Natural Gas Energy Efficiency Resource Development Potential in Con Edison Service Area

Executive Summary

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March 9, 2006

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E.1 PURPOSE AND CONTEXT OF STUDY

The New York State Energy Research and Development Authority (NYSERDA) commissioned this study of the potential for energy efficiency to displace natural gas consumption in the Consolidated Edison of New York, Inc. (Con Edison) service area in response to the Public Service Commision Order[1] issued for Con Edison's gas and steam businesses. This study evaluates the potential to reduce gas consumption using existing and emerging efficiency technologies and practices, with the overall goal to lower end-use natural gas requirements in residential, commercial, and industrial facilities. The study assessed Con Edison's gas efficiency potential for the 10-year period between 2007 and 2016.

The study had five main objectives:

- Evaluate the potential cost-effective natural gas efficiency savings (economic potential) in the Con Edison service area over a 10-year horizon (2007-2016)
- Evaluate natural gas efficiency program designs and recommend programs for implementation
- Estimate the potential cost-effective natural gas efficiency savings in the Con Edison service area over a 10-year horizon (2007-2016) from the implementation of a portfolio of recommended efficiency programs given a specified funding level (program scenario). The 10-year horizon includes program delivery for 5-years with 5-years post-program market effects
- Examine and recommend utility lost revenue recovery mechanisms
- Develop a reference case natural gas price forecast and, if applicable, consider the potential impact of efficiency programs on natural gas prices.

The analysis indicates that a large amount of natural gas efficiency would be cost effective when compared to forecasted natural gas prices. The authors of the study suggest caution in interpreting and using the analysis. The economic potential estimates do not account for market barriers to adoption of efficiency technologies or the costs of market intervention strategies to overcome these barriers.

The analysis also identifies substantial opportunities for delivery of cost-effective efficiency programs. The authors again recommend caution when interpreting the program scenario results. The study recommends a set of efficiency programs that would optimize efficiency efforts, given specific funding constraints and various policy objectives. However, alternative cost-effective portfolios could be developed at funding levels other than those assumed in the study while

1 Cases 03-G-1671 and 03-5-1672, *Con Edison Company of New York. Inc. – Gas and Steam Rates, Order adopting the terms of a Joint Proposal* (issued September 27, 2004).

satisfying policy constraints such as sector distribution, low income funding, and gas efficiency targets. The authors believe that, if fully understood, the economic potential and program scenario analyses can be useful to inform ultimate decisions about future natural gas efficiency programs and spending.

E.2 STUDY SCOPE AND APPROACHES

The project scope called for analyses of “economic” and “program scenario” efficiency potentials from natural gas efficiency technologies and practices among residential, commercial, and industrial facilities. The terms are defined below:

- **Economic Potential:** Economic potential refers to the total technical natural gas efficiency potential over the planning period from all measures that are cost effective, as compared with the avoided gas consumption valued at the forecasted natural gas supply costs. Economic potential does not take into account market barriers and costs of market intervention. Potential is defined as the additional savings over and above those expected to occur without gas program intervention.[2]
- **Program Scenario Potential:** Program scenario potential refers to the estimated maximum natural gas efficiency impacts over the planning period, given specific program designs and assumed funding levels. Program scenario potential considers economic and other barriers to efficiency adoption and specific funding and program strategies.

The study scope included all applicable natural gas efficiency technologies, with the exception of fuel switching, electricity generation measures, and combined heat and power technologies. The study analyzed more than 2,000 distinct efficiency measures, consisting of approximately 150 different technologies and practices applied to numerous facility types and markets (*e.g.*, new construction, major renovation, planned equipment replacement and remodeling, and early retirement of operating equipment and systems).

The study addressed only Con Edison’s full service gas customers and did not consider efficiency opportunities for transportation customers who use Con Edison to deliver gas purchased from third parties. These customers are likely to have significant efficiency potential, and programs designed to capture energy efficiency should target these customers. While not specifically analyzed, the efficiency potential from transportation gas consumption would be similar, in terms of the overall percent of consumption, to the full service customers. The study considered the potential from all firm and non-firm full service customers.

E.2.1. ECONOMIC POTENTIAL APPROACH

The basic conceptual framework for the economic analysis involved eight steps:

- Developing a comprehensive list of efficiency technologies and practices

[2] The base case forecast and technology penetrations include effects from autonomous efficiency improvements that would result from natural market shifts, existing and expected codes and standards, and continuation of New York’s current level of investment in electric energy efficiency.

