Commercial and Industrial Retrofit Rebates: What Does It Take?

Les Tumidaj, Pacific Energy Associates, Inc.
Fred Gordon, Pacific Energy Associates, Inc.
Gary Smith, Pacific Energy Associates, Inc.
Carol White, National Grid

ABSTRACT

Data was collected in 2001 from utilities throughout the U.S. regarding the rebates offered for commercial and industrial retrofit programs. The data was used in concert with other information to consider changes to rebates for a Northeast utility. Both participation rates and rebate levels were compared, yielding several conclusions: (1) Utilities were using markedly different levels of incentives; (2) some utilities with very low rebates were experiencing modest penetration; however, (3) among utilities with multi-year programs and significant penetration, there were significant differences in rebate levels. This information should be interpreted with caution, given that data were not available about response rates for specific measures, differences in customers, rate differences, etc. However, the study suggests that some utilities could lower their rebates and still achieve significant program penetration.

Introduction

Narragansett Electric (NECo) sponsored a study that compared rebates provided by its *Energy Initiative* program (EI) with other well-established utility commercial and industrial retrofit programs. Pacific Energy Associates, Inc. (PEA) performed this analysis to help assess whether NECo's program could pay lower rebates and continue to succeed. For these comparisons, rebates include both prescriptive measure incentives and incentives based on kWh savings.

This comparison was complicated by the differences in program histories, incentive formulas, eligible measures, and relative volume of various measures at different utilities. Therefore, all conclusions from this study should be checked against other information, and particularly against the program marketing experience of a particular utility, for validity.

Nevertheless, the findings provide a useful reference for ascertaining the overall scale of program performance with respect to different rebate levels. In effect, this study provides a meta-analysis which allows, within reason, an estimation of reasonable price points for rebated measures that provide the balance between sufficient motivation of customer program participation and prudent use of rate-payer funds.

Data Sources and Methodology

Data Sources

We initially conducted a scan of existing utility retrofit programs, through review of our files, contacts with experts, and contacts with utility personnel, to identify those which

had a sufficient track record and enough available information to provide a meaningful point of comparison for retrofit rebates. We found a modest number of programs that met these conditions, shown in Table 1. These were then subjected to more detailed analysis. We obtained the following information for these targeted programs:

- current program descriptions;
- detailed incentive offerings for both prescriptive and custom paths;
- program activity reports for the past few years; and
- recent Commercial and Industrial (C&I) load data.

While we could not obtain all of the detail information we were seeking, especially with respect to program participation and savings levels, we did succeed in compiling sufficient information to allow us to make broad-based findings concerning incentive levels.

Table 1. Detailed Retrofit Program Review—Utility Programs

Utility	Current Retrofit Program(s)	Comments
Targeted Utilities Receiving Detailed Review		
Pacific Gas & Electric PG&E)	Express Efficiency Rebates Standard Performance Contract	Obtained reports from CPUC
San Diego Gas & Electric (SDG&E)	Express Efficiency Rebates Standard Performance Contract	Received reports for past 3 years
Southern California Edison (SCE)	Express Efficiency Rebates Standard Performance Contract	Obtained report for 2000
Sacramento Municipal Utility District (SMUD)	Purchase of Energy Savings	Spreadsheet of results of last 3 years
Portland General Electric (PGE)	Equipment Rebates Custom Program	Received 3 years of program activity
Puget Sound Electric (PSE)	Energy Efficiency Services Program	3 years of limited program data
Seattle City Light (SCL)	Energy Smart Services *(purchase of energy savings)*	Received report for 1977-99 plus additional program information
United Illuminating (UI)	Energy Opportunities RFP Program (w/ CL&P)	Obtained program data for 2000
Connecticut Light & Power (CL&P)	RFP Program (w/ UI)	Received data for RFP program

Review and Analysis

Once the data were in hand, we compiled and analyzed the incentive offerings from the utility retrofit programs that were pertinent to our study. For those utilities with prescriptive (fixed dollar amount) rebates for specified equipment types, this proved to be a straightforward exercise. For those utilities with custom measure paths or purchased energy

savings using a $/kWh value, we calculated what the equivalent rebate values would be for a given measure. The results of this analysis are provided in Tables 2, 3, and 4.

