Multifamily Retrofit Conservation Programs:

Longitudinal Impact Evaluation

Volume II

Methodology, Tables & Figures

Evaluation Unit

Energy Management Services Division

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A. Appendix: Detailed Impact Methodology

A.1 Engineering Projections

Engineering projections of savings from the installation of program measures were constructed from data the utility evaluator extracted from program records. Seattle City Light engaged an engineer to review all lighting installation records and construct adjusted engineering projections of energy savings. Adjustments mainly addressed the exclusion from engineering data of estimated savings due to replaced ballasts. Lighting measures were installed in common areas only (e.g., lobbies, hallways, stairwells, laundry rooms); the impacts were measured on the commercial house meters.

The SCL evaluator also created files with detailed data on the square footage of each building-shell measure installed, R-values of insulation before and after retrofit, U-factors of installed windows, and number of showerheads installed. In particular, building-specific engineering savings were projectd for the installation of the following measures:

- High-efficiency windows,
- Wall insulation,
- Ceiling insulation,
- Under-floor insulation,
- Efficient-flow showerheads, and
- High efficiency lighting.

A.1.1 HIGH EFFICIENCY WINDOWS AND WALL, CEILING AND FLOOR INSULATION

The engineering projections of savings for windows, walls, ceilings and floors were developed from the following energy consumption equation.[1] In particular, for the shell measures, savings are specified as follows.

Eq. A-1 $$ENGPROJ_j = \frac{\Delta HEATL_j \times HDD\ norm \times 24}{\Delta TD \times k \times V}(CFAC_{DD})$$

where:

$ENGPROJ_j$	=	Projected change in annual energy consumption for measure *j* (kWh)
$\Delta HEATL_j$	=	Change in design heat loss, including infiltration and ventilation, from pre- to post-installation of high efficiency measure *j* (Btu per hour)
HDD norm	=	Number of 65° F degree-days for projected period (normal HDD)
24	=	Number of hours in a day (hours/day)
ΔTD	=	Design temperature difference (indoor minus outdoor °F)
$CFAC_{DD}$	=	Empirical correction factor for heating effect versus 65°F degree days (unit-less)
k	=	Correction factor that includes the effects of rated full-load efficiency, part load performance, oversizing and energy conservation devices (1.0 for electric heat)
V	=	Heating value of fuel (3413 Btu / kWh, consistent with $\Delta HEATL_j$ and *ENGPROJ*)

The design temperature difference[2] is assumed to be 60° F (74° F–14° F). However, this value is canceled by the use of the temperature differential in the calculation of change in design heat loss ($\Delta HEATL_j$). A value of one was used for *k* in accordance with ASHRAE documentation for electric resistance heat systems. A conversion factor of 3413 was used for V. This converts the units of design heat loss (Btu) to units used for savings (kWh). Normal heating degree-days in Seattle-Tacoma are 5,121 during most years and 5,143 in leap years (e.g., 1988 and 1992).

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[1] Parsons, Robert E. (ed.), ASHRAE HANDBOOK: FUNDAMENTALS, I-P (INCH-POUND) EDITION, American Society of Heating, Refrigerating and Air-conditioning Engineers, Inc., Atlanta, Georgia, 1989.

[2] Representative indoor and outdoor design temperatures are based on dry bulb temperature reading data. For Seattle, the outdoor design temperature ($TD_{outdoor}$=14° F) equals the median of annual extreme winter temperatures for the Seattle-Tacoma airport weather station. A general indoor design temperature (TD_{indoor}=74° F) may be based on engineering recommendations for winter indoor conditions in homes, apartments, and offices for healthy adults and children, normally clothed, seated at rest (Rizzi 1980).

The empirical correction factor for the heating effect versus 65° F days ($CFAC_{DD}$) is unit-less in this projection. $CFAC_{DD}$ is a weather sensitivity correction factor that is estimated as part of the realization rate analysis, equivalent to the product of temperature sensitivity and the retrofit reduction in sensitivity. The value for $CFAC_{DD}$ cannot be retrieved from the billing analysis as it is embedded in the realization rate coefficients estimated in the regression models. According to ASHRAE documentation (Ch. 28), $CFAC_{DD}$ tends be around 0.6 (bracketed by a standard deviation ranging from about 0.4 to 0.9) when annual heating degree-days are near 5,000, as in Seattle's normal meteorological year.

The change in heat loss ($\Delta HEATL_j$) is specified as:

Eq. A-2
$$\Delta HEATL_j = (TD_{indoor} - TD_{outdoor}) \times \sum_j \sum_i \left[\frac{PREU \times A - POSTU \times A}{A} \right] \times \sum_i A_{j,i} \times ACH$$

where:

TD	=	Design temperatures (indoor and outdoor °F)
PREU	=	Pre-retrofit U-factor (Btu/hour square foot per degree F) for area $A_{j,i}$
POSTU	=	Post-retrofit U-factor (Btu/hour square foot per degree F for area $A_{j,i}$
$A_{j,i}$	=	Area (square foot of surface covered by measure) for sub-area *i of measure j*
ACH	=	Infiltration adjustment factor (0.50 air exchanges)

The infiltration adjustment, which is correlated with air exchanges per hour, is assumed to be 0.50. This assumption is consistent with a study of low-income apartments conducted by Edison Electric Institute (ASHRAE, 1980.) However, this value may range between 0.50 and 0.90 in typical existing construction.

The product of $\Delta HEATL \times \Delta TD$ is equivalent to $\Delta U_0 A_0$ for a given building, that is, the overall change in inside-to-outside thermal conductance (transmittance). The value within brackets estimates the U_0, the average change in U-factor per affected square foot of surface, across all the measure types and sub-surfaces treated by the Multifamily Conservation Programs. This value is multiplied by the total square feet affected. When total heat-loss (rather than heat-loss change) is being estimated, the bracketed quantity would be equivalent to the following expanded example.

Eq. A-3
$$U_o A_o = U_{wall1} A_{wall1} + U_{wall2} A_{wall2} + U_{ceiling1} A_{ceiling1} + U_{ceiling2} A_{ceiling2} + U_{floor1} A_{floor1} + U_{floor2} A_{floor2} + U_{window1} A_{window1} + U_{window2} A_{window2} + U_{window3} A_{window3}$$

The pre- and post-retrofit U-factors were derived from program records and assumptions about baseline construction standards and practices. In particular, for measure *j*, post and pre-retrofit U-factors are specified as:

Eq. A-4 $$POSTU_j = \frac{1}{(R_{jbase} + R_{jpost})}$$

Eq. A-5 $$PREU_j = \frac{1}{(R_{jbase} + R_{jpre})}$$

where:

R_{jbase} = Assumed R-value for baseline (no insulation or high efficiency) construction
R_{jpost} = Reported R-value for post installation conditions
R_{jpre} = Reported R-value for pre-retrofit conditions

The pre- and post-installation conditions reflect changes in insulation levels for each of the shell elements. These factors were reported in program records provided by SCL staff. The assumed R-values for the baseline were provided by SCL program end engineering staff. Table A-1 summarizes the typical construction characteristics behind each baseline R-value used in the calculation of engineering projections for savings.

Table A-1: Assumed R-Values of Building Construction Baseline

Shell Element	Base R Value	Base Construction Characteristics	R
Windows	0.91	Flat glass 1/8" (U= 1.10)	0.91
Walls	4.10	Inside air film (still air)	0.68
		1/2" Gypsum board	0.45
		3-1/2" Air gap	1.01
		25/32" Wood sheath	0.98
		Wood bevel siding, lapped	0.81
		Outside air film (15 mph wind)	0.17
Ceiling	3.80	Inside air film (still air)	0.61
		3/4" Acoustic tile	1.78
		1/2" Gypsum board	0.45
		Building paper	0.06
		Outside air film (still air), attic gap	0.85
Floor	3.60	Inside air film (still air)	0.92
		3/4" Hardwood floor	0.68
		Vapor permeable felt paper	0.06
		25/32" Wood subfloor	0.98
		Outside air film (still air), crawl space gap	0.92

Buildings qualified for window retrofits had single-paned windows, assumed to have a U-factor of about 1.1. Four features characterize the double-paned replacement windows: frame material (aluminum, wood, or vinyl), glass surface (plain glass or low-emissivity film), the distance between panes (3/8", 1/2", 5/8", or 3/4"), and the gap fill gas (air or argon). Aluminum windows may also have a special thermal

break installed between the panes. Table A-2 provides the assumed U-factors assigned to windows with each combination of characteristics observed, to calculate engineering projections of savings from program participant buildings. Where U-factors were missing from program records, the mode value was substituted, as follows: Cohorts A to E, 0.75; Cohort F, 0.60, and Cohort G, 0.50.

Table A-2: Assumed U-factors of Program Replacement Windows

Frame	Gap Fill	Glass	3/8"	1/2"	5/8"	3/4"
Aluminum	Air		0.81	0.75	0.69	0.63
Aluminum	Air	Thermal Break	—	0.65	0.59	—
Aluminum	Argon		0.71	0.65	0.59	—
Aluminum	Air	Low-E film	—	0.60	—	—
Vinyl	Air		—	0.60	0.54	0.48
Wood	Air		0.60	0.55	0.49	—
Aluminum	Argon	Low-E film	—	0.50	—	—
Vinyl	Argon		—	0.50	0.44	0.38
Vinyl	Argon	Low-E film	—	0.35	0.35	0.33
Wood	Argon	Low-E film	—	0.35	—	—

A.1.1.1 Showerheads

Engineering projections of expected savings from the installation of low-flow showerheads were derived from Multifamily Conservation Program records and a study on savings from low-flow devices completed by Seattle City Light in conjunction with the Bonneville Power Administration.[3] In particular, savings per unit for each building were derived as the product of the average number of showerheads per unit multiplied by the average savings per showerhead (200 kWh). That is,

Eq. A-6 $$SAVSHOW_b = 200 \times AVGSHOW_b$$

where:

$SAVSHOW_b$ = Annual savings for the installation of low flow showerheads (kWh) per unit for building *b*

200 = Projectd annual savings per installed showerhead (kWh)

$AVGSHOW_b$ = Average number of showerheads per unit for building *b*.

[3] Hickman, Curtis, EFFICIENT SHOWERHEAD AND FAUCET AERATOR METERING STUDY: MULTIFAMILY RESIDENCES, by SBW Consulting, inc., for Bonneville Power Administration, Portland, Oregon, October 1994.

Other Multifamily Program hot water actions (such as water heater thermostat adjustments) are not reflected in the engineering projections due to lack of sufficient documentation.

A.1.1.2 Lighting

The engineering projections for savings from installed lighting measures were developed from program records by the Seattle City Light evaluator and a consulting engineer. The calculations are based on fixture counts by previous wattage, replacement wattage (lamps and ballasts), and specified operating hours (reported or by judgment). The change in lighting load is specified as:

Eq. A-7 $ENGPROJ_{lite} = POST_{lite} - PRE_{lite}$

where:

$ENGPROJ_{lite}$ = Projected change in annual energy consumption for lighting (kWh)
PRE_{lite} = Pre-retrofit load for affected common-area lighting (kWh)
$POSTU_{lite}$ = Post-retrofit load for affected common-area lighting (kWh)

The pre- and post-retrofit engineering calcuations for affected lighting loads are specified as:

Eq. A-8 $$POST_{lite} = \frac{\sum_i Qty_i \times W_i \times Hr_i \times \varepsilon_{hr}}{1000}$$

Eq. A-9 $$PRE_{lite} = \frac{\sum_i Qty_i \times W_i \times Hr_i \times \varepsilon_{hr} \times MF_i}{1000}$$

where:

Qty_i = Quantity of affected lumieres (lamps by fixture type$_i$)
W_i = Wattage of affected lumiere (lamps and ballasts)
Hr_i = Annual hours of lumiere operation
MF_i = Maintenance factor (average proportion of burned out lamps)
M_{hr} = Uncertainty about controls and operating hours

The empirical maintenance factor (MF_i), left unit-less in the engineering projection, represents the average proportion of existing lamps of a given type that are burned out and not yet replaced at any given

time. The maintenance factor cannot be retrieved in the billing analysis as it is embedded in the realization rate coefficients estimated in the regression models. The specified error term (M_{hr}) reflects the inherent uncertainty about actual annual operating hours for each lamp, given imperfect information about manual versus automatic lighting control operations.

Lighting measures were installed in common-areas only, presumably measured on house meters where these are present. Other Multifamily Program lighting actions (such as advice on the operation of existing lighting controls) are not reflected in the engineering projections due to lack of sufficient documentation.

A.2 Follow-up Measures Survey

Seattle City Light conducted a telephone survey of program participant and nonparticipant managers and owners of multi-family residence, with the services of a consultant fielding service. This survey was fielded in winter 1995-1996. The purpose of the survey was to collect data on changes at the residences that influence the use of energy. In particular, the questions related to the acquisition, replacement, and disposal of energy using equipment, changes in occupancy and building square footage, and the timing of these actions. These questions covered actions that may have affected the tenant dwelling meters as well as the common area meters. The collected data included the following key variables.

- Change in the number of multifamily building tenant units
- Changes in site square footage
- Changes in common area energy use functions.
- Acquisition, replacement or removal of appliances
  - Clothes washers
  - Clothes dryers
  - Dishwashers,
  - Water heaters (laundry and tenant)
  - Other major electricity using appliances.
- Removal or addition of program related equipment
  - High efficiency windows
  - Wall, ceiling and floor insulation
  - Low flow showerheads
  - Common-area lighting (interior and exterior)

These data were used to develop variables used in the regression analysis, to account for changes in annual consumption attributable to non-program measures or actions. In most cases, the variables were

binary (dummy) variables equal to 0 prior to the change in the energy using equipment at the site and equal to 1 after this date.

In cases where the change in equipment affected a portion of the tenants, the binary was set to the estimated portion of tenants affected after the change date. For example, if the survey response indicated that only 60 percent of the tenant dryers were replaced then the binary variable was set to 0.6 after the installation date. Similarly, the binary variable was adjusted in the year of the installation to represent the portion of the year affected by the change. For example, if an equipment change were made in May of a particular year, the binary would be set to 0.5 to account for the fact that only half of the annual consumption was affected.

A.3 Impact Research Design

The basic quasi-experimental research design for this longitudinal study addresses each program, meter type, and cohort independently. It also pools cohorts in several analyses, according to the following groupings:

Program Pilot Years: Cohorts A and B (measures installed in 1986-1987)

Program Maturity: Cohorts C to G (measures installed in 1988-1992)

- ***Early Window Technology:*** Cohorts C to E (1988-1990)
- ***New Window Technology:*** Cohorts F and G (1991-1992)

Several methods were used to calculate savings, each supplying adjustments for factors incompletely accounted for by the use of non-participant control groups and weather normalization. The results were compared across methods to demonstrate the most economic approach to estimating energy savings. These methods included the following:

Gross Change Scores: Post-installation minus pre-installation annual energy use

Net Change Scores:

- **Net Method I:** Participant gross savings minus non-participant gross savings
- **Net Method II:** Analysis of covariance in savings scores between participants and non-participants adjusting for differences in pre-period energy use levels, for each cohort and in each post-installation year (up to five)
- **Net Method III:** Net Method II for pooled cohorts across each of five post-installation years

Regression Analyses: Multiple linear regression incorporating analysis of covariance due to differences in pre-period energy use levels, along with annual effects, engineering projections of expected savings, and post-period changes in appliance holdings or the building shell; using

- ***Treatment Condition:*** Dummy variables for each of five post-years (categorizing participation as yes/no)

- ***Engineering Projections:*** Building-aggregate and measure-specific values replicated for each of five post-years in place of the treatment condition "yes" values (scaling the expected effect of participation)

- ***Building Change Variables:*** Treatment condition dummies or engineering projections paired with dummy variables to indicate specific post-period changes in appliance holdings or the building shell, for particular participant and non-participant buildings (segregating effects from external factors)

Table A-3: Data Years and Research Designs

Analysis Designs	Cohorts	Calendar Year									Post-Period						
		85	86	87	88	89	90	91	92	93	1	2	3	4	5	6	7
Data Source Years	A	P	M	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	B	P		M	X	X	X	X	X	X	X	X	X	X	X	X	
	C			P	M	X	X	X	X	X	X	X	X	X	X		
	D				P	M	X	X	X	X	X	X	X	X			
	E					P	M	X	X	X	X	X	X				
	F						P	M	X	X	X	X					
	G							P	M	X	X						
	N			X	X	X	X	X	X	X							
Annual Consumption	A,B	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
PRE, POST kWh	C,D,E			X	X	X	X	X	X	X	X	X	X	X	X		
	F,G						X	X	X	X	X	X					
	N			X	X	X	X	X	X	X							
Gross Savings Score	A,B			X	X	X	X	X	X	X	X	X	X	X	X	X	X
(POST - PRE) –	C,D,E					X	X	X	X	X	X	X	X	X	X		
	F,G								X	X	X	X					
	N				X	X	X	X	X	X							
Net Savings Score	A,B			*	*	*	*	*	*	*	*	*	*	*	*	*	*
(PART– - NPART–)	C,D,E					X	X	X	X	X	X	X	X	X	X		
Net Method I	F,G								X	X	X	X					
	N																
Post 1 - 5 Ancovas	A,B																
	C,D,E					X	X	X	X	X	X	X	X	X	X		
(PART– - NPART–)	F,G								X	X	X	X					
Net Method II	N					X	X	X	X	X							
Pooled Year 1 Ancova	A,B			X	X	X	X	X	X	X	X						
(PART– - NPART–)	C,D,E					X	X	X	X	X	X						
Net Method III	F,G								X	X	X						
	N				X	X	X	X	X	X							
Pooled Years & Cohorts	A,B			*	*	*	*	*	*	*	*	*	*	*	*	*	*
Covariate Regressions	C,D,E					X	X	X	X	X	X	X	X	X	X		
(PARTICIPATN DUMMIES)	F,G								X	X	X	X					
(SINGLE ENG EST)	N			X	X	X	X	X	X	X							
(MULTIPLE ENG ESTS)																	

A.4 Gross & Net Savings Scores

A.4.1 OVERVIEW

Several methods were established to estimate programmatic electricity savings. The basic design is quasi-experimental using methods of partial control for extraneous effects. Comparisons are made between program participants (treatment group) and non-participants (control group) to isolate the changes in electricity consumption that can be attributed to the influence of the program. These methods present a picture that progressively decreases known sources of error variance in electricity use change over time for the study groups.

A.4.2 GROSS SCORES METHOD

The Gross Scores Method calculates the change in energy use from pre-period to each post-period for participating buildings. This method also first introduces an adjustment for annual variations in weather conditions across the study period. Weather affects primarily the space heating and secondarily the water heating portions of electricity use. The gross tenant meter change scores are compared without and with a weather-normalization adjustment. House meter scores are not weather normalized; although some lighting use is seasonal, it follows the schedule of solstices and equinoxes rather than outdoor temperatures.

Pre- to post-period electricity use gain scores were computed for each building. As noted before, each score represents a building centroid expressed as kilowatt-hours per average dwelling unit.

Eq. A-10 $GROSS\ SAVINGS = ANNUAL\ kWh_{post-period} - ANNUAL\ kWh_{pre-period}$

where:

ANNUAL kWh = annual per building per unit metered energy consumption

A.4.3 NET SCORES, METHODS I-III

A.4.3.1 Net Method I Scores

The Net Scores Method I introduces a control group to adjust for changes across the study period due to economic and social effects in a presumable similar group of owners and tenants. These may be effects of a changing economy and electric rates, changing demographics and living habits, tenant turnover, changes in ownership, and conservation actions taken by tenants or owners/managers apart from the

building's program participation. The gross tenant meter scores of both participants and non-participants were compared without and with a weather-normalization adjustment.

Eq. A-11 $NET\ SAVINGS = GROSS\ SAVINGS_{participants} - GROSS\ SAVINGS_{non\text{-}participants}$

Student's t tests were also performed to assess the equivalence of pre-period energy consumption between the participant and nonparticipant groups; to judge the significance of within groups pre-to-post changes; and to decide whether any between group gain scores differences provided strong evidence of programmatic net electricity savings.

A.4.3.2 Net Method II

Net Method II introduces a correction for the correlation of pre- to post-period energy consumption and the contribution of this correlation to the error variance. For each post-period separately, the building scores of participants and non-participants are regressed against a program participation indicator (dummy code) and the pre-period score (covariate). This correction is performed because the participant (treatment) and non-participant (control) groups are not precisely equivalent. They were not randomly selected, are not homogeneous, and were not matched; the sizes of treatment and control groups are nonequivalent as well. Extraneous variance is controlled by the analysis of covariance in pre-period energy use patterns in this method (and in later design steps by introducing some specific extraneous factors as independent variables). This simple linear regression has the following specification:

Eq. A-12 $ANNUAL\ SCORE_{post} = \alpha + \beta_1 ANNUAL\ SCORE_{pre} + \beta_2 PART$

where:

PART is an dummy-coded indicator variable = 1 if Participant, 0 if Non-participant

The coefficient on *PART* (that is, ϑ_2) is an estimate of net energy savings.

As in the previous study of these programs (Okumo 1991), preliminary results from the Net Method I analysis indicated that the treatment and control groups varied in their pre-period electricity consumption. The gain score approach of Net Method I assumes that pre-period and post-period scores bear a one-to-one relationship, which an initial examination demonstrated was not the case. Analysis of covariance allows for a degree of correlation and corrects for varying pre-period group scores. Post-period consumption can be expected to be highly correlated with pre-period consumption, more so than with any other building characteristic. The analysis of covariance approach is expected to provide a better estimate of programmatic energy savings than either the Gross Score Method or Net Scores Method I.

The sampling error resulting from an analysis of covariance also differs from the standard error calculated from the ordinary net gain score approach. The standard error term from the gain score approach

includes all variance from the initial score, final score, and their intercorrelation; while the analysis of covariance error includes only the latter two forms of variance. Hence the covariance method is more sensitive and reduces further the degree of error in change estimates (McNemar 1969).

A.4.3.3 Net Method III

Net Method III summarizes the savings results in the first post year across clusters of cohorts. Buildings in each pooled analysis are represented by a first-year gross savings score and a dummy-coded binary indicator for program participation. This simple linear regression has the following specification:

Eq. A-13 $GROSS\,SAVINGS_{post1} = \alpha + \beta_1 PART$

where:

PART is an indicator variable = 1 if Participant, 0 if Non-participant

A.5 Regression Analysis

The Seattle City Light evaluator established the general regression models in the research design, while consulting staff from Regional Economics Research, Inc. developed the specific multivariate linear models implemented in the longitudinal impact regression analyses. Multiple linear regression analysis was used to continue the analysis of covariance across multiple observations per building. The following Regression Methods summarize the savings results across post-period years and groups, incorporating the variance corrections of Net Method II.

A.5.1 GENERAL MODEL FORMS

First-year savings estimates for standard income tenant and house meters were estimated using regression analysis. In particular, two modeling approaches were used to estimate first through fifth-year savings from participation in the Multifamily Conservation Program. The following sub-sections present general model specifications for the two models, discuss estimation of the specific models used to derive savings, and comment on the estimation results.

The annual per-unit per-building energy consumption values are weather normalized. As such, any changes in consumption from one year to the next can be characterized as a function of participation in the Multifamily Conservation Program and engineering projections of potential savings, as well as changes in appliance stocks and features, changes in building characteristics, fluctuations in occupancy rates, and changes in conservation practices not associated with the Multifamily Conservation Program. For purposes of this study, two models were specified:

- Participation Change Form, and
- Engineering Change Form.

These models that are described below were specified for tenant and house meters.

Participation Change Form. This form of the model utilizes billing records, weather data, participant file information, and data derived from the follow-up survey. It compares levels of energy use before and after participation (sometimes called a "level form", as opposed to a "savings score" form). In particular, the general model can be represented as:

Eq. A-14 $$ANNKWH_{it} = f\left(BASEKWH_i, \Delta AF_{it}, \Delta BC_{it}, \Delta OCC_{it}, \Delta CPR_{it}, PART_{it}\right)$$

where:

Δ_b	=	change operator for levels in period *t* minus levels in the pre-participation year (base year)
ANNKWH	=	annual weather normalized consumption
BASEKWH	=	pre-participation year (base-year) weather normalized consumption
AF	=	appliance features
BC	=	building characteristics
OCC	=	occupancy
CPR	=	conservation practices
PART	=	participation indicator (treatment) variable = 1 after participation; 0 otherwise

This Participation Change Form model was used to estimate tenant and house meter savings.

Engineering Change Form. The specification used for the Participation Change Form can be modified to include data on engineering projections of savings from installing program conservation measures. In particular, the general model can be specified as

Eq. A-15 $$ANNKWH_{it} = f\begin{pmatrix} BASEKWH_i, \Delta AF_{it}, \Delta BC_{it}, \Delta OCC_{it}, \Delta CPR_{it}, \\ PART_{it}, EINS_{it}, EWIN_{it}, ELOWFL_{it}, ELITE_{it} \end{pmatrix}$$

where:

Δ_b	=	change operator for levels in period *t* minus levels in the pre-participation year (base year)
ANNKWH	=	annual weather normalized consumption
BASEKWH	=	pre-participation year (base-year) weather normalized consumption
AF	=	appliance features

BC	=	building characteristics
OCC	=	occupancy
CPR	=	conservation practices
PART	=	participation indicator variable = 1 after participation; 0 otherwise
EINS	=	engineering projection of energy savings from increases in wall, ceiling and floor insulation
EWIN	=	engineering projection of energy savings from installation of energy-efficient windows
ESHWR	=	engineering projection of savings from installation of low-flow showerheads
ELITE	=	engineering projection of energy savings from installation of energy-efficient lighting measures

The engineering projections of savings are included in the specification to disaggregate savings across type of conservation measure. The engineering projections are positive and relative to the pre-participation or base-year for each program year. The coefficient on these engineering projections can be characterized as a realization of engineering potential savings projections. Engineering Change Form models were used to develop tenant meter and house meter savings.

A.5.2 OVERVIEW

Energy savings in the first five years after measure installation were estimated separately for Standard-Income Tenant Meters and House Meters, using multivariate linear regression analysis. In particular, two modeling approaches were used to estimate energy savings from participation in the Multifamily Conservation Program, as described below.

The unit-average values for annual energy consumption were weather-normalized for the aggregate of tenant meters in each building. Each building was represented by multiple cases, one for each post-period after measure installation. That is, Cohort C buildings were organized as five cases, one for each post-period, while Cohort G cases only appeared once for the first-post-year. The dependent variable was specified as post-period energy consumption, while independent variables included pre-period energy consumption as a covariate, along with other variables specified for each model.[4] The aggregate of house meters in each building was averaged over the number of tenant units, but was not weather-

[4] Using a pre-period consumption level covariate does not completely adjust for self-selection bias. This is because the statistical distributions have been truncated in the participation model. For more on this topic and the inverse Mills ratio, see J. Heckman, *Sample Selection Bias as a Specification Error*, ECONOMETRICA, 1979, 47:1, pp.153-62; and K. Train, *Estimation of Net Savings from Energy-Conservation Programs,* ENERGY, 1994, 19:4, pp. 423-41.

normalized. For purposes of this study, two types of model were specified: Participation Models, and Engineering Projection Models.

Participation Model. This model type utilizes billing records, weather data, participant file information, and data derived from the follow-up survey. This general form of the model was used to estimate Tenant-Meter and House-Meter savings. One participation dummy variable appeared in the model for each of the five post-installation years. These variable were initialized as 0 (zero) for all Participant and Non-participant cases. Then the variables were reset to 1 (one) under the conditions specified below in Table A-4; Non-participants remain coded as 0 (zero) for all Post-Year variables.

Table A-4: Conditions for Recoding Participation Dummy Variables from Zero

Data Year by Variable	1989	1990	1991	1992	1993
Post 1	C = 1	D = 1	E = 1	F =1	G =1
Post 2	—	C = 1	D =1	E =1	F =1
Post 3	—	—	C = 1	D =1	E =1
Post 4	—	—	—	C =1	D =1
Post 5	—	—	—	—	C =1
Post 1-5	N=0	N=0	N=0	N=0	N=0

Engineering Projection. This model type modifies the Participation Model to include data on engineering projections of savings from the program conservation measures installed. The engineering projections are positive values that reflect the expected change relative to the pre-participation baseline year for each Cohort. Models using engineering projections are calculated for House Meters (from common-area lighting measures) and for Tenant Meters (from an aggregate of effects expected from all shell measures, including insulation, windows, and showerheads).

A special form of the Engineering Projection model is applied only to Tenant Meters to disaggregate the effects by individual measure types. The engineering projection values (interval variables) are substituted into the place of the Participation Dummy values (dummy variables) described above. The advantage of this substitution is that the coefficient on the engineering variables can be characterized as a *realization rate* for estimates of potential savings.

Both types of models were also supplemented by information from the Measures Survey, with the aim of adjusted for unusual conditions that may have caused particular buildings to be *outliers*, or to confound the attribution of changes to programmatic effects. This is because any changes in consumption from one year to the next can be characterized as a function of participation in the Multifamily Conservation Program, and engineering projections of potential savings, as well as changes in appliance stocks and

features, changes in building characteristics, fluctuations in occupancy rates, and changes in conservation practices not associated with the Multifamily Conservation Program. Supplemental forms of the models incorporated only the few variables from the Measures Survey found to have explanatory power beyond program participation effects.

A.5.3 MODEL ESTIMATION: STANDARD INCOME TENANT METERS

The general forms of the two savings models presented above were used to estimate seven versions of savings for standard income tenant meters. The model versions differ in variable specifications and in the samples used to estimate the models. The seven estimated model versions are:

- Model I: Participation Model Full Sample, Cohorts A through G
- Model II: Participation Model Sub-sample with Engineering Projections
- Model III: Engineering Model Sub-sample with Engineering Projections
- Model IV: Measure Detail Model Sub-sample with Engineering Projections
- Model V: Participation Model Sub-sample with Engineering Projections plus Completed Follow-up Measures Survey
- Model VI: Engineering Model Sub-sample with Engineering Projections plus Completed Follow-up Measures Survey
- Model VII: Measure Detail Model Sub-sample with Engineering Projections plus Completed Follow-up Measures Survey

Models I, II, III, V, and VI were estimated for each individual Cohort C through G, and in a form that pooled all Cohorts in the sample (Model I) or sub-sample. Separate analyses were conducted for House Meters and for Tenant Meters (for which the pooled forms included Cohorts A and B as well). The models for House Meters used a single engineering projection calculated for the common-area lighting measures installed. Models IV and VII were estimated only for the Tenant Meters, because the engineering projections for the shell measures were originally calculated by measure type (windows, wall insulation, ceiling insulation, under-floor insulation, and showerheads) and could be disaggregated for these models.

These seven models are discussed below; a more detailed presentation may be found in Appendix A.

Model I, Participation Model: Full Sample, Cohorts A through G. Specification of the model for standard income tenant meters uses the product of a set of pre-/post-year dummy variables ($PYEAR1_{it}$ - $PYEAR5_{it}$) and a binary participation variable ($PART_i$) to indicate first- through fifth-year post participation. The estimated parameters on these binary variables (β_2, β_3, β_4, β_5, and β_6,) are the estimates of first-

through fifth-year program savings. Model I was estimated using the entire sample of Standard-Income Participants and the full sample of Non-participants.

Model Version I: Participation Change Form Model: All Cohorts. Specification of the model for standard income tenant meters is presented in Equation 9-16.

Eq. A-16

$$ANNKWHT_{it} = \beta_1 + \beta_2 PART_i PYEAR1_{it} + \beta_3 PART_i PYEAR2_{it} + \beta_4 PART_i PYEAR3_{it}$$
$$+ \beta_5 PART_i PYEAR4_{it} + \beta_6 PART_i PYEAR5_{it} + \beta_7 PYEAR1_{it} BASEKWHT_i$$
$$+ \beta_8 PYEAR2_{it} BASEKWHT_i + \beta_9 PYEAR3_{it} BASEKWHT_i$$
$$+ \beta_{10} PYEAR4_{it} BASEKWHT_i + \beta_{11} PYEAR5_{it} BASEKWHT_i$$
$$+ \varepsilon_{it}$$

where:

$ANNKWHT_{it}$	=	annual per building per unit weather normalized tenant consumption
$BASEKWHT_{it}$	=	annual pre-participation year per building per unit weather normalized tenant consumption
$PYEAR1_{it}$	=	a binary variable equal to 1 if first post participation year; 0 otherwise
$PYEAR2_{it}$	=	a binary variable equal to 1 if first post participation year; 0 otherwise
$PYEAR3_{it}$	=	a binary variable equal to 1 if first post participation year; 0 otherwise
$PYEAR4_{it}$	=	a binary variable equal to 1 if first post participation year; 0 otherwise
$PYEAR5_{it}$	=	a binary variable equal to 1 if first post participation year; 0 otherwise

The general form of the model uses a set of pre-/post-year dummy variables ($PYEAR1_{it}$ -$PYEAR5_{it}$) and a binary participation variable ($PART_i$) to indicate first- through fifth-year post participation. The estimated parameters on these binary variables (β_2, β_3, β_4, β_5, and β_6,) are the estimates of first- through fifth-year program savings.

Model Version I was estimated using all of the estimation sample of standard income participants and the sample of nonparticipants.

Model II, Participation Model: Sub-sample with Engineering Projections of Savings. The specifications presented above are used as for Model Version I. However, the model is estimated for the sub-sample of Participant buildings with engineering projections of savings and the full sample of Non-participants.

Model Version II: Engineering Change Form Model: Participants with Engineering Projections of Savings. The specification presented in equation (3) is used for Model Version I. However, the model is estimated for the sample of standard income tenant meters with engineering projections of savings and the sample of nonparticipants.

Model III, Engineering Model: Sub-sample with Engineering Projections of Savings. The major difference in this model from Models I and II is that the pre-/post-participation binary variables are replaced with prior engineering projections of savings. This variable enters the model as the total engineering projection of savings across all end-uses and measure types. The coefficients on the engineering savings terms (α_2, α_3, α_4, α_5, and α_6,) may be interpreted as *realization rates* in each year for the aggregate engineering projection of savings. This version of the model was estimated for the sub-sample of Standard-income Participants having available engineering projections of savings plus the full sample of Non-participants.

Model Version III: Engineering Change Form Model: Participants with Engineering Projections of Savings. The model specification of the level from engineering savings model is presented in Equation 9-17. The major differences from Version I and II are that the pre-/post-participation binary variables are replaced with prior engineering projections of savings. Specifically,

Eq. A-17

$$\begin{aligned} ANNKWHT_{it} = {} & \alpha_1 + \alpha_2 ESAV_i PYEAR1_{it} + \alpha_3 ESAV_i PYEAR2_{it} + \alpha_4 ESAV_i PYEAR3_{it} \\ & + \alpha_5 ESAV_i PYEAR4_{it} + \alpha_6 ESAV_i PYEAR5_{it} + \alpha_7 PYEAR1_{it} BASEKWHT_i \\ & + \alpha_8 PYEAR2_{it} BASEKWHT_i + \alpha_9 PYEAR3_{it} BASEKWHT_i \\ & + \alpha_{10} PYEAR4_{it} BASEKWHT_i + \alpha_{11} PYEAR5_{it} BASEKWHT_i \\ & + \varepsilon_{it} \end{aligned}$$

where:

Eq. A-18 $ESAV_i = EINS_i + EWIN_i + ESHWR_i + ELITE_i$

EINS	=	engineering projection of energy savings from increases in wall, ceiling and floor insulation
EWIN	=	engineering projection of energy savings from installation of energy-efficient windows
ESHWR	=	engineering projection of savings from installation of low-flow showerheads
ELITE	=	engineering projection of energy savings from installation of energy-efficient lighting measures

The engineering projections enter the model as the total engineering projection of savings across all end-uses (Equation 9-18). The coefficients on the engineering savings terms (α_2, α_3, α_4, α_5, and α_6,) may be interpreted as realization rates on the engineering projections of savings.

Model IV, Measure Detail Model: Sub-sample with Engineering Projections (First Year Savings Only). The major difference in this model from Model III is that first-year savings are estimated by measure type for the Tenant Meter aggregates only. This version of the model was estimated for the sub-sample of Standard-income Participants having available engineering projections of savings plus the full sample of Non-participants. The coefficients on the engineering projections of end-use savings (δ_4, δ_5, δ_6, and δ_7) may be interpreted as *realization rates* in the first post-year for each measure's engineering projection of savings. Only first-year savings were estimated using this version, since extending the model specification to multiple years by measure type would have introduced problems with the degrees of freedom. This version of the model was estimated for the sub-sample of Standard-income Participants having available engineering projections of savings plus the full sample of Non-participants.

Model Version IV: Engineering Change Form Model: First-Year Savings by End-Use for Participants with Engineering Projections of Savings. The Engineering Change Form model was used to estimate first-year savings by end use. The estimated model is presented below.

Eq. A-19

$$ANNKWHT_{it} = \delta_1 + \delta_2 ESAV_i PYEAR1_{it} + \delta_3 PYEAR1_{it} BASEKWHT_i$$

$$+ \delta_4 EINS_i + \delta_5 EWIN_i + \delta_6 ESHWR_i + \delta_7 ELITE_i + \varepsilon_{it}$$

This version of the model was estimated for all participants with engineering projections of savings and all nonparticipants. The coefficients on the engineering projections of end-use savings (δ_4, δ_5, δ_6, and δ_7) may be interpreted as realization rates on the engineering savings.

Only first-year savings were estimated using this model version, since extending the model specification to multiple years by end use introduces degrees of freedom problems.