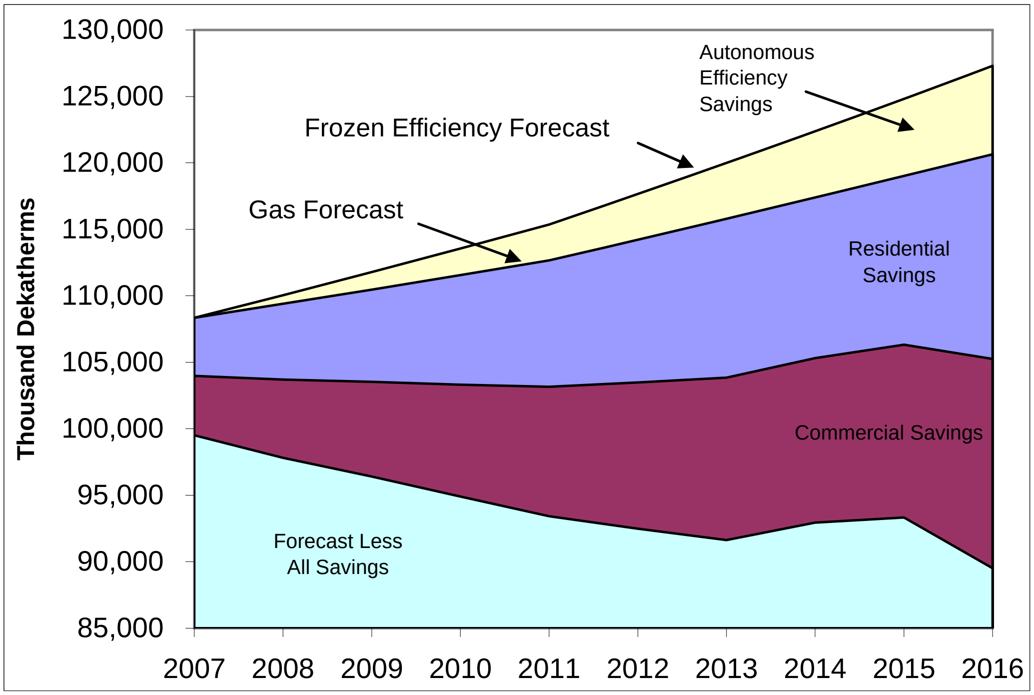
- Selecting efficiency technologies and practices for analysis based on an initial qualitative screening
- Characterizing the selected technologies and practices, including defining baseline and efficiency levels, costs, savings, and measure lives
- Characterizing the existing and forecasted markets for each technology and practice, including identifying important industrial and commercial sectors, estimating and disaggregating sector-level gas sales by facility type and end use, quantifying housing units and equipment saturations, and forecasting new construction activity
- Estimating baseline penetrations among the existing and forecasted markets of standard efficiency technologies and practices, given likely natural efficiency gains, likely codes and standards, and existing New York electric efficiency programs
- Applying per unit efficient technology and practice characterizations and baseline penetration projections to the relevant existing and forecasted markets to arrive at net potential impacts and costs
- Developing avoided costs using a propietary national gas supply-and-demand model for commodity costs and Con Edison data for capacity peak storage, transmission, and distribution costs
- Screening efficiency measures for cost-effectiveness based on avoided cost estimates
- Removing all non-cost-effective measures
- Adjusting for mutually exclusive measures and interactions among measures

The study relied on a variety of data to support the above approach, including: prior potential analyses; published research studies; equipment and market assessments; baseline studies; NYSERDA, Con Edison and New York Public Service Commission data; engineering analyses; building simulation modeling; and personal communications with industry experts.

E.2.2. ECONOMIC POTENTIAL RESULTS

The study concludes that the economic efficiency potential, if realized, could reduce Con Edison's annual natural gas generation requirements for its full service customers by more than 32,000 thousand dekatherms (MDth) by 2016. This represents 26.5% of Con Edison's expected 2016 requirements. The study also shows peak day economic potential of more than 300 MDth in 2016. Figure E.1. illustrates how the captured economic potential would reduce forecasted loads. Theoretically, if all the cost-effective gas efficiency measures (*i.e.*, economic potential) are implemented, there would be no load growth during the planning period.

