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1. EXECUTIVE SUMMARY

1.1 Background

For over 190 years, Consolidated Edison, Inc. (Con Edison or the company) has had the privilege of providing power, light, and heat to the people of New York City (NYC) and Westchester County through our natural gas delivery system. The vision for the company’s gas organization is to be industry best-in-class in safety, quality, compliance, and customer experience. Our strategic mission is to deliver natural gas safely, reliably and cost-effectively while enhancing the customer experience, to respect the environment, to create a culture of safety and compliance, and to support the development of our employees. This vision and mission are the basis for this Gas Long Range Plan (GLRP), which provides our gas system plan through the year 2035.

The GLRP includes cost projections to manage risk and maintain the safety and reliability of the gas system. System inspections, gas leak detection, emergency response to gas leaks, and replacement of gas distribution and transmission piping identified for replacement are key components to maintaining a safe gas system. Also critical to gas system safety are detailed operating, maintenance, and system design procedures, and strict compliance to those procedures.

In past years, Con Edison developed infrastructure plans for its gas distribution and transmission systems. The purpose of those infrastructure plans was to determine the work needed to build sufficient system capacity to meet customer energy requirements, based on stringent design criteria aimed to produce a very safe and reliable system. In 2010, we issued our original GLRP, which extended the transmission and distribution system infrastructure plans by adding other elements of our business, such as demand and supply drivers and customer and workforce implications, to present a single comprehensive plan for the business unit. In 2012, Con Edison developed an Integrated Long Range Plan (ILRP) that applied a common, integrated framework to our infrastructure planning processes for electric, steam, and gas, with the intent of capturing opportunities to limit growing delivery costs and identify cross-commodity solutions to meet customer energy needs. Our GLRP was also updated in 2012, and now again in 2016, to incorporate changes in technology, the economy, and both environmental and governmental policy. The key elements for the 2016 GLRP are:

- Managing System Risk
- Balancing Demand, Supply, and Environmental Profile
- Improving Infrastructure Planning and Design
- Enhancing the Customer Experience
- Focusing on Cost Management

1.2 Key Elements of the Plan

1.2.1 Managing System Risk

Learnings from both company and industry gas incidents have resulted in an urgency by both gas utilities and regulators to accelerate the replacement of cast iron and unprotected steel gas distribution piping. Utilities with older gas systems in the Northeast, like Con Edison, have large inventories of this piping in their systems. We also foresee future legislation involving gas transmission piping that may require rehabilitation or replacement of older transmission piping.

The company has a comprehensive strategy to manage risk in our gas system that involves the following components:
• **Prevention:** Minimizing leaks in the gas system by prioritized replacement of identified distribution and transmission piping. The company plans to replace all 12-inch-and-under diameter cast iron and unprotected steel gas distribution piping during the next 20 years. In addition, the company also has long-range plans, beyond the scope of this 20-year GLRP, to assess and rehabilitate or replace all cast iron and unprotected steel gas distribution piping larger than 12 inches in diameter as necessary, as well as all vintage gas transmission piping. Each piping replacement and rehabilitation program is very capital-intensive, but necessary to assure the safe operation of the gas system.

• **Detection:** Reducing the risks associated with gas leaks by employing leak detection methods continuously in our system and by seeking out improved leak detection technologies. Our operating procedures include a methane leak survey of all gas distribution mains, gas *service lines*, and transmission mains per federal and state requirements. In addition to these mandated leak surveys, the company has conducted monthly leak surveys of all gas distribution mains since November 2014. Con Edison is also pursuing the use of new technologies to improve gas leak detection of our system, such as residential methane detector technologies. Our vision is that residential methane detection will improve public safety, just as residential smoke and carbon monoxide detectors have.

• **Response:** Rapid emergency response to gas leak calls and making each situation safe as quickly as possible, to prevent a leak from becoming a safety issue. Our plan includes the use of our Code MuRRE (Multiple Resource Response Event) process, which provides a heightened response to specific high-hazard conditions by both company forces and the fire department. This process assists with getting more boots on the ground quickly to minimize the risks of these reported leaks.

• **Compliance:** Enhanced quality control and assurance programs. The company has an increased focus on quality control and assurance to assist with achieving a compliance culture that is best-in-class. The company formed a new organization in 2015 with increased resources focused on training, qualifications, work quality, field inspections and the use of improved technologies to monitor and assure these practices.

1.2.2 Balancing Demand, Supply and Environmental Profile

In April of 2011, New York City enacted clean heat regulations, which limited the use of No. 4 and No. 6 oil for heating buildings. To comply with the rules, heavy oil users can turn to Con Edison for clean burning natural gas service. These regulations, coupled with natural gas prices likely being favorable as compared to oil for the next 20 years, will increase our peak hour demand system-wide and will require a significant investment in capital infrastructure. The investments will include a continuation of oil-to-gas conversion work in New York City, as well as the expansion of gas service installations and conversions in Westchester. This initiative will allow customers to reduce their carbon emissions footprint and improve air quality in their communities.

We also need to plan for adequate supply and pipeline capacity to reliably operate our natural gas system. Furthermore, we face the logistical challenges that come with managing a significant number of natural gas service requests and effectively coordinating the infrastructure work needed to meet the demand. We must complete the work in a way that is customer-friendly, minimizes disruptions to the community, is cost-effective, and enhances safety.

1.2.2.1 Forecasting Demand

One of the most important steps in our expanded planning process is to develop forecasts for gas demand. We make assumptions about economic trends, environmental and regulatory requirements, and the competitiveness of natural gas prices to develop forecasts of customer demand. To develop the infrastructure projects and programs in this plan, we used demand forecasts and identified *signposts* that we will monitor and use to update our plan in the future as appropriate. The forecasted peak demand compound annual growth rate (CAGR) over the first five years of this plan is forecasted at 2.3 percent.
This is due mostly to oil-to-gas conversions, and is also influenced by large new construction and distributed generation forecasts.

Looking further out, our forecast for firm peak demand CAGR over this 20-year plan is 1.3 percent. Over the next twenty years, natural gas will remain an integral part of our community’s energy mix. We expect demand for natural gas to grow because it is a cost-effective, environmentally-responsible fuel for particular energy applications, such as heating, power generation, and transportation. Motivated by economic and environmental considerations, we anticipate that consumers will consider natural gas as a favorable heating fuel and power generation source, and will evaluate the economics of gas-fired distributed generation.

1.2.2.2 Meeting Supply Needs

Demand for natural gas applications is highly dependent on the commodity’s availability and its price relative to competing fuels and their price volatility. Recent North American unconventional gas discoveries, including Marcellus shale production in the Northeast United States, suggest that natural gas prices will likely remain competitive during the planning period. Through our supply diversification, gas procurement, and hedging strategies, we obtain adequate supplies of natural gas, while reducing the near-term commodity price volatility that our full-service customers experience. Reliable gas supply and service also depend upon adequate pipeline capacity and storage contracts to deliver gas to our city-gates.

To meet these challenges, we have growth strategies and marketing campaigns in place to bring customers onto our gas system as efficiently as possible. In addition, we support projects that give us access to new sources of low-cost natural gas supply.

1.2.2.3 Protecting the Environment

Con Edison is committed to environmental responsibility. Nearly all methane emissions caused by the gas distribution industry are due to unintended fugitive leaks. The company has been a member of the Environmental Protection Agency’s (EPA) Natural Gas STAR Program since its inception in 1993 and has achieved estimated cumulative reductions in released methane of 5.1 million mcf primarily through the repair or replacement of leaking pipe and the use of automated systems to reduce pressure.

Our Research and Development organization is currently participating in the development of an exciting technology that will be used to quantify actual methane emissions from Type 3 leaks. The company is working with the Environmental Defense Fund and other parties on a pilot project to quantify which non-hazardous leaks make the greatest contribution to greenhouse gas emissions from our system. The largest methane emitters will either be repaired or eliminated through capital replacements. This technology may not only help Con Edison to reduce methane emissions, but also help to promote the improvement of detection technology.

1.2.3 Improving Infrastructure Planning and Design

Our gas system consists of more than 4,300 miles of pipe transporting more than 300 million dekatherms (MMDth) of natural gas annually. These pipes run alongside other underground facilities (such as electric, telephone and cable television ducts and water, steam, and sewer pipes) and their location makes infrastructure repair and replacement projects logistically challenging and expensive. A key element of our GLRP is our infrastructure plan, which details our efforts in this area.

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1 Methane emissions are measured in thousand cubic feet (mcf).

2 A Type 3 leak is not immediately hazardous at the time of detection and can be reasonably expected to remain that way. However, Type 3 leaks shall be reevaluated during the next required leakage survey or annually, whichever is less.
1.2.3.1 Infrastructure Plan Overview

The programs outlined in our infrastructure plan help Con Edison manage a large, complex, logistically challenging, underground gas transmission and distribution infrastructure designed to the rigorous reliability and safety standards that our customers have come to expect. The cost of the programs total $20.5 billion over this 20-year plan. All capital figures in this long-range plan are expressed in nominal dollars and include an inflation assumption of 2.5 percent (post five-year business plan) to reflect future price level changes. Our current infrastructure initiatives represent three broad activities as shown below in Figure 2-1.

**Figure 2-1: Gas Infrastructure Plan (2016–2035 Capital Budget)**

- **Infrastructure Investment**: Expenditures in this category are designed to reduce risk, maintain system integrity, accommodate gas demand and maintain pressures and system reliability. The programs in this category represent two types of investments:
  - **Main replacement program**: Replacement of 12-inch-and-under cast iron and unprotected steel gas distribution mains. This program is a necessary effort that minimizes risk from aging infrastructure.
  - **Non-main replacement infrastructure investment**: Replacement or rehabilitation of all mains, services, and components in our gas distribution and transmission systems not covered under the main replacement program. These investments will further reduce system risk, and will also serve to reinforce or upgrade the system to accommodate new loads.

  Infrastructure managed under this category includes pipes, regulator stations, valve, etc. Over the planning period, this activity will represent 78 percent of our investments.

- **New Business**: Expenditures in this category represent the cost of installing new services or mains for connecting new customers to our system, which includes new construction, existing customers with increased load, and oil-to-gas conversions. Over the 2016–2035 planning period, this activity is expected to represent 15 percent of our investments.

**Infrastructure Investment**:

- **Public Improvement**: 7%
- **New Business**: 15%
- **Infrastructure Investment**:
  - **Main Replacement Program**: 38%
  - **Non-main Replacement**: 40%

**Total Capital Budget**: $20.5 Billion
Public Improvement: When a municipality decides to perform work under its streets, the presence of existing facilities such as sewer, water, telephone, electric, and gas can complicate both new installations and maintenance work. When gas facilities are in conflict with municipal activity, Con Edison has a legal obligation to remove or otherwise protect its facilities to accommodate that work at our—and therefore our customers’—expense. Due to the nature of the work, we have little control over the amount or timing of the required public improvement investments. However, we apply the same capital expenditure management to this part of the plan as for our infrastructure maintenance and new business work. Over the planning period, we forecast that this activity will represent 7 percent of our investments.

1.2.3.2 Key Gas Infrastructure Plan Initiatives

Our gas distribution system was primarily installed between 1880 and 1970. The original installations were predominately cast iron and unprotected bare steel. Over time, cast iron and unprotected steel pipes have become vulnerable to leaks because of steel corrosion, joint leaks, and main breaks associated with small-diameter cast iron, which can adversely affect our system’s integrity. Since 1971, new and replacement pipes have been mostly polyethylene plastic or cathodically-protected steel, which are much less susceptible to leakage. The plastic piping used today is the best available technology for new pipe. It eliminates corrosion issues and is resilient. As of January 2015, approximately 27 percent of the pipes in our system were cast iron, 25 percent were unprotected steel, 42 percent were plastic, and 6 percent were protected steel.

The projected cost of our gas distribution main replacement program in the 20-year plan is $7.7 billion, which is approximately 38 percent of the total $20.5 billion infrastructure plan. This distribution main replacement is, by far, our largest infrastructure initiative. The program’s objective is to replace all remaining cast iron and unprotected steel pipes of a diameter 12-inches-or-less, with plastic pipes or protected steel pipes over a 20-year period starting in 2017. In order to accomplish this, we will need to significantly increase our current replacement levels of unprotected steel and cast iron piping. This smaller-diameter category of piping is the most prone to cast iron breaks and corrosion leaks based on industry and company risk analysis. In 2015, 70 miles of this piping was replaced. This GLRP includes ramping-up to 100 miles of replacement a year by 2021, which will allow for completion by 2036.

In addition to the main replacement program, which targets our smaller-diameter distribution pipes, our Distribution Supply Main Projects involve replacement or rehabilitation of cast iron and unprotected steel pipes in our backbone system. These backbone supply mains are typically larger than 12 inches in diameter, and carry a lower risk than cast iron and unprotected steel pipes of 12 inch diameter and below. Where possible, we intend to rehabilitate pipe by using trenchless technologies to prevent future leaks, reduce the costs of pipe replacement, and minimize digging and disruption. We expect that industry experience and research and development advances will improve liner technologies significantly over the next decade, and that these liners will become a cost-effective long-term solution within the course of this GLRP. We expect to spend nearly $1.8 billion, or 9 percent of our capital budget, on supply main work during this 20-year plan. The supply main replacement/rehabilitation program will also extend beyond the twenty year plan.

Gas Transmission Projects are also a major portion of the infrastructure plan, and focus on the replacement of vintage transmission mains. Approximately 14 percent, or $2.9 billion of the overall $20.5 billion, is targeted for vintage transmission pipe replacement. The work during this 20-year plan includes replacement of approximately 18 miles of the oldest, least ductile piping in the system, which runs through the Bronx and Westchester. The infrastructure plan also includes transmission projects to connect additional gas supplies to our service territory via replacement of existing gate stations with larger capacity gate stations and the installation of additional gate stations. This work is needed to assure adequate gas supplies to meet demand requirements, ensure competitive pricing for our gas supplies, and maintain reliability during contingencies, such as the loss of a gate station.

1.2.4 Enhancing the Customer Experience

We will continue to seek new opportunities to minimize our customers’ gas energy costs. Our projections of customer bill impact indicate an increase in bills over the 20-year plan of approximately 2 percent
greater than inflation. This is predominately related to the increase in our planned replacement of gas distribution and gas transmission piping described in our Gas Infrastructure Plan Overview. Minimizing customers’ gas energy costs will be accomplished by better project designs, more efficient management of gas infrastructure, increased system usage, lower gas commodity costs and the leveraging of technology. We are committed to cost reduction efforts such as maximizing trenchless technologies, growing the number of qualified employees and contractors, adding work and cost management tools to better track unit costs and performance indicators, and by establishing and maintaining performance cost goals.

The Con Edison customer bill encompasses three sections: delivery, supply, and taxes and fees.

- The delivery portion comprises about 41 percent of the current bill and represents the costs associated with transporting natural gas from Con Edison’s point-of-supply to the customer.
- The taxes and fees portion makes up about 33 percent of the current bill, and is composed of sales taxes, Con Edison’s property and income tax, and fees imposed by the state associated with energy efficiency and renewable portfolio programs.
- The supply portion is about 26 percent of the current bill, and includes the commodity cost of the gas supply and the transportation costs of delivering natural gas to Con Edison before redistribution to customers.

While only the delivery portion of the customer bill is directly under Con Edison’s control, we work to mitigate increases to the bill through investments in transmission infrastructure that would give us access to lower cost sources of supply and by advocating for our customers to lower their taxes and fees. We forecast a 6.3 percent annual increase in the customer bill over the next five years and an average annual increase of 4.3 percent (approximately 2 percent greater than inflation) in the customer bill through 2035. This is due to near-term increases in supply costs, as well as modest increases forecasted in both the delivery and taxes and fees portions of the bill. See Figure 2-2.

**Figure 2-2: Total Bill Impact for Residential Heating Customer**

![Graph showing total bill impact](image)

- **Total Customer Bill**
  - 5-Year CAGR: 6.3%, 20-Year CAGR: 4.3%
- **Supply**
  - 5-Year CAGR: 7.1%, 20-Year CAGR: 3.6%
- **Taxes & Fees**
  - 5-Year CAGR: 5.8%, 20-Year CAGR: 5.1%
- **Delivery**
  - 5-Year CAGR: 5.9%, 20-Year CAGR: 4.2%

3 An average residential customer is projected to consume 135 therms of gas monthly.
As the energy landscape is changing, new methods of collecting customer usage data are emerging. An example is our AMI (Advanced Meter Infrastructure) “smart meter” initiative that will transform Con Edison’s relationship with our customers by providing them with a two-way communication device for monitoring energy usage and helping them become better consumers. This also ties in with New York State’s REV (Reforming the Energy Vision) initiative, which encourages programs that provide incentives for customers to actively participate in energy markets, control energy use, and take control of their monthly bill.

We are committed to having the right systems and resources in place to enhance the customer experience and to address key issues including cost, quality of service, and the ease of doing business with us. We will employ new media to offer customers an increased level of control over their gas use through energy management tools.

1.2.5 Focusing on Cost Management

The Gas Organization’s costs primarily involve construction, operation, and maintenance of the transmission and distribution infrastructure. Heightened awareness of our system risk, influenced by learnings from natural gas industry events both in our service territory and across the country, has increased the volume of incoming leak calls we receive, as well as the costs associated with responding to and repairing these leaks. We have also recognized a need to accelerate certain capital-intensive programs, such as our main replacement program, which will involve a significant increase in capital expenditures.

1.2.5.1 Capital Expenditure Patterns and Forecast

We anticipate capital expenditures to increase at an annualized rate of 3.5 percent during the 20-year planning horizon. See Figure 2-3. The main contributor to this spending growth is the acceleration and enhancement of our risk management programs, such as our distribution main replacement program, described in section 3.2.1. In 2015, we replaced 70 miles across our service territory, and by 2021, we will be ramping-up this amount to reach 100 miles per year. Within the next 20 years, 33 percent of the gas transmission system (30 miles) will also be replaced to improve safety and reliability. Further driving this expenditure growth is the increased main replacement in Manhattan, which will increase significantly from historical levels. Due to permit restrictions, density of utilities in the street and various other factors, replacing pipe in Manhattan can be up to six times more expensive than in the other boroughs. To save on our own project costs and avoid street disruption, we plan to coordinate and integrate our street work with concurrent Con Edison or NYC projects. Acceleration of near-term expenditures results in an annualized capital growth of 7.8 percent over the years 2015 through 2020. However, after 2020, our expenditures level off, and the forecasted annualized capital growth rate slows to a rate of 2.0 percent from 2020 through 2035.

To aid in managing work projects and the capital expenditures that fund them, Gas Operations identified the need for an integrated system to optimize its ability to plan and manage all types of work. Changes in technology, the economy, and both environmental and governmental policy present challenges for Gas Operations, and justify the need to implement a Work and Asset Management System. This system will permit Gas Operations to standardize work processes, improve work scheduling and prioritization, and provide a single repository for all work and asset data related to Con Edison’s gas facilities. This will be a seven-year capital expenditure scheduled to commence in 2016.
1.2.5.2 Operations and Maintenance Cost Patterns

The company's operations and maintenance (O&M) costs are also a critical component of our cost structure. These costs include our regular infrastructure maintenance programs, such as leak detection, leak repairs, system monitoring operations, inspections, and emergency response. In addition, increased capital-intensive infrastructure renewal programs drive incremental O&M expenditures associated with facilitating and transferring existing services to new mains.

The company has made a considerable effort to raise and maintain public awareness related to identifying and reporting gas odors. In wake of the upstate New York Horseheads incident in 2011, the Public Service Commission (PSC) issued an order to enhance gas safety public awareness. In response to this order, and to the more recent incidents in East Harlem and East Village, we have mounted an aggressive effort on many fronts to encourage the public to call if they suspect a gas odor. This has resulted in a significant increase in the company’s gas leak calls, which have subsequently led to increases in our emergency response, leak repair, and other O&M activities, as explained in section 3.3.1. In addition, the company has increased the number of proactive leak detection surveys. These changes have been the main drivers for the increase in O&M costs that we have experienced over the past few years. We anticipate that leak calls will remain at these higher levels for the near future, which we project, will result in a higher level of O&M expenditures over the next five years (2016 – 2020). We also forecast an $11 million O&M expenditure increase in 2017, which will be associated with changes to our Service Line Inspection Program in order to comply with recent changes in the New York State code Part 255, regarding the definition of a service line.

Currently, approximately 95 percent of all system main leaks are associated with cast iron or unprotected steel mains. Therefore, we anticipate a sharp decline in our system leak rates in the later years of the plan as a result of our to our 20-year main replacement program, which will eliminate 12-inch-and-under cast iron and unprotected steel mains at an aggressive rate. This decline in leaks will result in a significant long-term decline in our O&M budget.

We are currently developing capabilities to perform ongoing strategic workforce planning that will help us proactively direct our workforce to manage the increased volume of work that these initiatives create.
1.2.5.3 Optimizing Cost

Our cost management objectives are to minimize expenses through a combined strategy of improved processes and operations, effective human resource management, the use of advanced technology, and by encouraging a culture of safety and regulatory compliance.

To carry out our 20-year plan, we will need to develop new skill sets and implement the appropriate training to support the growth of our employees; improve upon our management and organizational processes; enhance our cultural values to be one of safety and compliance; and develop new systems to take advantage of emerging technologies that will enable the company’s initiatives. This will involve concentrating on four areas:

- **Job Skills and Organization**: Evolving the skill sets of our employees to meet the needs of tomorrow by implementing the proper hands-on training and to recruit and secure the talent we need by strategic workforce planning.

- **Information Technology**: Implement new projects to enable Gas Operations to streamline its work flows and improve efficiency.

- **Culture**: Developing a compliance culture that is best-in-class with tools to measure and check compliance.

- **Management Systems**: Implement new management systems or realign existing systems to meet changing organizational needs and to maintain clear accountabilities for estimating accuracy, tracking of results, analyzing variances, and implementing corrective actions as required.

1.3 Summary

This GLRP describes our intent to serve our customers cost-effectively with safe and reliable natural gas. It provides a strategic framework for implementing our plans, to manage demand and supply, invest in our infrastructure, provide environmental stewardship, and to serve our customers at a reasonable cost. Over the planning horizon, some uncertainties will be resolved, and other uncertainties will surface. It is because of this uncertainty that we must plan ahead.

In the process of developing a plan, we express desired outcomes, identify unknowns, and enhance our corporate ability to address contingencies and to adjust to new and unforeseen developments when they inevitably arise.

We developed this long range plan to reflect our most current thinking, approaches and roadmap towards the vision we plan to achieve over the next 20 years. During the planning period, we will measure our performance, manage our costs, and reduce the risks on our system. We have described the various uncertainties and identified key signposts, and we expect to update the plan as material changes occur in our operating environment. To accomplish our goals, we will collaborate with our customers, legislators, regulators, community leaders and others in order to communicate and implement our plan successfully.

This plan is consistent with the company’s mission to provide safe, reliable, and cost-effective energy to our customers, demonstrate respect for the environment, and create an atmosphere that encourages safety and development of our employees. We will do so by managing demand and supply and by protecting our environment. We will integrate our system design to meet the needs of our customers and improve our system through optimal replacement and maintenance of our infrastructure. We will provide our customers with cost-effective, safe and reliable service, and train our workforce to serve them into the future. It is in these ways that we expect to successfully carry out our objectives and implement our long range gas plan.
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2. INTRODUCTION

This section provides an overview of the vision, mission, and long range (20-year) plan objectives for Con Edison’s Gas Operations. It further reviews the unique requirements of our service territory, and describes the salient technical points of our transmission and distribution system.