Model V, Participation Model: Sub-sample with Engineering Projections plus Completed Measures Survey. This model is similar to Models I and II. However, variables to control for other non-program changes at the site are introduced into the model. These variables were developed from information gathered in the follow-up survey on post-installation changes in buildings, appliances, and occupancy. This version of the model was estimated for the sub-sample of Standard-income Participants having

available engineering projections of savings as well as a completed Measures Survey, plus the full sample of Non-participants.

Model Version V: Engineering Change Form Model: Participants with Engineering Savings and Completed Follow-up Survey. This version of the model is similar to Models I and II. However, variables to control for other non-program changes at the site are introduced into the model. These variables were developed from information gathered in the follow-up survey. This model version is specified as:

Eq. A-20

$$ANNKWHT_{it} = \beta_1 + \beta_2 PART_i PYEAR1_{it} + \beta_3 PART_i PYEAR2_{it} + \beta_4 PART_i PYEAR3_{it}$$
$$+ \beta_5 PART_i PYEAR4_{it} + \beta_6 PART_i PYEAR5_{it} + \beta_7 PYEAR1_{it} BASEKWHT_i$$
$$+ \beta_8 PYEAR2_{it} BASEKWHT_i + \beta_9 PYEAR3_{it} BASEKWHT_i$$
$$+ \beta_{10} PYEAR4_{it} BASEKWHT_i + \beta_{11} PYEAR5_{it} BASEKWHT_i$$
$$+ \beta_{12} REPWTRHT_i + \beta_{13} EFFWIND_i + \varepsilon_{it}$$

where:

$REPWTRHT_I$ = a binary variable equal to 1 if Participant replaced (changed out) domestic water heaters in tenant units; 0 otherwise

$EFFWIND_I$ = a binary variable equal to 1 if Nonparticipant added high-efficiency double-pane windows; 0 otherwise

Model VI, Engineering Model: Sub-sample with Engineering Projections plus Completed Measures Survey. This model is similar to Model III. However, variables to control for other non-program changes at the site are introduced into the model, as in Model V. This version of the model was estimated for the sub-sample of Standard-income Participants having available engineering projections of savings as well as a completed Measures Survey, plus the full sample of Non-participants.

Model Version VI: Engineering Change Form Model: Participants with Engineering Savings and Completed Follow-up Survey. This version of the model is similar to Version III. However, variables to control for other non-program changes at the site are introduced into the model. These variables were developed from information gathered in the follow-up survey. This model version is specified as:

Eq. A-21

$$ANNKWHT_{it} = \alpha_1 + \alpha_2 ESAV_i PYEAR1_{it} + \alpha_3 ESAV_i PYEAR2_{it} + \alpha_4 ESAV_i PYEAR3_{it}$$
$$+ \alpha_5 ESAV_i PYEAR4_{it} + \alpha_6 ESAV_i PYEAR5_{it} + \alpha_7 PYEAR1_{it} BASEKWHT_i$$
$$+ \alpha_8 PYEAR2_{it} BASEKWHT_i + \alpha_9 PYEAR3_{it} BASEKWHT_i$$
$$+ \alpha_{10} PYEAR4_{it} BASEKWHT_i + \alpha_{11} PYEAR5_{it} BASEKWHT_i$$
$$+ \alpha_{12} REPWTRHT_{13} + \alpha_{13} EFFWIND_i + \varepsilon_{it}$$

This model was estimated with the sample of participants with engineering projections of savings and a completed follow-up survey.

Model VII, Measure Detail Model: Sub-sample with Engineering Projections plus Completed Measures Survey (First Year Savings Only). This model is similar to Model IV. However, variables to control for other non-program changes at the site are introduced into the model, as in Models V and VI. The coefficients on the engineering projections of end-use savings (δ_4, δ_5, δ_6, and δ_7) may be interpreted as *realization rates* in the first post-year for each measure's engineering projection of savings. Only first-year savings were estimated using this version, since extending the model specification to multiple years by measure type would have introduced problems with the degrees of freedom. This version of the model was estimated for the sub-sample of Standard-income Participants having available engineering projections of savings as well as a completed Measures Survey, plus the full sample of Non-participants.

Model Version VII: Engineering Change Form Model: First-Year Savings by End-Use for Participants with Engineering Projections of Savings and Completed Follow-up Survey. This model version is similar to Version IV. Variables to control for other non-program changes at the site are introduced into the model. These variables were developed from information gathered in the follow-up survey. This model version is specified as:

Eq. A-22

$$ANNKWHT_{it} = \delta_1 + \delta_2 ESAV_i PYEAR1_{it} + \delta_3 PYEAR1_{it} BASEKWHT_i$$
$$+ \delta_4 EINS_i + \delta_5 EWIN_i + \delta_6 ESHWR_i + \delta_7 ELITE_i +$$
$$+ \delta_8 REPWTRHT_i + \delta_9 EFFWIND_i + \varepsilon_{it}$$

This version of the model was estimated for all participants with engineering projections of savings and all nonparticipants. Only first-year savings were estimated using this model version, since extending the model specification to multiple years by end use introduces degrees of freedom problems.

A.5.4 ESTIMATION RESULTS

Differences between Model I and Model II are due to the sample for which the model is being estimated. The cause of the difference in the estimated savings between Model II and Model III is more problematic. In particular, Model II may be influenced by self-selection problems and therefore may overstate the savings. Self-selection is characterized by participants who select themselves into a program and have a higher propensity to conserve energy than the non-participants used as a control group. In this case the self-selection might also reflect willingness to complete a survey interview; high response rates could mitigate this type of impact. Conversely, Model III may indicate that the engineering projections over-estimate the savings. Or, savings may occur due to changes in behavior and equipment use that are not captured by the engineering calculations on equipment changed out. Given these differences, it would be desirable to further investigate the self-selection issue and to review engineering calculation methods. Further, the differences between Model V and Model VI may have the same explanation.

Differences across samples from Participants with and without Measure Survey results (Model II and Model III versus Model V and Model VI, respectively) are not attributable solely to the change in sample. In particular, variables gleaned from the survey related to Non-participants are included in the model. Including Non-participant variables that control for the independent installation of conservation measures covered by the program transforms coefficients into *gross savings* estimates as opposed to estimates of *net savings*, as in Models I-III.

A.5.5 MODEL ESTIMATION: STANDARD INCOME HOUSE METERS

The general forms of the two savings models presented above were used to estimate five versions of savings for standard income house meters. The Model Versions differ in model specification and/or in the sample used to estimate the models. The five estimated model versions are:

- Model I: Participation Model Full Sample, Cohorts C through G
- Model II: Participation Model Sub-sample with Engineering Projections
- Model III: Engineering Model Sub-sample with Engineering Projections
- Model V: Participation Model Sub-sample with Engineering Projections plus Completed Follow-up Measures Survey
- Model VI: Engineering Model Sub-sample with Engineering Projections plus Completed Follow-up Measures Survey

These five models are discussed below; a more detailed presentation may be found in Appendix A.

Model I, Participation Model: Full Sample, Cohorts C through G. Specification of the model for standard income house meters uses the product of a set of pre-/post-year dummy variables (*PYEAR1* $_{it}$ -

$PYEAR5_{it}$) and a binary participation variable ($PART_i$) to indicate first- through fifth-year post participation. The estimated parameters on these binary variables (β_2, β_3, β_4, β_5, and β_6,) are the estimates of first- through fifth-year program savings. Model I was estimated using the entire sample of Standard-Income Participants and the full sample of Non-participants.

Model Version I: Participation Change Form Model: All Cohorts. Specification of the model for standard income house meters is presented in Equation 9-23.

Eq. A-23

$$ANNKWHH_{it} = \beta_1 + \beta_2 PART_i PYEAR1_{it} + \beta_3 PART_i PYEAR2_{it} + \beta_4 PART_i PYEAR3_{it}$$
$$+ \beta_5 PART_i PYEAR4_{it} + \beta_6 PART_i PYEAR5_{it} + \beta_7 PYEAR1_{it} BASEKWHH_i$$
$$+ \beta_8 PYEAR2_{it} BASEKWHH_i + \beta_9 PYEAR3_{it} BASEKWHH_i$$
$$+ \beta_{10} PYEAR4_{it} BASEKWHH_i + \beta_{11} PYEAR5_{it} BASEKWHH_i$$
$$+ \varepsilon_{it}$$

where:

$ANNKWHH_{it}$	=	annual per building per unit weather normalized house meter consumption
$BASEKWHH_{it}$	=	annual pre-participation year per building per unit weather normalized house meter consumption
$PYEAR1_{it}$	=	a binary variable equal to 1 if first post participation year; 0 otherwise
$PYEAR2_{it}$	=	a binary variable equal to 1 if first post participation year; 0 otherwise
$PYEAR3_{it}$	=	a binary variable equal to 1 if first post participation year; 0 otherwise
$PYEAR4_{it}$	=	a binary variable equal to 1 if first post participation year; 0 otherwise
$PYEAR5_{it}$	=	a binary variable equal to 1 if first post participation year; 0 otherwise

The level from of the model uses a set of pre-/post-year dummy variables ($PYEAR1_{it}$ -$PYEAR5_{it}$) and a binary participation variable ($PART_i$) to indicate first- through fifth-year post participation. The estimated parameters on these binary variables (β_2, β_3, β_4, β_5, and β_6,) are the estimates of first- through fifth-year program savings for house meters.

Model Version I was estimated using all of the estimation sample of standard income participants and the sample of nonparticipants.

Model II, Participation Model: Sub-sample with Engineering Projections of Savings. The specifications presented above are used as for Model Version I. However, the model is estimated for the

sub-sample of Participant buildings with engineering projections of savings and the full sample of Non-participants.

Model Version II: Engineering Change Form Model: Participants with Engineering Projections of Savings. The specification presented in equation (3) is used for Model Version I. However, the model is estimated for the sample of standard income house meters with engineering projections of savings and the sample of nonparticipants.

Model III, Engineering Model: Sub-sample with Engineering Projections of Savings. The major difference in this model from Models I and II is that the pre-/post-participation binary variables are replaced with a prior engineering projection of savings. This variable enters the model as the engineering projection of savings from common-area lighting measures. The coefficients on the engineering savings terms (α_2, α_3, α_4, α_5, and α_6,) may be interpreted as *realization rates* in each year for the engineering projection of savings. This version of the model was estimated for the sub-sample of Standard-income Participants having available engineering projections of savings plus the full sample of Non-participants.

Model Version III: Engineering Change Form Model: Participants with Engineering Projections of Savings. The model specification of the Engineering Change Form model is presented in equation (4). The major differences from Version I and II are that the pre-/post-participation binary variables are replaced with prior engineering projections of savings. Specifically,

Eq. A-24

$$\begin{aligned} ANNKWHH_{it} = {} & \alpha_1 + \alpha_2 ELITE_i PYEAR1_{it} + \alpha_3 ELITE_i PYEAR2_{it} + \alpha_4 ELITE_i PYEAR3_{it} \\ & + \alpha_5 ELITE_i PYEAR4_{it} + \alpha_6 ELITE_i PYEAR5_{it} + \alpha_7 PYEAR1_{it} BASEKWHH_i \\ & + \alpha_8 PYEAR2_{it} BASEKWHH_i + \alpha_9 PYEAR3_{it} BASEKWHH_i \\ & + \alpha_{10} PYEAR4_{it} BASEKWHH_i + \alpha_{11} PYEAR5_{it} BASEKWHH_i \\ & + \varepsilon_{it} \end{aligned}$$

where:

ELITE = engineering projection of energy savings from installation of energy-efficient lighting measures

The engineering projections enter the model as the savings from lighting measures. The coefficients on the engineering savings terms (α_2, α_3, α_4, α_5, and α_6,) may be interpreted as realization rates on the engineering projections of savings.

Model V, Participation Model: Sub-sample with Engineering Projections plus Completed Measures Survey. This model is similar to Models I and II. However, variables to control for other non-program changes at the site are introduced into the model. These variables were developed from information gathered in the follow-up survey on post-installation changes in buildings, appliances, and occupancy. This version of the model was estimated for the sub-sample of Standard-income Participants having available engineering projections of savings as well as a completed Measures Survey, plus the full sample of Non-participants.

Model Version V: Engineering Change Form Model: Participants with Engineering Savings and Completed Follow-up Survey. This version of the model is similar to Models I and II. However, variables to control for other non-program changes at the site are introduced into the model. These variables were developed from information gathered in the follow-up survey. This model version is specified as:

Eq. A-25

$$ANNKWHH_{it} = \beta_1 + \beta_2 PART_i PYEAR1_{it} + \beta_3 PART_i PYEAR2_{it} + \beta_4 PART_i PYEAR3_{it}$$
$$+ \beta_5 PART_i PYEAR4_{it} + \beta_6 PART_i PYEAR5_{it} + \beta_7 PYEAR1_{it} BASEKWHH_i$$
$$+ \beta_8 PYEAR2_{it} BASEKWHH_i + \beta_9 PYEAR3_{it} BASEKWHH_i$$
$$+ \beta_{10} PYEAR4_{it} BASEKWHH_i + \beta_{11} PYEAR5_{it} BASEKWHH_i$$
$$+ \beta_{12} ADRYER_i + \beta_{13} AHIEFLGT_i + \varepsilon_{it}$$

where:

$ADRYER_i$ = a binary variable equal to 1 if Participant added clothes dryers; 0 otherwise

$AHIEFLGT_I$ = a binary variable equal to 1 if Nonparticipant added high-efficiency common-area lighting; 0 otherwise

Model VI, Engineering Model: Sub-sample with Engineering Projections plus Completed Measures Survey. This model is similar to Model III. However, variables to control for other non-program changes at the site are introduced into the model, as in Model V. This version of the model was estimated for the

sub-sample of Standard-income Participants having available engineering projections of savings as well as a completed Measures Survey, plus the full sample of Non-participants.

Model Version VI: Engineering Change Form Model: Participants with Engineering Savings and Completed Follow-up Survey. This version of the model is similar to Version III. However, variables to control for other non-program changes at the site are introduced into the model. These variables were developed from information gathered in the follow-up survey. This model version is specified as:

Eq. A-26

$$ANNKWHH_{it} = \alpha_1 + \alpha_2 ELITE_i PYEAR1_{it} + \alpha_3 ELITE_i PYEAR2_{it} + \alpha_4 ELITE_i PYEAR3_{it}$$
$$+ \alpha_5 ELITE_i PYEAR4_{it} + \alpha_6 ELITE_i PYEAR5_{it} + \alpha_7 PYEAR1_{it} BASEKWHH_i$$
$$+ \alpha_8 PYEAR2_{it} BASEKWHH_i + \alpha_9 PYEAR3_{it} BASEKWHH_i$$
$$+ \alpha_{10} PYEAR4_{it} BASEKWHH_i + \alpha_{11} PYEAR5_{it} BASEKWHH_i$$
$$+ \alpha_{12} ADRYER_{13} + \alpha_{13} AHIEFLGT_i + \varepsilon_{it}$$

This model was estimated with the sample of participants with engineering projections of savings and a completed follow-up survey.

A.5.6 ESTIMATION RESULTS

As is indicated in the tables, savings estimates in some cases differ considerably across versions. Differences in Model Versions I and II are due to the sample for which the model is being estimated. The cause of the difference in the estimated savings between Model Version II and Model Version III is more problematic. In particular, Version II may be influenced by self-selection problems and therefore may overstate the savings. Self-selection is characterized by participants who select themselves into a program and have a higher propensity to conserve energy than the nonparticipants used as a control group. Conversely, Version III may indicate that the engineering savings overestimate the savings. Given these differences, we would suggest further research to investigate the self-selection problem and/or a further review of the engineering projections. Furthermore, the difference in Model Version V and Model Version VI may have the same explanation.

Differences across samples from participants with and without surveys (Versions II and III with Versions V and VI respectively) are not attributable solely to the change in sample. In particular, variables gleaned from the survey related to nonparticipants are included in the model. Including nonparticipant variables

that control for the installation of conservation measures covered by the program indicates gross savings as opposed to net savings. Version V and VI, having the largest estimates of savings, evidence this.

B. Appendix: Impact Result Tables

This appendix contains tables that provide statistical details for the longitudinal impact evaluation of the Multifamily Conservation Programs. In each table the unit of analysis is electricity savings (kWh) per residential unit, weighted by the number of units per building.

B.1 Low-Income Program, Gross Scores & Net Method I Scores: Tenant Meters (not weather normalized)

Table B-1: Cohort A (1986) by Post-Year

Low Income, Tenant Meter, Not Weather Normalized

Post Year (Year)	Retrofitted Buildings (# Bldgs, # Units)	Pre-Period Mean (SE) Median	Post-Period Mean (SE) Median	Gross Savings Mean (SE) Median	*One-tail* t-stat (prob)	*Percent (95%CI) Corr.*
1st Year (1987)	Participants (22, 180)	11,607 (1,024) 14,706	9,315 (745) 11,285	**2,292** (424) 2,829	*5.41* (0.00001)	20% (±38%) 0.93
2nd Year (1988)	Participants (22, 180)	11,607 (1,024) 14,706	9,919 (861) 12,006	**1,688** (370) 2,163	*4.56* (0.00008)	15% (±46%) 0.94
3rd Year (1989)	Participants (22, 180)	11,607 (1,024) 14,706	9,712 (770) 11,403	**1,894** (426) 1,937	*4.45* (0.00011)	16% (±47%) 0.93
4th Year (1990)	Participants (22, 180)	11,607 (1,024) 14,706	10,118 (810) 11,740	**1,488** (407) 1,192	*3.66* (0.00073)	13% (±57%) 0.93
5th Year (1991)	Participants (22, 180)	11,607 (1,024) 14,706	9,640 (730) 10,811	**1,967** (498) 2,252	*3.95* (0.00037)	17% (±53%) 0.89
6th Year (1992)	Participants (22, 180)	11,607 (1,024) 14,706	8,883 (748) 10,057	**2,724** (498) 3,421	*5.47* (0.00001)	23% (±38%) 0.89
7th Year (1993)	Participants (22, 180)	11,607 (1,024) 14,706	9,358 (793) 10,730	**2,248** (449) 2,538	*5.01* (0.00003)	19% (±42%) 0.91

Table B-2: Cohort B (1987) by Post-Year

Low Income, Tenant Meter, Not Weather Normalized

Post Year (Year)	Retrofitted Buildings (# Bldgs, # Units)	Pre-Period Mean (SE) Median	Post-Period Mean (SE) Median	Gross Savings Mean (SE) Median	Gross Savings *One-tail* t-stat (prob)	Gross Savings Percent (95%CI) Corr.
1st Year (1988)	Participants (30, 417)	9,237 (466) 9,767	7,779 (446) 8,480	**1,458** (249) 1,677	*5.86* (0.00000)	16% (±35%) 0.85
2nd Year (1989)	Participants (30, 417)	9,237 (466) 9,767	7,595 (394) 7,932	**1,643** (300) 2,028	*5.48* (0.00000)	18% (±37%) 0.77
3rd Year (1990)	Participants (30, 417)	9,237 (466) 9,767	7,626 (389) 7,692	**1,611** (287) 2,065	*5.62* (0.00000)	17% (±36%) 0.79
4th Year (1991)	Participants (30, 417)	9,237 (466) 9,767	7,685 (396) 8,115	**1,553** (314) 1,642	*4.95* (0.00001)	17% (±41%) 0.75
5th Year (1992)	Participants (30, 417)	9,237 (466) 9,767	6,985 (363) 7,675	**2,252** (290) 2,480	*7.76* (0.00000)	24% (±26%) 0.78
6th Year (1993)	Participants (30, 417)	9,237 (466) 9,767	7,109 (388) 7,728	**2,128** (322) 2,088	*6.61* (0.00000)	23% (±31%) 0.73

Table B-3: Cohort C (1988) by Post-Year

Low Income, Tenant Meter, Not Weather Normalized

Post Year (Year)	Retrofitted / Control (# Bldgs, # Units)	Pre-Period Mean (SE) Median	Post-Period Mean (SE) Median	Gross Savings Mean (SE) Median	Gross Savings *One-tail* t-stat (prob)	Gross Savings Percent (95%CI) Corr.	Net Method I Savings Mean (SE)	Net Method I Savings Percent (95%CI)
		8,581	7,706	**875**	*3.94*	10%	**1,586**	22.7%
1st	Participants	(521)	(437)	(222)	(0.00016)	(±51%)	(299)	(±39%)
Year	(41, 742)	9,008	8,222	471		0.91		
(1989)	Non-	6,990	7,701	**-711**	*-5.79*	-10%	*One-tail*	
	Participants	(292)	(322)	(123)	(0.00000)	(±36%)	*t-stat*	*5.31*
	(24, 502)	7,234	7,864	-743		0.92	(prob)	(0.00000)
		8,581	7,833	**748**	*3.66*	9%	**1,588**	22.7%
2nd	Participants	(521)	(465)	(194)	(0.00020)	(±52%)	(272)	(±35%)
Year	(41, 742)	9,008	8,435	862		0.89		
(1990)	Non-	6,990	7,831	**-841**	*-5.88*	-12%	*One-tail*	
	Participants	(292)	(309)	(143)	(0.00000)	(±35%)	*t-stat*	*5.85*
	(24, 502)	7,234	8,448	-890		0.89	(prob)	(0.00000)
		8,581	7,684	**897**	*3.77*	10%	**1,638**	23.4%
3rd	Participants	(521)	(466)	(238)	(0.00026)	(±54%)	(366)	(±42%)
Year	(41, 742)	9,008	7,999	997		0.89		
(1991)	Non-	6,990	7,730	**-741**	*-4.06*	-11%	*One-tail*	
	Participants	(292)	(359)	(182)	(0.00024)	(±51%)	*t-stat*	*4.88*
	(24, 502)	7,234	8,199	-666		0.86	(prob)	(0.00000)
		8,581	7,298	**1,283**	*6.28*	15%	**1,582**	22.6%
4th	Participants	(521)	(432)	(204)	(0.00000)	(±32%)	(287)	(±37%)
Year	(41, 742)	9,008	8,100	1,350		0.93		
(1992)	Non-	6,990	7,289	**-299**	*-1.97*	-4%	*One-tail*	
	Participants	(292)	(336)	(152)	(0.03051)	(±105%)	*t-stat*	*5.52*
	(24, 502)	7,234	7,627	-500		0.89	(prob)	(0.00000)
		8,581	7,644	**937**	*4.23*	11%	**1,394**	20.0%
5th	Participants	(521)	(459)	(221)	(0.00007)	(±48%)	(321)	(±48%)
Year	(41, 742)	9,008	8,025	1,157		0.91		
(1993)	Non-	6,990	7,447	**-457**	*-2.35*	-7%	*One-tail*	
	Participants	(292)	(366)	(194)	(0.01378)	(±88%)	*t-stat*	*4.34*
	(24, 502)	7,234	7,708	-236		0.85	(prob)	(0.00003)

Pre-period Equivalency Test (1987):

$Mean_{participant}$ - $Mean_{Non\text{-}participant}$ = 1,591 (Two-tail) t-stat = 2.26 df = 63 (prob) (0.02)

Table B-4: Cohort D (1989) by Post-Year

Low Income, Tenant Meter, Not Weather Normalized

Post Year (Year)	Retrofitted / Control (# Bldgs, # Units)	Pre-Period Mean (SE) Median	Post-Period Mean (SE) Median	Gross Savings Mean (SE) Median	*One-tail* t-stat (prob)	Gross Savings Percent (95%CI) Corr.	Net Method I Savings Mean (SE)	Net Method I Savings Percent (95%CI)
		7,954	7,509	**445**	*1.93*	6%	**591**	7.7%
1st	Participants	(491)	(403)	(230)	(0.03280)	(±107%)	(261)	(±91%)
Year	(24, 467)	8,476	7,777	477		0.89		
(1990)	Non-	7,684	7,831	**-147**	*-1.15*	-2%	*One-tail*	
	Participants	(331)	(309)	(128)	(0.13112)	(±180%)	*t-stat*	*2.27*
	(24, 502)	7,790	8,448	-183		0.92	(prob)	(0.01397)
		7,954	7,300	**654**	*2.40*	8%	**700**	9.1%
2nd	Participants	(491)	(456)	(264)	(0.01055)	(±84%)	(310)	(±92%)
Year	(24, 467)	8,476	7,361	825		0.85		
(1991)	Non-	7,684	7,730	**-46**	*-0.28*	-1%	*One-tail*	
	Participants	(331)	(359)	(168)	(0.39227	(±748%)	*t-stat*	*2.26*
	(24, 502)	7,790	8,199	-27		0.89	(prob)	(0.01444)
		7,954	6,914	**1,040**	*4.14*	13%	**645**	8.4%
3rd	Participants	(491)	(412)	(251)	(0.00020)	(±50%)	(284)	(±91%)
Year	(24, 467)	8,476	6,899	1,186		0.86		
(1992)	Non-	7,684	7,289	**395**	*2.86*	5%	*One-tail*	
	Participants	(331)	(336)	(138)	(0.00446)	(±72%)	*t-stat*	*2.27*
	(24, 502)	7,790	7,627	433		0.91	(prob)	(0.01397)
		7,954	7,222	**732**	*2.92*	9%	**495**	6.4%
4th	Participants	(491)	(412)	(251)	(0.00384)	(±71%)	(314)	(±131%)
Year	(24, 467)	8,476	7,367	572		0.86		
(1993)	Non-	7,684	7,447	**237**	*1.24*	3%	*One-tail*	
	Participants	(331)	(366)	(192)	(0.11441)	(±167%)	*t-stat*	*1.58*
	(24, 502)	7,790	7,708	268		0.85	(prob)	(0.06072)

Pre-period Equivalency Test (1988):

$Mean_{participant} - Mean_{Non\text{-}participant}$ = 270 (Two-tail) t-stat = 0.46 df = 46 (prob) (0.50)

Table B-5: Cohort E (1990) by Post-Year

Low Income, Tenant Meter, Not Weather Normalized

Post Year (Year)	Retrofitted / Control (# Bldgs, # Units)	Pre-Period Mean (SE) Median	Post-Period Mean (SE) Median	Gross Savings Mean (SE) Median	*One-tail* t-stat (prob)	Gross Savings Percent (95%CI) Corr.	Net Method I Savings Mean (SE)	Net Method I Savings Percent (95%CI)
1st Year (1991)	Participants (43, 619)	9,701 (398) 10,462	8,772 (406) 9,663	**929** (209) 767	*4.44* (0.00003)	10% (±46%) 0.86	**958** (285)	12.4% (±62%)
	Non-Participants (24, 502)	7,701 (322) 7,864	7,730 (359) 8,199	**-29** (141) 37	*-0.21* (0.41930)	0% (±1,004%) 0.92	*One-tail t-stat* (prob)	*3.36* (0.00066)
2nd Year (1992)	Participants (43, 619)	9,701 (398) 10,462	8,348 (398) 9,022	**1,353** (208) 1,531	*6.51* (0.00000)	14% (±31%) 0.86	**940** (276)	12.2% (±61%)
	Non-Participants (24, 502)	7,701 (322) 7,864	7,289 (336) 7,627	**412** (117) 463	*3.52* (0.00091)	5% (±59%) 0.94	*One-tail t-stat* (prob)	*3.41* (0.00056)
3rd Year (1993)	Participants (43, 619)	9,701 (398) 10,462	8,491 (398) 9,687	**1,209** (203) 1,145	*595* (0.00000)	12% (±34%) 0.87	**955** (290)	12.4% (±63%)
	Non-Participants (24, 502)	7,701 (322) 7,864	7,447 (366) 7,708	**254** (171) 431	*1.49* (0.07549)	3% (±139%) 0.88	*One-tail t-stat* (prob)	*3.29* (0.00089)

Pre-period Equivalency Test (1989):

$Mean_{participant}$ - $Mean_{Non\text{-}participant}$ = 1,999 (Two-tail) t-stat = 3.55 df = 65 (prob) (0.002)

Table B-6: Cohort F (1991) by Post-Year

Low Income, Tenant Meter, Not Weather Normalized

Post Year (Year)	Retrofitted / Control (# Bldgs, # Units)	Pre-Period Mean (SE) Median	Post-Period Mean (SE) Median	Gross Savings Mean (SE) Median	*One-tail* t-stat (prob)	Percent (95%CI) Corr.	Net Method I Savings Mean (SE)	Net Method I Savings Percent (95%CI)
		9,178	7,586	**1,593**	*7.96*	17%	**1,051**	13.4%
1st	Participants	(654)	(601)	(200)	(0.00000)	(±26%)	(240)	(±47%)
Year	(31, 417)	9,403	8,687	1,738		0.95		
(1992)	Non-	7,831	7,289	**542**	*4.19*	7%	*One-tail*	
	Participants	(309)	(336)	(129)	(0.00018)	(±49%)	*t-stat*	*4.37*
	(24, 502)	8,448	7,627	695		0.92	(prob)	(0.00003)
		9,178	7,906	**1,272**	*5.66*	14%	**889**	11.3%
2nd	Participants	(654)	(575)	(225)	(0.00000)	(±36%)	(304)	(±71%)
Year	(31, 417)	9,403	9,056	1,171		0.94		
(1993)	Non-	7,831	7,447	**384**	*1.89*	5%	*One-tail*	
	Participants	(309)	(366)	(202)	(0.03540)	(±109%)	*t-stat*	*2.92*
	(24, 502)	8,448	7,708	565		0.83	(prob)	(0.0 254)

Pre-period Equivalency Test (1990):

$Mean_{participant}$ - $Mean_{Non\text{-}participant}$ = 1,348 (Two-tail) t-stat = 1.84 df = 53 (prob) (0.05)

Table B-7: Cohort G (1992) by Post-Year

Low Income, Tenant Meter, Not Weather Normalized

Post Year (Year)	Retrofitted / Control (# Bldgs, # Units)	Pre-Period Mean (SE) Median	Post-Period Mean (SE) Median	Gross Savings Mean (SE) Median	*One-tail* t-stat (prob)	Percent (95%CI) Corr.	Net Method I Savings Mean (SE)	Net Method I Savings Percent (95%CI)
		7,881	6,733	**1,148**	*6.42*	15%	**865**	11.2%
1st	Participants	(478)	(464)	(179)	(0.00000)	(±32%)	(213)	(±51%)
Year	(27, 599)	9,158	8,231	1,155		0.93		
(1993)	Non-	7,730	7,447	**283**	*2.87*	4%	*One-tail*	
	Participants	(359)	(366)	(99)	(0.00435)	(±72%)	*t-stat*	*4.06*
	(24, 502)	8,199	7,708	464		0.96	(prob)	(0.00009)

Pre-period Equivalency Test (1991):

$Mean_{participant}$ - $Mean_{Non\text{-}participant}$ = 151 (Two-tail) t-stat = 0.25 df = 49 (prob) (0.50)

B.2 Low-Income Program, Gross Scores & Net Method I Scores: Tenant Meters (weather normalized)

Table B-8: Cohort A (1986) by Post-year

Low Income, Tenant Meter, Weather Normalized

Post Year (Year)	Retrofitted Buildings (# Bldgs, # Units)	Pre-Period Mean (SE) Median	Post-Period Mean (SE) Median	Gross Savings Mean (SE) Median	*One-tail* t-stat (prob)	Percent (95%CI) Corr.
1st Year (1987)	Participants (22, 180)	11,519 (1,024) 14,618	9,698 (745) 11,668	**1,821** (424) 2,358	*4.30* (.00016)	16% (±48%) 0.93
2nd Year (1988)	Participants (22, 180)	11,519 (1,024) 14,618	10,062 (861) 12,149	**1,457** (370) 1,933	*3.94* (0.00037)	13% (±53%) 0.94
3rd Year (1989)	Participants (22, 180)	11,519 (1,024) 14,618	9,901 (770) 11,592	**1,618** (426) 1,661	*3.80* (0.00052)	14% (±55%) 0.93
4th Year (1990)	Participants (22, 180)	11,519 (1,024) 14,618	10,357 (810) 11,978	**1,162** (407) 866	*2.86* (0.00473)	10% (±73%) 0.93
5th Year (1991)	Participants (22, 180)	11,519 (1,024) 14,618	9,764 (730) 10,935	**1,755** (498) 2,040	*3.52* (0.00101)	15% (±59%) 0.89
6th Year (1992)	Participants (22, 180)	11,519 (1,024) 14,618	9,374 (748) 10,548	**2,145** (498) 2,842	*4.31* (0.00016)	19% (±48%) 0.89
7th Year (1993)	Participants (22, 180)	11,519 (1,024) 14,618	9,500 (793) 10,872	**2,019** (449) 2,308	*4.50* (0.00010)	18% (±46%) 0.91

Table B-9: Cohort B (1987) by Post-Year

Low Income, Tenant Meter, Weather Normalized

Post Year (Year)	Retrofitted Buildings (# Bldgs, # Units)	Pre-Period Mean (SE) Median	Post-Period Mean (SE) Median	Gross Savings Mean (SE) Median	Gross Savings *One-tail* t-stat (prob)	Gross Savings Percent (95%CI) Corr.
1st Year (1988)	Participants (30, 417)	9,150 (466) 9,679	7,922 (446) 8,624	**1,227** (249) 1,446	*4.93* (0.00002)	13% (±41%) 0.85
2nd Year (1989)	Participants (30, 417)	9,150 (466) 9,679	7,784 (394) 8,121	**1,366** (300) 1,752	*4.56* (0.00004)	15% (±45%) 0.77
3rd Year (1990)	Participants (30, 417)	9,150 (466) 9,679	7,865 (389) 7,931	**1,285** (287) 1,739	*4.48* (0.00005)	14% (±46%) 0.79
4th Year (1991)	Participants (30, 417)	9,150 (466) 9,679	7,809 (396) 8,240	**1,341** (314) 1,430	*4.28* (0.00009)	15% (±48%) 0.75
5th Year (1992)	Participants (30, 417)	9,150 (466) 9,679	7,477 (363) 8,166	**1,673** (290) 1,901	*5.76* (0.00000)	18% (±35%) 0.78
6th Year (1993)	Participants (30, 417)	9,150 (466) 9,679	7,251 (388) 7,870	**1,898** (322) 1,859	*5.90* (0.00000)	21% (±35%) 0.73

Table B-10: Cohort C (1988) by Post-Year

Low Income, Tenant Meter, Weather Normalized

Post Year (Year)	Retrofitted / Control (# Bldgs, # Units)	Pre-Period Mean (SE) Median	Post-Period Mean (SE) Median	Gross Savings Mean (SE) Median	*One-tail* t-stat (prob)	Gross Savings Percent (95%CI) Corr.	Net Method I Savings Mean (SE)	Net Method I Savings Percent (95%CI)
		9,079	7,895	**1,184**	*5.33*	13%	**1,643**	21.9%
1st	Participants	(521)	(437)	(222)	(0.00000)	(±38%)	(299)	(±38%)
Year	(41, 742)	9,506	8,411	780		0.91		
(1989)	Non-	7,487	7,947	**-459**	*-3.74*	-6%	*One-tail*	
	Participants	(292)	(322)	(123)	(0.00054)	(±55%)	*t-stat*	*5.50*
	(24, 502)	7,732	8,110	-491		0.92	(prob)	(0.00000)
		9,079	8,072	**1,007**	*5.19*	11%	**1,660**	22.2%
2nd	Participants	(521)	(465)	(194)	(0.00000)	(±39%)	(272)	(±34%)
Year	(41, 742)	9,506	8,673	1,122		0.93		
(1990)	Non-	7,487	8,140	**-653**	*-4.56*	-9%	*One-tail*	
	Participants	(292)	(309)	(143)	(0.00007)	(±45%)	*t-stat*	*6.11*
	(24, 502)	7,732	8,758	-702		0.89	(prob)	(0.00000)
		9,079	7,808	**1,270**	*5.34*	14%	**1,675**	22.4%
3rd	Participants	(521)	(466)	(238)	(0.00000)	(±38%)	(336)	(±41%)
Year	(41, 742)	9,506	8,123	1,370		0.89		
(1991)	Non-	7,487	7,892	**-405**	*-2.22*	-5%	*One-tail*	
	Participants	(292)	(359)	(182)	(0.01826)	(±93%)	*t-stat*	*4.49*
	(24, 502)	7,732	8,361	-330		0.86	(prob)	(0.00000)
		9,079	7,789	**1,289**	*6.31*	14%	**1,729**	23.1%
4th	Participants	(521)	(432)	(204)	(0.00000)	(±32%)	(287)	(±34%)
Year	(41, 742)	9,506	8,591	1,356		0.93		
(1992)	Non-	7,487	7,927	**-440**	*-2.89*	-6%	*One-tail*	
	Participants	(292)	(336)	(152)	(0.00409)	(±71%)	*t-stat*	*6.03*
	(24, 502)	7,732	8,265	-640		0.89	(prob)	(0.00000)
		9,079	7,786	**1,293**	*5.84*	14%	**1,437**	19.2%
5th	Participants	(521)	(459)	(221)	(0.00000)	(±35%)	(321)	(±46%)
Year	(41, 742)	9,506	8,167	1,513		0.91		
(1993)	Non-	7,487	7,631	**-144**	*-0.74*	-2%	*One-tail*	
	Participants	(292)	(366)	(194)	(0.23300)	(±279%)	*t-stat*	*4.47*
	(24, 502)	7,732	7,892	77		0.85	(prob)	(0.00002)

Pre-period Equivalency Test (1987):

$Mean_{participant}$ - $Mean_{Non\text{-}participant}$ = *1,591 (Two-tail) t-stat = 2.26 df = 63 (prob) (0.02)*