Figure E.1. Gas Sales Forecast Less Sector Energy Savings

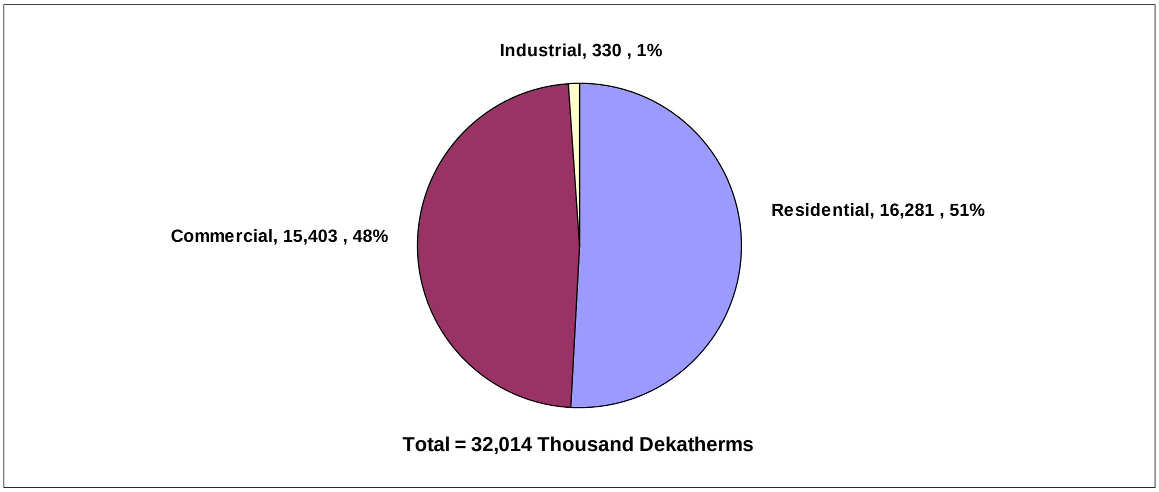


Notes: Industrial sales are too small to depict separately, but are included in "Forecast Less All Savings".

"Autonomous efficiency" is the efficiency that is expected to occur from naturally occurring improvement, changes to codes and standards, and current and future electric efficiency programs.

Figure E.2. shows that 2016 energy savings for the residential sector are slightly more than savings for the commercial sector, and only 1% of savings are attributable to the industrial sector. The greatest opportunities for efficiency are in space heating, followed by domestic water heating, service technologies, and food production.

Figure E.2. 2016 Economic Potential by Sector and as Percent of Total



The economic potential, if captured, would be extremely cost-effective. Present value net benefits (in 2005 dollars) would be $4,128 million. In other words, the economic welfare in the Con Edison service area would be improved by this amount if economic potential could be captured with no additional program costs.[3] The overall benefit-cost ratio (BCR) is 3.23. The results are based on a total resource cost test (TRC) that considers all the benefits and costs from efficiency from a societal perspective. The TRC test does not, however, include any monetized values for externalities. Table E.1. shows the TRC economic results. The commercial sector would provide about 52% of the total net benefits and has the highest benefit-cost ratio, at 3.87.

Table E.1. 2016 Total Resource Net Benefits and Benefit-Cost Ratio

Sector	Gross Benefits ($Million)	Net Benefits ($Million)*	Costs ($Million)	Benefit/Cost Ratio**
Residential	$3,079	$1,979	$1,100	2.80
Commercial	$2,872	$2,130	$742	3.87
Industrial	$27	$18	$9.3	2.94
All Sectors	**$5,979**	**$4,128**	**$1,851.3**	**3.23**

*Net Benefits = Benefits minus costs, present worth 2005
** B/C Ratio = Gross Benefits/Costs

When considering the overall levelized cost of saved energy, the economic potential costs, excluding program design costs, would be $1.92 per dekatherm, a figure considerably lower than current avoided costs. The economic potential, if captured, would also result in lifetime reductions of 47 million metric tons of CO_2, 21 thousand metric tons of SO_2, and 7,346 metric tons of NOx.

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3 Note that it would take significant effort and program intervention costs to capture a large portion of the economic potential and, even then, 100% would not be achievable.

Finally, capture of economic potential would result in annual customer bill savings in 2016 of approximately $300 million, based on 2004 average gas rates.