Next, we developed and analyzed indicators that would give us a reasonable measure of program performance. Originally we had intended to conduct performance comparisons for specific measures among the examined programs, but such data were either too time consuming to obtain, too inconsistent for reasonable comparison, or simply not available. As a result, we resorted to developing broad-brush indicators of overall program performance to determine the efficacy of overall rebate offerings. These indicators are used in Table 5 and are described below:

- Lifetime cost per kWh saved. This is the total annual program cost divided by the average lifetimes of the measures. This value was based on utility provided data and is meant to make rough comparisons between programs and not to reflect on the actual cost-effectiveness of these programs.
- Annual program savings as a percent of utility C&I loads for a reference year (namely, 1999). Again, this is meant as a rough indicator of program performance for gross comparison purposes.
- Percent of C&I load that consists of commercial loads. This indicator was solely used to determine if any given utility's commercial/industrial split was significantly at variance with other utilities and, thus, would not offer a reasonable comparison.

Finally, we drew comparisons between the indicators of overall program performance and the overall levels of incentives (i.e., rebates or rebate equivalents) that were offered by the programs.

Some Important Considerations/Limitations

In making the comparisons discussed in the following sections, several important limitations to the data and methodology as well as the unique histories of specific utility programs must be considered.

- NECo, the study sponsor, has been funding EI at a high cumulative per-customer level for many years. Thus, much of the "low-hanging fruit" (easy measures, highly motivated customers) may already be picked in its service territory. Reduced rebates may be less effective at reaching measures where there are technical, or physical issues that make retrofits more expensive, or customers who are less able to pursue efficiency.
- These comparisons do not tell us whether, at the high-market-volume utilities, specific pieces of equipment are experiencing high market volumes.
- Although C&I retrofit programs are meant to target pure retrofit situations (functional equipment replaced largely for efficiency reasons), cases inevitably occur where customers plan to replace equipment for other purposes. In these cases, customers are already prepared to pay for new equipment, so smaller rebates should be adequate motivation for efficiency upgrades. At Narragansett, most of these potentially low-cost installations are addressed through the Design 2000+ program. The California investor-owned utilities cited in this paper had a separate remodeling program, so it is

reasonable to think that their program, like NECo's, would be dominated by true retrofit installations. However, we know little about the mix of retrofit versus functional and appearance-driven installations at other utilities.

- Comparisons are based on data collected in 2001. Revisions at some utilities may be significant.

Even with these qualifications in mind, we believe that the subsequent analysis and findings still have considerable utility.

Findings and Comments

Comparison of Detailed Rebates

We have provided comparison tables of retrofit rebates for the major lighting measures (which represent that bulk of prescriptive lighting rebates and, for that matter, prescriptive rebate incentive payouts) in Tables 2, 3, and 4 (utility offerings for high efficiency fluorescent and HID fixtures were fragmented from utility to utility and, thus, comparisons are less conclusive). For major lighting measures, several utility retrofit programs offer lighting rebates that were less (in some cases significantly less) than those offered by the EI program. Some of the utilities with these lower specific rebates were achieving significant overall program volume. However, we do not have the data to say whether volumes are comparable for specific measures, or even specific end-uses. Our observations regarding these prescriptive rebates follow:

- **T-8's / Electronic Ballasts:** NECo offered significantly higher rebates for T-8/electronic ballast measures, especially for one-to-two lamp fixtures, whereas Seattle City Light and UI offer moderately lower rebates, and the California utilities (PG&E/SDG&E/SCE and SMUD), Portland General Electric and Puget Sound Electric over significantly lower rebates. For example, whereas NECo offered $18 each for one-to-two lamp fixtures, the comparison utility programs offer $5 to $10 for equivalent equipment. This gap is less, but still significant, for the three and four lamp fixtures.
- **Compact Fluorescents (CFs)**: NECo offered rebates for equivalent hard-wired compact fluorescents (high power factor magnetic ballast) that were significantly higher than other utility programs (e.g., $25 for one lamp/fixture versus $10 to $15 at most other utilities). The utilities with purchase-of-energy-savings programs (i.e., offering $/kWh rebates) would pay at most about $12 to $20 for equivalent CFs.
- **Lighting Controls:** NECo offered rebates for equivalent, common lighting controls that were significantly higher than other utility programs. For example, NECo offered $30 per wall-mounted motion sensor versus $8 to $12 for other utility rebate and purchase-of-energy savings offerings. The case is similar for remote mounted sensor and, to a lesser extent, dimming controls.