2.1 Vision and Mission

The Con Edison Gas Operations vision statement is as follows:

“We will be industry best-in-class in safety, quality, compliance and customer experience.”

The company’s NYC and Westchester County service territory is a densely-populated, largely urban environment that is also host to one of the world’s largest commercial hubs. Con Edison Gas Operations serves a wide range of residential, small business, large commercial, and energy generation customers in this territory who use natural gas for a variety of applications.

Individual homes and multifamily dwellings depend on natural gas provided by Con Edison for their space heating, water heating, and cooking needs. Con Edison has approximately 650,000 residential cooking gas customers and 290,000 residential heating customers. Our customers include the largest cooperative housing development in the world and the largest public housing authority in North America.

Commercial enterprises, such as Fortune 500 companies, and commercial buildings require natural gas for heating, combined heat and power generation (distributed generation), and as a fuel for transportation. Con Edison serves approximately 80,000 commercial heating customers and an additional 70,000 commercial non-heating customers. Our approximately 650 large-volume, dual-fuel, interruptible customers include in-city electric and steam generation plants. The reliability of gas service is critical to these generation plants and to the electric and steam customers in our service area, as the majority of NYC’s in-city electric power generation and steam capacity is dependent on natural gas as a primary or backup fuel.

Given the density of our urban service territory, it is our highest priority to ensure the safe and reliable operation of our gas system and to use the lessons learned from gas industry episodes and incidents in the Con Edison system to continuously reduce risk. Given the harshness of recent winters in the Northeastern United States and the criticality of the area as a commercial hub, reliable gas delivery ranks high among customer expectations in our high-density service territory. System reliability is a priority because gas outages have the potential to affect many customers at any given time, and restoration of service requires a meticulous process that requires customer premise piping to be inspected and integrity tested prior to restoring gas service.

Con Edison Gas Operations is also dedicated to being a responsible steward of the environment. We support the reduction of energy consumption with energy efficiency programs and are committed to helping our community achieve a cleaner energy mix. Natural gas is the most efficient energy source for heating purposes, and the cleanest fossil fuel available to fulfill our area’s energy needs. Con Edison environmental commitments include meeting the natural gas demand that supports the environmental goals of New York State (NYS) and NYC, and minimizing our own methane gas emissions.

We also believe that the needs of NYC and Westchester County will continue to grow and change and we pledge to meet the needs of both existing and future customers. While appliance and building codes and standards will continuously improve the efficiency of gas-fired applications and reduce per-capita gas consumption, we believe overall gas demand will increase based on the need to reduce environmental impacts and use optimal fuels.

Con Edison has defined a strategic mission to align near-term objectives with our longer-term vision. Our mission to deliver natural gas safely, reliably, and cost-effectively while enhancing the customer experience serves as a touchstone for our planning and decision-making processes. We will respect the environment, create a culture of safety and compliance, and support the development of our employees.
We will also continue to upgrade and expand our natural gas infrastructure to meet the future needs of our customers.

We have developed five themes to guide the development of the Gas Long Range Plan. The plan themes reflect our mission and individually describe areas of Con Edison strategy by which individual programs and investments are developed. Figure 2-1 illustrates how the objectives support the Con Edison vision and mission.

Figure 2-1: Con Edison Gas Vision, Mission, and Plan Themes

2.2 Background on the Con Edison Gas System

2.2.1 Service Territory

As depicted in Figure 2-2 below, Con Edison’s gas service territory is comprised of 460 square miles with approximately 5 million residents. The territory includes Manhattan, the Bronx, northern Queens, and almost all of Westchester County. As of August 2015, Con Edison served approximately 1.1 million firm customers and 650 large-volume interruptible customers, several of which are in-city gas-fired power generation plants.
Figure 2-2: Con Edison Gas Service Territory

Table 2-1: Service Territory Statistics

<table>
<thead>
<tr>
<th>Region</th>
<th>Square Miles of Gas Service Area</th>
<th>Number of Customers(^4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bronx</td>
<td>42</td>
<td>304,799</td>
</tr>
<tr>
<td>Manhattan</td>
<td>28</td>
<td>332,887</td>
</tr>
<tr>
<td>Queens</td>
<td>43</td>
<td>207,517</td>
</tr>
<tr>
<td>Westchester County</td>
<td>347</td>
<td>233,083</td>
</tr>
<tr>
<td>Total</td>
<td>460</td>
<td>1,078,286</td>
</tr>
</tbody>
</table>

\(^4\) The number of customers is determined based on the number of active Gas Accounts.
2.2.2 Con Edison Gas System

As illustrated in Figure 2-3 below, Con Edison manages a large, complex, logistically challenging, underground gas transmission and distribution infrastructure designed to rigorous reliability and safety standards.

Our gas system consists of more than 4,300 miles of main transporting more than 300 million dekatherms of natural gas annually. Gas is transported from interstate transmission pipelines, through gate stations, into Con Edison-owned transmission pipelines and then through key regulator stations into backbone systems and finally, into our distribution network to supply our customers.

Figure 2-3: Illustration of Con Edison Gas System

We have gas mains and facilities installed under almost every street and/or sidewalk in our service community, and we are constantly working to maintain or improve our infrastructure. Examples of this work are shown below in Figure 2-4.

Figure 2-4: Installation of Con Edison Gas Main and Regulator Station
2.2.2.1 Gas Transmission

Con Edison’s gas transmission system is comprised of 92 miles of 6 inch to 36 inch diameter cathodically-protected steel mains, operating at pressures ranging from 125 psig\(^6\) to 350 psig, in Manhattan, Queens, the Bronx and Westchester County. The majority of these mains were installed between 1947 and 1973.

Of these 92 miles of transmission main, 46.5 miles operate at a maximum allowable operating pressure (MAOP) of 350 psig in Manhattan, Queens, and the Bronx. The remaining 45.5 miles operate at a MAOP of 245 psig in the Bronx and Westchester. Con Edison’s transmission system is currently supplied by seven gate stations and the distribution system is directly supplied by four additional gate stations at the locations shown in Figure 2-5 below. The Hunts Point Station in the Bronx is the demarcation point between the 245 and 350 psig transmission systems. Gas flows seasonally through the two pressure systems by way of a regulator station during the heating season and a compressor station during the summer.

Figure 2-5: Con Edison Gas Transmission System

\(^6\) Pound-force per square inch gauge
The seven gate stations supplying the gas transmission system are from four pipeline companies—two Transco stations in Manhattan, three Tennessee stations in Westchester, one Iroquois station in the Bronx, and one Texas Eastern (Tetco) station in Manhattan. We have an additional four gate stations in northern Westchester that supply our high-pressure distribution system from Spectra Energy Algonquin Pipeline.

Con Edison’s transmission system is also part of a larger regional network called the New York Facilities (NYF) System. The NYF System is jointly operated and maintained by National Grid and Con Edison. Con Edison is connected to National Grid at two bi-directional metering station interconnects—one at Newtown Creek at the Brooklyn/Queens border and one at Lake Success at the Long Island/Queens border.

2.2.2.2 Gas Distribution

Con Edison’s gas distribution system consists of 4,239 miles of main, operating at pressures less than 99 psig in Manhattan, the Bronx, Queens and Westchester.

Key regulator stations and backbone systems, called supply mains, are critical facilities that transport gas from transmission to distribution systems. Most of these supply mains are large diameter and are located under major roadways.

The remaining miles of the distribution system consist of smaller diameter mains, operating at a variety of pressures:

- 33 percent of the system is high-pressure (HP) operating between 15–99 psig.
- 11 percent of the system is medium pressure (MP) operating between 1–15 psig.
- 56 percent of the system is low pressure (LP) operating between 4–12 inches of water column (inWC).

As noted above, a large portion of the distribution system consists of low-pressure mains that support smaller residential heating and non-heating loads. This configuration of the distribution system limits the type of growth the system can accommodate without significant enhancement or reinforcement.

Emanating from the distribution mains, 370,000 steel, plastic, and copper services connect the distribution system to customer premises. See Figure 2-6 below.
Figure 2-6: Con Edison Gas Distribution System

The distribution system was primarily installed using cast iron, unprotected steel or coated steel mains. Since 1971, as mains and services are replaced or added, the pipe being installed is composed of polyethylene plastic or cathodically-protected steel to increase its longevity and reduce corrosion and leaks. Today, approximately 27 percent of the mains are cast iron, 25 percent are unprotected steel, 42 percent are plastic, and 6 percent are protected steel. Approximately 67 percent of the services are plastic.

2.2.2.3 Design Specifications

Con Edison’s gas transmission and distribution systems are designed to meet the requirements of the gas safety code: NYS Codes, Rules and regulations Part 255. In addition to Part 255, Con Edison’s gas transmission and distribution systems are subject to a variety of federal, state, and city regulations, along with standards published by professional organizations.
The Con Edison system is designed to meet the load requirements of all firm customers\(^6\) 24 hours per day, 365 days per year, based on the forecasted peak hourly load.

The purpose of these design criteria is to govern key reliability, safety, and system integrity conditions:

- Maintain the reliability of supply mains in the event of an outage to a gate station or critical regulating station.
- Maintain the reliability of the transmission system.
- Reduce the potential of incoming gas leaks each year.
- Maintain the system at optimal operating pressures while satisfying detailed design basis conditions.

### 2.2.2.4 Reliability

Con Edison’s gas customers have come to expect a high level of gas system availability, and our goal is to consistently meet that expectation. We have lowered operating pressures in our high-pressure systems in Queens and Westchester. This reduced pressure allows for increased reliability for increasing capacity and adds to public and employee safety. Over the past ten years, gas system availability (time of uninterrupted gas service out of total system time) has been greater than 99.999 percent.

During the recent Superstorm Sandy, the dependability of our gas system was tested. Although it had a much greater impact on Con Edison’s electric system, Superstorm Sandy also identified some significant vulnerabilities where gas system reliability could be enhanced to withstand future storms. We identified five key system components that contained storm vulnerabilities, and have designed gas “storm hardening” programs and projects to address these vulnerabilities.

The five system components targeted by the storm hardening work are:

- flood-prone piping
- tunnel facilities
- the liquefied natural gas (LNG) plant
- regulator stations/remote operated valves
- service vent lines

Flood-prone pipe replacement involves replacing 12-inch-and-less low-pressure cast iron and unprotected steel pipe in flood-prone areas, which is taken to mean all land included in the Federal Emergency Management Agency (FEMA) 100-Year Flood Zone. Hardening work for the other four components has included enhancing the structures that protect the entrances to our tunnel head-houses and house critical LNG plant controls, installing new devices to protect our high-pressure service vent lines, and waterproofing critical components of our regulator stations and remotely-operated valves to reduce the risk of water intrusion. For these components, we look to harden all facilities within the 100-Year Flood Zone plus three feet of flooding along the horizontal plane (“FEMA 100 Year Flood Zone + 3 feet”). Construction work for these storm hardening projects and programs began during our 2014-2016 rate case. Our storm hardening designs have also been incorporated into our system design criteria, and so will continue to be prevalent in programs and projects located within flood-prone areas going forward.

For 2017, the company has created a new capital program to address system reliability called the **Gas System Vulnerability Elimination Program**. This is a program to proactively identify vulnerable areas of our infrastructure, where the failure of a single component could result in a large-scale outage. During the next rate case period, capital replacement and reinforcement projects will be initiated to mitigate

\(^6\) For off-peak firm and other non-firm customers, Con Edison’s obligations are less stringent, allowing interruptions at higher temperatures or for other reasons.
targeted system vulnerabilities. To continue high-reliability performance, the company will strive to maintain and exceed its high performance levels in system reliability and customer restoration.

2.3 Performance, Cost, and Risk Management

One of the company's greatest management challenges is to assure a safe gas system and balance the often competing priorities of risk reduction, cost control, and performance. Our strategic priorities and specific initiatives are designed to improve one or more of these attributes and make informed trade-offs. For example, the desirable result of reducing risk through programs such as our main replacement program will result in increased capital expenditures. Increasing our gas system performance through measures such as faster emergency response, improving system reliability, and reducing our environmental impact can also have large cost implications on both the capital and operations and maintenance budgets. In response, the company develops strategies to mitigate the cost increases otherwise associated with these strategic priorities. For example, in order to balance performance improvement and risk management with capital cost impacts, we use a formalized optimization process described in section 6.1.4. We make all business decisions related to operation, maintenance, and investment in the gas system in the context of their impact on the system's performance, cost, and risk metrics.

2.4 Summary

This section provided an overview of Con Edison, our customers, and our service area. The section also described our plan objectives and plan development process.

The remainder of this GLRP addresses each element of the plan in further detail.

Section 3 outlines the initiatives we are undertaking to manage system risk. Specifically, we discuss our plan to manage the risk of a gas distribution event through enhanced quality assurance and control, prevention, detection, and response mitigation strategies.

Section 4 provides an outlook for gas supply over the planning period, and our strategic priorities for ensuring that adequate supply reaches our service territory.

Section 5 discusses the natural gas demand and customer growth aspects of the plan. It provides details on anticipated customer needs and the impacts that economic growth, environmental regulation and technology development will have on our gas usage forecasts.

Section 6 describes our infrastructure plan, in particular, the programs and initiatives we undertake to maintain our system and to take on new customers. It further provides details on our capital plan estimates during the plan horizon as well as steps we’ve undertaken to manage our capital investments.

Section 7 describes what Con Edison is doing to enhance the customer experience. Efforts are underway to engage customers using the platforms they are most comfortable with and to adapt our plans to meet the changing expectations of our customer base.

Section 8 describes cost management practices that affect our workforce, including skill needs and the business continuity planning necessary to manage and maintain a complex gas system in a consistently safe, reliable and cost-effective manner.

Section 9 is a summary that recounts the internal and external challenges that face a public utility like Con Edison, the cost-reduction opportunities that we are pursuing and some of the signposts we are watching to anticipate change and prepare for it.
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3. MANAGE SYSTEM RISK

We are committed to delivering our gas service safely, with high reliability and resilience. To execute on this commitment and support the company’s corporate strategy objective of strengthening its core utility businesses, Con Edison has a comprehensive strategy in place to manage system risk. In this section, we will focus specifically on how we manage the risk of a gas distribution event through enhanced quality assurance and control, prevention, detection, and response mitigation strategies. In order to help manage this risk, we promote a company culture which has a strong focus on both public and employee safety.

Con Edison uses learnings from both industry and company incidents to manage risk and minimize the risk of such future incidents. Recent events, such as the unfortunate Horseheads, East Harlem and East Village incidents have created a heightened public awareness of risks associated with natural gas systems. This awareness has affected our internal procedures and programs, and has also led us to expend considerable efforts to raise and maintain public awareness. We have encouraged the public to call if they suspect a gas odor with our “Smell Gas, Act Fast” campaign, and this has resulted in a significant increase in the number of gas odor calls, which have subsequently led to increases in our emergency response, leak repair and other O&M activities. Con Edison continues to maintain a high emergency response performance in light of these increased leak calls.

The increase in leak call volume has resulted in an associated increase in our Operations and Maintenance (O&M) costs since 2013, which includes emergency response, leak repairs, system monitoring operations, and our regular infrastructure maintenance and inspection programs. We anticipate that leak call volumes will remain high, and have planned a five-year O&M cost forecast that will allow us to maintain our high response, while enhancing operational performance. Throughout the later years of the plan, we will begin to see a decline in our system leak rates, as a result of our 20-year main replacement program. This decline in leaks will lead to a significant long-term decline in our O&M budget.

Given the complexity of our gas system, there are numerous inherent operational, financial, and safety risks that could potentially impact our customers, the communities we serve, our employees, and the public at large. The company evaluates its risks and seeks to mitigate them whenever possible to improve its performance. As a result, these risks drive many O&M programs and capital investments, and are considered within the project prioritization process when planning operating and capital budgets.

3.1 Enterprise Risk Management

The company has always placed a high priority on identifying and mitigating risk and has implemented a formal Enterprise Risk Management (ERM) process to monitor this activity. Con Edison’s ERM program, initiated in 2005, is the subject of ongoing refinement to improve its usefulness. Through a collaborative process of risk assessment, ERM has become embedded into the planning and budgeting functions of all operating groups. As part of the annual ERM cycle, each group identifies operational and administrative risks, and assesses their severity, likelihood, and controllability. These assessments are reviewed and adjusted through the active participation of senior management.

ERM is a process to identify, analyze, integrate, evaluate, manage, monitor, and communicate risks across the company. Our risk management program has three primary objectives:

- **Systematic risk mitigation**: Continually evaluate the likelihood, severity, and control mechanisms of risk categories and ensure proper risk mitigation and preparedness. Promote a culture of comprehensive risk assessment and prevention throughout Con Edison.

- **Proper allocation of resources**: Integrate ERM into the development and evaluation of business cases. Ensure that annual budgeting and longer-term program development allocate appropriate funding for risk mitigation.
• **Enhanced communication and transparency**: Allow for greater transparency and collaboration by actively involving all levels and functions of the organization, up to and including the CEO and Board members. Establish clear accountability by assigning specific officers to each risk.

As shown in Table 3-1 below, ERM allows Con Edison to translate a broad concept such as “risk” into quantifiable measures of severity, likelihood, and controllability.

- **Severity**: Estimate of the potential impact of the event on public perception, safety, or finances
- **Likelihood**: Estimate of the likelihood that an event will occur within a set timeframe based on past experience and current probability
- **Controllability**: Estimate of the likelihood that existing detection or control mechanisms could predict or prevent the event

For each identified risk, these three components are assigned a value from 2 to 10. These component factors are then multiplied to produce a Risk Priority Number (RPN). The RPN quantifies the relative priority of risks across the company. This value is a key input into our Capital Optimization process described in section 6.1.4.

**Table 3-1: Risk Assessment Factors**

<table>
<thead>
<tr>
<th>Factor</th>
<th>Public Perception Perspective</th>
<th>Safety Perspective</th>
<th>Financial Perspective (After taxes and insurance)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insignificant</td>
<td>No effect</td>
<td>First Aid</td>
<td>up to $3M</td>
</tr>
<tr>
<td>Moderate</td>
<td>Minor impact</td>
<td>Medical</td>
<td>$3 to $15M</td>
</tr>
<tr>
<td>Significant</td>
<td>Marginal impact</td>
<td>Restricting</td>
<td>$15 to $50M</td>
</tr>
<tr>
<td>Severe</td>
<td>Significant public perception impact</td>
<td>Disabling</td>
<td>$50 to $250M</td>
</tr>
<tr>
<td>Catastrophic</td>
<td>Major public perception impact</td>
<td>Fatality</td>
<td>&gt;$250M</td>
</tr>
</tbody>
</table>

**Severity Factor**
Estimate the severity of the event using the five-point scale and use the highest score of the three perspectives:

<table>
<thead>
<tr>
<th>Factor</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rarely</td>
<td>One incident in 10 years</td>
</tr>
<tr>
<td>Unlikely</td>
<td>One incident in 5 years</td>
</tr>
<tr>
<td>Likely</td>
<td>One incident in 3 years</td>
</tr>
<tr>
<td>Frequent</td>
<td>One incident in 1 years</td>
</tr>
<tr>
<td>Certain</td>
<td>Greater than one incident per year</td>
</tr>
</tbody>
</table>

**Controllability Factor**
Determine the likelihood that existing detection or control mechanisms would predict or prevent the triggering event:

<table>
<thead>
<tr>
<th>Factor</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Almost Certain</td>
<td>Excellent detection and control over the triggering event</td>
</tr>
<tr>
<td>High Probability</td>
<td>Highly predictable detection and control over the triggering event</td>
</tr>
<tr>
<td>Moderate</td>
<td>Detection and control are reasonably achievable</td>
</tr>
<tr>
<td>Low</td>
<td>Detection and control are very limited</td>
</tr>
<tr>
<td>Impossible</td>
<td>No ability to detect or control the triggering event</td>
</tr>
</tbody>
</table>

The outputs of the ERM process are detailed mitigation plans for each key risk. Illustrative examples of risks are set forth in Table 3-2 below.
Table 3-2: Illustrative Gas Operations Risks

<table>
<thead>
<tr>
<th>Event</th>
<th>Illustrative Mitigation Programs</th>
</tr>
</thead>
</table>
| Gas distribution system events (e.g., explosion/fire caused by damages, inside/outside leaks, etc.) | • Monthly leak surveys of the entire main system  
• Safety inspections of key assets  
• Maintain low inventory of leaks pending repair  
• Install corrosion-resistant plastic mains and services  
• Operate at lower pressures than historical past practices  
• Timely response to gas odor complaints  
• Accelerate annual main replacement program  
• Increase leak-qualified workforce  
• Continuous cast iron frost patrols from January through April  
• Leaking service replacement program |
| Gas transmission system events (e.g., explosion/fire caused by damages, inside/outside leaks, etc.) | • Patrols of transmission system (minimum weekly) to proactively identify excavators who fail to follow utility mark out protocols  
• Monitoring of excavation activities within 25 feet of transmission mains  
• Installation and maintenance of remotely-operated valves  
• Notification protocols with local fire departments for transmission leaks |
| Workforce Management: Inability to meet mandated replacement programs, accommodate growing demand, and respond to increasing odor complaints | • Increased employee hiring  
• Employee development and training streamlined into cohorts  
• Increased contractor onboarding  
• Yard expansion plan in place for each operating region |
| Cyber Security: Cyber infiltration of corporate networks resulting in the inability to control, monitor, and account for gas deliveries and maintain system pressures | • Enhanced Cyber Attack Response Plan  
• Deploy “Tipping Point” technology (intrusion prevention/detection) on corporate networks  
• Segmentation of network/systems using firewall technologies  
• Two-levels of authentication for backup  
• Regular drills |

Other Gas Operations risks tracked within ERM include:

- Water main breaks that might impact our low-pressure gas system and cause an extensive customer outage
- Loss of gas supply into the service territory for an extended period of time
- The physical security of a company facility being compromised by a terrorist attack or act of sabotage

3.2 Prevention

Prevention is the most integral part of our comprehensive approach to manage system risk. For example, to prevent a distribution event, there are programs in place to mitigate primary failure causes that compromise the integrity of our mains resulting in a leak condition. Due to the large inventory of cast iron and unprotected steel in our service territory, our gas distribution system generates a large volume of leaks. Leak repairs constitute a major component of our overall O&M costs, totaling approximately $50 million per year.
3.2.1 Main Replacement Program

The major proactive program to reduce the risks associated with leaks on our gas system is the replacement of cast iron and unprotected steel distribution mains with polyethylene pipe or cathodically protected steel pipe. Wrought iron pipe replacement is also addressed in this program, and is included in the cast iron category. This program permits us to improve public and employee safety by reducing the potential risk of loss of life, injury, and/or property damage.

In addition to the safety benefits, main replacement has the added benefits of reducing:

- financial expenditures necessary to respond to and repair gas leaks
- negative public reaction/loss of public confidence
- insurance deductibles and increases in insurance premiums

Since 2010, the company has accelerated its main replacement program in order to strengthen our focus on safety. Beginning in 2017, replacement of main will become a stronger focus in our capital expenditure program with a significant emphasis on reducing the risk posed by cast iron and unprotected steel distribution mains. Our main replacement program will target:

- cast iron distribution mains when interference or encroachment criteria is met, as is our current practice
- all cast iron gas mains’ 12-inch-and-under by the year 2036 (within 20 years), which expands upon our current program that targets the replacement of 8 inch and under mains
- all unprotected steel gas mains 12-inch-and-under by the year 2036 (within 20 years), which expands upon our current program that targets the replacement of 8 inch and under mains

Con Edison’s enhanced main replacement program will utilize a replacement prioritization model that allows us to optimize risk reduction (see the next section). We will also incorporate the replacement of these mains within geographic areas on a risk prioritized basis. These and other planning efforts will form an integrated capital program to address our aging system.

