Steam Long Range Plan

May, 2012
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1.0 EXECUTIVE SUMMARY

For 130 years, Consolidated Edison, Inc. (Con Edison or the Company) has had the privilege of providing steam service to customers including many of the landmark buildings in New York City. Foremost, it is the historic quality of Con Edison service that has made it the energy service of choice to many of New York’s most prominent and unique properties. The Company's Plan is to continue to provide Steam Service to customers by, maintaining the current high reliability and operational excellence on production and distribution, incorporating technological advancements into the system, optimizing system efficiency, pursuing new opportunities for productivity, performance improvements, and cost reductions, and by bringing additional value to the customer base.

The Con Edison Steam System has earned several prestigious awards and recognition in recent years which include:

- The U.S. Environmental Protection Agency (USEPA) Energy Star Combined Heat and Power (CHP) award for East River Stations’ Units 1/10 and 2/20, for significant energy savings (2009)

Con Edison, as a Company, has received additional recognition for carbon disclosure and reduction. The Con Edison Steam System, being the producer of steam and electric in the Company, was a major contributor to these reductions.

- In the newly released 2011 rankings, Con Edison placed first among utilities in the S&P 500 Carbon Disclosure Leadership Index
- The only utility listed in the S&P 500 Carbon Performance Leadership Index
- #1 Utility in Newsweek Green Rankings

The Con Edison Steam System provides tangible and intangible benefits to customers. These include:

**Green Technology** - Cogeneration, regulated emissions and no local flue exhausts

**Reliability** - Continuous service

**Dependability** - Consistent pressures

**Simplicity** - No certifications required to operate

**Flexibility** - Point source demand and usage control
**Versatility** - One source for high and low pressure applications (heating, cooking, cooling, etc)

**High Energy Content** - Steam delivered at average gauge pressure in excess of 125 psig

**Customer Service** - Knowledgeable and responsive to customer needs

**High Quality Steam** - Industrial grade water treatment and quality controls

The Steam System provides significant benefits to Electric Customers, Gas Customers, and the community:

Benefits to the Electric System and its Customers

The use of steam air conditioning (“AC”) in lieu of electric AC offsets peak load requirements on the electric supply and delivery infrastructure in critical electric networks, benefitting Electric Customers. There is approximately 550,000 tons of installed steam-driven AC on the Steam System and this equates to an installed capacity of about 357 MW. If the coincident load of these installed machines were converted to electric, it is estimated that 304 MW of additional electric load would be added to Con Edison’s Electric System peak. If the Steam System was to be phased out over the next 40 years, the value of steam to electric is approximately $3.9 billion (present value of real 2011 $) for the 40-year period.

 Benefits to the Gas System and its Customers

The use of Steam Service for heating eliminates the prospect of additional strains on the natural gas delivery infrastructure. Without the Steam System, approximately 11.5 MDt/hr of additional gas load would be added to the Con Edison Gas System peak day. If the Steam System was to be phased out over the next 40 years, the value of steam to gas is approximately $4.1 billion (present value of real 2011 $) for the 40-year period.

Benefits to the Customers and Community

Without the Steam System there would be significant impacts on customers, the environment, and New York City. For existing Steam Customers, the capital costs to install on-site, gas-fired boilers or Combined Heat and Power (“CHP”) units and electric air conditioning equipment would be approximately $9 billion (present value of real 2011 dollars). The lost rental revenue from the space occupied by on-site boilers or CHP units would be approximately $16 million per year. If the Steam System was phased out, local emissions sources would be densely located throughout about 1,735 buildings south of west 96th and south of east 89th Street down to the Battery. Such emissions source will adversely impact local ambient air quality impacts as well as visual impacts. Con Edison’s steam production, with more than half
of the supply coming from cogeneration units, is efficient, clean, and better monitored than the use of onsite oil and gas fired boilers or CHP units. Through the application of cogeneration, the release of approximately 1.33 million tons of CO₂ per year is avoided (equivalent to 235,730 cars)¹, when compared to individual electric and steam production methods. The Steam System’s actual emission rates per thousand pounds of steam produced yield NOₓ, SO₂, CO₂, and particulate matter emission rates that are lower than U.S. Environmental Protection Agency published emission rates for commercial boilers. Customers that use steam as an energy source are also able to reap benefits toward LEEDS (Leadership in Energy and Environmental Design) recognition.

Con Edison believes that the Steam Long Range Plan (“SLRP”) contained herein is the first step towards achieving the Company’s vision for the Steam System. The SLRP is based on a forecast of customer demand that recognizes that it operates in a mature steam market in which customers seek to use less steam. It acknowledges that there is unlikely to be any catalyst, such as major technological breakthrough, that will significantly increase steam demand, especially during the off-peak period.

Customers continue to see value in receiving steam service, but there has to be control over rate increases, and the business must earn a fair ROE to remain sustainable. Although there are many challenges, there are an equal number of opportunities to address these issues and maintain the system as a viable energy choice for the next 20 years and beyond. The distribution system will not require any major modifications, such that expenses can be limited to a relatively moderate level of new investment. Capacity resources exceed the current and forecasted peak, and as such we can determine the best fit between supply and load and appropriately manage/reduce assets as well curtail any new investment to affect cost savings. In addition, there is a need to manage the peak to limit any future major plant investments. In the event generating assets are to be replaced or added, cogeneration units would be the configuration sought, as determined by City and local electrical needs. There may be a need for tariff and policy changes to ensure that the peak load is effectively managed. Fuel changes, from No. 6 oil to natural gas at our 59th Street and 74th Street Generating Stations, will require infrastructure investment, but this will benefit customers with fuel diversity mix enabling the benefits of lower fuel costs and will allow steam to comply with environmental regulations and will provide benefits to the environment in the form of emissions reductions.

During the plan period from 2011-2031, the Company expects to invest $1.38 billion in capital infrastructure in real dollars, or an average of $60.6 million a year. At this level of expenditure, along with projected increases in the cost of supply including fuel and taxes, we anticipate a typical SC-2 customers’ monthly rate per Mlb for steam, in real dollars would increase from $31.13 today to $31.81 in 2031, an annual average growth rate of 0.10%

¹ Equivalent number of passenger cars is calculated using the EPA’s Greenhouse Gas Equivalencies Calculator in the following link:

http://www.epa.gov/cleanenergy/energy-resources/calculator.html
The key messages of this Steam Long Range Plan are as follows:

1. Steam Operations will relentlessly pursue safety excellence, cost management, and operational excellence.
2. Steam remains the heating solution of choice for a select group of customers.
3. Steam will work alongside Gas and Electric in order to present one face to our customers and to ensure alignment and consistency between each commodity’s long range plans.
4. Demand and sales are expected to decline marginally (essentially stay flat) for the next 20 years.
5. Steam will continue to reinforce the application of Cost Management and Cost Management techniques.
6. #4 / #6 oil conversion customers will offset lost business for the first half of the plan period.
7. A decline in steam air conditioning will result in additional capital costs on the electric system.
8. Steam demand response and customer sited supply pilots will provide insight on how to manage load and supply.
9. Steam will contribute to a significant amount of emissions reductions in the near term and beyond.
10. Steam will continue to be a viable energy choice over the 20-year plan period.
11. Steam can be an important alternative to electric cooling in networks that require load relief and Steam can be an important alternative to natural gas or oil heating.
2.0 INTRODUCTION

2.1 VISION AND PLAN OBJECTIVES

The key objectives of the Steam Long Range Plan are to define the Company’s vision, evaluate the challenges and opportunities facing the Steam Business, discuss future growth prospects in the context of the current and projected future business environment, develop a long-term strategy for achieving that vision, and determine the operational steps necessary to carry out the strategy.

The Con Edison Steam System vision and mission statements are as follows:

Vision

To be a competitive green energy choice provider in the New York City marketplace

Mission

To be the first choice district energy provider in New York City as well as the industry leader

Con Edison has developed five objectives to guide the development of the Steam Long Range Plan and provide for integration with the Electric and Gas Long Range Plans. These plan themes collectively carry out the mission and individually describe areas of Con Edison’s strategic intent by which programs and investments are categorized. Figure 2-1 illustrates how the plan themes support the Con Edison vision and mission.
Figure 2 - Con Edison Steam Vision and Plan Themes

**Vision**

To be a competitive green energy choice provider in the New York City marketplace

<table>
<thead>
<tr>
<th>Plan Themes</th>
<th>Managing Demand, Supply, and Environmental Profile</th>
<th>Improving Operational Efficiency of Steam Production</th>
<th>Managing the Customer Base and Providing Additional Customer Value</th>
<th>Operational Management of the Distribution System</th>
<th>Gaining Critical Policy and Regulatory Approval</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Right-size production assets as needed and or replace future supply with cogeneration capacity to better align with demand, future electric requirements, and customer-sited generation</td>
<td>Less expensive and cleaner supply through operational improvements and fuel switching</td>
<td>Customer demand and supply management through tariff changes, conservation programs, and customized pricing and service option</td>
<td>Enhancements to the distribution system to support minimizing risk and improving service</td>
<td>Positioning of the system as an environmentally responsible alternative, recognition of the value to customers, Gas, and Electric, and its positive role in the NYC energy portfolio</td>
</tr>
</tbody>
</table>
The first step in this enhanced planning process was to develop forecasts for steam demand. Assumptions were made regarding potential environmental and regulatory requirements, economic trends, and included possible technological advances to develop three forecasts for potential customer demand: a High Case, Plan Case, and Low Case. To develop the production and infrastructure projects and programs in this Steam Long Range Plan (“SLRP” or the “Plan”) the Company used the Plan Case demand forecast and identified uncertainties and signposts that will be monitored to test and adapt the Plan in the future.

Over the next 20 years, if and when necessary, the Company will seek to integrate energy efficiency, CHP, and demand response to further the goals of deferring new production and infrastructure investments while providing safe, reliable, and competitively priced service that is environmentally responsible. Currently there is ample steam capacity to meet the forecasted 20–year peak load such that there is no need to formally implement any energy efficiency, permanent demand response, or permanent customer sited CHP supply programs. The Company will work with customers to manage their energy consumption, and expenditures.

The Company will implement initiatives to defer or minimize the investment requirements on the system, increase asset utilization, and improve overall performance. The Plan continues to reap the benefit realized from condition based maintenance programs which provide productivity, efficiency, and cost savings. Advances in plant control system upgrades, distribution remote monitoring technologies and customer demand meters, have and will continue to give greater visibility into the status of system components, allowing the Company to increase system automation, improve the accuracy of predictive system models, and direct efforts to those system components or service areas that need the most attention, all with the goal of reducing total costs.

The Steam Long Range Plan provides a roadmap for steam supply and distribution for the next two decades. The Company’s objective for the Steam System is:

A long-term viable Steam System that continues to deliver safe, reliable, efficient, competitively priced, and clean energy to customers while providing a fair return to shareholders.

Based on this vision the long term strategic objectives are to:

- Have reasonable cost allocations and competitive rate structures to retain customers and promote growth which is beneficial to the existing customer base and the business
- Manage supply capacity to better align it with the customer demand and in the longer term potentially increase the level of cogeneration capacity from Company or customer sources to replace existing supply as it requires replacement
- Increase system load factor
- Increase customer awareness that the Con Edison Steam System is fully recognized by the United States Green Building Council for its environmental value. Through modifications made to the Leadership in Energy and Environmental Design (LEED) certification criteria, district heating
systems can help customers increase their individual ratings. Being a Con Edison steam customer can assist customers in the achievement of LEED credits related to the following:

- Energy savings
- Water Conservation
- Emissions reduction
- Refrigeration management

- Reduce tax and rate base through optimization of the system portfolio and promulgate City and State regulatory changes
- Maintain a safe and environmentally responsible system for the Company and the community it serves
- Achieve a fair return on equity

During the period from 2011-2031, the Company expects to invest $1.38 billion in capital infrastructure in real dollars, or an average of $60.6 million a year. At this level of expenditure, along with projected increases in the cost of supply including fuel and taxes, we anticipate a typical SC-2 customers’ monthly rate per Mlb for steam, in real dollars would increase from $31.13 today to $31.81 in 2031, an annual average growth rate of 0.10%.

Con Edison can say with confidence that Steam is here to stay for several years to come as the progress made in analysis and process improvement since the last Steam Long Range Plan was issued has been significant. Not only has the Company avoided the need for capital to replace the steam capacity at its Hudson Avenue Generating Station, but has also realized or expects to realize the following economic benefits through projects and operating improvements:

**Steam Long-Range Plan initiatives**

While capital expenditures are a material component of steam cost, they are less significant to the overall cost structure of steam service than they are to the cost structure of our electric and gas businesses. Our steam business therefore presents relatively fewer opportunities to reduce capital expenditures; rather, the opportunities to manage customer bills effectively largely arise from reducing operating expenses; which includes fuel costs. Our steam long-range plan thus focuses on such expenses.

For the 2011 Steam Long Range Plan, the estimated 20 year operating expense savings are approximately $1.8 billion. They include:

- O&M savings due to the shutdown of the Hudson Avenue Boilers and Management of Ravenswood A-House.
- Fuel savings resulting from:
- Hudson Avenue Boiler Retirement
- Revised Steam Production Plant Operating Criteria
- Minimum Oil Burn Settlement at FERC
- Gas Additions at the 59th Street and 74th Street Generating Stations

Figure 2 - 2. 20-year steam savings

Source: CECONY Steam Customer and Business Services, Steam Operations, as of December 2011
2.2 KEY ELEMENTS OF THE PLAN

To meet the objectives of the Plan, the Company has developed initiatives, some of which are short-term focused, while others are to be implemented over a longer time horizon. These initiatives are broken out into several categories including Demand and Supply, Distribution Infrastructure, and Customer Initiatives.

Under the Plan Case, aggregate customer load is projected to decline marginally (essentially stay flat) for the next 20-year period. Based on the peak demand for the winter of 2010/2011, the forecast starts with a weather adjusted peak demand of 9,620 Mlb/hr in 2011 and slightly increases to 9,640 and then tapers back down to 9,240 Mlb/hr by 2031. This relative flatness is based primarily on the maturity of the Steam market and an expectation that when customers build or renovate they are encouraged to implement the latest efficiency and demand control techniques. The two alternative forecasts for the high and low scenarios project a peak load of 9,695 Mlb/hr and 7,400 Mlb/hr by 2031 respectively. The differences across the forecasts consider the uncertainties of market conditions including New York City (NYC) employment, new building development, and other factors. They also help to identify the significance of load and capacity management in mitigating customer exposure to significant capital requirements for new incremental load capacity and higher per unit cost risk under a lower aggregate load.
**Demand and Supply**

Con Edison will ensure that it has sufficient capacity to meet customers’ peak steam demand and to continue to provide the reliability and dependability that customers have come to expect from the system. At the same time, capacity must be closely aligned to demand so as to minimize the cost of operating the system. The three potential forecasts incorporate the impact of various economic, legislative, and technological drivers on customer demand for steam.

Compared to electric and gas, steam systems are a less common energy service. Steam is used mainly by large buildings for heating and cooling, and is only available in a portion of Manhattan south of 96th Street. We project the steam peak demand and steam sales will remain relatively flat over the next 20 years. (Less than 5% decline for peak and sales over the 20-year period.)

The expected slight decline in steam peak demand and steam sales results from the choices available to energy consumers and energy efficiency measures. Technological improvements have allowed our customers to create their own steam onsite. Our customers can install their own combined-heat power
units (CHPs), boilers, and electric-driven chillers for cooling. Customers’ decreased reliance on our steam-distribution system will result in modest sales decline in the future.

The Plan Case peak demand forecasts subtle negative growth through 2031 representing a compounded average annual growth rate of -0.20%. The Plan Case reflects the expectation that the economy will recover, albeit slowly, over the next few years. Consequently, the Company expects moderate net growth in new business from new construction offset by historical levels of lost business as well as energy efficiency driven by customer education, and codes and standards. The evolving energy efficiency services market and resulting building codes with higher efficiency thresholds are expected to net out a relatively flat demand for the system between the lost business and new or renovated and returned business projections.

This Plan has also been formulated and written in parallel with the Company’s Electric and Gas Long Range plans to ensure consistency with the overall corporate strategy. Key Components of the plan and their relative changes from 2011 to 2031 are listed in Table 2-1.

Table 2-1. Summary of the Future State of the Business

<table>
<thead>
<tr>
<th></th>
<th>2011 Actual</th>
<th>2031 (Plan Case)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer base</td>
<td>1,735</td>
<td>Slightly lower number of customers but with a greater proportion of larger SC-2 and SC-3 customers</td>
</tr>
<tr>
<td>Customer price per Mlb</td>
<td>$30.88</td>
<td>$30.88</td>
</tr>
<tr>
<td>Rate structure</td>
<td>3 customer classes, largely usage based billing</td>
<td>Customer classes shifted towards demand based billing tiers and including interruptible rates</td>
</tr>
<tr>
<td>Peak capacity (Mlb/hr)</td>
<td>11,676</td>
<td>11,676</td>
</tr>
<tr>
<td>Peak demand (Mlb/hr)</td>
<td>9,620 Weather Adjusted</td>
<td>9,240</td>
</tr>
<tr>
<td>Annual sales (MMlb)</td>
<td>22,322</td>
<td>21,731</td>
</tr>
<tr>
<td>Supply footprint</td>
<td>High base capacity: East River, 59th Street, 60th Street, 74th Street, and Ravenswood</td>
<td>• East River, 59th Street, 60th Street, 74th Street, and Ravenswood</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Purchased steam from BNY</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Potential additional 3rd party steam purchases depending on the competitive nature of any proposed contracts</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Removal of select capacity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Possible cogeneration either at Con Edison facilities or a small amount of customer-sited CHP providing steam back to the system</td>
</tr>
<tr>
<td>Oil burn</td>
<td>&lt;10%</td>
<td>&lt;5%</td>
</tr>
<tr>
<td>Conservation efforts</td>
<td>Education - Best Practices and Customer Seminars</td>
<td>Expanded education program with limited inspections</td>
</tr>
<tr>
<td>Revenue streams</td>
<td>Single Source—steam service</td>
<td>Diversified—electric and gas allocations, steam service</td>
</tr>
<tr>
<td>Distribution system</td>
<td>105 miles of pipe, some digital meters for larger customers, system event monitoring</td>
<td>105 miles of pipe, accommodation of a small amount of customer-sited CHP, digital meters for nearly all SC-2 and SC-3 customers with demand response capabilities</td>
</tr>
<tr>
<td>ROE</td>
<td>9.43%</td>
<td>Competitive with other utilities with similar risk profiles</td>
</tr>
<tr>
<td>Emissions of Air Pollutants attributable to steam including BNY, Tons/Year</td>
<td>Tons/Year</td>
<td>Tons/Year</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>NO\textsubscript{x}</td>
<td>1,762</td>
<td>1,163</td>
</tr>
<tr>
<td>SO\textsubscript{2}</td>
<td>994</td>
<td>361</td>
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<td>CO\textsubscript{2}</td>
<td>1,594,000</td>
<td>1,436,000</td>
</tr>
<tr>
<td>PM-10</td>
<td>235</td>
<td>131</td>
</tr>
<tr>
<td>CO</td>
<td>562</td>
<td>658</td>
</tr>
</tbody>
</table>

**Capacity Strategies**

Capacity resources exceed the current and forecasted peak and required reserve margin for the Plan Case. No additional capacity is necessary for the High Case. Currently there is a need for the Ravenswood A-House under the Plan Case to help with peak loads greater than 9,300 Mlb/hr as well as providing much needed capacity for reserve during large planned outages; we will need the Ravenswood A-House when we have Station outages at the 59\textsuperscript{th} Street and 74\textsuperscript{th} Street Generating Stations to tie in gas burning capability in 2013. If the Low Case were to materialize, the Company would look to phase out the Ravenswood A-House, East River South Steam Station, and possibly 60\textsuperscript{th} Street.

The SLRP tested cogeneration economics in the High Case scenario with reasonable results under assumed cost allocations and tax benefits. There is not much difference between the High Case and the Plan Case, and as such there is no need for additional steam capacity. Additional we are studying managing supply and load through the following initiatives:

- Customer Sited Supply Pilot Program (CSS)
- Demand Response Pilot Program (DR)

**Capital Investment**

Should the Steam System capacity or distribution infrastructure need to be expanded in order to serve new customers, the SLRP proposes that expansions be evaluated with modified tariff provisions designed to impose more cost responsibility on customers that cause the Company to incur material incremental costs.

**Distribution Infrastructure**

The distribution system currently has adequate capacity to serve the Company’s needs well into the future. No major modifications are anticipated to serve existing customers.
Safe design and operation of the distribution system is a critical component of the SLRP. Con Edison’s steam distribution assets are well maintained and continuously monitored. Past and future planned investments in a number of initiatives designed to improve the system safety and design, including a $200 million program completed in 1999 that enhanced and improved piping components and system enhancements. Future planned investments that were initiated in 2008 to install remote monitoring within the steam manholes to protect against water infiltration and monitor steam trap operability are targeted to further improve the system safety.

The major distribution investments the Company will undertake to meet the Plan Case are as follows:

- Continue expansion of existing remote monitoring program in flood prone locations and trap monitoring
- Extend distribution system monitoring and Research and Development (R&D) initiatives on water hammer to continue enhancing employee and public safety
- Implementation of a smart-grid approach to Steam that includes additional monitoring of the network and the expansion of advanced metering to allow for a demand response (DR) program. This would also provide better customer usage data which may be used to improve conservation program efforts and load shedding capability
- Sustain our condition based repair program aimed at replacing anchors, valves, and other critical pieces of the distribution system
- Continued evaluation of R&D initiatives for monitoring technologies to detect leaks and predict water hammer

Under the Plan Case, the Company will invest about $1.38 billion in real dollars over the course of the next twenty years.

For the most part these investments are relatively flat with the exception of cyclical spikes in production projects based on condition based repairs. The distribution system will be evaluated with modified tariff provisions designed to impose more cost responsibility on customers that cause the Company to incur material incremental costs.

Figure 2-4 shows the Plan Case 20-year capital projections. It includes the capital cost for the gas additions at the 59th Street and 74th Street Generating Stations (Traditional Recovery) in 2012 through 2014.
Customer Initiatives

Increasing the value of steam service to Con Edison’s customers is an important component of maintaining and growing the customer base. This vision revolves around a deep understanding of customers and stronger partnerships with them. The system’s small customer base and improved data collection capability means that Con Edison understands each customer better including their load shapes, building attributes, conservation efforts, and operating criteria. Armed with this knowledge, the Company actively encourages customers to make more efficient use of the Steam System especially as regards load factor which is a critical component in helping to keep capacity aligned with a more stable demand.

In terms of better controlling the steam peak and allocating costs to customers, the Company conducted a Steam Peak Reduction Collaborative ("SPRC") with participants from the Company, DPS Staff, Customers, the City, and other interested parties.

The major program/policy initiatives the Company has addressed or working on through this SPRC to support the Plan Case are:
Demand Response

Obligation to Serve

Energy Efficiency (Customer)

Re-Design Rates to Incent Efficient Customer Behavior

Steam Air Conditioning

Customer Sited Supply

Additional program policy initiatives the Company has reviewed through its current Joint Proposal to support the Plan Case are:

CHP Strategy

District Cooling

Steam System Efficiency (Variance Reduction)

**Customer Bill Impact**

Throughout the development of the SLRP, the Company has evaluated the cost effectiveness of various options for supply and delivery of steam service against the bill impact to the average customer. Figure 2-5 portrays how the composition (delivery, supply, taxes) and value of an example customer’s bill is expected to appear in 2031 as the result of the Plan Case. The example uses a Large Commercial customer that receives bills under a demand rate structure (SC-2 Rate II).

Figure 2 - 5. Average Monthly Bill for a Large Commercial (Demand Billed) Customer
2.3 CRITICAL POLICY AND REGULATORY APPROVAL STRATEGIES

Steam’s position in the Manhattan market for energy services is also controlled by legislation and utility specific regulations and is therefore influenced differently than free market competitors.

*Taxes*

*Boiler Fuel Tax*

New York City charges a 4.5 percent sales tax on Natural gas and Fuel oil that is burned in the generating stations to produce electricity and steam. Accordingly, when Con Edison buys the fuel to generate energy, it is subject to a 4.5 percent sales tax. Natural gas is subject to a Gross Receipts Tax (GRT) of about 2.4 percent and No. 6 fuel oil is subject to a Spill Tax and a Petroleum Business Tax approximately $3.10 per barrel. As the price of fuel rises, the tax paid on that fuel increases. These taxes become a cost component of the energy, which, when sold to end use customers, are subject to the City’s 2.44 percent GRT, a 4 percent State sales tax for residential customers, and an 8.875 percent
sales tax for commercial customers (i.e., State 4 percent sales tax, MTA sales tax of 0.375 percent, and a City sales tax of 4.5 percent). This tax application disadvantages Con Edison Steam in competing against self-generation, because on-site boilers are not subject to this level and compounding effect of taxation.

Sales Taxes

The State of New York currently exempts the delivery portion of the bill for large commercial customers who purchase from ESCOs from sales taxes. This tax (State and City combined) is 8.875 percent. There is no comparable tax exemption for steam, which is particularly disadvantageous in competing for large commercial customers that have natural gas boilers and purchase their natural gas requirements from ESCOs.

Gross Receipts Tax

The Gross Receipts Tax, which is now levied only by the City and not the State, particularly hurts a business like steam that has modest net income. Its taxes remain the same even though its net income is low. Changing to a net income tax would help the steam business vis-à-vis the gas and electric businesses.

Figures 2-6 and 2-7 reflect a cost comparison of fuel prices and taxes for a customer using steam as compared to an on-site boiler for both #6 fuel oil and natural gas burning.