Table B-11: Cohort D (1989) by Post-Year

Low Income, Tenant Meter, Weather Normalized

Post Year (Year)	Retrofitted / Control (# Bldgs, # Units)	Pre-Period Mean (SE) Median	Post-Period Mean (SE) Median	Gross Savings Mean (SE) Median	*One-tail* t-stat (prob)	Percent (95%CI) Corr.	Net Method I Savings Mean (SE)	Percent (95%CI)
		8,140	7,748	**392**	*1.71*	5%	**663**	8.4%
1st	Participants	(491)	(403)	(230)	(0.05075)	(±121%)	(261)	(±81%)
Year	(24, 467)	8,662	8,015	424		0.89		
(1990)	Non-	7,870	8,140	**-270**	*-2.12*	-3%	*One-tail*	
	Participants	(331)	(309)	(128)	(0.02266)	(±98%)	*t-stat*	*2.54*
	(24, 502)	7,976	8,758	-307		0.92	(prob)	(0.00721)
		8,140	7,425	**715**	*2.71*	9%	**737**	9.4%
2nd	Participants	(491)	(456)	(264)	(0.00627)	(±76%)	(310)	(±87%)
Year	(24, 467)	8,662	7,486	887		0.85		
(1991)	Non-	7,870	7,892	**-22**	*-0.13*	0%	*One-tail*	
	Participants	(331)	(359)	(168)	(0.44840)	(±1,578%)	*t-stat*	*2.38*
	(24, 502)	7,976	8,361	-3		0.89	(prob)	(0.01087)
		8,140	7,406	**735**	*2.92*	9%	**792**	10.1%
3rd	Participants	(491)	(412)	(251)	(0.00384)	(±71%)	(284)	(±74%)
Year	(24, 467)	8,662	7,390	880		0.86		
(1992)	Non-	7,870	7,927	**-57**	*-0.41*	-1%	*One-tail*	
	Participants	(331)	(336)	(138)	(0.34164)	(±501%)	*t-stat*	*2.79*
	(24, 502)	7,976	8,265	-19		0.91	(prob)	(0.00386)
		8,140	7,364	**776**	*3.10*	10%	**538**	6.8%
4th	Participants	(491)	(412)	(251)	(0.00254)	(±67%)	(314)	(±121%)
Year	(24, 467)	8,662	7,509	616		0.86		
(1993)	Non-	7,870	7,631	**238**	*1.24*	3%	*One-tail*	*1.71*
	Participants	(331)	(366)	(192)	(0.11290)	(±166%)	*t-stat*	(0.04672)
	(24, 502)	7,976	7,892	270		0.85	(prob)	

Pre-period Equivalency Test (1988):

$Mean_{participant}$ - $Mean_{Non\text{-}participant}$ = 270 (Two-tail) t-stat = 0.46 df = 46 (prob) (0.50)

Table B-12: Cohort E (1990) by Post-Year

Low Income, Tenant Meter, Weather Normalized

Post Year (Year)	Retrofitted / Control (# Bldgs, # Units)	Pre-Period Mean (SE) Median	Post-Period Mean (SE) Median	Gross Savings Mean (SE) Median	*One-tail* t-stat (prob)	Percent (95%CI) Corr.	Net Method I Savings Mean (SE)	Percent (95%CI)
		9,946	8,896	**1,050**	*5.02*	11%	**995**	12.5%
1st	Participants	(398)	(406)	(209)	(0.00001)	(±40%)	(285)	(±59%)
Year	(43, 619)	10,707	9,788	888		0.86		
(1991)	Non-	7,947	7,892	**55**	*0.39*	1%	*One-tail*	
	Participants	(322)	(359)	(141)	(0.35089)	(±534%)	*t-stat*	*3.49*
	(24, 502)	8,110	8,361	120		0.92	(prob)	(0.00044)
		9,946	8,839	**1,107**	*5.33*	11%	**1,087**	13.7%
2nd	Participants	(398)	(398)	(208)	(0.00000)	(±38%)	(276)	(±53%)
Year	(43, 619)	10,707	9,513	1,285		0.86		
(1992)	Non-	7,947	7,927	**20**	*0.17*	0%	*One-tail*	
	Participants	(322)	(336)	(117)	(0.43438)	(±1,238%)	*t-stat*	*3.94*
	(24, 502)	8,110	8,265	70		0.94	(prob)	(0.00010)
		9,946	8,633	**1,313**	*6.46*	13%	**998**	12.6%
3rd	Participants	(398)	(398)	(203)	(0.00000)	(±31%)	(290)	(±60%)
Year	(43, 619)	10,707	9,829	1,249		0.87		
(1993)	Non-	7,947	7,63	**315**	*1.84*	4%	*One-tail*	
	Participants	(322)	(366)	(171)	(0.03922)	(±112%)	*t-stat*	*3.44*
	(24, 502)	8,110	7,892	492		0.88	(prob)	(0.00051)

Pre-period Equivalency Test (1989):

$Mean_{participant}$ - $Mean_{Non\text{-}participant}$ = 1,999 (Two-tail) t-stat = 3.55 df = 65 (prob) (0.002)

Table B-13: Cohort F (1991) by Post-Year

Low Income, Tenant Meter, Weather Normalized

Post Year (Year)	Retrofitted / Control (# Bldgs, # Units)	Pre-Period Mean (SE) Median	Post-Period Mean (SE) Median	Gross Savings Mean (SE) Median	*One-tail* t-stat (prob)	Percent (95%CI) Corr.	Net Method I Savings Mean (SE)	Percent (95%CI)
		9,488	8,077	**1,411**	*7.05*	15%	**1,198**	14.7%
1st	Participants	(654)	(601)	(200)	(0.00000)	(±29%)	(240)	(±42%)
Year	(31, 417)	9,713	9,178	1,557		0.95		
(1992)	Non-	8,140	7,927	**213**	*1.65*	3%	*One-tail*	
	Participants	(309)	(336)	(129)	(0.05657)	(±126%)	*t-stat*	*4.98*
	(24, 502)	8,758	8,265	366		0.92	(prob)	(0.00000)
		9,488	8,048	**1,440**	*6.40*	15%	**931**	11.4%
2nd	Participants	(654)	(575)	(225)	(0.00000)	(±32%)	(304)	(±68%)
Year	(31, 417)	9,713	9,198	1,339		0.94		
(1993)	Non-	8,140	7,631	**509**	*2.51*	6%	*One-tail*	
	Participants	(309)	(366)	(202)	(0.00973)	(±82%)	*t-stat*	*3.06*
	(24, 502)	8,758	7,892	690		0.83	(prob)	(0.00172)

Pre-period Equivalency Test (1990):

$Mean_{participant}$ - $Mean_{Non\text{-}participant}$ = 1,348 (Two-tail) t-stat = 1.84 df = 53 (prob) (0.05)

Table B-14: Cohort G (1992) by Post-Year

Low Income, Tenant Meter, Weather Normalized

Post Year (Year)	Retrofitted / Control (# Bldgs, # Units)	Pre-Period Mean (SE) Median	Post-Period Mean (SE) Median	Gross Savings Mean (SE) Median	*One-tail* t-stat (prob)	Percent (95%CI) Corr.	Net Method I Savings Mean (SE)	Percent (95%CI)
		8,043	6,875	**1,168**	*6.53*	15%	**907**	11.5%
1st	Participants	(478)	(464)	(179)	(0.00000)	(±31%)	(213)	(±49%)
Year	(27, 599)	9,320	8,373	1,175		0.93		
(1993)	Non-	7,892	7,631	**260**	*2.64*	3%	*One-tail*	
	Participants	(359)	(366)	(99)	(0.00738)	(±78%)	*t-stat*	*4.26*
	(24, 502)	8,361	7,892	441		0.96	(prob)	(0.00005)

Pre-period Equivalency Test (1991):

$Mean_{participant}$ - $Mean_{Non\text{-}participant}$ = 151 (Two-tail) t-stat = 0.25 df = 49 (prob) (0.50)

B.3 Low-Income Program, Gross Scores & Net Method I Scores: House Meters (not weather normalized)

Table B-15: Cohort A (1986) by Post-Year

Low Income, House Meter

Post Year (Year)	Retrofitted Buildings (# Bldgs, # Units)	Pre-Period Mean (SE) Median	Post-Period Mean (SE) Median	Gross Savings Mean (SE) Median	Gross Savings *One-tail* t-stat (prob)	Gross Savings Percent (95%CI) Corr.
1st Year (1987)	Participants (3, 18)	6,289 (1,074) 7,494	4,849 (691) 5,592	**1,440** (383) 1,891	*3.76* (0.03199)	23% (±88%) 1.00
2nd Year (1988)	Participants (3, 18)	6,289 (1,074) 7,494	5,376 (931) 5,913	**912** (256) 779	*3.57* (0.03514)	15% (±93%) 0.98
3rd Year (1989)	Participants (3, 18)	6,289 (1,074) 7,494	5,137 (1,132) 6,352	**1,152** (62) 1,142	*18.67* (0.00143)	18% (±18%) 1.00
4th Year (1990)	Participants (3, 18)	6,289 (1,074) 7,494	5,710 (868) 6,587	**578** (211) 768	*2.74* (0.05559)	9% (±120%) 1.00
5th Year (1991)	Participants (3, 18)	6,289 (1,074) 7,494	5,675 (802) 6,372	**614** (330) 539	*1.86* (0.10191)	10% (±177%) 0.98
6th Year (1992)	Participants (3, 18)	6,289 (1,074) 7,494	4,126 (987) 3,128	**2,162** (1,131) 690	*1.91* (0.09805)	34% (±173%) 0.40%
7th Year (1993)	Participants (3, 18)	6,289 (1,074) 7,494	3,267 (1,906) 2,951	**2,661** (2,070) 783	*1.29* (0.16370)	42% (±257%) 0.12

Table B-16: Cohort B (1987) by Post-Year

Low Income, House Meter

Post Year (Year)	Retrofitted Buildings (# Bldgs, # Units)	Pre-Period Mean (SE) Median	Post-Period Mean (SE) Median	Gross Savings Mean (SE) Median	Gross Savings *One-tail* t-stat (prob)	Gross Savings Percent (95%CI) Corr.
1st Year (1988)	Participants (20, 303)	1,803 (272) 1,061	1,237 (157) 987	**566** (193) 297	*2.93* (0.00430)	31% (±71%) 0.72
2nd Year (1989)	Participants (20, 303)	1,803 (272) 1,061	1,282 (171) 996	**520** (200) 308	*2.60* (0.00874)	29% (±80%) 0.68
3rd Year (1990)	Participants (20, 303)	1,803 (272) 1,061	1,299 (169) 973	**504** (191) 313	*2.64* (0.00810)	28% (±79%) 0.72
4th Year (1991)	Participants (20, 303)	1,803 (272) 1,061	1,311 (172) 954	**491** (192) 259	*2.56* (0.00960)	27% (±82%) 0.71
5th Year (1992)	Participants (20, 303)	1,803 (272) 1,061	1,304 (163) 1,071	**499** (188) 254	*2.65* (0.00795)	28% (±79%) 0.73
6th Year (1993)	Participants (20, 303)	1,803 (272) 1,061	1,255 (171) 1,028	**548** (213) 261	*2.57* (0.00933)	30% (±81%) 0.62

Table B-17: Cohort C (1988) by Post-Year

Low Income, House Meter

Post Year (Year)	Retrofitted / Control (# Bldgs, # Units)	Pre-Period Mean (SE) Median	Post-Period Mean (SE) Median	Gross Savings Mean (SE) Median	*One-tail* t-stat (prob)	Gross Savings Percent (95%CI) Corr.	Net Method I Savings Mean (SE)	Net Method I Savings Percent (95%CI)
		2,121	1,928	**192**	*1.66*	9%	**331**	17.9%
1st	Participants	(575)	(511)	(116)	(0.05484)	(±124%)	(130)	(±81%)
Year	(26, 496)	1,235	1,266	88		0.98		
(1989)	Non-	1,849	1,988	**-138**	*-2.71*	-7%	*One-tail*	
	Participants	(200)	(213)	(51)	(0.00643)	(±77%)	*t-stat*	*2.55*
	(23, 496)	1,566	1,610	2		0.97	(prob)	(0.00700)
		2,121	1,945	**176**	*1.45*	8%	**456**	24.7%
2nd	Participants	(575)	(541)	(122)	(0.08022)	(±142%)	(163)	(±74%)
Year	(26, 496)	1,235	1,157	90		0.98		
(1990)	Non-	1,849	2,129	**-280**	*-2.61*	-15%	*One-tail*	
	Participants	(200)	(253)	(107)	(0.00802)	(±80%)	*t-stat*	*2.80*
	(23, 496)	1,566	1,590	-43		0.91	(prob)	(0.00374)
		2,121	1,945	**175**	*1.22*	8%	**476**	25.8%
3rd	Participants	(575)	(538)	(143)	(0.11618)	(±168%)	(186)	(±81%)
Year	(26, 496)	1,235	1,183	65		0.97		
(1991)	Non-	1,849	2,150	**-301**	*-2.59*	16%	*One-tail*	
	Participants	(200)	(251)	(116)	(0.00829)	(±80%)	*t-stat*	*2.56*
	(23, 496)	1,566	1,751	-168		0.89	(prob)	(0.00680)
		2,121	1,823	**298**	*2.01*	14%	**556**	30.0%
4th	Participants	(575)	(490)	(148)	(0.02793)	(±103%)	(204)	(±76%)
Year	(26, 496)	1,235	1,049	64		0.97		
(1992)	Non-	1,849	2,107	**-258**	*-1.85*	-14%	*One-tail*	
	Participants	(200)	(243)	(139)	(0.03863)	(±112%)	*t-stat*	*.272*
	(23, 496)	1,566	1,752	-159		0.82	(prob)	(0.00456)
		2,121	1,884	**236**	*2.35*	11%	**545**	29.5%
5th	Participants	(575)	(598)	(100)	(0.01342)	(±88%)	(192)	(±73%)
Year	(26, 496)	1,235	1,079	100		0.99		
(1993)	Non-	1,849	2,158	**-309**	*-1.85*	-17%	*One-tail*	
	Participants	(200)	(260)	(167)	(0.03902)	(±112%)	*t-stat*	*2.83*
	(23, 496)	1,566	1,776	-89		0.77	(prob)	(0.00340)

Pre-period Equivalency Test (1987):

$Mean_{participant}$ - $Mean_{Non\text{-}participant}$ = 271 (Two-tail) t-stat = 0.43 df = 47 (prob) (0.50)

Table B-18: Cohort D (1989) by Post-Year

Low Income, House Meter

Post Year (Year)	Retrofitted / Control (# Bldgs, # Units)	Pre-Period Mean (SE) Median	Post-Period Mean (SE) Median	Gross Savings Mean (SE) Median	*One-tail* t-stat (prob)	Gross Savings Percent (95%CI) Corr.	Net Method I Savings Mean (SE)	Net Method I Savings Percent (95%CI)
		1,380	1,145	**235**	*3.29*	17%	**429**	22.2%
1st	Participants	(219)	(204)	(71)	(0.00202)	(±64%)	(129)	(±63%)
Year	(19, 415)	1,120	900	220		0.95		
(1990)	Non-	1,935	2,129	**-194**	*-1.90*	-10%	*One-tail*	
	Participants	(198)	(253)	(102)	(0.03498)	(±109%)	*t-stat*	*3.32*
	(23, 496)	1,542	1,590	-106		0.93	(prob)	(0.00097)
		1,380	1,184	**196**	*2.41*	14%	**411**	21.2%
2nd	Participants	(219)	(199)	(81)	(0.01332)	(±87%)	(142)	(±72%)
Year	(19, 415)	1,120	970	123		0.93		
(1991)	Non-	1,935	2,150	**-215**	*-1.95*	-11%	*One-tail*	
	Participants	(198)	(251)	(110)	(0.03218)	(±106%)	*t-stat*	*2.89*
	(23, 496)	1,542	1,751	-128		0.91	(prob)	(0.00306)
		1,380	1,146	**234**	*2.79*	17%	**405**	20.9
3rd	Participants	(219)	(191)	(84)	(0.00611)	(±75%)	(164)	(±84%)
Year	(19, 415)	1,120	1,013	152		0.93		
(1992)	Non-	1,935	2,107	**-172**	*-1.30*	-9%	*One-tail*	
	Participants	(198)	(243)	(132)	(0.10348)	(±160%)	*t-stat*	*2.47*
	(23, 496)	1,542	1,752	-1		0.84	(prob)	(0.0 886)
		1,380	1,148	**232**	*2.76*	17%	**454**	23.5%
4th	Participants	(219)	(199)	(84)	(0.00648)	(±76%)	(193)	(±88%)
Year	(19, 415)	1,120	957	50		0.92		
(1993)	Non-	1,935	2,158	**-222**	*-1.38*	-11%	*One-tail*	
	Participants	(198)	(260)	(161)	(0.09116)	(±151%)	*t-stat*	*2.35*
	(23, 496)	1,542	1,776	-1		0.78	(prob)	(0.01182)

Pre-period Equivalency Test (1988):

$Mean_{participant} - Mean_{Non\text{-}participant}$ = -556 (Two-tail) t-stat = -1.88 df = 40 (prob) =(0. 05)

Table B-19: Cohort E (1990) by Post-Year

Low Income, House Meter

Post Year (Year)	Retrofitted / Control (# Bldgs, # Units)	Pre-Period Mean (SE) Median	Post-Period Mean (SE) Median	Gross Savings Mean (SE) Median	*One-tail* t-stat (prob)	Gross Savings Percent (95%CI) Corr.	Net Method I Savings Mean (SE)	Net Method I Savings Percent (95%CI)
		3,121	2,669	**451**	*3.97*	14%	**614**	30.9%
1st	Participants	(529)	(459)	(114)	(0.00030)	(±52%)	(141)	(±48%)
Year	(24, 473)	1,511	1,302	190		0.98		
(1991)	Non-	1,988	2,150	**-163**	*-1.94*	-8%	*One-tail*	
	Participants	(213)	(251)	(84)	(0.03252)	(±107%)	*t-stat*	*4.35*
	(23, 496)	1,610	1,751	-90		0.95	(prob)	(0.00004)
		3,121	2,571	**550**	*4.55*	18%	**670**	33.7%
2nd	Participants	(529)	(444)	(121)	(0.00007)	(±46%)	(171)	(±53%)
Year	(24, 473)	1,511	1,270	197		0.98		
(1992)	Non-	1,988	2,107	**-120**	*-0.99*	-6%	*One-tail*	
	Participants	(213)	(243)	(121)	(0.16699)	(±210%)	*t-stat*	*3.91*
	(23, 496)	1,610	1,752	5		0.87	(prob)	(0.00015)
		3,121	2,637	**483**	*4.34*	15%	**654**	32.9%
3rd	Participants	(529)	(478)	(111)	(0.00012)	(±48%)	(183)	(±58%)
Year	(24, 473)	1,511	1,380	160		0.98		
(1993)	Non-	1,988	2,158	**-170**	*-1.17*	-9%	*One-tail*	
	Participants	(213)	(260)	(145)	(0.12707)	(±177%)	*t-stat*	*3.57*
	(23, 496)	1,610	1,776	43		0.83	(prob)	(0.00043)

Pre-period Equivalency Test (1989):

$Mean_{participant}$ - $Mean_{Non\text{-}participant}$ = 1,133 (Two-tail) t-stat = 1.99 df = 45 (prob) (0.05)

Table B-20: Cohort F (1991) by Post-Year

Low Income, House Meter

Post Year (Year)	Retrofitted / Control (# Bldgs, # Units)	Pre-Period Mean (SE) Median	Post-Period Mean (SE) Median	Gross Savings Mean (SE) Median	Gross Savings *One-tail* t-stat (prob)	Gross Savings Percent (95%CI) Corr.	Net Method I Savings Mean (SE)	Net Method I Savings Percent (95%CI)
		1,341	1,160	**180**	*4.63*	13%	**158**	7.4%
1st	Participants	(242)	(255)	(39)	(0.00014)	(±46%)	(97)	(±127%)
Year	(17, 280)	1,007	790	122		0.99		
(1992)	Non-	2,129	2,107	**22**	*0.30*	1%	*One-tail*	
	Participants	(253)	(243)	(75)	(0.38438)	(±697%)	*t-stat*	*1.63*
	(23, 496)	1,590	1,752	11		0.96	(prob)	(0.05526)
		1,341	1,172	**169**	*3.71*	13%	**197**	9.3%
2nd	Participants	(242)	(253)	(46)	(0.00096)	(±57%)	(129)	(±136%)
Year	(17, 280)	1,007	800	187		0.98		
(1993)	Non-	2,129	2,158	**-28**	*0.28*	-1%	*One-tail*	
	Participants	(253)	(260)	(101)	(0.39139)	(±743%)	*t-stat*	*1.52*
	(23, 496)	1,590	1,776	-7		0.92	(prob)	(0.06804)

Pre-period Equivalency Test (1990):

$Mean_{participant} - Mean_{Non\text{-}participant}$ = 789 (Two-tail) t-stat = -2.16 df = 38 (prob) (0.05)

Table B-21: Cohort G (1992) by Post-Year

Low Income, House Meter

Post Year (Year)	Retrofitted / Control (# Bldgs, # Units)	Pre-Period Mean (SE) Median	Post-Period Mean (SE) Median	Gross Savings Mean (SE) Median	Gross Savings *One-tail* t-stat (prob)	Gross Savings Percent (95%CI) Corr.	Net Method I Savings Mean (SE)	Net Method I Savings Percent (95%CI)
		3,171	2,538	**634**	*2.3*	20%	**641**	29.8%
1st	Participants	(542)	(483)	(275)	(0.01638)	(±91%)	(283)	(±92%)
Year	(20, 498)	1,374	1,097	118		0.86		
(1993)	Non-	2,150	2,158	**-7**	*-0.08*	0%	*One-tail*	
	Participants	(251)	(260)	(93)	(0.46890)	(±2,628%)	*t-stat*	*2.26*
	(23, 496)	1,751	1,776	20		0.93	(prob)	(0.01448)

Pre-period Equivalency Test (1991):

$Mean_{participant} - Mean_{Non\text{-}participant}$ = 1,021 (Two-tail) t-stat = 1.74 df = 41 (prob) (0.10)

B.4 Low-Income Program, Summary Net Method I Scores

Table B-22: Low Income, Tenant Meter, Weather Normalized
Summary of Net Method I Scores

Cohort	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year
A[1] (1986)	1,821	1,457	1,618	1,162	1,755	2,145	2,019
B[1] (1987)	1,227	1,366	1,285	1,341	1,673	1,898	
C (1988)	1,643	1,660	1,675	1,729	1,437		
D (1989)	663	737	792	538			
E (1990)	995	1,087	998				
F (1991)	1,198	931					
G (1992)	907						

Notes
[1] *Savings estimates are gross savings*.

Table B-23: Low Income, House Meter

Summary of Net Method I Scores

Cohort	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year
A[1] (1986)	1,440	912	1,152	578	614	2,162	2,661
B[1] (1987)	566	520	504	491	499	548	
C (1988)	331	456	476	556	545		
D (1989)	429	411	405	454			
E (1990)	614	670	654				
F (1991)	158	197					
G (1992)	641						

Notes

[1] *Savings estimates are gross savings.*

Table B-24: Low Income, Total Building (Tenant Meter + House Meter)
Summary of Net Method I Scores

Cohort	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year
A[1] (1986)	3,261	2,369	2,770	1,740	2,369	4,307	4,680
B[1] (1987)	1,793	1,886	1,789	1,832	2,172	2,446	
C (1988)	1,974	2,116	2,151	2,285	1,982		
D (1989)	1,092	1,148	1,197	992			
E (1990)	1,609	1,757	1,652				
F (1991)	1,356	1,128					
G (1992)	1,548						

Notes
[1] *Savings estimates are gross savings.*

B.5 Low-Income Program, Net Method II Scores

Tenant Meters (not weather-normalized)

Table B-25: Cohort C (1988) by Post-year

Low Income, Tenant Meter, Not Weather Normalized

Net Method II	Net Savings Mean (SE)	Net Savings Percent (95% CI)	95% Confidence Interval	Adj R^2 (*df*) *F Value*
1st Year (1989)	**1,251** (271)	14.59% (±36%)	797 To 1,706	0.81 (64) *141*
2nd Year (1990)	**1,335** (259)	15.56% (±32%)	902 To 1,768	0.85 (64) *176*
3rd Year (1991)	**1,358** (327)	15.82% (±40%)	811 to 1,903	0.77 (64) *106*
4th Year (1992)	**1,256** (259)	14.63% (±35%)	822 to 1,689	0.83 (64) *157*
5th Year (1993)	**1,119** (311)	13.05% (±46%)	599 to 1,640	0.79 (64) *118*

Table B-26; Cohort D (1989) by Post-year

Low Income, Tenant Meter, Not Weather Normalized

Net Method II	Net Savings Mean (SE)	Net Savings Percent (95% CI)	95% Confidence Interval	Adj R^2 (*df*) *F Value*
1st Year (1990)	**529** (231)	6.66% (±73%)	141 to 918	0.80 (47) *94*
2nd Year (1991)	**658** (307)	8.27% (±78%)	141 to 1,174	0.73 (47) *64*
3rd Year (1992)	**588** (264)	7.39% (±76%)	143 to 1,033	0.76 (47) *75*
4th Year (1993)	**440** (300)	5.53% (±115%)	-65 to 945	0.71 (47) *59*

Table B-27: Cohort E (1990) by Post-year

Low Income, Tenant Meter, Not Weather Normalized

Net Method II	Net Savings Mean (SE)	Net Savings Percent (95% CI)	95% Confidence Interval	Adj R^2 (*df*) *F Value*
1st Year (1991)	**787** (304)	8.11% (±65%)	279 to 1,295	0.77 (66) *114*
2nd Year (1992)	**717** (290)	7.40% (±68%)	232 to 1,203	0.78 (66) *119*
3rd Year (1993)	**756** (308)	7.79% (±68%)	242 to 1,270	0.77 (66) *109*

Table B-28: Cohort F (1991) by Post-year

Low Income, Tenant Meter, Not Weather Normalized

Net Method II	Net Savings Mean (SE)	Net Savings Percent (95% CI)	95% Confidence Interval	Adj R^2 (*df*) *F Value*
1st Year (1992)	**913** (241)	9.94% (±44%)	510 to 1,315	0.89 (54) *216*
2nd Year (1993)	**694** (300)	7.56 (±72%)	192 to 1,196	0.82 (54) *127*

Table B-29: Cohort G (1992) by Post-year

Low Income, Tenant Meter, Not Weather Normalized

Net Method II	Net Savings Mean (SE)	Net Savings Percent (95% CI)	95% Confidence Interval	Adj R^2 (*df*) *F Value*
1st Year (1993)	**853** (215)	10.83% (±42%)	495 to 1,212	0.88 (50) *184*

B.6 Low-Income Program, Net Method II Scores

Tenant Meters (weather-normalized)

Table B-30: Cohort C (1988) by Post-year

Low Income, Tenant Meter, Weather Normalized

Net Method II	Net Savings Mean (SE)	Net Savings Percent (95% CI)	95% Confidence Interval	Adj R^2 (*df*) *F Value*
1st Year (1989)	**1,308** (272)	14.41% (±35%)	854 to 1,763	0.81 (64) *141*
2nd Year (1990)	**1,406** (259)	15.49% (±31%)	973 to 1,839	0.84 (64) *176*
3rd Year (1991)	**1,395** (327)	15.36% (±39%)	849 to 1,941	0.77 (64) *107*
4th Year (1992)	**1,402** (259)	15.45% (±31%)	969 to 1,836	0.83 (64) *158*
5th Year (1993)	**1,162** (311)	12.80% (±45%)	641 to 1,682	0.79 (64) *118*

Table B-31: Cohort D (1989) by Post-year

Low Income, Tenant Meter, Weather Normalized

Net Method II	Net Savings Mean (SE)	Net Savings Percent (95% CI)	95% Confidence Interval	Adj R^2 (*df*) *F Value*
1st Year (1990)	**601** (231)	7.38% (±65%)	212 to 989	0.80 (47) *95*
2nd Year (1991)	**695** (307)	8.54% (±74%)	179 to 1,211	0.73 (47) *64*
3rd Year (1992)	**734** (264)	9.02% (±61%)	290 to 1,179	0.76 (47) *76*
4th Year (1993)	**482** (300)	5.92 (±105%)	-23 to 987	0.71 (47) *59*

Table B-32: Cohort E (1990) by Post-year

Low Income, Tenant Meter, Weather Normalized

Net Method II	Net Savings Mean (SE)	Net Savings Percent (95% CI)	95% Confidence Interval	Adj R^2 (*df*) *F Value*
1st Year (1991)	**824** (304)	8.28% (±62%)	316 to 1,332	0.77 (66) *114*
2nd Year (1992)	**864** (290)	8.69% (±56%)	379 to 1,349	0.78 (66) *117*
3rd Year (1993)	**798** (308)	8.03% (±64%)	284 to 1,312	0.76 (66) *108*

Table B-33: Cohort F (1991) by Post-year

Low Income, Tenant Meter, Weather Normalized

Net Method II	Net Savings Mean (SE)	Net Savings Percent (95% CI)	95% Confidence Interval	Adj R^2 (*df*) *F Value*
1st Year (1992)	**1,059** (241)	11.17% (±38%)	657 to 1,462	0.89 (54) *216*
2nd Year (1993)	**736** (300)	7.76 (±68%)	234 to 1,238	0.82 (54) *127*

Table B-34: Cohort G (1992) by Post-year

Low Income, Tenant Meter, Weather Normalized

Net Method II	Net Savings Mean (SE)	Net Savings Percent (95% CI)	95% Confidence Interval	Adj R^2 (*df*) *F Value*
1st Year (1993)	**896** (215)	11.14% (±40%)	537 to 1,254	0.88 (50) *184*

B.7 Low-Income Program, Net Method II Scores

House Meters (not weather-normalized)

Table B-35: Cohort C (1988) by Post-year

Low Income, House Meter

Net Method II	Net Savings Mean (SE)	Net Savings Percent (95% CI)	95% Confidence Interval	Adj R^2 (*df*) *F Value*
1st Year (1989)	**301** (113)	14.18% (±63%)	110 to 491	0.96 (48) *591*
2nd Year (1990)	**441** (164)	20.78% (±63%)	164 to 717	0.93 (48) *315*
3rd Year (1991)	**457** (186)	21.54% (±69%)	144 to 769	0.91 (48) *238*
4th Year (1992)	**514** (185)	24.22% (±61%)	201 to 826	0.89 (48) *199*
5th Year (1993)	**551** (198)	25.96% (±61%)	217 to 884	0.91 (48) *256*

Table B-36: Cohort D (1989) by Post-year

Low Income, House Meter

Net Method II	Net Savings Mean (SE)	Net Savings Percent (95% CI)	95% Confidence Interval	Adj R^2 (*df*) *F Value*
1st Year (1990)	**404** (139)	29.25% (±58%)	170 to 637	0.87 (41) *139*
2nd Year (1991)	**405** (153)	29.35% (±64%)	147 to 663	0.84 (41) *108*
3rd Year (1992)	**445** (175)	32.26% (±66%)	150 to 740	0.78 (41) *72*
4th Year (1993)	**486** (207)	35.24% (±72%)	137 to 835	0.72 (41) *54*

Table B-37: Cohort E (1990) by Post-year

Low Income, House Meter

Net Method II	Net Savings Mean (SE)	Net Savings Percent (95% CI)	95% Confidence Interval	Adj R^2 (*df*) F Value
1st Year (1991)	**490** (136)	15.71% (±47%)	201 to 719	0.94 (46) *362*
2nd Year (1992)	**498** (159)	15.95% (±54%)	230 to 765	0.91 (46) *240*
3rd Year (1993)	**545** (188)	17.46% (±58%)	228 to 861	0.89 (46) *195*

Table B-38: Cohort F (1991) by Post-year

Low Income, House Meter

Net Method II	Net Savings Mean (SE)	Net Savings Percent (95% CI)	95% Confidence Interval	Adj R^2 (*df*) *F Value*
1st Year (1992)	**197** (107)	14.67% (±92%)	16 to 377	0.94 (39) *289*
2nd Year (1993)	**220** (145)	16.44 (±111%)	-24 to 465	0.89 (39) *165*

Table B-39: Cohort G (1992) by Post-year

Low Income, House Meter

Net Method II	Net Savings Mean (SE)	Net Savings Percent (95% CI)	95% Confidence Interval	Adj R^2 (*df*) *F Value*
1st Year (1993)	**444** (278)	13.99% (±105%)	-24 to 911	0.76 (42) *67*

B.8 Low-Income Program, Summary of Net Method II Scores

Table B-40: Low Income, Tenant Meter, Weather Normalized
Summary of Net Method II Scores

Cohort	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year
A[1] (1986)							
B[1] (1987)							
C (1988)	1,273	1,327	1,282	1,367	1,119		
D (1989)	615	689	601	422			
E (1990)	1,056	1,001	1,036				
F (1991)	929	552					
G (1992)	859						

Notes
[1] *No pre-period non participant data available.*

Table B-41: Low Income, House Meter

Summary of Net Method II Scores

Cohort	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year
A[1] (1986)							
B[1] (1987)							
C (1988)	301	441	457	514	551		
D (1989)	404	405	445	486			
E (1990)	490	498	545				
F (1991)	197	220					
G (1992)	444						

Notes

[1] *No pre-period non participant data available.*

Table B-42: Low Income, Total Building (Tenant Meter + House Meter)
Summary of Net Method II Scores

Cohort	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year
A[1] (1986)							
B[1] (1987)							
C (1988)	1,574	1,768	1,739	1,881	1,670		
D (1989)	1,019	1,094	1,046	908			
E (1990)	1,546	1,499	1,581				
F (1991)	1,126	772					
G (1992)	1,303						

Notes
[1] *No pre-period non participant data available.*

B.9 Low-Income Program, Net Method III Scores

Table B-43: Cohorts A through E Pooled, First Post-year
Low Income, Total Building (Tenant + House)

Net Method III Analysis of Covariance Meter Type	Net Savings Mean (SE)	Net Savings 95% Conf. Interval	Adj R^2 (df) F Value
Tenant	**829** (158)	513 to 1,145	0.79 (177) 344
Tenant Weather Normalized	**905** (159)	587 to 1,223	0.79 (177) 336
Common Area	**387** (88)	211 To 563	0.94 (88) 665

Table B-44: Cohorts F and G Pooled, First Post-year
Low Income, Total Building (Tenant + House)

Net Method III Analysis of Covariance Meter Type	Net Savings Mean (SE)	Net Savings 95% Conf. Interval	Adj R2 (df) F Value
Tenant	**855** (159)	537 to 1,173	0.88 (103) 399
Tenant Weather Normalized	**973** (157)	659 to 1,287	0.89 (103) 422
Common Area	**399** (153)	93 to 705	0.81 (80) (179)

B.10 Standard-Income Program, Gross Scores & Net Method I Scores

Tenant Meters (not weather normalized)

Table B-45: Cohort A (1986) by Post-Year

Standard Income, Tenant Meter, Not Weather Normalized

Post Year (Year)	Retrofitted Buildings (# Bldgs, # Units)	Pre-Period Mean (SE) Median	Post-Period Mean (SE) Median	Gross Savings Mean (SE) Median	Gross Savings One-tail t-stat (prob)	Gross Savings Percent (95%CI) Corr.
1st Year (1987)	Participants	8,062 (369) 8,583	6,370 (387) 7,047	**1,722** (179) 1,636	*9.60* (0.00000)	21% (±22%) 0.89
2nd Year (1988)	Participants	8,062 (369) 8,583	7,138 (419) 7,578	**924** (301) 1,030	*3.07* (0.00281)	11% (±68%) 0.71
3rd Year (1989)	Participants	8,062 (369) 8,583	6,852 (386) 7,925	**1,210** (147) 1,213	*8.26* (0.00000)	15% (±25%) 0.93
4th Year (1990)	Participants	8,062 (369) 8,583	7,134 (391) 7,715	**928** (179) 1,115	*5.17* (0.00002)	12% (±40%) 0.89
5th Year (1991)	Participants	8,062 (369) 8,583	6,963 (379) 7,670	**1,099** (179) 1,184	*6.15* (0.00000)	14% (±34%) 0.89
6th Year (1992)	Participants	8,062 (369) 8,583	6,523 (370) 7,405	**1,539** (188) 1,616	*8.19* (0.00000)	19% (±25%) 0.87
7th Year (1993)	Participants	8,062 (369) 8,583	6,800 (392) 7,288	**1,262** (223) 1,308	*5.65* (0.00001)	16% (±37%) 0.83

Table B-46: Cohort B (1987) by Post-Year

Standard Income, Tenant Meter, Not Weather Normalized

Post Year (Year)	Retrofitted Buildings (# Bldgs, # Units)	Pre-Period Mean (SE) Median	Post-Period Mean (SE) Median	Gross Savings Mean (SE) Median	Gross Savings *One-tail* t-stat (prob)	Gross Savings Percent (95%CI) Corr.
1st Year (1988)	Participants (28, 466)	7,619 (452) 8,967	6,227 (388) 7,846	**1,393** (124) 1,439	*11.21* (0.00000)	18% (±18%) 0.97
2nd Year (1989)	Participants (28, 466)	7,619 (452) 8,967	6,302 (408) 7,559	**1,317** (170) 1,286	*7.73* (0.00000)	17% (±27%) 0.93
3rd Year (1990)	Participants (28, 466)	7,619 (452) 8,967	6,293 (429) 7,578	**1,326** (144) 1,367	*9.23* (0.00000)	17% (±22%) 0.95
4th Year (1991)	Participants (28, 466)	7,619 (452) 8,967	6,437 (417) 7,979	**1,182** (176) 1,265	*6.71* (0.00000)	16% (±31%) 0.92
5th Year (1992)	Participants (28, 466)	7,619 (452) 8,967	5,806 (410) 7,160	**1,813** (167) 1,929	*10.85* (0.00000)	24% (±19%) 0.93
6th Year (1993)	Participants (28, 466)	7,619 (452) 8,967	6,121 (414) 7,639	**1,498** (179) 1,681	*8.38* (0.00000)	20% (±24%) 0.92

