration Rate Assumptions by Vintage

Vintage	Assumed infiltration rate	Notes
Older, poorly insulated	1 ACH	
Existing, average insulation	0.5 ACH	
New construction	0.35 ACH	Minimum without forced ventilation per ASHRAE Standard 66.

SMALL RETAIL

A prototypical building energy simulation model for a small retail building was developed using the DOE-2.2 building energy simulation program. The [illegible] of the small retail building prototype are summarized in Table 5.

Table 5. Small Retail Prototype Description

Characteristic	Value
Vintage	Existing (1970s) vintage
Size	6400 square foot sales area 1600 square foot storage area 8000 square feet total
Number of floors	1
Wall construction and R-value	Concrete block with brick veneer, R-5
Roof construction and R-value	Wood frame with built-up roof, R-12
Glazing type	Single pane clear
Lighting power density	Sales area: 3.4 W/SF Storage area: 0.9 W/SF
Plug load density	Sales area: 1.2 W/SF Storage area: 0.2 W/SF
Operating hours	10 – 10 Monday-Saturday 10 – 8 Sunday
HVAC system type	Packaged single zone, no economizer
HVAC system size	230 – 250 SF/ton depending on climate
Thermostat setpoints	Occupied hours: 76 cooling, 72 heating Unoccupied hours: 81 cooling, 67 heating

A computer-generated sketch of the small retail building prototype is shown in Figure 1.

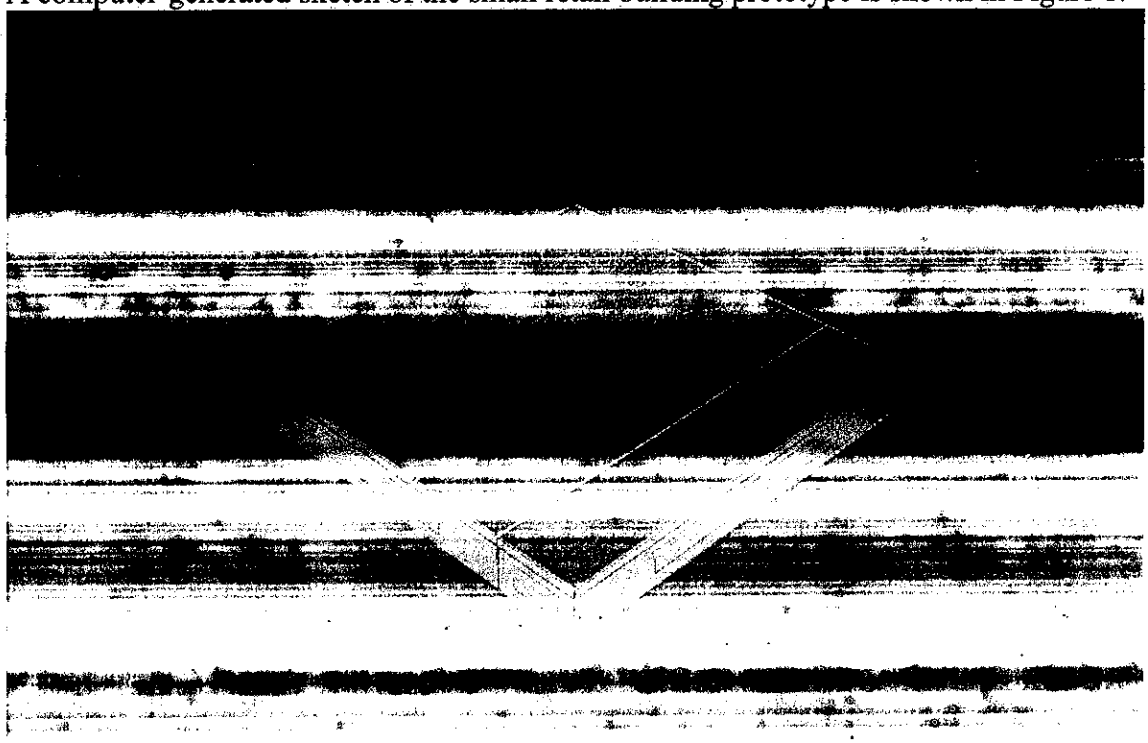


Figure 1. Small Retail Prototype Building Rendering

FULL-SERVICE RESTAURANT

A prototypical building energy simulation model for a full-service restaurant was developed using the DOE-2.2 building energy simulation program. The characteristics of the full service restaurant prototype are summarized in Table 6.