Table 2. Comparison of Retrofit Rebates—T-8s / Electronic Ballasts

Utility	Incentive Type	Incentive Level
T-8/EB – Four Foot - 1 Lamp		
NECo	Rebates	$18 unit (lamps & ballast)
PG&E / SDG&E / SCE Express Efficiency Program	Rebates	T-5/8's—$3.75–4.25 per lamp EB—$2 per lamp controlled
PGE	Rebates	$5 per lamp
PSE	Rebates	$5/fixture
SCL	Purchase of energy savings	Retrofit kits—9¢/kWh New lighting fixtures—14¢/kWh Up to 70% of measure cost, 80% for industrial Equivalent rebate = $6.30/fixture for lamp and ballast only, $9.80 for new fixture **
SMUD	Purchase of energy savings	$200/AVG Peak kW Equivalent rebate = $4/fixture**
United Illuminating	Purchase of energy savings	12¢/kWh or 30% total cost* Equivalent rebate = $8.40/fixture**
T-8/EB – Four Foot - 2 Lamp		
NECo	Rebates	$18 unit (lamps & ballast)
PG&E / SDG&E / SCE Express Efficiency Program	Rebates	T-5/8's—$3.75–4.25 per lamp EB—$2 per lamp controlled
PGE	Rebates	$10 per fixture conversion (lamp for lamp) $15 per fixture (for new fixtures in retrofit project)
PSE	Rebates	$5/fixture
SCL	Purchase of energy savings	Retrofit kits—9¢/kWh New lighting fixtures—14¢/kWh Up to 70% of measure cost, 80% for industrial Equivalent rebate = $7.50/fixtue for lamps and ballasts only, $11.70 if new fixture**
SMUD	Purchase of energy savings	$200/AVG Peak KW Equivalent rebate = $4.75/fixture**
United Illuminating	Purchase of energy savings	12¢/kWh or 30% total cost* Equivalent rebate = $10/fixture**

Continued

T-8/ELEC – Four Foot - 3 Lamp		
NECo	Rebates	$18 unit (lamps & ballast)
PG&E / SDG&E / SCE Express Efficiency Prog	Rebates	T-5/8's—$3.75–4.25 per lamp EB—$2 per lamp controlled
PGE	Rebates	$10 per fixture conversion (lamp for lamp) $15 per fixture (new fixture in retrofit project) $10/fixture conversion—delamped to 2 lamps
PSE	Rebates	$10/fixture
SCL	Purchase of energy savings	Retrofit kits—9¢/kWh New lighting fixtures—14¢/kWh Up to 70% of measure cost, 80% for industrial Equivalent rebate = $13.80/fixture for lamps and ballasts only, $21.50 for new fixture**
SMUD	Purchase of energy savings	$200/AVG Peak kW Equivalent rebate = $8.75/fixture**
United Illuminating	Purchase of energy savings	12¢/kWh or 30% total cost* Equivalent rebate = $18.50/fixture**
T-8/ELEC – Four Foot- 4 Lamp		
NECo	Rebates	$18 unit (lamps & ballast)
PG&E / SDG&E / SCE Express Efficiency Prog	Rebates	T-5/8's—$3.75–4.25 per lamp EB—$2 per lamp controlled
PGE	Rebates	$10/fixture conversion—delamped to 3 or 2 lamps $5/fixture conversion (requires 4-T8's with a reduced wattage ballast)
PSE	Rebates	$8/fixture
SCL	Purchase of energy savings	Retrofit kits—9¢/kWh New lighting fixtures—14¢/kWh Up to 70% of measure cost, 80% for industrial Equivalent rebate = $15/fixture for lamps and ballasts only, $23.30 for new fixture **
SMUD	Purchase of energy savings	$200/AVG Peak kW Equivalent rebate = $9.50/fixture**
United Illuminating	Purchase of energy savings	12¢/kWh or 30% total cost* Equivalent rebate = $20/fixture**

* Recently decreased to these levels due to budget limitations, previously 50% max.