Figure 2 - 6. Fuel Prices and Taxes for Steam Customer vs. On-Site Boiler Final Fuel Bill - #6 Fuel Oil

![Diagram showing cost comparison of fuel prices and taxes for #6 fuel oil](image-url)
Regulatory Issues

Among the various regulatory issues affecting the Con Edison Steam System are the following:

- The City has currently suspended its effort to expand the use of Joint Bidding beyond the Lower Manhattan region. This results in additional costs on ratepayers.

- Past changes and future planned changes in cost allocations between the Electric and Steam Systems have played a significant role in increasing rates to steam customers.

- The Company will pursue NYSERDA incentives or to create new incentive vehicles for steam powered air-conditioning that would put this measure on a par with competing alternatives and mitigate future electric infrastructure investments. The Company is also working with NYSERDA to establish a policy and criteria for siting CHP within the footprint of the steam system.

2.4 CHALLENGES

The challenge for Con Edison Steam is to continue to provide steam in today’s competitive market. Customer self-supply is a viable and economic alternative for many of Con Edison’s existing Steam Customers. While Steam serves a wide variety of purposes, some high load factor buildings choose...
alternatives when it makes financial sense and when the building configuration can accommodate on site
generation equipment. Specific technologies and drivers that challenge the role of steam include:

On-site boilers

Floor by floor (packaged) AC units in lieu of central chiller plants

Building envelope and system energy efficiency measures

Thermal Storage Systems

Fuel Cells

Combined Heat and Power (CHP) with NYSERDA incentives tax incentives and environmental incentives
that provide a disproportionate advantage

Building Developers limited knowledge of steam value in building design

Economic conditions and the cost of energy, more specifically fuel, have promoted efficiency and
conservation measures with steam customers and are likely to continue. The Company will work more
closely with customers to help them better manage their environmental profile and mitigate increases to
their bills.

Rates and Return are affected by the following factors:

- Lower sales primarily driven by warmer than normal temperatures
- Regulatory changes which have contributed to increasing costs on Steam Customers which were
  previously shared between steam and electric
- Events – one major event has a significant impact on the small base of customers resulting in
  significant impact to revenues which results in increase in investment contributing to rate
  increases

2.5 UNCERTAINTIES AND SIGNPOSTS

For the purposes of this plan there are four forces that the Company deems to be potential impacts to the
SLRP:

The price of fuel

The pace of technology innovation

The nature of regulation and legislation

The future of the economy
The SLRP was developed under considerable uncertainty around emerging technologies, energy and environmental regulations, customer demand, cost of fuel supplies, economic conditions, availability of financing and utility regulation and ratemaking approaches. Con Edison realizes that with the passage of time, the nature of these uncertainties will change and new uncertainties will emerge. As such, the plan is intended to be a flexible, living document that will be monitored and reshaped as circumstances change. In addition, the uncertainty of the economy will add variability to forecasting.

Where signposts reveal significant reductions will occur in steam sales and demand, the Company will apply the capacity reduction and load management options evaluated under the Low case that meet the revised projections

**Natural Gas and Fuel Oil**

The price of natural gas has fluctuated in the last ten years. As part of this Plan, Con Edison is in the process of converting the remaining oil burning generating units to dual-fuel capability, for both price and environmental reasons. The price of gas is expected to be less than oil on a BTU basis, but there are no guarantees that this will not change in the future. Also, there are risks related to the available supply of gas to NYC on gas system peak days since steam system demand will peak on those days. In addition, there will be increased gas customers with the City regulations driving conversion from oil to gas. The emerging environmental regulations are also forcing generating stations to switch to cleaner fuels such as gas and rely less on No. 6 fuel oil.

**Technological Incentives**

Two areas of technological uncertainty that most affect the system’s future are customer end-use and distributed generation. Already new packaged air conditioning systems, implemented by developers on each floor of commercial office buildings, are used to redirect service cost and risk to tenants and obviates the need for central chiller plants altogether.

Conservation measures for steam are not as widespread as they are for electricity but advances in energy management systems, will reduce usage. In addition, increases to the efficiency of the building envelopes may reduce the Company’s steam sales. New or recently renovated buildings are likely to use less steam per square foot than older buildings. The extent of this future impact is unknown but serves as a signpost for decreasing demand and usage.

**Environmental Regulation and Legislation**

Energy issues are central to many of the current environmental, economic, and security debates occurring at all levels of government. Energy and environmental policies are under ongoing review and Con Edison cannot know with certainty what specific regulatory proposals will be adopted or what revisions will be made in the near term. Any additional legislation is likely to have a significant impact on the Steam Business, in the form of increased regulation, higher expenses to retrofit existing steam plants with environmental measures, and higher operating costs.

The emerging environmental regulations and their impact on the steam system are discussed later in this report. To mitigate the impact of these regulations, Con Edison Steam has undertaken several initiatives that benefit the environment including fuel switching projects, retirement of an older plant, peak load
reduction, energy conservation programs, and active participation in the commenting process and discussions with Federal, State and City environmental agencies on the emerging revisions to the regulations.

Following is a brief summary of challenges, uncertainties and opportunities arising from environmental regulations:

- New York State issued the NO\textsubscript{x}-RACT regulation requiring all existing emission sources to install “Reasonably Available Control Technology” (RACT) emission control equipment that is available at “reasonable cost” to reduce nitrogen oxide (NO\textsubscript{x}) emissions. The compliance plan recently submitted by the Company commits all Steam System boilers (except Ravenswood A-House) to fuel switching by July 2014, burning natural gas as the primary fuel, with a limited use of No. 6 oil as back up. Ravenswood A-House will be required to operate with a restricted NO\textsubscript{x} emission rate that would be subject to a “case by case” determination because none of the available emission control technologies are within the “reasonable cost” defined in the regulation. The NYS Department of Environmental Conservation (DEC) is currently reviewing the Company’s compliance plan.

- The EPA recently issued the “Mercury and Air Toxics” (MATS) rule for reducing hazardous air pollutants (mercury, acid vapors, organic compounds etc) from electric generating units. This rule requires oil burning units to install expensive emission control equipment with no cost consideration. In order to be exempted from this rule, the dual fuel electric generating units at East River Station need to obtain a permit restriction limiting the oil firing heat input to less than 10% in each unit. These electric units are already operating with less than 10% oil burn so the new regulation is not a major constraint.

- The EPA also issued a similar rule (known as the “Boiler MACT Rule”) that would impact the steam system boilers. Our approach is to accept permit restrictions that would limit the amount of annual fuel oil heat input permissible for each boiler. This would reduce emissions of mercury and other hazardous pollutants below the “threshold” for the rules that require retrofitting new emission control equipment on these boilers. Installing the emission control equipment for these pollutants is impractical or infeasible for our boilers.

- After the 2013 Gas Addition Projects installation, the Ravenswood A-House will be the only plant in the system with #6 oil as its primary fuel. This plant will be operated as a backup plant with limited generation to comply with these rules.

- Compliance with the NO\textsubscript{x}-RACT and MACT regulations described above require natural gas as the predominant fuel irrespective of the gas versus oil fuel price trends in the long term.

- While evaluating repair / replace options for degraded boilers, the New York State regulation for New Source Review (NSR) may potentially preclude some repair options. This regulation would require stricter emission limits if any major modification is implemented to an existing boiler. This would trigger the requirement for expensive back-end emission controls making the repair option
cost prohibitive. This would forestall the projects that would increase the generating capacity of an existing unit or recapture the boiler capacity lost due to aging degradation.

- In previous years, the Steam Business did not incur the cost of purchasing NO\textsubscript{x} and SO\textsubscript{2} emissions allowances. This would change with the EPA's new Cross State Air Pollution Rules (CSAPR). CSAPR alters the rules for cap and trade program impacting the electric units East River 1, 2, 6, and 7. The EPA has favorably ruled on the Company's petition requesting an increase in the NO\textsubscript{x} and SO\textsubscript{2} allowance allocations in New York State. However the Company is projected to incur the cost of NO\textsubscript{x} allowance purchases, which will be offset by sales of SO\textsubscript{2} allowances. Currently there is uncertainty in the allowance prices because the CSAPR is being litigated and the EPA may issue further revisions. The net cost increase cannot be estimated until the regulation is implemented (estimated to be by the end of 2012).

- The Company has been procuring carbon dioxide emission allowances from the Regional Greenhouse Gas Initiative (RGGI) for the electric generating units (East River 1, 2, 6 and 7). So far, the market prices were minimal (< $2 per ton). However, the allowance prices are likely to increase significantly in the future when RGGI reduces the emissions caps, or if a future Congress passes legislation for a federal greenhouse gas program.

- In April 2011, New York City adopted a new heating oil regulation requiring buildings to phase-out the use of #6 and #4 heating oil. The steam and gas departments will continue coordinated marketing efforts to the affected 7,000 buildings in Con Edison territory while helping the customers compare and choose the energy supply.

2.6 BUSINESS OVERVIEW

For 130 years the Steam System has provided customers with reliable heating, and with steam-driven air conditioning. The system year-end customer count for 2011 was approximately 1,735, including 308 cooling customers, serving many of the most recognizable landmarks in NYC such as Rockefeller Center, the United Nations, the Empire State Building, and the Metropolitan Museum of Art.

In recent years, the cost of steam for customers has increased and has put steam in a less cost-competitive position relative to alternative energy sources. The key drivers behind rising costs to steam customers are:

- Fuel: represented about 41% of the total customer bill in 2011. The Company mitigates fuel cost volatility through hedging and storage

- Major Capital Investments: The steam generation assets are still reliant, in part, on oil. While assets are well maintained, they are advancing in age and require increased maintenance. In recent years, significant capital investments have been made including monitoring technologies for the distribution system, adding cogeneration to the East River Generating Station, and new
water treatment systems to improve water source chemistry to sustain the integrity of the distribution system.

- Regulatory changes which have contributed to increasing costs on Steam Customers which were previously shared between steam and electric

Figure 2 - 8. Steam Price and ROE History

Customers are telling Con Edison that higher prices are a catalyst for them to leave the system. Some customers will be able to accept higher prices but others are likely to leave when their systems reach retirement age. Customer price sensitivity is determined by service costs, physical constraints of the building, system conversion costs and their ability to purchase alternative energy sources at a cost that provides a short payback period for their switching costs. Nevertheless, loss of customers is an important issue to address since a reduction in the customer base generally means that those remaining must incur more of the cost burden of the system.

While customer departures currently remain low, higher bills, and a weak economy have driven customers to reduce their usage and continue to look for ways to conserve energy through energy efficiency measures. In the past year, weather adjusted sales declined by 2%. Five year trends show a five year reduction of 13.4% in weather adjusted sales. Most of the reduction has come from a decrease in summer sales related to a drop in installed steam cooling equipment and the higher efficiency of new replacement equipment installed by the SC-2 large commercial customer class. Many of these customers have migrated away from central plant chiller designs all together. For business reasons they have
installed electric HVAC units where the tenant absorbs the cost of their electric cooling by sub-metering and maintenance costs are invoiced directly. The interest in steam chillers has also been dampened by the increasing differential cost between steam and electric equipment, higher than expected maintenance costs, and the expiration of valuable financial incentives for steam while incentives for electric have been continually renewed. To this end, the Steam Business remains largely seasonal with winter usage equaling that of the other three seasons combined.

Over the past 5 years, weather adjusted winter peak demand has dropped 6.7% from 10,310 Mlb/hr to 9,620 Mlb/hr. This is attributed to customer conservation efforts which have accelerated in response to the down economy. Actual summer peak demand has declined by 14.1% in the last five years partially due to weather but also as a consequence of a change in customer approach towards steam for cooling.

The system has an installed capacity of 11,676 Mlb/hr of which the balance is utilized as a reserve margin to maintain system reliability. During the summer months peak demand drops to a little more than half of the winter demand and the installed steam capacity after electric generation commitments are considered drops to about 7,800 Mlb/hr. Maintaining under-utilized capacity is one of the key cost drivers affecting the direction of the Plan. The Plan provides for the Company to close the gap between capacity and demand.

2.7 VALUE OF THE STEAM SYSTEM

The Steam System provides advantages to customers that cannot be provided by alternative services. For example, the most competitive alternatives to steam heating are gas boilers and CHP. Not only do gas boilers or CHP units consume valuable space within buildings, they require flues that often are impractical to construct without adversely impacting the NYC viewscape, and local environment. Steam heating also provides reliability, ease of use, capital cost avoidance, additional rentable space, and risk mitigation (e.g., avoided fuel and chemical storage ad, emissions responsibility). Even the supply of an itemized bill provides some customers a benefit in that it clearly communicates measured costs to their owners or tenants.

The Steam System provides significant benefits to Electric and Gas Customers. For electric, when taking into account the additional transmission and distribution capital, electric capacity costs, increased property taxes, as well as the effects of the operational changes to East River Units 1 and 2, the steam system provides benefits to electric equivalent to approximately $3.9 billion. Similarly for gas, when taking into account the additional transmission and distribution capital, capacity costs, system operation and maintenance, as well as increased property taxes, the steam system provides benefits to gas equivalent to approximately $4.1 billion. The Steam System provides several environmental benefits. Through the use of cogeneration, the release of approximately 1.33 million tons of CO₂ per year is avoided (equivalent to 235,730 cars)², when compared to individual electric and steam production methods.
An in-house analysis showed that if customers install their own distributed generation with on-site individual boilers and/or combined heat and power plant, the result would be a city-wide increase in NOₓ, CO, and CO₂ emissions compared to the Company’s central station generating plants. This is due to the following reasons:

- For efficient cogeneration, steam and electricity need to be generated simultaneously. Customer sited CHP cogeneration has inherent seasonal inefficiency because individual buildings typically do not have simultaneous demand for steam and electricity. Most of their steam demand occurs in winter and electric demand in summer.

- Con Edison is able to utilize the benefits of cogeneration throughout the year because there is adequate demand for steam in all seasons from a large diverse customer base.

- The East River Cogeneration units and Brooklyn Navy Yard units provide about 57% of steam and these cogeneration units are equipped with environmental control equipment (selective catalytic reactor and oxidation catalyst) that remove most of NOₓ and CO emissions from the exhaust. Most of the customer sited boilers and CHPs are not equipped with such environmental controls.

Finally, if the Steam System were no longer available, there would be significant impacts on customers, the environment, New York City, and the Gas and Electric Systems. For existing Steam Customers, the capital costs to install on-site, gas-fired boilers and electric air conditioning equipment would be approximately $9 billion. The lost rental revenue from the space occupied by on-site boilers or CHP is about $16 million per year. The emission rates for NOₓ, CO, and CO₂, would increase without the Steam System along with substantial amounts of local emissions and the additional annual costs to Electric and Gas Customers. Figures 2-9 and 2-10 show net citywide emissions increase if the Steam System were no longer available, and all the customers switched to in-house boilers or one of the CHP technologies (either diesel engine, gas turbine or micro-turbine based CHP with a backup boiler).

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3 Equivalent number of passenger cars is calculated using the EPA’s Greenhouse Gas Equivalencies Calculator in the following link:

http://www.epa.gov/cleanenergy/energy-resources/calculator.html
Figure 2 - 9. Citywide Emissions Impact without the Steam System

- NOx
- CO
- SO$_2$
- PM

- Boiler
- Gas Turbine CHP
- Reciprocating Engine CHP
- Microturbine CHP
**Historical Sales and Key Sales Drivers**

The composition of the Con Edison Steam Customer base has changed over time as the result of small building teardowns that were replaced with single larger developments. Having fewer small customers is not necessarily detrimental to system economics, particularly if they can be replaced with higher load factor customers. Figure 2-11 illustrates the significant loss of SC-1 customers replaced by fewer albeit larger commercial and residential accounts.
The declining usage in steam from 2001 to 2011 as shown in Figure 2-11 below is attributed to:

1. Loss of NYSERDA Steam AC incentives which has resulted in a continued decline in use of steam AC
2. Competing technologies (CHP, On-Site Boilers, and Gas Heaters)
3. Energy efficiency and conservation
During the past year, actual sales declined 3.1%. The recent decline in sales is in line with a longer-term trend. Over the past ten years, actual sales have declined by 9% or 1% per year on average (see Figure 2-12). There are several key reasons for the decline in sales:

- Less air conditioning required due to cooler summers (during recent years)
- Customers switching from steam AC to other cooling technologies (either a full switch or hybrid electric and steam systems)
- Less heating due to warmer winters
- Increase in customer conservation due to a weakened economy or implementation of energy management systems or other measures
In the past ten years, the Steam has lost 2,200 MMB in actual sales. Approximately 71% of this decline came from reduced air conditioning usage during the summer season.
Customers are using less steam powered air conditioning. While most continue to be customers of the Steam System and use steam heat, some customers have switched their AC units to competing technologies or simply use their systems less often. This is likely attributed to efficiency measures like “free cooling” where installation of a plate and frame heat exchanger allows AC to be run off cooling tower water instead of a chiller when conditions are right.
According to the Figure 2-15, lost summer AC sales is attributed to customers who have left the system since the year 2001. The remaining two thirds of lost AC sales are due to other customers using their steam driven chiller systems less often or not at all.

Figure 2 - 16. Degree Days Compared to 30-Year Rolling Average
Weather has also contributed to the decline in sales over recent years (see Figure 2-16). For example, in 2011 a warmer winter (3.6% fewer heating degree days) reduced the need for heating.

The effects of temporary and permanent conservation efforts are hard to quantify because customer behavior changes or efficiency improvement initiatives are often unknown to Con Edison. Regardless, weather adjusted sales data shows that sales per customer have declined by 10.2% during the past five years and 9.4% in the last ten years. It is evident that customers are addressing their energy usage and, in particular, their steam usage.

2.8 BENCHMARKING

In recent years, Steam Operations has benchmarked with other district heating entities, both foreign and domestic.

As part of the Steam Long Range Plan process, Con Edison researched and interviewed district energy utilities in the United States (primarily from the northeast and northern regions) to understand how the Steam System compares on financial and operating dimensions. The benchmark consisted of data gathered from the International District Energy Association, publically available data, and interviews with executives from other district energy systems. The compiled information suggests the Company’s approach in the SLRP is reasonable and attainable and that the expected outcomes of these efforts are likely to be achieved.

Steam Operations hosted technical discussions with the following international district energy systems:

- Copenhagen Energy, Denmark
- CPCU (Paris, France)
- Moscow United Energy Company

Among the topics for comparison discussed were the following:

- System Configuration
- Combined Heat and Power
- Fuel
- Hot Water Use
- Chilled Water Use
- Condensate Return
- Remote Monitoring
2.9 CUSTOMER BASE

Con Edison has a diverse range of heating and cooling customers, many of who are also customers of the Company’s electric business. The Company’s customer base is segmented according to six general service classifications\(^3\). The Con Edison Steam System serves 1,735 (2011 Actual) customers ranging from single-family brownstones to hospital complexes comprised of multiple buildings. Customer accounts are fairly evenly distributed across three tariff classes; General Service (SC-1) which comprises small commercial and residential properties; Annual Power (SC-2) which primarily consists of large commercial buildings; and Apartment House (SC-3) for large multi-family facilities.

<table>
<thead>
<tr>
<th>Classification</th>
<th>Percentage of Customers</th>
</tr>
</thead>
<tbody>
<tr>
<td>SC-1  General Service</td>
<td>28%</td>
</tr>
<tr>
<td>SC-2  Annual Power Service</td>
<td>39%</td>
</tr>
<tr>
<td>SC-3  Apartment House Service</td>
<td>33%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Con Edison’s customers are distributed across four geographical locations in Manhattan. Midtown contains many of the large commercial customers that are part of the Annual Power Service classification. The Upper East Side and Upper West Side are home to many of the General Service and Apartment House Service customers. Downtown contains large commercial customers in the financial district.

In terms of sales, Midtown consumes sixty-five percent of the annual production. Downtown is second at eighteen percent followed by the Upper East Side at twelve percent. The Upper West Side trails at five percent and is also distinct in that it is the only region without a noticeable summer peak from steam cooling and without a major hospital account.

\(^3\) SC-4 Back-up/Supplementary Service Classification and SC-5 Negotiated Agreement Service Classification is a tariff to the Account’s respective Customer Service Classification SC-2 or SC-3
Table 2 - 3. Sales by Geography

<table>
<thead>
<tr>
<th>Geographical Location</th>
<th>Percentage of Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>Downtown</td>
<td>18%</td>
</tr>
<tr>
<td>Midtown</td>
<td>65%</td>
</tr>
<tr>
<td>Upper East Side</td>
<td>12%</td>
</tr>
<tr>
<td>Upper West Side</td>
<td>5%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Commercial customers comprise over 44% of Steam System revenues, while residential customers contribute nearly 18% of revenues. The remainder is comprised of revenue from hospitals, hotels, museums, and other large buildings*.
The SC-2 Annual Power Service customers account for almost 72 percent of both sales volume and revenues, while the SC-3 Apartment Building Service customers account for 26 percent of the sales volume and revenue. The SC-1 General Service customers contribute relatively little to either sales or revenues. This proportion has not changed in recent years largely as a result of the Company’s efforts to retain the larger customers and the negligible impact of losing SC-1 accounts.

* Other includes government facilities, restaurants, schools, dry cleaners, churches, dormitories, theaters, supermarkets, and other facilities.
Customer Size and Revenue Distribution

A relatively small number of customers account for most of the Steam System’s revenue and sales. The top 450 customers account for 75 percent of revenues. The concentration of commercial and retail building ownership in New York City means that Con Edison Steam works with an even smaller group of owners and decision makers. This concentration of customers can be viewed as both positive and negative from a business perspective. While it is easier to communicate and educate a small customer population, around topics such as conservation, the Company feels a more immediate impact when adverse decisions are made by the same small number of people.
2.10 COMPONENTS OF THE STEAM BILL

Figure 2 - 19. 2011 Customer Bill

For most Steam Customers, there are three components to their bills:

- Delivery represents base rates less base cost of fuel ($10.049 per Mlb) and the fixed fuel component in the customer charge.

- Supply represents Fuel adjustment charge, plus the base cost of fuel and the fixed fuel component of the customer charge.

- Taxes and Fees represents Base fees and taxes in base rates, plus 18-a assessment collected as a separate surcharge to base rate, plus GRT and sales tax collected.

In addition, the rates for approximately 409 SC-2 and SC-3 customers, with consumption in excess of 14,000 Mlb per year, include a demand rate component. These customers are also charged for their peak demand (between 6 a.m. and 11 a.m. on weekdays) and all time peak demand during 4 months of the Winter Peak Period (specifically December through March). on the basis of a per Mlb/hr charge. The demand component of a demand-billed customer’s total winter peak steam bill ranges between 5% and 15%.

Presently, substantially less than 50% of the total average Steam Customer’s bill is for the base rate (net revenue). The balance covers fuel costs, fees, and taxes.
2.11 ALTERNATIVES TO STEAM HEATING AND COOLING

Steam heating’s primary competition comes from on-site gas-fired boilers. New package boiler technology can approach 84 percent efficiency at optimal load. On average, on-site boilers could produce steam at a lower overall cost compared to Con Edison steam. Nevertheless, many customers find that the features of the Company’s Steam Service, especially the low space requirements, the convenience of the service, and a growing awareness of the environmental value of Con Edison steam more than outweigh a cost differential.

Electric and gas chillers are the main competitors to steam centrifugal chillers. Based on a 2011 study of various air conditioning technologies, conducted by Con Edison, annual costs to use electric chillers are approximately one-third less than the steam equivalent. Gas chillers cost were more comparable to steam equipment. Most of the cost savings come from the lower upfront costs (amortized over the lifetime of the equipment) associated with purchasing gas or electric chillers. In addition, the NYSERDA sponsored financial incentives for steam air conditioning customers have expired, thereby increasing the total first cost of the equipment. Con Edison has not been successful in adding new steam air conditioning customers for several years and the Company does not see strong growth prospects for this product without incentives or a significant decrease in steam energy rates. We discuss a potential steam AC incentive program further in this Plan.

Customer-sited cogeneration offers large customers the capability to self-generate energy for both heating and cooling purposes. Cogenerating steam and power has the potential to allow the system to price steam or electric favorably by, in effect, offsetting steam production costs with electricity margins or vice versa. On-site, dedicated generation facilities may provide a measure of protection from future capacity cost-related increases in utility rates. Cogeneration is also attractive because the technology is eligible for LEED points. LEED certification helps building owners attract premium rents. We recognize that CHP is not cost effective in most buildings.

2.12 TECHNICAL OVERVIEW OF THE SYSTEM

Today, Con Edison owns and operates the 10th largest district energy System in the world and the largest in the United States. It is the largest steam system in the world. The Steam System currently has a total of 11,676 Mlb/hr of installed net steam generating capacity. Con Edison owns and operates five steam and steam/electric generating stations throughout the City. Generating Stations include East River, 59th Street, 74th Street, 60th Street, and Ravenswood A-House (the Hudson Avenue boilers were retired in 2011). The Brooklyn Navy Yard Cogeneration Partners (“BNYCP”) supplies steam via an energy sales agreement. About 57% of the steam supplied by Con Edison is produced through cogeneration technology with the remainder produced through gas and oil-fired units.

2.12.1 Generation Overview

There are four generating stations in Manhattan and one each in Brooklyn and Queens that supply steam. The East River Generating Station and BNYCP have cogeneration units that provide electricity and steam. The simple cycle gas turbines at Hudson Avenue, 59th Street, and 74th Street are primarily
used only during the summer peak demand hours and for black start capability. All of the plants are located in Manhattan except for Ravenswood, which is located in Queens, and BNYCP which is located in Brooklyn.

The list of station unit groups and capacities is shown in Figure 2-20 below.

Figure 2 - 20. Steam Generation Capacity 2011

![Pie chart showing steam generation capacity by station for 2011.]