Approximately 1870 miles of main will be replaced during our 20-year main replacement program. This total includes all 12-inch-and-under cast iron and unprotected steel inventory projected to be remaining in the system as of January 1, 2017. This inventory is made up of roughly equal percentages of both cast iron (including wrought iron) and unprotected steel mains, and is distributed throughout the system as illustrated in Figure 3-1.

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7 The cast iron main replacement program category also encompasses wrought iron mains up to 12-inches in diameter.
Prior to this revision of our GLRP, the gas distribution main replacement program targeted replacement of all 8-inch-and-under diameter cast iron and unprotected steel distribution gas mains. Based on recent analysis and benchmarking, we have expanded our main replacement prioritization program to include up to 12-inch cast iron and unprotected steel. This revision permits us to further reduce the risk of an incident impacting public or employee safety due to natural gas leaks from cast iron or unprotected steel mains.

Due to their greater thickness, cast iron and unprotected steel mains larger than 12-inches in diameter are less susceptible to the cast iron breaks and corrosion leaks that are associated with many natural gas incidents. These larger distribution mains will be addressed concurrently through our supply main programs, explained in section 6.3.2. These programs include both rehabilitation and replacement of larger diameter cast iron and unprotected steel mains, and are anticipated to be completed beyond the scope of this 20-year GLRP.

### 3.2.1.1 Main Replacement Prioritization Model

We currently optimize the removal of cast iron and unprotected steel mains by targeting mains that are predicted to contribute most to the likelihood of a gas distribution event. In order to do this, the company has historically used a main replacement prioritization model. This model prioritizes unprotected steel and cast iron main segments by calculating a relative condition and risk score for each pipe segment. These scores are generated by analyzing main condition parameters (e.g., diameter and age), previous

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8 The inventory for the 20-year main replacement program is subject to change depending upon 2016 main replacement program results.
failure history, the physical area surrounding the main (e.g., adjacent main failures), as well as certain risk factors (e.g., ease of gas ingress).

We are continuously working to better understand correlations between leaks and additional condition and consequence factors. To enhance our main replacement prioritization model, we have recently added additional condition factors (such as concentration of vintage services) and consequence factors (such as population density). We will also further integrate the Distribution Integrity Management Program (DIMP) requirements with our main replacement prioritization software model. The DIMP program calculates a separate risk score for each geographic area, using a Frequency of Failure factor, and four Consequence of Failure factors (population density, hazardous leaks, mechanical fitting failures, and cast iron breaks). Going forward, we plan to further utilize these DIMP risk scores by integrating them into the main prioritization model score assigned to each pipe segment.

3.2.1.2 Geographic Main Replacement Approach

Beginning in 2017, we will begin using our main replacement prioritization model to target geographic areas that contain high concentrations of prioritized main, which will supplement the traditional model output of prioritized high-risk main segments. This will improve the way that the results from the model are translated into tangible construction projects. Prioritized geographic areas will be selected for construction with a target to complete each geographic replacement project within a one-year construction season.

This geographic replacement approach will significantly change the way that mains are prioritized and replaced. Prioritization will be predominately determined based on “area” scores instead of individual segment scores. This approach will concentrate annual replacement across our service territory to the areas that will result in the greatest risk reduction, and will also allow for bundling of other work streams within the selected areas. Other work activities that can be integrated into these area replacement projects include:

- installation of isolation valves
- new business (NB) services
- oil-to-gas service conversions (OTG)
- winter load relief (WLR)
- regulator station installations
- replacement/rehabilitation of large-diameter cast iron and unprotected steel

Additionally, the future impact to communities will be minimized by addressing all gas main and service concerns during one construction period. Geographic replacement is key to the development of our 20-year plan to replace all cast iron and unprotected steel distribution gas mains 12-inch-and-under.

3.2.1.3 Accelerating the Rate of Main Replacement

Original plans for our main replacement program included a projected timeline of 34 years to eliminate all 12-inch-and-under cast iron and unprotected steel. In order to reach our 20-year target for the replacement of 12-inch-and-under cast iron and unprotected steel, the annual mileage goal of the main replacement program will be increased significantly. As shown in Figure 3-2 below, we replaced 70 miles of cast iron and unprotected steel pipe in 2015, and plan to replace a minimum of 74 miles in 2016. The company will propose to ramp-up to 80 miles in 2017, and then to increase the annual replacement mileage by 5 miles every year, until reaching 100 miles by 2021, as illustrated in Figure 3-2. This will permit the completion of the 20-year program in 2036 (beginning in 2017) to eliminate approximately 1,900 miles of 12-inch-and-under cast iron and unprotected steel. The majority of replacement in this 20-year program will be geographic area projects. The remainder of the replacement mileage will be selected based on emergent issues, public improvement interference, and isolated high-risk main segments highlighted and prioritized by the main replacement prioritization model.
Incorporated into this yearly replacement mileage will be an annual target of four miles of flood-prone pipe replacement until all cast iron and unprotected steel inventory 12-inch-and-less is replaced within the FEMA 100 Year Flood Zone. As of June 2015, we had 49 miles of flood-prone pipe in our system. Prioritizing the replacement of this pipe will help to harden our gas distribution system against the impacts of a future storm, as explained in section 2.2.2.4.

![Figure 3-2: Main Replacement Program Annual Mileage Forecast](image_url)

### 3.2.2 Transmission Main Replacement Programs

The company selects transmission main projects that support its efforts to provide safe and reliable gas service to its customers at reasonable rates. To meet this objective, Con Edison will employ a risk-based approach to identify and replace vintage segments of the gas transmission system. This will include the elimination of transmission piping with the following characteristics:

- Operating at ≥ 30 percent SMYS
- Original pressure test for the main does not meet the present-day standards. Some of our main was originally tested with air at a pressure of approximately 1.2 times the MAOP. Present requirements require use of water as the testing medium at 1.5 times the MAOP.
- Material has been evaluated for fracture toughness and has been found to have fracture toughness below that of newly-installed gas piping, and therefore, a lower degree of ductility. These mains may also have associated fittings that may affect the safe operation and overall reliably of the section of main.

Within the next 20 years, the company plans to replace approximately 30 miles (33 percent) of what are deemed to be the riskiest mains in the gas transmission system that meet these criteria. Replacement of vintage gas transmission piping is also a major portion of the infrastructure plan. $2.9 billion of the overall $20.5 billion budget (approximately 14 percent) is targeted for vintage transmission pipe replacement. Beyond the scope of this GLRP, we also have plans to complete the replacement of all vintage transmission main.
We will also be replacing mains that will allow us to eventually meet the company’s future transmission system design criterion, which calls for the system, with the exception of radial systems, to withstand the loss of one gate station during a peak hourly load (without causing customer outages).

The replacement of these mains gives the company the opportunity to increase capacity for future growth at a minimal incremental cost, by replacing the existing mains with larger diameter mains. All new replacement transmission piping will be made of material that permits the pipe to operate below 20 percent SMYS. This will reduce the risk associated with these pipes, as well as provide long-term savings of costs associated with maintaining aging transmission infrastructure. The new pipes fall below the regulatory threshold and definition of being transmission pipe, and will be identified as distribution piping operating above 125 psig.

3.2.3 Security

Our security programs address physical and cyber vulnerabilities to enhance safety and reliability for our customers and employees.

3.2.3.1 Cyber Security

Cybersecurity is a priority at Con Edison. As there is increasingly more interconnectivity between elements of the gas system, Con Edison is vigilant in defending against the potential for a remote attacker to compromise customer accounts, gain access to protected information, affect physical equipment, and threaten system reliability. Con Edison has a Cybersecurity team within its Information Technology department responsible for deploying preventative cyber security control technologies and for continuous monitoring of networks. Con Edison also has a first-in-the-industry Cyber Action Team. It is dedicated to responding to and investigating security threats as part of each department’s Cyber Incident Response Plan, as well as for helping to create controls that prevent such incidents going forward. This combination of proactive and reactive measures helps to protect the security and reliability of Con Edison’s Gas System.

3.2.3.2 Physical Security

Included in the Gas Capital Budget are specific projects that address potential security vulnerabilities at critical Gas Operations facilities. These projects include the installation and/or upgrade of physical security components in order to secure and mitigate threats to critical Gas Operations facilities. Mitigation measures will be designed to deter, delay, detect, assess and respond to potential threats. These physical security measures may include closed circuit cameras providing live feed of the sites, digital video recording of the live feeds, lighting to provide 24/7 camera coverage, intrusion detection, continuous physical perimeter barrier, electronic access control, and/or security signage.

3.3 Gas Leak Detection

Detection of gas leaks is critical to our comprehensive approach to risk management. Through detection programs, we can determine where vulnerabilities on our system exist, decide upon the appropriate method of response and remediation, and eliminate a potential hazard more quickly.

3.3.1 Leak Management

Increased public awareness stemming from recent gas incidents and enhanced outreach and education efforts has resulted in a significant increase in the gas odor calls the company receives. In 2013, our Gas Emergency Response Center received of approximately 26,000 calls. In 2014, we received over 41,000 emergency response calls. In 2015, the number of incoming calls climbed to over 56,000. This number of incoming odor calls has directly led to an increase in the number of confirmed outside leaks, as illustrated in Figure 3-3.
These emergency response calls originate from the public, Con Edison workers and contractor crews. Call volumes from each of these sources increased significantly in 2015. For example, the number of calls the company received from fire departments (New York City and Westchester County) as part of the campaign to have customers “call 911” when they smell gas combined with the fire department response protocol change to notify Con Edison of every leak call received has increased enormously, from 2,717 calls in 2013, 5,605 calls in 2014, to 20,807 calls in 2015. Con Edison continues to maintain a high emergency response performance despite these increased leak calls.

In order to manage these incoming leaks, Con Edison performs an extensive number of leak repairs annually and has been able to successfully reduce the backlog of leaks consistently over the past 15 years. In 1988, the gas leak backlog peaked at over 15,000 leaks. Since then, the backlog has been greatly reduced.

Despite the dramatic increase of leak calls over the past few years, we have consistently decreased our number of outstanding leaks annually. At year-end 2015, the leak backlog was 523, as shown in Figure 3-4 below. The vast majority of the leaks in the leak backlog are non-hazardous Type 3 leaks. For example, only seven of the 523 leaks in the 2015 year-end inventory were Type 1 (4) or Type 2 (3) leaks. Gas leak repairs are a major component of our O&M expenses. Con Edison’s goal with the NYS Public Service Commission (PSC), as per our 2014–2016 rate case agreement, is to achieve a leak backlog of less than 750 leaks at year-end 2016.

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<table>
<thead>
<tr>
<th>Year</th>
<th>Deaths</th>
<th>Deaths</th>
<th>Deaths</th>
<th>Deaths</th>
<th>Deaths</th>
<th>Deaths</th>
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<td>9,841</td>
<td>5,437</td>
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<td>2008</td>
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<td>5,997</td>
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<tr>
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<td>5,696</td>
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<td>6,079</td>
<td>5,150</td>
<td>6,031</td>
<td>5,997</td>
</tr>
</tbody>
</table>

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9 A Type 3 leak is not immediately hazardous at the time of detection and can be reasonably expected to remain that way. However, Type 3 leaks shall be reevaluated during the next required leakage survey or annually, whichever is less.

10 A Type 2 gas leak is non-hazardous at the time of detection, but requires a scheduled repair based on the potential for becoming a hazard.

11 A Type 1 leak requires continuous attention until the leak is made safe, and daily inspection until permanent repairs are completed.
3.3.1.1 Traditional Leak Survey

As explained in section 2.2.2.2, over 50 percent of our distribution mains are composed of either cast iron or unprotected steel. These pipes are vulnerable to corrosion or leakage due to a variety of factors including age, soil condition, weather, etc. Corrosion adversely affects the integrity of the system by causing leaks. Leaks give rise to a host of safety and reliability issues including reduced efficiency through gas losses along the system, possible pressure drops causing outages, and flammable gas in the atmosphere. To manage the safety and reliability risks posed by a loss of system integrity, Con Edison has an extensive leak management program to detect, monitor, prevent, and prioritize leaks for repair.

Historically, the company has performed methane leak surveys on all 4,239 miles of its gas distribution mains annually and on all 92 miles of the gas transmission mains three times per year. Gas services in our business districts are surveyed once per year and gas services in non-business districts are surveyed every three years. The company also performs special cast iron surveys during extreme weather conditions, special surveys as needed, such as pre-paving and pre-parade routes, and it conducts visual inspections of above-ground gas service piping for atmospheric corrosion. Additionally, in June 2014, we began testing the capability of additional outside mobile leak surveys. Our survey frequency was ramped up throughout the year, and by November of 2014, we reached our current level of continuous leak surveys, where all gas distribution mains are now surveyed on a monthly basis. All methane leak detection surveys are conducted by Con Edison technicians or contractors who are dedicated to this task.

Another program that serves to proactively reduce leaks in the system is the main replacement program described in section 3.2.1, which replaces 12-inch-and-under diameter cast iron and unprotected steel mains.

3.3.1.2 Picarro Surveyor Technology

In our ongoing pursuit to further increase public safety by identifying outside leaks on our gas system, Con Edison has been working with Picarro Inc. to test their mobile leak survey equipment in our service area. Picarro is a leading provider of solutions to measure trace gases and stable isotopes such as methane. The Picarro Surveyor system is comprised of detection equipment that utilizes Cavity Ring Down Spectroscopy (CRDS). Based on stated claims, the equipment’s sensitivity and the use of propriety algorithms incorporating real-time atmospheric and meteorological conditions, allow the system to detect methane leaks much farther from the source when compared to traditional leak survey equipment.

Continuing through 2016, the Leak Survey section of Gas Technical Operations will work with Con Edison’s Research and Development group to further test and deploy the Picarro technology in targeted areas.
areas, with the goal of creating a standard for its continued use. Testing the system first before advancing deployment will provide an opportunity to gain experience with this new technology, understand its capabilities to identify leaks on our gas infrastructure and understand the impact it will have on our operations.

We plan to purchase the Picarro survey equipment in 2017. Based on experience gained in 2016, protocols for its continued use will be developed and include a focus on leak-prone piping that is targeted for replacement. Initially, we anticipate the technology will be used to survey areas where we will be performing geographic bundling of pipe replacement, areas that require special surveys (events, parade routes, etc.), and to pinpoint hard-to-find leaks. Our efforts to incorporate this state-of-the-art leak detection technology may further improve our ability to identify and mitigate outside leaks on our gas system, thus improving public safety.

3.3.2 Methane Detection Technology

Recent industry events have brought to light the need to embrace technology in order to improve public safety. The use of residential methane detectors is a way to address this need. Over the past two years, the company has led a concerted effort to promote industry improvements and the widespread adoption of residential methane detectors by consumers as a means of enhancing the safe delivery of natural gas to our customers.

The current governing standard for residential methane detectors, written by Underwriters Laboratory (UL), prescribes alarm limits at 25 percent of the lower explosive limit (LEL) of natural gas. However, federal and New York State codes for the distribution of natural gas mandate odor threshold limits of 20 percent and 10 percent of LEL, respectively. This means that consumers using a residential methane detector would smell gas well before an alarm would activate. This disparity with the UL standard could create negative consumer sentiment and could also potentially provide less time for consumers to respond to an alarm in the event of a natural gas emergency. Therefore, part of our effort will be to work with industry stakeholders, research collaboratives, and the American Gas Association to develop a second UL performance standard that will mandate a lower (10 percent LEL) alarm level. We will also recommend for this second standard to include a “fit for purpose” aspect, which will address application matters such as placement, actions in event of alarm, warnings, packing labels, etc.

We are currently supporting a residential methane detector test project that is being performed by the Operations Technology Development (OTD) group, in conjunction with the Gas Technology Institute (GTI). Based upon the results of this program, we will deploy approximately 300 of the top-rated methane detector units throughout our system as a part of a residential methane detector pilot program. The pilot program will evaluate performance of the units through four seasons as well as confirm that the units do not provide false positive alarms when exposed to normal household chemicals. This pilot program will also help us to promote the benefits of the technology and the need to promulgate regulations for widespread use to customers and New York City and State regulators. We will look to foster regulations for methane detectors that are similar to the current NYC Department of Buildings carbon monoxide detector requirements in new and existing buildings (i.e., hard-wired into new buildings and surface mounted into existing older buildings). These goals have received recent support from Bill A09027, proposed to the NYS Assembly in January, 2016.

3.3.3 Service Line Inspection Program

On April 2, 2015, the New York State Public Service Commission issued an amendment to Part 255 that revised the service line definition to align with the federal definition. This essentially expanded the prior service line definition, which limited operator responsibility for jurisdictional piping to the first fitting inside the building wall, to include jurisdictional responsibility to the outlet of the meter, regardless of who owns the piping within the building. The specific implementation requirements related to this revision have been stayed pending further commission action. The proposed change in language to Part 255—the definition of service line—will have a great impact on the company. All of the company’s operations, practices, and procedures have been geared to the definition of service line reflected in the PSC’s regulations prior to the amendment. Changes to the company’s process, procedures, and performance of
leak surveys and corrosion inspections for inside pipe extending to the outlet of the customer’s meter will take significant time and additional resources to practically and effectively implement.

The company has more than one million inside meter sets, with approximately 900,000 inside building sets, located in more readily-accessible building areas (e.g., basements), and approximately 200,000 inside building sets in apartments (room sets) that are much less-readily accessible. The company estimates the incremental cost of a leak survey and atmospheric corrosion inspection program that comprises all interior gas piping, excluding all room sets, would be approximate $11 million annually. This increase in our operations and maintenance costs is forecasted to begin in 2017. This expenditure level assumes an inside leak survey and corrosion inspection program, where the company would address accessible inside piping associated with approximately 900,000 inside meters during a nine-year inspection cycle, pending the results of a currently ongoing study of room sets.

This study is supported by Northeast Gas Association (NGA) membership under contract with the Gas Technology Institute and includes developing a comprehensive New York State-specific inside piping assessment data set to support evaluation of an appropriate DIMP-based reassessment frequency. The study will also focus on presumed unique low-risk installations referred to as “room sets.” If detailed assessment confirms the low-risk nature of these installations, a special permit may be pursued limiting the need for future inspections. The study commenced in January 2016 and will be completed by June 2017.

The company and National Grid have been working with the Plumbing Foundation for the City of New York (Plumbing Foundation) on proposed legislation that would mandate that owners of residential buildings containing three or more units and commercial buildings have licensed plumbers perform safety inspections of indoor gas piping up to utilization equipment. These inspections would become part of the NYC Department of Buildings code and would be performed on a five-year cycle in conjunction with other mandated safety inspections (e.g., fire protection systems). The Plumbing Foundation has provided proposed legislative language to a City of New York council member and a late-February 2016 release for public comment is anticipated. Additional work is being done to provide licensed plumbers with training and qualification to be equivalent to the gas operator qualification program that is required by for gas distribution companies by Part 255. Efforts are also being made to include the plumbers as part of a federal Department of Transportation compliant drug and alcohol program.

3.3.4 Public Awareness

Following the 2014 East Harlem incident, there were multiple accounts that people smelled gas in the preceding days, but no one reported it. In an effort to understand why people failed to report the smell of gas, Con Edison immediately initiated market research, focus groups, and phone surveys. The research found that, despite outreach efforts, people did not call for different reasons. Some people assumed that another person would report the leak, while others did not recognize the situation as an emergency. Apartment dwellers also mentioned the informal practice of reporting problems directly to their building’s superintendent or landlord, and expressed concern that departing from this practice could jeopardize their relationship with building management. In addition, the research found that people are more likely to call when they know that reports can be made anonymously. Other information provided to Con Edison by municipal emergency responders indicates that some people do not call to avoid having their gas service interrupted for repairs or building code compliance issues.

As a result of this study, we reevaluated our Public Awareness Program and initiated a “Smell Gas, Act Fast” campaign, revamping the public awareness campaign messaging to reinforce calling 911 or 1-800-75-CONED when a gas smell is detected. The new campaign messages also emphasize that gas leaks can be reported anonymously. Con Edison has always accepted calls made anonymously. The NGA’s Gas Pipeline Safety Study that was conducted in May of 2014 measured the effectiveness of Con Edison’s outreach and education efforts. This study found that the majority of customers surveyed are “very” or “somewhat familiar” with the smell of natural gas and said they could identify a gas leak by smell.

Con Edison’s Public Awareness Program (PAP) identifies specific program objectives, message types, and contents to enhance public, environmental, and safety protection through increased public awareness and knowledge. Con Edison’s Public Awareness program has identified, and targets each of the four stakeholder groups in the following sections.
3.3.4.1 Affected Public

This stakeholder group includes distribution customers, transmission customers, residents along the distribution and/or transmission systems, places of public assembly, and school districts. Con Edison’s baseline requirement for this group is satisfied through a bilingual newsletter issued two times per year. Supplemental programs for the affected public include a combination of multilingual bill insert newsletters and brochures, bilingual “peel and sniff” bill inserts, community and youth outreach efforts, digital outreach, social media, and paid media advertisements.

Con Edison reaches an estimated nine million people in the public at-large by consistently spreading the word about gas safety and the urgency of reporting gas leaks through a variety of outreach efforts in New York City and Westchester County.

Additionally, in 2014, Con Edison launched an interactive online gas leak map, shown below in Figure 3-5, that provides the location of current leaks on the system, along with data indicating the severity of the leaks. The map, which is updated every 24 hours, provides greater transparency with respect to gas leak information and reinforces the need to report the smell of gas.

Figure 3-5: Interactive Gas Leak Map

3.3.4.2 Emergency Officials

This group includes fire departments, police departments, and emergency management agencies. Con Edison meets its baseline requirement to this stakeholder group by annually mailing a letter to approximately 120 emergency officials that includes:

- an offer of free in-person gas hazards awareness training
- information on excavation safety
- a link to the Pipeline and Hazardous Materials Safety Administration’s pipeline mapping system
- copies of the Con Edison gas hazards DVD (on responding to natural gas emergencies)
- a natural gas safety brochure (“What you need to know”)
Supplemental programs for emergency officials include training sessions and/or drill exercises and tests, videos, and the Code MuRRE protocol, which will summon additional company resources to incidents that require an escalated response.

3.3.4.3 Public Officials

This stakeholder group includes government officials, city and county managers, building code enforcement departments, permitting departments, and public works officials. Con Edison meets its baseline requirement to this group by emailing a letter to over 300 public officials every three years highlighting important gas safety information that should be shared with constituents.

In addition, Con Edison offers an Energy 101 supplemental program annually to our public official stakeholders as part of our Public Liaison Program. This program provides a better understanding about the electric, gas, and steam systems in our service territory and any special projects that may be ongoing.

3.3.4.4 Excavators

These stakeholders consist of construction companies, landscapers, and any trade or business that is involved with excavation or demolition. Con Edison meets its baseline requirement to this group by mailing a quint-fold poster with a detachable visor card containing natural gas safe-digging information to almost 30,000 excavators annually. Additionally, supplemental programs offer seminars and training on public awareness and safety issues, sponsorship of the annual Northeast Gas Association campaign, and face-to-face meetings with municipalities that have high instances of contractor damage. The company has a member on the board for each of the One Call Centers and sponsors various One Call Center programs such Excavation Safety Seminars, 811 national campaigns, and statewide calendars. The company hosts and chairs the New York City Damage Prevention Committee and is a secretary for Hudson Valley Damage Prevention Council.