** Equivalent rebate = (standard fixture wattage—efficient fixture wattage) x 3500 equivalent full load hours x utility retrofit incentive. Wattages were taken from National Grids wattage tables.

Table 3. Comparison of Retrofit Rebates—Compact Fluorescents

Utility	Incentive Type	Incentive Level
NECo	Rebates	$25/fixture for 1 (HPF mag's) $30/fixture for 2+ (HPF mag's)
PG&E / SDG&E / SCE Express Efficiency Program	Rebates	Hardwired (EB for =>18w lamps): 5-13w—$9/fixture 14-26w—$11/fixture 27-65w—$12.50/fixture 66-90w—$18/fixture >90w—$22.50/fixture
PGE	Rebates	HPF magnetic ballast (7-39w)—$10/fixture-new fixtures & conversions Hardwire EB (13-25w)—$15/fixture Hardwire EB (26-35w)—$20/fixture Hardwire EB (36+)—$25/fixture Modular w/reflector, dedicated base—$10/fixture
PSE		Hardwired ballast or locking EB w/ lamp—$10/fixture Dedicated fixture—$20/fixture
SCL	Custom	Retrofit kits—9¢/kWh New lighting fixtures—14¢/kWh Up to 70% of measure cost, 80% for industrial Equivalent rebate = $15/fixture if not hardwired, $23.30 if hardwired*
SMUD	Purchase of energy savings	$200/AVG Peak KW Equivalent rebate = $9.50/fixture*
United Illuminating	Purchase of energy savings	12¢/kWh or 30% total cost Equivalent rebate = $20/fixture*

* Equivalent rebate = (standard fixture wattage – efficient fixture wattage) x 3500 equivalent full load hours x utility retrofit incentive. Wattages were taken from National Grids wattage tables.

Table 4. Comparison of Retrofit Rebates—Lighting Controls

Utility	Incentive Type	Incentive Level
Motion Sensors		
NECo	Rebates	Wall mount—$30/control Remote mount—$75/control
PG&E / SDG&E / SCE Express Efficiency Program	Rebates	Wallbox—$8.25/sensor Wall/ceiling mount—$22/sensor
PGE	Rebates	$10 wall mount $20 ceiling mount
PSE	Rebates	Wall mount—$10 Ceiling mount—$20
SCL	Purchase of energy savings	Retrofit kits—9¢kWh New lighting fixtures—14¢/kWh Up to 70% of measure cost, 80% for industrial Equivalent rebate = $9-14/control*
SMUD	Purchase of energy savings	$0.04/kWh saved through lighting controls measures Equivalent rebate = $4/control*
United Illuminating	Purchase of energy savings	12¢/kWh or 30% total cost Equivalent rebate = $12/control*
Dimming Controls		
NECo	Rebates	$40/dimming ballast
PG&E / SDG&E / SCE Express Efficiency Prog	Rebates	$10/lamp controlled (for dimmable EB only)
PGE	Rebates	$30 per auto dimming ballast
PSE	Rebates	$25/dimming ballast
SCL	Purchase of energy savings	Retrofit kits—9¢/kWh New lighting fixtures—9¢/kWh Up to 70% of measure cost, 80% for industrial
SMUD	Purchase of energy savings	$0.04/kWh saved through lighting controls measures
United Illuminating	Purchase of energy savings	12¢/kWh or 30% total cost

* Equivalent rebate = efficient fixture wattage x 3500 equivalent full load hours x 30% reduction in operating hours x utility retrofit incentive. Wattages were taken from National Grids wattage tables.

Comparison of Custom Rebates

We have provided comparison tables of retrofit rebates for custom and purchase of energy savings paths in Table 2 along with the prescriptive incentives. Our findings include the following:

- In many cases, other utility retrofit programs offered custom measure rebates that were less (in some cases significantly less) than the EI program. These included: SCL, UI, PGE, SMUD and PSE. For example, SMUD caps payments at 40% of costs, but has been running a major program for many years with good penetration.
- NECo offered to pay up to 50% of the cost of custom measures, but did not pay to reduce the payback beyond 18 months. Some utilities offered higher caps on the percentage of cost that they would pay, but show lower *average* costs due to an additional cap, or in some cases competition, based on cost/kWh. (e.g., SCE, SDG&E and PG&E).
- Northeast Utilities' and United Illuminating's Request for Proposals (RFP) program is of particular note, because it takes place in close proximity to NECo and offers an alternative, competitive approach to acquiring savings. It had only been operating for a year and a half at the time of the study. It solicits proposals for measures and pays based on verification of savings at time of installation. Costs at Northeast Utilities were roughly comparable to EI. Costs at United Illuminating, where there were fewer contractors competing, were significantly higher (1.9 m/kWh). Based on program experience to date, it appears that the RFP program can operate economically only on a modest scale until a large pool of contractors and customers decide to work with its mechanisms. Otherwise, the supply of funds exceeds the market offers, and the bid price can creep up. The Connecticut utilities have reached the point where the program can efficiently acquire a few million dollars of conservation a year on a statewide basis.

Broad-Brush Analysis

Table 5 (based on detailed analysis by the authors) provides a synopsis of the reviewed programs including: gross lifetime costs per kWh for the C&I retrofit programs in total; and, gross program penetration rates for the C&I retrofit programs in total with respect to a reference year (1999 EIA data). This analysis is intended to provide a broad-brush assessment as to the comparative overall volume of program activity and the gross cost of the program savings. It is best considered in conjunction with the detailed incentive comparisons that follow. Our key observations are presented below:

- Several of the other utility retrofit programs appear to have had equivalent volumes of activity, in terms of gross penetration rates, to NECo's EI program, while exhibiting lifetime costs that were equivalent to or less than EI. These utilities include United Illuminating, Southern California Edison, San Diego Gas & Electric (SDG&E), Pacific Gas & Electric, and Seattle City Light. Each of these utilities, however, offers complicating perspectives as noted below.

Table 5. Comparison of Retrofit Program Broad-Brush Indicators—2000 Program Year

Utility / Program	Incentive Basis	Percent of C&I Load = Commercial	Lifetime $/kWh[A]	Percent Penetration of C&I Loads[B]
NECo	Up to 50%	77%		
EI Total Program			$0.011	0.54%
Lighting Rebates			$0.008	
Custom			$0.019	
United Illuminating				
Energy Opportunities	50%	67%	$0.013	0.56%
RFP Program [C]			$0.0193	0.003%
CL&P		69%		
RFP Program [D]			$0.011 approx	0.15%
Pacific Gas & Electric	Up to 70%	73%		
Total program			$0.008	0.78%
Express rebates			$0.007	
Standard Perf Contract			$0.010	
San Diego Gas & Electric	Up to 70%	76%		
Total program			$0.010	0.89%
Express rebates			$0.018	
Standard Perf Contract			$0.007	
Southern California Edison	Up to 70%	54%		
Total program			$0.008	0.57%
Express rebates			$0.005	
Standard Perf Contract			$0.009	
Portland General Electric[E]	30%	62%	$0.007	0.27%
Puget Sound Energy	Up to 50%	65%	$0.005	0.20%
Seattle City Light [F]	Up to 70%	78%	$0.011	0.78 %
SMUD	Up to 40%/cap	Mostly Comm.	$0.020	0.36%

[A] Lifetime $/kWh indicator is only intended for making rough comparisons between programs, and is not meant to reflect on the actual cost-effectiveness of these programs.

[B] Reference year based on 1999 EIA data.

[C] New program: Data covers 4th Quarter 2000 through 2nd Quarter 2001.

[D] New program: Through Second Quarter 2001.

[E] Program only covers commercial retrofits.

[F] Based on 1999 program activity, Governmental loads included in commercial and industrial figures.