- **East River, 5,825**
- **74th Street, 2,008**
- **60th Street, 726**
- **59th Street, 1,381**
- **Ravenswood, 750**
- **BNYCP, 986**

Total 11,676 Mlb/hr

Figure 2-21 represents the percentages of total 2011 steam sendout from each station. Units are dispatched to meet demand, subject to considerations such as cost, operational reliability, and emissions impact. East River Units 1/10, 2/20, 6/60, and BNYCP are cogeneration units and are the principal base-load steam plants. During 2011 the ER 1/10, 2/20, 6/60 Units and the BNYCP Plant produced approximately 57% of the total sendout.
Figure 2 - 21. Steam Sendout by Station 2011

2 12.2 Steam Distribution System

The system contains approximately 105 miles of main and service pipes. It consists of steel piping for the mains and a combination of steel and brass for its service and condensate piping. The system operates as one continuous network and the physical location of the piping is directly correlated to the location of production supply sources and customer demands. The design parameters for the system are 400 psig at 475°F and 200 psig at 413°F.

The entire steam distribution network contains a variety of components that are displayed in the following diagram.
Piping

There are approximately 86 miles of steam mains varying from 2” to 36” pipe diameters and another 19 miles of steam services varying from 1” to 20” pipe diameters.

The piping at certain supply outlets (approximately 11 miles) is designed for 400 psig; the majority of the system (approximately 93 miles) is designed for 200 psig. The original Steam System was constructed beginning in 1882, prior to the development of commercial gas or electric arc fusion welding. Flanged pipe and fittings were utilized and can develop gasket leaks over time.

Approximately 101 miles of steam piping and components are buried. Buried steam mains are insulated and routed inside a protective housing. The current standard insulation material is fiberglass. However, most of the buried system is insulated with asbestos insulation. The majority of the housing is made of concrete, which is the current standard. The remainder of the housing is made of shell housing (pipe within another pipe), cast iron coffin type, brick and/or tile, or combinations of the above. Steam mains are supported by anchors, rollers and guides within the housing.

There is approximately one mile of steam mains running through customer buildings (a/k/a circulating mains). There is also approximately one mile of leased line which Metro North operates and maintains under a lease agreement with the company.

The Steam System also consists of over 2 miles of mains routed inside 10 tunnels and a micro tunnel. Three of the ten tunnels are operated and maintained by the Gas Tunnel Operations, and another seven tunnels and one micro tunnel are operated and maintained by Steam Operations.
2.13 EXTERNAL STAKEHOLDERS INPUT

In developing this plan, the Company incorporated input from various external stakeholders which included our customers, the PSC Staff, and NYC. Additional input from focus groups provided knowledge on specific outreach topics. Outreach topics have covered affordability, reliability, energy efficiency, infrastructure upgrades, and the pace of adoption of new technologies. In addition, the Company initiates Customer and Industry Seminars, Informational Meetings and one-on-one interviews with large commercial customers. Attendees in these venues have the opportunity to express their own issues or priorities as it relates to the steam service.

The results obtained from all venues are consistent in that customers value our service; are interested in new technology; want to make sure the Steam System keeps up with their needs; and are concerned with cost increases. The primary feedback can be summarized as follows:

- Concerned with rising energy costs, including steam, and some recognize fuel volatility is a major factor
- Steam AC is cost prohibitive from an upfront capital perspective
- Excellent reliability of Con Edison Steam Service
- Excellent customer service levels from meter reading to account managers
- Product is easy to use and dependable
- Value environmental benefits and green energy

2.14 KEY BUSINESS DRIVERS AND COMPARATIVE PERFORMANCE TRENDS

Economic Conditions

Employment is not anticipated to fully recover to the annual average level of 2008 and no earlier than 2012. The Company’s projections of the impact of employment changes are based on forecasts from Moody’s Economy.com. The projected change in employment is considered in determining the steam sales forecast.

Weather

Weather has a major impact on both winter and summer steam sales. In determining winter and summer sales forecasts, average weather patterns are used to determine the projected sales, eliminating the impact of warmer or colder than normal weather. Normal weather is defined as the average weather condition over the 30 calendar years ended 2009. A 30-year condition is used by the National Weather Service to define normal conditions and is a widely accepted standard in the energy industry. Actual weather conditions are clearly beyond the control of the Company. A weather normalization clause or a revenue decoupling mechanism (as discussed earlier) in setting Con Edison’s steam rates would eliminate the uncertainty of weather conditions from the rate setting process. All of Con Edison’s steam heating and air conditioning customers are subject to this weather uncertainty on a continuous basis.
3.0 MANAGING DEMAND, SUPPLY, AND ENVIRONMENTAL PROFILE

3.1 OVERVIEW

The Plan forecast indicates flat demand over the next five years and throughout the forecast period. To meet this demand, the Company expects to make continued investments to maintain necessary production and distribution assets while integrating demand management to enable the Company to meet its mission of delivering safe, reliable, and affordable service while minimizing Con Edison’s environmental impact. Con Edison will leverage customer-based demand and supply side management (in the forms of CSS, demand response and energy efficiency) in order to defer or eliminate the need for building replacement infrastructure, while at the same time potentially reducing greenhouse gases.

3.2 DEMAND AND SALES FORECASTS

As shown in Figure 3-1 below, weather-normalized peaks have been very modestly declining over the past decade. The most notable decline coincided with the 2008-09 recession where a 3.3% decline in peak was observed between winter 07-08 and 08-09. That rate of decline moderated back to historic levels the following winter with this past winter experiencing a 1.5% decline. This has been calculated with weather-normalized peak of 9,620 Mlb. These modest declines in peak demands are a result of customer conservation, efficiency improvements, and reductions from customer sited generation, net of new business connections.

Figure 3 - 1. Actual Weather-Normalized Steam Peak Demand
Con Edison’s peak demand forecast provides the basis for determining production capacity requirements. A standard forecast consists of two components: a sales forecast and a peak demand forecast. The sales forecast is a projection of steam consumed throughout the year, measured in terms of millions of pounds (MMlb). The peak demand forecast is a projection of the maximum steam production requirements that Con Edison’s customers demand at a single point in time, measured in thousand pounds per hour (Mlb/hr). Peak demand, or the maximum steam that customers require at a single point in time, drives infrastructure investment because Con Edison must build to that demand even if it is a relatively infrequent occurrence. For the Con Edison Steam System, peak demand occurs in winter when heating loads are the highest.

The primary drivers of steam demand and sales growth are overall economic growth in the region, which affects employment, construction and population in the service territory; and specific new business growth including the World Trade Center.

To facilitate the development of the Steam Long Range Plan, the Company developed a Plan Case and two alternate bounding cases. These three forecasts for sales and peak demand are described in brief and depicted in Figure 3-2. The starting point for each of the cases is the weather normalized peak for winter 2010-11 of 9,620 Mlb/hr.
The Plan Case Scenario

The Plan Case forecasts subtle negative growth through 2031 representing an average annual growth rate of -0.20%. The Plan Case reflects the expectation that the economy will recover, albeit slowly over the next few years. Consequently, the Company expects moderate net growth in new business from new construction offset by historical levels of lost business as well as energy efficiency driven by customer education, and codes & standards.

For 2012 through 2016, new business growth is based on new service requests received by Con Edison. Only service requests deemed “firm” are included in the Plan Case. Beyond 2016, the new residential and commercial business forecast is based on a five-year average of prospective “firm” service requests. The growth in new business is offset by the continued extrapolation of historical lost business trends.

Also included in the Plan Case are the implications of NYC regulation prohibits the use of lower grade residual oils for commercial buildings referred to as #4 & #6 Oil. This could result in displacement of oil heat with steam supply from Con Edison.
Table 3-1 summarizes the key assumptions included in the Plan Case. As indicated, no additional demand response is included in the Plan Case and no additional CHP (Combined Heat & Power) or boiler conversions are anticipated beyond the historical trends already captured in the forecast.

Table 3 - 1. Summary of Plan Case Demand Forecast

<table>
<thead>
<tr>
<th>Driver</th>
<th>Plan Case</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Business</td>
<td>110 Mlb/hr increase to the peak by 2016</td>
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<tr>
<td>World Trade Center (part of employment growth)</td>
<td>139 Mlb/hr addition</td>
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<tr>
<td>Customer-Driven Energy Efficiency (by 2030)</td>
<td>298 Mlb/hr reduction</td>
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<tr>
<td>Customer Driven Demand Response (by 2030)</td>
<td>None</td>
</tr>
<tr>
<td>Customer Conversion from No. 4/ No. 6 oil to Steam (by 2030)</td>
<td>15 Mlb/hr addition</td>
</tr>
<tr>
<td>Customer Conversion to CHP or Boilers (by 2030)</td>
<td>679 Mlb/hr reduction</td>
</tr>
</tbody>
</table>

The High Demand Scenario

In the High Case, the Company projects peak demand to grow from 9,620 Mlb/hr in 2011 to 9,695 Mlb/hr in 2031, representing a twenty year compound annual growth rate of 0.04%. In the High Case it is assumed that there will be stronger new business growth identified by customer service requests the Company deemed unlikely to materialize during the 2011–2016 period in the Plan Case. In addition to these service requests a 65 Mlb/hr contribution to the peak over the 2016–2031 period accounts for unscheduled World Trade Center projects that may materialize in the future.

The High Case assumed the inclusion of several more customers converting from #4 or #6 oil to Steam, which the Company deemed a lower probability. These customers that have a lower probability of converting to Steam contribute an additional 55 Mlb/hr to the peak by 2016.

The High Case it is assumed that there will be no demand reduction or demand side management programs in place as well as no energy efficiency impact on the steam peak demand.

Table 3-2 summarizes the assumptions included in the High Case.
Table 3 - 2. Summary of High Case Demand Forecast

<table>
<thead>
<tr>
<th>Driver</th>
<th>High Case</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Business</td>
<td>154 Mlb/hr addition by 2016</td>
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<tr>
<td>World Trade Center (part of employment growth)</td>
<td>204 Mlb/hr addition by 2031</td>
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<tr>
<td>Customer-Driven Energy Efficiency (by 2030)</td>
<td>None</td>
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<tr>
<td>Customer Driven Demand Response (by 2030)</td>
<td>None</td>
</tr>
<tr>
<td>Customer Conversion from No. 4/No. 6 oil to Steam (by 2030)</td>
<td>55 Mlb/hr addition by 2016</td>
</tr>
<tr>
<td>Customer Conversion to On-site CHP or Boilers</td>
<td>679 Mlb/hr reduction</td>
</tr>
</tbody>
</table>

**The Low Demand Scenario**

In the Low Case, Con Edison projects peak demand to decline from 9,620 Mlb/hr in 2011 to 7,400 Mlb/hr in 2030, representing a twenty year compound annual growth rate of -1.3%. The Low Case differs from the Plan Case by assuming that peak demand is lower due to a sizable customer base switching to on-site boilers and CHP. The annual reduction is approximately twice that of the Plan Case reflecting the largest single year loss in the last 5 years. The Low Case also assumes lower consumption per customer due to more strict building codes, more conservation, and peak load shifting through more successful customer education. The Low Case also includes the assumption that demand response programs will play a greater role in suppressing the Steam Peak.

The Company has also indentified customers whose use of Steam for generating air conditioning may not be as economical as electricity as their equipment ages. A Low Case assumption is that as customers switch from steam air conditioning to electric air conditioning a portion of these customers might leave the steam system all together representing a 20 Mlb/hr reduction per year beginning in 2013.

Table 3.3 summarizes the input variables for the Low Case.
Table 3 - 3. Summary of Low Case Demand Forecast

<table>
<thead>
<tr>
<th>Driver</th>
<th>Low Case</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Business</td>
<td>110 Mlb/hr addition by 2016</td>
</tr>
<tr>
<td>World Trade Center</td>
<td>139 Mlb/hr addition</td>
</tr>
<tr>
<td>Customer-Driven Energy Efficiency (by 2030)</td>
<td>28 Mlb/hr reduction demand reduction per year beginning in 2013</td>
</tr>
<tr>
<td>Customer Driven Demand Response (by 2030)</td>
<td>20 Mlb/hr reduction beginning in 2013</td>
</tr>
<tr>
<td>Customer Conversion from No. 4/No. 6 oil to Steam (by 2030)</td>
<td>None</td>
</tr>
<tr>
<td>Customer Conversion to On-site CHP or Boilers (including prospective lost AC customers)</td>
<td>1,738 Mlb/hr steam reduction</td>
</tr>
</tbody>
</table>

3.3 STEAM RESOURCE PLAN: MANAGING PRODUCTION CAPACITY

The Steam Resource Plan is designed to meet the Plan Case demand forecast and is consistent with the Company’s Long Range Planning Process and has been evaluated in the context of long range plans being developed for the natural gas and electric segments of Con Edison Company of New York, Inc.

3.3.1 Outlook for 2012 – 2031

Under the Plan Case demand forecast, there are no plans to reduce costs by reducing installed capacity since the demand forecast going forward is projected to decline marginally (essentially stay flat). The savings from the accelerated retirement of Hudson Avenue are currently being realized. The Hudson Avenue property is still utilized for energy purposes. There are three electric combustion turbines, several high tensions feeder traversing the property, an electric cable oil cooling pumping system, and the Brooklyn Navy Yard Plant’s overhead steam main. The property is available for future development by the Company for electric service should the need arise. Some allowance for maintaining the site, buildings and waterfront infrastructure in safe conditions and in conformance with building codes is allotted.

Under the Low Case demand forecast, there could be potential cost savings associated with the removal of Ravenswood, East River South Steam, and 60th Street from service.
3.3.2 Capital Plan for Ongoing Production Resources

The following is a sample of near-term, major capital projects at each of the generating stations.

**East River Generating Station**

*East River Units 1/10 and 2/20*

East River 1/10 and 2/20 cogeneration units each have a gas turbine and heat recovery steam generator (HRSG), with no steam turbines. These units began commercial operation in April 2005 and replaced the Waterside Generating Station, which was retired a few months later. Each unit is currently rated with a net steam sendout capacity of about 1,600 Mlb/hr (with duct firing). Each unit consists of a General Electric Model 7FA combustion turbine capable of burning natural gas or distillate oil and a HRSG with supplemental duct firing. East River Units 1/10 and 2/20 use selective catalytic reduction (SCR) technology to reduce nitrogen oxides (NOₓ), and oxidation catalyst to reduce emissions of carbon monoxide (CO) and volatile organic compounds (VOCs). The units have a combined electric capacity of 360 MW.

The capital plan provides for the water treatment system to be upgraded to reduce the anticipated increase in labor and chemical costs due to the lower quality of water supply. The City of New York will switch the water source in 2013 to Croton water supply, which will affect the steam equipment. Environmental control equipment (selective catalytic reduction and oxidation catalyst) is scheduled for replacement of the elements every five to seven years depending upon operating hours and performance degradation.

*East River South Steam Station (ERSSS)*

There are five operational package boilers at the East River South Steam Station (ERSSS). These are natural circulation, balanced-draft units. These boilers (Units 115-119) were converted to dual fuel capability in 2004, burning either natural gas or No. 6 fuel oil, and are currently rated at 130 Mlb/hr net steam sendout each.

Projects are planned for upgrading the water treatment and chemical monitoring systems, and for improving oxygen removal from deaerators to mitigate corrosion of feed water piping and boiler components.

*East River 6/60*

East River Unit 6/60 generates both electricity and steam. This is a natural-circulation, balanced-draft, non-reheating unit that burns natural gas and No. 6 fuel oil. The unit is currently rated at 830 Mlb/hr net steam sendout in extraction mode and 980 Mlb/hr in the drag valve mode (live steam when turbine is bypassed).
**East River 7/70**

East River Unit 7/70 operates as an electric-only unit in the summer and as a steam-only unit in the winter. This is a natural-circulation, balanced-draft, reheat unit. It was converted to steam sendout in 1995. The unit burns natural gas and No. 6 fuel oil and is currently rated at 1,200 Mlb/hr net steam sendout.

**74th Street Generating Station**

There are three High Pressure Boilers (Boilers 120, 121, and 122) and six Package Boilers (Boilers 1-6) at the 74th Street Generating Station. The High Pressure Boilers are natural-circulation, balanced-draft, non-reheat boilers, which burn No. 6 oil and currently have a combined total rated capacity of 1,300 Mlb/hr net steam sendout. The Package Boilers are natural-circulation, balanced-draft units that burn No. 6 oil, and currently have a combined total rated net steam sendout capacity of 708 Mlb/hr.

Capital projects include the gas burning capability to all of the boilers, internal and external gas piping reinforcements, and burner modifications.

**60th Street Generating Station**

There are six package boilers (Boilers 1-6) at the 60th Street Generating Station. These are natural-circulation, balanced-draft units, and presently have a combined total rated net steam sendout capacity of 726 Mlb/hr and these boilers burn natural gas.

Capital improvements targeted for 60th Street include Package Boiler and auxiliary equipment upgrades for NOx compliance and a waste neutralization system to meet DEC state discharge limits to the waterways.

**59th Street Generating Station**

There are two Annex Boilers (Boilers 114 and 115) and three package boilers (Boilers 116, 117, and 118) at the 59th Street Station. The Annex Boilers are natural-circulation, balanced-draft, non-reheat boilers, which burn No. 6 oil and a limited amount of natural gas. They currently have a combined total rated net steam sendout capacity of 1,000 Mlb/hr. The package boilers are natural-circulation, balanced-draft units that burn natural gas and No. 6 oil. They currently have a combined total rated net steam sendout capacity of 381 Mlb/hr.

Capital projects include the gas burning capability to the Annex Boilers, internal and external gas piping reinforcements, and burner modifications.

**Ravenswood Steam Station (Ravenswood A-House)**

There are four boilers (Boilers 1-4) at Ravenswood Steam Station. These are natural-circulation, balanced-draft units that fire No. 6 oil and 10% natural gas. The total site net capacity is 750 Mlb/hr. This reflects deratings of the units relative to their original total net design capacity of 976 Mlb/hr.
**Hudson Avenue Generating Station**

The four remaining boilers at Hudson Avenue were shut down and the steam plant closed in April of 2011. These are natural-circulation, balanced-draft, non-reheat boilers, which burned No. 6 oil. They contributed a net design capacity of 1,600 Mlb/hr to the system capacity.

The shutdown of these boilers was based on the following factors: sufficient residual system capacity of 11,676 Mlb/hr, and lowered peak winter load of 9,620 Mlb/hr.

Beyond 2011, allotments to safely retire the steam plant in place are included. The three simple cycle gas turbines will remain in service at approximately 15 MW summer capacity each.

**Brooklyn Navy Yard Cogeneration Partners**

This plant is located within the Brooklyn Navy Yard and is owned by Brooklyn Navy Yard Cogeneration Partners (BNYCP). Con Edison purchases the plant’s entire net electric and steam output of the plant under a 40-year Energy Service Agreement (ESA) that began on November 1, 1996. This plant is comprised of two Siemens V84.2 combustion turbines, each nominally rated at approximately 100 MW, two associated HRSGs, and two Siemens steam turbines each nominally rated at approximately 40 MW. This plant utilizes natural gas as a primary fuel, with distillate oil as a back-up. The ESA requires that BNYCP deliver 220 MW to Con Edison, with an associated seasonal steam output of 800 Mlb/hr in the winter (December through March), 750 Mlb/hr in the spring (April to May) and fall (October to November), and 550 Mlb/hr in the summer (June through September). This cogeneration facility is capable of producing maximum steam output of 986 Mlb/hr when its electric output is reduced below 220 MW. The Brooklyn Navy Yard Cogeneration Partners (BNYCP) plant generates about 17% of total steam send out.

**3.3.3 Gas Addition Projects**

Currently, the primary fuel at both the 59th Street and 74th Street Generating Stations is No. 6 fuel oil. At 59th Street, the two Annex Boilers fire No. 6 fuel oil. Natural gas is used for the three Package Boilers and the Annex Boilers' igniters. At 74th Street, all of the boilers (i.e., three High Pressure and six Package Boilers) fire only No. 6 fuel oil. The gas addition plan includes projects to install gas supply systems at each station with capacity sufficient to fuel all of the boilers. These projects will convert the stations' primary fuel to natural gas while maintaining the dual-fuel firing capability for all boilers, i.e., each boiler would be capable of using either No.6 fuel oil or natural gas.

On March 21, 2011, the U.S. Environmental Protection Agency (“EPA”) issued its final regulations governing the emissions of hazardous air pollutants (“HAPs”) from industrial, commercial, and institutional boilers and process heaters requiring the installation of maximum achievable control technologies (the “ICI Boiler MACT Rule”), 76 Fed. Register 15608 (March 21, 2011). The Company has determined that the only way that it can meet the more stringent emissions requirements specified in the ICI Boiler MACT Rule, while maintaining the boilers’ economic and technical viability as steam generating facilities, is to install gas burning capability at the 59th Street and 74th Street Stations.
The Company estimates that the gross capital cost of the Project will be approximately $129 million (2013 dollars). Specifically, the 59th Street Station portion of the Project is estimated to cost approximately $46 million (2013 dollars). The Company negotiated a $20 million (2012 dollars) contribution to the work being undertaken at the 59th Street Station from CRP/Extell Parcel L, LP and CRP/Extell Parcel N, LP (“Extell”) which is discussed below. With the Extell contribution, the net capital cost to steam customers for the 59th Street Station’s portion of the Project is reduced to an estimated $26 million (2013 dollars). The 74th Street Station portion of the Project is estimated to cost approximately $83 million (2013 dollars), thus the net total cost of the Project is estimated to be approximately $109 million (2013 dollars).

3.3.4 Gas Additions Projects Economic and Environmental Benefits

Due to well known fundamental shifts in the availability and price of natural gas throughout the United States, the current projected annual fuel cost savings for the Project is substantially greater than the level of savings that was projected during the Company’s last rate proceeding. The annual fuel cost savings for the Project is estimated to be approximately $64 million, on a real (2011) dollar basis, for the first five years, which amounts to approximately $270 million (2011 dollars) of fuel savings cost over the first five years of the Project when calculated on a net present value basis. These savings are based on the most recent long range fuel price forecast.

There are several benefits of the Project. First, adding gas burning capability at the stations enables the Company to comply with recent environmental regulations, including the EPA’s ICI Boiler MACT Rule and the NYSDEC’s NOx RACT regulations, which provide for more stringent control of NOx emissions.

Second, the Project provides significant fuel cost savings that will inure to the benefit of Con Edison’s steam customers immediately and over the life of the Project based on the projected substantial fuel price differentials between oil and gas. Third, by decreasing the amount of oil used at the stations, the Project will, in turn, reduce the risk of an oil spill that could run into the adjacent waterways. Fourth, adding dual fuel capability to the stations’ boilers and the CT will provide the Company with increased operational flexibility and will significantly enhance the reliability of the steam and electric systems in the event that either fuel supply is disrupted. Finally, the Project enables the Company to make a significant contribution to economic development in New York City.

The use of natural gas rather than No. 6 fuel oil also benefits the environment because emissions such as Nitric oxide ("NOx"), Sulfur Dioxide ("SOx") Carbon Dioxide ("CO2") and particulate matter are reduced. The estimated annual emission reductions resulting from firing natural gas as the primary fuel at 59th Street Annex are as follows: 190 Tons NOx, 330 Tons SO2, 35,000 Tons CO2 and 35 Tons PM 10. Similarly, for 74th Street, the annual estimated emissions reductions are 300 Tons NOx, 600 Tons SO2, 39,000 Tons CO2 and 100 tons PM 10. The CO2 reductions at these two stations are equivalent to removing about 13,000 passenger cars from the streets (based on EPA calculator given in the link: http://www.epa.gov/cleanenergy/energy-resources/calculator.html).
3.3.5 Methodology for Evaluating Production Resource Modifications

The first ten years of this resource plan incorporate recommendations made by the Public Service Commission in prior steam resource planning studies and reflects the Company’s ongoing commitment to effective planning and long range strategic decision-making, and has been designed to accomplish the following:

- Maintain adequate capacity and reserve for reliable system operation.
- Comply with all applicable environmental requirements, including anticipated new regulations.
- Minimize the cost of service to ratepayers while providing acceptable return for shareholders, consistent with reliability and environmental requirements.

The 2007 Steam Resource Plan described the Company’s reliability criteria for the Steam System and applied this to determine combinations of resources needed to meet the peak load forecast at that time. The 2009 Steam Resource Plan Update applies similar reliability criteria to determine system and site-specific requirements under the plan, low, and High Case scenarios. The criteria are installed reserve, system Loss-Of-Load Expectation (LOLE), and pressure control. Each reliability criterion is described below.