3.4 Incident Response

A prompt response is crucial in preventing reported leaks from becoming distribution or transmission events. The programs the company has in place are focused on making the situation safe as quickly as possible.

3.4.1 Leak Response

Con Edison’s commitment to public safety is evidenced by the investments the company makes in reliability, environmental performance, risk mitigation and, most importantly, leak management programs. Despite these measures, incidents ranging in severity from gas leaks to explosions have occurred throughout the gas industry. Con Edison has an emergency response system designed to act quickly and efficiently during an incident to minimize its severity.

During 2015, Con Edison responded to 56,135 emergency calls, of which 88 percent were responded to in less than 30 minutes, and 99 percent had a less than 45 minute response.

Despite the response challenges in NYC’s highly congested and densely-populated urban area, Con Edison continues to exceed our mandated response targets to safeguard the public. Increased public awareness of the importance of gas safety has resulted in a significant and sustained increase in gas odor calls. We are committed to maintaining our high performance in emergency response despite the dramatic increase in odor calls. Further, through risk mitigation programs, we also seek to improve the processes utilized during an emergency to protect life and property. For example, Con Edison monitors both "response time" as well as “made safe” time for each reported gas leak emergency. A leak is considered “made safe” when positive physical action is taken and the threat to life and property is eliminated. In 2015, 76 percent of leaks were made safe within 75 minutes.
When warranted, we also continue to initiate Code MuRRE, which is an alert to field personnel for high hazard conditions requiring a heightened response by both company and fire department personnel. Getting more “boots on the ground” in the form of qualified personnel who are capable of taking proactive measures—such as obtaining gas readings and evacuating and ventilating structures—is critical to protecting life and property. In 2015, over 4,000 Code MuRREs were initiated, resulting in an expedited response to reported gas leak emergencies, further ensuring the safety of the public.

In addition to responding to significant leak conditions, the local fire departments are also called to assist on contractor damage investigations. These are high-hazard events and the additional support can reduce the time needed to make situations safe. This multi-resource response provides additional support to company forces and municipal responders during emergency events. We also link coincident gas and electric events for multi-commodity response. This strategy focuses on mitigating the historic causes of distribution events.

### 3.4.2 Installation of Isolation Valves

During an incident or emergency, isolation valves in a gas distribution system allow for affected areas to be isolated in a timely manner, minimizing the danger to first responders and the public, and reducing the delay in recovery operations. Because much of our system is cast iron, and installation of these mains in the late 1800’s and early 1900’s did not include isolation valves, much of our low-pressure system cannot be isolated without excavating to the main to cut and physically block the flow of gas.

Starting in 2016, Con Edison will proactively install isolation valves at locations that will permit area isolation of critical customers in the case of an emergency. Over 520 critical customers will be targeted, requiring the installation of approximately 1,200 valves for quicker area isolation. These customers include, but are not limited to: hospitals, nursing homes, daycare centers, and customers utilizing life-sustaining equipment. The installation of these valves will permit faster isolation during a potential gas event, and will also mitigate the possible impacts to critical customers. In addition to this initiative, isolation valves will also be installed during the normal course of our cast iron and unprotected steel mains replacement programs, which will continue at an accelerated level. We will review and update the Gas Operations Critical Customer list on an annual basis and propose new locations as necessary.

We are also exploring a new technology known as Emergency Mains Stop-Off Station (EMSOS). EMSOS is a cost-effective trenchless means of installing isolation points on the larger-diameter low-pressure gas distribution system without the need of a main cut-out and the associated large excavations required to install a valve. Our Research and Development organization recently completed a study on this technology, and is now supporting its commercialization.

### 3.4.3 Remote Operated Valves

In order to minimize potential impacts to the gas transmission and distribution systems, maintain supply to firm gas customers, and protect the public at large, we install remote operated valves (“ROV’s) at strategic locations on the gas transmission system. The ROV Program involves installing new ROVs, or converting existing transmission valves to operate as ROVs. ROVs are installed to achieve rapid isolation of:

- a compromised section of the transmission system to minimize affected areas
- the transmission system at river and tunnel crossings and at the outlet of gate stations
- intersecting transmission or supply mains at tee or branch locations, thereby minimizing affected areas
- mains feeding electric and steam generating facilities from our gas transmission system

Prioritization of new ROV installations is based on the total number of customers that would be negatively impacted by an emergency isolation within the existing ROV configuration. ROV locations are designed so that:

- loss of regulator stations will impact no more than one high-pressure and one low-pressure regulator station
• closure of any two ROVs will not negatively impact supply mains or the distribution system on an average winter day (20°F)

The ROV Program includes the installation of at least one retrofit or new ROV per year.

3.5 Quality Control / Quality Assurance

Quality Control and Assurance are essential to delivering safe, reliable, and resilient gas service. The company is focused on improving the quality of our workmanship and safety of our system by putting the right controls in place, providing our people with the proper tools and training, and monitoring the health of our equipment using advanced analytics. In order to promote an organizational culture of risk management, and streamline the increased workload that comes with enhancing this culture, Con Edison formed a new Gas Compliance and Quality Assessment Organization in 2015, containing the following three functional groups:

- **Quality Assurance**: Conducts reviews of processes and controls within Gas Operations to identify areas for improved compliance, efficiency, and recordkeeping

- **Quality Control**: Supports Gas Operations by conducting field inspections to promote continuous improvement

- **Training & Employee Development**: Assists in the development of Gas employee skills by coordinating and tracking training requirements, and assisting with the development of new employees as they join Gas Operations and progress through their career path

A fourth section focused on **Regulatory Strategy and Compliance** will also be created in 2016 that will focus on planning, intake, and interpretation of new and changed regulations, and will provide guidance on compliance-related matters to Gas Operations employees.

Recent improvements to improve quality and assure full compliance with procedures are detailed below.

3.5.1 Plastic Fusion Procedure Alterations

Con Edison has amended its plastic fusion procedures to require pipe and fitting surfaces to be cleaned using alcohol for all methods of heat fusion, regardless of whether any contaminant is visible on the fusion surfaces. This procedural change exceeds the current ASTM standard and eliminates operator discretion with respect to determining whether the pipe surfaces are visibly contaminated.

To drive standardization in the industry, the company will sponsor an Operations Technology Development (research collaborative group) study by the Gas Technology Institute, a leading gas research, development and training organization, to evaluate solvent cleaning and polyethylene joining procedures. The goal of the study, which will begin in 2016, is to gain knowledge of the issues related to the use of liquid cleaning solvents, develop a data-driven consensus on solvent cleaning best practices, and to optimize the surface preparation process for plastic fusion. The study is anticipated to take approximately 18 months. Con Edison plans to adopt the applicable guidelines and best practices that result from the study.

We also revised our heat fusion joining procedure to include additional language specifically stating that heat fusion joints shall be inspected after they have cooled and solidified to verify that the beads are uniform around the circumference of the joint. We have previously trained our employees to inspect to this standard, but we elaborated on this detail in our procedure.

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12 ASTM International is an international standards organization that develops and publishes voluntary consensus technical standards for a wide range of materials, products, systems, and services.
4. NATURAL GAS SUPPLY OUTLOOK

The demand for natural gas for any end-use purpose is sensitive to the availability and price of natural gas. The purpose of this section is to provide an outlook for gas supply over the planning period. This section covers three key aspects of gas supply:

- The availability of natural gas resources (domestic and global)
- The wholesale competiveness of natural gas compared to other fuels
- The deliverability of natural gas to the New York City area

4.1 Natural Gas Resource Availability

4.1.1 Historical Reserves and Discoveries

Natural gas reserves in the United States reached a peak in the late 1960s at almost 300 trillion cubic feet and began to decline over the next 30 years to 164 trillion cubic feet in 1998 due to depleting gas fields. At the same time, historically low prices did not encourage the exploration of harder-to-access gas. The recent discovery of natural gas in shale formations, supported by the development of horizontal drilling and stronger prices, has resulted in proved reserves rising to nearly 389 trillion cubic feet in 2014, a 137 percent increase over the reserves known in 1998.

The rate of annual natural gas discoveries has also more than quadrupled over the last decade, as shown in Figure 4-1, with over 75 percent of the increase in discoveries from 2002 to 2014 coming from unconventional (including tight sands and shale) gas discoveries. Shale gas reserves increased from nearly 132 billion cubic feet in 2011 to almost 200 billion cubic feet in 2014, now comprising 51.4 percent of all proven U.S. gas reserves.

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13 Proved reserves of natural gas as of December 31 of the report year are the estimated quantities that analysis of geological and engineering data demonstrate with reasonable certainty to be recoverable in future years from known reservoirs under existing economic and operating conditions. Volumes of natural gas placed in underground storage are not to be considered proved reserves.

14 Natural Gas Discoveries are defined by the U.S. Energy Information Administration (EIA) as net proved reserve additions of natural gas from discoveries of new fields, identification of new reservoirs in fields discovered in prior years, and extensions (reserve additions that result from the extension of previously-discovered reservoirs).
4.1.2 Projected Natural Gas Supplies

4.1.2.1 Shale Gas

Shale gas is an emerging type of unconventional natural gas deposit. The gas is distributed throughout low-permeability shale formations rather than accumulating in a more permeable reservoir. The occurrence of gas in this manner requires special production techniques that involve horizontal drilling into the gas-bearing formation, followed by hydraulic fracturing of the rock (exerting pressure in the gas well so high that it causes brittle rock to fracture (also known as hydraulic fracturing) to release the gas from the rock. Shale gas developments are occurring over much of North America as shown in Figure 4-2.
The major shale opportunities are in the Marcellus (located in West Virginia, Pennsylvania, and New York) and Haynesville Shale (Gulf region) plays (a geographic region with gas fields). Promising shale plays are also emerging in Western Canada with the Horn River play, and in the Western U.S. in the Colorado shale gas basin.

The Marcellus shale is a significant emerging regional resource for New York City and for Con Edison. Wood Mackenzie, a commodity research and consultancy group, now projects deliverability of gas from the Marcellus shale to grow to 15.3 billion cubic feet per day by 2020, which is 70 percent higher than the total Mid-Atlantic Region (New York, New Jersey, and Pennsylvania) requirements of 9 billion cubic feet per day. The New York State Energy Plan also has a stated objective of leveraging in-state Marcellus gas for energy, security and economic development reasons.

The development of shale gas is currently very economic, but production is sensitive to the price of natural gas. The development of the shale plays is in the early stages and there is not much historical data available. There have been improvements in drilling productivity and additional low-cost supplies have emerged. Current well economics, aided by associated gas found in reserves that are developed for the production of oil, provide ample incentives for continued development even at gas prices under $3 per Dt. The breakeven cost for production is likely to stay low until the need for higher cost supplies arise.

While the prospects for shale gas growth are substantial, the use of hydraulic fracturing has caused some environmental concerns. These concerns stem from the injection of large amounts of water into the gas well, concerns about the chemical composition of the injected fluids, fears that the fractured rock will expose local water wells to non-potable waters, and cases where unacceptable levels of radiation were released. Environmental regulations related to hydraulic fracturing could limit the extent to which shale gas opportunities can be captured. Current concerns, reflected in proposed state regulations and potential federal legislation, will likely result in increased cost of well development and place some restrictions on where wells can be drilled, thereby limiting shale gas growth prospects.
4.2 Natural Gas Price and Volatility Expectations

Compared to previous decades, the first decade of this millennium saw a notable increase in natural gas price volatility, driven to some extent by market speculation. Given the improvements in resource availability in the past five years, wellhead gas prices are not expected to rise dramatically over the 20-year planning period. However before the necessary infrastructure is constructed, gas prices will likely continue to experience short-term volatility comparable to historical patterns.

4.2.1 Wholesale Spot Prices for Oil vs. Natural Gas

Changes in U.S. supply developments in the past three years have resulted in natural gas prices at the Henry Hub (a point in the Gulf that is the pricing point for natural gas futures on the New York Mercantile Exchange) no longer tracking at its historical relationships of 60–90 percent of West Texas Intermediate Crude (WTI) prices. Natural gas prices are projected to exhibit a much lower relationship to oil prices (in the range of 30–50 percent) as a result of evolving gas supply developments and expected gas-on-gas competition. Propane, the other significant heating fuel alternative in our service territory, generally follows the pricing trends of crude oil, and so is also forecasted to price higher than natural gas. Given these forecasts, we expect that natural gas will remain a competitive energy source for customers and provide sufficient economic incentive for producers to develop technology and wells for continued unconventional extraction.

4.2.2 City Gate Prices

As shown in Figure 4-3, since 2011, Con Edison’s city gate cost of gas for firm customers has held, and is projected to continue to hold a competitive advantage for natural gas on an average annual basis relative to No. 2 fuel oil New York Harbor (NYH) prices. This cost, which represents the total cost of the gas supply delivered to our system (including the cost of pipeline and storage capacity), will remain, on average, within $4–5 per Dt (in constant 2015 dollars), and will increase at a CAGR of 3.1 percent over the planning period.

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15 Volatility could be restrained by changes, such as increased gas storage, more long-term pipeline contracts, or government regulation.

16 West Texas Intermediate (WTI) is a grade of crude oil used as a benchmark in oil pricing. It is the underlying commodity of the New York Mercantile Exchange’s oil futures contracts.
4.3 Deliverability of Natural Gas to the New York City Area

Con Edison recognizes the importance of having adequate pipeline capacity and storage contracts to deliver gas to our city gates and reliably operate our gas system. A substantial portion of our planning activity is dedicated to this important business requirement.

4.3.1 Diversification of Con Edison’s Natural Gas Supply

Con Edison has a diversified gas supply portfolio that will become increasingly diversified over the planning horizon in terms of regions and sources. Con Edison’s traditional sources include the Gulf Coast production area (mostly onshore and offshore Texas, Louisiana, and Mississippi) and Canadian gas (mostly from Western Canada in Alberta). In recent years, our sources have grown to also include gas from Eastern Canada and the Northeast (mostly Pennsylvania). In addition, Con Edison has access to storage fields in both the Gulf Coast and the Northeast, where gas is injected during off-peak periods and withdrawn during high-load periods to meet customer needs.

The map in Figure 4-4 shows these existing and developing sources of natural gas for Con Edison.

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17 Comparison of Con Edison's city gate average cost of gas for firm gas customers versus No. 2 New York Harbor (NYH) oil prices based on NYMEX crude futures. Gas costs are based on historical bills, including pipeline and storage fixed-capacity charges.
In 2012, Con Edison began to introduce gas from shale suppliers to the system. Before this, gas supply had been primarily from the Gulf Coast. As shown in Figure 4-5, the mix of our resource supply portfolio between shale and non-shale supply has changed dramatically over the past four years. This shift has been driven by technology advances, which have permitted increasing low-cost production of shale gas in close proximity to our service territory.

### Figure 4-5: Composition of Con Edison’s Gas Supply (Shale Gas vs. Non-shale)

<table>
<thead>
<tr>
<th>Year</th>
<th>Shale</th>
<th>Non-shale</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>39%</td>
<td>61%</td>
</tr>
<tr>
<td>2015 (as of 10/15)</td>
<td>81%</td>
<td>19%</td>
</tr>
</tbody>
</table>
4.3.2 New Pipeline Capacity

In order to meet growing gas demand, the Company has developed, and will continue to develop, major enhancements to its natural gas transmission-level facilities. Whenever necessary, we will enter into firm agreements to increase pipeline capacity to our city gates. As shown in Figure 4-6, our projected demand growth over the course of the plan indicates a need for new pipeline capacity to the NYC region.

Figure 4-6: Projected Gap in Pipeline Capacity

There are two means for meeting our demand:

- Procure additional capacity from existing capacity holders
- Become a shipper on new pipeline projects to the NYC city gates

Due to the limited availability of unsubscribed capacity on existing pipelines, and the long lead time of new pipeline projects to the city gate, Con Edison has started to explore and evaluate potential pipeline projects that come to the NYC and Westchester County region.

The company is looking to select pipeline projects that would increase the reliability of our system, increase our flexibility, provide access to an abundant source of supply, are feasible to complete, and provide delivered gas that is economic compared to existing alternatives. New pipeline projects to the NYC area would also benefit other stakeholders in the region by increasing the amount of pipeline capacity available to utilities, marketers, and power generators.

Marketers and producers who subscribe to pipeline capacity also offer delivered services that can be made available to meet peak demands. Increased pipeline capacity to the region would increase the amount of delivered services that are potentially available and, all else being equal, can serve to reduce or at least maintain current gas prices for all stakeholders.

The construction and operation of pipelines entails impacts and risks that must be minimized. In a densely developed area such as the New York metropolitan region, reconciling new pipeline construction with existing conditions is an extremely delicate undertaking. Con Edison believes that pipelines can be built and operated safely. However, the risks and consequences of unlikely events should be considered.
in the siting process. Co-location of critical infrastructure projects, such as electric and gas distribution facilities is equally important to evaluate.

The abundant, low-cost supply of natural gas in the Marcellus shale has changed the flows of gas in the Northeast supply region. New pricing paradigms have been created that support the need for additional pipeline expansion to export Marcellus shale gas to other regions.

While existing Northeast pipeline capacity is constrained in general, there are a number of prospective pipeline expansion projects that will provide Con Edison increased access to supplies from the Marcellus supply region. The timing and volume of future pipeline expansion projects will be highly-dependent on shipper commitments to long-term contracts and constructability. The economics of expansions to the pipelines will be a key determining factor in which of these pipeline projects will actually go forward. The potential need for future capacity to meet demand is further discussed in section 5.5.1.3.

4.3.2.1 PennEast Pipeline

This as-filed $1.131 billion project is being jointly financed by AGL Resources, NJR Pipeline, PSEG Power, South Jersey Industries, Spectra Energy and UGI Energy Services. It was pre-filed at the FERC in early October 2014 and the full FERC application was made on September 25, 2015. The proposal is for the construction of a 1 billion cubic feet/day, 114-mile long 36-inch diameter pipeline designed to bring lower-cost Marcellus shale gas in Eastern Pennsylvania (Luzerne County) southeasterly to an interconnection with Transco in Mercer County, NJ. The proposed pipeline path is illustrated in Figure 4-7.

Figure 4-7: PennEast Project - Upstream Pipeline Connectivity

Siting is the process of determining the optimal location for a pipeline after all impact factors are taken into consideration.
As a result of an open season (a solicitation for interest) held in August 2015, PennEast has signed precedent agreements with 13 shippers for the entire 1 billion cubic feet/day capacity. Con Edison is a Foundation Shipper taking capacity of 100,000 Dt/day. At the northwest end of the project, it will be receiving gas from the Auburn, Springville and Wyoming gathering systems as well as Transco’s Leidy line. For deliveries, there will be interstate pipeline interconnections with Columbia Gas, Texas Eastern and Algonquin Gas, as well as Transco’s Trenton-Woodbury lateral in order to facilitate flexible deliveries with Con Edison. Service is expected to begin in late 2017.

4.3.2.2 Mountain Valley Pipeline (MVP)

The MVP is an approximately 300-mile long, 42-inch diameter pipeline, with an estimated total project cost of $3-$3.5 billion. With the rapid development and vast supply of natural gas in the Appalachian region, the strategic design of the MVP will extend from the Equitrans transmission system in Wetzel County, West Virginia, to Transcontinental Gas Pipeline Company’s (Transco) Zone 5 compressor station 165 in Pittsylvania County, Virginia. The MVP is expected to provide at least two million dekatherms per day of firm transmission capacity and has secured commitments at 20-year terms for this amount, which will support communities along the route, as well as the growing demand markets of the Mid-Atlantic and Southeast regions of the United States. The project is being co-financed by EQT Midstream Partners, Con Edison, NextEra Energy, WGL Holdings, Vega Energy Partners, and RGC Resources.

Con Edison entered a 20-year transportation agreement to deliver 250,000 dekatherms per day of firm capacity on MVP and 250,000 dekatherms per day on the Equitrans system. These capacity agreements enable customers to achieve significant future savings through access to low-cost, reliable supply.

Mountain Valley Pipeline, LLC filed a certificate application with the Federal Energy Regulatory Commission (FERC) in October 2015, and subject to approval by the FERC, the MVP is targeting to be fully in-service during the fourth quarter of 2018.
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5. DEMAND, SUPPLY, AND ENVIRONMENTAL PROFILE

Con Edison has approximately 1.1 million residential, commercial, distributed, steam and electric generation natural gas customers. Traditionally, growth in firm gas volumes from residential and commercial uses has been dependent upon the economic and environmental benefits of natural gas versus other sources of fuel. As seen in Figure 5-1 below, Con Edison’s adjusted\(^\text{19}\) volume from firm gas demand has grown at a 3.7 percent Compound Annual Growth Rate (CAGR) between 2005 and 2015.

Figure 5-1: Historical Volume\(^\text{20}\)

Based on environmental compliance considerations and the economics of gas versus other fuels that lead to customer growth, the near-term average annual growth rate for firm natural gas is estimated to be 2.0% per year from 2015 through 2020 and about 1.3% per year from 2015 through 2035. This forecast is illustrated in Figure 5-2.

\(^{19}\) Adjustments made for variations, principally for weather

\(^{20}\) Actual 2015 interruptible data used through October. Proxy data was used November–December 2015.
This section provides additional detail on anticipated customer needs from economic growth, environmental regulation, and technology developments underlying our gas usage forecasts. We will review expected gas usage trends in three major categories:

- **End-user Residential, Commercial, and Industrial**: explores the evolving needs of our primarily residential and commercial customer base
- **Distributed Generation**: explores a growing interest in on-site generation as a heat and power alternative
- **Transportation**: explores the renewed interest in natural gas vehicles in our service territory

### 5.1 End-user Oil-to-gas Conversions

Customers have a number of choices to meet their heating needs. Within our service territory, customers primarily choose among four options: heating oil, natural gas, propane, or steam. Electric heating is much less prevalent in our service territory than in other areas of the country due to relatively high electricity prices in the Northeast. Propane tends to be used in the northernmost areas of our service territory.

In 2007, New York City’s Mayor Michael Bloomberg launched PlanNYC 2030. The 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.”\(^{21}\) One of the findings was that 1 percent of buildings in New York City (approximately 10,000\(^{22}\)) produced 86 percent of the city’s soot pollution, more than all

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\(^{22}\) Source: NYC Department of Buildings
the cars and trucks in New York City combined\textsuperscript{22}. The buildings that were identified are unique in that they burn No.4 or No. 6 heating oil ("heavy fuel oil").

In April 2011, after two years of stakeholder engagement, Mayor Bloomberg adopted new clean heat regulations to improve air quality. The new regulations targeted heavy fuel oil and required the following:

- No new permits for No. 6 or No. 4 boilers would be issued, (unless emissions were as clean as No. 2 oil).
- No certificate of operation was to be renewed after July 1, 2012 for boilers burning No. 6 oil (unless emissions were as clean as No. 4 oil).
- All boilers were to use the cleanest fuels (No. 2 oil, natural gas, or equivalent) upon retirement or by 2030, whichever is sooner.

Since the launch of this regulation, many oil users in New York City have chosen to convert to natural gas service. Modest growth is expected over the next four years in the heavy heating oil market. In order to provide service for these interested customers, we are faced with the challenge of meeting natural gas demand and infrastructure needs. We also need to have adequate supply and pipeline capacity to operate our natural gas system reliably. Furthermore, we face logistical challenges in managing a significant number of natural gas service requests and effectively coordinating the work. We must complete the work in a way that minimizes disruptions to the community, is cost-effective, and does not contribute to higher overall firm delivery rates for existing customers.