Table B-47: Cohort C (1988) by Post-Year

Standard Income, Tenant Meter, Not Weather Normalized

Post Year (Year)	Retrofitted / Control (# Bldgs, # Units)	Pre-Period Mean (SE) Median	Post-Period Mean (SE) Median	Gross Savings Mean (SE) Median	Gross Savings *One-tail* t-stat (prob)	Gross Savings Percent (95%CI) Corr.	Net Method I Savings Mean (SE)	Net Method I Savings Percent (95%CI)
		7,451	7,654	**-203**	*-1.66*	-3%	**574**	7.6%
1st	Participants	(389)	(409)	(122)	(0.05269)	(±122%)	(223)	(±79%)
Year	(39, 682)	8,284	7,962	-216		0.95		
(1989)	Non-	7,541	8,318	**-777**	*-3.82*	-10%	*One-tail*	
	Participants	(179)	(262)	(204)	(0.00029)	(±54%)	*t-stat*	*2.58*
	(33, 429)	7,548	7,794	-534		0.63	(prob)	(0.00603)
		7,451	7,723	**-272**	*-2.09*	-4%	**643**	8.5%
2nd	Participants	(389)	(407)	(130)	(0.02167)	(±97%)	(234)	(±74%)
Year	(39, 682)	8,284	8,305	-222		0.95		
(1990)	Non-	7,541	8,456	**-915**	*-4.31*	-12%	*One-tail*	
	Participants	(179)	(272)	(212)	(0.00007)	(±47%)	*t-stat*	*2.75*
	(33, 429)	7,548	7,929	-784		0.63	(prob)	(0.00380)
		7,451	7,560	**-108**	*-0.68*	-1%	**715**	9.5%
3rd	Participants	(389)	(418)	(158)	(0.24908)	(±295%)	(246)	(±70%)
Year	(39, 682)	8,284	8,188	-237		0.93		
(1991)	Non-	7,541	8,365	**-824**	*-4.22*	-11%	*One-tail*	
	Participants	(179)	(259)	(195)	(0.00009)	(±48%)	*t-stat*	*2.91*
	(33, 429)	7,548	7,929	-645		0.66	(prob)	(0.00245)
		7,451	7,111	**340**	*2.19*	5%	**723**	9.6%
4th	Participants	(389)	(391)	(155)	(0.01720)	(±92%)	(250)	(±71%)
Year	(39, 682)	8,284	7,522	280		0.92		
(1992)	Non-	7,541	7,924	**-382**	*-1.86*	-5%	*One-tail*	
	Participants	(179)	(255)	(206)	*(0.03599)*	(±110%)	*t-stat*	*2.90*
	(33, 429)	7,548	7,792	-384		0.60	(prob)	(0.00253)
		7,451	7,279	**173**	*1.12*	2%	**878**	11.6%
5th	Participants	(389)	(402)	(155)	(0.13534)	(±181%)	(246)	(±57%)
Year	(39, 682)	8,284	7,389	85		0.92		
(1993)	Non-	7,541	8,246	**-705**	*-3.52*	-9%	*One-tail*	
	Participants	(179)	(240)	(201)	(0.00067)	(±58%)	*t-stat*	*3.56*
	(33, 429)	7,548	8,106	-508		0.58	(prob)	(0.00033)

***Pre-period Equivalency Test (1987)*:**

$Mean_{participant}$ - $Mean_{Non\text{-}participant}$ = -90 (Two-tail) t-stat = -0.19 df = 70 (prob) (0.50)

Table B-48: Cohort D (1989) by Post-Year

Standard Income, Tenant Meter, Not Weather Normalized

Post Year (Year)	Retrofitted / Control (# Bldgs, # Units)	Pre-Period Mean (SE) Median	Post-Period Mean (SE) Median	Gross Savings Mean (SE) Median	Gross Savings *One-tail* t-stat (prob)	Gross Savings Percent (95%CI) Corr.	Net Method I Savings Mean (SE)	Net Method I Savings Percent (95%CI)
		8,511	7,669	**843**	*5.12*	10%	**1,098**	13.4%
1st	Participants	(289)	(234)	(164)	(0.00001)	(±40%)	(200)	(±37%)
Year	(35, 580)	8,184	7,649	730		0.82		
(1990)	Non-	8,200	8,456	**-256**	*-2.57*	-3%	*One-tail*	
	Participants	(254)	(272)	(99)	(0.00743)	(±79%)	*t-stat*	*5.48*
	(33, 429)	7,803	7,929	-198		0.93	(prob)	(0.00000)
		8,511	7,561	**950**	*4.18*	11%	**1,115**	13.6%
2nd	Participants	(289)	(242)	(227)	(0.00010)	(±49%)	(264)	(±48%)
Year	(35, 580)	8,184	7,467	696		0.65		
(1991)	Non-	8,200	8,365	**-165**	*-1.64*	-2%	*One-tail*	
	Participants	(254)	(259)	(100)	(0.05541)	(±125%)	*t-stat*	*4.22*
	(33, 429)	7,803	7,929	-112		0.92	(prob)	(0.00004)
		8,511	7,205	**1,306**	*5.98*	15%	**1,030**	12.6%
3rd	Participants	(289)	(269)	(218)	(0.00000)	(±34%)	(264)	(±52%)
Year	(35, 580)	8,184	7,012	1,188		0.70		
(1992)	Non-	8,200	7,924	**277**	*2.20*	3%	*One-tail*	
	Participants	(254)	(255)	(126)	(0.01753)	(±93%)	*t-stat*	*3.91*
	(33, 429)	7,803	7,792	119		0.88	(prob)	(0.00011)
		8,511	7,286	**1,225**	*7.33*	14%	**1,272**	15.5%
4th	Participants	(289)	(233)	(167)	(0.00000)	(±28%)	(224)	(±36%)
Year	(35, 580)	8,184	6,891	1,314		0.82		
(1993)	Non-	8,200	8,246	**-46**	*-0.32*	-1%	*One-tail*	
	Participants	(254)	(240)	(143)	(0.37468)	(±634%)	*t-stat*	*5.69*
	(33, 429)	7,803	8,106	-10		0.83	(prob)	(0.00000)

Pre-period Equivalency Test (1988):

$Mean_{participant}$ - $Mean_{Non\text{-}participant}$ = 311 (Two-tail) t-stat = 0.80 df = 66 (prob) (0.50)

Table B-49: Cohort E (1990) by Post-Year

Standard Income, Tenant Meter, Not Weather Normalized

Post Year (Year)	Retrofitted / Control (# Bldgs, # Units)	Pre-Period Mean (SE) Median	Post-Period Mean (SE) Median	Gross Savings Mean (SE) Median	*One-tail* t-stat (prob)	Gross Savings Percent (95%CI) Corr.	Net Method I Savings Mean (SE)	Net Method I Savings Percent (95%CI)
1st Year (1991)	Participants (51, 706)	8,592 (333) 8,714	7,717 (324) 8,008	**875** (114) 949	*7.67* (0.00000)	10% (±26%) 0.94	**921** (161)	11.1% (±36%)
	Non-Participants (33, 429)	8,318 (262) 7,794	8,365 (259) 7,929	**-46** (92) -107	*-0.50* (0.30935)	-1% (±406%) 0.94	*One-tail t-stat* (prob)	*5.73* (0.00000)
2nd Year (1992)	Participants (51, 706)	8,592 (333) 8,714	7,053 (311) 6,929	**1,539** (119) 1,575	*12.95* (0.00000)	18% (±15%) 0.93	**1,144** (179)	13.8% (±32%)
	Non-Participants (33, 429)	8,318 (262) 7,794	7,924 (255) 7,792	**395** (125) 305	*3.16* (0.00171)	5% (±65%) 0.88	*One-tail t-stat* (prob)	*6.39* (0.00000)
3rd Year (1993)	Participants (51, 706)	8,592 (333) 8,714	7,320 (337) 7,282	**1,272** (108) 1,111	*11.79* (0.00000)	15% (±17%) 0.95	**1,200** (174)	14.4% (±30%)
	Non-Participants (33, 429)	8,318 (262) 7,794	8,246 (240) 8,106	**72** (138) 80	*0.52* (0.30217)	1% (±390%) 0.85	*One-tail t-stat* (prob)	*6.9* (0.00000)

Pre-period Equivalency Test (1989):

$Mean_{participant}$ - $Mean_{Non\text{-}participant}$ = 274 (Two-tail) t-stat = 0.59 df = 82 (prob) (0.50)

Table B-50: Cohort F (1991) by Post-Year

Standard Income, Tenant Meter, Not Weather Normalized

Post Year (Year)	Retrofitted / Control (# Bldgs, # Units)	Pre-Period Mean (SE) Median	Post-Period Mean (SE) Median	Gross Savings Mean (SE) Median	*One-tail* t-stat (prob)	Percent (95%CI) Corr.	Net Method I Savings Mean (SE)	Net Method I Savings Percent (95%CI)
		7,750	6,200	**1,550**	*13.29*	20%	**1,018**	12.0%
1st	Participants	(242)	(208)	(117)	(0.00000)	(±15%)	(183)	(±37%)
Year	(58, 1,219)	8,075	6,324	1,376		0.88		
(1992)	Non-	8,456	7,924	**532**	*4.44*	6%	*One-tail*	
	Participants	(272)	(255)	(120)	(0.00005)	(±46%)	*t-stat*	*5.55*
	(33, 429)	7,929	7,792	606		0.90	(prob)	(0.00000)
		7,750	6,587	**1,162**	*11.47*	15%	**953**	11.3%
2nd	Participants	(242)	(208)	(101)	(0.00000)	(±17%)	(175)	(±38%)
Year	(58, 1,219)	8,075	6,736	1,065		0.91		
(1993)	Non-	8,456	8,246	**210**	*1.36*	2%	*One-tail*	
	Participants	(272)	(240)	(154)	(0.09190)	(±150%)	*t-stat*	*5.44*
	(33, 429)	7,929	8,106	133		0.83	(prob)	(0.00000)

Pre-period Equivalency Test (1990):

$Mean_{participant} - Mean_{Non\text{-}participant}$ *= -706 (Two-tail) t-stat = -1.83 df = 89 (prob) (0.10)*

Table B-51: Cohort G (1992) by Post-Year

Standard Income, Tenant Meter, Not Weather Normalized

Post Year (Year)	Retrofitted / Control (# Bldgs, # Units)	Pre-Period Mean (SE) Median	Post-Period Mean (SE) Median	Gross Savings Mean (SE) Median	*One-tail* t-stat (prob)	Percent (95%CI) Corr.	Net Method I Savings Mean (SE)	Net Method I Savings Percent (95%CI)
		7,375	6,226	**1,149**	*11.20*	16%	**1,030**	12.3%
1st	Participants	(306)	(278)	(103)	(0.00000)	(±18%)	(166)	(±33%)
Year	(40, 782)	7,957	7,125	1,128		0.94		
(1993)	Non-	8,365	8,246	**119**	*0.86*	1%	*One-tail*	
	Participants	(259)	(240)	(138)	(0.19907)	(±238%)	*t-stat*	*6.22*
	(33, 429)	7,929	8,106	235		0.85	(prob)	(0.00000)

Pre-period Equivalency Test (1991):

$Mean_{participant} - Mean_{Non\text{-}participant}$ *= -990 (Two-tail) t-stat = -2.35 df = 71 (prob) (0.02)*

B.11 Standard-Income Program, Gross Scores & Net Method I Scores

Tenant Meters (weather normalized)

Table B-52: Cohort A (1986) by Post-Year

Standard Income, Tenant Meter, Weather Normalized

Post Year (Year)	Retrofitted Buildings (# Bldgs, # Units)	Pre-Period Mean (SE) Median	Post-Period Mean (SE) Median	Gross Savings Mean (SE) Median	*One-tail* t-stat (prob)	Percent (95%CI) Corr.
1st Year (1987)	Participants (23, 242)	7,968 (369) 8,489	6,586 (387) 7,293	**1,382** (179) 1,296	*7.7* (0.00000)	17% (±27%) 0.89
2nd Year (1988)	Participants (23, 242)	7,968 (369) 8,489	7,230 (419) 7,670	**737** (301) 843	*2.45* (0.01137)	9% (±85%) 0.71
3rd Year (1989)	Participants (23, 242)	7,968 (369) 8,489	6,974 (386) 8,046	**994** (147) 997	*6.78* (0.00000)	12% (±31%) 0.93
4th Year (1990)	Participants (23, 242)	7,968 (369) 8,489	7,287 (391) 7,868	**680** (179) 868	*3.79* (0.00050)	9% (±55%) 0.89
5th Year (1991)	Participants (23, 242)	7,968 (369) 8,489	7,043 (379) 7,750	**925** (179) 1,010	*5.17* (0.00002)	12% (±40%) 0.89
6th Year (1992)	Participants (23, 242)	7,968 (369) 8,489	6,839 (370) 7,720	**1,129** (188) 1,206	*6.01* (0.00000)	14% (±35%) 0.87
7th Year (1993)	Participants (23, 242)	7,968 (369) 8,489	6,891 (392) 7,379	**1,076** (223) 1,123	*4.82* (0.00004)	14% (±43%) 0.83

Table B-53: Cohort B (1987) by Post-Year

Standard Income, Tenant Meter, Weather Normalized

Post Year (Year)	Retrofitted Buildings (# Bldgs, # Units)	Pre-Period Mean (SE) Median	Post-Period Mean (SE) Median	Gross Savings Mean (SE) Median	Gross Savings *One-tail* t-stat (prob)	Gross Savings Percent (95%CI) Corr.
1st Year (1988)	Participants (28, 466)	7,525 (452) 8,877	6,318 (388) 7,938	**1,207** (124) 1,252	*9.72* (0.00000)	16% (±21%) 0.97
2nd Year (1989)	Participants (28, 466)	7,525 (452) 8,877	6,423 (408) 7,680	**1,102** (170) 1,070	*6.47* (0.00000)	15% (±32%) 0.93
3rd Year (1990)	Participants (28, 466)	7,525 (452) 8,877	6,446 (429) 7,731	**1,079** (144) 1,120	*7.52* (0.00000)	14% (±32%) 0.95
4th Year (1991)	Participants (28, 466)	7,525 (452) 8,877	6,517 (417) 8,059	**1,008** (176) 1,091	*5.72* (0.00000)	13% (±36%) 0.92
5th Year (1992)	Participants (28, 466)	7,525 (452) 8,877	6,121 (410) 7,476	**1,404** (167) 1,519	*8.42* (0.00000)	19% (±24%) 0.93
6th Year (1993)	Participants (28, 466)	7,525 (452) 8,877	6,212 (414) 7,730	**1,313** (179) 1,495	*7.35* (0.00000)	17% (±28%) 0.92

Table B-54: Cohort C (1988) by Post-Year

Standard Income, Tenant Meter, Weather Normalized

Post Year (Year)	Retrofitted / Control (# Bldgs, # Units)	Pre-Period Mean (SE) Median	Post-Period Mean (SE) Median	Gross Savings Mean (SE) Median	Gross Savings *One-tail* t-stat (prob)	Gross Savings Percent (95%CI) Corr.	Net Method I Savings Mean (SE)	Net Method I Savings Percent (95%CI)
		7,987	7,776	**211**	*1.72*	3%	**717**	8.9%
1st	Participants	(389)	(409)	(122)	(0.04653)	(±117%)	(223)	(±63%)
Year	(39, 682)	8,819	8,083	198		0.95		
(1989)	Non-	8,076	8,582	**-506**	*-2.48*	-6%	*One-tail*	
	Participants	(179)	(262)	(204)	(0.00922)	(±82%)	*t-stat*	*3.22*
	(33, 429)	8,083	8,058	-263		0.63	(prob)	(0.00098)
		7,987	7,876	**110**	*0.85*	1%	**823**	10.2%
2nd	Participants	(389)	(407)	(130)	(0.20082)	(±238%)	(234)	(±58%)
Year	(39, 682)	8,819	8,458	161		0.95		
(1990)	Non-	8,076	8,789	**-712**	*-3.36*	-9%	*One-tail*	
	Participants	(179)	(272)	(212)	(0.00101)	(±61%)	*t-stat*	*3.52*
	(33, 429)	8,083	8,262	-582		0.63	(prob)	(0.00038)
		7,987	7,639	**347**	*2.19*	4%	**809**	10.0%
3rd	Participants	(389)	(418)	(158)	(0.01721)	(±92%)	(246)	(±62%)
Year	(39, 682)	8,819	8,268	218		0.93		
(1991)	Non-	8,076	8,539	**-462**	*-2.37*	-6%	*One-tail*	
	Participants	(179)	(259)	(195)	(0.01197)	(±86%)	*t-stat*	*3.29*
	(33, 429)	8,083	8,103	-284		0.66	(prob)	(0.00079)
		7,987	7,427	**560**	*3.61*	7%	**1,094**	13.5%
4th	Participants	(389)	(391)	(155)	(0.00044)	(±56%)	(250)	(±47%)
Year	(39, 682)	8,819	7,837	499		0.92		
(1992)	Non-	8,076	8,610	**-534**	*-2.60*	-7%	*One-tail*	
	Participants	(179)	(255)	(206)	(0.00707)	(±79%)	*t-stat*	*4.38*
	(33, 429)	8,083	8,478	-535		0.60	(prob)	(0.00002)
		7,987	7,370	**617**	*3.99*	8%	**985**	12.2%
5th	Participants	(389)	(402)	(155)	(0.00015)	(±51%)	(246)	(±51%)
Year	(39, 682)	8,819	7,480	529		0.92		
(1993)	Non-	8,076	8,444	**-368**	*-1.84*	-5%	*One-tail*	
	Participants	(179)	(240)	(201)	(0.03781)	(±111%)	*t-stat*	*4.00*
	(33, 429)	8,083	8,304	-171		0.58	(prob)	(0.00008)

Pre-period Equivalency Test (1987):

$Mean_{participant} - Mean_{Non\text{-}participant}$ *= -90 (Two-tail) t-stat = -0.19 df = 70 (prob) (0.50)*

Table B-55: Cohort D (1989) by Post-Year

Standard Income, Tenant Meter, Weather Normalized

Post Year (Year)	Retrofitted / Control (# Bldgs, # Units)	Pre-Period Mean (SE) Median	Post-Period Mean (SE) Median	Gross Savings Mean (SE) Median	Gross Savings *One-tail* t-stat (prob)	Gross Savings Percent (95%CI) Corr.	Net Method I Savings Mean (SE)	Net Method I Savings Percent (95%CI)
		8,711	7,822	**889**	*5.41*	10%	**1,278**	15.2%
1st	Participants	(289)	(234)	(164)	(0.00000)	(±38%)	(200)	(±32%)
Year	(35, 580)	8,384	7,802	777		0.82		
(1990)	Non-	8,400	8,789	**-388**	*-3.91*	-5%	*One-tail*	
	Participants	(254)	(272)	(99)	(0.00022)	(±52%)	*t-stat*	*6.37*
	(33, 429)	8,003	8,262	-331		0.93	(prob)	(0.00000)
		8,711	7,641	**1,070**	*4.70*	12%	**1,209**	14.4%
2nd	Participants	(289)	(242)	(227)	(0.00002)	(±43%)	(264)	(±45%)
Year	(35, 580)	8,384	7,547	816		0.65		
(1991)	Non-	8,400	8,539	**-138**	*-1.38*	-2%	*One-tail*	
	Participants	(254)	(259)	(100)	(0.08876)	(±148%)	*t-stat*	*4.58*
	(33, 429)	8,003	8,103	-86		0.92	(prob)	(0.00001)
		8,711	7,520	**1,191**	*5.45*	14%	**1,400**	16.7%
3rd	Participants	(289)	(269)	(218)	(0.00000)	(±37%)	(264)	(±38%)
Year	(35, 580)	8,384	7,328	1,072		0.70		
(1992)	Non-	8,400	8,610	**-210**	*-1.67*	-2%	*One-tail*	
	Participants	(254)	(255)	(126)	(0.05242)	(±122%)	*t-stat*	*5.31*
	(33, 429)	8,003	8,478	-368		0.88	(prob)	(0.00000)
		8,711	7,377	**1,334**	*7.98*	15%	**1,379**	16.4%
4th	Participants	(289)	(233)	(167)	(0.00000)	(±26%)	(224)	(±33%)
Year	(35, 580)	8,384	6,982	1,423		0.82		
(1993)	Non-	8,400	8,444	**-44**	*-0.31*	-1%	*One-tail*	
	Participants	(254)	(240)	(143)	(0.37918)	(±658%)	*t-stat*	*6.16*
	(33, 429)	8,003	8,304	-8		0.83	(prob)	(0.00000)

Pre-period Equivalency Test (1988):

$Mean_{participant} - Mean_{Non\text{-}participant}$ *= 311 (Two-tail) t-stat = 0.80 df = 66 (prob) (0.50)*

Table B-56: Cohort E (1990) by Post-Year

Standard Income, Tenant Meter, Weather Normalized

Post Year (Year)	Retrofitted / Control (# Bldgs, # Units)	Pre-Period Mean (SE) Median	Post-Period Mean (SE) Median	Gross Savings Mean (SE) Median	*One-tail* t-stat (prob)	Percent (95%CI) Corr.	Net Method I Savings Mean (SE)	Percent (95%CI)
		8,592	7,717	**875**	*7.67*	10%	**1,015**	11.8%
1st	Participants	(333)	(324)	(114)	(0.00000)	(±26%)	(161)	(±32%)
Year	(51, 706)	8,714	8,008	949		0.94		
(1991)	Non-	8,582	8,539	**44**	*0.47*	1%	*One-tail*	
	Participants	(262)	(259)	(92)	(0.31988)	(±432%)	*t-stat*	*6.31*
	(33, 429)	8,058	8,103	-17		0.94	(prob)	(0.00000)
		8,592	7,053	**1,539**	*12.95*	18%	**1,515**	17.6%
2nd	Participants	(333)	(311)	(119)	(0.00000)	(±15%)	(179)	(±24%)
Year	(51, 706)	8,714	6,929	1,575		0.93		
(1992)	Non-	8,582	8,610	**-28**	*-0.22*	0%	*One-tail*	
	Participants	(262)	(255)	(125)	(0.41314)	(±923%)	*t-stat*	*8.46*
	(33, 429)	8,058	8,478	-117		0.88	(prob)	(0.00000)
		8,592	7,320	**1,272**	*11.79*	15%	**1,307**	15.2%
3rd	Participants	(333)	(337)	(108)	(0.00000)	(±17%)	(174)	(±27%)
Year	(51, 706)	8,714	7,282	1,111		0.95		
(1993)	Non-	8,582	8,444	**138**	*1.00*	2%	*One-tail*	
	Participants	(262)	(240)	(138)	(0.16274)	(±204%)	*t-stat*	*7.51*
	(33, 429)	8,058	8,304	145		0.85	(prob)	(0.00000)

Pre-period Equivalency Test (1989):

$Mean_{participant}$ - $Mean_{Non\text{-}participant}$ = 274 (Two-tail) t-stat = 0.59 df = 82 (prob) (0.50)

Table B-57: Cohort F (1991) by Post-Year

Standard Income, Tenant Meter, Weather Normalized

Post Year (Year)	Retrofitted / Control (# Bldgs, # Units)	Pre-Period Mean (SE) Median	Post-Period Mean (SE) Median	Gross Savings Mean (SE) Median	*One-tail* t-stat (prob)	Percent (95%CI) Corr.	Net Method I Savings Mean (SE)	Percent (95%CI)
		8,082	6,515	**1,567**	*13.43*	19%	**1,388**	15.8%
1st	Participants	(242)	(208)	(117)	(0.00000)	(±15%)	(183)	(±27%)
Year	(58, 1,219)	8,408	6,639	1,393		0.88		
(1992)	Non-	8,789	8,610	**179**	*1.49*	2%	*One-tail*	
	Participants	(272)	(255)	(120)	(0.07269)	(±137%)	*t-stat*	*7.57*
	(33, 429)	8,262	8,478	252		0.90	(prob)	(0.00000)
		8,082	6,678	**1,404**	*13.86*	17%	**1,060**	12.1%
2nd	Participants	(242)	(208)	(101)	(0.00000)	(±14%)	(175)	(±34%)
Year	(58, 1,219)	8,408	6,827	1,306		0.91		
(1993)	Non-	8,789	8,444	**344**	*2.23*	4%	*One-tail*	
	Participants	(272)	(240)	(154)	(0.01643)	(±92%)	*t-stat*	*6.05*
	(33, 429)	8,262	8,304	268		0.83	(prob)	(0.00000)

Pre-period Equivalency Test (1990):

$Mean_{participant} - Mean_{Non\text{-}participant}$ *= -706 (Two-tail) t-stat = -1.83 df = 89 (prob) (0.10)*

Table B-58: Cohort G (1992) by Post-Year

Standard Income, Tenant Meter, Weather Normalized

Post Year (Year)	Retrofitted / Control (# Bldgs, # Units)	Pre-Period Mean (SE) Median	Post-Period Mean (SE) Median	Gross Savings Mean (SE) Median	*One-tail* t-stat (prob)	Percent (95%CI) Corr.	Net Method I Savings Mean (SE)	Percent (95%CI)
		7,549	6,317	**1,232**	*12.00*	16%	**1,137**	13.3%
1st	Participants	(306)	(278)	(103)	(0.00000)	(±17%)	(166)	(±30%)
Year	(40, 782)	8,130	7,216	1,211		0.94		
(1993)	Non-	8,539	8,444	**94**	*0.68*	1%	*One-tail*	
	Participants	(259)	(240)	(138)	(0.25088)	(±301%)	*t-stat*	*6.87*
	(33, 429)	8,103	8,304	210		0.85	(prob)	(0.00000)

Pre-period Equivalency Test (1991):

$Mean_{participant} - Mean_{Non\text{-}participant}$ *= -990 (Two-tail) t-stat = -2.35 df = 71 (prob) (0.02)*

B.12 Standard-Income Program, Gross Scores & Net Method I Scores House Meters (not weather normalized)

Table B-59: Cohort A (1986) by Post-Year
Standard Income, House Meter

Post Year (Year)	Retrofitted Buildings (# Bldgs, # Units)	Pre-Period Mean (SE) Median	Post-Period Mean (SE) Median	Gross Savings Mean (SE) Median	Gross Savings *One-tail* t-stat (prob)	Gross Savings Percent (95%CI) Corr.
1st Year (1987)	Participants (17, 197)	1,610 (142) 1,321	1,390 (132) 1,209	**220** (78) 70	*2.81* (0.00629)	14% (±75%) 0.84
2nd Year (1988)	Participants (17, 197)	1,610 (142) 1,321	1,374 (127) 1,283	**236** (75) 37	*3.15* (0.00312)	15% (±67%) 0.85
3rd Year (1989)	Participants (17, 197)	1,610 (142) 1,321	1,390 (125) 1,258	**220** (84) -6	*2.62* (0.00928)	14% (±81%) 0.81
4th Year (1990)	Participants (17, 197)	1,610 (142) 1,321	1,394 (119) 1,339	**216** (85) -2	*2.55* (0.01076)	13% (±83%) 0.80
5th Year (1991)	Participants (17, 197)	1,610 (142) 1,321	1,343 (120) 1,330	**267** (68) 121	*3.92* (0.00062)	17% (±54%) 0.88
6th Year (1992)	Participants (17, 197)	1,610 (142) 1,321	1,331 (120) 1,334	**279** (68) 135	*4.11* (0.00041)	17% (±52%) 0.88
7th Year (1993)	Participants (17, 197)	1,610 (142) 1,321	1,373 (121) 1,295	**237** (68) 239	*3.49* (0.00153)	15% (±61%) 0.88

Table B-60: Cohort B (1987) by Post-Year

Standard Income, House Meter

Post Year (Year)	Retrofitted Buildings (# Bldgs, # Units)	Pre-Period Mean (SE) Median	Post-Period Mean (SE) Median	Gross Savings Mean (SE) Median	Gross Savings *One-tail* t-stat (prob)	Gross Savings Percent (95%CI) Corr.
1st Year (1988)	Participants (24, 431)	1,570 (169) 1,626	1,061 (142) 1,405	**506** (73) 493	*6.91* (0.00000)	32% (±30%) 0.90
2nd Year (1989)	Participants (24, 431)	1,570 (169) 1,626	1,105 (175) 978	**462** (75) 353	*6.18* (0.00000)	29% (±33%) 0.91
3rd Year (1990)	Participants (24, 431)	1,570 (169) 1,626	1,118 (165) 1,002	**451** (78) 348	*5.78* (0.00000)	29% (±36%) 0.89
4th Year (1991)	Participants (24, 431)	1,570 (169) 1,626	1,129 (148) 1,018	**440** (74) 448	*5.96* (0.00000)	28% (±35%) 0.90
5th Year (1992)	Participants (24, 431)	1,570 (169) 1,626	1,158 (138) 1,069	**409** (70) 444	*5.83* (0.00000)	26% (±35%) 0.91
6th Year (1993)	Participants (24, 431)	1,570 (169) 1,626	1,133 (141) 1,036	**433** (67) 409	*6.47* (0.00000)	28% (±32%) 0.92

Table B-61: Cohort C (1988) by Post-Year

Standard Income, House Meter

Post Year (Year)	Retrofitted / Control (# Bldgs, # Units)	Pre-Period Mean (SE) Median	Post-Period Mean (SE) Median	Gross Savings Mean (SE) Median	Gross Savings *One-tail* t-stat (prob)	Gross Savings Percent (95%CI) Corr.	Net Method I Savings Mean (SE)	Net Method I Savings Percent (95%CI)
		1,844	1,411	**433**	*5.31*	23%	**476**	23.7%
1st	Participants	(281)	(228)	(82)	(0.00000)	(±38%)	(106)	(±46%)
Year	(34, 633)	1,300	881	349		0.97		
(1989)	Non-	2,009	2,051	**-42**	*-0.75*	-2%	*One-tail*	
	Participants	(222)	(202)	56	(0.22911)	(±273%)	*t-stat*	*4.47*
	(28, 395)	1,389	1,594	-64		0.97	(prob)	(0.00002)
		1,844	1,406	**438**	*4.48*	24%	**511**	25.5%
2nd	Participants	(281)	(215)	(98)	(0.00004)	(±46%)	(124)	(±50%)
Year	(34, 633)	1,300	915	319		0.96		
(1990)	Non-	2,009	2,082	**-73**	*-1.24*	-4%	*One-tail*	
	Participants	(222)	(204)	(59)	(0.11233)	(±165%)	*t-stat*	*4.11*
	(28, 395)	1,389	1,603	-128		0.97	(prob)	(0.00006)
		1,844	1,404	**440**	*4.33*	24%	**474**	23.6%
3rd	Participants	(281)	(226)	(102)	(0.00007)	(±47%)	(132)	(±57%)
Year	(34, 633)	1,300	919	330		0.94		
(1991)	Non-	2,009	2,043	**-34**	*-0.49*	-2%	*One-tail*	
	Participants	(222)	(192)	(69)	(0.31284)	(±416%)	*t-stat*	*3.59*
	(28, 395)	1,389	1,585	-44		0.95	(prob)	(0.00033)
		1,844	1,442	**402**	*3.00*	22%	**254**	12.6%
4th	Participants	(281)	(230)	(134)	(0.00255)	(±68%)	(176)	(±143%)
Year	(34, 633)	1,300	949	256		0.88		
(1992)	Non-	2,009	1,861	**148**	*1.52*	7%	*One-tail*	
	Participants	(222)	(179)	(97)	(0.06964)	(±135%)	*t-stat*	*1.44*
	(28, 395)	1,389	1,376	62		0.90	(prob)	(0.07780)
		1,844	1,520	**325**	*2.06*	18%	**220**	11.0%
5th	Participants	(281)	(265)	(158)	(0.02366)	(±99%)	(196)	(±182%)
Year	(34, 633)	1,300	960	289		0.84		
(1993)	Non-	2,009	1,905	**104**	*1.30*	5%	*One-tail*	
	Participants	(222)	(196)	(80)	(0.10186)	(±158%)	*t-stat*	*1.13*
	(28, 395)	1,389	1,456	7		0.93	(prob)	(0.13237)

Pre-period Equivalency Test (1987):

$Mean_{participant}$ - $Mean_{Non\text{-}participant}$ = -165 (Two-tail) t-stat = -0.44 df = 60 (prob) (0.50)

Table B-62: Cohort D (1989) by Post-Year

Standard Income, House Meter

Post Year (Year)	Retrofitted/ Control (# Bldgs, # Units)	Pre-Period Mean (SE) Median	Post-Period Mean (SE) Median	Gross Savings Mean (SE) Median	Gross Savings *One-tail* t-stat (prob)	Gross Savings Percent (95%CI) Corr.	Net Method I Savings Mean (SE)	Net Method I Savings Percent (95%CI)
		1,473	1,256	**216**	*3.76*	15%	**341**	17.4%
1st	Participants	(109)	(93)	(58)	(0.00033)	(±54%)	(75)	(±45%)
Year	(34, 572)	1,074	937	97		0.85		
(1990)	Non-	1,957	2,082	**-125**	*-3.07*	-6%	*One-tail*	
	Participants	(186)	(204)	(41)	(0.00240)	(±67%)	*t-stat*	*4.57*
	(28, 395)	1,490	1,603	-58		0.98	(prob)	(0.00001)
		1,473	1,288	**185**	*3.09*	13%	**271**	13.8%
2nd	Participants	(109)	(91)	(60)	(0.00201)	(±66%)	(79)	(±60%)
Year	(34, 572)	1,074	934	137		0.83		
(1991)	Non-	1,957	2,043	**-86**	*-1.92*	-4%	*One-tail*	
	Participants	(186)	(192)	(45)	(0.03244)	(±107%)	*t-stat*	*3.45*
	(28, 395)	1,490	1,585	-69		0.97	(prob)	(0.00052)
		1,473	1,194	**278**	*4.47*	19%	**182**	9.3%
3rd	Participants	(109)	(77)	(62)	(0.00004)	(±46%)	(92)	(±104%)
Year	(34, 572)	1,074	887	187		0.83		
(1992)	Non-	1,957	1,861	**97**	*1.42*	5%	*One-tail*	
	Participants	(186)	(179)	(68)	(0.08294)	(±144%)	*t-stat*	*1.97*
	(28, 395)	1,490	1,376	-27		0.93	(prob)	(0.02669)
		1,473	1,220	**253**	*3.66*	17%	**201**	10.3%
4th	Participants	(109)	(80)	(69)	(0.00043)	(±56%)	(97)	(±100%)
Year	(34, 572)	1,074	930	153		0.77		
(1993)	Non-	1,957	1,905	**53**	*0.80*	3%	*One-tail*	
	Participants	(186)	(196)	(66)	(0.21608)	(±257%)	*t-stat*	*2.06*
	(28, 395)	1,490	1,456	-33		0.94	(prob)	(0.02187)

Pre-period Equivalency Test (1988):

$Mean_{participant} - Mean_{Non\text{-}participant}$ *= -484 (Two-tail) t-stat = -2.38 df = 60 (prob) (0.02)*

Table B-63: Cohort E (1990) by Post-Year

Standard Income, House Meter

Post Year (Year)	Retrofitted / Control (# Bldgs, # Units)	Pre-Period Mean (SE) Median	Post-Period Mean (SE) Median	Gross Savings Mean (SE) Median	*One-tail* t-stat (prob)	Percent (95%CI) Corr.	Net Method I Savings Mean (SE)	Percent (95%CI)
		1,787	1,338	**449**	*6.31*	25%	**441**	21.5%
1st	Participants	(193)	(138)	(71)	(0.00000)	(±32%)	(95)	(±44%)
Year	(42, 590)	1,198	993	284		0.96		
(1991)	Non-	2,051	2,043	**8**	*0.18*	0%	*One-tail*	
	Participants	(202)	(192)	(46)	(0.42920)	(±1,139%)	*t-stat*	*4.65*
	(28, 395)	1,594	1,585	-4		0.97	(prob)	(0.00001)
		1,787	988	**799**	*4.41*	45%	**608**	29.6%
2nd	Participants	(193)	(74)	(181)	(0.00004)	(±46%)	(229)	(±77%)
Year	(42, 590)	1,198	900	322		0.35		
(1992)	Non-	2,051	1,861	**191**	*2.77*	9%	*One-tail*	
	Participants	(202)	(179)	(69)	(0.00506)	(±74%)	*t-stat*	*2.66*
	(28, 395)	1,594	1,376	38		0.94	(prob)	(0.00487)
		1,787	965	**822**	*4.52*	46%	**676**	33.0%
3rd	Participants	(193)	(80)	(182)	(0.00003)	(±45%)	(230)	(±70%)
Year	(42, 590)	1,198	918	383		0.34		
(1993)	Non-	2,051	1,905	**147**	*2.02*	7%	*One-tail*	
	Participants	(202)	(196)	(73)	(0.02686)	(±102%)	*t-stat*	*2.93*
	(28, 395)	1,594	1,456	88		0.93	(prob)	(0.00229)

Pre-period Equivalency Test (1989):

$Mean_{participant} - Mean_{Non\text{-}participant} = -264$ *(Two-tail) t-stat = -0.92 df = 68 (prob) (0.50)*

Table B-64: Cohort F (1991) by Post-Year

Standard Income, House Meter

Post Year (Year)	Retrofitted / Control (# Bldgs, # Units)	Pre-Period Mean (SE) Median	Post-Period Mean (SE) Median	Gross Savings Mean (SE) Median	*One-tail* t-stat (prob)	Percent (95%CI) Corr.	Net Method I Savings Mean (SE)	Net Method I Savings Percent (95%CI)
		1,376	1,046	**331**	*7.57*	24%	**109**	5.2%
1st Year	Participants	(89)	(62)	(44)	(0.00000)	(±26%)	(75)	(±141%)
	(55, 1,150)	1,211	888	372		0.89		
(1992)	Non-Participants	2,082	1,861	**222**	*3.71*	11%	*One-tail*	
		(204)	(179)	(60)	(0.00047)	(±55%)	*t-stat*	*1.46*
	(28, 395)	1,603	1,376	63		0.96	(prob)	(0.07429)
		1,376	1,032	**345**	*6.63*	25%	**167**	8.0
2nd Year	Participants	(89)	(56)	(52)	(0.00000)	(±30%)	(87)	(±107%)
	(55, 1,150)	1,211	897	384		0.84		
(1993)	Non-Participants	2,082	1,905	**178**	*2.78*	9%	*One-tail*	
		(204)	(196)	(64)	(0.00488)	(±74%)	*t-stat*	*1.92*
	(28, 395)	1,603	1,456	118		0.95	(prob)	(0.02888)

Pre-period Equivalency Test (1990):

$Mean_{participant} - Mean_{Non\text{-}participant} = -706$ *(Two-tail) t-stat = -3.86 df = 81 (prob) (0.002)*

Table B-65: Cohort G (1992) by Post-Year

Standard Income, House Meter

Post Year (Year)	Retrofitted / Control (# Bldgs, # Units)	Pre-Period Mean (SE) Median	Post-Period Mean (SE) Median	Gross Savings Mean (SE) Median	*One-tail* t-stat (prob)	Percent (95%CI) Corr.	Net Method I Savings Mean (SE)	Net Method I Savings Percent (95%CI)
		1,824	1,457	**367**	*6.3*	20%	**228**	11.2%
1st Year	Participants	(159)	(127)	(58)	(0.00000)	(±32%)	(82)	(±73%)
	(37, 742)	1,270	993	229		0.94		
(1993)	Non-Participants	2,043	1,905	**138**	*2.76*	7%	*One-tail*	
		(192)	(196)	(50)	(0.00518)	(±74%)	*t-stat*	*2.80*
	(28, 395)	1,585	1,456	111		0.97	(prob)	(0.00342)

Pre-period Equivalency Test (1991):

$Mean_{participant} - Mean_{Non\text{-}participant} = -220$ *(Two-tail) t-stat = -0.89 df = 63 (prob) (0.50)*

B.13 Standard-Income Program, Summary Net Method I Scores

Table B-66: Standard Income, Tenant Meter, Weather Normalized
Summary of Net Method I Scores

Cohort	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year
A[1] (1986)	1,382	737	994	680	925	1,129	1,076
B[1] (1987)	1,207	1,102	1,079	1,008	1,404	1,313	
C (1988)	717	823	809	1,094	985		
D (1989)	1,278	1,209	1,400	1,379			
E (1990)	1,015	1,515	1,307				
F (1991)	1,388	1,060					
G (1992)	1,137						

Notes
[1] *Savings estimates are gross savings*.