**Installed Reserve**

Installed reserve is a deterministic criterion that requires total supply to exceed forecast load by a reserve margin at least equal to the loss of the single largest unit. This “single-contingency” design criterion requires installed reserve to be no less than 1,600 Mlb/hr, which is equal to the capacity of East River Unit 1/10 or 2/20. Table 3-4 indicates the amount of winter period installed reserve anticipated will be available. The table indicates that adequate reserve margin in the winter period is maintained throughout the twenty year planning period. In the Steam System, not meeting the load would result in a decline in pressure. Depending on the severity of the shortfall, interruption of customer load could occur.
Table 3 - 4. Steam System Capacity: Load and Reserve

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<td>9,020</td>
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<td>9,020</td>
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<td>9,020</td>
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<tr>
<td><strong>Reserve Requirement</strong></td>
<td>1,500</td>
<td>1,600</td>
<td>1,600</td>
<td>1,600</td>
<td>1,600</td>
<td>1,600</td>
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<td>1,600</td>
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<tr>
<td><strong>Surplus/Deficiency</strong></td>
<td>466</td>
<td>466</td>
<td>466</td>
<td>466</td>
<td>466</td>
<td>466</td>
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<tr>
<th>Station/Unit</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
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<td>East River 10</td>
<td>1,600</td>
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<td>1,600</td>
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<tr>
<td>East River 80*</td>
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<td>835</td>
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<tr>
<td>East River 70</td>
<td>1,200</td>
<td>1,200</td>
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<td>1,200</td>
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<tr>
<td>Aux Steam ER 60 &amp; 70**</td>
<td>455</td>
<td>455</td>
<td>455</td>
<td>455</td>
<td>455</td>
<td>455</td>
<td>455</td>
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<tr>
<td>BWP CP***</td>
<td>498</td>
<td>498</td>
<td>498</td>
<td>498</td>
<td>498</td>
<td>498</td>
<td>498</td>
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<td>498</td>
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<tr>
<td>East River SSS****</td>
<td>950</td>
<td>950</td>
<td>950</td>
<td>950</td>
<td>950</td>
<td>950</td>
<td>950</td>
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<td>1,300</td>
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<tr>
<td>74th Package</td>
<td>708</td>
<td>708</td>
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<td>708</td>
<td>708</td>
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<td>60th Package</td>
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<tr>
<td>58th Package</td>
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<td>1,000</td>
<td>1,000</td>
<td>1,000</td>
<td>1,000</td>
<td>1,000</td>
</tr>
<tr>
<td>Ravenswood A' House</td>
<td>381</td>
<td>381</td>
<td>381</td>
<td>381</td>
<td>381</td>
<td>381</td>
<td>381</td>
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</tr>
<tr>
<td><strong>Project Capacity</strong></td>
<td>11,576</td>
<td>11,676</td>
<td>11,676</td>
<td>11,676</td>
<td>11,676</td>
<td>11,676</td>
<td>11,676</td>
<td>11,676</td>
<td>11,676</td>
<td>11,676</td>
<td>11,676</td>
</tr>
<tr>
<td><strong>Base Forecast</strong></td>
<td>9,525</td>
<td>9,500</td>
<td>9,475</td>
<td>9,445</td>
<td>9,410</td>
<td>9,375</td>
<td>9,345</td>
<td>9,315</td>
<td>9,280</td>
<td>9,250</td>
<td>9,240</td>
</tr>
<tr>
<td><strong>Reserve Requirement</strong></td>
<td>1,800</td>
<td>1,600</td>
<td>1,600</td>
<td>1,600</td>
<td>1,600</td>
<td>1,600</td>
<td>1,600</td>
<td>1,600</td>
<td>1,600</td>
<td>1,600</td>
<td>1,600</td>
</tr>
<tr>
<td><strong>Surplus/Deficiency</strong></td>
<td>551</td>
<td>576</td>
<td>601</td>
<td>631</td>
<td>666</td>
<td>701</td>
<td>731</td>
<td>761</td>
<td>796</td>
<td>826</td>
<td>836</td>
</tr>
</tbody>
</table>

Notes:
1. ER 60 Under extraction mode the capacity is 830 MMBtu/hr. Max capacity 966 MMBtu/hr on drag valve mode.
2. 65 MMBtu/hr Aux steam is needed from either ER60 or ER70 at Max load.
3. BWP CP with Max steam conversion is 656 MMBtu/hr. Under normal operation capacity is 800 MMBtu/hr.
4. East River SSS Max capacity while burning oil.

Table provides peak load for the winter starting from November 16th of the previous year through March 31st.
Probabilistic Reliability Evaluations Based on Loss-of-Load Expectation

Resource portfolios are also evaluated for their conformance with the probabilistic reliability criterion using General Electric Company's Multi-area Reliability Simulation Program ("MARS"). MARS was used to quantify the probability that the available resources would not be able to meet forecasted load, as measured by LOLE.¹

A sequential Monte Carlo simulation forms the basis for MARS and allows for the calculation of time-correlated measures, such as frequency (outages/year) and duration (hours/outage). To determine the reliability of the Steam System, MARS took into consideration the randomly occurring events associated with forced outages. Numerous resource and load combinations were tested relative to a 1.0 day per year maximum LOLE criterion. MARS results for a peak load of 9,800 Mlb/hr is shown below assuming capacity at Hudson Avenue (HA) reduced to zero, existing capacity levels at remaining units and normal planned maintenance schedules. This is conservative as the current peak is about 9,620 Mlb/hr. As indicated in Table 3-6, the LOLE reliability criteria of one day in one year are met after Hudson Avenue is assumed to be removed. Table 3-5 indicates that the annual LOLE is 0.943 days per year that steam capacity could not serve load.
Table 3 - 5. Steam System Capacity: Load and Reserve

<table>
<thead>
<tr>
<th>Capacity with seasonal outages &amp; deratings</th>
<th>Maintenance at time (week) of peak</th>
<th>Peak 9,300 Mlb/hr</th>
<th>Current Reserve less seasonal &amp; nitte &amp; peak</th>
<th>Reserve (less HA)</th>
<th>LOLE</th>
<th>days per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan 13,272</td>
<td>0</td>
<td>9.800</td>
<td>3.472</td>
<td>1.872</td>
<td>0.195</td>
<td></td>
</tr>
<tr>
<td>Feb 13,272</td>
<td>0</td>
<td>8.531</td>
<td>4.741</td>
<td>3.741</td>
<td>0.028</td>
<td></td>
</tr>
<tr>
<td>Mar 13,272</td>
<td>0</td>
<td>8.668</td>
<td>4.614</td>
<td>3.014</td>
<td>0.062</td>
<td></td>
</tr>
<tr>
<td>Apr 13,051</td>
<td>3.798 wk 2</td>
<td>6.979</td>
<td>2.274</td>
<td>6.74</td>
<td>0.395</td>
<td></td>
</tr>
<tr>
<td>May 11,651</td>
<td>2.668 wk 5</td>
<td>3.735</td>
<td>5.448</td>
<td>3.848</td>
<td>0.065</td>
<td></td>
</tr>
<tr>
<td>Jun 9,413</td>
<td>0</td>
<td>5.350</td>
<td>4.063</td>
<td>2.463</td>
<td>0.012</td>
<td></td>
</tr>
<tr>
<td>Jul 9,413</td>
<td>0</td>
<td>5.350</td>
<td>4.063</td>
<td>2.463</td>
<td>0.014</td>
<td></td>
</tr>
<tr>
<td>Aug 9,413</td>
<td>0</td>
<td>5.350</td>
<td>4.063</td>
<td>2.463</td>
<td>0.027</td>
<td></td>
</tr>
<tr>
<td>Sep 11,651</td>
<td>2.398 wk 2</td>
<td>5.350</td>
<td>3.903</td>
<td>2.303</td>
<td>0.007</td>
<td></td>
</tr>
<tr>
<td>Oct 13,051</td>
<td>5.479 wk 3</td>
<td>5.200</td>
<td>2.372</td>
<td>7.72</td>
<td>0.146</td>
<td></td>
</tr>
<tr>
<td>Nov 13,051</td>
<td>3.712 wk 2</td>
<td>5.967</td>
<td>3.372</td>
<td>1.772</td>
<td>0.048</td>
<td></td>
</tr>
<tr>
<td>Dec 13,272</td>
<td>0</td>
<td>8.123</td>
<td>5.143</td>
<td>3.549</td>
<td>0.064</td>
<td></td>
</tr>
</tbody>
</table>

(1) An alert in the MARS program is indicated when operating reserve is used to meet the demand for the peak hour of the day.

**Hydraulic and Contingency Analyses**

In order to be in line with Steam’s Design Criteria of an LOLE less than 1, a reserve margin equal to loss the of the largest unit, ER 1/10 or ER 2/20, is necessary. Each of these Units is rated at about 1,600 Mlb/hr, and this amount is Steam’s Design Reserve Margin.

Hydraulic studies are conducted utilizing the STONER Model for analysis of pressure and flow and the Contingency Model is utilized for pressure decay analysis when examining different system scenarios. The STONER Model analyzes steady state pressure and flow conditions on the Steam System. The Contingency Model is used to determine the transient effect between the “before” and “after” cases simulated by STONER. These engineering tools will be applied as opportunities arise and Steam will monitor the peak demand to determine if any capacity can be retired going forward.

**Design Criteria**

- The Steam System Design Criteria is as it pertains to production is as follows: N-1, Loss of the largest Unit (ER Unit 1/10 or 2/20)
- Continuous Service; supplied at an average gage pressure in excess of 125 pounds
- LOLE < 1, Supply cannot meet demand for 1 day in 1 year, which is equated to 24 hours of pressure below 125 psig in a 1 year period
• 1 in 3 chance of Design Weather, 30 year temperature look back with the Design Temperature Variable occurring between the 10th and 11th year.

3.3.6 Long-Term Initiatives

While longer term initiatives (2020-2031) are less definite, the Plan Case includes a capital plan as well the exploration of several new programs.

  Ongoing Equipment Repair and Replacement

The Company expects it will continue to be cost-effective to operate existing plants relative to the cost of building new capacity. The capital requirement forecast for maintaining the existing plants is based on anticipated major overhauls and recurring equipment repairs and replacements based on historic expenditures.

The electric generating units, East River Units 1, 2, 6, and 7 require periodic turbine/generator overhauls every 5 to 7 years depending upon their operating hours and number of starts and stops. During these overhauls, the subject equipment will be opened up and inspections and repairs will be performed on all components to ensure reliable performance until the next scheduled major overhaul.

Certain equipment such as boiler components, pumps, deaerators, air heaters, heat exchangers (feedwater heaters, condenser tubing, fuel oil heaters, waste heat recovery systems, lubricating oil coolers, etc), electrical controls and other auxiliary equipment experience service induced degradation and may need replacements during the plan periods. Specific equipment replacements will be determined based on inspections, however the plan provides for forecasted expenditures for such replacements based on historic replacement frequencies.

Corrosion related failures of plant equipment and distribution piping remains a challenge. A recent change in the City water supply to the plants needed additional resources for water treatment in the generation stations. Water treatment and chemical systems upgrades will continue at various units during the plan period.

Con Edison expects long term capital requirements for operating the plants to change in the future based on several factors. These include age of the boilers/equipment, operating conditions, peak load, overall demand/dispatch, material costs, environmental regulations, governmental regulations, and other outside factors. The Company will continue to be cost effective in its operation and maintenance of its existing equipment/plants.
Joint Proposal Studies Summary

The 2010 Steam Rate Order required Consolidated Edison Company of New York, Inc. ("Con Edison" or the "Company") to prepare four (4) individual studies related to the steam system. The following is a list and brief description of the Joint Proposal studies completed and filed by the Company:

- Study #1 - Assessment of the End to End Efficiency of the Steam System
- Study #2 - Assessment of the Long Range Incremental Costs of Steam Service Over the Horizon of the Steam Long Range Plan, Including Production Costs
- Study #3 - Identification of Potential Measures to Balance Load and Supply, Including Rate Incentives to Attract, Limit and Reduce Steam Load, as the Case May Be an Assessment of the Costs and Benefits of Alternatives to Steam Supply
- Study #4 - Assessment of the Costs and Benefits of Alternatives to Steam Supply

These studies were officially filed on May 2nd, 2011 with the PSC. A brief description of each study and their associated conclusions can be found below.

Joint Proposal Study #1

The 2010 Steam Rate Order required Consolidated Edison Company of New York, Inc. ("Con Edison" or the "Company") to assess the end to end efficiency of the steam system ("Study #1"). Accordingly, pursuant to the requirements of the 2010 Steam Rate Order, the Company provides the results of this study as well as offers additional information relative to alternatives to Con Edison steam.

As part of this effort, the Company performed the following analyses and review:

1. The actual 2010 end to end efficiency of the Con Edison steam system.
2. The forecasted 2015 end to end efficiency of the Con Edison steam system.
3. The manufacturer efficiency ranges of different types of combined heat and power (cogeneration or "CHP") technologies and boiler-only technologies that a customer can install in its building in lieu of using Con Edison steam.
4. The energy use efficiency of the different types of combined heat and power technologies and boiler-only technologies installed in a proxy Manhattan commercial customer's building, in lieu of Con Edison steam.
5. The estimated efficiency of a district energy system constructed in Manhattan.

End to end efficiency is defined as the total amount of energy used (electrical and thermal) by a customer divided by the total fuel input. Only the electric energy used by the customer that was produced by steam system cogeneration (for the steam end to end efficiency calculation) and the electric energy produced by the customer-sited sources were accounted for in these end to end efficiency assessments.

One assumption that was common for all of the foregoing cases was that there were no building equipment heat losses, or in other words the building’s equipment utilizing steam was 100% efficient. This was assumed because every building is different and there were too many different types of equipment configurations that could be possible. The following tables summarize the findings of this
study. Figure 1 shows the end to end efficiency of the Con Edison steam system for 2010 and 2015. Figure 2 shows the end to end efficiency of various district energy system options. Figure 3 shows the efficiency of various types of manufacturers’ equipment that could be used by a customer. Figure 4 shows the end to end efficiency of a proxy customer’s building based on the type of equipment used to provide energy to that building.

**Figure 1 - Steam System End to End Efficiency Results**

<table>
<thead>
<tr>
<th>Steam System</th>
<th>Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010 Con Edison Steam System</td>
<td>60%</td>
</tr>
<tr>
<td>2010 Con Edison Steam System – Winter</td>
<td>62%</td>
</tr>
<tr>
<td>2010 Con Edison Steam System – Summer</td>
<td>57%</td>
</tr>
<tr>
<td>2015 Con Edison Steam System</td>
<td>60%</td>
</tr>
<tr>
<td>2015 Con Edison Steam System – Winter</td>
<td>63%</td>
</tr>
<tr>
<td>2015 Con Edison Steam System – Summer</td>
<td>57%</td>
</tr>
</tbody>
</table>

**Figure 2 - District Energy System End to End Efficiency**

<table>
<thead>
<tr>
<th>District System Type</th>
<th>Chilled Water</th>
<th>Hot Water</th>
<th>Combined Chilled and Hot Water</th>
<th>Combined Chilled and Hot Water with Cogeneration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calculated End to End Efficiency</td>
<td>72%</td>
<td>68%</td>
<td>70%</td>
<td>74%</td>
</tr>
</tbody>
</table>

**Figure 3 - Efficiency Range (Manufacturers’ Ideal Ratings)**

<table>
<thead>
<tr>
<th>Technology</th>
<th>Minimum Efficiency</th>
<th>Maximum Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas Turbine w/o duct firing</td>
<td>21%</td>
<td>79%</td>
</tr>
<tr>
<td>Gas Turbine with duct firing</td>
<td>21%</td>
<td>95%</td>
</tr>
<tr>
<td>Reciprocating Engine</td>
<td>34%</td>
<td>59%</td>
</tr>
<tr>
<td>Microturbine</td>
<td>26%</td>
<td>64%</td>
</tr>
<tr>
<td>Fuel Cell</td>
<td>36%</td>
<td>81%</td>
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<tr>
<td>Steam Boiler</td>
<td>79%</td>
<td>79%</td>
</tr>
<tr>
<td>Hydronic Boiler</td>
<td>82%</td>
<td>82%</td>
</tr>
<tr>
<td>Electric Resistance Heating</td>
<td>35%</td>
<td>35%</td>
</tr>
</tbody>
</table>
**Figure 4 - Proxy Customer End to End Efficiency**

<table>
<thead>
<tr>
<th>Technology</th>
<th>Annual Operation Building Efficiency</th>
<th>Seasonal Operation Building Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas Turbine with duct firing</td>
<td>37%</td>
<td>67%</td>
</tr>
<tr>
<td>Reciprocating Engine</td>
<td>46%</td>
<td>73%</td>
</tr>
<tr>
<td>Microturbine</td>
<td>56%</td>
<td>63%</td>
</tr>
<tr>
<td>Fuel Cell</td>
<td>63%</td>
<td>73%</td>
</tr>
<tr>
<td>Steam Boiler</td>
<td>79%</td>
<td>N/A</td>
</tr>
<tr>
<td>Hydronic Boiler</td>
<td>82%</td>
<td>N/A</td>
</tr>
<tr>
<td>Electric Resistance Heating</td>
<td>35%</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Figure 5 illustrates how the efficiencies of various types of technologies compare with the Con Edison steam system. Except for the Con Edison steam system, the Technology Efficiencies within are not reduced for aging, fouling, blowdown, any condensate losses, leaks, meter error, unit cycling, or start up fuel.

The end to end efficiency of the Con Edison steam system was 60% annually ranging from 57% in the summer to 62% in the winter and compared favorably with many of the alternative technologies. Since Con Edison is, in effect, a large distributed generator, its equipment sees high thermal and electrical
loads throughout the year and can operate at higher efficiencies more often than most of the alternate technologies that a single supplier can use in trying to meet its electrical and thermal needs. Moreover, as the graph above shows, if the thermal loads are not being fully utilized, the efficiencies for all the technologies except the Con Edison steam system and boilers can be low depending on the building load factor and equipment sizing. Conversely, if a building or hospital complex has a high electric and thermal load factor, it will realize higher efficiencies. One size does not fit all when it comes to customer-sited steam and cogeneration choices. Moreover, there are factors other than energy efficiency that should be considered in evaluating whether to utilize Con Edison Steam or whether to go with customer-sited boilers or some form of CHP. If a customer decides to exit the steam system, that customer will need to invest significant capital in a new system and will incur annual fuel, maintenance, and incremental property taxes. Based on the findings of Joint Proposal Study # 4, Assessment of the Costs and Benefits of Alternatives to Steam Supply, various first and annual costs associated with the installation of new alternative energy sources may preclude the customer from realizing an acceptable payback period.

It is concluded that the efficiency of various combined heat and power technologies was greatly dependent on the operation schedule and load profile for a particular customer. Based on this conclusion it was determined that to achieve efficiencies higher than the overall efficiency of the steam system, customers would be required to size their system to the service the thermal baseload of the property. With this sizing criterion, a customer would be required to produce or purchase additional steam and/or electric during non-baseload peaking periods. Moreover, it was found that if customers decided to leave the steam system and install one of the potential alternate technologies, the overall environment would see an increase in three out of five emissions compounds (Nitrogen Oxide, Carbon Monoxide, Carbon Dioxide) examined.

*Joint Proposal Study # 2*

The 2010 Steam Rate Order required Consolidated Edison Company of New York, Inc. (“Con Edison” or the “Company”) to assess the long range incremental costs of steam service over the horizon of the steam long range plan, including production costs (“Study #2”). Accordingly, pursuant to the requirements of the 2010 Steam Rate Order, the Company provides the results of this study as well as offers additional information relative to alternatives to Con Edison steam.

The Company performed an update to the Steam Long Range Plan’s capital cost estimates and revenue requirement for the period 2011-2031 and determined the associated bill impacts for large commercial steam customers. The overall 20-year customer bill impact has a Compounded Annual Growth Rate (“CAGR”) of 0.96%, which is less than the projected rate of inflation over that time period. Steam Operations continues to look for ways to reduce customer costs through operational excellence, fuel management, and its cost management program. This has been exemplified in the recent shutdown of the boilers at Hudson Avenue, the change in the system operating criteria, and the plan for gas additions at the 59th Street and 74th Street Generating Stations. The Steam Long Range Plan and the integrated planning of electric, gas, and steam will help to reduce customers’ bills and provide the best energy choice and service to New York City.
Joint Proposal Study #3

The 2010 Steam Rate Order required Consolidated Edison Company of New York, Inc. ("Con Edison" or the "Company") to identify potential measures to balance load and supply, including rate incentives to attract, limit and reduce steam load, ("Study #3"). Accordingly, pursuant to the requirements of the 2010 Steam Rate Order, the Company provides the results of this study as well as offers additional information relative to alternatives to Con Edison steam.

The Steam Peak Reduction Collaborative ("SPRC") Report, which was filed with the Commission on April 11, 2011, provided several in depth reviews and assessments of potential tools to balance steam load and supply.

In addition to the assessments that were part of the SPRC Report, Study #3 considered eliminating particular steam customers and retiring the steam supply associated with those customers. In the assessment, pursuant to consultation with Staff, the approach that was taken was to utilize the results from Joint Proposal Study, "Assessment of the Benefits and Costs for Alternatives to the Steam System", ("Study #4") and determine if "forced migration" of steam customers is a cost effective means of reducing the steam peak. The Company has recently updated this analysis based on the latest unit ratings, peak demand forecast, and operating criteria. For purposes of the analysis, the Company sought to determine the number of customers that would need to migrate to an alternative energy source in order to reduce the steam peak by approximately 300 to 400 Mlb/hr (from 9,620 Mlb/hr to approximately 9,300 Mlb/hr), which is an amount that might enable the Company to retire the Ravenswood A-House Steam Plant using the current operating criteria.

It is important to note that the analysis did not consider the significant legal issues raised by a forced migration scenario (e.g., what legal authority may be needed if any; the estimated time frame for obtaining such authority; the likelihood of protests/legal challenges by affected customers; and the estimated time frame for implementing such authority).

The SPRC and its recommendations provide several in depth reviews and assessments of potential tools which can be used to balance steam load and supply. This study provides information on various scenarios where a significant number of customers are forced off the Con Edison steam system in an amount that could enable the Company to retire the Ravenswood A-House Steam Plant. The study shows that there will be an increase in steam prices to remaining customers. The study also shows that there is a significant cost associated with forced migration of steam customers that if paid by remaining steam customers, would raise steam rates significantly for the remaining customers. That is, having the remaining steam customers pay to move these customers to an alternative energy source (gas), there would be a rate shock to the remaining steam customers. This was because the marginal generating asset that was retired had low avoided costs but the reduction in customer base and sales was significant enough to produce a shortfall of revenues above those avoided in costs. It should be noted that this analysis does not consider the potential for these remaining customers to subsequently leave the steam system as a result of increased steam rates. This study also did not consider the adverse impact of forced migrations of customers off of the system on the steam system minimum load.
Moreover, as shown in Study #4, it does not make economic sense for certain customers to voluntarily exit the steam system. This is because the annual energy savings that these customers may realize from switching to an onsite system will not be sufficient to recoup the cost of installing such systems over a reasonable payback period. Thus, the only way for customers to leave the system would be if they were forced off the system and had the costs of their new onsite systems subsidized by remaining customers. However, as indicated above, paying for this subsidy would add significant costs to the bills of the remaining steam customers, which could ultimately force additional customers off of the steam system.

**Joint Proposal Study # 4**

The 2010 Steam Rate Order required Consolidated Edison Company of New York, Inc. (“Con Edison” or the “Company”) to prepare an assessment of the benefits and costs for alternatives to the steam system (“Study # 4). These alternatives include on-site steam boilers, on-site condensing hot water boilers, electric resistance radiant heating, electric driven centrifugal chillers, and various combined heat and power (“CHP”) systems. A number of CHP technologies were examined in this assessment. They include natural gas fired turbines with boiler back-up, natural gas fired reciprocating engines with boiler back-up, and natural gas fired microturbines with boiler back-up. The Company provides the results of this assessment herein as well as offers additional information relative to alternatives to Con Edison steam.

To perform this assessment, Staff asked the Company to create and use six proxy customers to represent the different steam service classifications. These proxy customer parameters were based on actual data on existing or previous steam customers. With these six proxy customers, a total of twelve unique customer scenarios were examined and analyzed. For each customer scenario, the total first cost of the replacement system and applicable annual costs were calculated and reviewed. These data were then processed using a comparative life cycle cost analysis (“LCCA”) tool. The overall LCCA compared the cost of remaining on the steam system versus the overall costs for a customer to leave the system and operate an on-site plant. The total costs to the Company associated with the proxy customer leaving the system were also examined and calculated.

As indicated in the results and conclusion section of this report, the calculated first and annual costs of the replacement systems had a significant impact on the payback period for each proxy customer. The majority of the customer scenarios did not yield a favorable payback period for the customer. Proxy customers C and C1 were the only scenarios examined that yielded a favorable payback period. This was mainly due to the enormous amount of incentives that were applied to these scenarios as well as the limited challenges faced by these proxy customers associated with leaving the steam system.

As shown in these analyses, a customer will incur significant first and annual costs to construct an on-site service plant in lieu of Con Edison steam service and if the cost for this plant is not incentivized, the customer may never experience a payback on its investment. Thus, the Company believes that it is not likely that a customer would voluntarily choose to leave the Company’s steam system without significant incentives.
**CHP Strategy**

New York State and the City of New York have both recognized the need to improve air quality and reduce the economic risk of high energy prices on the City’s economy. Development of customer-sited CHP plants in New York City’s largest buildings is perceived to be essential to meet the PlaNYC CHP goal of adding 800 MW of CHP production capacity by 2030. As a result, NYSERDA currently offers significant incentives for customer-sited CHP and has yet to consider Con Edison supplied CHP.

There are some drawbacks to CHP, such as backup fuel source requirements, local emissions, exhaust ducting often creating an adverse impact on the cityscape, less robust system monitoring capabilities, and impact on the gas infrastructure. Based on conclusions drawn from the Joint Proposal studies completed and filed by Con Edison, CHP systems operate at their highest efficiency when they are properly sized for the building which they are serving. If a building with a poor load factor does not utilize the full electrical and thermal production of the CHP system, the efficiency rating of the overall system decreases significantly. For this reason, customers should size their CHP system to accommodate their annual base load requirements.

Based on conclusions drawn from the Joint Proposal Studies completed and filed by Con Edison, there is an increased environmental impact realized for three out of five emissions compounds examined when a customer converts to an on-site CHP system. This is in addition to the potential impact of combined localized emissions throughout the City.

The market potential for CHP in the Steam System footprint is significant. There are numerous sites on the Steam System that have the potential for relatively large CHP installations. These include facilities with large thermal loads and electric loads in excess of 1.5 MW, particularly those adjacent to the Steam and Gas Systems and those in need of renovation or redevelopment. According to the Con Edison DG/CHP Ombudsman, currently there are 5 commercial sites within the steam service territory that could potentially add as much as 42 MW of CHP capacity.

There are currently eleven (11) Steam Customers that are operating CHP facilities accounting for a total steam and electric load offset of approximately 101 Mlb/hr and 20.9 MW, respectively. Steam Business Development actively monitors the status of CHP projects in the steam territory and there are currently 25 additional potential CHP projects that are under study or design by Steam Customers. The total load offset potential is estimated to be 200 Mlb/hr of steam load and 54 MW of electric delivery and supply.

In order to explore the technical and operating feasibility of procuring supply from customer-sited CHP, the Company plans to conduct a pilot project. The pilot will serve to test the reliability, pressure, and steam quality impact of steam feedback into the distribution system. It will serve to help Con Edison develop the control and dispatch technology and protocols to ensure steam is dispatched at the right place at the right time with minimal impact to the system.