5.1.1 Oil-to-gas Conversion in New York City

5.1.1.1 Recent History and Progress

Con Edison has had tremendous success with converting No. 4 and No. 6 heating oil customers in the New York City portion of its service territory to natural gas for heating purposes. Since the promulgation of rules by the City of New York in April 2011, Con Edison has completed over 3,200 conversions, or approximately 46 percent of the total heavy heating oil population identified in Con Edison’s NYC gas service territory in 2011. We estimate that we have removed nearly 400 tons of fine particulate matter (defined as 2.5 microns or less) from the air through these conversions.

The company applied for a tariff amendment as part of its “Area Growth Program” in 2013 and the New York State Public Service Commission approved the tariff in November 2013. Simply, it allows for the aggregation of customers in a defined geographic zone with the intent of completing all construction at the same time (minimizing disruptions to the neighborhoods) and aligning capital expenditures with revenue so that we can offer customers a zero capital connection cost. The program is expected to end in 2020, at which time every heavy heating oil customer will have been offered a connection opportunity through the program, and we expect to have converted approximately 70 percent of the available population by that time.

5.1.1.2 NYC OTG Conversion Forecast

Over the next 15 years, we anticipate converting an additional 2,000 No. 4 and No. 6 heating oil customers in the New York City portions of our service area. In 2015, we converted more than 500 large No. 2 heating oil customers in New York City and project a similar conversion rate in the short-term forecast. The recent drop in oil prices may dampen near-term conversion forecasts, as oil prices fell to a seven-year low in 2015. However, a projected rebound in oil prices paired with stability in long-term natural gas price forecasts (Figure 4-3), and new construction being almost exclusively natural gas-only, provides a basis for optimism that the number of oil-to-gas conversions will continue to grow.

\textsuperscript{22} NYC.government press release April 21, 2011: \textit{Mayor Bloomberg Presents an Update to PlaNYC: A Greener, Greater New York}
5.1.2 Oil-to-gas Conversion in Westchester County

In Westchester County alone, there are 225,000 Con Edison gas customers. However, only 60 percent of those customers are using gas for heating. Con Edison is seeking to increase the use of natural gas in Westchester County through oil-to-gas conversions and by changing the usage profile of existing natural gas customers from a winter-peak commodity to a more consistent year-round profile by encouraging customers to use natural gas for air conditioning, emergency generation, recreational use (outdoor food preparation, pool heating, etc.) and heating.

The gas expansion approach has five main areas of focus, shown in Figure 5-3 and is described below:

**Figure 5-3: Gas Expansion Areas of Focus**

- **Service Adequate/Meter Only**: This involves increasing marketing efforts for residential gas non-heating customers whose gas service is sized to support the gas heating demand and who are eligible for the rebate program to offset conversion costs. This program requires only a meter replacement/upgrade to facilitate the gas heating footprint and enables customers to convert with minimal external disruptions/excavations.

- **Service Installation Only**: This area of focus involves increasing marketing in areas where the existing gas infrastructure in the area is adequate to accommodate the conversion of residential non-heating gas customers who have an existing unprotected steel gas service, to residential heating customers. This effort will improve the reliability of the existing gas system by eliminating unprotected steel gas services while facilitating lower cost gas conversions. This program requires a service replacement and a meter replacement/upgrade to facilitate the gas heating footprint but enables customers to convert with minimal external disruptions/excavations.

- **Micro-area Growth** (Lower 5 municipalities): Here, we will target specific municipalities to facilitate conversions. This program will focus on the marketing of gas heat to multi-family and commercial customers and includes associated system reinforcement to facilitate conversions through main extensions and reinforcements, as well as the installation of new regulator stations where necessary.

- **Joint Projects with Municipalities**: This will entail partnering with the municipalities and determining if their proposed plans align with either future expansion potential for areas that are
not yet served and/or areas that need reinforcement to facilitate future conversion to natural gas for heat.

- **Main Replacement Program/Capital Work Coordination**: This involves internal coordination with main replacement program work so that the sizing of the gas main accommodates this large growth potential. As of 2015, nearly 2,100 of the 4,300 miles of gas main in the Con Edison gas system are within Westchester County. Of the 2,100 miles, 46 percent are planned for replacement over the next 20 years. Our plan is to ensure that the mains are appropriately-sized during replacement to facilitate growth in the future.

Our plan initially supports infrastructure build-out to capture approximately 50 percent of the total projected non-gas heating multi-family/commercial customers in each specific municipality. Importantly, our area and phase plan is designed to maintain flexibility to respond to unexpected events—including seeing more or less demand than we expect.

In order to guard against building for customers who ultimately choose not to take gas service for heating, we will develop a plan to require commitments from customers before we confirm the connection price for a particular area before we build. Our approach can be simply described as:

- plan to 50 percent of potential large non-gas heating customer conversions
- build to actual commitments of all pending load up to planned capacity

This program will initially target the five Westchester municipalities with the highest volume of large commercial/multi-family non-gas heating customers:

- Mount Vernon
- New Rochelle
- Port Chester
- White Plains
- Yonkers

We anticipate that each municipality will need a new regulator station and significant main reinforcement and/or extensions. With the area growth model in place, these areas will be marketed in order to drive enough revenue to substantiate the build-out for these customers.

For example, in 2016, we plan to market to nearly 600 multi-family/commercial customers in the City of White Plains, with a heightened focus on targeting the No. 4 and No. 6 oil customers in the city. Based on the conversion commitments we receive, significant main reinforcement and service work will be performed in White Plains over the subsequent years.

We anticipate the program to take multiple consecutive years in each municipality. Based on reinforcement and customer commitment, schedules would be subject to be either accelerated or extended in order to effectively build out the system and maximize the growth potential in each geographic area.

### 5.1.3 Marketing Strategy

Proactive marketing will be critical to our growth program for two reasons:

- to manage growth of the natural gas system in a cost-effective manner for both the company and our customers
- to help New York City achieve its clean heat goals

Our marketing strategy consists of mailings, town hall meetings, door-to-door canvassing, and presentations to real estate and building management organizations to educate customers on the benefits of natural gas.
We will employ targeted marketing to cluster customers in geographic proximity to convert to natural gas at the same time, minimizing disruption to the community. We can also work with local community boards to gather groups of potential customers to a common meeting. Here, we are able to explain to customers the benefits of clustering and converting as a group at the same time.

The cost of connecting to Con Edison’s natural gas system varies based on a combination of the size of the building, type of customer, expected revenue, and distance from Con Edison’s existing gas distribution mains, as defined in our PSC-approved tariff. Clustering of customers often helps customers to pass our revenue test, and can serve to minimize their connection cost.

5.1.4 Dedicated Resources to Meet Growing Demand

Con Edison is dedicating resources to meet the challenges associated with oil conversions. We have created a department called the Gas Customer Conversion Group with responsibility for executing the company’s conversion activities.

The Gas Customer Conversion Group is comprised of a number of sections:

- **Gas Customer Solutions**: serves as a single point-of-contact for the customer; responsible for the sales, marketing, and call center functions
- **Planning**: makes recommendations or gas service determinations for customers, and ensures that new business processes are aligned with engineering recommendations
- **Conversion Operations**: manages installations for conversion customers
- **Analytics**: analyzes the financial aspects of a conversion; tracks conversion metrics, trends, and quantity
- **Strategic Support**: coordinates with internal departments and external stakeholders, such as New York City agencies, the Public Service Commission, and the Real Estate Board of New York

The group has created a website (http://www.conEd.com/gasconversions) for customer interaction, communication, and education. It also provides a link for potential customers to apply for natural gas service.

5.2 Distributed Generation

Distributed generation (DG) is the installation of an electric generating system on customer premises that reduces the need to purchase energy from traditional energy providers, either the local utility or an Energy Service Companies (ESCO). Where customers were once simply an energy user receiving electricity flow one-way from traditional generation sources, the installation of DG has changed their role into both an electric generation source and a consumer, resulting in two-way energy flow for the grid in some cases.

There are numerous types of DG installations throughout the Con Edison service territory, but the two primary technologies are combined heat and power (CHP) systems, fueled by natural gas, and solar photovoltaic (PV) generation. Natural gas-fueled CHP technologies also offer the customer the extra benefit of using the heat byproduct of electricity generation to create steam or hot water for facility heating, and it can be used to replace existing fuel oil-fired boilers. In most cases, customers do not choose DG to allow them to disconnect from the grid; they choose it instead to offset or supplement some of the energy currently purchased.

Customers can choose to use their DG for emergency use only, to offset thermal energy requirements, for peak shaving, for total energy offset, or to produce surplus energy to sell back to the grid. Most of the current DG installations in Con Edison’s territory are used only for backup/standby power, though more than 130 MW of customer-owned gas-fueled DG is interconnected to the electric distribution system, operating continuously.
5.2.1 A Brief History of Gas-Fired Distributed Generation at Con Edison

The adoption of gas-fired DG is not new to Con Edison or its customers, who have been installing these systems since the 1980s. There are currently over 100 CHP project requests pending development, representing over 85 MW of capacity. Approximately 75 percent of all Con Edison Electric CHP customers are located within Con Edison’s gas-service territory.

Gas-fired CHP technologies can meet the needs of a wide range of users in the residential, commercial, and industrial sectors, but it is best-suited to customers with large and consistent thermal and electric loads throughout the year (e.g., hospitals). The need to defer electric transmission and distribution (T&D) investments (such as substation construction) is also likely to be another source of gas-fired DG growth. More than half of the potential gas usage from CHP systems would be in Manhattan, with several large projects scattered around the remaining divisions.

5.2.2 Gas-fired Distributed Generation Forecast

The Con Edison Electric Long Range Plan developed preliminary forecasts for DG adoption, including technical and market potential in the service territory. Technical potential measures what is possible, taking into account the physical availability of resources, but does not project actual adoption as it does not include any evaluation of cost. We use a preliminary estimate of technical potential as an upper-bound and then make estimates about the cost of various technologies and fuel sources to arrive at an estimate of market potential, or what we could actually see in our service territory, based on historical adoption rates.

There are signs that the trend of gas-fired DG growth will continue. See Figure 5-4 below. Based on expected projects, historic adoption rates, market trends—including increased interest in fuel cells, and the stable spark spread—we predict that CHP will make up more than 150 MW of new grid-connected DG by 2035.

Using this forecast, Gas Operations can better plan their investments in infrastructure required to serve or accommodate these gas-fired DG assets. In particular, New York State’s Reforming the Energy Vision (REV) proceeding is looking to leverage the electricity output of DG to offset the need for building additional substation and local distribution system equipment, while simultaneously growing the market for DG Installers to create jobs throughout the state. The use of CHP and Fuel Cell technologies to achieve the REV goals means a corresponding rise in the forecast for future gas availability and an increased need for high-pressure gas distribution infrastructure. In addition to REV, there are several other ongoing and future programs that will positively affect the gas outlook going forward.

24 For additional detail about the ELRP technical and market potential forecasts, please refer to the Con Edison Electric Long Range Plan, Section 3.

25 A fuel cell is a device that converts the chemical energy from a fuel into electricity through a chemical reaction of positively charged hydrogen ions with oxygen or another oxidizing agent.

26 The stable spark spread is the difference between the cost of electricity and the cost to produce it with a natural gas generator. It is used to demonstrate the profitability of gas-fired generation.

27 Reforming the Energy Vision (REV) is Governor Cuomo’s comprehensive energy strategy for New York to help consumers make better and more informed energy choices, enable the development of new energy products and services, protect the environment and create new jobs and economic opportunity throughout New York State.
5.2.3 NYSERDA Incentive Programs

The New York State Energy Research and Development Authority (NYSERDA) promotes energy efficiency and the use of renewable energy sources in order to develop a less-polluting and more reliable and affordable energy system for all New Yorkers. To that end, NYSERDA administers several incentive programs, funded by surcharges on the utility bill, to help establish a thriving market for clean energy technologies and energy efficient products.

For CHP technologies, NYSERDA has two main programs that currently have multi-million dollar funding—the CHP Acceleration Program for systems with electric generation sized at 1.3 MW and smaller, and the CHP Performance Program for systems sized 1.3 MW and larger.

NYSERDA’s fuel cell programs have been less funded, and historically more focused on introducing the technology to consumers rather than widespread customer adoption. Both CHP and fuel cells typically require either a high-pressure gas line or booster to supply their steady fuel needs during operation. In addition to helping fund the cost of the systems themselves, NYSERDA’s Flex Tech program performs cost-shared technical services and energy evaluations to help customers understand the energy efficiency opportunities provided by these technologies and to make better energy choices to reduce consumption and costs.

5.3 Natural Gas Vehicles

Economic and environmental issues have coincided to create a burgeoning interest in alternative fuel vehicles in North America. Key concerns are:

- **Economic concerns**: Affordability and availability of oil as a continued transportation fuel in 20–30 years
- **Environmental concerns**: The transportation sector has dominated the growth in US carbon dioxide emissions since 1990, accounting for 69 percent of the total increase in US energy-related carbon dioxide emissions, and petroleum is by far the largest source of carbon dioxide emissions in the transportation sector
• **Public health concerns:** Air quality concerns from burning oil and its effect on public health, such as respiratory diseases

Compressed natural gas (CNG) can be used as an alternative transport fuel in vehicles that have been converted to operate as natural gas vehicles (NGVs). This offers an ideal solution to many environmental and economic concerns:

- Natural gas is an abundant domestic resource, particularly with large reserves of unconventional shale gas
- NGVs will result in increased utilization of the nation’s current gas infrastructure
- Natural gas is the cleanest fossil fuel available
- Use of NGVs vs. conventional vehicles results in lower vehicle emissions

Despite its many benefits in aligning the nation’s political and economic interests, NGV growth has lagged behind other alternative fuel vehicle technologies. Electric vehicles (EVs) have dominated the national alternative fuel dialog due to a variety of reasons, including powerful support from automakers and electric and coal lobbies. However, EVs also face some important limitations including limited vehicle range, inadequate battery storage technology (size and capacity), and lack of a charging infrastructure. These limitations affect the applicability of electric vehicles in medium and heavy-duty vehicles or long-haul segments. Natural gas vehicles, on the other hand, are well-suited to serve these segments.

Fleets today represent a significant CNG market, with the most vehicle sales in government and transit bus market segments. To spur CNG growth, federal, state, and local governments provide a significant number of incentives across several different dimensions. We believe that the use of CNG will grow among fleets in Con Edison’s service territory over the next 20 years.

Con Edison’s fleet currently contains approximately 300 CNG fueled vehicles including Class 1 passenger sedans, Class 2 cargo vans and even Class 4 step vans. We have been servicing both company and non-company NGVs for over 35 years. The company currently owns eight CNG stations that are located throughout its service territory in Brooklyn, Queens, Manhattan, the Bronx and Westchester. Five of the eight stations are currently open to the public.

Gas consumed by natural gas vehicles and discharged via CNG fueling stations represents firm gas demand for Con Edison. This assumes that current levels of incentives continue to exist and current mandated environmental regulations will be met.

Among the many signposts that Con Edison is watching are potential environmental and/or energy efficiency mandates to be posed by New York State or the federal government. Enactment of stringent air, carbon-related laws or federal renewable portfolio standards could promote compressed natural gas as a viable option for reaching transportation policy goals or change the economics of certain distributed generation technologies—particularly those powered by natural gas—and thus alter adoption patterns.

### 5.4 Gas Energy Efficiency

#### 5.4.1 Energy Efficiency Plan

Con Edison’s energy efficiency plan is to work with customers proactively to manage their energy needs and costs, cooperating with regulatory and other agencies to develop, offer, and continually refine a suite of programs that drive efficient end-use behavior and technologies that permanently reduce per-unit energy use.

Because of our direct relationship with our gas customers, we believe we are well-positioned to directly partner with customers to reduce energy usage. **Energy Efficiency Portfolio Standard** (EEPS) programs have gained momentum and have effectively established relationships and awareness at the community and customer level. Looking ahead, the company will build upon this momentum and improve gas programs in a way that streamlines the customer experience in order to cost-effectively increase savings while achieving energy savings goals and associated emissions reduction.
Moving forward, the company’s proposed Energy Efficiency Transition Implementation Plan (ETIP) will offer a framework for a more integrated approach to customer-oriented demand side management (DSM) offerings, including gas programs. Improving programs in 2016 and beyond in anticipation of—and in response to—customer demand will be a priority.

Based on acquisition rates from recent years and program targets for subsequent years, we believe Con Edison and NYSERDA programs in the Con Edison service territory will be able to achieve savings of approximately 1.5 million dekatherms through 2018, as shown below in Figure 5-5.

![Figure 5-5: Con Edison and NYSERDA Incremental Achievements](image)

Con Edison’s projected savings over the 2016–2020 period are based on targets set forth by the PSC in the ETIP. The included programs span across all customer segments in the Con Edison territory, such as commercial, multifamily and residential customer groups. As REV evolves, subsequent updates to the ETIP will include changes to the portfolio to better align with REV objectives, thus potentially modifying goals.

### 5.4.2 Demand Management Platform

We are currently developing a Demand Management Platform. The system will streamline and integrate customer relationship management, data tracking and reporting, and analytics. This will greatly enhance our ability to understand program participation and market dynamics and to market our programs effectively to the public. The Platform will be the system of record for all demand management programs, and will consist of a robust business intelligence component, as well as a customer relationship component. The system is scheduled for full implementation by the fourth quarter of 2016.

### 5.4.3 Uncertainties May Affect Outcomes

The company realizes the uncertainty that is inherent to initiatives that are highly-dependent on customer behavior as well as regulatory and economic factors. This plan is designed to balance a long-term vision with the flexibility required to meet changing demand. As such, the company has identified the market, regulatory, and legislative conditions that need to be monitored on an ongoing basis to continually refine the plan. Customers may not respond as expected and planned results may not be achievable at the expected cost levels projected for post-2015 gas program goals. Codes and standards may emerge as expected or
may far under- or over-achieve targeted levels of efficiency. From a regulatory and legislative standpoint, there may be a change in targets, in the role of NYSERDA, or in future State or Federal legislation.

### 5.5 Meeting Natural Gas Demand

The natural gas peak demand forecast drives the timing and magnitude of the required investment in transmission and distribution infrastructure. Con Edison currently develops a 20-year peak demand forecast to ensure that our transmission and distribution infrastructure is adequate to support the economic growth of NYC and Westchester County.

A standard forecast consists of two components: a volumetric forecast and a peak demand forecast. The volumetric forecast is a projection of annual gas consumption by both firm and interruptible customers, measured in millions of dekatherms (MMDth). The peak demand forecast is a projection of the maximum gas requirements that Con Edison’s firm gas customers demand at a single point in time, measured in thousands of dekatherms per day (MDth/day). Forecasting peak demand drives infrastructure investment because we must build to that demand, even if it is a relatively infrequent occurrence, to provide reliable gas service when it is most needed. For the Con Edison natural gas system, firm gas peak demand occurs in the winter when customers have a high demand for reliable gas service for heating purposes.

Economic conditions, along with environmental energy policy and regulation influence customer fuel choices and usage. Con Edison’s gas system will experience growth due to conversion of fuels from liquid fuel to natural gas. Innovations and price changes in end-use technology (e.g., higher efficiency boilers, building management systems, natural gas vehicles) also affect customer energy use. To facilitate the development of the Gas Long Range Plan, we developed a base case for peak demand. This case is the basis for all initiatives and assumptions discussed in the plan. The case incorporates modest energy efficiency gains, an increased oil-to-gas conversion rate through the end of 2015 followed by moderate conversion rates for the remaining years, and historical rates of growth for gas-fired distributed generation and natural gas vehicles. The 20-year gas peak demand forecast is depicted graphically in Figure 5-6. We expect a 1.3 percent compound annual growth rate in peak demand over the planning period. A significant volume of conversions is expected in the next five years, with a 2.3 percent compound annual growth rate over that period.

#### Figure 5-6: Daily Firm Peak Demand Forecasts (MDt/day)

<table>
<thead>
<tr>
<th>Year</th>
<th>Base Demand</th>
<th>Demand with Oil Conversions</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>1,000</td>
<td>1,100</td>
</tr>
<tr>
<td>2011</td>
<td>1,100</td>
<td>1,200</td>
</tr>
<tr>
<td>2016</td>
<td>1,200</td>
<td>1,300</td>
</tr>
<tr>
<td>2021</td>
<td>1,300</td>
<td>1,400</td>
</tr>
<tr>
<td>2026</td>
<td>1,400</td>
<td>1,500</td>
</tr>
<tr>
<td>2031</td>
<td>1,500</td>
<td>1,600</td>
</tr>
</tbody>
</table>

For the next five years, the company expects the peak demand to grow by 12.2 percent cumulatively, or 167,000 Dt/day. The peak positive components considered in this projection—listed in descending order
—are: No. 4 and No. 6 oil-to-gas conversions, large new construction, DG/steam lost business, large No. 2 oil-to-gas conversions, net transfers, and small residential. The forecast is also affected by peak negative components, including Con Edison and NYSERDA energy efficiency programs and natural conservation.

Historically, peak demand growth has depended on the rate of economic growth. Following this same logic, growth, not including oil conversions, would be 0.7 percent over the next twenty years, as shown in the chart above.

5.5.1 Logistics

New York City is one of the most densely populated, urban environments in the world. In such a congested area, we are faced with many oil conversion customers in the same vicinity potentially requesting conversions to natural gas at different times. If this random conversion process were allowed to occur, it would require digging up the streets multiple times, causing ongoing disruption to the community and adding to the connection costs of many of the new customers. We plan to minimize these situations through customer aggregation and work coordination strategies.

As mentioned earlier, we expect to have completed a significant number of oil conversions in the near term. We forecast that approximately 67 percent (4,700) of the total heavy heating oil population identified in Con Edison’s NYC gas service territory in 2011 will have converted by 2020. The timeline of these conversions is largely dependent upon the boiler age distribution in our service territory. Once the boiler requires replacement, these oil customers will not be allowed to renew their No. 4 or No. 6 oil burning certification and must choose a cleaner-burning fuel alternative. A rapid number of conversions complicates matters because there will be many jobs scheduled for construction in a short period of time.

To accommodate the new demand on our system, we will be reinforcing both our transmission and distribution gas systems by installing regulator stations, replacing mains, installing new mains, and connecting services to customers. The infrastructure itself is costly, and in some instances, one infrastructure solution is more cost-effective than another while achieving the same level of reliability. Wherever possible, we will pursue the least-cost solution for high reliability.

Expanding and reinforcing our system to meet new demand will require significant investment. System expansion and reinforcement requires a significant amount of trenching in the streets, resulting in high costs for excavation, construction, and restoration.

In the next 20 years, we plan to spend over $3.1 billion on all growth programs, of which $350 million is to continue our efforts to convert the heavy oil users in NYC to natural gas. Going forward, we anticipate significant investments to support all oil-to-gas conversions, expanding our heating footprint, and all other new business opportunities. Described below are examples of gas transmission and gas distribution projects needed to support the growth in demand associated with this 20-year plan for the gas system.

5.5.1.1 Transmission System Reinforcement Projects

- Astoria to 3rd Ward of Queens Oil-to-gas Transmission Main Reinforcement: In 2008, a new 36-inch, 350 psig MAOP transmission main was installed in our Astoria Tunnel, which feeds gas from our Hunts Point regulator station in the Bronx to the 1st Ward of Queens. As a part of planned transmission system reinforcement, and to support future growth from oil-to-gas conversions, the transmission main, which runs east from the Astoria Tunnel, will be replaced with a larger main, in order to increase gas supply capacity to the 3rd Ward of Queens.