Table 6. Full Service Restaurant Prototype Description

Characteristic	Value
Vintage	Existing (1970s) vintage
Size	2000 square foot dining area 600 square foot entry/reception area 1200 square foot kitchen 200 square foot restrooms
Number of floors	1
Wall construction and R-value	Concrete block with brick veneer, R-5
Roof construction and R-value	Wood frame with built-up roof, R-12
Glazing type	Single pane clear
Lighting power density	Dining area: 1.7 W/SF Entry area: 2.5 W/SF Kitchen: 4.3 W/SF Restrooms: 1.0 W/SF
Plug load density	Dining area: 0.6 W/SF Entry area: 0.6 W/SF Kitchen: 3.1 W/SF Restrooms: 0.2 W/SF
Operating hours	9am – 12am
HVAC system type	Packaged single zone, no economizer
HVAC system size	140 – 160 SF/ton depending on climate
	Unoccupied hours: 82 cooling 67 heating

A computer-generated sketch of the full-service restaurant prototype is shown in Figure 2.

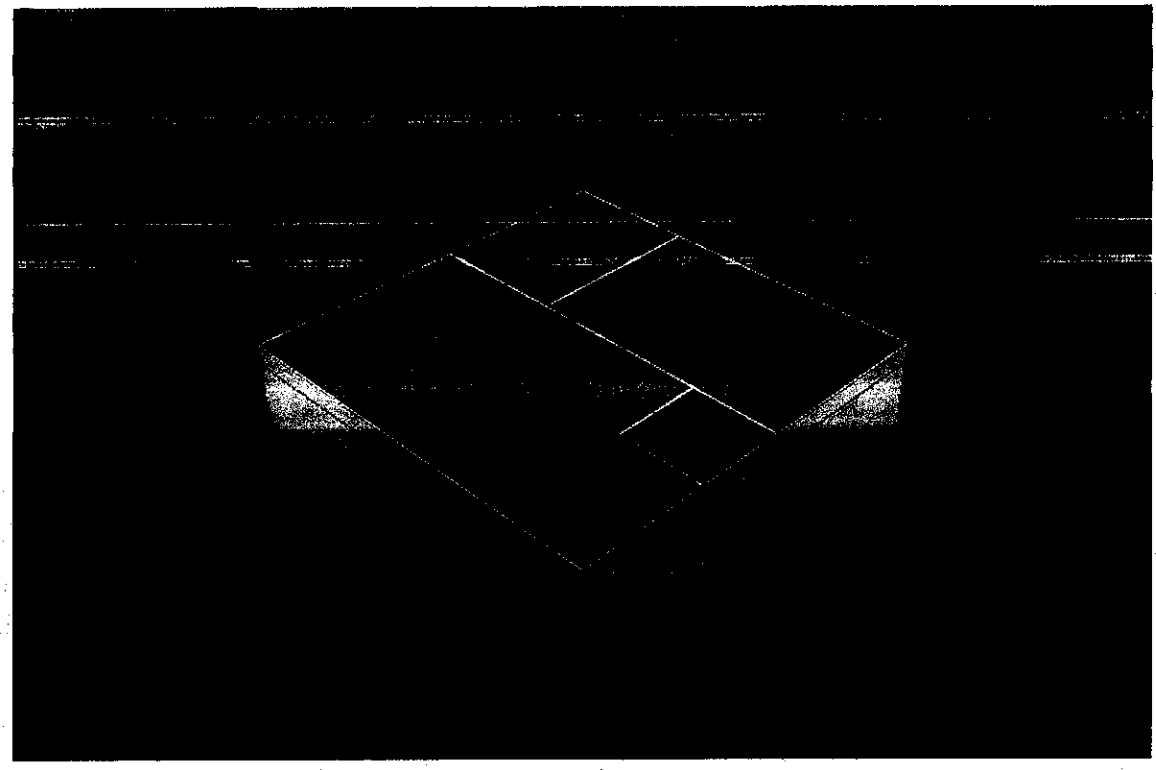


Figure 2. Full Service Restaurant Prototype Rendering

FAST FOOD RESTAURANT

A prototypical building energy simulation model for a fast food restaurant was developed using the DOE-2.2 building energy simulation program. The characteristics of the prototype are summarized in Table 7.