In addition to the pilot, the Company will conduct additional research to gain further understanding of the following complexities of relying on distributed resources:
How reliable are customers and/or equipment manufactures in delivering contracted supply at the right time? How much back-up capacity must Con Edison maintain to ensure no disruption on service?

What are the implications of relying on non Con Edison personnel for equipment maintenance? Should the Company enter into alternative ownership models or maintenance contracts to ensure CHP plants are operated and maintained appropriately?

What are the implications to customer-sited suppliers if Con Edison needs to shut down sections of the distribution system to conduct maintenance?

Ultimately the mix of customer-sited CHP in the supply portfolio will be determined based on what is the lowest cost for customers without compromising reliability or safety. If CHP becomes more widespread, the Company aims to opportunistically integrate distributed supply options into the system if there is a need and when it makes sense technically and economically.

**District Cooling**

District Cooling is an emerging model to utilize summer capacity. It has been evaluated in the past and deemed infeasible under a regulated business model, particularly because of the expense of adding new pipes to the distribution system. If the right circumstance presents itself the Company would consider evaluating the business model again.

As building envelopes improve and buildings experience greater internal heat generation from computers, lights, and people, cooling capability is now often a 12-month requirement. As a result, the heating market is declining relative to the cooling market in many urban areas, particularly in commercial office buildings. This phenomenon has stimulated many district energy companies to expand into district cooling.

Several district energy systems produce and circulate both hot and chilled water. On the chilled water side, this value proposition eliminates on-site equipment ownership and operating costs and has the ease-of-use advantages of steam heating. District cooling is still a modest factor in the overall energy market. However, it is growing rapidly. The installed cooling capacity in North American cities is 875,000 tons. Campuses, military bases and hospital complexes have 960,000 tons installed and there are known plans to add 110,000 tons in the next 3-5 years. Some notable chilled water systems include Chicago, Toronto, Indianapolis, Denver, Baltimore, and Washington DC. Many of these systems were developed to augment existing Steam Systems, capture summer revenue and margins, and respond to market demands.

Many regulated and unregulated district energy companies have developed district cooling systems to supplement their base heating businesses. The business development and public policy attractions of district cooling include:

- A competitive cooling product that does not require an on-site chiller offered by Steam Systems to offset the cost disadvantage of steam turbine chillers.
- A low first cost, low maintenance option for cooling customers with the plug-and-play features of steam heat.
- Increased steam capacity utilization and, hence, lower average fixed costs for all customers.
- An alternative to high cost new electricity capacity to meet summer cooling loads.
- A new revenue source to offset the declining need for heat in new buildings with high internal heat generation.

It is very expensive to extend steam lines. Most of these line costs reflect the higher construction costs associated with steam lines, which must be insulated, set into channels, and encased in four-foot-by-four-foot concrete jackets to withstand traffic disturbances. In addition, the line extension cost reflects the difficulty of adding new lines to the dense network of pipes and conduit under the streets of New York City, which, has been a factor in utility construction for many years. While New York City does face extraordinary underground congestion, high construction costs, and dense urban markets that make any sort of expansion expensive, these conditions are not unknown in other major cities where cooling systems have been developed.

Based on the foregoing, Con Edison will not purposefully pursue local district cooling systems in the New York City area but will consider future potential opportunities as they arise.

In addition to district cooling for customers, Con Edison has also been reviewing the potential to provide steam powered cooling for various electrical equipment to assist in projected electric load relief efforts. This concept has been reviewed and has been deemed to be a feasible alternative when compared to electric infrastructure upgrades. No installations have been approved but the group will continue to evaluate each occurrence to determine if this strategy might be the most cost effective.

### 3.3.7 Signposts for Managing Production Capacity

Con Edison plans the production resource investments necessary to meet the Plan Case demand forecast. Due to the new High Demand schedule, the Company eliminated any possibility of re-powering Hudson Avenue and actually determined the system can be maintained without Hudson Avenue, thus shutting it down.

If demand underperforms against the plan case forecast, tracking closer to the Low Case forecast, the Company expects that Ravenswood, East River South Steam Station, and 60th Street could also be sequentially removed from service over the 20-year period.

Figure 3-3 illustrates the impact on Rate Base of from the High, Low, and Plan Cases. The Plan and High cases have equivalent capital spending and Rate Bases due to the close proximity of the demand estimates. The Low Case looks at the potential of closing Ravenswood, followed by East River South Steam, and finally 60th Street, resulting in a slightly lower rate base in the outer years.
Figure 3-4 highlights the correlating total system revenue requirements for these cases. The figure shows the Low Case and the benefits of the rate base removals noted above.
3.4 BILL IMPACT ANALYSIS

Revenue requirements drive customer bill rates and are consequently a crucial control mechanism for evaluating cost commitments in operating and maintaining the Steam System. Depending upon the costs of projects in each forecast scenario and their associated allocations to expenses or capital and the sources of offsetting revenues, the resulting impact on a customer’s bill will vary. In the early period of the SLRP the bill will increase as historical costs of service and improvements, as presented in the Rate Case, are recovered. Concurrently, the efforts described within the SLRP, as the Plan and High Cases, will provide for rate changes to level off after 2014. This result meets the Company’s primary objective in the SLRP to balance customer service expectations with service provided at competitive rates. The Low Case represents the savings customers will see from retiring Ravenswood, East River South, and 60th Street.
The Figure 3-6 portrays how the composition (delivery, supply, and taxes) and value of an example customer’s bill is expected to appear in 2031 as the result of the Plan Case. The example uses a Large Commercial customer that receives bills under a demand rate structure (SC2 Rate II). A breakdown of the major components is as follows:

Delivery - Steam Production and Steam Distribution Capital, O&M, and Property Taxes.

Supply - Commodity Costs for fuel, purchased steam, and East River Units 1&2 CT fuel shift from electric to steam.


In total, the example customer’s bill will increase at a rate of 0.1% CAGR which is a typical SC-2 customer. A primary objective of the SLRP is to continue to provide reliable service at a competitive rate and the Plan Case accomplishes this by supplying and delivering steam at near current rates. The components of Delivery and Supply at a CAGR of 0.5% and 0.2% respectively and this reflects the planned efforts to reduce overall installed capacity, add dual-fuel capacity to existing Generating Stations, and the resulting benefits of ongoing modernization and enhancement work.
3.5 ENVIRONMENTAL SUSTAINABILITY INITIATIVES

Con Edison has a long standing commitment to protect the environment. The Company’s Environmental Sustainability Strategy is a plan to reduce the Company’s environmental impact, encourage and assist customers in managing energy use, build partnerships with stakeholders to support the Company’s vision, and develop infrastructure for clean energy alternatives. Long-term objectives of this strategy include: integrating more sustainable choices in the Company’s decision making, enhancing the Company’s role in policymaking, and improving stakeholder relations. This strategy is constructed of six key principles incorporating environmental, social, and financial considerations:

- Model green behavior internally
- Promote green behavior to external stakeholders
- Innovate to meet customer preferences for a greener lifestyle
- Partner with government to shape policies and standards consistent with sustainability vision
- Develop infrastructure to advance the use and delivery of value-creating clean energy alternatives
- Incorporate environmental and societal value into decision making
The Steam System has specific sustainability initiatives and targets, outlined below, relevant to the first principle.

- Focus on the use of cleaner fuels at steam plants while maintaining system reliability and affordability
  - **Goal:** Achieve 95% natural gas fuel burn at steam generating facilities
  - **Benefits:**
    - Reduction in GHG emissions
    - Emission reductions in NO\textsubscript{x}, SO\textsubscript{2}, and PM
    - Operational cost savings through greater use of natural gas
4.0 MANAGING THE CUSTOMER BASE AND PROVIDING ADDITIONAL CUSTOMER VALUE

4.1 OVERVIEW OF THE CUSTOMER STRATEGY

The Con Edison Steam System serves 1,735 (2011 Actual) customers ranging from single-family brownstones to hospital complexes comprised of multiple buildings. Customer accounts are fairly evenly distributed across three tariff classes; General Service (SC-1) which comprises small commercial and residential properties; Annual Power (SC-2) which primarily consists of large commercial buildings; and Apartment (SC-3) for large multi-family facilities.

Con Edison’s customer strategy has two primary components. The first component is to strategically manage the customer base so that each customer is making as positive a contribution to the system as possible recognizing one benefit of a district system is its ability to accommodate less optimal customers. This may require changes to the rate structure so that customers with low load factors contribute to their fair share to the system revenue requirements. It may also require the Company to modify its service offering to better load factor customers to align their view of cost vs. service in order to compete with market alternatives and keep the system working as a complete district. This specifically applies to the addition of new customers that should be brought into the system under a structure that ensures positive contribution to the system. To accomplish this, a “Collaborative” was initiated with participants from the PSC, the counties of New York and Westchester, and representatives for the customer base in an effort to devise the changes and programs that would be most successful. The collaborative focused on peak demand management.

The second component is to provide additional value to customers. This will come in the form of deeper customer relationships, expanded demand side management initiatives to help customers with their environmental footprint and mitigate bill increases, restoration of financial incentives to make steam competitive with alternatives, and pursuit of LEED certification for Steam. In addition, customer-sited CHP may open up the opportunity for Con Edison to work with customers to provide additional services to the entire customer base.

By promoting stronger customer relationships, Con Edison believes that it can mitigate the risk of losing customers and can capture new strategic customer accounts.

4.2 MANAGING THE CUSTOMER BASE

The Steam Business Development (SBD) team’s work during the past six years has helped identify customers that are likely to make a positive contribution to the Steam System. These types of customers generally have the following characteristics:

- High load factors since customers with low load factors require that Con Edison maintain expensive capacity for that customer even if that capacity is only used intermittently
- Year-round steam needs, such as steam powered cooling systems, to utilize available capacity during off-peak periods
Located near existing service lines that have available capacity, such as in Midtown
- Pay rates that are commensurate with the peak demand they create
- Likely to remain on the system for a long period of time either because their switching costs are high or they value the service for all of its benefits

These factors retain their merit when evaluating new customers prior to extending steam service.

### 4.3 CHANGES TO THE TARIFF STRUCTURE

While not all customers are an ideal match with the Steam System, changes to the tariff structure can help influence the types of customers that decide to join or stay on the system. Adjusting the demand portion of the customer bill or expanding the eligibility of customers to receive demand billing is an important tool in encouraging customers to reduce their peak usage, which in turn will avoid investments by the Company in additional supply capacity.

Commencing in the winter of 2010/2011, demand billing was extended to all customers with an annual usage greater than 14,000 Mlb.

The current rate structure for demand billed customers applicable to the winter peak period reflects: (1) on-peak and all-time peak demand charges stated on a $ per Mlb/hr basis; (2) energy charges stated on a $ per Mlb basis; and (3) a monthly customer charge. The on-peak demand rate is applied to demands recorded during the on-peak period (Monday-Friday) from 6 a.m. to 11 a.m. during the winter peak period. The all-time peak rate is applied to demands recorded for all hours and all days during the winter peak period. Demand rates recover about 25 percent of winter peak period pure base revenues that would otherwise be collected from these customers during the winter peak period at current rates. The demand charge for the “on-peak” period is designed to recover 90 percent of the demand revenue requirement (i.e., 90 percent of 25 percent of winter peak period pure base revenues) and the demand charge for the “all hours – all days” period is set to recover the balance (i.e., 10 percent of 25 percent of winter peak period pure base revenues). The balance of the winter peak period pure base revenue requirement (including the station electric usage charges) is recovered through usage charges and a customer charge.

**Rate Comparison**

In order to assess the customer bill impacts of implementing higher demand rates, the SC-2 and SC-3 demand rates to become effective October 1, 2011 were redesigned to reflect recovery of 50 percent of winter peak period pure base revenues through the on-peak and all-time peak demand rates. In order for this change to be overall revenue neutral, energy usage rates for the winter peak period (December through March) were correspondingly reduced to offset the effect of higher demand rates. There was no change made to customer charges, summer usage charges (May through October) and shoulder period usage charges (April and November).
Bill Impact Analysis

The bill impact analysis showed that one-half of the demand billed customers would experience bill increases assuming no shift in usage patterns while the other one-half would experience bill decreases. On a total bill basis, the bill impacts range between a 4.7% decrease to a 10.3% increase. It should also be noted that SC-2 and SC-3 demand billed customers with load factors greater than the SC-2 or SC-3 demand class average load factors of 31.1 percent and 33.8 percent, respectively, will generally receive bill decreases. On the other hand, customers with load factors less than the class load factors would generally experience bill increases (assuming no shift in usage patterns resulting from customer efforts to manage their peak requirements).

Pursuant to the Commission’s September 22, 2010 Order Establishing Three-Year Steam Rate Plan, in Case 09-S-0794 (Attachment 1, p. 38), the Company filed on April 11, 2011, a report on the results of the Steam Peak Reduction Collaborative discussions (the “SPRC report”). As provided in the SPRC report, the Company was to evaluate the bill impact of redesigning the October 1, 2011 SC-2 and SC-3 demand rates to increase the amount of winter peak period pure base revenues recovered through demand rates from 25 percent to up to 50 percent.

As explained in the SPRC report, demand billing was implemented for SC-2 and SC-3 customers with annual usage equal to or greater than 22,000 Mlb commencing with the 2007-2008 winter peak period. The threshold for demand billing was then reduced to 14,000 Mlb commencing with 2010-2011 winter peak period.

As noted in the SPRC report, we agree that any proposal to change demand rates should consider the loss of lower load factor customers existing the steam system since these are customers who will experience bill increases. The Company does not recommend increasing demand rates at this time.

Recommendation

The Steam Peak Reduction Collaborative (SPRC) was established to examine various ways to manage the Company’s steam system peak in order to avoid or mitigate the need to add new capacity infrastructure and improve the long term viability of the system. Specifically, the SPRC studied the potential ability to manage the Company’s steam system peak through: (1) demand response programs; (2) modification of the Company’s obligation to serve; (3) energy efficiency; and (4) higher demand rates that encourage demand management and improved load factors. The SPRC also studied (5) expansion of steam air-conditioning load to increase off-peak sales and improve system load factor, as a means to lower rates to all customers; and (6) reliance on alternative sources of steam supply (i.e., customer sited combined heat and power supply), as a means to avoid additional investment in production capacity infrastructure.

The Collaborative met on more than twenty occasions through conference calls and meetings. The key participants in the SPRC were the Department of Public Service Staff (“Staff”), New York City Economic Development Corporation (“City”), Consumer Power Advocates (“CPA”), New York Energy Consumers Council (“NYECC”), and the New York State Energy and Research Development Authority (“NYSERDA”).
The SPRC sought to develop an estimate of how much each recommended program/measure could contribute to managing the steam peak, the cost of such program/measure, and a determination of any associated lost revenue. As a result the following pilots and studies were recommended:

- **Customer Sited Supply Pilot Program** (targeted maximum of 50 Mlb/hr) – approved as Rider G to the Steam tariff in December 2011. Up to 5 Customers could participate in the pilot and will be required to produce a minimum of 10,000 lb/hr each and an aggregate maximum of 50,000 lb/hr of steam as well as adhere to the Company’s Operational Requirements for Interconnecting and Supplying Steam and Steam Purchase Specification (see Appendices C and D). Participating customers would be paid for the heat value of the net steam that they sell to the Company at a fixed value of 1,200 Btu/lb multiplied by the NYMEX Henry Hub monthly three day close of natural gas prices plus a delivery basis. The potential for CHP raises issues for the electric and gas systems and is being examined in greater depth through the Company’s integration of its long-range utility plans.

- **The SPRC examined whether to modify the Company’s tariff-based obligation to serve** (e.g., reducing the existing tariff requirement of 250 feet to the statutory requirement of 100 feet). The SPRC determined that reducing the current tariff-based obligation from 250 feet to 100 feet would not have a material impact (if any) in reducing the steam peak. The SPRC then considered whether the pure base revenue test used to evaluate new customer applications for service should be clarified to include costs associated with new generation facilities that may be needed to supply a new customer. While new steam capacity is not needed at this time to serve new customers, if in the future the Company determines that new capacity is needed based on the net effect of lost business and new service requests, the SPRC concluded that incremental production costs need to be considered in the economic test (i.e., new customers will be required to pay a portion of the incremental cost to bring on new capacity). Accordingly, the Company plans to modify its tariff and is evaluating the obligation to serve.

- **With respect to demand billing**, the SPRC agreed that higher demand rates for customers that take service under Steam Service Classifications (“SCs”) 2 and 3 could promote better price signals, encourage demand management and reduce cost subsidies borne by high load factor customers. The SPRC also recognized after a review of information presented at a technical conference with Staff and other Interested Parties, that new demand rates should not be considered until the entering class of Demand Billed customers (14,000 to 22,000 in annual sales) had an opportunity to operate under the existing tariff schedules.

- **The SPRC also reviewed the impact that energy efficiency measures could have on the steam peak.** This review indicated that anticipated cost-effective, customer-initiated and funded energy efficiency measures would reduce the steam peak by 300 Mlb/hr - 400 Mlb/hr over the next eight years. The Company has embarked on a study to determine the value of establishing a steam energy efficiency program. Staff is involved with this ongoing assessment.

- **The SPRC reviewed the value of steam air conditioning ("AC") to the electric system.** The Company’s analysis originally showed that, on a network by network basis, over a 20-year period, steam AC avoids approximately $178 to $286 million dollars in additional transmission and
distribution capital expenditures. Moreover, an average increase in electric commodity costs of approximately $30 million dollars per year would be absorbed by Con Edison electrical customers. Further analysis has been performed and as such, the Company is working with Staff and NYSERDA to obtain Commission recognition for the load relief that steam air conditioning provides to the Manhattan Electric networks and infrastructure. Such recognition should help address the public policy implications of providing economic incentives to convert electric driven chillers to steam driven chillers. Such recognition could also help address the costs and benefits of encouraging increased use of steam air conditioning. Goals of this initiative include, but are not be limited to:

1. Securing incentives for Steam AC

2. Obtaining Commission recognition of Steam AC as a means for achieving Electric DSM (e.g., through appropriate cost allocation)

3. Establishing a mechanism to fund Steam AC projects where there is a demonstrated electric infrastructure savings

4. Working with NYSERDA to re-establish Steam AC incentives

Steam Air Conditioning

The Consolidated Edison Steam System, services 1,735 (2011 actual) customers throughout the borough of Manhattan. The majority of customers utilize this service to meet their heating and domestic hot water requirements however there are 308 customers that also use the service to produce chilled water via steam cooling. These customers contribute the following:

- Summer steam peak load – 2,610 Mlb per hour
- Summer steam sales – 3,357,812 Mlb
- Summer steam revenue – $34,008,194 per year
- Equivalent installed electrical capacity – 361.6 MW
- Equivalent estimated electrical capacity coincident load relief – 304 MW

Due to a number of factors, an increase in steam to electric AC conversions has been observed in recent years. Since 2001, the Con Edison steam system has lost 78 steam AC customers. This customer loss equates to approximately 84 MW of load equivalent coincident electrical load transferred to the electrical system. This local trend can be contributed to a combination of the following drivers:

- Electric chiller equipment efficiency
- Advances of electric motor technology
- Energy rates
- Chiller equipment size and installation expenses
- Availability of equipment
- Cost of equipment
• Poor maintenance of steam equipment

When speaking to various manufacturers, it appears that this trend is prevalent throughout the industry. In a response to this industry trend, many manufacturers have discontinued their steam driven chiller products. Johnson Controls and Thermax are the two largest chiller manufacturers that still provide and promote steam driven cooling equipment in the New York City market.

Based on the projected natural attrition of steam AC customers, it has been determined that approximately 189 MW of equivalent coincident electrical load will be transferred to the electrical infrastructure over the next 20 years. Of this projected load transfer, approximately 42.1 MW is associated with electrical networks that will have a direct impact on the construction of the proposed York substation. Furthermore, a 39.9% loss of steam customer summer sales is expected as well. It should be noted that this forecast is a snap shot of the current market trend and does not take into account changes in energy rates, technology, etc. This information has been incorporated into the 20 year forecast for various departments including electric distribution engineering, steam operations, steam forecasting, and resource planning. The electrical distribution engineering group has reviewed the projected forecast and has incorporated an additional 109 MW of converted steam AC load over the next 10 years. The projected natural attrition of steam AC customers will continue to be tracked and updated on an annual basis for incorporation into the planning efforts for the previously listed departments.

Due to the various reasons described above, it is predicted that overtime nearly of the existing steam AC customers will eventually convert to electric powered chiller equipment unless significant changes in energy rates, technology, or equipment costs are implemented. The Steam Business Development department is currently developing an internal study that will examine the impacts to steam distribution and production related to this natural attrition forecast. This study will examine the impacts on the existing infrastructure as well as the steam customer base. Various tools are being investigated to alleviate the impact on steam and electric customers. One proposed tool is a potential steam AC preservation incentive funded through the targeted direct site management program. This potential incentive is still in the preliminary stages of completion but will assist in the preservation of steam AC customers as well as management of this eventual load transfer.

Utilizing Steam AC to defer electric load relief projects has enabled Con Edison Steam and Electric to integrate and provide customers with the best possible information to make an informed decision on their energy choice for cooling. As such, we have launched a new “Stick with Steam” program, which incentivizes customers to stay with steam air-conditioning. The energy efficiency efforts we have taken to reduce electric demands include:

• Improved lighting efficiency to reduce cooling requirements
• HVAC systems that allow for the conditions of the inside air to be controlled for human comfort all the time based on a number of factors that fluctuate with building conditions

Our “Stick with Steam” program intends to limit overall cost increases and reduce the need to for near-term upgrades to strained electrical networks in Manhattan by incentivizing customers whose equipment is approaching end of useful life to stay with steam air conditioning.
Under the program, Con Edison would fund incentives to cover some or all of the upfront cost of new steam chillers through electric’s targeted DSM program. Installing new steam chillers for some customers would stave off electric growth for the life of the chiller (15-20 years). This program confers other advantages as well:

- Installing new steam chillers now will bridge a gap in the steam system’s evolution over the next 20 years. It will limit cost increases for both steam and electric customers and maintain steam-cooling revenues with minimal fixed costs.

- Maintaining steam-cooling use will mitigate the need for near-term upgrades to strained electric networks in Manhattan.

- Delaying the migration of large amounts of electric cooling demand will give Con Edison time to let other factors play out during this period of major systemic and regulatory change. Potential significant shifts on the horizon include Indian Point relicensing decisions, full adoption of the 3G optimization strategy, and Smart Grid technology rollout.

- Buy-down energy efficiency incentives are less time and labor-intensive than other measures, such as audits and direct installations.

In sum, maintaining the steam system preserves critical fuel diversity in Manhattan. The steam incentive program will allow us to prepare for a more gradual electric demand increase over a longer period of time while preserving the viability of the steam system.

While the “Stick with Steam” program is still in the conceptual stage, the team has developed a draft procedure that outlines the process that would be followed by applicable customers and the program directors:

1. Con Edison develops and promotes the program to Manhattan building consultants, property managers, and customers.

2. Customers apply for a buy-down incentive to purchase a new steam chiller, to replace an existing steam chiller, or to replace an existing electric chiller.

3. Eligibility is limited to customers in networks targeted by Con Edison’s Distribution Engineering group for demand relief in the next ten years.

4. Eligible customers submit the following to Con Edison Steam:
   a. Basic information about the building’s cooling load,
   b. An application detailing the type and size of chiller that they intend to purchase with the buy-down incentive, and
   c. A signed agreement to operate the chiller for its factory-estimated lifetime – subject to penalty for early departure – and to purchase steam service from Con Edison for the life of the chiller.

5. The customer provides Con Edison documentation of the chiller purchase and installation.
6. Con Edison issues a check for the amount of incentive.

7. Con Edison Steam and EE provide project completion information back to Distribution Engineering and Resource Planning.

4.4 FORMING DEEPER CUSTOMER RELATIONSHIPS

Con Edison recognizes that steam is a premium product that has a higher price point than other alternative energy sources. As a component of providing a premium product, the Steam Business places an emphasis on customer service. The creation of the Steam Business Development ("SBD") Group in 2000 was a first step in a plan to counteract market influences on the cost of steam services by actively seeking out new growth opportunities, becoming more proactive with customers, and identifying areas for energy efficiency or demand reduction improvements, amongst other goals. In the past ten years, the primary accomplishment has been a better understanding of customer needs and the strengthening of relationships with customers. Steam continues its customer seminars, where steam safety, equipment maintenance, and energy efficiency is the focus. The department also hosts an annual Fall Customer Seminar whereby many customers, consultants, agencies, and other interested parties have attended. The purpose of this seminar is to communicate Steam’s new programs, analyses, and long range plans. Steam’s customer service and relationships with customers are positive and robust. Steam has been ranked “Best in Class” in several consecutive customer satisfaction surveys. Please refer to Assessment Document D.

4.5 DEMAND SIDE MANAGEMENT

In the steam context, Demand Side Management generally consists of installation of energy efficiency (EE) measures, adoption of conservation strategies, peak demand shifting, and demand response events initiated by the utility. The primary EE measures include improvements to the building envelope, such as the installation of better insulated windows, frequent cleaning of traps, or roof replacements. Conservation strategies may be as simple as turning down the heat or not heating unused floors. Energy Management Control Systems (EMCS) can facilitate conservation efforts by automatically managing the building’s steam use through strategies such as monitoring the temperature on each floor or timing the building’s use of heat to the occupancy levels at various times of the day.

Based on the data presented in Figure 4-1, there is no single conservation measure that is universally adopted. This is partially due to the fact that steam service requires less equipment on the customer site. The most popular actions are improving steam system maintenance, adding pipe insulation, installing low flow showerheads or faucets and installing double pane windows.
The study also looked at uptake potential for conservation measures. For the SC-2 customer class, biannual steam trap replacement, condensate heat recovery, and exterior wall insulation have the highest potential for implementation at SC-2 sites with 51%, 58%, and 49% uptake potential, respectively. Energy Management Control Systems already have a high level of implementation, and only 12% of sites do not have one. Even when these systems are installed, they are often not programmed to shift peak demand to off-peak times.