Table B-67: Standard Income, House Meter

Summary of Net Method I Scores

Cohort	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year
A[1] (1986)	220	236	220	216	267	279	237
B[1] (1987)	506	462	451	440	409	433	
C (1988)	476	511	474	254	220		
D (1989)	341	271	182	201			
E (1990)	441	608	676				
F (1991)	109	167					
G (1992)	228						

Notes

[1] *Savings estimates are gross savings.*

Table B-68: Standard Income, Total Building (Tenant Meter + House Meter)
Summary of Net Method I Scores

Cohort	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year
A[1] (1986)	1,602	973	1,214	896	1,192	1,408	1,313
B[1] (1987)	1,713	1,564	1,530	1,448	1,813	1,746	
C (1988)	1,193	1,334	1,283	1,348	1,205		
D (1989)	1,619	1,480	1,582	1,580			
E (1990)	1,456	2,123	1,983				
F (1991)	1,497	1,227					
G (1992)	1,365						

Notes
[1] *Savings estimates are gross savings.*

B.14 Standard-Income Program, Net Method II Scores

Tenant Meters (not weather-normalized)

Table B-69: Cohort C (1988) by Post-Year

Standard Income, Tenant Meter, Not Weather Normalized

Net Method II	Net Savings Mean (SE)	Net Savings Percent (95% CI)	95% Confidence Interval	Adj R^2 (*df*) *F Value*
1st Year (1989)	**575** (233)	7.71% (±68%)	186 to 964	0.82 (71) *159*
2nd Year (1990)	**644** (244)	8.64% (±63%)	236 to 1,052	0.80 (71) *144*
3rd Year (1991)	**716** (257)	9.62% (±60%)	287 to 1,146	0.79 (71) *131*
4th Year (1992)	**730** (258)	9.80% (±59%)	300 to 1,161	0.76 (71) *113*
5th Year (1993)	**884** (255)	11.86% (±48%)	457 to 1,310	0.77 (71) *121*

Table B-70: Cohort D (1989) by Post-Year

Standard Income, Tenant Meter, Not Weather Normalized

Net Method II	Net Savings Mean (SE)	Net Savings Percent (95% CI)	95% Confidence Interval	Adj R^2 (*df*) *F Value*
1st Year (1990)	**1,030** (188)	12.10% (±31%)	716 to 1,345	0.75 (67) *101*
2nd Year (1991)	**1,015** (241)	11.93% (±40%)	612 to 1,419	0.58 (67) *48*
3rd Year (1992)	**945** (251)	11.11% (±44%)	527 to 1,364	0.59 (67) *49*
4th Year (1993)	**1,179** (199)	13.86% (±28%)	847 to 1,511	0.70 (67) *79*

Table B-71: Cohort E (1990) by Post-Year

Standard Income, Tenant Meter, Not Weather Normalized

Net Method II	Net Savings Mean (SE)	Net Savings Percent (95% CI)	95% Confidence Interval	Adj R^2 (*df*) *F Value*
1st Year (1991)	**898** (160)	10.46% (±30%)	631 to 1,166	0.88 (83) *313*
2nd Year (1992)	**1,108** (173)	12.90% (±26%)	819 to 1,397	0.86 (83) *249*
3rd Year (1993)	**1,179** (175)	13.72% (±25%)	887 to 1,472	0.87 (83) *275*

Table B-72: Cohort F (1991) by Post-Year

Standard Income, Tenant Meter, Not Weather Normalized

Net Method II	Net Savings Mean (SE)	Net Savings Percent (95% CI)	95% Confidence Interval	Adj R^2 (*df*) *F Value*
1st Year (1992)	**1,179** (183)	15.21% (±26%)	878 to 1,480	0.81 (90) *198*
2nd Year (1993)	**1,114** (171)	14.38% (±25%)	831 to 1,397	0.83 (90) *220*

Table B-73: Cohort G (1992) by Post-Year

Standard Income, Tenant Meter, Not Weather Normalized

Net Method II	Net Savings Mean (SE)	Net Savings Percent (95% CI)	95% Confidence Interval	Adj R^2 (*df*) *F Value*
1st Year (1993)	**1,188** (166)	16.11% (±23%)	910 to 1,466	0.88 (72) *269*

B.15 Standard-Income Program, Net Method II Scores

Tenant Meters (weather-normalized)

Table B-74: Cohort C (1988) by Post-Year

Standard Income, Tenant Meter, Weather Normalized

Net Method II	Net Savings Mean (SE)	Net Savings Percent (95% CI)	95% Confidence Interval	Adj R^2 (*df*) *F Value*
1st Year (1989)	**717** (233)	8.98% (±54%)	328 to 1,106	0.82 (71) *161*
2nd Year (1990)	**824** (244)	10.31% (±50%)	416 to 1,232	0.80 (71) *146*
3rd Year (1991)	**810** (257)	10.15% (±53%)	381 to 1,241	0.79 (71) *132*
4th Year (1992)	**1,101** (258)	13.79% (±39%)	671 to 1,531	0.77 (71) *118*
5th Year (1993)	**991** (255)	12.41% (±43%)	564 to 1,417	0.77 (71) *123*

Table B-75: Cohort D (1989) by Post-Year

Standard Income, Tenant Meter, Weather Normalized

Net Method II	Net Savings Mean (SE)	Net Savings Percent (95% CI)	95% Confidence Interval	Adj R^2 (*df*) *F Value*
1st Year (1990)	**1,210** (188)	13.89% (±26%)	895 to 1,524	0.76 (67) *105*
2nd Year (1991)	**1,109** (241)	12.73% (±36%)	706 to 1,513	0.59 (67) *49*
3rd Year (1992)	**1,316** (251)	15.11% (±32%)	897 to 1,735	0.62 (67) *55*
4th Year (1993)	**1,287** (199)	14.77% (±26%)	955 to 1,619	0.71 (67) *82*

Table B-76: Cohort E (1990) by Post-Year

Standard Income, Tenant Meter, Weather Normalized

Net Method II	Net Savings Mean (SE)	Net Savings Percent (95% CI)	95% Confidence Interval	Adj R^2 (*df*) *F Value*
1st Year (1991)	**992** (160)	11.20% (±27%)	724 to 1,260	0.88 (83) *315*
2nd Year (1992)	**1,479** (173)	16.70% (±20%)	1,190 to 1,767	0.86 (83) *262*
3rd Year (1993)	**1,286** (175)	14.52% (±23%)	994 to 1,579	0.87 (83) *278*

Table B-77: Cohort F (1991) by Post-Year

Standard Income, Tenant Meter, Weather Normalized

Net Method II	Net Savings Mean (SE)	Net Savings Percent (95% CI)	95% Confidence Interval	Adj R^2 (*df*) *F Value*
1st Year (1992)	**1,550** (182)	19.17% (±19%)	1,248 to 1,851	0.83 (90) *220*
2nd Year (1993)	**1,222** (171)	15.11% (±23%)	939 to 1,505	0.83 (90) *227*

Table B-78: Cohort G (1992) by Post-Year

Standard Income, Tenant Meter, Weather Normalized

Net Method II	Net Savings Mean (SE)	Net Savings Percent (95% CI)	95% Confidence Interval	Adj R^2 (*df*) *F Value*
1st Year (1993)	**1,295** (166)	17.15% (±21%)	1,017 to 1,573	0.88 (72) *278*

B.16 Standard-Income Program, Net Method II Scores House Meters (not weather-normalized)

Table B-79: Cohort C (1988) by Post-Year
Standard Income, House Meter

Net Method II	Net Savings Mean (SE)	Net Savings Percent (95% CI)	95% Confidence Interval	Adj R^2 (*df*) *F Value*
1st Year (1989)	**507** (83)	27.48% (±27%)	368 to 646	0.94 (61) *471*
2nd Year (1990)	**549** (94)	29.78% (±29%)	392 to 706	0.92 (61) *336*
3rd Year (1991)	**512** (106)	27.74% (±35%)	335 to 689	0.90 (61) *264*
4th Year (1992)	**299** (149)	16.23% (±83%)	50 to 549	0.79 (61) *112*
5th Year (1993)	**254** (189)	13.76% (±124%)	-62 to 570	0.73 (61) *84*

Table B-80: Cohort D (1989) by Post-Year

Standard Income, House Meter

Net Method II	Net Savings Mean (SE)	Net Savings Percent (95% CI)	95% Confidence Interval	Adj R^2 (*df*) *F Value*
1st Year (1990)	**368** (80)	25.01% (±36%)	235 to 502	0.89 (61) *258*
2nd Year (1991)	**324** (81)	22.01% (±42%)	188 to 460	0.88 (61) *217*
3rd Year (1992)	**288** (88)	19.53% (±51%)	141 to 434	0.83 (61) *145*
4th Year (1993)	**282** (99)	19.14% (±59%)	117 to 447	0.81 (61) *128*

Table B-81: Cohort E (1990) by Post-Year

Standard Income, House Meter

Net Method II	Net Savings Mean (SE)	Net Savings Percent (95% CI)	95% Confidence Interval	Adj R^2 (*df*) *F Value*
1st Year (1991)	**503** (68)	28.16% (±23%)	389 to 617	0.92 (69) *423*
2nd Year (1992)	**776** (141)	43.43 (±30%)	541 to 1,011	0.53 (69) *39*
3rd Year (1993)	**837** (153)	46.83 (±31%)	580 to 1,093	0.52 (69) *38*

Table B-82: Cohort F (1991) by Post-Year

Standard Income, House Meter

Net Method II	Net Savings Mean (SE)	Net Savings Percent (95% CI)	95% Confidence Interval	Adj R^2 (*df*) *F Value*
1st Year (1992)	**301** (66)	21.90% (±37%)	191 to 412	0.89 (82) *317*
2nd Year (1993)	**372** (81)	26.99% (±37%)	235 to 508	0.84 (82) *209*

Table B-83: Cohort G (1992) by Post-Year

Standard Income, House Meter

Net Method II	Net Savings Mean (SE)	Net Savings Percent (95% CI)	95% Confidence Interval	Adj R^2 (*df*) *F Value*
1st Year (1993)	**264** (77)	14.45% (±49%)	136 to 391	0.90 (64) *277*

B.17 Standard-Income Program, Summary of Net Method II Scores

Table B-84: Standard Income, Tenant Meter, Weather Normalized
Summary of Net Method II Scores

Cohort	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year
A[1] (1986)							
B[1] (1987)							
C (1988)	606	671	681	954	892		
D (1989)	1,089	1,009	1,170	1,185			
E (1990)	1,013	1,445	1,360				
F (1991)	1,513	1,167					
G (1992)	1,224						

Notes
[1] *No pre-period non participant data available.*

Table B-85 Standard Income, House Meter

Summary of Net Method II Scores

Cohort	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year
A[1] (1986)							
B[1] (1987)							
C (1988)	507	549	512	299	254		
D (1989)	368	324	288	282			
E (1990)	503	776	837				
F (1991)	301	372					
G (1992)	264						

Notes

[1] *No pre-period non participant data available.*

Table B-86: Standard Income, Total Building (Tenant Meter + House Meter)
Summary of Net Method II Scores

Cohort	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year
A[1] (1986)							
B[1] (1987)							
C (1988)	1,113	1,220	1,193	1,253	1,146		
D (1989)	1,457	1,333	1,458	1,467			
E (1990)	1,516	2,221	2,197				
F (1991)	1,814	1,539					
G (1992)	1,488						

Notes
[1] *No pre-period non participant data available.*

B.18 Standard-Income Program, Net Method III Scores

Table B-87: Cohorts A through E Pooled, First Post-year
Standard Income, Total Building (Tenant + House)

Net Method III Analysis of Covariance Meter Type	Net Savings Mean (SE)	Net Savings 95% Conf. Interval	Adj R^2 (df) F Value
Tenant	**832** (125)	582 to 1,082	0.79 (221) 414
Tenant Weather Normalized	**981** (120)	741 to 1,221	0.81 (221) 467
Common Area	**467** (59)	349 to 585	0.92 (121) 698

Table B-88: Cohorts F and G Pooled, First Post-year
Standard Income, Total Building (Tenant + House)

Net Method III Analysis of Covariance Meter Type	Net Savings Mean (SE)	Net Savings 95% Conf. Interval	Adj R^2 (df) F Value
Tenant	**1,234** (127)	980 to 1,488	0.84 (161) 424
Tenant Weather Normalized	**1,462** (124)	1,214 to 1,710	0.85 (161) 474
Common Area	**271** (50)	171 to 371	0.89 (145) 611

B.19 Standard-Income Program, Tenant Meter Regression Model Results

Table B-89: Cohort C (1988), Multi-Year

Standard Income, Tenant Meter, Weather Normalized

Regression Analyses	All Parts	Participants with Eng. Estimates		Participants with Eng. Estimates & Surveys	
Model Version	**I**	**II**	**III**	**V**	**VI**
Intercept	1,027 *(4.71)*	1,037 *(4.63)*	808 *(3.81)*	1,155 *(3.62)*	1.249 (4.03)
1st Yr Participation	-554 *(2.34)*	-562 *(2.34)*	-	-604 *(2.39)*	-
2nd Yr Participation	-646 *(2.73)*	-642 *(2.67)*	-	-756 *(2.98)*	-
3rd Yr Participation	-705 *(2.98)*	-705 *(2.94)*	-	-736 *(2.90)*	-
4th Yr Participation	-883 *(3.74)*	-884 *(3.69)*	-	-1,008 *(3.97)*	-
5th Yr Participation	-852 *(3.61)*	-861 *(3.59)*	-	-1,079 *(4.19)*	-
Base kWh_1	.92 *(28.99)*	.92 *(28.30)*	.95 *(30.88)*	.90 *(20.77)*	.89 *(21.34)*
Base kWh_2	.94 *(29.74)*	.94 *(29.06)*	.97 *(31.49)*	.91 *(21.17)*	.90 *(21.74)*
Base kWh_3	.92 *(29.01)*	.92 *(28.33)*	.95 *(30.94)*	.90 *(20.76)*	.89 *(21.47)*
Base kWh_4	.91 *(28.86)*	.91 *(28.18)*	.94 *(30.40)*	.89 *(20.65)*	.88 *(21.08)*
Base kWh_5	.90 *(28.48)*	.90 *(27.80)*	.92 *(29.90)*	.88 *(20.34)*	.87 *(20.82)*
1st Yr Engineering Estimates *(III) 1,156 (37) / (VI) 1,198 (19)	-	-	.57 *(3.43)*	-	.54 *(2.84)*
2nd Yr Engineering Estimates *(III) 1,160 (37) / (VI) 1,203 (19)	-	-	.55 *(3.34)*	-	.65 *(3.42)*
3rd Yr Engineering Estimates *(III) 1,153 (37) / (VI) 1,191 (19)	-	-	.70 *(4.23)*	-	.74 *(3.89)*
4th Yr Engineering Estimates *(III) 1,157 (37) / (VI) 1,196 (19)	-	-	.70 *(4.25)*	-	.80 *(4.22)*
5th Yr Engineering Estimates *(III) 1,151 (37) / (VI 1,189 (19)	-	-	.65 *(3.92)*	-	.90 *(4.63)*
Changed-Out Water Htr	-	-	-	314 *(0.99)*	360 *(1.16)*
Npart X Add H-Eff Wind	-	-	-	-1,416 *(1.44)*	-1,398 *(1.47)*
1st Year Savings	554	562	659	604	647
2nd Year Savings	646	642	638	756	782
3rd Year Savings	705	705	807	736	881
4th Year Savings	883	884	810	1,008	957
5th Year Savings	852	861	748	1,079	1,070
Adjusted R^2	.79	.78	.80	.76	.78
Df	354	344	344	199	199
F Value	133	126	138	55	60

t-statistics in parentheses
**Mean Engineering kWh (n)*

Table B-90: Cohort D (1989), Multi-year

Standard Income, Tenant Meter, Weather Normalized

Regression Analyses	All Parts	Participants with Eng. Estimates		Participants with Eng. Estimates & Surveys	
Model Version	**I**	**II**	**III**	**V**	**VI**
Intercept	2,487 *(8.49)*	2,487 *(8.49)*	1,996 *(6.32)*	2,880 *(8.38)*	2,366 *(6.09)*
1st Yr Participation	-1,118 *(5.56)*	-1,118 *(5.56)*	-	-990 *(4.36)*	-
2nd Yr Participation	-990 *(4.92)*	-990 *(4.92)*	-	-907 *(4.00)*	-
3rd Yr Participation	-1,339 *(6.61)*	-1,339 *(6.61)*	-	-1,223 *(5.34)*	-
4th Yr Participation	-1.176 *(5.85)*	-1,176 *(5.85)*	-	-1,206 *(5.26)*	-
Base kWh_1	.74 *(19.61)*	.74 *(19.61)*	.79 *(19.20)*	.69 *(15.63)*	.73 *(14.45)*
Base kWh_2	.72 *(19.04)*	.72 *(19.04)*	.76 *(18.57)*	.66 *(15.02)*	.70 *(13.80)*
Base kWh_3	.72 *(18.95)*	.72 *(18.95)*	.74 *(18.13)*	.66 *(15.01)*	.69 *(13.61)*
Base kWh_4	.70 *(18.52)*	.70 *(18.52)*	.73 *(17.75)*	.66 *(14.85)*	.68 *(13.43)*
1st Yr Engineering Estimates *(III) 1,429 (34) / (VI) 1,370 (26)	-	-	.61 *(5.13)*	-	.48 *(3.20)*
2nd Yr Engineering Estimates *(III) 1,423 (34) / (VI) 1,370 (26)	-	-	.47 *(3.97)*	-	.36 *(2.41)*
3rd Yr Engineering Estimates *(III) 1,429 (34) / (VI) 1,375 (26)	-	-	.54 *(4.61)*	-	.46 *(2.94)*
4th Yr Engineering Estimates *(III) 1,423 (34) / (VI) 1,370 (26)	-	-	.45 *(3.78)*	-	.43 *(2.75)*
Changed-Out Water Htr	-	-	-	91 *(0.12)*	1,062 *(1.12)*
Npart X Add H-Eff Wind	-	-	-	-1,022 *(1.12)*	-658 *(0.64)*
1st Year Savings	1,118	1,118	872	990	658
2nd Year Savings	990	990	669	907	493
3rd Year Savings	1,339	1,339	772	1,223	633
4th Year Savings	1,176	1,176	640	1,206	584
Adjusted R^2	.67	.67	.61	.65	.55
df	262	262	262	186	186
F Value	66	66	52	35	24

t-statistics in parentheses
**Mean Engineering kWh (n)*

Table B-91: Cohort E (1990), Multi-year

Standard Income, Tenant Meter, Weather Normalized

Regression Analyses	All Parts	Participants with Eng. Estimates		Participants with Eng. Estimates & Surveys	
Model Version	**I**	**II**	**III**	**V**	**VI**
Intercept	1,028 *(4.54)*	1,006 *(3.81)*	386 *(1.31)*	1,101 *(3.63)*	371 *(1.10)*
1st Yr Participation	-983 *(5.32)*	-1,023 *(5.35)*	-	-1,015 *(4.20)*	-
2nd Yr Participation	-1,385 *(7.50)*	-1,422 *(7.43)*	-	-1,416 *(6.13)*	-
3rd Yr Participation	-1,281 *(6.94)*	-1,348 *(7.05)*	-	-1,567 *(6.37)*	-
Base kWh_1	.88 *(30.90)*	.89 *(26.87)*	.93 *(24.69)*	.87 *(22.85)*	.93 *(21.20)*
Base kWh_2	.87 *(30.68)*	.88 *(26.70)*	.93 *(24.69)*	.86 *(22.70)*	.93 *(21.17)*
Base kWh_3	.87 *(30.68)*	.87 *(26.41)*	.90 *(23.98)*	.87 *(22.73)*	.91 *(20.76)*
1st Yr Engineering Estimates *(III) 1,405 (42) / (VI) 1,393 (29)	-	-	.44 *(3.47)*	-	.48 *(2.85)*
2nd Yr Engineering Estimates *(III) 1,411 (42) / (VI) 1,398 (29)	-	-	.77 *(6.05)*	-	.84 *(4.98)*
3rd Yr Engineering Estimates *(III) 1,401 (42) / (VI) 1,387 (29)	-	-	.55 *(4.28)*	-	.71 *(4.17)*
Changed-Out Water Htr	-	-	-	733 *(1.57)*	763 *(1.45)*
Npart X Add H-Eff Wind	-	-	-	-1,129 *(1.17)*	-805 *(0.75)*
1st Year Savings	983	1,023	618	1,015	669
2nd Year Savings	1,385	1,422	1,086	1,486	1,174
3rd Year Savings	1,281	1,348	771	1,567	985
Adjusted R^2	.83	.81	.76	.82	.78
df	248	221	221	149	149
F Value	204	153	117	87	67

t-statistics in parentheses
**Mean Engineering kWh (n)*

Table B-92: Cohort F (1991), Multi-year

Standard Income, Tenant Meter, Weather Normalized

Regression Analyses	All Parts	Participants with Eng. Estimates		Participants with Eng. Estimates & Surveys	
Model Version	**I**	**II**	**III**	**V**	**VI**
Intercept	2,054 *(6.73)*	2,057 *(6.65)*	1,108 *(3.34)*	2,485 *(7.23)*	1,633 *(4.39)*
1st Yr Participation	-1,391 *(8.13)*	-1,403 *(8.07)*	-	-1,448 *(7.20)*	-
2nd Yr Participation	-1,193 *(6.98)*	-1,178 *(6.78)*	-	-1,227 *(5.98)*	-
Base kWh_1	.74 *(20.79)*	.74 *(20.51)*	.80 *(19.45)*	.69 *(17.14)*	.74 *(16.19)*
Base kWh_2	.73 *(20.46)*	.73 *(20.16)*	.80 *(19.44)*	.69 *(17.13)*	.75 *(16.40)*
1st Yr Engineering Estimates *(III) 1,445 (56) / (VI) 1,389 (38)	-	-	.49 *(4.69)*	-	.55 *(4.51)*
2nd Yr Engineering Estimates *(III) 1,440 (56) / (VI) 1,384 (38)	-	-	.45 *(4.27)*	-	.49 *(3.96)*
Changed-Out Water Htr	-	-	-	-1,028 *(3.48)*	-1,753 *(5.21)*
Npart X Add H-Eff Wind	-	-	-	-1,233 *(1.37)*	-946 *(0.92)*
1st Year Savings	1,391	1,403	708	1,448	764
2nd Year Savings	1,193	1,178	648	1,227	678
Adjusted R^2	.78	.77	.71	.80	.74
df	179	175	175	117	117
F Value	156	151	106	79	56

t-statistics in parentheses
**Mean Engineering kWh (n)*

Table B-93: Cohort G (1992), Single-year

Standard Income, Tenant Meter, Weather Normalized

Regression Analyses	All Parts	Participants with Eng. Estimates		Participants with Eng. Estimates & Surveys	
Model Version	**I**	**II**	**III**	**V**	**VI**
Intercept	1,687 *(3.81)*	1,673 *(3.65)*	1,066 *(2.39)*	1,886 *(2.88)*	1,407 *(2.20)*
1st Yr Participation	-1,229 *(6.65)*	-1,225 *(6.40)*	-	-1,249 *(4.85)*	-
Base kWh_1	.79 *(15.61)*	.79 *(15.11)*	.85 *(15.97)*	.77 *(10.19)*	.82 *(10.75)*
1st Yr Engineering Estimates *(III) 1,567 (37) / (VI) 1,588 (25)	-	-	.65 *(5.85)*	-	.70 *(4.77)*
Changed-Out Water Htr	-	-	-	-100 *(0.21)*	-62 *(0.13)*
Npart X Add H-Eff Wind	-	-	-	-	-
1st Year Savings	1,229	1,225	1,019	1,249	1,112
Adjusted R^2	.82	.82	.81	.75	.74
df	71	68	68	45	45
F Value	160	154	142	45	45

t-statistics in parentheses
**Mean Engineering kWh (n)*

Table B-94; All Cohorts Pooled, Multi-year

Standard Income, Tenant Meter, Weather Normalized

Regression Analyses	All Parts	Participants with Eng. Estimates		Participants with Eng. Estimates & Surveys	
Model Version	**I**	**II**	**III**	**V**	**VI**
Intercept	1,370 *(11.65)*	1,390 *(11.34)*	780 *(6.61)*	1,608 *(11.51)*	880 *(6.41)*
1st Yr Participation	-1,152 *(12.41)*	-1,162 *(12.33)*	-	-1,186 *(11.34)*	-
2nd Yr Participation	-1,115 *(10.81)*	-1,113 *(10.64)*	-	-1,157 *(10.02)*	-
3rd Yr Participation	-1,161 *(9.59)*	-1,169 *(9.54)*	-	-1,219 *(9.09)*	-
4th Yr Participation	-1,046 *(7.25)*	-1,050 *(7.22)*	-	-1,150 *(7.26)*	-
5th Yr Participation	-1,239 *(6.59)*	-1,245 *(6.57)*	-	-1,425 *(6.87)*	-
Base kWh_1	.85 *(56.06)*	.84 (53.68)	.89 *(56.86)*	.81 *(45.73)*	.87 *(47.72)*
Base kWh_2	.85 *(54.02)*	.85 *(51.83)*	.90 *(55.34)*	.81 *(44.45)*	.87 *(46.30)*
Base kWh_3	.86 *(51.20)*	.85 *(48.97)*	.90 *(52.40)*	.82 *(42.18)*	.88 *(43.80)*
Base kWh_4	.86 *(45.72)*	.85 *(44.47)*	.90 *(48.56)*	.83 *(38.07)*	.87 *(40.08)*
Base kWh_5	.87 *(38.85)*	.86 *(37.95)*	.91 *(41.93)*	.84 *(32.30)*	.89 *(34.46)*
1st Yr Engineering Estimates *(III) 1,389 (257) / (VI) 1,391 (174)	-	-	.61 *(10.84)*	-	.58 *(8.86)*
2nd Yr Engineering Estimates *(III) 1,357 (220) / (VI) 1,359 (149)	-	-	.60 *(9.62)*	-	.55 *(7.66)*
3rd Yr Engineering Estimates *(III) 1,323 (164) / (VI) 1,349 (111)	-	-	.59 *(7.89)*	-	.55 *(6.32)*
4th Yr Engineering Estimates *(III) 1,296 (122) / (VI) 1,334 (82)	-	-	.54 *(6.05)*	-	.49 *(4.72)*
5th Yr Engineering Estimates *(III) 1,245 (88) / (VI) 1,316 (56)	-	-	.71 *(5.82)*	-	.75 *(5.42)*
Changed-Out Water Htr	-	-	-	-161 *(1.10)*	-441 *(2.83)*
Npart X Add H-Eff Wind	-	-	-	-1,355 *(2.69)*	-1,089 *(2.03)*
1st Year Savings	1,152	1,162	847	1,186	806
2nd Year Savings	1,115	1,113	814	1,157	746
3rd Year Savings	1,161	1,169	781	1,219	728
4th Year Savings	1,046	1,050	700	1,150	635
5th Year Savings	1,239	1,245	884	1,425	934
Adjusted R^2	.77	.75	.74	.78	.75
df	1446	1402	1402	936	936
F Value	335	309	290	212	180

t-statistics in parentheses
**(Model Version) Mean Engineering kWh (n)*

Table B-95 Model Version II, All Cohorts Pooled

Standard Income, Tenant Meter, Weather Normalized

Summary of Regression Analyses	1st Year Savings *(SE)* (95% CI)	2nd Year Savings *(SE)* (95% CI)	3rd Year Savings *(SE)* (95% CI)	4th Year Savings *(SE)* (95% CI)	5th Year Savings *(SE)* (95% CI)
All Cohorts Pooled	**1,162** *(94)* *(±155)*	**1,113** *(105)* *(±173)*	**1,169** *(122)* *(±201)*	**1,050** *(145)* *(±239)*	**1,245** *(189)* *(±311)*
Cohort C	**562** *(240)* *(±395)*	**642** *(240)* *(±395)*	**705** *(240)* *(±395)*	**884** *(240)* *(±395)*	**861** *(240)* *(±395)*
Cohort D	**1,118** *(201)* *(±331)*	**990** *(201)* *(±331)*	**1,339** *(203)* *(±334)*	**1,176** *(201)* *(±331)*	
Cohort E	**1,023** *(191)* *(±314)*	**1,422** *(191)* *(±314)*	**1,348** *(191)* *(±314)*		
Cohort F	**1,403** *(174)* *(±286)*	**1,178** *(174)* *(±286)*			
Cohort G	**1,225** *(192)* *(±321)*				

Table B-96: Model Version III, All Cohorts Pooled

Standard Income, Tenant Meter, Weather Normalized

Summary of Regression Analyses	1st Year Savings *(Realization Rate)* *(SE)* (95% CI)	2nd Year Savings *(Realization Rate)* *(SE)* (95% CI)	3rd Year Savings *(Realization Rate)* *(SE)* (95% CI)	4th Year Savings *(Realization Rate)* *(SE)* (95% CI)	5th Year Savings *(Realization Rate)* *(SE)* (95% CI)
All Cohorts Pooled	**847** *(.61)* *(.06)* *(±128)*	**814** *(.60)* *(.06)* *(±138)*	**781** *(.59)* *(.08)* *(±163)*	**700** *(.54)* *(.09)* *(±190)*	**884** *(.71)* *(.12)* *(±248)*
Cohort C	**659** *(.57)* *(.17)* *(±316)*	**638** *(.55)* *(.17)* *(±317)*	**807** *(.70)* *(.17)* *(±315)*	**810** *(.70)* *(.17)* *(±316)*	**748** *(.65)* *(.17)* *(±316)*
Cohort D	**872** *(.61)* *(.12)* *(±277)*	**669** *(.47)* *(.12)* *(±276)*	**772** *(.54)* *(.12)* *(±277)*	**640** *(.45)* *(.12)* *(±279)*	
Cohort E	**618** *(.44)* *(.13)* *(±296)*	**1,086** *(.77)* *(.13)* *(±297)*	**771** *(.55)* *(.13)* *(±295)*		
Cohort F	**708** *(.49)* *(.11)* *(±250)*	**648** *(.45)* *(.11)* *(±251)*			
Cohort G	**1,019** *(.65)* *(.11)* *(±293)*				

Table B-97: Model Version V, All Cohorts Pooled

Standard Income, Tenant Meter, Weather Normalized

Summary of Regression Analyses	1st Year Savings *(SE)* (95% CI)	2nd Year Savings *(SE)* (95% CI)	3rd Year Savings *(SE)* (95% CI)	4th Year Savings *(SE)* (95% CI)	5th Year Savings *(SE)* (95% CI)
All Cohorts Pooled	**1,186** *(105)* *(±173)*	**1,157** *(115)* *(±189)*	**1,219** *(134)* *(±220)*	**1,150** *(158)* *(±260)*	**1,425** *(207)* *(±341)*
Cohort C	**604** *(253)* *(±416)*	**756** *(254)* *(±418)*	**736** *(254)* *(±418)*	**1,008** *(254)* *(±418)*	**1,079** *(258)* *(±424)*
Cohort D	**990** *(227)* *(±373)*	**907** *(227)* *(±373)*	**1,223** *(229)* *(±377)*	**1,206** *(230)* *(±378)*	
Cohort E	**1,015** *(241)* *(±396)*	**1,486** *(242)* *(±398)*	**1,567** *(246)* *(±405)*		
Cohort F	**1,448** *(201)* *(±333)*	**1,227** *(205)* *(±340)*			
Cohort G	**1,249** *(257)* *(±433)*				

Table B-98: Model Version VI, All Cohorts Pooled

Standard Income, Tenant Meter, Weather Normalized

Summary of Regression Analyses	1st Year Savings *(Realization Rate)* *(SE)* (95% CI)	2nd Year Savings *(Realization Rate)* *(SE)* (95% CI)	3rd Year Savings *(Realization Rate)* *(SE)* (95% CI)	4th Year Savings *(Realization Rate)* *(SE)* (95% CI)	5th Year Savings *(Realization Rate)* *(SE)* (95% CI)
All Cohorts Pooled	**806** *(.58)* *(.07)* *(±149)*	**746** *(.55)* *(.07)* *(±161)*	**728** *(.55)* *(.09)* *(±192)*	**635** *(.49)* *(.10)* *(±220)*	**934** *(.75)* *(.14)* *(±283)*
Cohort C	**647** *(.54)* *(.19)* *(±372)*	**782** *(.65)* *(.19)* *(±374)*	**881** *(.74)* *(.19)* *(±374)*	**957** *(.80)* *(.19)* *(±374)*	**1,070** *(.90)* *(.20)* *(±381)*
Cohort D	**658** *(.48)* *(.15)* *(±338)*	**483** *(.36)* *(.15)* *(±338)*	**633** *(.46)* *(.16)* *(±353)*	**589** *(.43)* *(.16)* *(±356)*	
Cohort E	**669** *(.48)* *(.17)* *(±386)*	**1,174** *(.84)* *(.17)* *(±389)*	**985** *(.71)* *(.17)* *(±393)*		
Cohort F	**764** *(.55)* *(.12)* *(±281)*	**678** *(.49)* *(.12)* *(±283)*			
Cohort G	**1,112** *(.70)* *(.15)* *(±393)*				

Table B-99: All Cohorts Pooled, First Post-year

Standard Income, Tenant Meter, Weather Normalized

Regression Analyses	All Parts	Participants with Engineering Estimates			Participants with Engineering Estimates and Surveys		
Model Version	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**
Intercept	1,517 *(7.40)*	1,540 *(7.16)*	1,074 *(5.08)*	1,218 *(5.81)*	1,803 *(7.52)*	1,376 *(5.67)*	1,447 *(6.00)*
Pre Participation Year kWh	.83 *(35.45)*	.83 *(33.46)*	.87 *(34.38)*	.85 *(34.17)*	.79 (28.39)	.83 *(28.58)*	.83 *(28.56)*
Participation Dummy	-1,091 *(11.77)*	-1,100 *(11.71)*	-	-	-1,117 *(11.23)*	-	-
Building Engineering Estimate *(III) 1,467(257) / (VI) 1,477(174)	-	-	.60 *(11.76)*	-	-	.60 *(10.41)*	-
Window Engineering Estimate *(IV) 918(257) / (VII) 936(174)	-	-	-	.74 *(6.78)*	-	-	.67 *(4.94)*
Wall Engineering Estimate *(IV) 26(257) / (VII) 30(174)	-	-	-	.89 *(2.41)*	-	-	.73 *(1.76)*
Ceiling Engineering Estimate *(IV) 77(257) / (VII) 83(174)	-	-	-	1.06 *(3.96)*	-	-	1.13 *(3.78)*
Floor Engineering Estimate *(IV) 276(257) / (VII) 255(174)	-	-	-	.11 *(.90)*	-	-	.06 (.43)
Showerhead Enginrg Estimate *(IV) 171(257) / (VII) 173(174)	-	-	-	.92 *(1.43)*	-	-	1.20 *(1.52)*
Changed-Out Water Heater	-	-	-	-	-100 *(.27)*	-334 *(.88)*	-211 *(.56)*
1st Year Savings - Total	1,091	1,100	880	971	1,117	880	966
Windows	-	-	-	679	-	-	627
Wall Insulation	-	-	-	23	-	-	22
Ceiling Insulation	-	-	-	82	-	-	94
Floor Insulation	-	-	-	30	-	-	15
Showerheads	-	-	-	157	-	-	208
Adjusted R^2	.75	.74	.74	.76	.73	.72	.73
df	432	416	416	416	333	333	333
F Value	660	599	601	213	297	281	127

t-statistics in parentheses

**(Model Version) Mean Engineering kWh (n)*

B.20 Standard-Income Program, House Meter Regression Model Results

Table B-100: Cohort C (1988), Multi-year
Standard Income, House Meter, Weather Normalized