Table 7. Fast Food Restaurant Prototype Building Description

Characteristic	Value
Vintage	Existing (1970s) vintage
Size	2000 square feet 1000 SF dining 600 SF entry/lobby 300 SF kitchen 100 SF restroom
Number of floors	1
Wall construction and R-value	Concrete block with brick veneer, R-5
Roof construction and R-value	Concrete deck with built-up roof, R-12
Glazing type	Single pane clear
Lighting power density	1.7 W/SF dining 2.5 W/SF entry/lobby 4.3 W/SF kitchen 1.0 W/SF restroom
Plug load density	0.6 W/SF dining 0.6 W/SF entry/lobby 4.3 W/SF kitchen 0.2 W/SF restroom
Operating hours	Mon-Sun: 6am – 11pm
HVAC system type	Packaged single zone, no economizer
HVAC system size	100 – 120 SF/ton depending on climate
Thermostat setpoints	Occupied hours: 77 cooling, 72 heating Unoccupied hours: 82 cooling, 67 heating

A computer-generated sketch of the prototype is shown in Figure 3.

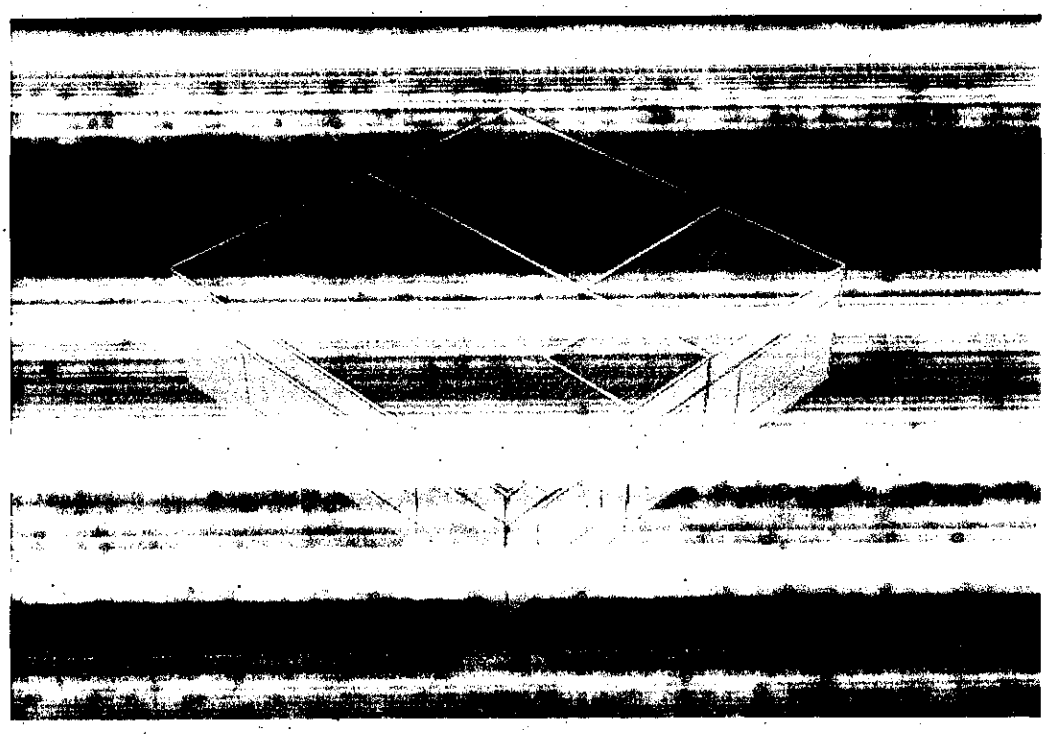


Figure 3. Fast Food Restaurant Building Rendering

ASSEMBLY

A prototypical building energy simulation model for an assembly building was developed using the DOE-2.2 building energy simulation program. The characteristics of the prototype are summarized in Table 8.