SC-3 customers have the highest average load factors but there is also significant room to help them improve their efficiency. Within this customer class, only 30% use EMCSs so it has a high level of

6 The market potential study consisted of a statistical sampling of the Con Edison Steam Customer base, including face to face surveys of large customers, mailings and phone interviews.
potential uptake. Biannual steam trap inspections, outdoor temperature reset and Energy Management Systems have uptake potentials of 50%, 47%, and 63% respectively.

**Conservation Efforts**

As mentioned, there is no efficiency measure that would single handedly allow Con Edison to reduce demand across the customer base. Furthermore, the diverse nature of the customer base means that they have varying building footprints, use a wide variety of technologies, and have different levels of capability and economic interests in identifying and managing conservation efforts. A prescriptive conservation program is unlikely to meet the needs of Con Edison’s customers. Instead, the Company envisions a DSM effort that is targeted to very specific customers and tailored to individual customers needs. Initial DSM efforts will likely to focus on the SC-2 and SC-3 customer classes where Con Edison is able to achieve demand reduction at the lowest cost.

Other district energy systems have had a high level of success with customized DSM efforts. As identified during peer interviews, many of these efforts have been similar to Con Edison’s. In the past, the Company has held workshops to teach customers about steam and to share best practices. These have been successful and well attended.

A program focused around the use of Energy Advisors serves some additional benefits. Most notably, it allows Con Edison to form stronger ties with its customers through more frequent contact. Steam service is considered by some to be a premium service with a premium price point so forming and maintaining relationships is essential. Also, customers are actively seeking Con Edison’s guidance in helping them keep their bills from increasing. Steam is a product that may not be as familiar to many building operators and as such, the Company will continue to educate customers on steam best practices as part of its good customer service.

The Company recently contracted a survey of our Customers to establish the viability and possible form of a Steam Energy Efficiency Program. The initial results of the survey data indicate there is a market for steam efficiency, based on the activity of customers who have and have not implemented measures, and more importantly a need for information on steam efficiency measures, as expressed by a majority of surveyed customers.

The evaluation of the survey data is ongoing but initial observations confirm the following:

1. There is a high uptake potential for a number of heating efficiency measures that are common to all three major Service Classifications (SC 1, SC 2, and SC 3).
2. Simple paybacks for measures, based on industry data, are generally below 5 years and a large percentage below 3 years.
### SC1 (Residential and Small Commercial Accounts)

<table>
<thead>
<tr>
<th>Steam Space Heating</th>
<th>Simple Payback Period (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regular inspection &amp; tune-up</td>
<td>0.83</td>
</tr>
<tr>
<td>Outdoor temperature reset</td>
<td>2.36</td>
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<tr>
<td>Thermostatic radiator valves</td>
<td>2.89</td>
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<tr>
<td>Insulation of building envelope</td>
<td>1.06</td>
</tr>
<tr>
<td>Weatherization of building envelope</td>
<td>1.73</td>
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<tr>
<td>Heating setback on thermostat</td>
<td>2.41</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Steam Water Heating</th>
<th>Simple Payback Period (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-flow showerheads/faucets</td>
<td>0.74</td>
</tr>
<tr>
<td>Low water clothes washer</td>
<td>2.07</td>
</tr>
<tr>
<td>Pipe insulation</td>
<td>2.29</td>
</tr>
</tbody>
</table>

### SC2 (Large Commercial Accounts)

<table>
<thead>
<tr>
<th>Steam Space Heating</th>
<th>Simple Payback Period (years)</th>
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</thead>
<tbody>
<tr>
<td>Regular inspection &amp; tune up</td>
<td>0.51</td>
</tr>
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</tr>
<tr>
<td>Thermostatic radiator valves</td>
<td>2.39</td>
</tr>
<tr>
<td>Energy management control system</td>
<td>3.14</td>
</tr>
<tr>
<td>Heating setback on thermostat</td>
<td>2.54</td>
</tr>
<tr>
<td>Weatherization of building envelope</td>
<td>1.45</td>
</tr>
<tr>
<td>Simple Payback Period (years)</td>
<td>Steam Water Heating</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>Pump controller</td>
<td>0.93</td>
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<tr>
<td>Pipe insulation</td>
<td>3.18</td>
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</table>

<table>
<thead>
<tr>
<th>Simple Payback Period (years)</th>
<th>Steam Space Cooling</th>
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<tbody>
<tr>
<td>Upgrade evaporator of turbine chiller</td>
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<tr>
<td>Insulation of building envelope</td>
<td>2.79</td>
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<tr>
<td>Energy management control system</td>
<td>7.59</td>
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<tr>
<td>Weatherization of building envelope</td>
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**SC3 (Apartment and Large Multi-Family Residential Accounts)**

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<tr>
<th>Simple Payback Period (years)</th>
<th>Steam Space Heating</th>
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</thead>
<tbody>
<tr>
<td>Energy management control system</td>
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<tr>
<td>Insulation of building envelope</td>
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<tr>
<td>Heating setback on thermostat</td>
<td>3.54</td>
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<tr>
<td>Weatherization of building envelope</td>
<td>2.46</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Simple Payback Period (years)</th>
<th>Steam Water Heating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-flow showerheads/faucets</td>
<td>0.58</td>
</tr>
<tr>
<td>Low water clothes washer</td>
<td>2.18</td>
</tr>
<tr>
<td>Pump controller</td>
<td>4.26</td>
</tr>
<tr>
<td>Pipe insulation</td>
<td>2.06</td>
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</table>
To achieve the most cost effective implementation of an efficiency program for steam customers neither prescriptive or measure based incentives look appropriate since the hurdle would not seem to be economic based on these payback values. What is expected to be recommended from the study is a program based approach which would enable customers to receive their desired guidance along with targeted incentives for savings based on what would be the appropriate mix of measures for their individual application of steam.

The recommendation will be vetted by the interested parties of the SPRC and Staff for expected implementation in 2013. Estimated impacts on steam sales will be included in the recommendation.

**Demand Response**

Demand Response Pilot Program (target 120 Mlb/hr) – approved as Rider F to the Steam tariff in December 2011. The program consists of two winter and one summer test period with up to five events called for each period. The events would have a duration of 5 hours. The first winter period was only a partial winter and started January 1, 2012. The second winter period will be December 1, 2013 to March 31, 2013. The summer period is from April 1, 2012 to November 30, 2012. Participation criteria was set as up to 12 participating accounts and Demand Response targets of no less than 2 Mlb/hr or more than 10 Mlb/hr load reductions per participant. The program would pay winter period participants an upfront fee of $2,000 along with a performance payment of $40 per 1,000 lb of reduced demand for a period of up to five hours per event. For summer period participants the upfront fee would be $1,000 with the same performance payment. At the recommendation of Staff the performance payment for any event will be paid for performances within 20% plus or minus of the Accounts nominated demand reduction but not outside the 2 and 10 Mlb/hr boundaries. Performance is measured against a forecast based on the accounts 3 year historical usage pattern and corresponding weather variables. As of this writing the first winter period had 12 participants (some for a part of the first winter period) and an aggregate nominated load reduction of 34 Mlb/hr.

**4.6 NEW REVENUE MODELS EXPLORING MANAGEMENT OF CUSTOMER CHP**

It is expected that some large customers and prospective Steam Customers will pursue customer-sited CHP options. Con Edison has extensive experience operating large CHP facilities and there is an opportunity to provide service contracts to customers. Customer-sited CHP could potentially allow the Company to provide district energy services in areas not currently served with much less financial risk than could be achieved extending the existing supply and distribution footprint. Some of these topics were discussed earlier.
As part of the Steam Planning Proceeding in Case 09-S-0029, the Company indicated its willingness to develop a pilot program to gauge the interest in and the ability of customers to install CHP facilities that sell steam back to the Company. The SPRC report carried forward this commitment and provided for the development of a Pilot Program for Customer Sited Supply (CSS) which was formalized as Rider G - CSS Pilot Program in the tariff.

In addition to the tariff filing the Company established a procedure, steam station specification, water quality specifications and an application package to enable prospective participants to investigate, prepare and apply to participate in the pilot program.


4.7 PROVIDING ADDITIONAL CUSTOMER VALUE

Conservation programs are part of the strategy for positioning the Steam System as a green alternative to other energy sources. Approximately 30% of the System’s installed capacity and 56% of the annual steam generated comes from clean cogeneration. Also, centralized generation is more efficiently maintained and monitored than vast numbers of customer-sited boilers. Customers indicate that environmentally friendly supply is becoming an important part of their purchase criteria, although interest varies by customer type and industry.

Environmentally conscious customers are likely to pay a premium for steam service. For example, developers can gain a competitive advantage by obtaining LEED certification which commands higher rental prices. In the future, a continued emphasis will be placed on the environmental benefits of the system through marketing efforts and interactions with customers, engineers, architects, and other stakeholders.

LEED Certification

Con Edison along with the International District Energy Association have worked for the last two years with the U.S. Environmental Protection Agency (USEPA) and the U.S. Green Building Council (USEPA) to ensure that district energy systems are accurately represented throughout the various internationally recognized "Green Building" certification standards known as LEED (Leadership in Energy and Environmental Design Standards). Currently, co-generation and CHP, which are commonly considered "green technologies" and are used to produce approximately 50% of annual steam sales, is unrecognized by these two organizations.

As a result of the Company’s continued efforts to engage these organizations, USGBC has issued a new guidance document applicable to new green building projects that are connected to district energy systems. This guidance document details the methodology that buildings connected to CHP-based district systems could use to obtain up to 8 out of 19 available Energy Performance LEED points. To put it in perspective, a building must obtain at least 40 total points out of 100 available to obtain the minimum
level of green building certification. Therefore, 8 points represents a significant contribution to a customer's LEED certification project and would provide significant value to customers.

Additionally, the Company and IDEA have worked with the USEPA to obtain a similar recognition of district steam CHP utilization in its Energy Star Portfolio Manager Energy benchmarking tool which is commonly known as Portfolio Manager. This on-line tool compares a building's energy consumption to that of similar buildings throughout the country and provides a performance score. A score of 75 and above is required to obtain the Energy Star certification, which is required for existing buildings that want to become LEED certified.

The Portfolio Manager tool does not currently recognize the efficiency benefits of Steam Systems that employ CHP and assumes that all Steam Systems in the country utilize boilers only. However, Con Edison has compiled and presented production data from all major district systems in the country indicating that up to 30% of all steam produced annually by these systems is produced through co-generation. Therefore, the EPA currently overestimates the energy losses by district Steam Systems in their on-line tool. As a result of numerous discussions with the USEPA, they have agreed in principal to revise their calculations and to publish an update to the Portfolio Manager tool in April, 2010.

The Con Edison Steam System has earned several prestigious awards and recognition in recent years which include:

- The U.S. Environmental Protection Agency (USEPA) Energy Star Combined Heat and Power (CHP) award for East River Stations' Units 1/10 and 2/20, for significant energy savings (2009)

Con Edison, as a Company, has received additional recognition for carbon disclosure and reduction. The Con Edison Steam System, being the producer of steam and electric in the Company, was a major contributor to these reductions.

- In the newly released 2011 rankings, Con Edison placed first among utilities in the S&P 500 Carbon Disclosure Leadership Index
- The only utility listed in the S&P 500 Carbon Performance Leadership Index
- #1 Utility in Newsweek Green Rankings

The charts below show the emission comparison of Con Edison CHP against onsite generation alternatives:
Figure 4 - 2. NOx Comparisons

![NOx Emissions Comparison](image1)

Figure 4 - 3. CO2 Comparisons

![CO2 Emissions Comparison](image2)
4.8 NUMBER 6 OIL AND NUMBER 4 OIL CONVERSIONS TO STEAM

In 2007, New York City’s Mayor Michael Bloomberg launched PlaNYC 2030. This purpose of this plan was to “prepare the city for one million more residents, strengthen our economy, combat climate change, and enhance the quality of life for all New Yorkers.” One of the findings was that 1% of buildings in New York City (approximately 10,000) burn #6 and #4 heating oil, some of the dirtiest grades of heating fuel available, known as residual oils; those buildings produced 86% of the city’s soot pollution, more than all the cars and trucks in New York City (“NYC” of “City”) combined.

On April 21, 2011, after two years of stakeholder engagement, Mayor Bloomberg finalized rules phasing out heavy heating oil. The new rules require that:

– No new #6 or #4 boilers will be permitted, effective immediately
– No #6 oil permit renewals after July 1, 2012
– All boilers must use cleanest fuels (Ultra Low Sulfur #2 oil, gas, or equivalent) upon retirement or by 2030, whichever is sooner
– Compliance waivers will be considered

In tandem with developing the rule phasing out heavy oil, the City pursued legislation at the State level and locally to require cleaner classes of #2 and #4 oil. The passage of these laws was an integral part of the overall public health strategy. They are as follows:

• **State Law Cleaning #2 Oil (A.8642-A/S.1145-C)**
  – Limits the sulfur content of #2 heating oil to 15 parts per million beginning July 1, 2012
  – Represents a 99% reduction in sulfur content, down from 2,000 ppm
  – Will dramatically reduce air emissions from 70% of NYC households that use #2 oil

• **Local Law Cleaning #4 Oil (LL 43 of 2009)**
  – Limits the sulfur content of #4 heating oil to 1,500 ppm beginning October 1, 2012

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8 NYC.gov Press Release April 21, 2011 Mayor Bloomberg Presents an Update to PlaNYC: A Greener, Greater New York
– Represents a 50% reduction in sulfur content, down from 3,000 ppm
– Requires 2% biodiesel admixture in all heating oils

Con Edison is committed to support these buildings in their switch off of these fuel sources to either natural gas or steam. The City provided Con Edison a list of the approximately 10,000 buildings that burn #6 and #4 heating oil. The list provided a wealth of information, including but not limited to, addresses, borough, block and lot coordinates, fuel type, building type (e.g. commercial or residential), square footage, building age, boiler age, and number of boilers. There were approximately 7,000 buildings in the Con Edison territory (the remaining 3,000 in the National Grid territory). Of the 7,000, approximately 4,000 were in Manhattan. After removing all the buildings that already burned natural gas as a backup heating source, steam operations measured the distance from the steam mains to the remaining buildings (approximately 3,300). 777 buildings (#6 – 592/#4 – 185) were found to be within 250 feet of a steam main. The 250 foot criterion was selected because it is the distance from a steam main that a building must be within in order to require Con Edison to serve that building. One should also note that buildings beyond this distance are not likely to pass the Pure Base Revenue (“PBR” is the sum of all revenues collected from the customer except those associated with the variable portion of their bill, i.e., fuel) test that would enable them to have a steam service at no charge. In order for a potential customer to pass steam’s PBR test, the estimated PBR for 2 years must be greater than the estimated cost of installing steam pipe from the main to the property line. Steam Operations is willing to serve buildings beyond 250 feet and will assess the PBR test on these buildings accordingly. Of the 777 buildings, 488 buildings (#6 – 426/#4 – 62) passed steam’s PBR test and qualified for steam pipe to be installed from the closest steam main to their building at no cost. Of the 488 buildings that passed steam’s PBR test, 135 buildings (#6 – 123/#4 – 12) were greater than 250,000 square feet. Steam Operations worked with Gas Operations and Energy Management to compare the customer cost of steam to the cost of both natural gas and #2 oil. The following figure illustrates the aforementioned segmentation:
It was determined that the 135 buildings had the best potential for subscribing to steam service. Steam Operations, Energy Management, and Gas Operations made the following assumptions in calculating customer costs for these 135 buildings:

- Buildings with boilers that were 30 years old or older would need to be replaced if the building switched to natural gas or #2 oil.
- Buildings that have been built in the last 30 years would not need to reline their flues if the building switched to natural gas or #2 oil.
- Estimated steam sales and steam PBR were based on building square footage and building type, not the usage reported by the City. The City reported the fuel purchased for a particular boiler, not the actual fuel used. The building square footage and type of building are better predictors unless there is actual usage from the building owner.
- A weighted average of $4,000 per foot of steam pipe was used in the calculation of the cost of service.
- All buildings would need a steam/regulator station. Estimated range for a steam meter / regulator station is about $100K – $300K.
• There is no charge for the first 100 feet of gas service main.
• The total capital costs for each of the 3 commodities was multiplied by 15%, and assumed to be levelized carrying charges in the calculation of the annual cost of each commodity.

Annual steam bills were calculated by applying current steam rates, current tax rates, and the previous annual average of fuel adjustment charges to the estimated steam sales. That amount was added to 15% of the steam capital cost (levelized carrying charge) of $250,000 (steam meter/regulator station) to determine the estimated annual steam cost.

Annual natural gas bills were calculated by applying current natural gas rates to the estimated gas usage, which was calculated using the estimated steam sales, not the oil usage provided by NYC. There are 3 potential gas capital costs:

1. **Burner or boiler replacement** – This cost was calculated based on the age of the boiler and square footage of the building. If the boiler was 30 years or older, the cost for the boiler replacement was calculated by multiplying the steam peak load (in pounds) by $40. If the boiler was less than 30 years old, and larger than 150,000 square feet, the cost for burner replacement and/or boiler upgrade was $200,000.

2. **Flue replacement** – This cost was calculated for buildings 30 years or older, by multiplying the total number of floors by a certain dollar amount, based on the height of the building. For buildings less than 5 stories, the number of stories was multiplied by $6,000. For buildings 5 to 15 stories, the cost per floor ranged from $7,300 through $9,300 based on a regression analysis. For buildings greater than 15 stories, the number of stories was multiplied by $10,000.

3. **Gas main extension** – This cost was calculated by measuring the buildings’ distance from either a high pressure ("HP") or low pressure ("LP") gas main and multiplying that distance (excluding the 100 foot entitlement) by $1,100 (HP main) or $1,300 (LP main). If the building passed either the LP or HP Revenue tests, the gas main extension costs are waived. If the PBR is 40% of the capital costs (excluding entitlement), the costs are waived; if it’s less than 40%, the customer would be required to pay a surcharge. If the customer is required to pay a surcharge for the main extension, their PBR is reviewed annually to determine if in any two consecutive years the total PBR is greater than 40% of the initial capital costs. If so, the surcharge will cease.

15% of the applicable natural gas capital costs were added to the above referenced gas commodity costs.

Annual #2 oil bills were calculated by multiplying current natural gas prices by 1.65 (#2 oil prices are forecasted to be 165% the cost of natural gas), then multiplying that amount by 0.97. When comparing burning natural gas to burning fuel oil, the energy from firing natural gas is valued at 97% of the energy of firing fuel oil. This is due to the stoichiometry of combusting carbon, hydrogen, and oxygen. There is only 1 potential #2 oil capital cost:

• **Burner or boiler replacement** – As with natural gas, this cost was calculated based on the age of the boiler and square footage of the building. If the boiler was 30 years or older, the cost for
the boiler replacement was calculated by multiplying the steam peak load (in pounds) by $40. If the boiler was less than 30 years old, and larger than 150,000 square feet, the cost for burner replacement and/or boiler upgrade was $150,000.

The annual customer costs, including carrying charges for gas, steam and #2 oil were compared. Of the 135 buildings none showed favorable economics for #2 oil. Most of these buildings had favorable economics for gas. However, the number of buildings that had favorable economics for gas may be overestimated due to additional concerns of the building owners, e.g., the need for more available space or not wanting to pay the upfront costs of replacing the boiler or extending a gas main, which could be significantly higher than the cost of a steam station. The decision significantly depended on customer’s value which was not solely based on economics. None of the analyses add in the value of rentable space, which can bring in revenues to the building owner. Such an instance has been proven as steam is currently evaluating a building currently firing #6 fuel oil and the building’s boilers are located in a valued space. The property manager sees the potential for renting this space and is valuing it in the analysis of converting to gas and converting steam.

Steam’s estimate is that 135 buildings have a viability of considering steam as an alternative to Gas. Steam has provided service to two oil fired buildings that went live this past September. The first building was within 50 feet of a steam main, had an 8 year boiler that fired #4 oil, and was 112,000 ft². The second building was within 50 feet of a steam main, had a 38 year old that fired #6 oil, and 211,000 ft². These two cases are not part of the 135 buildings and show that there are other drivers besides the ones that were selected to screen potential customers. Steam has signed on two additional oil fired buildings that will go to steam in 2012. Both buildings have greater than 250,000 ft² and within 60 feet of a steam main. One building has a 26 year old #4 fired boiler and the other has a 41 year old #6 fired boiler. As of November 2011, steam has had several leads and is evaluating another 23 buildings that are not part of the 135 buildings described in the foregoing. As such, steam’s current best estimate is that it will sign on 20-30 oil fired buildings between 2011 and 2015.
The current winter steam peak demand forecast is about 9,650 Mlb/hr on average for the next five years. The two buildings that have recently gone live and the two that were have signed on for service have their potential coincident steam peaks reflected in the current peak demand forecast. Four other buildings also have their potential coincident steam peaks reflected in the current peak demand forecast. If steam were to sign on a total of 30 buildings, the coincident steam peak would increase by about 100 Mlb/hr for a total peak of 9,750 Mlb/hr on average for the next five years. The steam system has ample headroom to support such an increase. The current installed steam capacity is about 11,700 Mlb/hr. Subtracting a design reserve requirement of 1,600 Mlb/hr plus 100 Mlb/hr for resetting the system back to its original state leaves 10,000 Mlb/hr of steam capacity available to serve load. As such, an additional load of 250Mlb/hr can be readily served within the available capacity about and beyond the projected 20-30 oil fired buildings between 2011 and 2015.

New York City's Clean Heat Initiative has enabled Con Edison Steam and Gas to integrate and provide customers with the best possible information to make an informed decision on their energy choice for heat and hot water.
5.0 OPERATIONAL AND ENVIRONMENTAL CONSIDERATIONS OF STEAM PRODUCTION

5.1 OVERVIEW

This chapter will discuss ongoing efforts and opportunities to improve the cost effectiveness of steam operations while maintaining reliability.

5.2 OPERATIONAL IMPROVEMENTS AND O&M EFFICIENCY

Con Edison works to continually improve our operational processes by closely managing our plant workforce and proactively identifying workforce productivity enhancements.

5.2.1 Workforce Management

To manage labor costs, the Company will adopt best practice principles of developing detailed 5 and 10 year workforce strategies. The key input elements of workforce strategic plan include the following:

- Workforce age and service profiles
- Projected retirements
- Expected workforce turnover and attrition
- FTE re-deployment and reduction plans
- Future plant requirements given plant retirements
- Impact of technology improvements and plant modifications on workforce requirements
- Process and productivity improvements
- Implications of regulations and operational requirements

Plant staffing plans include overall staffing levels and specific training and development plans for each employee.

The Company conducted workforce benchmarking which identified 20 peer steam production plants of comparable size, type, fuel, and operational characteristics. The benchmarking revealed that Con Edison plants, on average, employ more full time equivalents (FTEs) than peer plants. This is consistent with the Company’s operation of older steam boiler plants that require more labor than newer units or cogeneration facilities.

Specific challenges Con Edison faces in terms of workforce management include the high percentage of employees likely to retire in the next five years (the current estimate is 17%). At the same time, 22% of employees have less than five years of service, potentially limiting their productivity. Figure 5-1 illustrates the makeup of the steam workforce in terms of years of service.
To address these challenges Con Edison has and will continue to conduct rigorous organizational reviews and invest in training. A comprehensive training program will be required to qualify employees in existing and new job positions.

5.2.2 Productivity Improvements

To continually improve workforce productivity the Company will focus on:

- Cross training and on-the-job training
- Control room integration
- Workforce communication strategies
- Cost Management training at all levels
- Centralization or outsourcing of non-core activities

In line with best practices, Con Edison continues to develop cross-training initiatives such that operating teams are multi-disciplined and trained for all aspects of plant operations and maintenance. Part of this effort may include sharing employee resources between various plants as the need arises. In the past, Con Edison has cross trained operating personnel into maintenance positions and will continue to explore opportunities for further cross training.

The Company will explore opportunities of further combining control rooms to eliminate the need for fixed posts which may require some capital investment. This concept has been proven extensively at peer plants with the adoption of currently available control and monitoring technology.
As part of this Plan, Con Edison will seek to build employee support and interest in the Companies’ vision for the future. In line with best practice companies, Con Edison will develop formal plans for communicating the vision to all employees via regular expanded employee meetings, face-to-face meetings, and Q&A sessions. Steam leadership is involving managers, supervisors, bargaining units, and senior executive participation in the communication process.

Con Edison, in line with peer companies, continues to analyze opportunities to outsource noncore needs and activities where it is cost beneficial.

5.2.3 Cost Management and Control

Forced Outages

Forced Outages are the removal from service of boilers via an automatic operation or when the equipment is taken out of service on an emergency basis. The number of forced outages is a barometer of equipment reliability and the effectiveness the Company’s maintenance program. Reducing the number and duration of unit outages lowers overall O&M costs as well as fuel costs.

Turbine forced outage rates and boiler forced outage rates are closely monitored and are calculated monthly to allow for the trending and examination of equipment that is out of service and the root cause identified. The industry standard according to NERC is 5.9. The force outage rate for Con Edison steam units was 3.5 in 2011. The performance of Con Edison’s steam generating units has consistently outperformed NERC industry standards over the past five consecutive years. This performance is partly attributable to efforts over the last several years to reduce forced outages. The Company holds monthly meeting attended by operations, maintenance, technical managers and engineering staff to ensure root cause analysis is conducted and corrective actions taken. This process also ensures that other plants are made aware of similar susceptibility for themselves. Action items are tracked to ensure that they are completed.

5.2.4 Maintenance Processes

Con Edison tracks and monitors maintenance schedules and work progress on a daily basis. Work planning is done on a work order, crew, daily and weekly basis. The Company targets best practice statistics of plant emergent work of 10-20%, depending on the plant operation loading. Planned work makes up the balance.