Regression Analyses	All Parts	Participants with Eng. Estimates		Participants with Eng. Estimates & Surveys	
Model Version	**I**	**II**	**III**	**V**	**VI**
Intercept	385 *(6.56)*	414 *(9.37)*	281 *(6.46)*	482 *(8.33)*	350 *(6.41)*
1st Yr Participation	-493 *(4.43)*	-539 *(5.63)*	-	-531 *(4.55)*	-
2nd Yr Participation	-487 *(4.37)*	-561 *(5.86)*	-	-533 *(4.56)*	-
3rd Yr Participation	-461 *(4.14)*	-564 *(5.90)*	-	-564 *(4.83)*	-
4th Yr Participation	-308 *(2.77)*	-420 *(4.39)*	-	-457 *(3.82)*	-
5th Yr Participation	-320 *(2.88)*	-473 *(4.95)*	-	-531 *(4.40)*	-
Base kWh_1	.83 *(22.89)*	.82 *(29.74)*	.84 *(28.47)*	.80 *(25.46)*	.82 *(25.41)*
Base kWh_2	.82 *(22.73)*	.81 *(29.52)*	.83 *(28.17)*	.79 *(25.16)*	.80 *(25.07)*
Base kWh_3	.81 *(22.49)*	.80 *(29.15)*	.81 *(27.84)*	.79 *(25.05)*	.79 *(24.83)*
Base kWh_4	.75 *(20.85)*	.73 *(26.65)*	.75 *(25.66)*	.73 *(23.07)*	.74 *(22.78)*
Base kWh_5	.80 *(22.23)*	.77 *(28.12)*	.79 *(26.92)*	.78 *(24.30)*	.78 *(23.76)*
1st Yr Engineering Estimates *(III) 515 (25) / (VI) 508 (17)	-	-	.65 *(4.13)*	-	.69 *(3.73)*
2nd Yr Engineering Estimates *(III) 517 (25) / (VI) 508 (17)	-	-	.64 *(4.11)*	-	.66 *(3.60)*
3rd Yr Engineering Estimates *(III) 513 (25) / (VI) 506 (17)	-	-	.65 *(4.15)*	-	.67 *(3.64)*
4th Yr Engineering Estimates *(III) 513 (25) / (VI) 506 (17)	-	-	.46 *(2.92)*	-	.51 *(2.73)*
5th Yr Engineering Estimates *(III) 512 (25) / (VI) 505 (17)	-	-	.52 *(3.27)*	-	.56 *(2.95)*
Added Washer Dryer	-	-	-	-	-
Npart X Add H-Eff Lgt	-	-	-	-263 *(2.11)*	-137 *(1.07)*
1st Year Savings	493	539	335	531	351
2nd Year Savings	487	561	331	533	335
3rd Year Savings	461	564	333	564	339
4th Year Savings	308	420	236	457	258
5th Year Savings	320	473	266	531	283
Adjusted R^2	.85	.91	.90	.92	.91
df	309	264	264	174	174
F Value	170	271	230	188	167

t-statistics in parentheses
**(Model Version) Mean Engineering kWh (n)*

Table B-101: Cohort D (1989), Multi-year
Standard Income, House Meter, Weather Normalized

Regression Analyses	All Parts	Participants with Eng. Estimates		Participants with Eng. Estimates & Surveys	
Model Version	**I**	**II**	**III**	**V**	**VI**
Intercept	254 *(3.92)*	190 *(2.60)*	106 *(1.80)*	203 *(2.13)*	137 *(2.04)*
1st Yr Participation	-391 *(4.81)*	-474 *(4.50)*	-	-515 *(3.98)*	-
2nd Yr Participation	-330 *(4.07)*	-395 *(3.75)*	-	-436 *(3.37)*	-
3rd Yr Participation	-288 *(3.55)*	-378 *(3.58)*	-	-4.13 *(3.12)*	-
4th Yr Participation	-297 *(3.66)*	-414 *(3.93)*	-	-467 *(3.46)*	-
Base kWh_1	.94 *(23.71)*	.97 *(21.80)*	1.02 *(26.25)*	.98 *(18.21)*	1.01 *(24.45)*
Base kWh_2	.91 *(22.94)*	.94 *(21.08)*	.99 *(25.47)*	.95 *(17.65)*	.99 *(23.93)*
Base kWh_3	.82 *(20.83)*	.86 *(19.24)*	.90 *(23.14)*	.86 *(15.54)*	.91 *(20.98)*
Base kWh_4	.85 *(21.59)*	.89 *(19.94)*	.92 *(23.88)*	.90 *(15.66)*	.95 *(21.12)*
1st Yr Engineering Estimates *(III) 613 (19) / (VI) 606 (14)	-	-	.76 *(6.37)*	-	.83 *(6.33)*
2nd Yr Engineering Estimates *(III) 611 (19) / (VI) 606 (14)	-	-	.65 *(5.52)*	-	.78 *(5.97)*
3rd Yr Engineering Estimates *(III) 611 (19) / (VI) 606 (14)	-	-	.56 *(4.71)*	-	.72 *(5.42)*
4th Yr Engineering Estimates *(III) 611 (19) / (VI) 606 (14)	-	-	.59 *(4.99)*	-	.80 *(5.94)*
Added Washer Dryer	-	-	-	-	-
Npart X Add H-Eff Lgt	-	-	-	-40 *(0.24)*	-92 *(0.71)*
1st Year Savings	391	474	466	515	503
2nd Year Savings	330	395	397	436	473
3rd Year Savings	288	378	342	413	436
4th Year Savings	297	414	360	467	485
Adjusted R^2	.83	.83	.87	.84	.90
df	247	187	187	127	127
F Value	156	115	151	76	128

t-statistics in parentheses
**(Model Version) Mean Engineering kWh (n)*

Table B-102; Cohort E (1990), Multi-year
Standard Income, House Meter, Weather Normalized

Regression Analyses	All Parts	Participants with Eng. Estimates		Participants with Eng. Estimates & Surveys	
Model Version	**I**	**II**	**III**	**V**	**VI**
Intercept	633 *(7.55)*	623 *(6.89)*	462 *(5.23)*	684 *(5.74)*	468 *(3.95)*
1st Yr Participation	-573 *(5.50)*	-610 *(5.12)*	-	-682 *(4.42)*	-
2nd Yr Participation	-516 *(4.95)*	-578 *(4.85)*	-	-663 *(4.18)*	-
3rd Yr Participation	560 *(5.32)*	-630 *(5.22)*	-	-741 *(4.51)*	-
Base kWh_1	.73 *(16.58)*	.74 *(15.44)*	.77 *(15.56)*	.73 *(12.87)*	.77 *(12.80)*
Base kWh_2	.57 *(12.98)*	.58 *(12.12)*	.60 *(12.14)*	.53 *(9.28)*	.55 *(8.91)*
Base kWh_3	.60 *(13.46)*	.60 *(12.58)*	.62 *(12.58)*	.55 *(9.32)*	.56 *(8.84)*
1st Yr Engineering Estimates *(III) 566 (30) / (VI) 557 (21)	-	-	.75 *(4.14)*	-	.80 *(3.22)*
2nd Yr Engineering Estimates *(III) 566 (30) / (VI) 557 (21)	-	-	.60 *(3.32)*	-	.60 *(2.36)*
3rd Yr Engineering Estimates *(III) 563 (30) / (VI) 552 (21)	-	-	.68 *(3.71)*	-	.69 *(2.64)*
Added Washer Dryer	-	-	-	-	-
Npart X Add H-Eff Lgt	-	-	-	294 *(1.41)*	485 *(2.19)*
1st Year Savings	573	610	425	682	446
2nd Year Savings	516	578	340	663	334
3rd Year Savings	560	630	383	741	381
Adjusted R^2	.71	.72	.68	.74	.69
df	208	172	172	115	115
F Value	87	73	62	47	37

t-statistics in parentheses
**(Model Version) Mean Engineering kWh (n)*

Table B-103: Cohort F (1991), Multi-year
Standard Income, House Meter, Weather Normalized

Regression Analyses	All Parts	Participants with Eng. Estimates		Participants with Eng. Estimates & Surveys	
Model Version	**I**	**II**	**III**	**V**	**VI**
Intercept	353 *(5.25)*	166 *(2.42)*	42 *(0.76)*	176 *(1.92)*	38 *(0.53)*
1st Yr Participation	-351 *(5.64)*	-321 *(5.09)*	-	-358 *(4.28)*	-
2nd Yr Participation	-381 *(6.11)*	-373 *(5.91)*	-	-400 *(4.58)*	-
Base kWh_1	.73 *(23.63)*	.82 *(24.97)*	.86 *(28.59)*	.81 *(20.44)*	.86 *(23.77)*
Base kWh_2	.74 *(23.83)*	.85 *(25.88)*	.89 *(29.41)*	.85 *(21.60)*	.89 *(24.34)*
1st Yr Engineering Estimates *(III) 561 (35) / (VI) 618 (25)	-	-	.44 *(5.23)*	-	.42 *(4.25)*
2nd Yr Engineering Estimates *(III) 561 (35) / (VI) 618 (25)	-	-	.49 *(5.82)*	-	.46 *(4.50)*
Added Washer Dryer	-	-	-	317 *(1.46)*	139 *(0.65)*
Npart X Add H-Eff Lgt	-	-	-	42 *(0.28)*	96 *(0.68)*
1st Year Savings	351	321	247	358	260
2nd Year Savings	381	373	275	400	284
Adjusted R^2	.87	.91	.91	.91	.92
df	165	125	125	85	85
F Value	265	299	314	147	154

t-statistics in parentheses
**(Model Version) Mean Engineering kWh (n)*

Table B-104; Cohort G (1992), Single-year
Standard Income, House Meter, Weather Normalized

Regression Analyses	All Parts	Participants with Eng. Estimates		Participants with Eng. Estimates & Surveys	
Model Version	**I**	**II**	**III**	**V**	**VI**
Intercept	175 *(1.81)*	115 *(1.12)*	-10 *(0.13)*	-17 *(0.13)*	-23 *(0.19)*
1st Yr Participation	-274 *(3.48)*	-330 *(3.84)*	-	-194 *(1.75)*	-
Base kWh_1	.85 *(22.19)*	.88 *(21.18)*	.95 *(25.94)*	.95 *(18.10)*	.96 *(19.27)*
1st Yr Engineering Estimates *(III) 589 (26) / (VI) 535 (14)	-	-	.58 *(6.21)*	-	.40 *(2.51)*
Added Washer Dryer	-	-	-	-	-
Npart X Add H-Eff Lgt	-	-	-	-	-
1st Year Savings	274	330	342	194	214
Adjusted R^2	.90	.90	.93	.92	.92
df	63	52	52	31	31
F Value	270	239	337	171	190

t-statistics in parentheses
**(Model Version) Mean Engineering kWh (n)*

Table B-105: All Cohorts Pooled, Multi-year

Standard Income, House Meter, Weather Normalized

Regression Analyses	All Parts	Participants with Eng. Estimates		Participants with Eng. Estimates & Surveys	
Model Version	**I**	**II**	**III**	**V**	**VI**
Intercept	383 *(12.49)*	374 *(11.85)*	247 *(8.52)*	418 *(9.80)*	296 *(7.72)*
1st Yr Participation	-429 *(11.13)*	-486 *(10.90)*	-	-511 *(8.71)*	-
2nd Yr Participation	-414 *(10.0)*	-497 *(10.15)*	-	-543 *(8.51)*	-
3rd Yr Participation	-399 *(8.23)*	-517 *(8.75)*	-	-585 *(7.63)*	-
4th Yr Participation	-329 *(5.90)*	-436 *(5.87)*	-	-470 *(4.94)*	-
5th Yr Participation	-349 *(5.03)*	-452 *(4.47)*	-	-461 *(3.53)*	-
Base kWh_1	.80 *(48.71)*	.82 *(47.48)*	.85 *(49.10)*	.81 *(38.38)*	.84 *(40.47)*
Base kWh_2	.77 *(43.46)*	.78 *(42.15)*	.80 *(43.56)*	.77 *(34.54)*	.79 *(35.83)*
Base kWh_3	.76 *(39.03)*	.76 *(37.85)*	.79 *(39.23)*	.75 *(30.96)*	.77 *(32.08)*
Base kWh_4	.77 *(34.16)*	.77 *(32.68)*	.80 *(34.15)*	.77 *(26.61)*	.79 *(28.06)*
Base kWh_5	.80 *(29.75)*	.78 *(27.53)*	.80 *(28.08)*	.78 *(22.64)*	.78 *(23.43)*
1st Yr Engineering Estimates *(III) 567 (135) / (VI) 570 (91)	-	-	.65 *(10.17)*	-	.68 *(8.20)*
2nd Yr Engineering Estimates *(III) 561 (109) / (VI) 576 (77)	-	-	.60 *(8.50)*	-	.65 *(7.39)*
3rd Yr Engineering Estimates *(III) 559 (74) / (VI) 553 (52)	-	-	.61 *(7.12)*	-	.70 *(6.49)*
4th Yr Engineering Estimates *(III) 557 (44) / (VI) 554 (31)	-	-	.53 *(5.04)*	-	.64 *(4.83)*
5th Yr Engineering Estimates *(III) 512 (25) / (VI) 505 (17)	-	-	.50 *(3.12)*	-	.49 *(2.46)*
Added Washer Dryer	-	-	-	250 *(0.75)*	-30 *(0.09)*
Npart X Add H-Eff Lgt	-	-	-	-80 *(0.96)*	6 *(0.07)*
1st Year Savings	429	486	369	511	388
2nd Year Savings	414	497	337	543	374
3rd Year Savings	399	517	341	585	387
4th Year Savings	329	436	295	470	355
5th Year Savings	349	452	256	461	247
Adjusted R^2	.81	.85	.85	.86	.85
df	1259	804	804	536	536
F Value	397	464	443	269	264

t-statistics in parentheses
**(Model Version) Mean Engineering kWh (n)*

Table B-106: Model Version II, All Cohorts Pooled

Standard Income, House Meter, Weather Normalized

Summary of Regression Analyses	1st Year Savings *(SE)* (95% CI)	2nd Year Savings *(SE)* (95% CI)	3rd Year Savings *(SE)* (95% CI)	4th Year Savings *(SE)* (95% CI)	5th Year Savings *(SE)* (95% CI)
All Cohorts Pooled	**486** *(45)* *(±74)*	**497** *(49)* *(±81)*	**517** *(59)* *(±97)*	**436** *(74)* *(±122)*	**452** *(101)* *(±166)*
Cohort C	**539** *(96)* *(±158)*	**561** *(96)* *(±158)*	**564** *(96)* *(±158)*	**420** *(96)* *(±158)*	**473** *(96)* *(±158)*
Cohort D	**474** *(105)* *(±173)*	**395** *(105)* *(±173)*	**378** *(105)* *(±173)*	**414** *(105)* *(±173)*	
Cohort E	**610** *(119)* *(±196)*	**578** *(119)* *(±196)*	**630** *(121)* *(±199)*		
Cohort F	**321** *(63)* *(±104)*	**373** *(63)* *(±104)*			
Cohort G	**330** *(86)* *(±144)*				

Table B-107: Model Version III, All Cohorts Pooled

Standard Income, House Meter, Weather Normalized

Summary of Regression Analyses	1st Year Savings *(Realization Rate)* *(SE)* (95% CI)	2nd Year Savings *(Realization Rate)* *(SE)* (95% CI)	3rd Year Savings *(Realization Rate)* *(SE)* (95% CI)	4th Year Savings *(Realization Rate)* *(SE)* (95% CI)	5th Year Savings *(Realization Rate)* *(SE)* (95% CI)
All Cohorts Pooled	**369** *(.65)* *(.06)* *(±60)*	**337** *(.60)* *(.07)* *(±66)*	**341** *(.61)* *(.09)* *(±78)*	**295** *(.53)* *(.11)* *(±97)*	**256** *(.50)* *(.16)* *(±135)*
Cohort C	**335** *(.65)* *(.16)* *(±134)*	**331** *(.64)* *(.16)* *(±133)*	**333** *(.65)* *(.16)* *(±133)*	**236** *(.46)* *(.16)* *(±133)*	**266** *(.52)* *(.16)* *(±133)*
Cohort D	**466** *(.76)* *(.12)* *(±120)*	**397** *(.65)* *(.12)* *(±120)*	**342** *(.56)* *(.12)* *(±120)*	**360** *(.59)* *(.12)* *(±120)*	
Cohort E	**425** *(.75)* *(.18)* *(±169)*	**340** *(.60)* *(.18)* *(±169)*	**383** *(.68)* *(.18)* *(±169)*		
Cohort F	**247** *(.44)* *(.08)* *(±78)*	**275** *(.49)* *(.08)* *(±78)*			
Cohort G	**342** *(.58)* *(.09)* *(±93)*				

Table B-108: Model Version V, All Cohorts Pooled

Standard Income, House Meter, Weather Normalized

Summary of Regression Analyses	1st Year Savings *(SE)* (95% CI)	2nd Year Savings *(SE)* (95% CI)	3rd Year Savings *(SE)* (95% CI)	4th Year Savings *(SE)* (95% CI)	5th Year Savings *(SE)* (95% CI)
All Cohorts Pooled	**511** *(59)* *(±97)*	**543** *(64)* *(±105)*	**585** *(77)* *(±127)*	**470** *(95)* *(±156)*	**461** *(131)* *(±215)*
Cohort C	**531** *(117)* *(±192)*	**533** *(117)* *(±192)*	**564** *(117)* *(±192)*	**457** *(119)* *(±196)*	**531** *(121)* *(±199)*
Cohort D	**515** *(129)* *(±214)*	**436** *(129)* *(±214)*	**413** *(132)* *(±219)*	**467** *(135)* *(±224)*	
Cohort E	**682** *(154)* *(±255)*	**663** *(158)* *(±262)*	**741** *(164)* *(±272)*		
Cohort F	**358** *(84)* *(±140)*	**400** *(87)* *(±145)*			
Cohort G	**194** *(111)* *(±188)*				

Table B-109: Model Version VI, All Cohorts Pooled

Standard Income, House Meter, Weather Normalized

Summary of Regression Analyses	1st Year Savings *(Realization Rate)* *(SE)* (95% CI)	2nd Year Savings *(Realization Rate)* *(SE)* (95% CI)	3rd Year Savings *(Realization Rate)* *(SE)* (95% CI)	4th Year Savings *(Realization Rate)* *(SE)* (95% CI)	5th Year Savings *(Realization Rate)* *(SE)* (95% CI)
All Cohorts Pooled	**388** *(.68)* *(.08)* *(±77)*	**374** *(.65)* *(.09)* *(±83)*	**387** *(.70)* *(.11)* *(±99)*	**355** *(.64)* *(.13)* *(±120)*	**247** *(.49)* *(.20)* *(±165)*
Cohort C	**351** *(.69)* *(.18)* *(±154)*	**335** *(.66)* *(.18)* *(±154)*	**339** *(.67)* *(.18)* *(±153)*	**258** *(.51)* *(.19)* *(±156)*	**283** *(.56)* *(.19)* *(±156)*
Cohort D	**503** *(.83)* *(.13)* *(±132)*	**473** *(.78)* *(.13)* *(±132)*	**436** *(.72)* *(.13)* *(±134)*	**485** *(.80)* *(.14)* *(±136)*	
Cohort E	**446** *(.80)* *(.25)* *(±231)*	**334** *(.60)* *(.25)* *(±235)*	**381** *(.69)* *(.26)* *(±238)*		
Cohort F	**260** *(.42)* *(.10)* *(±102)*	**284** *(.46)* *(.10)* *(±105)*			
Cohort G	**214** *(.40)* *(.16)* *(±146)*				

C. Appendix: Impact Result Figures

In the body of this report, several displays of figures were greatly reduced to illustrate generalities across programs, cohorts, and meter types. Larger versions of those figures from Chapters 3-5 are reproduced here in Appendix C.

C.1 Annual Energy Consumption by Calendar Year

Figure C-I: Standard-Income Tenant Meters

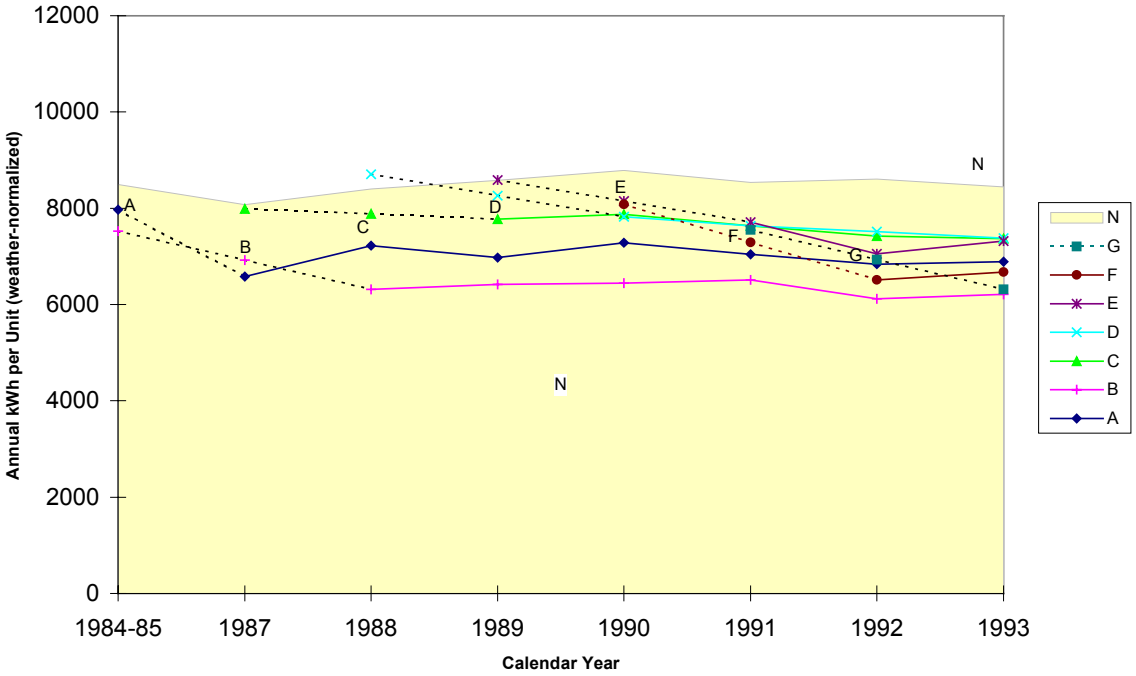


Figure C-II: Low-Income Tenant Meters

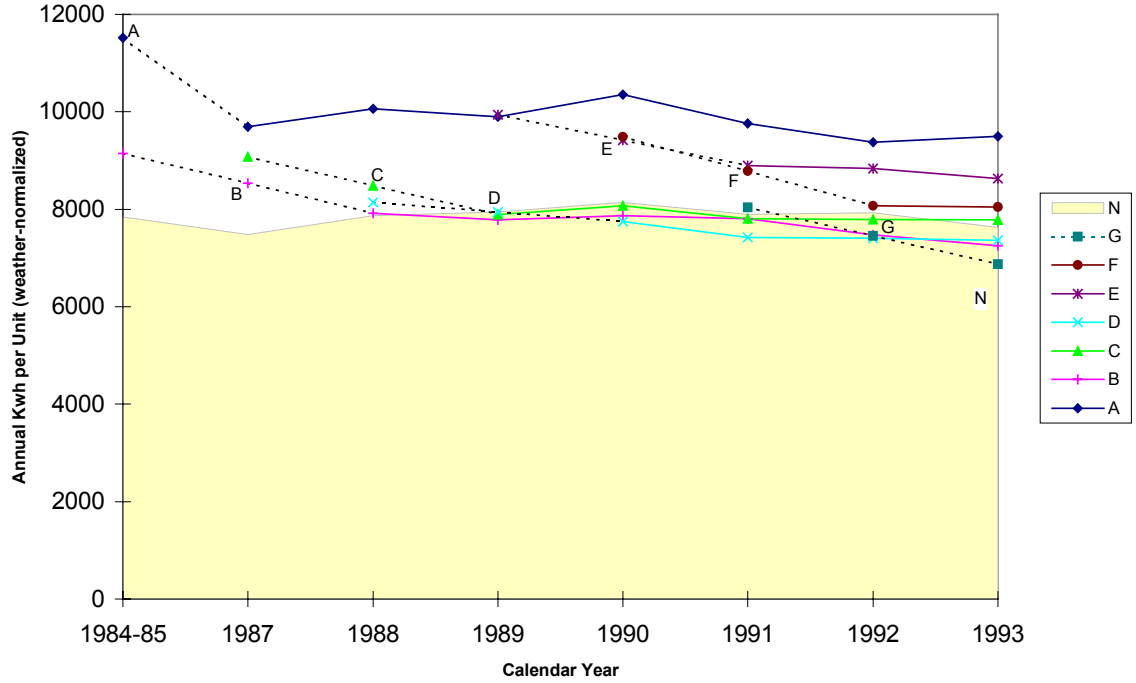


Figure C-III: Standard-Income House Meters

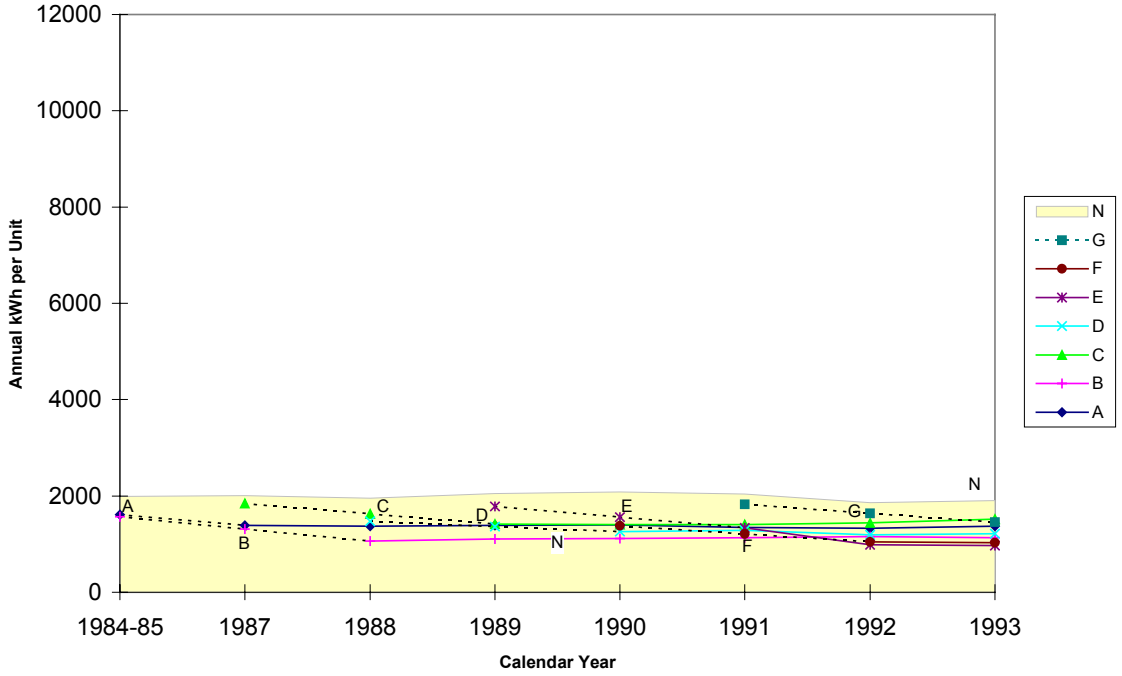
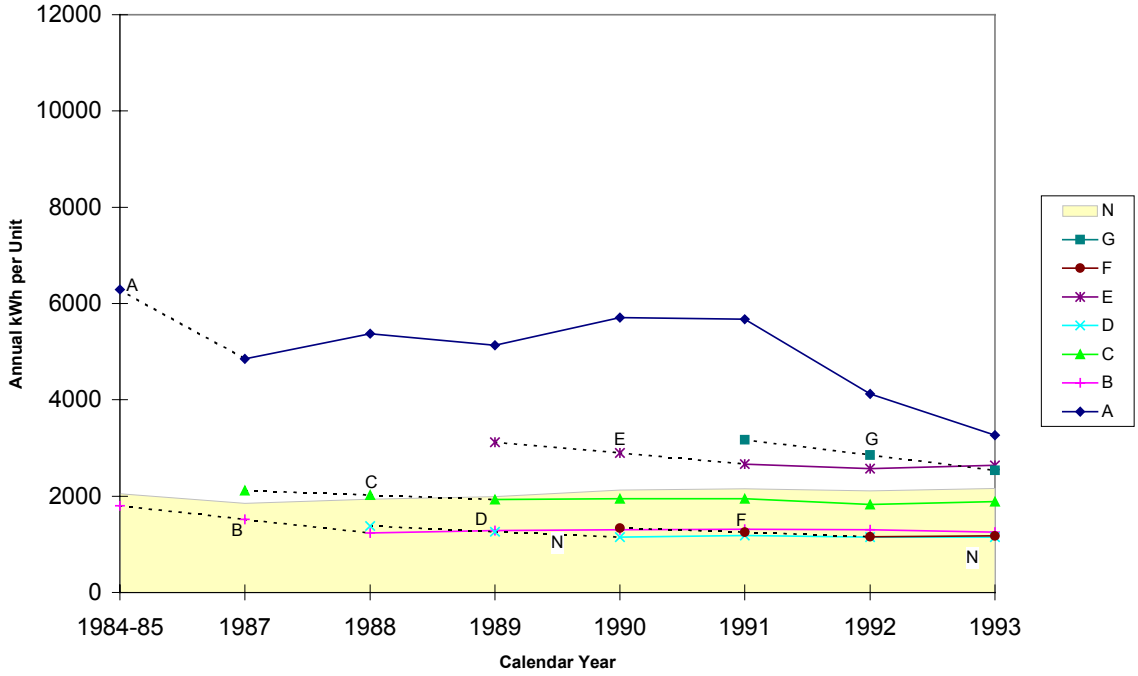


Figure C-IV: Low-Income House Meters



C.2 Annual Energy Consumption by Period

Figure C-V: Standard-Income Tenant Meters

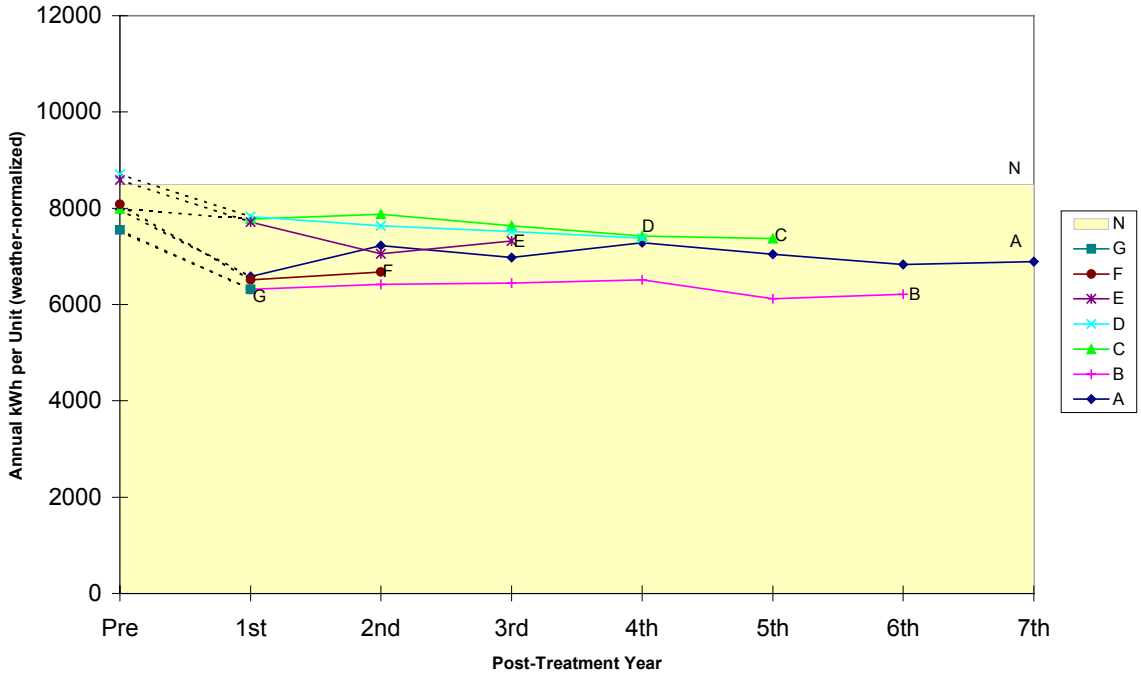


Figure C-VI: Low-Income Tenant Meters

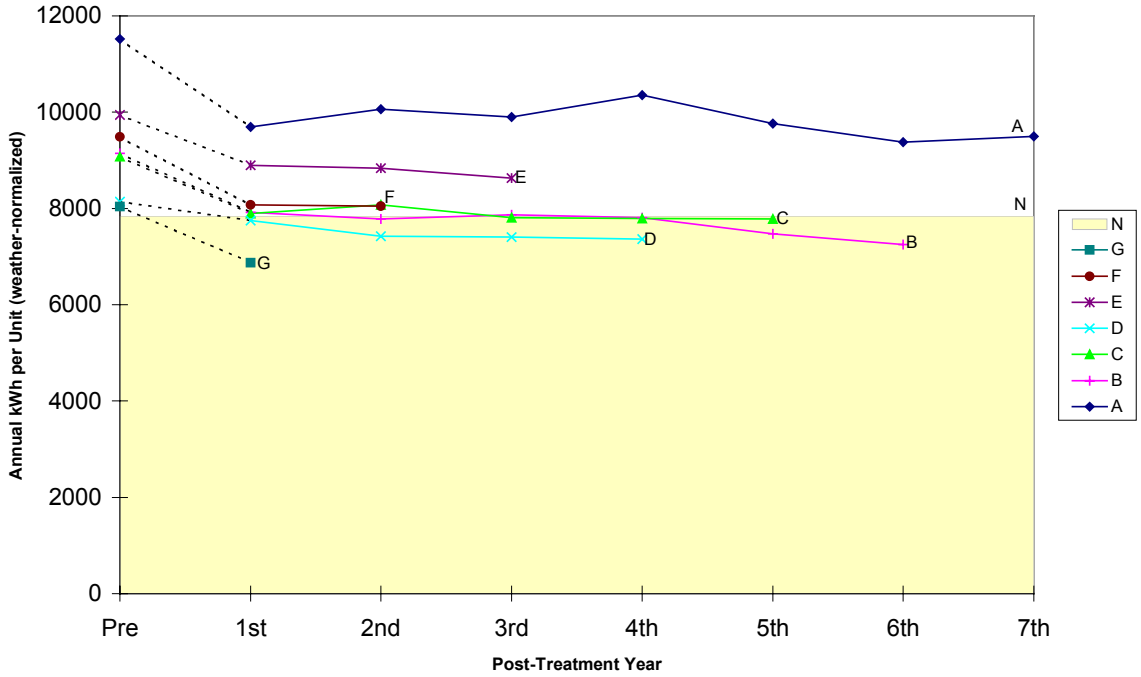


Figure C-VII: Standard-Income House Meters

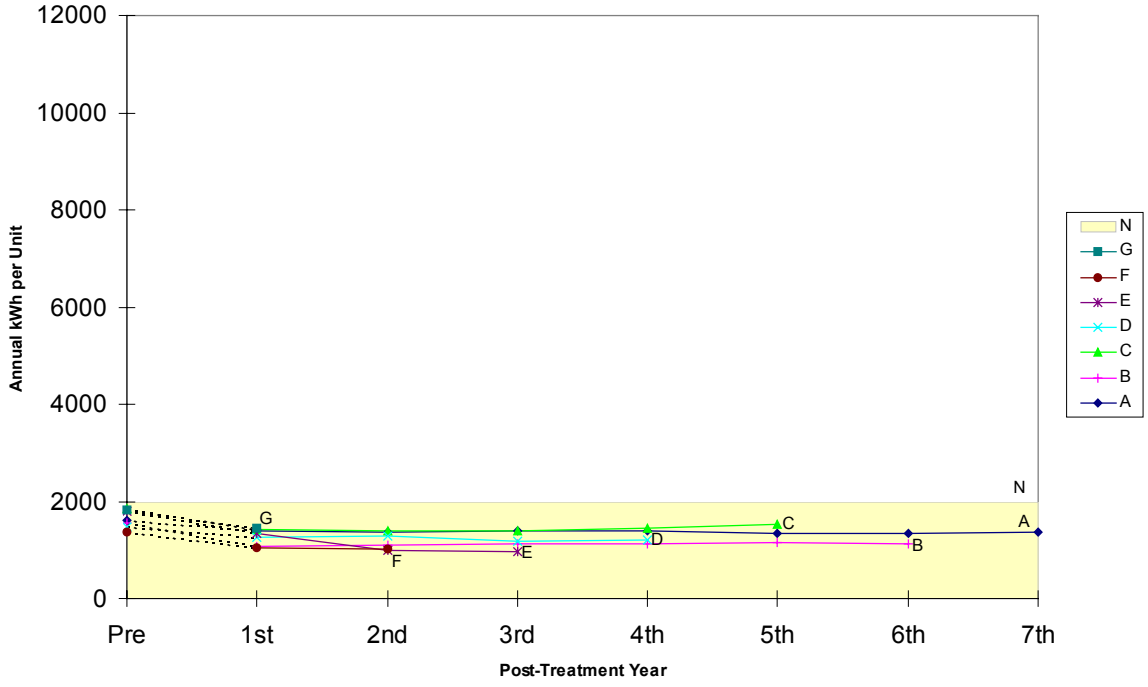
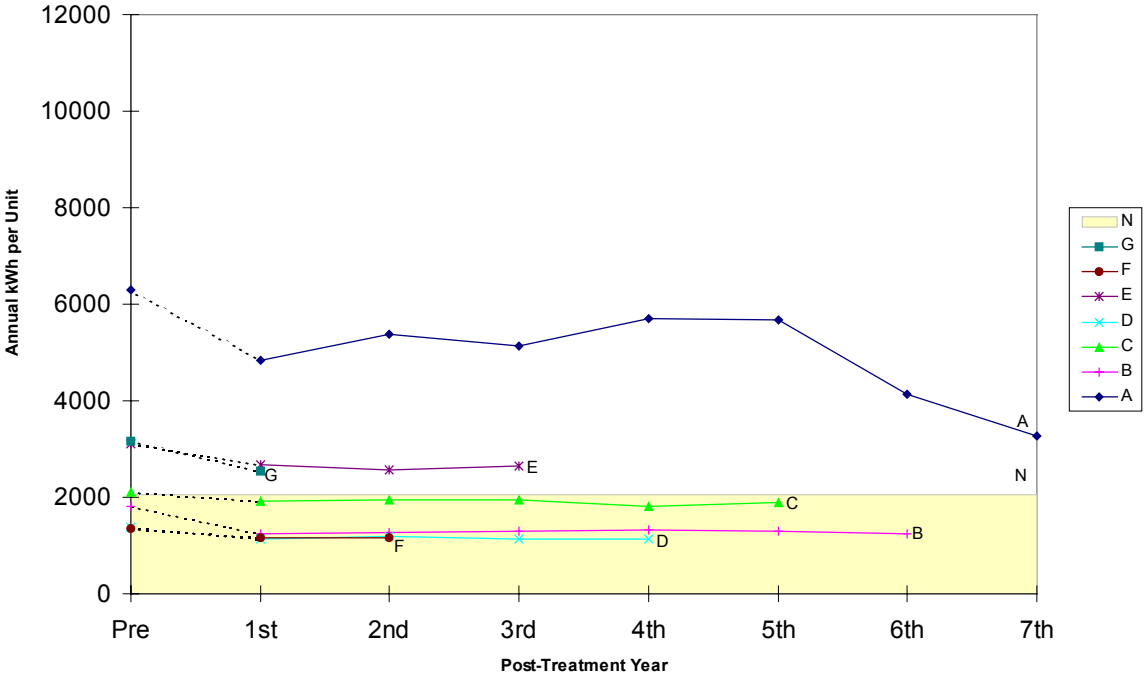