- This reinforcement project requires installation of approximately 13,000 feet of 36-inch, 350 psig transmission main that will replace an existing 20-inch, 350 psig transmission main. The replacement will also involve reestablishing a number of main connections to feed various Con Edison regulator stations and commercial and industrial customers. This is a multi-year project that is scheduled to begin in 2017, and will be phased-in over a number of years. Annual footage installation amounts will be reevaluated on an annual basis utilizing the latest 20-year gas forecast.
The replacement of the 20-inch, 350 psig main, will ensure adequate pressure to the firm gas customers in the 3rd Ward of Queens. The new 36-inch main will operate at less than 20 percent specified minimum yield strength (SMYS), meaning that this section of main will no longer meet the Federal DOT definition of transmission lines and will therefore operate as a distribution main, operating at greater than 125 psig. The new gas main will be constructed of piping with both higher-yield strength and increased ductility than the existing transmission main.

5.5.1.2 Distribution System Reinforcement Projects

A large portion of our distribution system consists of low-pressure mains, which are adequate for our current customer needs, but will require reinforcement to accept our growing load. There are three ways that we reinforce the system for increased demand:

- Install new district regulators, where possible. Where there is a higher pressure main nearby, we can install a regulator and associated main ties/extensions to provide an additional supply to the low-pressure system in the area.
- Replace smaller-diameter mains with larger-diameter mains to add capacity.
- Install new main extensions to supply new customers.

Each year, we complete a combination of each of these types of distribution reinforcement work designed to accommodate demand, taking into consideration all anticipated load growth. For example, in 2015 we installed eight new regulator stations, reinforced two existing regulator stations, and installed and replaced over 16 miles of pipe in order to meet the demands of the current load growth and prepare the system for expected growth.

5.5.1.3 New Gas Supply to Infrastructure

We also recognize that we must have adequate supply to meet growing demand. To this end, we support projects that give us access to new sources of low cost natural gas supply. Within the next ten years, up to two new pipeline supply points are planned to enter our service territory.

Con Edison is evaluating potential new transmission supply sources that will increase reliability in the system and mitigate risks of severe disruptions in Queens and Westchester.

The addition of these proposed supply points will also allow Con Edison to source natural gas from a number of areas, providing diversity and flexibility in purchases.

5.6 Environmental Concerns

Con Edison is fully-committed to improving the environmental elements associated with our gas system infrastructure. The aggressive main replacement program that we are undertaking will not only improve safety by reducing the risk associated with gas leaks, but will also reduce fugitive methane emissions. We are dedicated to working with new technologies to better quantify gas leaks so that leak repairs can be prioritized to effectively reduce methane emissions. We are also being proactive by participating in collaborative climate change studies that will help us anticipate and plan for environmental trends potentially impacting our system.

5.6.1 Environmental Performance

The company is committed to environmental responsibility. We have been a member of the EPA’s Natural Gas STAR Program since its inception in 1993. The Natural Gas STAR Program is a flexible, voluntary partnership that encourages natural gas companies to adopt proven, cost-effective technologies and practices to improve operational efficiency and reduce methane emissions. Nearly all distribution sector methane emissions are due to unintended fugitive leaks.
According to the latest available EPA report, between 1993 and 2013, Con Edison has achieved cumulative methane reductions of over 5 billion cubic feet (Bcf), primarily through the rehabilitation of leaking pipe and the use of automated systems to reduce pressure. In 2013 alone, the company achieved 141,337 Mcf of methane reductions, largely through the identification and rehabilitation of leaking pipe.

Methane is considered a potent greenhouse gas (GHG)—25 times more powerful than carbon dioxide in trapping heat in the atmosphere over a 100-year period. Table 5-1 below illustrates the magnitude of Con Edison’s methane reductions in some commonly used carbon dioxide and greenhouse gas equivalents.

<table>
<thead>
<tr>
<th>Con Edison’s Methane Emissions Reductions (Mcf)</th>
<th>Metric Ton CO2 Equivalent</th>
<th>Equivalent CO2 Emissions from Electricity Use In Homes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>141,337</td>
<td>67,755</td>
</tr>
<tr>
<td>Cumulative Since 1993</td>
<td>5,138,043</td>
<td>2,463,121</td>
</tr>
</tbody>
</table>

Source: EPA Natural Gas STAR Program

Since 2011, Con Edison has also reported total GHG emissions from the company’s natural gas distribution system to the EPA under Subpart W of the Mandatory Greenhouse Gas Reporting program. Table 5-2 summarizes the emissions reported under this program.

<table>
<thead>
<tr>
<th>Reporting Year</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Dioxide (metric tons)</td>
<td>2,626</td>
<td>1,973</td>
<td>1,653</td>
<td>993</td>
</tr>
<tr>
<td>Methane (metric tons)</td>
<td>12,799</td>
<td>12,605</td>
<td>10,678</td>
<td>10,337</td>
</tr>
<tr>
<td>Carbon Dioxide Equivalent (CO2e, metric tons)</td>
<td>322,590</td>
<td>317,095</td>
<td>268,611</td>
<td>259,415</td>
</tr>
</tbody>
</table>

Another indicator of our environmental performance is the number of reportable liquid spills within Gas Operations. These liquid spills average approximately half a gallon quantity each, and are generally vehicle-based. In 2015, Gas Operations had six reportable spills. Gas remains committed to improvement in this area.

Our Research and Development organization is currently participating in an exciting new technology development that will be used to quantify actual methane emissions from Type 3 leaks. This technology could be used to characterize the emissions of methane into categories such as small, medium, and large, which would then be used to prioritize repairs of the greatest emitters. The company is working with the Environmental Defense Fund and other parties on a pilot project to identify the leaks that contribute the most to greenhouse gases and repair or replace such leaks on a prioritized basis. We are also participating in a parallel effort with industry research collaboratives to advance development of this technology.

26 The irregular drop between 2012 and 2013 was due to a change in the company reporting method for gas service count.

29 A Type 3 leak is not immediately hazardous at the time of detection and can be reasonably expected to remain that way. However, Type 3 leaks shall be reevaluated during the next required leakage survey or annually, whichever is less.
technology, with the goal of creating a commercially-available product. The company is also planning to lease in 2016, then purchase in 2017 similar leakage survey technology in order to test, analyze and begin to implement the technology into our detection efforts.

5.6.2 Climate Change

In 2009, a climate change study was conducted for NYSEARCH member utilities that investigated the effect of climate change during the periods 2005–2025 and the potential impacts that it would have on local gas distribution company infrastructures. A few of the findings were as follows:

- Hotter summers may lead to more demand for power generation, which would increase demand for natural gas. This could increase the demand for gas not only in our service vicinity, but across the country, creating capacity issues in transmission lines.

- The increased frequency of rain may cause flooding. As part of the company’s post-Sandy Storm Hardening initiatives described in section 2.2.2.4 of this plan, the company is working towards making the gas system more resilient to future storms and the rising of sea level.
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6. GAS INFRASTRUCTURE PLAN

In this section, we describe the system design strategies that Con Edison uses to efficiently manage our planned capital infrastructure investments. Further, the investment projections for the plan period and the expected benefits of our planned investments are outlined, along with some details of the programs within the gas capital infrastructure plan.

This section also highlights our robust research and development (R&D) efforts to enhance our equipment, practices, design and infrastructure management approaches with new materials and innovative technologies.

6.1 Developing the Gas Infrastructure Plan

Con Edison employs a variety of methods and tools to monitor, analyze, and optimize the performance of our gas system, and to develop our infrastructure plan. These tools and methods include:

- Defining system design criteria to meet regulatory requirements and internally-specified performance standards
- Employing tailored system design approaches
- Integrating the demand forecast in conjunction with system design criteria to meet reliability, system integrity, and safety standards
- Optimizing capital spend to achieve targeted system capacity, reliability and integrity requirements
- Monitoring and managing system performance

Customer demand drives our reliability and reinforcement needs. Our system design criteria are developed to meet safety and operational performance levels. All infrastructure projects are put through a rigorous review to evaluate alternatives that will result in the most cost-effective capital funding.

6.1.1 Defining System Design Criteria

The Con Edison system is designed to deliver gas service safely and reliably. It also must be flexible enough to accommodate new customers or increased load from existing customers. Our mission is to always look at the long-range solution and incorporate that view in addressing today's needs.

Con Edison’s gas transmission and distribution systems are designed to meet the requirements of the gas safety code: NYS Codes, Rules and Regulations Part 255. In addition to Part 255, Con Edison’s gas transmission and distribution systems are subject to a variety of federal, state, and city regulations, along with standards published by professional organizations.

The purpose of our design criteria is to ensure key safety, reliability, and system integrity conditions:

- Maintain the reliability of supply mains in the event of an outage of a critical regulating station
- Maintain the reliability of the transmission system
- Reduce incoming gas leaks
- Maintain the system at optimal operating pressures while satisfying detailed design basis conditions

The company’s design criteria includes specifications for operating pressures, pipeline material, main replacement versus repair, design of regulator stations, tunnels, and service connections, as well as contingency procedures.
6.1.2 Employing Tailored System Design Approaches

Our design specifications also have built-in flexibility. They offer design alternatives and provide criteria for choosing among those alternatives.

For example, given the anticipated increase in gas conversion load, wherever economically justified, we connect new services to the highest pressure main available on the street to enable us to scale up quickly (and without the extra costs of additional excavation and a new connection) if a customer's load increases.

When replacing mains, we strategically replace small-diameter mains with larger-diameter mains, in order to enable our system to accommodate larger gas loads. Such tailoring of our system for future new business is especially important given that anticipated new loads (heating oil to natural gas conversions, distributed generation, etc.) are often larger than our current average customer size. Alternatives like district regulating stations or larger-diameter mains also will help reduce the capital costs required for us to support new customer demands.

6.1.3 Integrating the Demand Forecast

Con Edison has had a solid approach to forecasting demand for many years, but as part of this planning process, we have expanded the analysis and have increased the involvement of a number of corporate organizations to better integrate planning efforts that are taking place around the company. As explained in section 5.5, our demand forecast is made up of a number of component parts, including traditional growth and oil-to-gas conversion demand growth.

6.1.4 Optimizing Capital Investments

Con Edison has developed and implemented a capital budgeting process to evaluate projects and programs on an enterprise-wide basis, and to optimize expenditure decisions within operating units through the use of standardized analytical methods and guidelines. The process has been in place since 2010 at Con Edison of New York, and was developed through an initiative facilitated by the Business Improvement Services organization, in conjunction with the company's senior management team.

Capital Optimization is the first step of the capital budgeting process and aligns and ranks all capital project and program requests with the corporate strategic drivers, risks, and benefits. Proposed capital projects or programs are grouped under one of three categories—regulatory mandated, operationally required, and strategic. The company has adopted a strategic alignment methodology to evaluate projects and programs so that funds are allocated to reduce operating risks and meet strategic objectives efficiently. This methodology takes into account the portfolio's cost, benefits, and weighted strategic value, allowing for analysis of all projects and programs as an integrated portfolio.

Our Business Finance organization performs the optimization analysis, applying the constraints outlined in the Budget Guideline Memos (unless otherwise directed), and provides the strategic value and ranking of the projects and programs within the portfolio to the respective portfolio Optimization Teams. These teams consist of subject matter experts selected for their respective expertise to vet the results of the optimization. Several iterations may occur until the Optimization Teams recommend the portfolio to the respective Governance Committee for final approval. The final recommended portfolio is then input into the next step of the budget process.

6.1.5 Monitoring and Managing System Performance

We constantly monitor the performance of our gas transmission and distribution infrastructure through the tracking of key performance indicators in our monthly Gas Operations Performance Trends report. This is a detailed 80-page report that provides the latest results and historical trends such as incoming leaks, leak backlogs, time- and cost-per-unit worked, units of work accomplished, and actual costs versus budget. We review this report monthly, and where we see variances from plan, adjust project schedules and priorities to accommodate immediate needs and risks.
In addition to the indicators listed above, the PSC also requires the company to monitor specific metrics that represent our customer service and reliability performance. As a result of the current rate case agreement with the PSC, specific goals and performance measures for Con Edison were developed and are monitored on an ongoing basis, and penalties are incurred if these thresholds are not met. The PSC may change the thresholds for each rate case period. The PSC Performance Measures for the current rate case period include company targets for customer satisfaction rate, annual system gas leak backlog, response time for gas leak calls, and total damages to company gas facilities.

6.2 Gas Infrastructure Plan Overview

Figure 6-1: Gas Capital Expenditure Forecast ($000)

Our tools and methods described above were used to create the company’s overall 20-year capital investment profile, presented in Figure 6-1 above. At our current investment trajectory, we will be investing approximately $1 billion annually or $20.5 billion during the planning period. All capital figures in this long range plan are expressed in nominal dollars and include an inflation assumption of 2.5 percent (post five-year business plan) to reflect future price level changes. The annualized growth rate of capital investment is 3.5 percent per year from 2015–2035. The drivers of these investments can be grouped into the following:

- **Infrastructure Investment**: Expenditures in this category are designed to reduce risk, maintain system integrity, accommodate gas demand and maintain pressures and system reliability. The programs in this category represent two types of investments:
  - **Main replacement program**: Replacement of 12-inch-and-under cast iron and unprotected steel gas distribution mains. This program is a necessary effort that minimizes risk from aging infrastructure.
  - **Non-main Replacement Infrastructure Investment**: Replacement or rehabilitation of all mains, services, and components in our gas distribution and transmission systems not covered under the main replacement program. These investments will further reduce system risk, and will also serve to reinforce or upgrade the system to accommodate new loads.
• Infrastructure managed under this category includes pipes, regulator stations, valves, etc. Over the planning period, this activity will represent 78 percent of our investments, as shown in Figure 6-2 below.

• **New Business**: Expenditures in this category represent the cost of installing new services or mains for connecting new customers to our system, which includes new construction, existing customers with increased load, and oil-to-gas conversions. Over the 2016–2035 planning period, this activity is expected to represent 15 percent of our investments.

• **Public Improvement**: When a municipality decides to perform work under its streets, the presence of existing facilities such as sewer, water, telephone, electric, and gas can complicate both new installations and maintenance work. When gas facilities are in conflict with municipal activity, Con Edison has a legal obligation to remove or otherwise protect its facilities to accommodate that work at our—and therefore our customers’—expense. Due to the nature of the work, we have little control over the amount or timing of public improvement investments required. However, we apply the same capital expenditure management to this part of the plan as for our infrastructure maintenance and new business work. Over the planning period, we forecast that this activity will represent 7 percent of our investments.

The programs outlined in our infrastructure plan will help the company to manage our complex, logistically challenging, underground gas transmission and distribution infrastructure designed to the rigorous reliability and safety standards that our customers have come to expect.

**Figure 6-2: 20-year Gas Infrastructure Plan Breakdown**
6.3 Infrastructure Investments

As stated above, programs and projects in this category target ongoing infrastructure replacement of pipes and components along with new facilities that reduce risk, maintain system pressures for system reliability, to reduce leaks, to maintain the system’s integrity and safety, and to accommodate new loads. Figure 6-3 shows the various programs that make up our infrastructure investments.

Figure 6-3: 20-year Gas Infrastructure Investment Breakdown

![Infrastructure Investment Breakdown Diagram]

6.3.1 Main Replacement Program

The main replacement program is the largest component of our infrastructure maintenance plan and comprises 48 percent of the $15.9 billion infrastructure investment at $7.7 billion over the 20-year plan. It involves replacement of cast iron and unprotected steel distribution mains with plastic or cathodically-protected steel pipe to reduce leaks and maintain system integrity.

The level of main replacement is generally mandated by our regulators during each rate case agreement. Replacement is prioritized using a statistical computer program that considers main conditions (material, age, and size), and main risk (ease of gas ingress and consequence). As described in section 3.2.1, this replacement program has been accelerated to achieve the replacement of all 12-inch-and-under cast iron and unprotected steel mains within the next 20 years. This acceleration will result in a significant increase from historical capital expenditures for this program.

As shown in Figure 6-4 below, the capital spending for main replacement will ramp up over the next five years, from a forecasted budget of $149.3 million in 2016, to $364.2 million in 2021. The increase is driven by increased levels of replacement in Manhattan and the overall annual increase in replacement mileage. Once the planned replacement level reaches 100 miles per year in 2021, the budget will undergo a more gradual annual increase, reaching a peak of $472.9 million in 2031. Our budget will
begin to decline slowly as this program is completed, ending at a forecasted annual budget of $433.9 million in 2035.

Along with the challenge to replace our 12-inch-and-under cast iron and unprotected steel infrastructure over the next 20 years is an equal challenge to assemble the company and contractor resources needed to complete this effort. These needs will be largely addressed by new contractors that will need to build up their internally-trained and qualified employees over time. In the short-term, the unit cost of the replacement program will likely increase as the annual replacement level increases and the resources become fully qualified and efficient. This is reflected in the capital budget forecast shown above.

Investments to reduce system risk will reduce operations and maintenance expenditures over the long run. For example, replacing cast iron and unprotected steel pipes 12-inch diameter and less will reduce the operations and maintenance costs incurred annually to repair leaks on these mains.

We continue to seek opportunities to utilize trenchless technology measures on replacements where such methods are appropriate and prove to be the most cost-effective approach. Our main replacement work has been completed generally by contractors or by company forces with area contractor support. While the increased use of trenchless technology, where appropriate, helps mitigate the excessive cost of trenching and restoration associated with traditional direct bury installation methods, we will also transition to a geographic replacement approach in specific areas selected based on their relative risk and solicit competitive bid packages accordingly.

In addition to the replacement of 12-inch-and-under cast iron and unprotected steel mains, our replacement program also includes a small amount of funding for the installation of cathodic protection, such as test stations and anodes, on existing steel mains. This program allows the lifespan of existing steel mains to be extended during the course of the replacement program.

6.3.2 Distribution Supply Main Projects

Supply mains represent the backbone systems that transport gas from the transmission mains to the distribution system. The cast iron and unprotected steel portions of these supply mains pose a potential safety and operational risk if not properly maintained. To proactively address this issue, these supply mains are identified and prioritized for replacement or rehabilitation based on an evaluation of their leak
history together with the results of the main replacement prioritization model. These projects replace sections of pipe with larger diameter mains where appropriate, to reduce the risk of a significant customer outage during the coldest winter days resulting from loss of supply to local networks or downstream regulator stations. Con Edison will spend nearly $1.8 billion, or 11 percent of its infrastructure budget, in the 2016–2035 period to complete these projects.

One of our newer initiatives for cast iron piping greater than 12-inch diameter is to utilize cured-in-place lining that would be designed to prevent joint leakage and breaks. Although liner technology exists today, more research and development work can further improve the technology to achieve the most reliable product that can be used as a longer-term solution. The expectation is that liner technology will continue to develop over the next decade. This technology is and will continue to be very cost-effective compared to replacement of these large-diameter cast iron pipes. Larger-diameter cast iron pipes are a much lower risk than cast iron pipes of 12-inch diameter and below, since they have higher thickness and beam strength compared to smaller-diameter piping, and are therefore much more resilient to breaks. Also, leaks at joints can be addressed with other technologies that exist today, such as CISBOT and external joint sealing at a much lower cost than pipe replacement. Our plan for unprotected steel piping greater than 12-inch diameter will also utilize trenchless technologies that can offer more cost-effective long-term reliability.

We also have a number of other programs which address additional risks and vulnerabilities in the supply main system, including the Winter Load Relief Program, and the System Vulnerabilities Program, each described below.

6.3.2.1 Winter Load Relief

Winter Load Relief is an ongoing annual program that involves the installation and replacement of gas mains for system reinforcement in areas where pressures are forecasted to drop below design criteria during a peak hour, based on expected demand growth for the following heating season. Without this program, the system low points and downstream regulator inlet pressures could fall below design criteria and possibly result in customer outages on the coldest winter days. Because of the capital investments associated with this reinforcement ($439.7 million to be spent over 20 years), we seek to maximize system benefits by evaluating alternative solutions including upsizing mains, installing regulator stations and upgrading mains to higher operating pressures.

6.3.2.2 System Vulnerabilities

In many cases, the failure of a single component on our gas system could result in a large-scale outage during winter peak heating system. Beginning in 2017, we will be implementing a new program that will proactively address these vulnerabilities through system reinforcement projects. Parts of the system where a single failure would have the largest impact will be targeted first. Network analysis modeling studies will be performed annually in order to determine the prioritization of planned projects, and identify emergent vulnerabilities.

6.3.3 Transmission Projects

During this GLRP, our transmission projects are focused on replacing segments of the gas transmission system that operate greater than 20 percent of the SMYS and are constructed of lower ductility pipe than currently used in our new transmission mains. The objectives of these investments, which are budgeted at nearly $2.9 billion over the next 20 years, are to improve reliability, increase gas supply take-away capacity, and reduce the risk of pipe failure. The projects will maximize supply flexibility and deliverability and help us meet electric load-generating requirements. This category also includes the installation of

30 CISBOT is a robot that seals cast iron pipe joints in live gas mains. Working inside live 16” to 36” low-pressure gas mains, CISBOT can seal up to 40 joints through one small access pit.
remotely-operated valves (ROVs) to rapidly isolate desired sections of the system in the event of damage or for planned repair purposes.

6.3.3.1 Bronx Tunnel to White Plains Transmission Projects

Over the next 15 years, an 18-mile section of the oldest transmission main in our system, a 24-inch steel main stretching from Hunts Point in the Bronx, across the Bronx River, and north to White Plains, will be replaced with new 36-inch steel through a series of three capital projects: the Bronx River Tunnel to Bronx-Westchester Border project, the Westchester-Bronx Border to White Plains project, and Bronx River Tunnel and Easement project.

This 24-inch transmission main is constructed of lower strength steel joined with mechanical couplings. The new main will replace the lower ductility pipe with transmission pipe that is made of steel that is stronger and more resilient.

The work will also require the installation of ROVs as required to meet the Con Edison design criteria. The installation will also require the replacement or reconnection of supply to existing regulator stations. The existing 24-inch transmission main in the Bronx River Tunnel will be replaced by either the installation of a new 36-inch main within the tunnel or by horizontal directionally drilling (HDD) with a new 36-inch main alongside the tunnel.

This replacement will provide many significant enhancements:

- It will permit future elimination of the 245 psi maximum allowable operating pressure system.
- A continuous, 36-inch 350 psig system from White Plains to Hunts Point connected to the existing 36-inch transmission piping from Hunts Point to Astoria, Queens, will enhance operation of the transmission system allowing for flexibility of economic dispatch of various sources of gas.
- It will permit future elimination of the Hunts Point Compressor Station and expenses associated with the facility.
- A 36-inch, 350 psig system from White Plains to Hunts Point will provide contingency in the event of the loss of a gate station should the supply of gas from a pipeline be interrupted. The larger diameter main is crucial to withstanding the loss of the White Plains Gate Station and to withstand the isolation of a section of transmission main along the southern route of this line.
- The 36-inch will operate at less than 20 percent SMYS, therefore supplying safe and reliable gas service to the firm gas customer.
- The new facility will have much greater fracture toughness/greater ductility and will provide a safer delivery of natural gas.
- It will increase take-away capacity at our White Plains Gate Station (i.e., support additional supplies for oil-to-gas conversions).
- It will provide for the elimination of potential corrosion issues associated with current field-coated mains.

6.3.4 Service Replacement

There are three main service programs in our infrastructure plan. The first involves the replacement of vintage unprotected steel services performed in conjunction with main replacement projects. As our level of main replacement increases, this associated program will also increase. Our second service program will replace the approximately 400 services in our systems, which do not currently contain outdoor shut-off valves, in order to meet the requirements of the New York City Fuel Gas Code.