Table 8. Assembly Prototype Building Description

Characteristic	Value
Vintage	Existing (1970s) vintage
Size	34,000 square feet Auditorium: 33,240 SF Office: 760 SF
Number of floors	1
Wall construction and R-value	Concrete block, R-5
Roof construction and R-value	Wood frame with built-up roof, R-12
Glazing type	Single pane clear
Lighting power density	Auditorium: 3.4 W/SF Office: 2.2 W/SF
Plug load density	Auditorium: 1.2 W/SF Office: 1.7 W/SF
Operating hours	Mon-Sun: 8am – 9pm
HVAC system type	Packaged single zone, no economizer
HVAC system size	100 - 110 SF/ton depending on climate
Thermostat setpoints	Occupied hours: 76 cooling, 72 heating Unoccupied hours: 81 cooling, 67 heating

A computer-generated sketch of the prototype is shown in Figure 4.

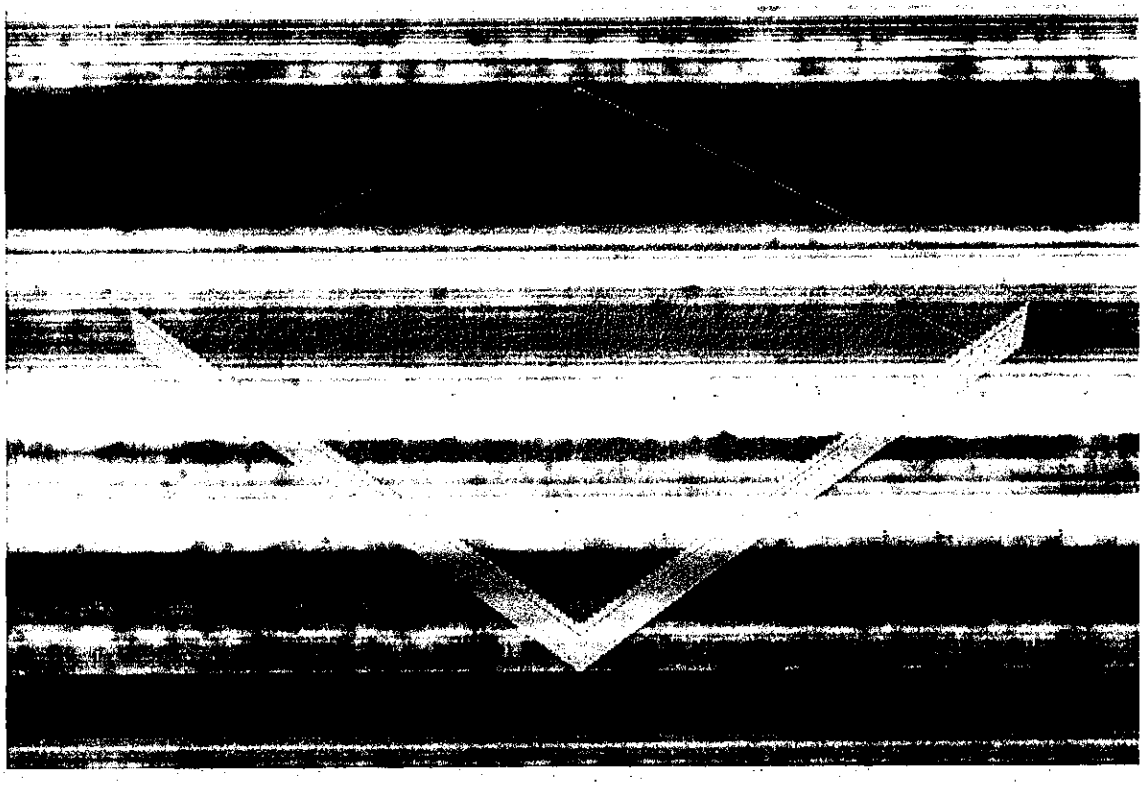


Figure 4. Assembly Building Rendering