Figure C-VIII: Low-Income House Meters



C.3 Annual Energy Savings by Period: Gross Scores

Figure C-IX: Standard-Income Tenant Meters

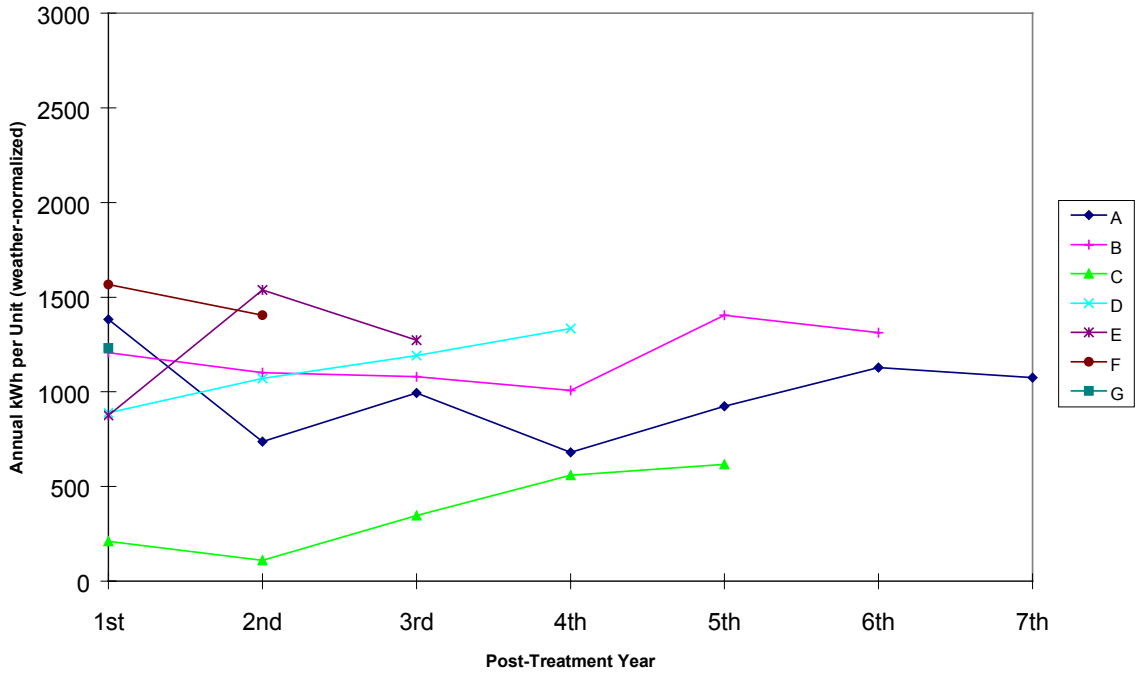


Figure C-X: Low-Income Tenant Meters

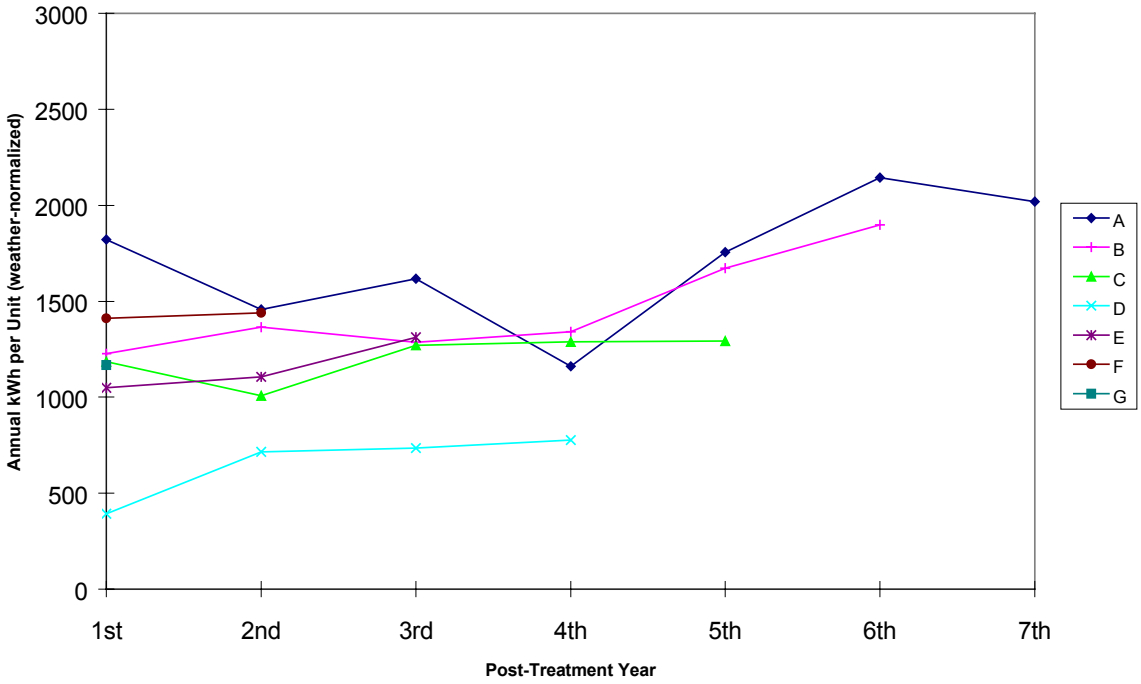


Figure C-XI: Standard-Income House Meters

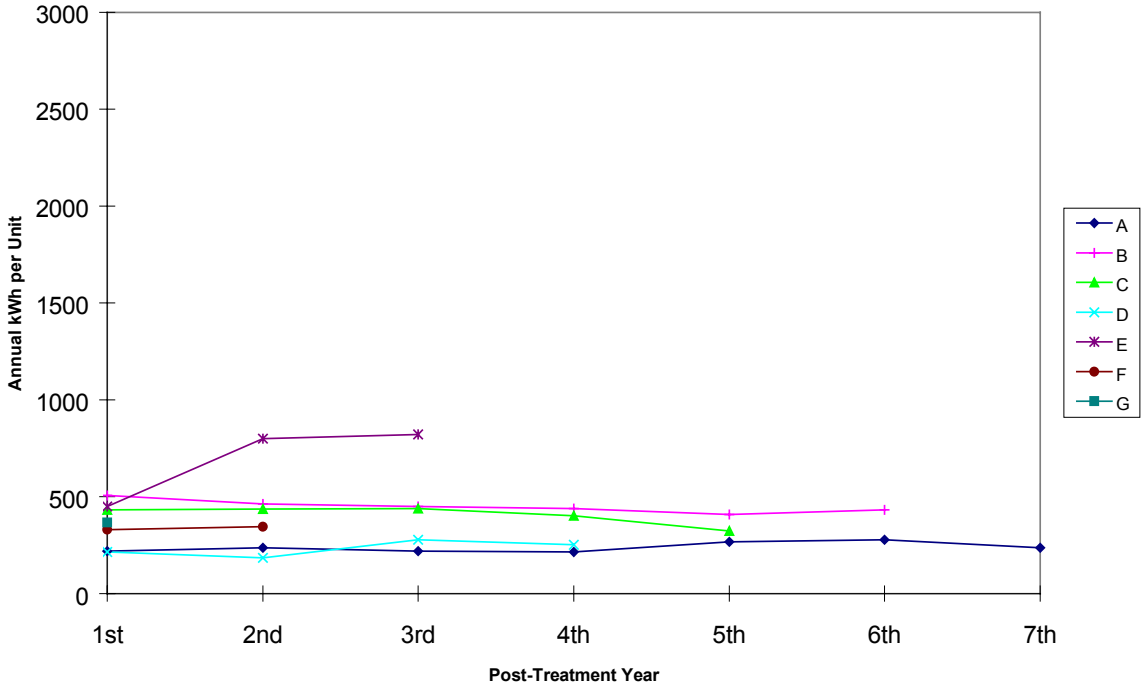
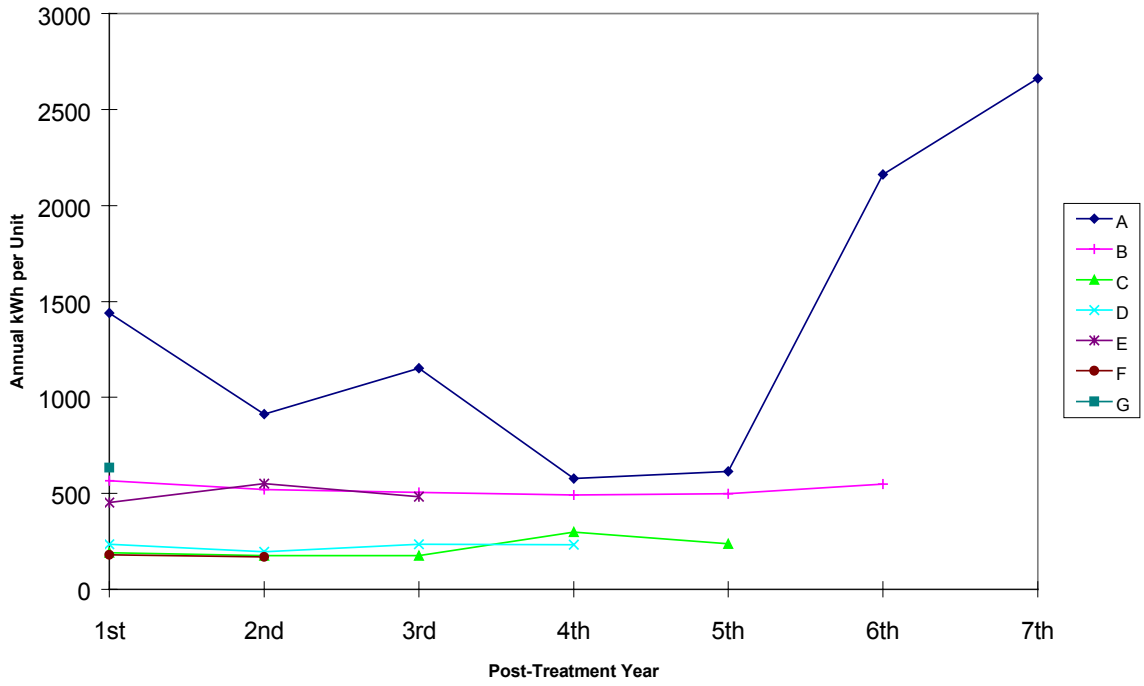


Figure C-XII Low-Income House Meters



C.4 Annual Energy Savings by Period: Net I Scores

Figure C-XIII: Standard-Income Tenant Meters

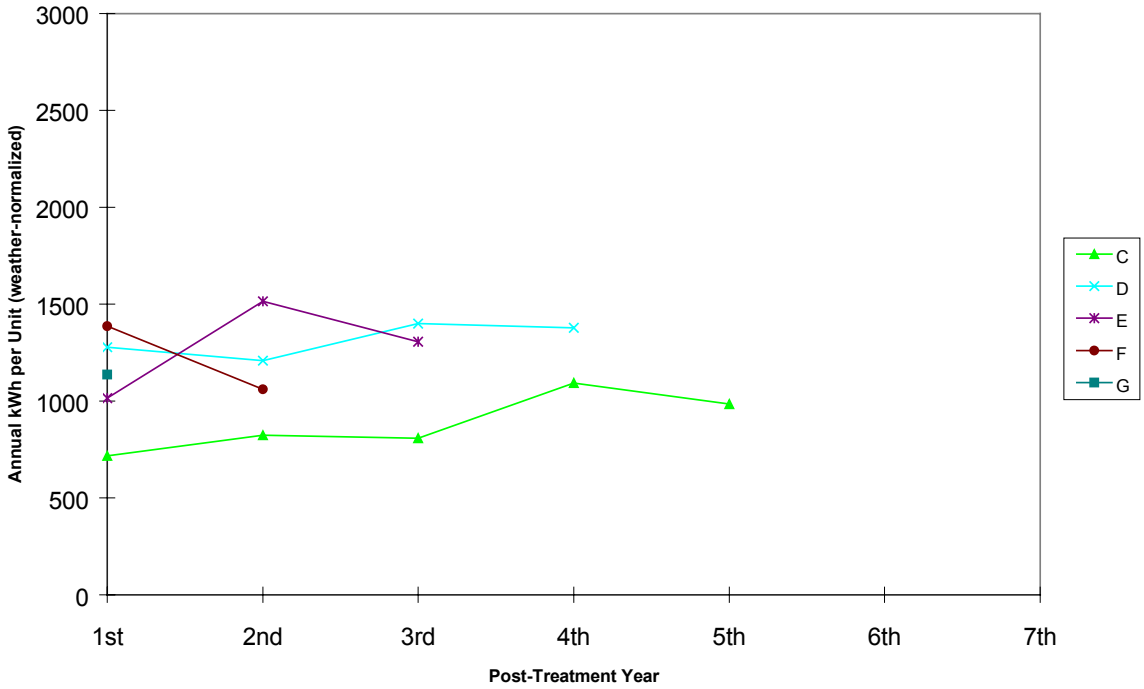


Figure C-XIV: Low-Income Tenant Meters

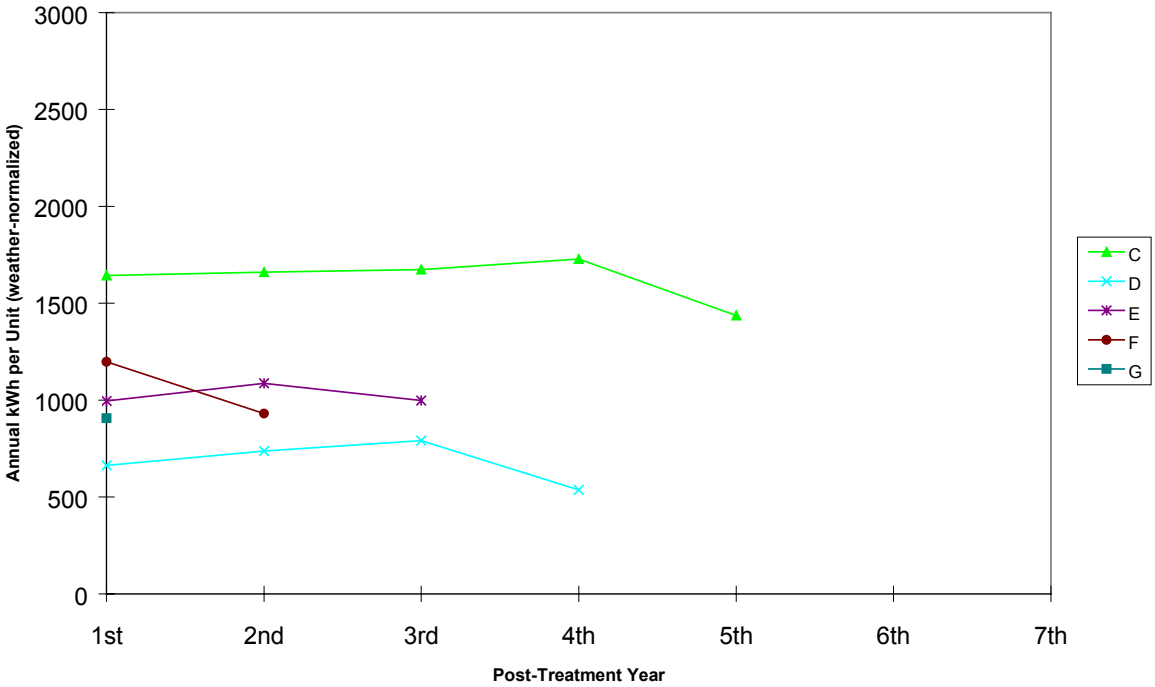


Figure C-XV: Standard-Income House Meters

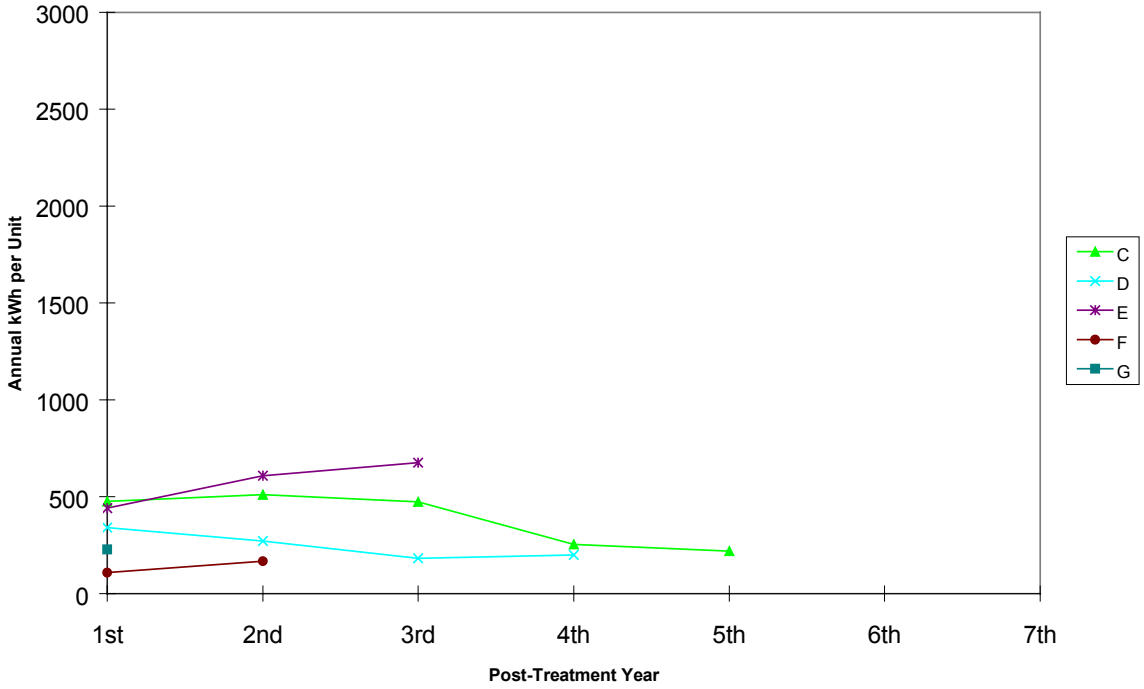
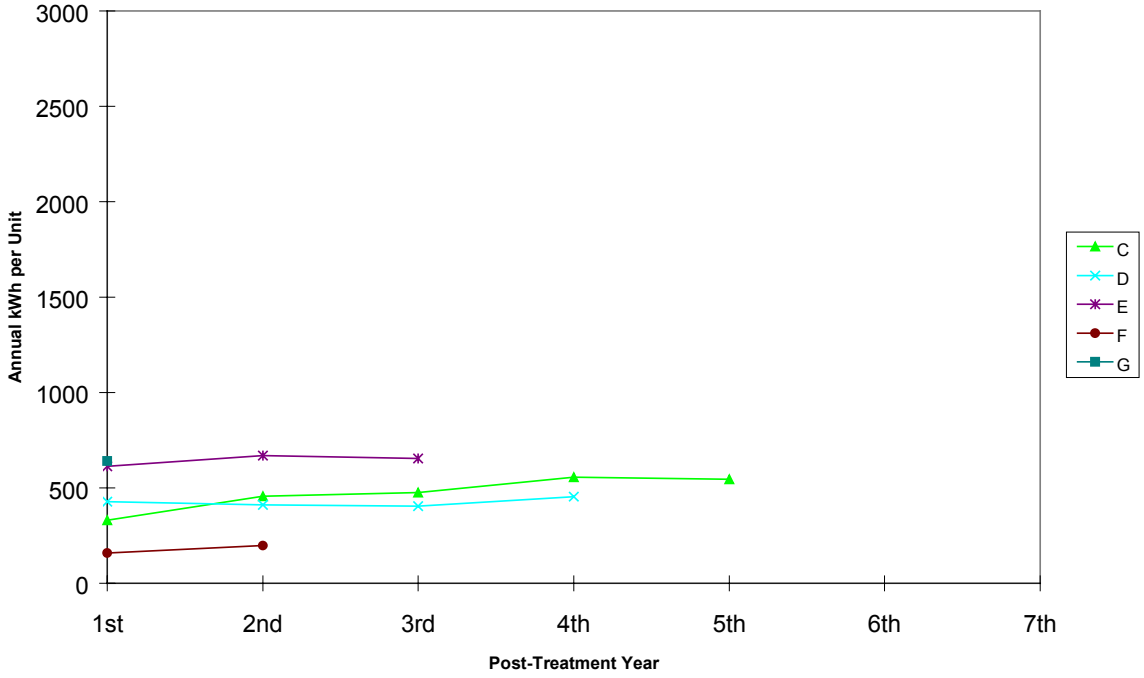


Figure C-XVI: Low-Income House Meters



C.5 Net I Comparison of Past Participants to Control Groups

Figure C-XVII: Tenant Meter Net I Comparison: Nonparticipants and Past Participants

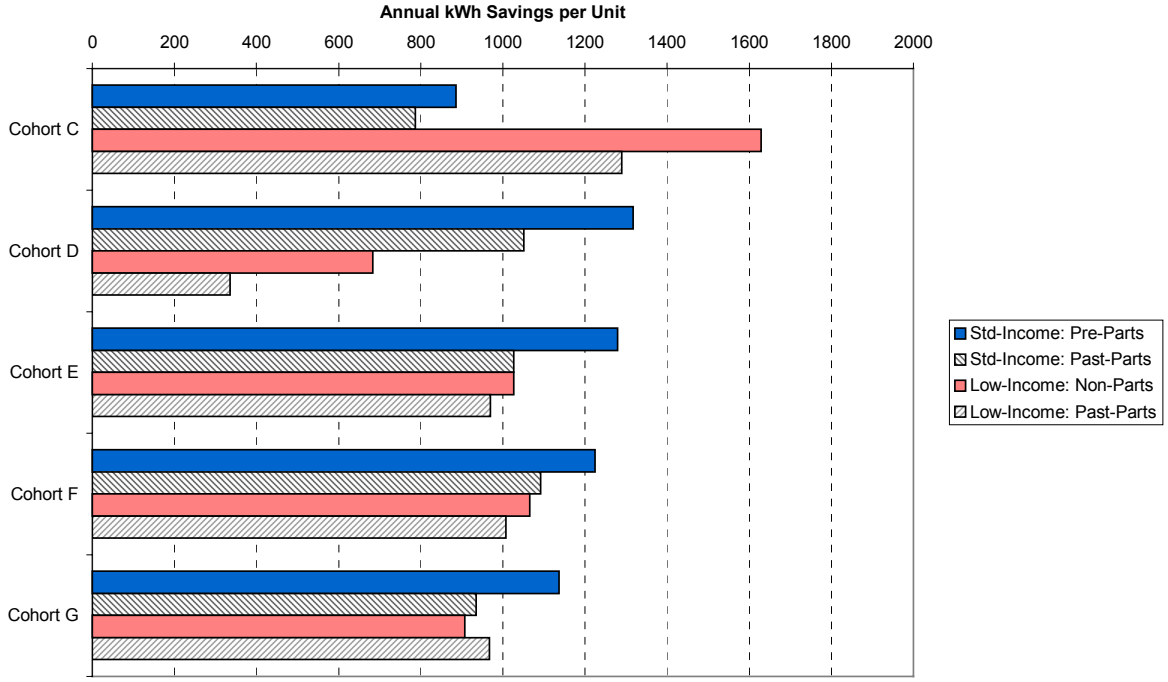


Figure C-XVIII: House Meter Net I Comparison: Nonparticipants and Past Participants

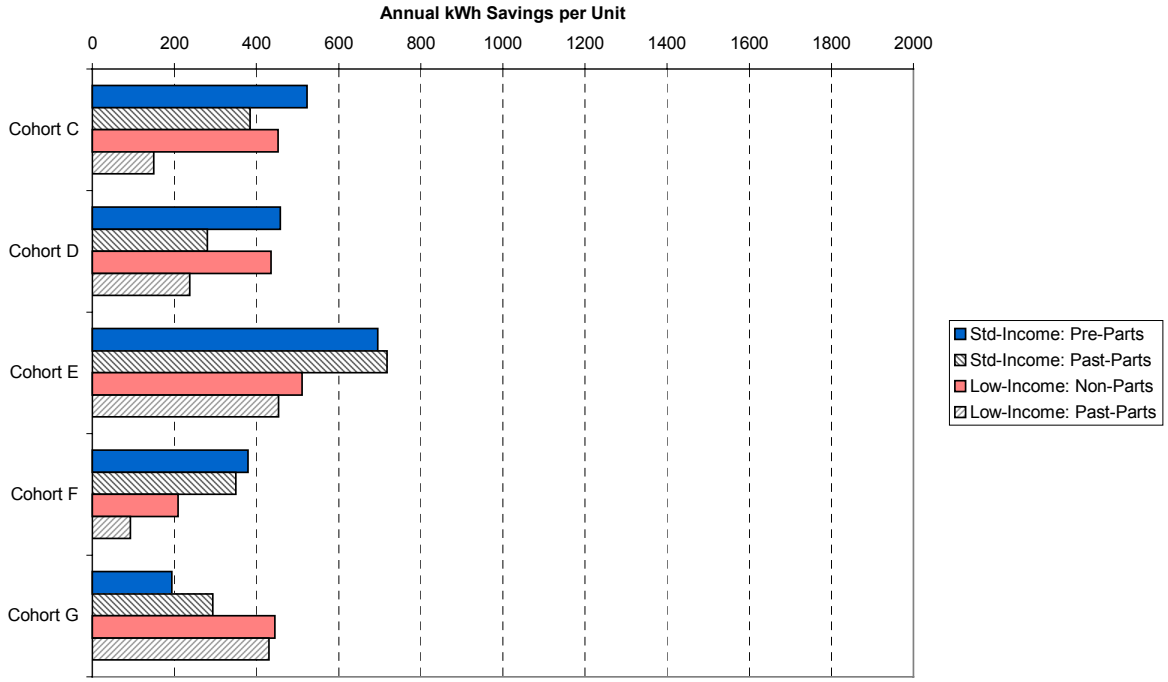
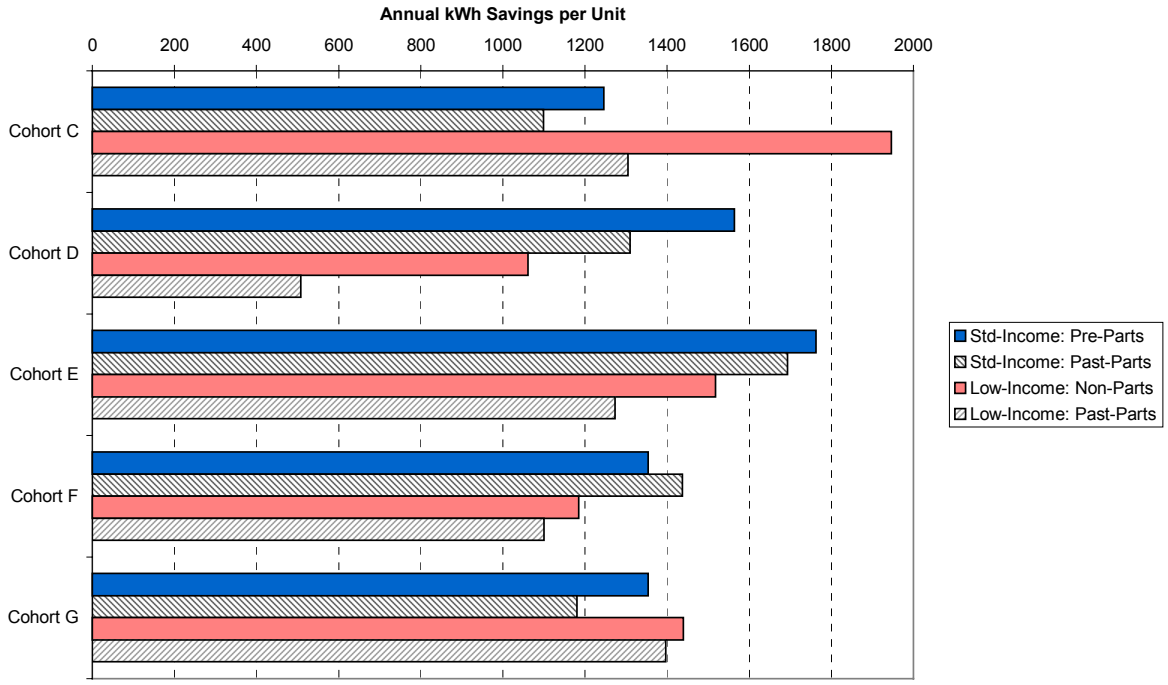


Figure C-XIX: Building Score Net I Comparison: Nonparticipants and Past Participants



C.6 Annual Energy Savings by Period: Net II Scores

Figure C-XX: Standard-Income Tenant Meters

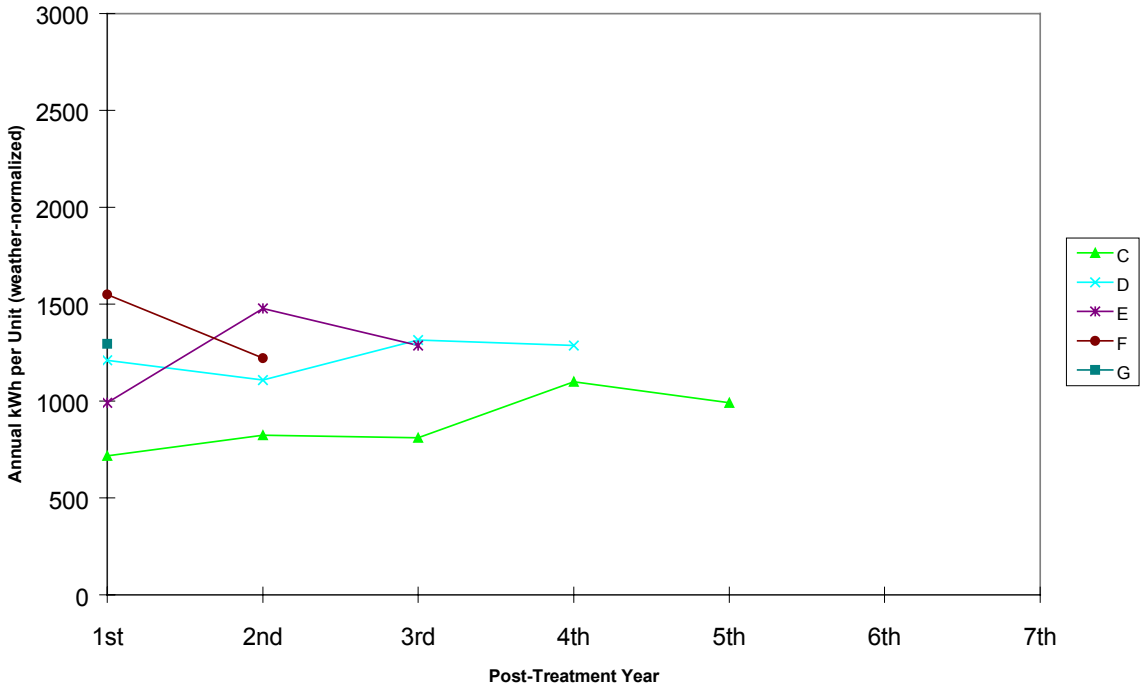


Figure C-XXI: Low-Income Tenant Meters

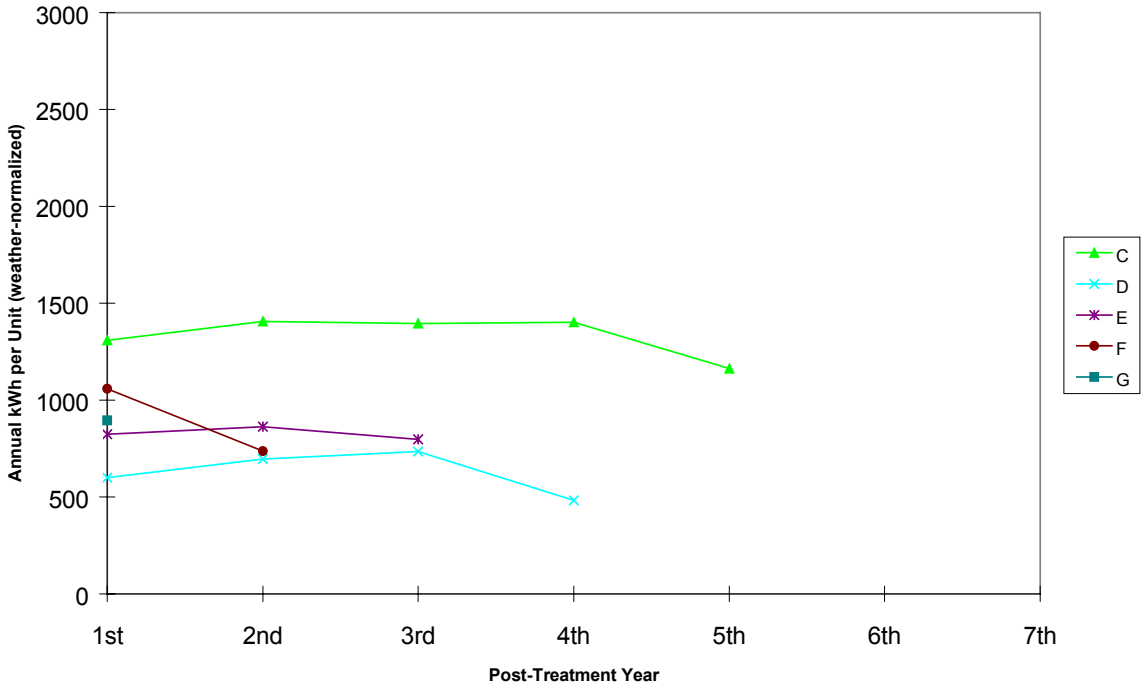


Figure C-XXII: Standard-Income House Meters

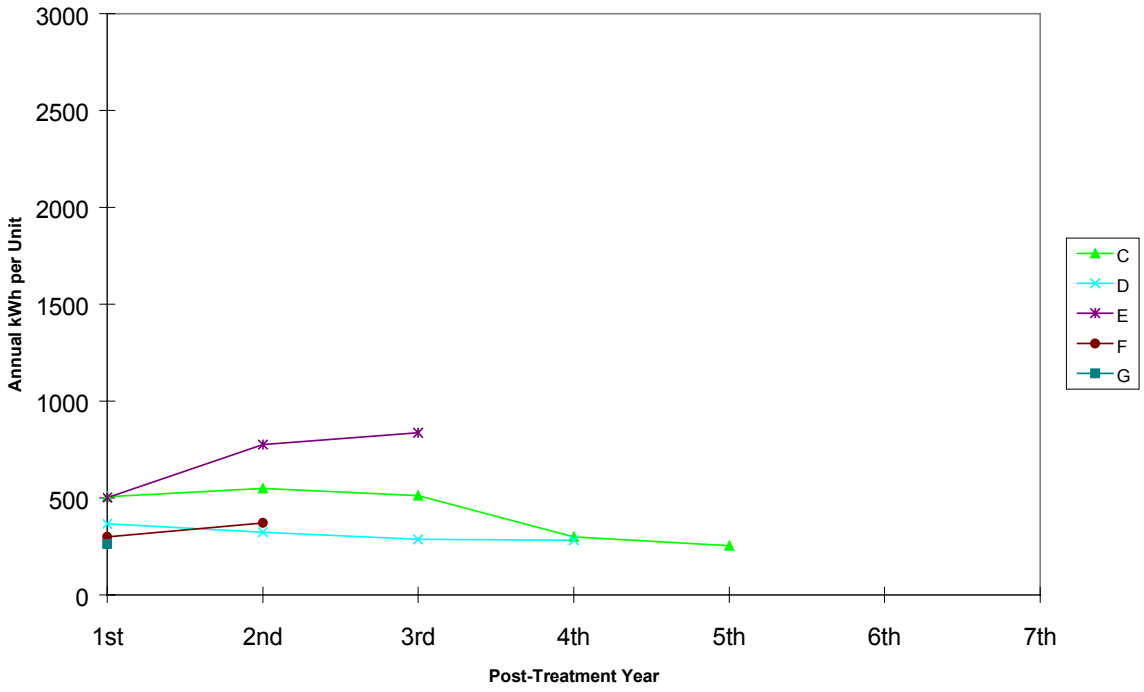
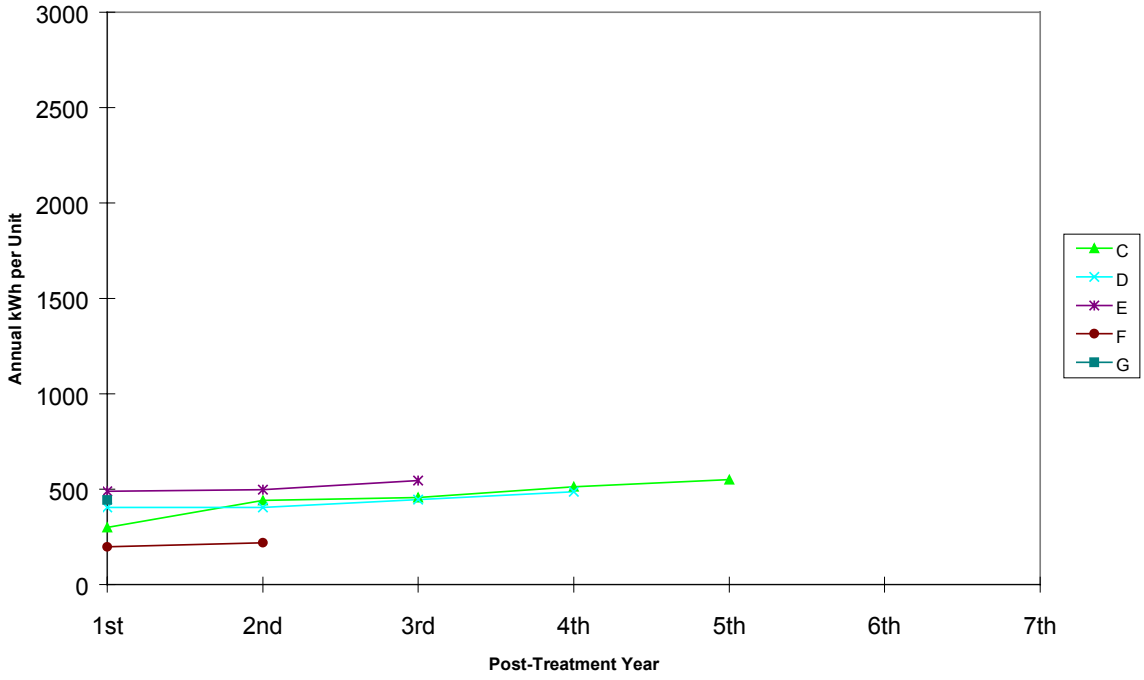