The third service program in our plan replaces leaking services installed before 1972, which have been identified as being the source of an active leak. For pre-1972 steel gas services, replacement is the most prudent means to clear a gas leak and make the condition safe. Approximately 25 percent of the
incoming outside leaks received result in a service replacement. Over $1.7 billion will be spent in the next 20 years to fund these service activities.

6.3.5 Other

This category includes programs such as the physical security enhancements projects, described in section 3.2.3, and the installation of isolation valves, described in section 3.4.2. Also included in this budget category are programs that are managed by the company’s Pressure Control department. This department is responsible for the maintenance and operation of our more than 300 regulator stations, which require capital maintenance and equipment replacement projects.

Projects that involve replacement and rehabilitation of our LNG facility are also included in this category. The LNG facility requires new equipment and refurbishment whenever parts become obsolete or equipment life-cycle expires. Some of the larger projects that will be performed at the LNG plant throughout the plan are the upgrade of two vaporizers, and the rebuild of two gas turbines.

Our tunnel facilities also require regular refurbishment and equipment replacement. While the tunnels house the company’s electric, gas, and steam facilities, Gas Operations is responsible for the operation and maintenance of all company tunnels. Capital projects planned for the tunnel facilities include replacement of radio communications, electrical services, facility supports, and walkway passages. All are included in this “other” portion of the gas capital budget.

Overall, we plan to spend $461 million on isolation valves, Pressure Control programs, LNG projects, and tunnels projects throughout the plan.

6.3.6 Special Projects

In addition to distribution and transmission main replacement work and service replacements, we have various other special projects included in the infrastructure investment category of our GLRP. Included in this category are projects such as the implementation of the Gas Work and Asset Management System, detailed further in section 8.2.1, which will require an investment of $152 million over the planning period. In total, Con Edison will be investing nearly $650 million for the duration of this plan to fund special projects.

6.4 New Business

New Business investments include the installation of new gas mains and/or services to provide gas service to new customers or to existing customers with increased load. Most jobs are small, requiring a single service and in some cases, a short main extension. As discussed in section 5, recent trends have led to a large increase in the number of oil-to-gas service conversions in our territory. As a result, New Business has become a more significant part of the budget in recent years.

New Business also includes reinforcement investments, including system reinforcements, new district regulators, upgrades to supply mains, and pipe replacements with larger sizes required to accommodate growth and maintain adequate delivery pressures.

Beyond 2015, it is anticipated that we will continue to construct at least two new distribution regulator stations per year to accommodate demand across the distribution system. In addition to these regulator stations, we will need to construct associated pipes and services to serve new customers. We will also need to perform necessary infrastructure upgrades and reinforcements associated with new customer growth. This expected investment is required to support incremental growth in No. 2, 4 and 6 oil conversions, distributed generation, and natural gas vehicles in addition to traditional new business (new construction, and existing customers with increased load). Overall, we plan to spend $3.1 billion on new business work throughout the course of the plan.
6.5 Public Improvement

In a city as congested as New York, Con Edison’s gas infrastructure must share the space under the city’s streets with other utility facilities, such as telephone and cable TV owned by private companies, and also with sewer and water systems owned by municipalities. When a municipality decides to perform work under its streets, the work is often complicated by the presence of our facilities. Under these circumstances, the company has the legal obligation to remove or otherwise protect its facilities to accommodate the municipal activity.

When a city or a municipal entity plans to perform work within these streets and is prevented from completing the proposed plan due to other facilities being in the way, the term interference is used. Interference can be direct or indirect. Direct interference occurs when the existing facility needs to be moved to accommodate and provide space for the new facility, resulting in a capital expense. An indirect interference occurs when an existing gas main is placed in the angle of repose due to third party excavation. This is resolved through a short main replacement, resulting in either an O&M or capital expenditure depending upon the extent of the affected main length.

If the City of New York or a municipality performs work, such as installing new or upgrading water mains, sewers, catch basins, curbs, and sidewalks and so forth around a Con Edison gas main or service, then Con Edison must bear the cost to move or replace its facilities affected by the city’s or municipalities’ proposed construction activity. Often the facilities replaced have many years of useful life left. We have little control over the amount or timing of public improvement investments required. However, we do apply the same capital expenditure management to this part of the plan as for our infrastructure maintenance and new business work.

During the years 2011–2015, we spent approximately $70–84 million annually in public improvement projects. Gas infrastructure relocations have significantly increased in the past several years and are anticipated to continue at higher than historical levels.

As with all of our work, we endeavor to realize productivity and technology-related gains wherever we can. We work to coordinate main replacement with public improvement projects. This is especially critical in Manhattan where there is an extensive infrastructure impact due to many ongoing and planned New York City municipal projects. Historically, these have included the NYC Water Tunnel and Second Avenue Subway projects, along with numerous other public improvement ventures. These can be considered one-time opportunities to install the correct size facilities required to accommodate anticipated load growth. We also collaborate with the other entities involved to benefit from common project elements (for example, a common trench) to reduce costs and disruption. Throughout the course of the plan, we forecast expenditures of $1.5 billion for public improvement projects.

6.6 Research and Development

The Con Edison Research and Development (R&D) organization strives to be an agent of change that drives innovative technological solutions—addressing both short-term operations issues and long-term strategic objectives. They review technology developments in all industries, participate in utility industry groups, and perform benchmarking in an effort to leverage best practices and opportunities to improve operations.

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31 The maximum angle from horizontal at which a given material will rest on a given surface without sliding or rolling. For trenches, this is the natural collapse line of any excavation that is not supported.
R&D administers projects through internal staff and through two external gas industry research and development consortia (NYSEARCH\textsuperscript{32} & OTD\textsuperscript{33}). Between these two organizations, R&D is currently participating in over 62 projects that address various areas important to the company, such as plastic pipe leak repair, methane quantification, leak detection and pinpointing, third-party damage, trenchless technologies, repair technologies, facility locating, corrosion mitigation, gas interchangeability, pipeline integrity, and environmental, health, and safety.

The company has a well-established program that identifies, prioritizes, secures funding, and manages research, development and demonstration projects. Internal R&D is particularly important to the company because no other gas utility faces the same level of customer density and underground utility congestion. The company’s average customer density per city block is substantially higher than that of most other utilities, resulting in a higher average cost of maintaining a section of main. Utility congestion under the streets of our territory is also the highest of any gas utility in this country, making the cost and complexity of maintaining our systems higher than other gas utilities.

6.6.1 R&D Program Objective

The objective of the company’s R&D program is to match the needs of company operations with opportunities for new business solutions in the form of technologies, processes and methodologies to accomplish the following objectives:

- Reduce risk and enhance public and employee safety
- Increase operational performance and flexibility
- Enhance customer experience and engage our customer
- Create new cost efficiencies in our everyday work

The R&D group works with Gas Operations employees to identify areas where there is a need for new technologies, processes, and methodologies. R&D also conducts periodic brainstorming sessions and seminars to discuss problems with various gas departments, solicit ideas for new projects, and showcase new technologies. This results in a highly customer-driven process, where the customer is the Gas Operations organization.

6.6.2 R&D Sponsorship

Once a potential new business solution is identified, a user/sponsor is obtained within Gas Operations to assist in preparing a cost/benefit justification for the appropriate R&D project. The analysis of candidate projects considers potential advantages compared to the financial and human resources required for successful development, to arrive at the right amount of investment.

R&D projects are staffed and managed either internally, where the user/sponsor Gas Department provides support as the project progresses through its development phases through to field demonstration, or as a collaboration with outside organizations where another group shares in the staffing and management and helps fund the project.

\textsuperscript{32} NYSEARCH is a collaborative research, development and demonstration (RD&D) organization dedicated to serving its gas utility member companies. Members of NYSEARCH voluntarily participate in projects and programs to target RD&D areas that directly address their unique challenges and opportunities. The NYSEARCH Committee is a voluntary sub-organization within the Northeast Gas Association.

\textsuperscript{33} Operations Technology Development (OTD) is a not-for-profit established in May 2003 to facilitate collaborative research on issues relating to gas operations and infrastructure with a focus on reducing operating costs, enhancing safety, and increasing the operating efficiency of natural gas distribution systems. OTD’s membership has grown to 23 members, representing utilities throughout the United States and Canada.
6.6.3 Increased Adoption of New Technologies

The R&D group has completed or is in the process of completing a number of successful internal and collaborative R&D projects that are in various stages of adoption by the Gas Operations areas, such as the Residential Methane Detector test project discussed in section 3.3.2. Some of the most impressive recent successes have involved trenchless technologies that collectively allow the Company to repair or rehabilitate gas mains without the need to excavate and create an open trench. These technologies not only reduce the need to excavate, but they also reduce traffic congestion and combustion emissions from trenching equipment and utility vehicles; they improve safety for pedestrians and workers; and they reduce noise that would be associated with traditional excavation activities.

Illustrative examples of recent trenchless technology successes include:

- Development of a no-dig anode installation method to install a 17 lb. anode that prevents main corrosion on an existing steel main or service without the need for excavation. This method demonstrated cost savings due to the reduction in excavations, and resulted in corrosion prevention, which will reduce future leak repairs.

- Completion of the longevity testing of field-aged cured-in-place linings used to rehabilitate piping by lining steel or cast iron mains. CIPLs serve as an economical option for replacing steel or cast iron gas mains. The results of these tests demonstrated that the current lining product will provide over 100 years of service.

Other recent successful R&D projects include:

- In conjunction with R&D, Gas Operations successfully performed a live main insertion project in Queens. The process inserts a smaller high-pressure main into an existing low-pressure main, leaving existing customers on low-pressure until work to transfer those customers to high-pressure can proceed on a scheduled basis. This results in only one interruption of gas to the customer instead of the current process that interrupts the customer twice.

- R&D partnered with National Grid to develop and test a cast iron joint sealing robot (CISBOT) that seals leaking cast iron joints on 20-inch to 36-inch cast iron mains. The robot has been tested in Westchester and successfully sealed over 200 feet of cast iron main on Route 9A from one excavation.

Gas Operations has historically incorporated successful R&D projects into our work processes and project designs. For example, trenchless technologies like the CISBOT, and ConSplit\(^\text{TM}\) are routinely evaluated as alternatives to main replacement. We are committed to continually incorporating new technologies into our work.

\(^{34}\) ConSplit\(^\text{TM}\) is a pipeline splitting technique in which a tool is launched into an existing pipe at an entry pit and pulled through the pipeline to an exit pit. The old pipe is split open and expanded out into the soil, allowing a polyethylene pipe to be pulled into the enlarged hole immediately behind the ConSplit tool.
7. ENHANCING CUSTOMER EXPERIENCE

7.1 Overview

Over the past five years, low commodity costs, increasing supply, customer demand, environmental regulations and an expectation of reliability have prompted consumers to adopt gas for heating purposes in record numbers. Despite recent drops in the price of oil, Con Edison believes that interest in natural gas will continue to rise. We expect customers to continue to use gas, not only for residential/commercial heating and food preparation, but also for air conditioning, emergency backup, and distributed generation. While environmental regulations, low commodity prices and reliability are certainly components in the customer decision-making process, we cannot forget the end user’s impression of the company.

Enhancing the customer experience is mission critical for the Gas Organization and for Con Edison as a whole. Efforts are underway to engage customers using the platforms they are most comfortable with—including mobile applications and social media. We not only need to have a safe, reliable system and to make the appropriate investments in infrastructure improvements and expansion, but we also need to adapt our own plans to meet the changing expectations of our customer base.

7.2 Customer Perspectives

The gas we provide affects the lives of our customers every day—and their feedback is invaluable to us.

Customers interact with us across multiple platforms—through online applications for service, inquiries to our customer call centers, social media (such as Facebook and Twitter), emergency calls routed to the Fire Department or the Gas Emergency Response Center, and through stakeholder engagement meetings. Customers inquire about gas service installations, restorations after emergency shut-offs, billing inquiries and gas service availability.

In addition to direct contact from customers, we maintain an active dialog with community-based organizations, civic leaders, advocacy groups, concerned citizens and public officials throughout the year in various forums. Our Public Affairs staff interacts with homeowners, renters, small business owners, and community leaders on numerous occasions, including community and employer meetings, environmental fairs, and senior events. We conduct at least one annual conference for community-based and social service organizations, and we interact with countless numbers of elected officials and community boards. This type of interaction is expected to continue throughout the course of our long range plan.

To benchmark our performance and ensure that we are aware of relevant concerns, we participate in J.D. Power and Associates surveys of residential and business customers for gas and electric utilities. In addition, we conduct surveys on customer satisfaction, and monitor our information and education programs to identify their effectiveness as well. We actively use the feedback we receive from each of these areas about customer concerns, information requirements, and expectations. Con Edison also has an online community that we pulse regularly to provide us with feedback on various issues and topics. Participation in the online community is voluntary.

7.2.1 Customer Research Enhances Plan Development

Success in defining and executing this plan is dependent upon a strong partnership with our customers. Gathering feedback on key issues directly from our customer base has allowed us to build on our daily interactions with them, and to better understand customers’ energy needs and priorities. What we have learned has helped to refine the objectives of this plan and has confirmed our belief that customers value reliability, prefer that we are proactive with our investment programs rather than reactive, and understand that there are significant costs associated with maintaining a complex system that meets their expectations.
In addition to the customer surveys indicated above, our Gas Conversions group meets with the real estate community and has surveyed the members of the Real Estate Board of New York. Customers have indicated the following:

- Customers see gas as a long-term (permanent) option for heating purposes and will continue to convert at boiler end-of-life.
- Despite increased awareness of gas safety, customers have not abandoned conversion projects.
- Lack of coordination of infrastructure work/delays in restoration is a source of frustration for them.
- Customers want access to information.

7.3 Enhancing the Customer Relationship

One of our key strategic objectives is the continuous improvement of our relationship with our customers. In order to achieve this, we need systems and processes that are effective and that satisfy customer needs. For example, we plan to use new media, as appropriate, to expand our communication and customer service programs. We will also use new technology, including improvements to our internal systems, to make it easier for customers to do business with us and foster more interactive communication and collaboration that can eliminate the need for a customer to have to take the time to contact us.

Consistent with our environmental goals and the expectations and concerns of some customers, we will also search for effective ways to increase awareness of energy efficiency via energy management tools, incentives, and education.

7.3.1 Digital Customer Experience

The Digital Customer Experience (DCX) programs that we have planned will deliver an improved online experience for customers through a redesign of the customer interface, that will include the www.coned.com external website, the mobile website, the “My Account” portal and the mobile app. This will include purchase and implementation of new technology-supporting enhanced digital interactions, development of a new web and mobile customer experience, and the implementation of tools to support multi-channel communication preferences such as chat, text, and email.

The company seeks to provide this best-in-class user experience by providing customers with better and more coordinated information across multiple channels. This will be achieved through a transformation of current digital offerings, new technology, improved analytics, and a new digital operating model. The DCX program will also enable efforts such as REV\textsuperscript{35} and AMI\textsuperscript{36}, contributing to customer engagement opportunities.

In 2015, a project team was formed, and a planning phase was completed. In 2016, a Web Experience Management (WEM) platform will be installed, a secure and streamlined customer authentication process will be put into place, a redesign of public web pages will be released with simple and intuitive navigation and social media integration with customer feedback survey tools will become available.

\textsuperscript{35} REV (Reforming the Energy Vision) is New York State’s effort to dramatically change how energy is generated and consumed in the state. It is intended to spur the energy industry to evolve beyond the traditional electric grid structure.

\textsuperscript{36} AMI (Advanced Metering Infrastructure) With AMI, customers will have access to new energy management tools that provide them with detailed information about their energy use, and Con Edison will be able to automatically detect when customers lose power, leading to faster restoration times.
In 2017, a redesign of My Account will be released along with a new mobile site and mobile app experiences. New usage analysis tools will offer high-bill alerts, anticipated bill amounts, and suggestions for lowering bills. Live chat and communication preference management will provide customers with greater freedom to access the company in the manner they desire.

In 2018, energy efficiency and steam customers will see revamped portions of their sites, and mobile apps will be further enhanced. Continuous improvement and refreshed strategy will be ongoing throughout these periods and beyond.

### 7.4 Impact on the Customer Bill

All of the programs discussed in the previous section will help us to enhance the customer experience over the planning horizon. Much of this plan has illustrated our infrastructure investment projects and programs. These programs will minimize risk and provide the high reliability and safety our customers have come to expect. The infrastructure plan that supports these projects and programs leads to the following projections for the customer bill.

We strive to minimize customer bills and have outlined in this document several programs and initiatives designed to monitor our infrastructure costs as well as to work directly with customers to manage their energy usage. While we will continue to make every effort to keep our transmission and distribution rates down, it is important to convey that market and policy forces outside of our control will impact our customers’ bill. In particular, the composition, availability, and affordability of the gas supply may experience changes over the 20-year planning horizon.

The customer bill reflects Con Edison’s tariff charges for delivery, supply, taxes, and regulatory fees. See Figure 7-1. As the operator of delivery systems, we collect all components of the bill in a single customer payment and remit payments as required to appropriate parties. In June 2015, delivery charges represented approximately 41 percent of the heating customer’s residential gas bill; the remaining 59 percent are attributable to costs of supply and costs of taxes and fees imposed by various suppliers and government agencies.

As a proxy for our gas customers’ bill, we look at a typical New York City residential apartment building customer with constant monthly consumption of approximately 135 therms over the planning period.

![Figure 7-1: June 2015 Residential Customer Bill](image)
7.4.1 Delivery Charges

The delivery rate represents the cost of transporting energy from the point-of-supply to the Con Edison system, and ultimately to the customer. This rate covers costs to build and maintain our transmission and distribution assets, and also to maintain and operate customer billing and other operations that serve customers. As a regulated utility, we recover our costs of providing service through our rates. As we invest in our system, we recuperate the costs of those investments over time through accounting expenses, and earn a return on our capital.

The delivery rate represents Con Edison’s “cost of service”, including:

- Capital expenditures to provide service, upgrade the infrastructure, and to ensure safety and reliability
- Operating and maintenance expenditures to maintain the infrastructure and to respond to emergencies
- General and administrative expenses required to run Con Edison’s business

From 2010–2015, Con Edison’s delivery charges declined approximately 12 percent for residential heating customers.

7.4.2 Taxes and Fees

Customers typically pay a Supply Gross Receipts Tax (GRT), a Delivery GRT, and a Sales Tax on their bill. In June 2015, these taxes represented approximately 8 percent of the residential customer’s gas bill. Also included are taxes paid by Con Edison, such as income and property taxes, which represent 66 percent of the taxes and fees or 21 percent of the customer’s total as of the June 2015 residential heating bill. In total, taxes make up approximately 30 percent of the customer’s total gas bill.

The customer bill also includes fees collected for external entities. The System Benefits Charge and Renewable Portfolio Standard surcharge are mandated fees that finance energy efficiency and renewable portfolio programs operated by NYSERDA. The System Benefits Charge funds programs have been determined by the Public Service Commission to be inadequately addressed by New York’s competitive energy markets. In addition, there is an 18a Assessment, which is a fee imposed by the New York State Legislature for the support of the State’s General Fund. This fee will be phased out by March 2017. There are also supply taxes imposed on each customer, which are based on a sales tax rate applied against purchased supply and a general receipts tax applied against Con Edison total revenues. These fees comprise approximately 3 percent of the customer’s bill.

7.4.3 Supply Charges

Supply costs are also a major component of our customers’ bills. Although Con Edison does not own significant sources of supply, we procure energy for our full-service customers and those procurement costs are part of their bill.

As much as practical, our supply comes from the least-cost options available and is typically a composite of short- and long-term firm supply contracts, and spot market purchases made by the company. To mitigate increases on the supply portion of the bill we invest, or support investment, in transmission projects that would give us access to lower cost sources of supply. Supply charges include the actual cost of the commodity (i.e., the cost of the natural gas itself) and related charges for the cost of storage and delivering the gas to Con Edison for redelivery to customers. In June 2015, this represented 26 percent of the average residential heating bill.

As mentioned above, Con Edison procures gas for some residential and commercial customers from various gas suppliers. We then pass on the actual cost of the gas to the customer without any additional markup. The company charges a nominal fee, known as the Merchant Function Charge (MFC), as its
charge for competitive functions that have been unbundled from base rates, and may be avoided by any customer purchasing gas transportation service only\textsuperscript{37}. The MFC currently is comprised of:

- Supply-related charges, primarily procurement
- Credit and collections-related charges
- Gas-in-storage working capital
- Gas Cost Factor (GCF)-related uncollectibles

Figure 7-2 below depicts what might comprise the customer bill over the planning period.

Figure 7-2: Customer Bill Forecast\textsuperscript{38}

The Gas Long Range Plan projects a customer bill CAGR of 4.3 percent over the planning horizon or 1.8 percent above inflation. The bill projection includes the requested capital project and program investments in the current rate case.

Near-term gas customer bill growth is driven nearly equally by each portion of the bill. Supply costs are increasing as prices rebound from recent low levels. These low levels have been caused by a gas oversupply due to pipeline constraints that have prevented Marcellus shale production from leaving this region. Those pipeline constraints will be alleviated in 2016–2017 when new projects become operational, increasing pipeline capacity, and leading to more demand for Marcellus shale and higher prices.

Additionally, there is upward pressure on the taxes and fees and delivery portions of the bill. Delivery increases are a function of increased capital expenditures to manage system risk via accelerated main replacement while decreases in fees (e.g., phase-out of 18-a assessment) are offset by increases in income and property tax as our rate base grows.

\textsuperscript{37} Full-service customers acquire their gas from Con Edison. Transportation customers acquire their gas from third party marketers.

\textsuperscript{38} An average residential customer is estimated to consume 135 therms of gas monthly. The 2015 data is based off of a calculated bill, not historic.
7.4.4 Property Tax Implications

Beyond the cost projections set forth in this study, there are additional opportunities to lower the tax component of customer bills.

Con Edison has consistently advocated on behalf of customers that New York’s state and local governments need to reform utility taxation because of the regressive nature of utility taxes. Con Edison’s energy services in NYC and Westchester County are subject to a plethora of taxes, assessments that function like taxes and fees, which are in turn, built into utility bills. Property taxes are the principal source of the company’s tax payments, but the Con Edison tax burden stretches beyond just property taxes. Federal and state income taxes, state and local gross receipt taxes, sales and use taxes, surcharges on utility company purchases, and various other “assessments” all add to our customers’ bills.

Property taxes are used to finance local governments and public schools. The funds raised via the property tax levy are often the major revenue source for municipalities, and as a result, there is always pressure on governments to either raise property taxes or cut services.

Con Edison has been, and remains very concerned about the high property taxes in our service territory and their impact on customer bills. We have voiced and demonstrated our concern through the pursuit of litigation and legislative relief for decades. The company has periodic meetings with the NYC Department of Finance and NYC’s Legal Department to discuss property tax issues, both to try to settle past litigation and to discuss legislative initiatives. We are currently working with the staff of the Public Service Commission and other gas utility companies in New York State (NYS) to have replacement small-diameter cast iron and unprotected steel mains exempt from property taxes. Our proposal is to have the existing assessment on the retired pipe continue, and treat the new pipe replacement as a repair, and therefore not assessable for property tax purposes. Our strategy to control property taxes consists of legislative initiatives, litigation initiatives, and compliance initiatives.

Our principal legislative strategies are to:

- Champion a bill to make rate base the basis for utility property tax assessment.
- Support legislation to remove utility property from local assessments and instead centralize the assessment process by having NYS assess all of the property.
- Pursue the elimination of a law known as the “Pegging Law” that unfairly taxes certain of our utility property in Westchester County.

The litigation strategy related to gas is to challenge in the courts the property tax assessments by the Office of Real Property Services on the company’s gas special franchise property.