- In 2000, United Illuminating had offered rebates in their Energy Opportunities program roughly comparable to EI and achieved comparable program volumes (kWh of lifetime savings per year compared to kWh of customer load). This was a relatively new program that initially has been tapping into pent-up demand. As a result, United Illuminating became oversubscribed this year and cut their rebates by roughly 40%. Since they had a budget shortage, they did not encourage further applications, so one cannot assess their success at this lower incentive level.
- California investor-owned utilities run a Standard Offer and Express Rebate programs. The Standard Offer costs appear to be 10% to 40% lower than EI costs (cents/lifetime kWh). Express rebate costs were, in general, a third less than EI costs. An exception was SDG&E, which exhibited substantially higher costs for the Express Program than the other California utilities in 2000. During that year, SDG&E and its third party contractors had placed special emphasis on marketing to hard-to-reach customers in the <100 kW market resulting in a large increase in program activity for this market. SDG&E program data for 1998 and 1999 show costs more consistent with the other California utilities; thus, the year 2000 results may reflect these unique circumstances. It is important to note that California investor-owned utilities cut their incentive budgets in recent years and then ramped back up. So they may be experiencing more pent-up demand than is present in NECo's service territory.
- In the Northwest, both Portland General Electric and Puget Sound Energy have historically paid significantly less per kWh, but achieved lower levels of penetration; therefore, these cases do not offer evidence that "higher performing" programs could sustain their current program volume at lower incentive levels. It is notable that Portland General Electric increased their rebates in 2001, and that their rebates are complemented by a state business energy tax credit. On the other hand, Seattle City Light has achieved similar participation rates to EI, at similar costs/kWh. Seattle has sustained a significant efficiency budget for many years, so their success is unlikely to be a result of pent-up demand.
- The Incentive Levels in Table 5 summarize the maximum percent of cost covered by each program. Many utilities had other limitations that resulted in rebates far lower than the "Up-to" levels shown (e.g., Seattle City Light pays a fixed amount per kWh "up to" 70%). The California utilities shown have prescriptive rebates for many lighting measures that pay far less than 70% of the cost of the new equipment. For this reason, the authors of this study consider the Lifetime $/kWh column to be a more useful summary basis for comparison of program costs. However, that column also includes program overhead, so it should not be used in isolation for comparing incentive levels. Rather it indicates which programs were low-cost, and therefore where the rebates should be investigated in more detail.

Discussion and Conclusions

Utilities have used markedly different levels of incentives. Some utilities with very low rebates experienced modest penetration. However, among utilities with multi-year programs and significant penetration, there were significant differences in rebate levels. In particular, the three California investor-owned utilities appear to offer retrofit programs with:

- roughly comparable penetration rates/program activity volumes;
- lesser costs on a lifetime savings basis; and
- lower incentive offerings for many prescriptive measures and what may be lower costs for custom measures.

Furthermore, Seattle City Light's program and United Illuminating's 2000 program had similar penetration, about the same cost per lifetime kWh, and some significantly lower prescriptive (UI) or custom (Seattle) rebates.

This may indicate that EI could sustain the existing levels of market penetration with moderately diminished rebates. If other important sources of information (e.g., market prices, feedback from utility sales representatives) supported these conclusions, the researchers suggested that NECo consider the following possible incentive reductions:

- T-8/electronic ballast rebates by 20-40%, with 40% for lamps with fewer fixtures;
- rebates for compact fluorescents by 20% for large sizes, more for smaller sizes; and
- rebates for motion sensors by 25% and dimming controls by 20%.

The biggest impact on NECo program costs would come from adjusting custom and T-8/electronic ballast rebates. These result in the largest share of rebate costs.

Current Status of EI Rebate Offerings

The following summarizes what steps were taken by NECo after completion of the study to amend the Energy Initiative Program for 2002:

- reduced the incentive for "recessed (or surface mount) troffer" from $40 to $35;
- reduced the incentive for "red" LED traffic signal from $75 to $70;
- reduced the incentive for LED/LEC Exit Signs from $25 to $20; and
- reduced incentive for lower wattage High bay/low bay fluorescent fixtures (called Code 56 at NECo) to $90 for new fixtures less than 220W (down from $125).

In balance, NECo chose not to lower custom incentives because they viewed the risk of diminishing response as greater than the risk of overpayment. In addition, NECo chose not to lower rebates for T-8/electronic ballasts, compact fluorescents or lighting controls because they viewed the risk of diminishing response as greater than the risk of overpayment, particularly in light of the declining economy. These decisions were based on both the study and the knowledge of program field personnel regarding local costs and customer response.

Although the above adjustments were made, demand for the program remains very strong. Early indications are that demand may drop off once the jobs that were developed in early 2001 finalize their way through the pipeline.

Reference

Tumidaj, L. G. Smith, and F. Gordon. 2001. *Comparison of Commercial and Industrial Program Rebates for Narragansett Electric, Final Report.* Portland, Oreg.: Pacific Energy Associates, Inc.