E.2.3. PROGRAM SCENARIO POTENTIAL APPROACH

The program scenario potential considers economic and other barriers to efficiency adoption, relying on past experiences of exemplary gas and electric efficiency programs. The assessment of the program scenario potential assumes five years of program delivery at an average budget of $15 million per year, with five years of post-program market effects. Neither the authors, NYSERDA, nor any of the advisory group members intend the selected funding level to represent a recommendation for future gas program funding. Rather, the funding level is provided to inform future discussions about appropriate funding levels and program portfolios.

Development of Program Portfolio

In developing a program portfolio, the study sought to meet certain criteria, including: maintaining equity across sectors by matching sector-level spending to existing sector revenues; providing low-income services, set at 20% of the residential budget; and providing a balance between short-term resource acquisition efforts and long-term market-transformation benefits. In addition, the study sought to provide program services targeting all Con Edison gas customers and to address all important end uses. Finally, the study explicitly designed the recommended programs around broad markets, rather than specific customers and technology types. In other words, the study designed programs that would comprehensively address multiple opportunities and customer types, with strategies and services designed around specific market and supply channels to reflect the way transactions typically occur in the marketplace.

Central to the approach and the focus on comprehensively addressing each market in the context of its unique characteristics, the study indicates the most successful and cost-effective approach to delivering gas programs in the Con Edison service area is to integrate them with electric efficiency services. To that end, an integrated delivery of fuel-neutral, one-stop-shopping programs to combined gas and electric customers was assumed.[4] The budgets and penetration rates presented reflect the assumption. The study did not, however, attempt to redesign, restructure, or analyze the existing electric programs. However, the current broad array of electric programs addresses all the same markets and service categories that are proposed here.

Developing the optimized investment portfolio included:

- Reviewing NYSERDA, Con Edison, and other existing electric and gas programs in New York
- Reviewing exemplary gas programs throughout the country

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[4] this approach did not assume that electric customers who do not purchase gas from Con Edison (*e.g.*, Brooklyn Union customers or those using oil) would contribute financially to the gas portion of programs, nor would they benefit from the gas services.

- Identifying the strategies and services that have been central to gas and electric efficiency program successes in the State and in other jurisdictions
- Assessing the economic potential results and identifying where the most important opportunities exist, both in terms of end uses, markets, customer types, and technologies
- Selecting a small set of broad-based programs designed to address key markets and take full advantage of the lessons learned from the implementation of exemplary programs reviewed for the study

The selected investment portfolio includes seven programs for the Con Edison service area:

Cross-Sector

- Heating, hot water, and washer equipment rebates

Residential

- New construction (ENERGY STAR® Homes)
- Home performance with ENERGY STAR®
- Low-income retrofit

Commercial / Industrial

- New construction
- Existing construction
- Food service and processing

Program Scenario Potential Savings Analysis

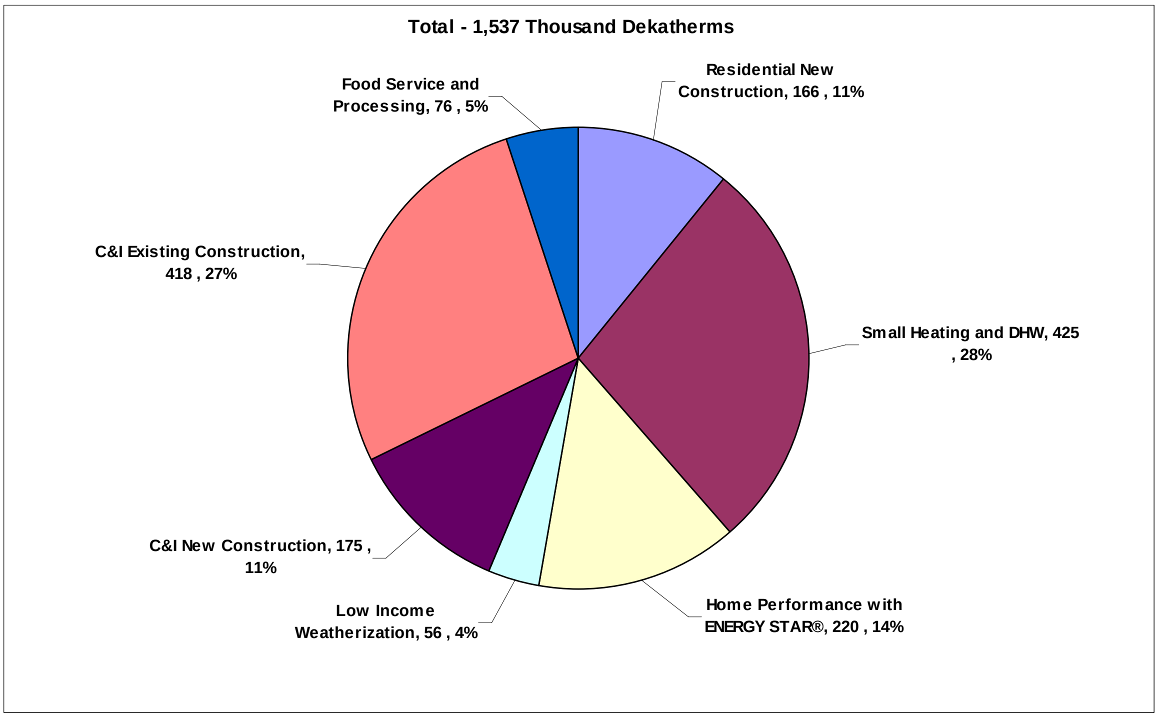
The starting point for analyzing the savings and costs resulting from implementing the program scenario is the economic potential described in section E.2.2. The following steps were used to estimate the program scenario potential:

- Mapping each measure permutation (combination of technology, market, and facility type) to a program
- Estimating the future market acceptance of each efficiency measure based on anticipated market intervention policies and programs.
- Applying the future measure penetrations to the economic potential analysis results to yield annual measure costs and savings
- Developing non-measure program budgets (costs for all program activities except measure incentives) that reflect the costs of delivering the programs within the Con Edison service area, assuming integration with electric programs
- Developing program incentive costs based on program design features and estimated measure costs for the measures
- Analyzing the portfolio to develop estimates of overall costs, benefits, net benefits, and benefit-cost ratios

E.2.4. PROGRAM SCENARIO RESULTS

Based on the funding and policy criteria constraints described above, annual program scenario savings are estimated at 1,537 MDth by 2016, and peak day load reductions are estimated at 11.8 MDth. These savings represent 1.3% of forecasted 2016 gas requirements. These estimates are based on programs operating for five years. If programs were to continue for a full 10 year period, savings by 2016 would be significantly higher. Figure E.3. shows program scenario potential by program. Neither the authors nor NYSERDA make any representations as to whether this funding level is appropriate. The scenario is presented to inform decision makers about the types of recommended programs and the overall gas efficiency cost-effectiveness at a sample level of spending.

Figure E.3. 2016 Program Scenario Potential by Sector and as Percent of Total.



The program scenario is highly cost-effective. Pursuit of the program scenario would result in estimated net benefits to the economy of $122 million, with an overall benefit-cost ratio of 2.13. In other words, for every dollar invested in efficiency, the scenario would return $2.13 to the local economy. The largest net benefits would come from the C&I Existing and Small Heating and DHW programs. Substantial net benefits would also come from the C&I New Construction, Residential New Construction, and Home Performance with ENERGY STAR® programs. Table E.2. shows economic results by program.

Table E.2. 2016 Total Program Scenario Resource Net Benefits

Cumulative net benefits (benefits minus costs, present worth 2005)	$ (Million)
Residential New construction	$ 13.5
Small Heating and DHW	$ 25.4
Home Performance with ENERGY STAR®	$ 14.0
Low Income Weatherization	$ 3.0
C&I New construction	$ 21.9
C&I Existing construction	$ 40.2
Food Service and Processing	$ 2.3
Total - Program Scenario Potential	**$ 122.2**
Cumulative benefit/cost ratio 2005	**2016**
Residential New construction	2.22
Small Heating and DHW	1.80
Home Performance with ENERGY STAR®	1.97
Low Income Weatherization	1.57
C&I New construction	2.25
C&I Existing construction	2.73
Food Service and Processing	1.73
All Programs - Program Scenario Potential	**2.13**

When considering the overall levelized cost of saved energy, pursuit of the program scenario would cost $5.6 per dekatherm, a figure considerably lower than current avoided costs. The program scenario would also result in lifetime reductions of 1.9 million metric tons of CO_2, 481 metric tons of SO_2, and 241 metric tons of NOx. Finally, annual customer bill savings in 2016 would be $1.1 million, based on 2004 average gas rates.