The Company utilizes MAXIMO software to improve maintenance productivity, minimize equipment losses and lower maintenance costs. To improve success, the Company is utilizing additional MAXIMO functionality such as analysis to determine if repeat maintenance is occurring and how to eliminate it. Efforts underway on Work Control Performance and Productivity improvements include the following items.
**Economic Improvements**

Initiate and provide more specific / granular Performance Indicators for Productivity, Unit Cost and Program Cost as the Maximo Computerized Maintenance Management System (CMMS) data matures into year’s five to ten.

Provide enterprise integration of Maximo to emerging / planned corporate financial systems to allow complete Work Order cost be reflected in Maximo at the Work Order level for all Own Labor, Other Department Labor, Accounts payable and Material Management System (MMS), essentially all costs to execute the Work Orders completion rolled up to corporate financial system through Maximo portal.

Implement a structure that provides for Units of Work reporting and trending at Station – Unit – Asset and Maximo Work type level. Implement Key Performance Indicators that capture the granular reporting to allow development of targeted action plans to reduce cost and support Corporate Cost Management Goals.

Plan Capital funding requirements for Maximo - CMMS software version upgrade every three to four years to ensure CMMS version remains functionally current and on a vendor supported platform. This will also ensure that Work Control Groups can leverage CMMS software functionality defined by industry experience that emerges in new software versions and improve work flow efficiency, reporting and processing.

**Operations**

Further develop the current Steam Operations Hand Held solution for use with a new Maximo Integrated - Operation Order (OO) and Work Permit (WP) software selected to replace the existing legacy mainframe based OO/WP system. This enhanced Maximo CMMS integrated software will leverage use of our Bar-Coded asset tags to minimize Operating Errors and improve plant safety and availability by ensuring hold off’s / tag outs are performed in the correct sequence and on the targeted assets.

Provide a modern Graphic Interface for P&ID’s and One-Line drawings assessable for use by all station personnel.

**Environmental**

Provide a Maximo CMMS solution to allow asset / station Work Orders to be further categorized according to Regulatory commitment. This initiative will provide the ability to query and sort Work Order and PM database information to ensure compliance is tracked by agency or discipline – i.e. SPDES, EPA, DEC, TITLE V, etc.

**Reliability**

Continue on-going initiative to maximize the migration of station assets PM basis toward Predictive Technologies (PDM). Develop Core Peer Teams that own the individual technologies (Vibration, Thermography, Valve Diagnostics etc.) to ensure uniform PM application across the plants varied asset categories. Enhance Predictive Maintenance failure trend tools and provide a web-based Steam Production Dashboard that provides automated failure trigger of Maximo - CMMS Corrective Maintenance
Work Orders, based on automated or manually gathered asset performance information vs. predefined set-points and other available analytical tools and failure modeling. The dashboard would also provide tools for risk assessment modeling.

Develop an asset specific Failure Class / Problem Code Hierarchy embedded in Maximo – CMMS to enhance craft failure reporting at the Work Order level – This data could then be uploaded automatically to an analytical failure analysis dashboard to determine correctness of asset PM basis, MTBF etc.

Identify and select a Corporate – Enterprise wide, IT supported Document Management System that is functionally capable of storing the wide array of Work Control – Work Order documents and the individual stations Procedure / Instruction documents in a structured hierarchy assessable at all locations.

Steam Operation’s production performance reliability for 2011 was 100% while the customer service availability was 99.94% for that period.

5.2.5 System Dispatch and Loading

Con Edison maintains several programs focused on optimizing dispatch. Notably, in the near future, the Company will implement both a predictive cost tool (Dispatch Optimizer) and a real time cost tracker. In addition the PROMOD software application is used as a simulation tool of steam/electric production and fuel forecasts used for budgets, cash flows, Rate Proceedings and studies. The Inputs are fuel type, fuel costs, heat rates, forced outages, outage schedule, ramp rates, DMNC Rates, minimum loads, emissions rates, and limitations. The primary outputs are steam sendout, electric generation, production costs, monthly dispatch by boiler, and unit costs. Steam Operations Planning provides West End Avenue dispatchers with an economic rating of each unit at least once a week.

5.2.6 Optimizing Plant Fuel Efficiency

Con Edison is continually focused on implementing and improving enhanced boiler efficiency programs. The Company currently has a program that tests each large boiler at a high steady load each month to determine losses due to boiler air in-leakage and ash fouling. A report and recommendations are given by the supervisor to the plant staff.

The Company also focuses on optimizing and minimizing boiler feed pump power since it is the major auxiliary consumer due to high heat requirements. In the fourth quarter of 2009, PI data was used to create intelligent graphs that display the running of excess boiler feed pumps and the recommended pumps to be running. This data is incorporated is a cumulative cost for excess pump power.

Minimizing boiler excess air and air leakage can for a small expenditure and effort generate a large payback in efficiency savings because it accumulates 24 hours a day every day the unit is on line. Air leakage detection has to be completed while the boiler is on line because you need the negative draft of the boiler to detect the leaks. The savings also include the reduced auxiliary power needed for the fans by not having to move the additional air introduced by leakage. Also repairing air leakage can lead to increased boiler capacity as the boilers will be able to produce more steam before they “run out of fan”. Air leakage fixing has to be methodical and detailed as the holes are often numerous small holes which have a large cumulative effect as well as the easy target larger holes, unwelded casing, and leaking
doors. In the fourth quarter of 2009 PI data was used to create intelligent graphs that display O₂ versus load so the plant staff can see how operators have/have not maintained good control as well as associated fuel losses

5.3 ASSET MANAGEMENT AND CAPITAL EFFICIENCY

To more effectively manage plant assets, the Company engages in plant and equipment lifecycle management. This allows management to remain proactive in knowing when to remove assets, invest in new equipment, or enter power purchasing contracts. We utilize a suite of integrated software, online / portable technology solutions and training to develop an on-going predictive diagnostic foundation of asset health. The available technologies include valve diagnostic, vibration analysis, laser alignment, infrared thermography and on-site oil / lubricant analysis. The data gathered from these predictive technologies are integrated with our CMMS (MAXIMO) to establish overall asset health and drives plant asset / overhaul decisions, as well as dynamic PM basis decisions which allow continuing plant mechanical and electrical asset optimization. The Maximo CMMS software tracks system / asset failure reporting through Failure Class / Problem Code methodology which allows performance trending at the system / asset level. Additionally, the CMMS Work Order cost data is rolled up to "Units of Work" cost metrics that further support capital investment decisions.

To obtain best practice levels of asset management and capital efficiency, the Company utilizes various metrics to track conditions of the system and plants such as forced outage rates and unit heat rates to develop a life cycle plan for each unit in the system.

Steam Production's capital program is comprised of work involving generating station boilers/HRSGs, auxiliaries, balance of plant components, water treatment, and structural/ facilities. Categories include:

- Environmental, Health, and Safety
- Boiler
- Control Systems
- Electrical Equipment
- Mechanical Equipment
- Security and Fire Protection
- Structural, Waterfront, and Roofs

For more station specific capital details, please refer to Section 3.3.2 of this Plan.
5.4 ENVIRONMENTAL COMPLIANCE MANAGEMENT

5.4.1 Environmental Air Regulations

This section summarizes the environmental regulations that have the potential to affect the operation of the Steam System’s generating stations. The Company’s options for future equipment upgrades and its plans to operate existing generating stations, as a result of new regulations, were considered. In terms of the removal of a unit or installation of new generation, environmental considerations, air emissions regulations, and permitting issues were also evaluated. (Previous reports had presented detailed environmental evaluations of repowering options). Some of the regulations considered with regards to existing generating units, and potential removal of such units or the installation of new units, include the following:

- Revisions to New York State Department of Environmental Conservation’s ("NYSDEC") regulations pertaining to Nitrogen Oxide - Reasonably Available Control Technology ("NO\textsubscript{x} - RACT") limits
- Compliance with NYSDEC revisions to Part 231 - New Source Review ("NSR") regulations
- Current NYC and NYS policies and regulations regarding greenhouse gases (Greenhouse Gas - GHG in NYC and Regional Greenhouse Gas Initiative – RGGI in NYS) to limit power plant carbon dioxide emissions
- EPA Clean Air Act Section 185
- EPA Clean Air Interstate Rule (CAIR) replaced by Cross State Air Pollution Rule (CSAPR) for Electric Generating Units (EGU)
- EPA Maximum Achievable Control Technology (MACT) rule for Hazardous Air Pollutants (HAP)
- Best Available Retrofit Technology (BART)

**NO\textsubscript{x} - RACT Regulations**

*Existing Rules*

Current NO\textsubscript{x} RACT rules provide specific NO\textsubscript{x} emission rate (lb/MMbtu) limits for various emissions sources based on the type and size of the unit. The rules permit the use of system-wide averaging (24-hour average during the ozone season, and 30-day average during the non-ozone season) as a compliance option. The allowable limit and actual measured emissions (total NO\textsubscript{x} lb / total MMbtu fuel burn) from each unit are calculated together for an overall emissions average that is weighted by the heat input. This determines the single system-wide allowable NO\textsubscript{x} limit and actual NO\textsubscript{x} emissions. All of the Company’s steam and electric generating units except East River Units 1/10 and 2/20 are included in the system-wide average. East River Units 1/10 and 2/20 are BACT / LAER units and are considered separate, stand-alone units for NO\textsubscript{x} RACT compliance. The BNYCP combined cycle plant continues to be excluded from the Company’s NO\textsubscript{x} system-wide average.
The current emission rate limits for the Company’s generating units are 0.25 lb/MMbtu for very large utility boilers, 0.30 lb/MMbtu for large package boilers, and 0.40 lb/MMbtu for simple cycle combustion turbines. This results in a system-wide permissible emission rate limit (weighted average) for the Company’s units of approximately 0.26 to 0.27 lb/MMbtu (excluding East River Units 1/10 and 2/20 and BNYCP).

*New Rules*

The New York State Department of Environmental Conservation (NYSDEC) has promulgated a revision to the NO\textsubscript{x} -RACT limits significantly lowering the acceptable NO\textsubscript{x} emission rates. This would impact the boilers and combustion turbines in the Steam System and the Hunts Point combustion turbine and heaters and Astoria combustion turbine, vaporizers flare and ground combustor operated by the Gas Department. The current Con Edison NO\textsubscript{x} RACT compliance plan, which uses system averaging, will no longer be technically feasible upon the effectiveness, in July 2014, of NYSDEC’s newly revised lower NO\textsubscript{x} RACT limits. To meet these lower limits, the Company initiated site-specific studies using expert consultants to identify alternate NO\textsubscript{x} emission technologies for each emission source, and assessed their technical feasibility, site specific constraints, potential emission reductions, capital and future O&M costs for the identified NO\textsubscript{x} reduction technologies. The regulation requires implementation of only those technologies that can achieve NO\textsubscript{x} reductions at a “reasonable cost”, which according to NYSDEC is $5,000 (+ 10%) per ton of NO\textsubscript{x} reduction in potential to emit (using a calculation assuming 100% capacity factor) for each emission source.

The Company has completed the studies and submitted the NO\textsubscript{x} - RACT Compliance Plan in December 2011. In order to achieve compliance by July 2014, the Company has initiated capital projects requiring approximately $123 million (net total cost excluding $20 million contribution to the 59th Street gas addition work from Extell), including Gas Addition Projects (at 59th Street Annex Boilers 114-115, 59th Street Combustion Turbine, 74th Street Station High Pressure Boilers 120-122 and Package Boilers 1-6), and Induced Flue Gas Recirculation (IFGR) systems for Package Boilers at 59th, 60th, 74th Street Stations and Low NO\textsubscript{x} burners at 74th Street Package Boilers. The Gas Addition Projects are also justified by the following other considerations: the need to comply with MACT regulations for mercury and toxic air pollutants (described below), a cost subsidy offered by Extel Corporation for gas addition to the 59th Street Combustion Turbine, the long term fuel cost savings to the customers, and the Company’s commitment to environmental excellence. The Gas Addition Projects are discussed in more detail in Section 3-3-3.

The dual fuel units, East River 60 and 70 will comply with the regulation under a “fuel switching to a cleaner burning fuel” provision in the regulation, with a commitment to burn predominantly the clean burning fuel (natural gas). During the ozone season (May to September), these units will burn the backup fuel (No.6 oil) only during fuel emergency events (such as gas curtailment or low gas pressure events) and to meet the Minimum Oil Burn (MOB) requirement by NYISO to ensure the fuel diversity needed for the New York City electric system reliability.

For the following units, the NO\textsubscript{x} - RACT Plan will propose “case by case determinations” of emission limits that may be higher than the presumptive limits listed in the regulation because none of the feasible emission control technologies can be implemented within the defined “reasonable cost” for these units:
Ravenswood Boilers 1-4, 59th Street Combustion Turbine GT1 with Gas Addition, 74th Street GT1 & GT2, Hudson Avenue GT3, GT4 and GT5, Hunts Point Combustion Turbine, and Astoria LNG Combustion Turbine. The Company will provide sufficient justification with historic data for the proposed case by case limits for approval by NYSDEC and USEPA. East River 1/10 and 2/20 Units are already subject to BACT/LAER limits, and most likely the existing limits for these units will be accepted as case by case limits.

The NOx - RACT Plan also submitted the fact the Company has retired the oil burning old boilers at Hudson Avenue significantly contributing to NOx emission reduction from the Steam System.

**NYSDEC Part 231 Revision - New Source Review (NSR)**

NYSDEC revised the 6 NYCRR Part 231 New Source Review (NSR) regulations effective March 5, 2009, and has required some additional analysis and recordkeeping for all power plant capital and O&M projects that may directly or indirectly impact emissions. This new rule compares the future predicted emissions (from PROMOD dispatch models) against past actual emissions (baseline) looking for projected increases in emissions (after correction for unused, but available, emissions during the baseline period). Prior to implementation of its new Part 231 regulations, a Part 231 analysis was directed at increases in the potential to emit from a specific unit. The new regulations basically ratchet down future emissions of older boilers/equipment/technology as they age and effectively force their replacement with new, cleaner technology rather than be rebuilt like-in-kind when they reach their end of useful life.

In accordance with the new NSR regulations, the Company has reviewed its 2009, 2010, and 2011 capital and O&M projects (steam and electric generation) for potential modifications which would trigger the regulations and potentially require additional emissions reduction measures to be taken. At present, these reviews have not resulted in or predict any significant modifications or increased costs for specific projects. However, over time, the potential for increased permitting requirements and triggering the need for BACT/LAER compliance in terms of any significant capital and O&M project expenditures relevant to the 20 year plan cannot be predicted.

**NYC Policy for Carbon Dioxide Emissions Reductions**

The City of New York’s PlaNYC sets an ambitious goal for reducing the City’s greenhouse gas (GHG) emissions 30% by 2030, and has a short-term goal of reducing carbon dioxide (CO2) emissions by seven million tons per year (“tpy”). These goals would be achieved using several initiatives, including improvements in energy efficiency, reduced demand, encouraging clean distributed generation, and facilitating repowering and construction of new cleaner power plants and dedicated transmission lines. The City of New York has indicated that it views in-city cogeneration of steam and electricity as a potential means for contributing to its GHG reduction targets. The Company currently provides more than 50% of steam supply from cogeneration, and continues to increase the role of cogeneration in the City’s infrastructure.

The City has also indicated that it would encourage new Combined Heat and Power installations at some of the City-owned and customer-owned buildings. Although this initiative would potentially result in a reduction in steam sales, the Company is promoting the Distributed Generation and Energy Efficiency
Programs considering that they would reduce the need for capital expenditures for new generation and transmission capacity.

**NYS Regulations for Carbon Dioxide Emissions**

The Company is procuring CO\(_2\) allowances to comply with the NYSDEC regulations governing CO\(_2\) emissions. This CO\(_2\) cap-and-trade regulatory framework implements in New York State the Regional Greenhouse Gas Initiative (“RGGI”) covering the northeast region (10 states including New York). It applies to electric generators greater than 25 MW, including Con Edison’s East River Units 1, 2, 6, and 7. Unlike other cap-and-trade programs, NYSDEC has not allocated emission allowances to generators, choosing instead to auction close to 100 percent of the allowances. The number of allowances available for the auctions was budgeted per the established caps, with one allowance giving the right to emit one ton of CO\(_2\). The number of allowances to be auctioned would be reduced each year, beginning in 2015, to achieve net reductions in CO\(_2\) emissions. As the number of available allowances diminishes, the expected cost per allowance is anticipated to increase. The Company’s operating budget now includes estimated allowance costs for the Con Edison electric units (ER 1, 2, 6, and 7) that are affected by these regulations, and the economic evaluations incorporate forecasted costs for procuring carbon allowances for options that include electric power generation.

There are uncertainties in the longer term implementation of CO\(_2\) cap-and-trade programs regionally and nationally. A federal cap-and-trade program is not likely in the near term, but a future administration may enact a federal program probably with higher allowance prices than the current RGGI program. It is not known if the current RGGI program would merge with the federal program or if its applicability would extend beyond currently affected units. Currently some of the participating states are planning to withdraw from this regional program.

Con Edison will participate and support in any federal, state or regional efforts for reducing greenhouse gas emissions, while maintaining that all revenues generated from the program should be spent exclusively on programs for improving the environment.

**EPA Clean Air Act Section 185**

A series of court decisions required EPA to impose Clean Air Act Section 185 fees on major sources and EPA required State Implementation Plan (SIP) updates by states to implement this program. Section 185 requires major sources of NO\(_x\) and VOCs in severe ozone non-attainment areas to pay fees ($8,000/ton) for emissions greater than 80% of specific baseline emissions. The actual fees will be determined based on actual annual emissions and final resolution as to what is an acceptable baseline. Clearly, the fees will be lower if emissions are reduced by increasing the amount of natural gas in the fuel mix.

New York filed its SIP revisions with a recommendation that the State be exempted from the Section 185 fee program because recent data have demonstrated the New York attainment of the currently required ozone standard. EPA has been attempting to revise the ozone standard to a lower limit, but a Presidential Order has postponed this revision to a future date.
The Clean Air Interstate Rule (CAIR) in March 2005 established a long term NO\textsubscript{x} and SO\textsubscript{2} reduction goal for most of the States in the eastern part of the United States, and created an emission allowance trading program modeled after the highly-successful Acid Rain Control Program. CAIR was overturned by court action in 2008. The courts agreed to postpone the implementation of its vacature of the CAIR, pending the development of a replacement rule by EPA. Accordingly, the SO\textsubscript{2} and NO\textsubscript{x} allowances allocated by NYSDEC and the cap and trade rules per CAIR are currently in force until the end of 2011.

The new Cross State Air Pollution Rule (CSAPR) replaces CAIR and will be implemented directly by EPA until the affected states develop their State Implementation Plans. The purpose of CSAPR is to address the “good neighbor” requirements of the Clean Air Act, which prohibits transport of pollutants across state boundaries impacting the downwind state’s attainment status. Under CSAPR, EPA defines “significant contribution” by reference to (1) a state’s “linkage” to downwind receptors based on dispersion modeling analysis and (2) the ability of the state to achieve emission reductions at the relevant cost threshold ($500 / ton). Only if emissions from a state are “linked” to a downwind receptor and the state can achieve emission reductions at costs below EPA’s cost-effectiveness threshold is a state included in the CSAPR.

EPA used Integrated Planning Model (IPM) to model the generation, transmission, emissions and their dispersions from EGUs in US. This model identified the upwind states that contribute significant impacts of the ozone precursors (NO\textsubscript{x} and SO\textsubscript{2}) in the downwind states. Based on this model, EPA identified the emission reductions needed in each upwind state and allocated allowance budget caps. The CSAPR requires 23 states to reduce annual SO\textsubscript{2} and NO\textsubscript{x} emissions to help downwind areas attain the 24-Hour and/or Annual PM2.5 NAAQS while exempting the other states from the rule. New York is identified as upwind state requiring large reductions in NO\textsubscript{x} and SO\textsubscript{2} emissions.

Con Edison and several other utilities in New York State have filed petitions with EPA stating that the IMP Model has several errors in the input data and assumptions. As a consequence of EPA’s flawed analysis, the New York State is significantly under-allocated for the statewide allowance budget caps and individual unit free allowance allocations. A free market for the allowance trading is not viable with such an under-allocated allowance budget because almost all the EGUs in the state need to buy allowances with very few selling. The cost threshold of $500/ton will not be able to achieve any further NO\textsubscript{x} reductions considering the New York State is already implementing the NO\textsubscript{x} -RACT regulation with a $5,500 / ton threshold for “reasonable cost”. The EPA has made some technical adjustments to their initial allowance budgets somewhat increasing the budget caps in a few states including New York. However, this revision does not address all the technical considerations submitted in the Company’s petition. The EPA reconsideration is currently on-going.

In order to comply with this program, the generators are forced to either achieve NO\textsubscript{x} emission reductions in a timely manner or purchase additional allowances on the market. Until now the Company is able to comply without having to purchase allowances because of the successful NO\textsubscript{x} reductions already achieved from the Company’s environmental projects. However, there are uncertainties regarding
possible drastic reductions in the caps and allowance allocations in future years 2012 and beyond and this is likely to result in increased fuel adjustment costs for steam and electric customers.

**MACT Rule for Hazardous Air Pollutants (HAP)**

EPA issued new MACT rules to reduce HAP emissions from Industrial Commercial and Institutional (ICI) Boilers, and is in the process of reconsidering the rules. Final rules will be issued in 2012 with implementation starting in 2014.

There are too many HAPs and it is impractical to monitor all. Therefore EPA selected a few HAPs as surrogates for the others and requires monitoring and reporting of mercury, particulate matter PM (as surrogate for metals other than mercury), and hydrochloric acid vapors (as surrogate for acid gas HAPs), carbon monoxide and dioxins &furans. Mercury, PM and HCl pollutants result from the contaminants in the fuel, whereas CO, dioxins & furans are the result of incomplete combustion.

These HAPs are present in very minute quantities in the flue gases, and it is very difficult and expensive to measure these from the stack. The Company’s EH&S has concluded that it would be almost impossible to meet the new MACT rule without permit restrictions on oil burning units, however gas burning units would not be impacted by this regulation. This adds the further justification for the Gas Addition projects discussed above.

**Best Available Retrofit Technology (BART)**

This regulation requires a dispersion modeling analysis of the affected plants to demonstrate their impact on the visibility in the pristine areas such as national parks. The only units affected by this regulation are the oil burning Annex 114 and 115 at 59th Street and Boiler #2 at Ravenswood. The Company submitted the BART report in 2010 with a dispersion model and an evaluation of alternate NOx control technologies, their site-specific feasibility, effectiveness, cost and their impact on the visibility in the national parks. In 2011 EPA sent comments through NYSDEC. The Company made a technical evaluation and responded. The Company has not yet received the final acceptance of the submitted report. BART may require the addition of permit conditions to the affected boilers’ permits, however impacts on the operation of the boilers is expected to be minimal.

**Environmental Considerations for Plant Closures**

Since plant closures may be a cost-effective option under low demand scenarios, environmental and policy considerations when retiring an existing generating plant are considered briefly in this subsection.

The local community surrounding an existing generating facility would likely view the closure and demolition of a facility favorably in light of the expected reduced local emissions and improved views. However, the Company and New York City would need to consider other regional factors pertaining to emissions and energy supply reliability. For example, the Company and the City have limited sites available that are suitable for generating plants. A site released for other uses, would, of course, not likely remain available to accommodate any generating facility that may subsequently be needed.
Closure of a facility would not preclude the application of emission reduction credits earned from the facility removal, which can be banked for future use. However, their value may be diminished in an NSR/PSD review when applied for a new plant permit at a different site.

**Water SPDES Management and Control**

Compliance with State Pollutant Discharge Elimination (SPDES) permits at our stations is integral to the way Steam Operations does business. Performance metrics are established each year that are aimed at driving performance to minimize the risk of non-compliant wastewater discharges to the environment.

We have enhanced our steam production systems with state of the art water treatment systems. These new demineralization systems result in higher purity steam, and reduce corrosion rates in the distribution system. Integral to these systems are updated controls and alarm response systems which provide the operators immediate system status. The demineralization systems minimize the overall blow down rate, provide less caustic waste flows to treatment systems, and reduce the wastewater discharge to the environment by as much as 9% per boiler. In addition, we have installed new robust wastewater neutralization and treatment systems.

We have embarked on a critical project as agreed to with the New York State Department of Environmental Conservation (NYS DEC) to reduce impact to marine life by installing a new traveling screen system for the cooling water intake at East River Station. This new system is considered Best Technology Available (BTA) for minimizing entrainment and impingement of marine life.

A preventive maintenance program consisting of station oil water separators, softening and demineralization equipment, and SPDES sampling assessments assists in ensuring continued compliance.
6.0 OPERATIONAL MANAGEMENT OF THE DISTRIBUTION SYSTEM

6.1 DISTRIBUTION STRATEGY

The Company is focusing its efforts toward a number of future initiatives which the Company feels will be beneficial to all stakeholders.

- Promote programs that allow the company to optimize the use of its assets in order to reduce cost and minimize outages.
- Implement remote monitoring where possible and utilize the technology as a more efficient monitoring process to identify potential problems before they are an issue.
- Install digital meters at customer locations in order to collect real-time system data for monitoring, allow more cost-effective meter reading, and to facilitate potential new time of use pricing and demand response models for the future.
- Pursue R&D projects to identify conditions that lead to “water hammer”\(^9\) in order to enhance employee and public safety.

With these initiatives as the foundation for the steam distribution strategy, the Company feels these initiatives will allow the system to continue to serve the people of Manhattan for years to come.

6.2 MANAGEMENT OF THE CURRENT ASSET BASE

6.2.1 Asset Management and Replacement

The steam distribution grid is a complex system requiring the interconnection of a number of different components. Successful operation requires that the Company ensure that each component is functioning correctly and doing its job to transport steam or remove condensate from the system. The Company uses an internally developed Steam Operations Mapping and Information System (SOMIS) which contains a database of all steam distribution assets. SOMIS is capable of providing information about any individual asset, as well as providing aggregate results of the system.