Figure C-XXIII: Low-Income House Meters



C.7 Annual Energy Savings by Period: Tenant Meter Regressions

Figure C-XXIV: Cohort C Tenant Meters

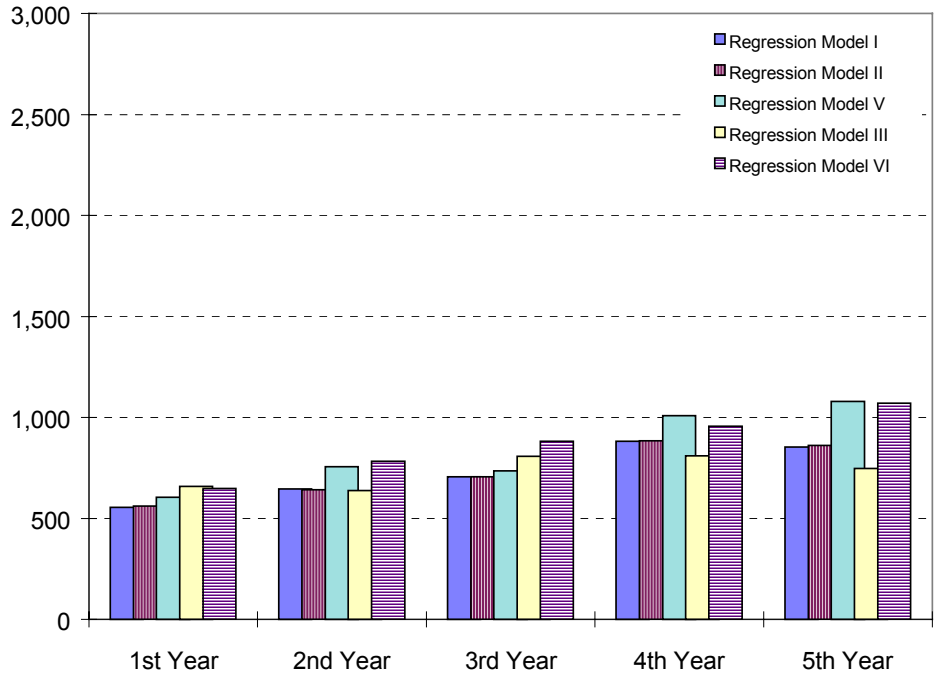


Figure C-XXV: Cohort D Tenant Meters

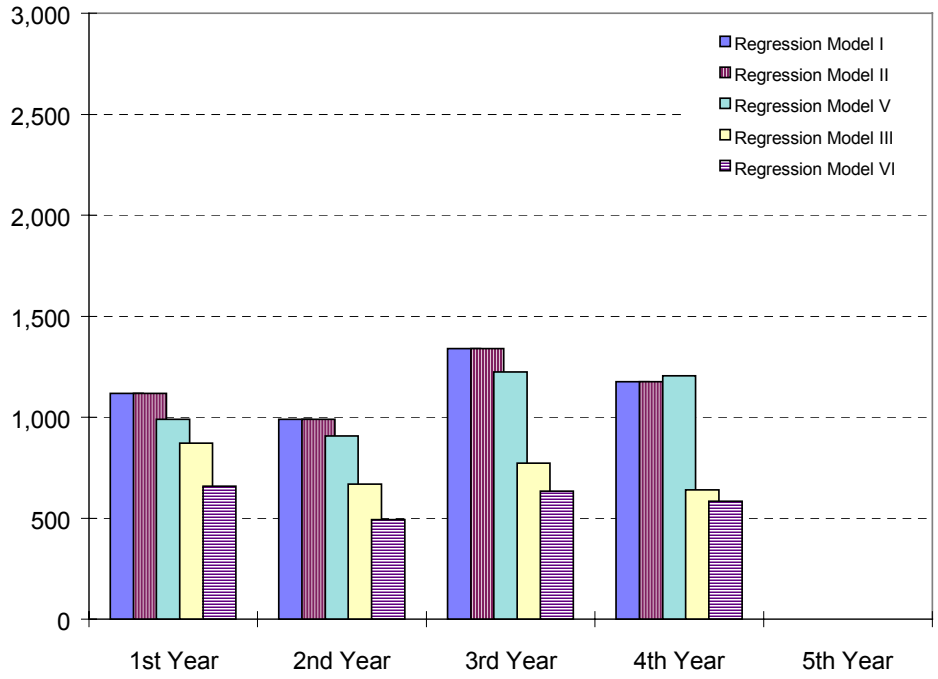


Figure C-XXVI Cohort E Tenant Meters

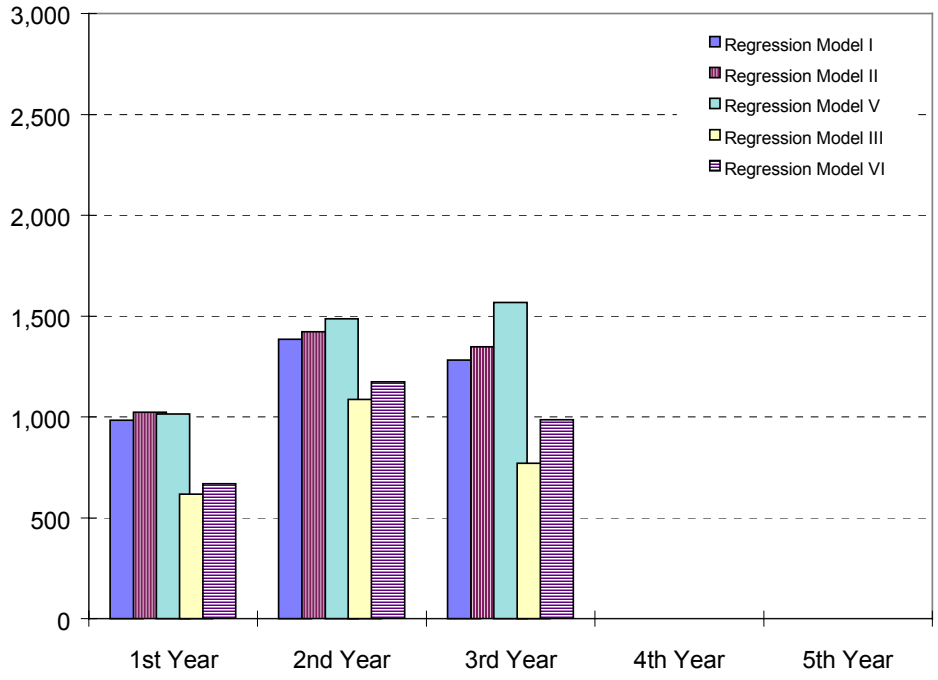


Figure C-XXVII Cohort F Tenant Meters

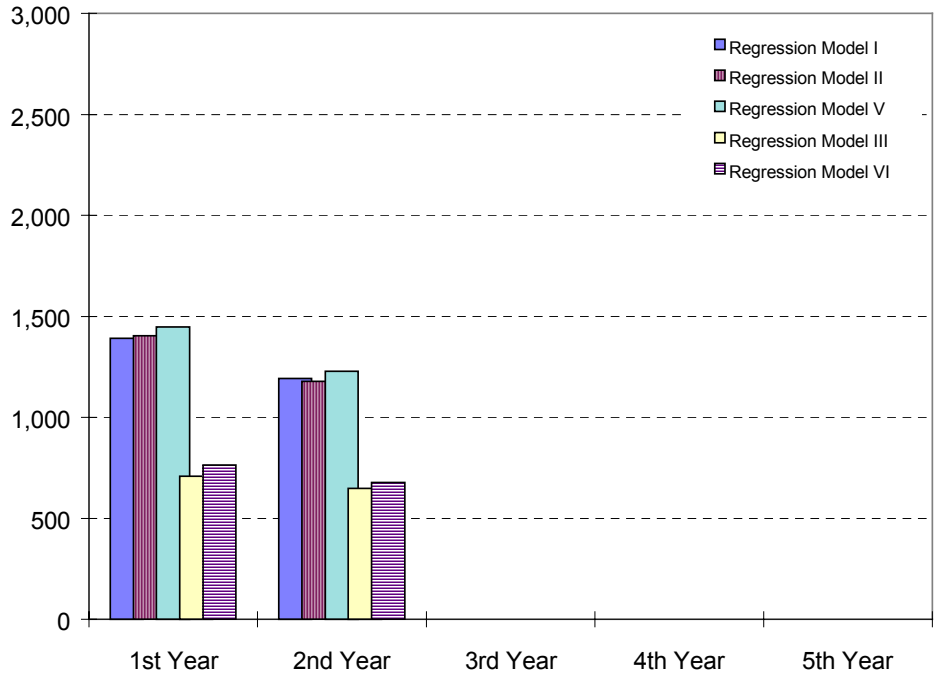


Figure C-XXVIII Cohort G Tenant Meters

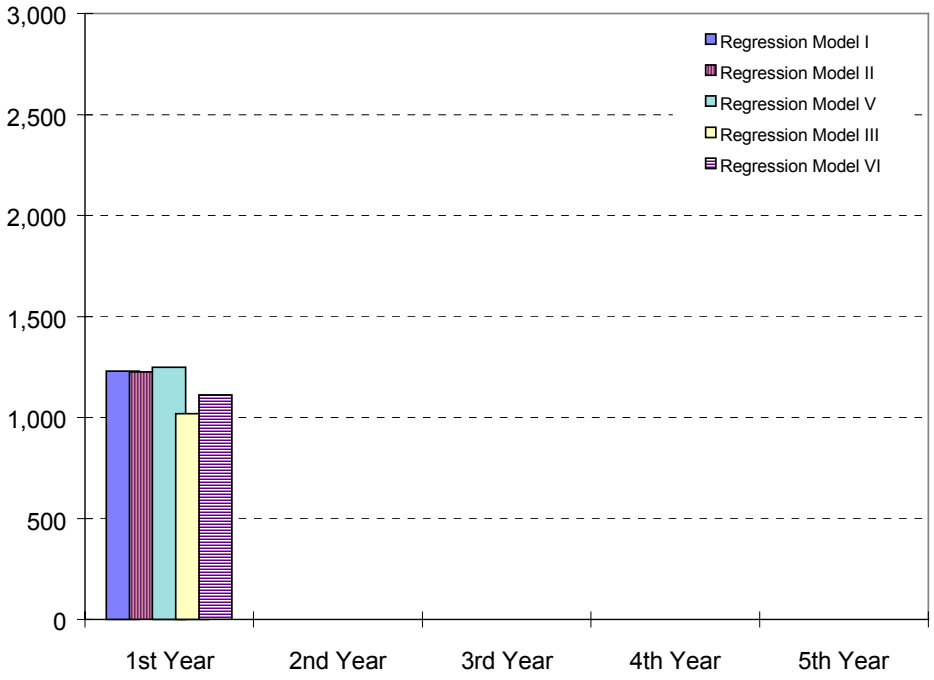
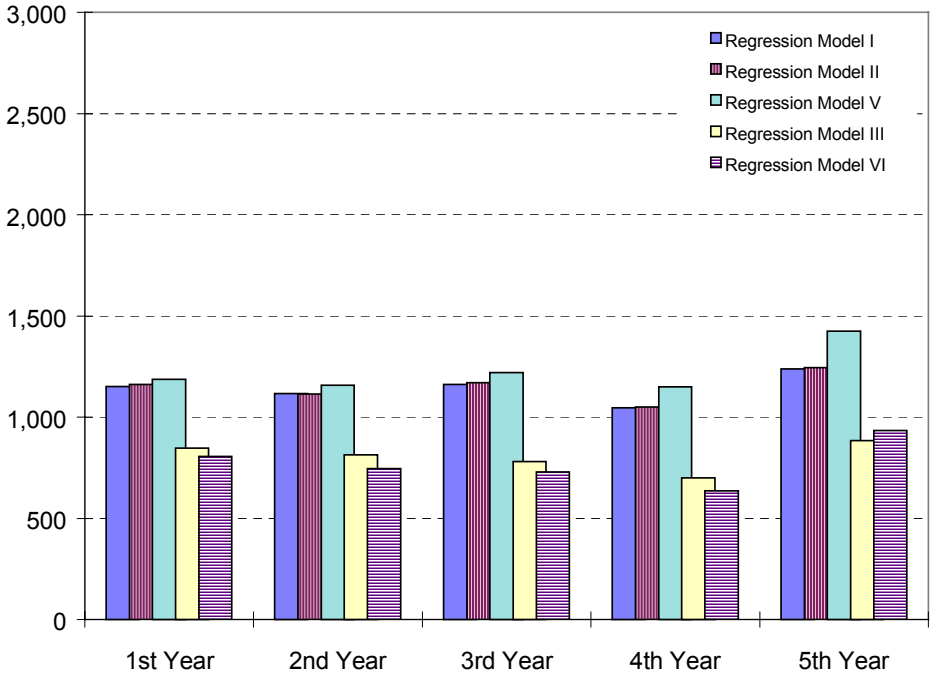


Figure C-XXIX Pooled Cohorts C-G Tenant Meters



C.8 Annual Energy Savings by Period: House Meter Regressions

Figure C-XXX: Cohort C House Meters

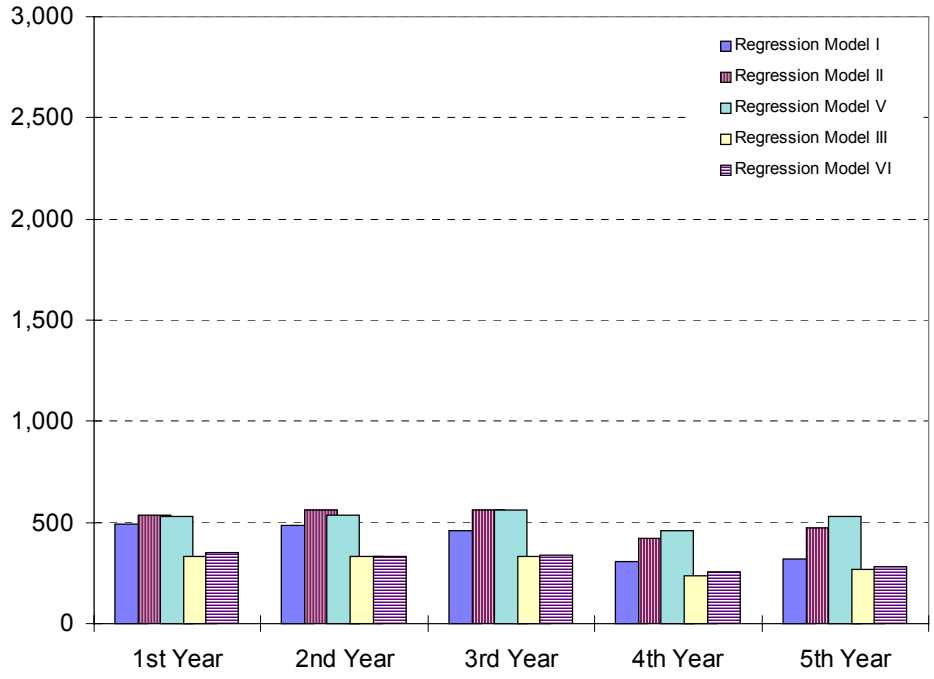


Figure C-XXXI: Cohort D House Meters

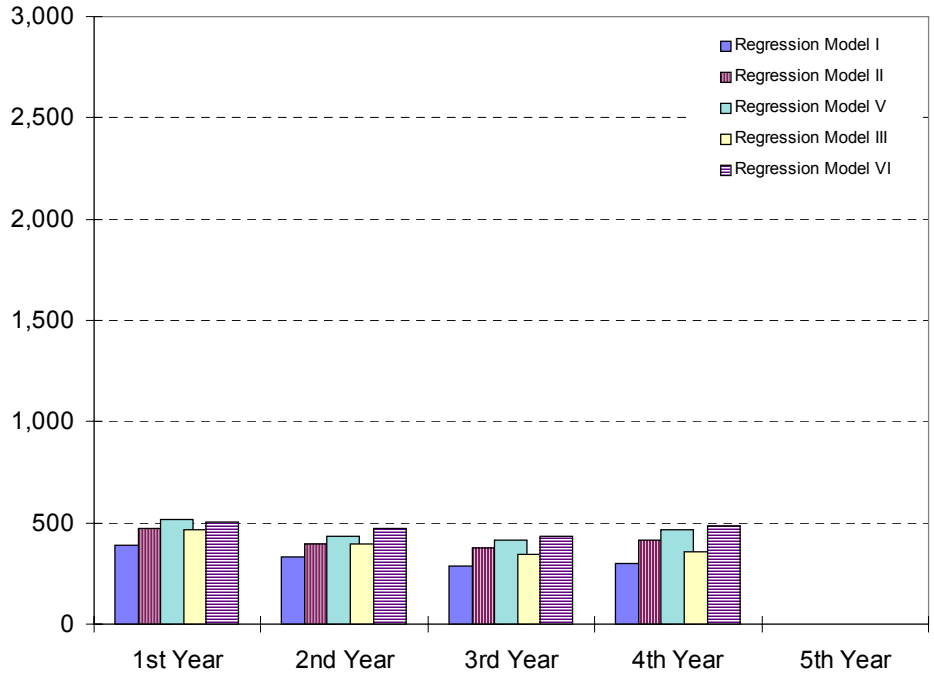


Figure C-XXXII: Cohort E House Meters

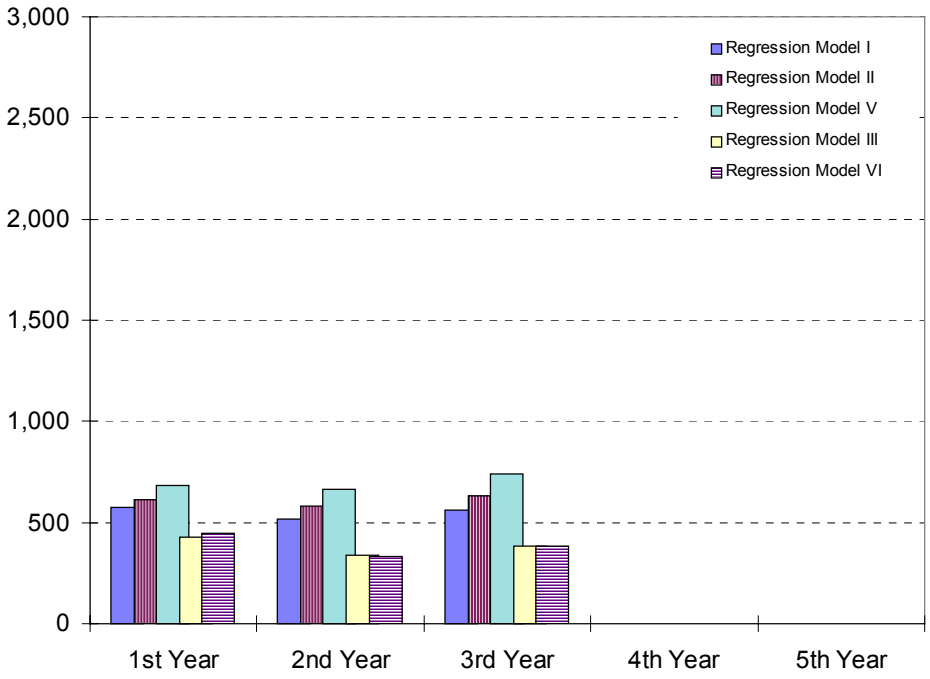


Figure C-XXXIII: Cohort F House Meters

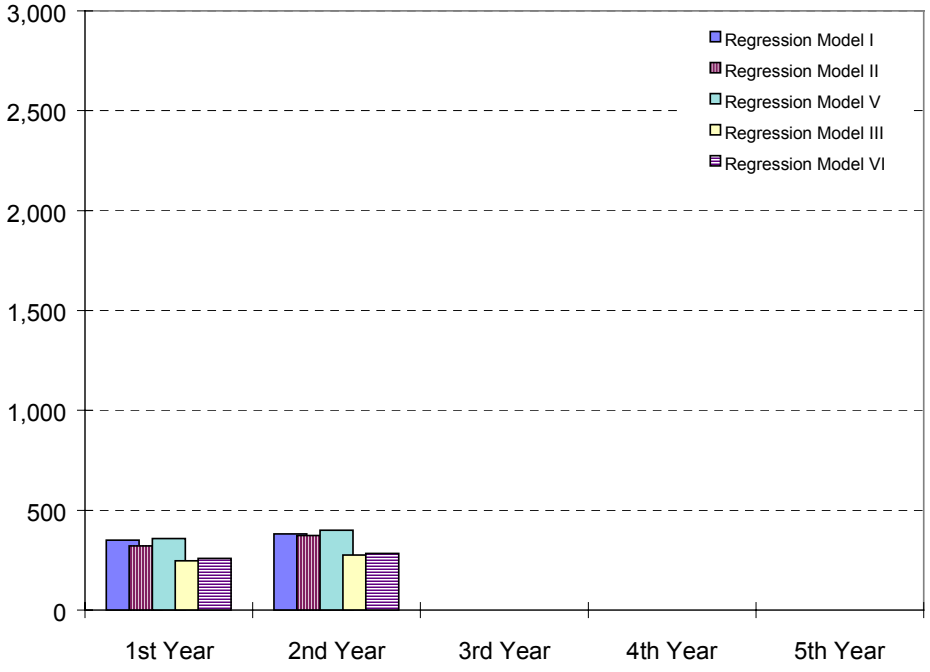


Figure C-XXXIV: Cohort G House Meters

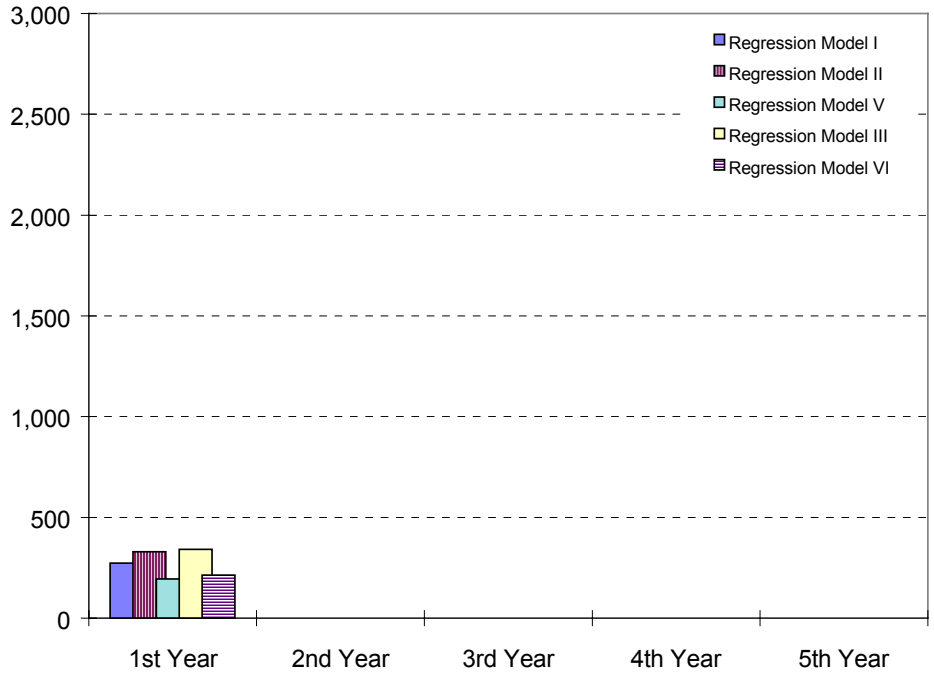
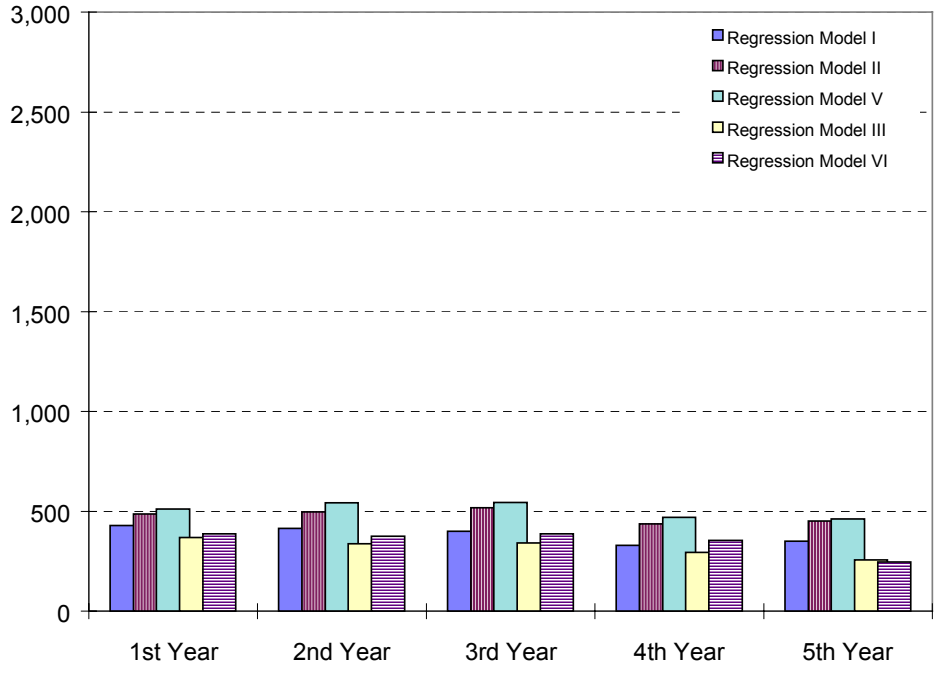


Figure C-XXXV: Pooled Cohorts C-G House Meters



C.9 Realization of Engineering Estimates

Figure C-XXXVI: Standard-Income Tenant Meters, Model III

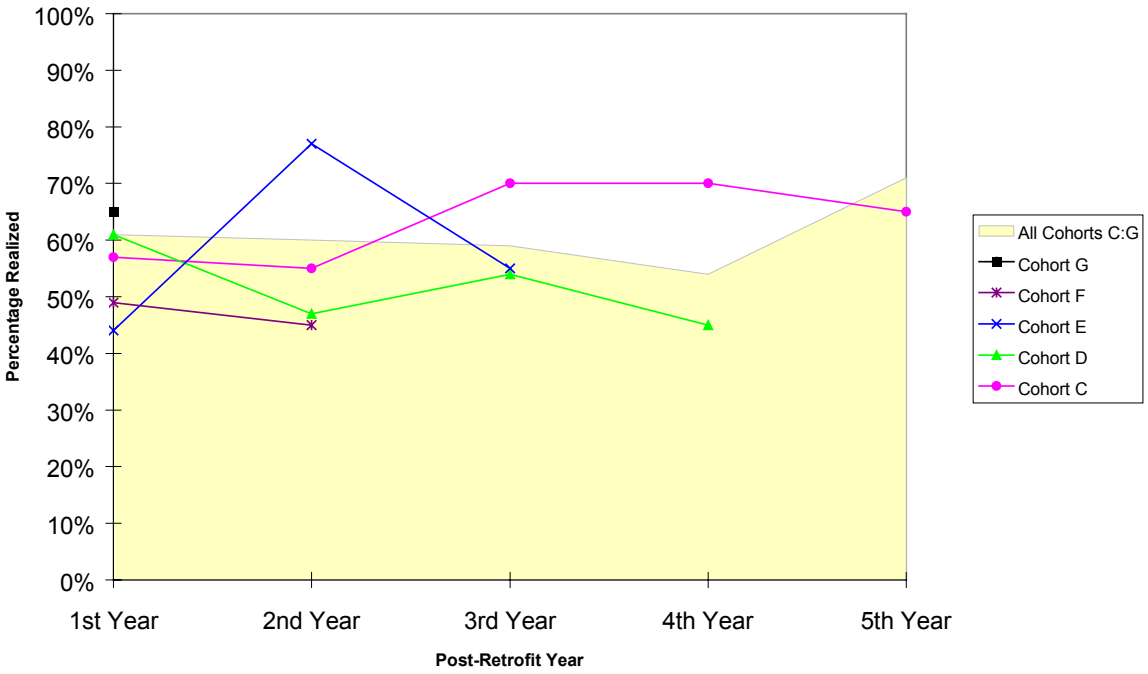


Figure C-XXXVII: Standard-Income Tenant Meters, Model VI

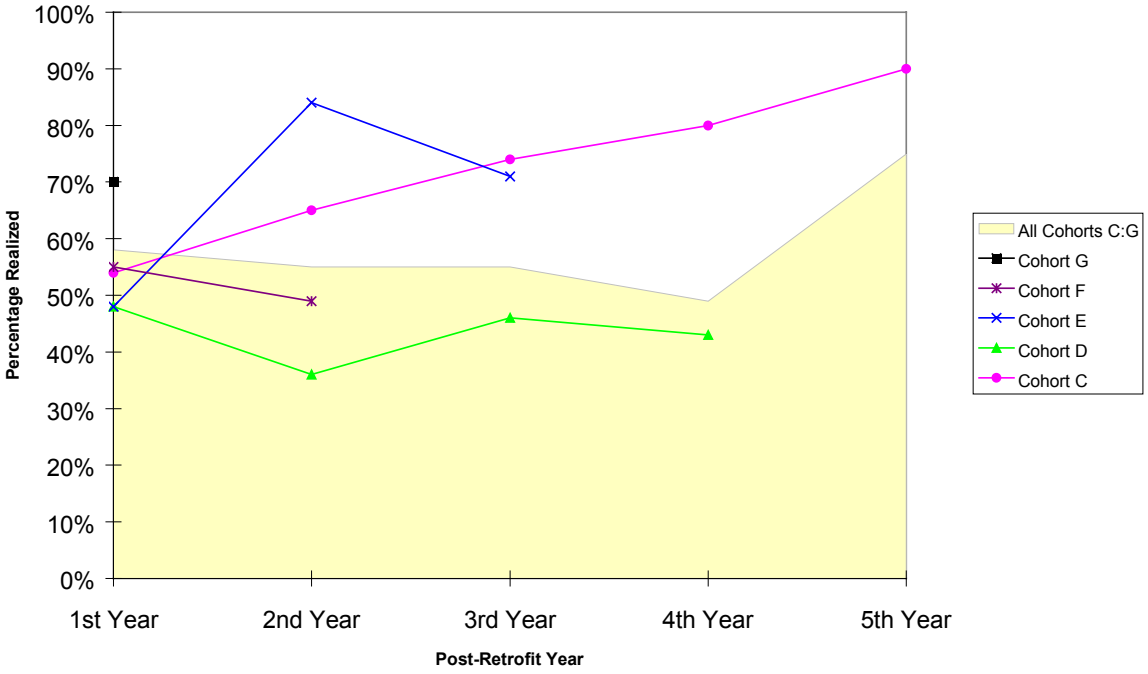


Figure C-XXXVIII Standard-Income House Meters, Model III

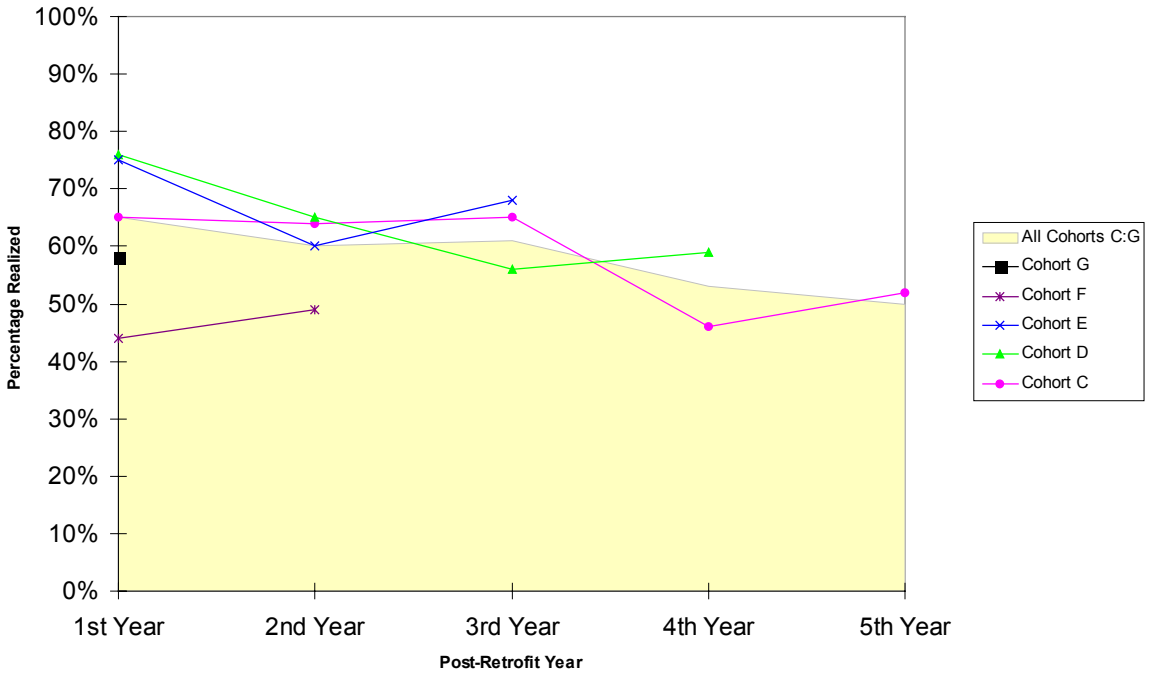


Figure C-XXXIX: Standard-Income House Meters, Model VI