E.3 LOST REVENUE RECOVERY MECHANISMS

The lost-revenue analysis considered the following types of programs:

- The Con Edison pilot program implemented by NYSERDA, lasting from October 2004 through October 2007. The order in Case No. 03-1671 provided for Con Edison to recover its lost revenues from the pilot program. The program, including lost revenues, is funded by a $5 million assessment on firm customers.
- A more extensive program, modeled as five years of program implementation and five years of post-program effects, with funding levels higher than the pilot and with Con Edison implementation.
- The more extensive program funded through an SBC-like charge and implemented by a third party.

The three program structures illustrate important differences, as follows:

- The pilot program has limited funding and a majority of the savings would occur shortly before or possibly just after the next rate case. Since rates are reset in each rate case to reflect expected sales, lost revenues from the pilot program are likely to be small. The Order provides for Con Edison's recovery of lost revenues.
- For the program scenario presented above, the increased funding would increase potential lost revenues. Most potential lost revenues could be captured in the sales forecasts in future rate cases, especially since such programs could be designed to be reflected in Con Edison's next rate case. If Con Edison is provided latitude in funding and implementation decisions with respect to the program, the company should not be rewarded for reducing the effectiveness of the program or punished for improving the program. Hence, a mechanism should be designed to recover the difference between the projected effects of the program (which can be incorporated in the rate case) and the best estimate of the actual revenue effect of the program.
- With programs receiving SBC funding and not administered by utilities, program effectiveness and lost revenues are obviously less sensitive to Con Edison's behavior, so ensuring exact computation of lost revenues would be less important. The projection of sales and revenues in each rate case could reflect the expected effects of the energy-efficiency programs, as they would any other drivers affecting load (*e.g.*, building starts, federal and state efficiency standards). Since Con Edison would have limited influence on the effectiveness of the program, no lost-revenue mechanism would be necessary. As a matter of fairness, the Commission could still choose to implement a lost-revenue adjustment to compensate Con Edison for actual increments of lost program revenues over the projected effects and compensate ratepayers if actual lost revenues are less than expected.

Lost revenues, estimated as described above, can be recovered through a combination of three approaches:

- **Forecasting expected sales reductions** during a rate case which results in higher unit rates, allowing the utility a fair opportunity to recover the revenues. This approach is not applicable to the Con Edison pilot program. In the next rate case, this approach would be straightforward and consistent with the Commission's approach to setting rates.
- **Automatic adjustment clauses** permit utilities to recover costs outside rate cases. The schedule for recovery can be independent of the schedule of rate cases (which for Con Edison occur every few years), and the utility's cash flow can be largely maintained.
- **Deferral accounting** allows the utility to accumulate costs, usually with an interest credit, until they can be included in a general rate case or other ratemaking proceeding. Deferred accounting mechanisms also maintain utility earnings but do nothing for cash flow until the deferred account is reflected in rates. No additional proceedings are required, although the utility may file rate cases more frequently if the deferred balance grows very large. Since the costs are not actually recovered from customers until after a full review, the utility receives the usual level of regulatory protection.

The lost revenues from the pilot program, including interest charges, are likely to be under $200,000 at the time of the next rate case, assuming the efficiency measure installation schedule in NYSERDA's Pilot Program Plan proves to be correct. For the program scenario presented above, lost revenues would vary with the rate of program implementation and saturation and with the interval between program start and the next rate case. If Con Edison does not file a rate case until

2016, and if Con Edison is allowed to recover lost revenues via deferral accounting, lost revenues could accumulate to $25 to $30 million. But it is unlikely Con Edison would delay their next rate case until 2016. Since the program scenario is modeled as starting in January 2007, if the next rate case is timed to match the expiration of the current rate plan, with an effective date of October 2007, the lost revenues prior to that rate case would be only about $50,000. If the program runs for three years before the next rate case, lost revenues might be in the range of $1.5 to $2.5 million, including interest. After the first rate case, whenever it occurs, most lost revenues could be captured in base rates, and any after-the-fact lost-revenue adjustment would be much smaller.

In short, for all the program scales considered in this report, Con Edison's lost revenues can be dealt with largely through forecasting sales reductions in rate cases. Deviations from the forecast are likely to be minimal and can be deferred for collection in subsequent rate cases.