Information available from SOMIS includes, but is not limited to:

\(^9\) Water hammer occurs when a bubble of steam gets trapped in subcooled condensate and the steam rapidly collapses causing the condensate to impact with a resulting high pressure pulse that could break or rupture an adjacent component on the system. Also, if condensate is collecting in the system it can be transported as a slug by the steam at the system pressure and velocity. When the slug reaches an obstruction such as an elbow or tee it collides with the fitting and the momentum of the slug results in a huge impulse force that could break or rupture the fitting.
In addition, the Company has a very detailed mapping system of its piping that shows the location of pipes, services, components and structures, date of installation, and construction details.

In order to maintain the assets in the system, the Company has initiated a number of programs to effectively optimize the usefulness of assets, including effectively replacing those assets that have reached the end of their useful lives, in most cases operating until failure. Refer to Table 6-1.

<table>
<thead>
<tr>
<th>Program</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anchor Replacement Program</td>
<td>Program designed to replace 5 deteriorated anchors per year between 2011 and 2014.</td>
</tr>
<tr>
<td>Cooling Chamber Replacement Program</td>
<td>Program to replace cooling chambers in approximately 25 locations annually between 2011 and 2014. Condensate collected in the cooling chambers has the negative effect of corroding the chamber over time, causing leakage and requiring replacement. A new design, involving the replacement of the solid end connection piping into and out of the cooling chamber, with a braided flexible pipe is expected to lengthen the life of the cooling chamber. In addition, utilizing a corrosion coating for external corrosion protection is also being evaluated.</td>
</tr>
<tr>
<td>Expansion Joint Replacement Program</td>
<td>Program forecasted to extend through 2021 in order to complete the change-out of Inconel internally pressurized joints due to the inherent design risk for an uncontrolled release upon failure. This program has a scheduled replacement rate of approximately 20 joints per year.</td>
</tr>
<tr>
<td>Flange Removal Program</td>
<td>Program targeting the replacement of approximately 33 pairs of flanges in 2011, approximately 20 pairs of flanges per year for 2012 &amp; 2013, and approximately 29 pairs of flanges in 2014. Flanges are typically replaced when leaking and also replaced in conjunction with other work that may occur on a section of the system.</td>
</tr>
<tr>
<td><strong>Infrastructure Condition Projects</strong></td>
<td>Program designed to make improvements to the Steam System infrastructure to prevent water infiltration into subsurface steam structures. In areas of high ground water or tidal areas this program will reduce water infiltration into steam structures to minimize accumulation in the structures and potential contact with the steam main. In addition, steam mains of certain configurations of mains are relocated under this program.</td>
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</tr>
<tr>
<td><strong>Leaks Upgrade Program (pipes)</strong></td>
<td>Program to address leaking pipe, performing approximately 60 leak repairs from 2011 to 2014.</td>
</tr>
<tr>
<td><strong>Main Valve Replacement Program</strong></td>
<td>Program designed to replace defective and inoperable main valves. The program is to replace 4 main valves in 2011, 6 main valves per year for 2012 &amp; 2013, and 13 main valves for 2014. The Company's ability to replace valves is limited by the complexity of the work and the customer outage impact. The Company is actively working with the valve suppliers to improve the service life.</td>
</tr>
<tr>
<td><strong>Manhole Cover Replacement Program</strong></td>
<td>Program to replace all cast iron manhole covers. As of today, there are approximately 10 cast iron manhole covers left in the system. All of these covers are non-standard size. The plan is to re-design the manhole roof slabs to accommodate the use of standard size hybrid manhole covers or composite. 8” Valve Box Covers. This is targeted to be complete by end of 2011. The Company continues to pursue a fully composite cover for future use.</td>
</tr>
<tr>
<td><strong>Pump Manhole Electrical Upgrade Program</strong></td>
<td>Program to install new high temperature pumps plus various electrical components inside the pump manholes will bring them up to current electrical standards and codes. This program is forecasted to upgrade approximately 25 pump locations in 2012 and 12 pump locations per year afterward until completion.</td>
</tr>
<tr>
<td><strong>Trap Combination Replacement Program</strong></td>
<td>Program designed to address future trap station improvements on an as needed basis, including a new design that has improved debris removal capability. These programs will reduce the amount of debris that gets into the trap by capturing this debris in the drip leg or the strainer that is upstream of the trap. The company expects to complete the upgrade to the new assembly types by the first quarter of 2012.</td>
</tr>
<tr>
<td><strong>Service Valve Replacement Program</strong></td>
<td>Program to replace street service valves on an as needed basis. From 2012 to 2014, the Company anticipates replacing approximately 14 street service valves per year. This program will be re-evaluated in 2014. The Company is actively working with the valve suppliers to improve the service life.</td>
</tr>
</tbody>
</table>
6.2.2 Managing Company Assets Inside Customer Buildings

Meters
In addition to underground components within the system, the Company has made an effort to replace components on the system that reside on the customer’s premises. The Company primarily utilizes three different types of meters within customer premises: EDP, Shuntflo and Vortex meters. Currently the Company replaces both the Shuntflo and Vortex meters on a 5 year schedule; however, the Company has instituted a program, the Shuntflo Meter Conversion project, with the intent of upgrading the mechanical Shuntflo meters to the digital Vortex meters. To date, the Company has already upgraded all customers who use 14,000 Mlb or greater per year, with plans to convert up to 50 additional customers annually through 2014. These new Vortex meters allow the Company to receive information in 15 minute intervals regarding customer usage and pressure.

The Company has also initiated a Meter Downsizing program designed to replace oversized steam meters at various customer locations due to operational changes and efficiency improvements by customers. Oversized meters will lose registration at lower flow rates. Downsizing the meters enables more accurate capturing of the lower customer demands. This program addresses Company-initiated meter station changes and is done on an as-needed basis.

Meter Regulating Valves
In conjunction with the replacement of Shuntflo meters with Vortex meters, the company also wants to replace the problematic mechanical meter regulating valves, both the M and Spence valves, with the motor operated ball valves under the M Valve Conversion program. It is anticipated to covert approximately 35 locations per year until completion. These ball valves provide a tighter seal than the previous design, thus virtually eliminating this as a source of losses in the system.

The company has instituted the Limotorque Angle Valve Replacement program designed to replace defective Limotorque actuator operated angle globe meter regulating valves with new valve assemblies which will be enabled with remote monitoring and control capability when the new generation of flow computers is installed in the future. This will allow remote determination of valve positions and remote isolation of meter lines in the event of an emergency. The program is anticipated to replace 2 locations per year and on an as-needed basis.

Meter Station Trap Assemblies
The Meter Station Trap Remote Monitoring program is designed to remotely monitor Company traps at customer premises to speed up detection of blowing or clogged traps. Late detection or non-detection of non-working company traps is a source of steam loss or a potential for condensate build-up which can result in water hammer. The program is to enhance the company-owned traps located before each meter station to be monitored around the clock by an automated system that will alert the 24-hour troubleshooting dispatcher when a problem is detected. Installations are done at the same time with the Shuntflo Meter Conversions. Currently, the Company has initiated a pilot program which will equip approximately 30 customer buildings with remote meter station trap monitoring. This program is estimated to convert approximately 70 locations per year depending on the budget until completion.
6.2.3 Asset Management Challenges

Managing a system as large as the steam distribution system, in a geographic region as complex as Manhattan, is not without its challenges. Since the majority of the system is underground, with only part of the system accessible through structures such as manholes, it is often necessary to dig under the streets to repair or upgrade parts of the system. This is difficult when working in the city that never sleeps, and it is necessary for the Company to undertake an arduous permitting process with the city to ensure that the customer’s, the Company’s, the city’s and the public’s needs are addressed. This includes excavating to connect new business to the existing system. New customers can be in excess of 200 ft from the nearest main, and depending on the location within the city, connecting them to the system can be an expensive endeavor for the Company.

The Company realizes that these challenges are not expected to improve over the next 20 years, and in fact may become more challenging as the city continues to expand Green Streets and Summer Street closures that inhibit the company’s ability to access its assets. It will be up to the Company to continue to manage around them.

Condensate Buildup

The steam distribution system is a “once through” network, which means that there is no recovery of the condensate. Due to its size and New York City subsurface congestion, the design of condensate recovery for the entire system is not feasible. Many customers collect the condensate within their buildings in collection tanks to be used for pre-heating domestic hot water. For customers who do not re-use the condensate, it is discharged into heat exchangers or tanks and eventually discharges into the sewer system.

Condensate generated from the distribution system is discharged into cooling chambers, collected in the chambers and allowed to cool before being discharged into the sewer. The Company has redesigned the trap assembly to improve capacity and debris transport and capture in the effort to prevent conditions that can lead to water hammer. These assemblies will be installed throughout the system by early 2012.

Construction in Manhattan

Construction in New York City streets is unlike any other construction. The subsurface infrastructure is congested with various utilities and structures, both in use and those abandoned in place. Facilities belonging to city and state agencies include sewers, water mains, the Transit Authority’s electric system, and signal systems for the Department of Transportation (DOT), and the Fire and Police Departments. In addition, there are electric, gas, steam, cable, telephone conduits, mail tubes, fiber optic cables and their associated structures. In some areas, old foundations and footings from long-retired elevated train structures and trolley tracks remain in place. Also, beneath the city streets are subways, train, and vehicular traffic tunnels. Due to these conditions, significant excavation by hand is required on most jobs. All of these make excavating to maintain or install new facilities challenging, time consuming and costly.

The company must design its facilities around New York City owned facilities. If a proposed City facility is designed with routing into steam assets, the Company must relocate, support, or protect the Company’s facilities and bear the resulting cost. On the other hand, if a Steam project runs into City owned facilities,
even if inaccurate City drawings are the cause, it is the Company’s responsibility to incur the added cost to support, protect or replace the interfering City facility. The Company also has to pay to relocate other facilities such as gas, electric and telephone cables for the Company’s own work. Therefore, to minimize unknowns, Steam Distribution Engineering conducts an extensive sub-surface investigation before any design begins. In all cases, New York City has the right to eminent domain.

**Permitting**

Street construction permits for excavation work are usually issued with traffic stipulations. Traffic stipulations restrict construction activities based on the volume of traffic and the size of the roadway in the area of the work. The restrictions vary for mid-block excavations, as opposed to those that take place at intersections. Also, extraordinary noise restrictions in hospital zones and similar sensitive areas, average noise restriction in residential areas, facility access, and holiday embargoes are also considered in traffic stipulations. The stipulations dictate what hours the company can work at a particular location, how much space can be used to perform the work, and how site conditions must be maintained. Restricted permits add to the duration of construction and also escalate the cost of performing work.

**Interconnecting New Business**

The Company currently has a commitment to connect any customer requesting steam service to the Steam System as long as that customer resides less than 250 feet from a main. If the customer is beyond 250 feet, they can still be connected, but Con Edison is not obligated to supply a connection. As described herein, the Company plans to modify its tariff to lessen its obligation to serve low load factor customers, including modifying the 250 foot rule.

Due to the combination of the variability in real estate prices, differing levels of congestion, and complexity of subsurface structures throughout Manhattan, the cost of adding customers to the Steam System varies considerably between different neighborhoods within Manhattan. The Company recently started trending the actual costs of adding new customers in different parts of Manhattan and created neighborhood boundaries for zones with similar costs. Therefore, location of customers has an impact on cost of providing service.

6.3 PLANNED SYSTEM IMPROVEMENTS

6.3.1 Remote Monitoring To Enhance Safety

As a result of the 41st Street Steam Incident that occurred in 2007, the Company instituted changes to its operation and maintenance programs. Specifically the Company established procedures for response during rain events. In addition, the PSC now requires all traps in the system to be replaced annually to ensure safe operation of the system. The company also performs an onsite visual inspection (cap inspection) within four months of installation of a trap. The company has four years history of data from trap inspections, which shows a positive trend that the new redesigned trap assemblies are better at preventing debris from transporting to the traps, and is looking to gain agreement from PSC to reduce the frequency of trap replacement to a 3-year cycle and to eliminate cap inspections on newly installed traps.
The Remote Manhole Monitoring System is a multi-year project in which the Company is installing instrumentation to measure trap temperatures and steam manhole water levels (see Figure 6-1). This information shall be retrieved by remote telemetry units (RTU's) installed at each field location. The data is then transmitted to a Company server where it shall be stored and then ultimately distributed to operator workstations for "real-time" monitoring of steam trap status and manhole conditions. To date, 350 locations are being monitored with the eventual goal of monitoring over 800 locations.

Figure 6 - 1. Remote Trap Monitoring

Presently, phase I of the program runs to the end of 2013 and plans to monitor all deep locations, priority locations, pumps location, and all street trap locations. Phase II will look to incorporate enhancements from various R&D initiatives currently under way. The goal of this program is to eventually be able to read and analyze data at a rate sufficient to identify and address conditions before they become a risk. Eventually this system should be able to eliminate the need to manually check manholes after heavy rains and indicate when trap should be replaced for cause and eliminate or reduce inspections.

6.3.2 Thermal Efficiency Improvement Program to Reduce Line Losses

A review of Steam Variance, the difference between metered steam sendout at the generating stations and metered steam sales at the customer locations, was conducted by an independent consultant in May 2009. Resulting recommendations included investigating the increase of superheat in steam sendout and the examination of the economics associated with the use of pumpable insulation. The Company determined there was no margin for increasing superheat by raising steam temperature and that from an economic standpoint, insulating with pumped insulation is not cost effective. The Company has
considered the impact on Steam Variance when steam pressures are lowered and results in an increase in superheat.

The Company has analyzed the impact of operating at various pressures which may provide a benefit on the variance loss with little impact to customer service. Presently, the Steam System is operated between 140 and 180 psig during the period October 1st thru April 30th and between 150 and 180 psig the rest of the year with a slight superheated temperature for both periods. There are customers who use steam turbines for cooling, requiring a minimum of 125 psig to drive their compressors for cooling. From a distribution perspective, lowering operating pressures proves to be beneficial in reducing thermal losses in the system since high temperature steam at lower pressures produces less condensate. This “dry steam” provides the operational benefit of reducing the risk of water hammer discussed previously in this chapter. Additionally, lowering operating pressure should provide less stress on the piping system, lengthening the useful life of those assets.

Steam Variance results in economic inefficiencies as the Company is forced to burn more fuel to create more steam than is needed by the customer. Based on historic studies, the aggregate Steam Variance was close to 16% per year due to metering inaccuracy, inherent thermal losses, and leaks. Recent Steam Variances are closer to 13% as meter modifications, steam main housing structure waterproofing, and remote monitoring projects were completed. Steam is constantly looking for cost effective ways to reduce steam variance.

The Con Edison Steam System has some mains installed at elevations that are below the water table. When a steam main is installed, it is surrounded by insulation and encased in a housing, which is meant to reduce thermal losses. Thermal losses increase in areas where there is a breach in the housing or breakdown of the original insulation, or when the insulation comes in contact with groundwater. Tidal conditions and rainfall affect the amount of water concentrated in the soil around buried steam mains. The Company will be addressing this through its waterproofing project.
6.3.3 Various Enhancement Reinforcement Program

Design of a Steam System results in some inherent inefficiencies. For example, if the system has surplus generation capacity in one area, there may not be a way to get that surplus to another part of the system where it might be needed. In addition, steam that is least expensive to generate cannot always flow into the “pocketed” areas of the system where generation may be more expensive to produce. This is discussed in detail in Chapter 6.4.6, Options for the Future.

6.3.4 Improve Transport Flexibility

Although peak load has been trending downward over the last few years, the Company has been actively studying the Steam Transmission and Distribution System to identify specific locations with congestion and restrictions that could use upgrades and enhancements to improve steam pressure, flow, and dispatch operations. With the goal of maintaining an acceptable pressure distribution across the system, several locations were identified that could be upgraded to result a system improvement. At this time the peak demand does not require these locations be addressed, nor would it be economically feasible at this time; however, the Company will keep them on the radar for the future.

**Spruce Street Main Upgrade** - This project un-bottles steam flow in the downtown steam district and facilitates steam flow from the east side to the west side, which normally operates at pressures lower than...
the rest of the System. This is expected to improve the transport flexibility up to 300 Mlb/hr across the downtown area.

**E 15th Street Main Upgrade** - This project makes for greater use of the steam capacity at the East River Generating Station by un-bottling the steam flowing from the East River Generating Station outlets to provide greater transport flexibility to both the uptown and downtown districts.

The benefits of this upgrade can improve the transport flexibility up to 600 Mlb/hr from the East River's Sendout Main and provide for greater steam flow uptown. The extra flexibility can be used to help improve steam pressures on the west side.

**Ravenswood Tunnel Exit Upgrade** - This project makes for greater use of the steam capacity from the Ravenswood Steam Plant by un-bottling steam flow at the Tunnel outlet and providing up to 226 Mlb/hr more steam from the Ravenswood Station to the Upper East Side and Midtown areas.

The benefits of this project are the ability to send out the full 976 Mlb/hr capacity from the Ravenswood Steam Plant to the Upper East Side and midtown areas.

**Grand and Water Street Main Tie** - This project would connect Mains in lower Manhattan and help to balance the steam flow on these Mains. However, since the implementation of the revised operating criteria and the retirement of the Hudson Avenue boilers, the balancing of the steam flows is less of an issue.

### 6.3.5 Study the Behavior of Condensate in the System

The Company is actively pursuing an R&D effort to better understand the causes of water hammer and the behavior of condensate. The Company has completed an effort to study, in a lab environment using air and water, the behavior of condensate combined with moving steam in sloped pipes, offsets and vertical risers. Tests were also conducted to determine the direction the water would preferentially flow at a junction. The results of the foregoing tests were validated using steam and water. As a result of the studies, the Company empirically determined the transitional velocity required to overcome gravitational effects to push the condensate “uphill” in the direction of the steam flow and preferential flow direction of condensate at junctions.

Ultimately, the results obtained from the studies shall be utilized in a “real-time” water hammer prediction model that will determine how much condensate is being formed and where the condensate is accumulating in the distribution system.
6.3.6 Operational Risk Mitigation

In order to keep the steam distribution system running effectively and in a safe and reliable manner, the PSC has developed a few operational and maintenance metrics which the company is subject to penalties if these metrics are not met (see Table 6-3).

Table 6-3. Distribution O&M Metrics

<table>
<thead>
<tr>
<th>Metrics</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency Response Performance Metrics</td>
<td>Steam operations must respond to 95% of the steam leak and vapor condition calls within 60 minutes and 85% of the calls within 45 minutes per the current Rate Case Performance Metrics.</td>
</tr>
<tr>
<td>Leak management performance metrics</td>
<td>Emergency leaks require immediate response and are worked continuously until repaired or the condition is no longer hazardous. Non-emergency leaks include any leak which is not immediately hazardous at the time of discovery and can be reasonably expected to remain that way. Non-emergency leaks shall be repaired within six months from the date of discovery. There is a current Rate Case Performance Metric target for a mid-year and year-end leak backlog to be less than or equal to 24 leaks based on 12 month average.</td>
</tr>
</tbody>
</table>

Table 6-4 shows the Company’s operational and maintenance programs as agreed to by the PSC.

Table 6-4. Distribution O&M Programs

<table>
<thead>
<tr>
<th>Programs</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manhole flood inspection</td>
<td>Flood prone manholes must be physically inspected after heavy rain</td>
</tr>
<tr>
<td>Identify and evaluate manholes requiring automatic pumping</td>
<td>The source of the water infiltration in flood prone manholes must be identified, and proper drainage or automatic pumping must be installed where necessary to keep the water level below the steam main if necessary.</td>
</tr>
<tr>
<td>Failure analysis</td>
<td>Failure analysis must be conducted to identify areas of system damage and/or degraded components. Permanent repairs should be made within 6 months for any temporary repairs made in the field.</td>
</tr>
<tr>
<td>Installation of</td>
<td>Existing traps must be replaced with high capacity traps at low points in the system.</td>
</tr>
</tbody>
</table>
### Remote Monitoring

**Remote Monitoring for Trap Operation and Water Infiltration, and the Installation of High Capacity Traps**

System where large amounts of condensate are expected to accumulate. Approximately 40 locations have been selected for the installation. The installation of 18 locations has been completed and the rest are scheduled for completion in 2012. Additional locations will be selected on an as needed basis.

### Inspect Street Traps Every 10 Weeks

Steam traps and trap piping assemblies are to be inspected for general condition and proper operation at least six times each calendar year at intervals not exceeding ten weeks.

### Inspect Slip Joints Twice Annually

Accessible expansion slip joints are inspected at least twice each calendar year at intervals not exceeding 30 weeks. The inspection includes checks for leakage, proper alignment, and traverse measurement.

### Manhole Inspection

Steam manholes are inspected for general conditions and adequacy of insulation at least once each calendar year at intervals not exceeding 15 months and must also be inspected for structural integrity at least once each ten calendar years. The structural inspections are included as part of the annual manhole inspection program.

### Blow Off Valve and By-Pass Valve Inspections

Blow-off valves and by-pass valves are checked for operability immediately prior to closing each associated main valve during a scheduled shut down of a section of the steam distribution pipeline system. Removal of condensate from a shut down section of pipeline must be done prior to re-opening main valves.

### Inside Service Valve Inspection

Inside service line valves are inspected at the time of periodic meter reading. Presently, the meter reading has been scheduled monthly. Valve seals, and warning tags stating that the opening of the service valve must be made only by authorized steam corporation personnel, are physically verified in field. Missing or illegible tags and broken seals must be replaced no later than one week, after the condition was discovered. Broken seals, indicating possible unauthorized operation of the valve, are investigated to determine cause.

### Inspect Traps Inside Buildings Once Every Month

Company owned steam traps and trap piping assemblies are to be inspected for general condition and proper operation at the time of periodic meter reading.

### System Telemetry

System pressure telemeter recording devices are inspected and tested for accuracy at least twice each calendar year at intervals not exceeding 30 weeks. At a minimum, pressure recording gauges are installed at the interface between portions of the system which are designed for different operating pressures.
6.4 SIGNPOSTS

By definition uncertainties are difficult to predict; however, The Company has identified a list of signposts that will trigger the review and adjustment of its plan at any point during implementation. This list is a reminder that the world is constantly changing, and the Company needs to change with it, which also means this list is never final and will continue to grow and change.

- **Interference projects identified by the City** - Can have a significant impact on the cost of operations and maintenance for the Steam System. Currently, the City has eminent domain of the streets of New York and whenever existing steam facilities will cause an interference issue with proposed City facilities, the Company would have to relocate its facilities or pay for accommodations to avoid the interference. Allowing the company to include accommodations, relocation and support and protection for its facilities in City projects based on competitive pricing would reduce costs impact to Steam Customers.

- **Results of the Condensate Behavior Tests** - May identify additional opportunities for programs, processes or system changes which can be implemented to improve the safety and operational efficiency of the system.

- **Distributed Generation, specifically CHP, adoption** - May drive load in certain pockets of the system which may need to be modified to allow for bidirectional steam flow in order to provide standby service to the customer during a customer outage as well as purchase steam from the customer should that be necessary.

- **Leak Detection Model Development** - Will allow the Company the ability to model operations of the distribution system to identify and locate underground leaks in order to reduce distribution losses. Leaks develop over time on piping, flanges, and valves, slip joints, trap discharge lines and cooling chambers, and can come from a variety of sources including corrosion, welds, gaskets, and packing. In addition, steam leaks affect the overall efficiency of the Steam System. Discovered steam leaks are currently required to be repaired within six months of discovery; however, non-visible leaks occurring in the middle of underground pipe, not near a structure, will remain undetected until that section of pipe needs future maintenance or the leak worsens.

- **Regulatory Changes** - Can reduce the amount of mandated replacement of assets required in the distribution system. By lengthening asset lives, while maintaining the current level of safety and service, the Company can reduce costs for both new assets and the labor expenditure to replace those assets. In addition, changes in environmental regulations can have an effect on the increased need for capital expenditures that are required in order to comply with the new regulations.
- **Fuel Prices** - Can have a significant impact to customer billing along in addition to affecting economic justification of fuel saving projects. The company monitors prices for economic dispatching of the units on the steam system in addition to monitoring long range fuel forecasts.

- **Electric System Generating Capacity Changes** - can have an effect on the required generation in Manhattan and the need for possible additional CHP/cogeneration installations.

- **Economy** - The state of the economy can have an impact on customer usage of steam sales and peak demand on the steam system.

- **Technological Advances and Energy Conservation** - new technological advances associated with energy management along with energy conservation might reduce steam sales and peak demand on the steam system.

- **#4/#6 Oil Conversions** - The Company is engaged in this market opportunity and has prepared materials to educate prospects on their Steam alternative. An estimated market potential was derived from data supplied by the City. Actual unsolicited inquiries and targeted cold calling results will be monitored to determine the acceptance rate for proposed steam services and gauge the potential for total new business from oil conversions. Variances to the assumptions behind the estimated market potential will then be addressed in further forecasts.

- **CHP incentives** - The Company will continually monitor sources of funding for CHP such as federal, state and local agencies. Trade association efforts and regulatory initiatives will be reviewed for their potential to change market opportunities for CHP. The Company’s Customer Sited Supply Pilot Program provides insight from prospective participants on the status of CHP as an alternative energy supply within the steam system footprint.
7.0 ASSESSMENT DOCUMENTS

A. Assessment Document: Steam Variance

B. Assessment Document: CECONY 2010/11 Winter Experience & Long-Term Steam Peak Demand Forecast and CECONY Steam Peak Demand Forecast Update Winters 2011/12 – 2020/21

C Assessment Document: Multi-Area Reliability Simulation (MARS)

D Assessment Document: Fourth Quarter 2011 Customer Satisfaction Summary

E Assessment Document: 20 Year Plan Emissions