Our principal compliance initiative is to continue and expand our efforts in pursuit of:

- Economic obsolescence
- Functional obsolescence
- To identify property that could be moved from taxable to non-taxable status
8. CONTINUED FOCUS ON COST MANAGEMENT

Our plan is focused on assuring that our gas service remains reasonably priced for our customers. We continuously review our cost management processes to ensure we maintain this focus and provide our employees with the skills and tools necessary to effectively track and manage costs. During the course of this plan, we will continue to improve our cost management practices in the following four key areas (see Figure 8-1):

- jobs, skills and organization
- information technology
- culture and values
- management systems.

This will entail the integration of planning, management, and review processes to incorporate financial and field operations and align these priorities with cost management. This will involve efforts such as putting an organizational structure into place that balances consistency in all policies and practices, and the alignment of activities and priorities with our stakeholder partnerships.

Figure 8-1: Four Point Implementation Program for Cost Management Improvement

8.1 Jobs, Skills and Organization

8.1.1 Skill Evolution

Our workforce of 2036 will look very different from today’s workforce. In looking out over the next 20 years, our staff—at all levels—will need stronger analytical skills. This is because each of the plan themes outlined in this report will require significantly-enhanced analytical work. The integrated management of new demand and supply resources will require a new, more complex level of planning and dispatching.

Tailoring our gas system design will require the quantitative evaluation of several options to address customer demand, reliability and safety constraints. Improving our infrastructure and the increasing monitoring and control of the system will require the processing and analysis of large volumes of data—from load and pressure flow analysis to condition-based maintenance. Managing the customer
experience will be transformed by the availability of new information and data and the exponential increase in customer service requirements to explain and make the data easily understood and actionable by customers. Jobs throughout the organization will become more complex and we expect that new jobs will be created to meet the great demand for analytical skills.

We are currently developing capabilities to perform ongoing strategic workforce planning, which will help us proactively anticipate and manage our staffing into the immediate and longer-term future. This involves identifying key skill gaps three-to-five years out, and developing and updating an ongoing strategy to fill those gaps through hiring, internal development, or a combination of both. One approach we are exploring is in building strategic partnerships with local high schools, community colleges, and universities.

We expect to manage the longer-term implications of skill gaps by carefully monitoring the relationship among industry trends, Con Edison strategic direction, and internal capabilities. This will ensure we are well-positioned for the future, attracting talented people and providing them with the necessary training, development, benefits, job satisfaction, and career growth, thereby minimizing turnover. Going forward, this skill gap analysis will be a standard activity in our workforce planning initiatives.

8.1.2 Strategic Workforce Planning

As mentioned above, we are working on plans to ensure that we fill future workforce gaps. As Figure 8-2 shows, the projected headcount over the next five years indicates growth in the Gas Operations organization due to a steadily increasing workload. This Gas Operations workload increase is driven by a commitment to public safety through two major work categories:

- **Acceleration of main replacement work**: Gas Operations will be accelerating the rate of small-diameter cast iron and unprotected steel main replacements from 65 to 100 miles per year by 2021, as a proactive measure to reduce risk, enhance public safety and improve system reliability. This will permit the company to complete the replacement of all cast iron and bare steel 12-inch-and-smaller diameter mains in 20 years.

- **Doubling of the leak call volume**: Leak response and public safety is a top priority for Gas Operations. Gas Operations will continue with the monthly gas system surveys and customer outreach efforts we are currently undertaking, which to date, have led to a doubling of the number of leak calls and leak repair work compared to prior years.

![Figure 8-2: Con Edison Gas Operations Headcount Five-Year Resource Plan](image-url)
Increases in hiring have altered our workforce demographics drastically. As Figure 8-3 below indicates, 71 percent of our workforce has been employed at Con Edison for less than ten years, and 47 percent for less than five years. This demonstrates that a large number of new employees requiring comprehensive training are coming into the organization. Training objectives must address the steep learning curve required to enable new employees to quickly develop functional knowledge and be effective on the job. Field personnel, for example, participate in apprenticeship programs coupled with formal hands-on training to provide the necessary skill sets to qualify them for promotions and increasing responsibilities.

![Figure 8-3: Con Edison Gas Operations Headcount by Years of Service, as of October 2015](image)

Based on the demographics of our workforce, and the structure of our retirement plan, we expect that about 11 percent of our employees working today will retire between 2016 and 2020. We will use systematic knowledge management transfer practices to ensure that we do not lose critical organizational capabilities as this workforce retires. We will focus on the following strategies:

- Employ a cohort training structure to provide employees with a clear path for developing the skills and qualifications needed to perform required tasks.
- Hire a larger percentage of qualified external candidates into the company at the mid-level Mechanic B title. These mechanics start with more experience and skills than typical entry-level hires, which reduces the amount of time needed to perform fully operator-qualified duties.

In another effort to meet the increased operational needs of Gas Operations, the company is working with local schools, local labor unions, and other qualified organizations to create workforce development programs that can be used to train future utility workers. These programs will enhance our candidate pool and empower potential mechanics with skills that will assist them in accelerating through their career path at Con Edison. The company also pursues specialized recruitment opportunities, such as veteran recruitment, and recruitment of women into non-traditional roles.

### 8.1.3 Highest Commitment to Employee Training

Training is one of the most significant investments we can make. The Con Edison Learning Center is a corporate education facility where we train and test employees in the skills they need to safely and productively perform their work. The Learning Center includes classrooms and hands-on labs for real-life learning (See Figure 8-4). Instructors are a combination of former field, office, and line personnel. The courses available at The Learning Center fall into two general categories: Skills and Leadership.
8.1.3.1 Skills Training

Training employees in hands-on skills for new positions is a high priority at The Learning Center. However, the type of employee we are training today and our organizational needs differ from the past. We have shifted our focus from providing veteran employees with new skills for different jobs to providing new employees with enhanced skills for more complex jobs. All of our newly-hired employees require basic training and then skill-enhancement training as they move through their career paths. We also provide refresher training for existing employees. This increase in training demand has compelled us to look at new instructional methods such as e-learning, simulation training, and self-study courses.

Figure 8-4: Con Edison Employee Training at The Learning Center

8.1.3.2 Leadership Training

It has also become increasingly important to look toward recruiting the company's future leaders. We have therefore adapted our training curriculum to provide leadership and analytical skills as well as career advice to develop and prepare employees to manage the Con Edison of tomorrow. An additional priority of both The Learning Center and our Talent Management organization is to develop employees with a greater sense of business acumen. This involves classroom discussions with such topics as ethics, open communications, lessons learned from incidents and audits, and continuous improvement.

8.2 Information Technology

8.2.1 Work and Asset Management System

Starting in 2016, a project team will deploy an integrated Work and Asset Management solution for Gas Operations that will allow for standardization of work processes, better work scheduling and prioritization, and provide a single repository for all work and asset data related to Con Edison’s gas facilities.
This project will yield strategic benefits that support both corporate and Gas Operations' goals and objectives. Some examples are:

- an integrated view of financial and operational data resulting in more effective risk mitigation strategies
- increased transparency
- more effective trending and analysis
- improved operational efficiencies
- an enhanced customer experience through more accurate and timely information around work flow and job status

In addition, while the business has always operated within a stringent regulatory environment, the advent (and ongoing) implementation of stricter integrity management regulations has given rise to a new set of requirements that the existing operating model, supporting systems, and processes will be challenged to maintain.

The new system will enhance our ability to comply with increasingly stringent regulations around pipeline safety and recordkeeping. It will also improve Gas Operation’s ability to meet new regulations for material/component traceability. Furthermore, it will allow for tighter management of public safety concerns on asset inspection and surveillance programs. Finally, it will permit the prioritization of work through condition-based analysis that balances safety, resources and cost effectiveness.

8.3 Safety Culture

It is important for each employee or contractor to focus on the safety of each task before, during, and after completion. All work requirements and tasks will be mapped to worker’s knowledge, skills, and abilities. Job safety is promoted in all company training materials and instruction.

We have a number of programs and initiatives in place to achieve an injury-free workplace. The main performance metric in the area of employee safety is the OSHA incidence rate.39 The incidence rate is a normalizing indicator that captures the number of recordable injuries/illnesses per standard unit of 100 full-time equivalent employees (each working 2,000 hours per year). It is dependent upon the number of recordable injuries/illnesses experienced and the number of productive hours worked, which includes all straight time, compensable overtime, training hours, and restricted-duty hours for both weekly and management employees.

Con Edison's current safety performance, as measured by the incidence rate, is at the midpoint of its industry peers. We finished 2015 on-target, with a company-wide incidence rate of 1.40 (or approximately one injury and illness per 100 workers). The company-wide OSHA rate goal for 2016 is also 1.40. We still believe there is a significant opportunity for improvement however, and have therefore established the reduction of this company-wide rate as a key objective for all operating groups.

Our Environment, Health and Safety group is working closely with all operating groups to make sure that we achieve our safety goals, including providing appropriate tools and resources to ensure compliance with safety rules, performing comprehensive job planning and briefings, documenting site safety observations— and more broadly—to promoting a culture of personal accountability. As we continuously improve our culture to embrace learning from our experiences and achieving personal and organizational bests, we will seek to maintain or improve that performance over the planning horizon.

39 The formula for calculating the incidence rate is: Number of Recordable Incidences x 100 x 2000 / Total Number of Productive Hours Worked.
8.3.1 Promoting a Culture of Compliance

Con Edison operates in a regulatory environment governed by federal and state rules. As such, our organization is designed to focus on compliance at every level of the organization. In order to ingrain this culture, we promote a self-correcting environment, where all employees are encouraged to have a questioning attitude, be open to internal findings, and embrace feedback. We also ensure that specifications and regulations are made readily-available to all field and office employees. This permits our organization’s employees to have all of the information that they need to perform their jobs in our regulatory environment, and to align with our Enterprise Risk Management process, which has enhanced communication and transparency as one of its goals.

As our GLRP plays out, the newly-established Gas Compliance and Quality Assessment Organization, described in section 3.5 will be at the forefront of our efforts to maintain a compliance culture.

8.4 Management Systems

The roles and responsibilities of all employees will be more clearly defined across our organization with an emphasis on creating a deliverable- and action-oriented culture. As the dynamics of our workload changes, we will implement new management systems as needed to maintain clear accountabilities for estimating accuracy, tracking of results, analyzing variances, and implementing corrective actions.

8.4.1 Centralize Construction Management

In 2015, the company created a centralized Construction Management Gas department, under the Central Operations construction organization, responsible for overseeing planned gas capital construction work completed by contractors.

Before this reorganization, both the Gas Operations organization and the Central Operations Construction Management department provided gas contractor supervision in their respective territories. Faced with the challenge of dramatically-increasing levels of capital gas work over the past five years, the company came to recognize that efficiencies could be gained through the creation of a gas-specific construction management organization. Centralization will enable the company to meet the growing gas workload as well as to standardize processes across the service territories. As the infrastructure investments plan explains, the increase in the level of capital work, driven primarily by the main replacement program, is expected to be sustained over the course of the 20-year plan. The centralized Gas Construction Management group will be crucial in streamlining the implementation of the new geographic approach to our main replacement program. This group will also support other gas capital programs, including commercial and residential service work, distribution supply main projects, and the isolation valve installation program.

8.4.2 Standardize Project Management

The company has made several significant changes to centralize and improve the management of major capital programs and projects within Gas Operations. This initiative will result in projects and programs being managed in a more effective and efficient manner.

In 2015, Gas Operations reorganized the department’s project management (PM) efforts into a more centralized PM model. This includes the assignment of PM duties to a dedicated project management group rather than to engineers and operations staff. This model provides management support for large capital projects. Its fundamental function is to provide improved cost and schedule management through industry-leading PM principles and techniques. We are also in the process of revising our project management processes and procedures, which includes the implementation of a new Enterprise Project Management System.

Before these improvements were implemented, project management largely fell to engineers and operations staff. As the number of major capital projects and programs has increased, the ability of engineers and operations staff to productively and efficiently perform their core responsibilities, while simultaneously managing several major projects, became more challenging.
A strong PM structure will improve overall coordination and execution of projects. This reorganization will help foster a results-driven environment that promotes striving for operational excellence, delivering a quality service/product, and ensuring that project and program activity scope are in compliance with regulatory requirements.
9. PLAN SUMMARY

9.1 Introduction

This Gas Long Range Plan describes some of the many challenges and opportunities that face Con Edison Gas Operations over the next 20 years, provides a roadmap of what we intend to do, and shares our strategy for accomplishing our goals and objectives. In this final section, we summarize what has been discussed and provide some signposts that we will heed to meet our objectives.

A signpost on the highway informs drivers of what lies ahead, whether it be a sharp curve, dangerous intersection or simply what city they are entering. Likewise, based on the information outlined in this plan and a careful analysis of the learnings from what has transpired in the past, this section discusses some of the realities that are foreseen for the future of the gas business at Con Edison and outlines some initiatives toward possible courses of action.

9.2 Vision and Objectives

Section 2 introduced us to the Con Edison Gas Operations vision and mission statements and five themes that will govern the plan. See Figure 2-1. The themes are:

- Managing System Risk
- Balancing Demand, Supply, and Environmental Profile
- Improving Infrastructure Planning and Design
- Enhancing the Customer Experience
- Focusing on Cost Management

The plan themes carry out our mission and individually describe areas of Con Edison strategy by which individual programs and investments are developed.

Background information on the Con Edison gas distribution and transmission systems was also provided in this section. One can see just how incredibly complex this system is and why it is necessary to have a detailed plan in place to help guide our decision-making process.

Risk reduction, performance, and cost control are key objectives of the plan and were introduced in this section. These are often competing priorities and the challenge is to balance them so that all can be accomplished successfully to some measure. Subsequent sections of this plan took a more in-depth look at those areas.

A signpost we need to follow is that we need to adapt our planning, design, and operational practices to meet internal challenges. As in the past, we will continue to build and maintain the necessary gas delivery infrastructure. To achieve excellence in this pursuit, we will utilize innovative approaches as compared to what were standard practices in the past. We will employ improved planning processes that leverage quantitative measures to optimize our project and program investment portfolio, and continuously prioritize and incorporate feedback into that process. We will continue to reevaluate our traditional design standards to find lesser-cost solutions to meeting our customers’ growing and changing needs, and furthermore, our designs will need to provide greater flexibility than ever before.

9.3 Risk Management

Managing risk is a major objective of the Gas Long Range Plan and the initiatives we are undertaking were discussed in-depth in section 3. Specifically, we discussed our plan to manage the risk of a gas
distribution event through enhanced quality control/assurance, prevention, detection, and response mitigation strategies.

The company has several programs in place, such as the main replacement program, that reduce risk by replacing aging infrastructure on a prioritized basis using a prioritization model and the results of our Distribution Integrity Management Program. This section also detailed how by strategically approaching the task, the replacement of these mains gives the company the opportunity to upsize capacity for future growth at a minimal cost increase.

Also discussed in the section was the Gas Compliance and Quality Assessment Organization, which plays a key role in the company’s risk management efforts. The organization will create a Regulatory Strategy and Compliance unit in 2016 that will focus on new or changed regulations and mandates that may be issued.

9.4 Natural Gas Supply Outlook

Section 4 provided an outlook of the gas supply over the 20-year planning period, and Con Edison’s strategic priorities for ensuring that an adequate supply reaches our service territory. It discussed the three aspects of gas supply, which are:

- The availability of natural gas resources (domestic and global)
- The wholesale competiveness of natural gas compared to other fuels
- The deliverability of natural gas to the New York City area

This plan assumes growing demand for natural gas based on a gas supply outlook with abundant natural gas resources—including shale—a relatively low natural gas price, and the relative affordability of natural gas compared to alternate energy sources. The section also details the steps that Con Edison has taken to assure adequate sourcing to meet demand through diversity of supply and additional capacity.

Key supply signposts would include considerations that might restrict gas supplies, drive prices significantly higher than the predicted range, or conditions that might alter the price/availability of competing fuels. Shale deposits are abundant, but the industry’s ability to tap that supply is dependent on the outcomes in city, state, and federal legislation/regulations regarding hydraulic fracturing. Rules that would adversely impact well development economics or restrict large areas of gas fields from exploration will reduce resource availability. Con Edison will closely monitor any rule changes associated with hydraulic fracturing of shale.

9.5 Natural Gas Demand and Customer Growth Factors

In section 5, we discussed the natural gas demand and environmental aspects of the plan. It provided background on the unprecedented amount of oil-to-gas conversions that have been taking place, how distributed generation is likely to play a larger role, and the impacts that economic growth, environmental regulation and technology development will have on our gas usage forecasts.

Also covered was Con Edison’s energy efficiency plan, which will offer, and continually refine, a suite of programs that drive efficient end-use behavior and technologies that permanently reduce per-unit energy use.

Finally, the section discussed our environmental performance and the progress the company has made toward reducing overall gas emissions and how we are employing exciting new technology and are collaborating with the Environmental Defense Fund and other parties to quickly respond to those threats that have the greatest impact on the environment.

There are many uncertainties surrounding demand and customer growth but Con Edison is cognizant of several signposts that it will need to monitor closely in order to ensure that demand can be met:
• The state of the economy with regard to any unusual spikes in the costs of our labor or commodity inputs
• Any abrupt change in oil-to-gas adaptation patterns
• Change in our customer mix (i.e., firm versus interruptible business)
• Cost of competing fuels
• The increased efficiency of natural gas end-use technologies or advancement in substitute technologies
• Wide adaptation of technological innovations, such as distributed generation and alternative energy sources
• Unexpected non-response by customers to initiatives making planned results not achievable at the expected cost levels projected

9.6 Capital Investments

Section 6 was dedicated to a discussion of the gas infrastructure plan—how the plan is developed, monitored and maintained. The programs and initiatives Con Edison undertakes to manage our system and to take on new customers were outlined. It also provided details on the company’s capital plan estimates during the current planning period, some of the projects being funded, and the steps that are being undertaken to optimize our capital investments. This section also contained information about Con Edison’s Research and Development department and many of the R&D efforts that are underway.

Our signpost for this section is that we need to continue to invest in infrastructure. As uses of, and needs for natural gas change over the next 20 years, so too will the need to make the necessary gas infrastructure investments in order to maintain our commitment to assure the safety and reliability of our gas system while balancing affordability for our customers.

9.7 Enhancing the Customer Experience

Con Edison recognizes the importance of our customers in every aspect of our operations and section 7 detailed what the company is doing to improve upon how we interact with our customer base. The section described how enhancing the customer experience is mission critical for the Gas Organization and for Con Edison as a whole and the efforts that are underway to engage customers using the platforms they are most comfortable with—including mobile applications and social media.

The customer bill was broken down into sections and the various charges were explained in detail. The section also contained information on Con Edison’s advocacy efforts to reduce the tax burden and the effect that taxes have on the customer bill.

As our customer’s needs and usage patterns change over the next 20 years, so too will the ways in which we interact with them. Adoption of digital media through smart phones, tablets and social networks offers additional opportunities for Con Edison to interact with customers. Continuous customer feedback helps us understand emerging issues within our stakeholder groups, as well as identify gaps that may exist between stakeholder expectations and company actions.

Our signposts for this section are that customers want communication channels to be open and easy to use and that we need to be aware of social trends and use the methods that our customers use to communicate. Continual dialog with our customers, whether via outreach or customer research, will ensure that we remain aware of our customers’ priorities. In addition, we will need to provide our customers with tools to better manage their gas usage. To carry out these objectives, we will take advantage of innovative technologies and provide our employees with the necessary skill sets.
9.8 Cost Management and Containment

The Gas Long Range Plan wrapped up with a discussion of the company’s Cost Management Process in section 8. We saw that the four components of the process are:

- jobs, skills & organization
- information technology
- culture & values
- management systems

These four areas play crucial roles in Con Edison’s operations and make up the foundation upon which the company conducts its business.

A signpost for Con Edison is to reduce our overall cost structure. To accomplish this, we need to continually reevaluate and enhance our operational and cost management practices. In short, we will plan for change, implement design and operational practices that support those changes, and meet the ever-shifting needs of our customers, while providing safe, reliable service in a cost-effective manner.

Another signpost is to continue improving our internal processes and educating our employees to ensure our people have the skills needed to perform the Con Edison jobs of the future. Our work is becoming more analytical, and our challenge will be to train our employees to meet new skill demands. Through strategic workforce planning, we will monitor and identify potential skill gaps and address them through resources such as training (e.g., The Learning Center), systematic knowledge management, career management, and targeted hiring.

9.9 Conclusion

This Gas Long Range Plan provides us with a roadmap for our gas system for the next 20 years. This plan guides us toward a responsible energy future for our customers, using a safe, reliable energy resource that is both environmentally responsible and affordably-priced. Building that future will require that we meet the challenges described in this plan by maintaining the gas infrastructure necessary for the transmission and distribution of gas, and expanding it in an efficient way to meet new demand.

This comprehensive plan is a holistic way to effectively integrate our gas system infrastructure plans with the non-infrastructure-related elements of our business, such as demand, supply, and environmental drivers. The plan considers ongoing improved management of existing infrastructure and a tailored approach to design, that includes alternatives and innovative technologies. The plan also provides a framework that links short-term projects and long-term actions to our goals and objectives.

To develop the forecasts for gas demand and a supply outlook, we made assumptions regarding potential environmental and regulatory requirements, economic trends, and included possible technological advances to develop forecasts for prospective customer need. Our plan was developed under considerable uncertainty (i.e., technological, regulatory, and economic) and, as a result, we identified signposts that we will monitor and use to adapt our plan as changes occur. This long range plan is intended to be a living document, with assumptions that will be refined in future versions.

This plan is consistent with the company’s mission to provide safe, reliable energy to our customers, demonstrate respect for the environment, and create an atmosphere that encourages safety and development of our employees. We will accomplish this mission by maintaining a safe gas system, managing demand and supply, and protecting our environment. We will integrate our system design to meet the needs of customers in specific areas and improve our infrastructure through increased use and optimal replacement and maintenance of our assets. We will extend the life of our system if feasible, and optimize capital investments. We will provide our customers with cost-effective, safe, and reliable service, and train our workforce to be positioned to serve today and in the future. It is in these ways that we expect to successfully carry out our objectives and implement our long-range gas plan.
Appendix A - Glossary

The following terms are found throughout this document. For clarification, explanations are provided for your reference.

<table>
<thead>
<tr>
<th>Term</th>
<th>Explanation</th>
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<tbody>
<tr>
<td>49 CFR Part 192</td>
<td>Federal code that prescribes minimum safety requirements for pipeline facilities and the transportation of gas.</td>
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<tr>
<td>assets</td>
<td>Items of value owned by or owed to a business. Utility assets include: Utility Plant, Other Property and Investments, Current and Accrued Assets, and Deferred Debits.</td>
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<tr>
<td>capital optimization</td>
<td>A process that allows the company to attain objectives by evaluating projects system wide, and make reductions across operating units through standardized analytical methods and guidelines.</td>
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<tr>
<td>cast iron pipe</td>
<td>Pipe made by pouring molten iron into molds. This pipe has had historic use as a pressure pipe for water, gas and sewerage. It has relatively good corrosion characteristics but is less ductile than the piping used today.</td>
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<tr>
<td>city gate</td>
<td>Point at which a distribution gas company receives gas from a pipeline company.</td>
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<tr>
<td>coated steel</td>
<td>Steel pipe that has been covered with a corrosion-resistant coating or compound (such as asphalt or tar) to prevent corrosion from soil conditions.</td>
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<tr>
<td>Code MuRRE (Multiple Resource Response Event)</td>
<td>An alert to field personnel for situations that require an escalated response to a reported gas leak or event.</td>
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<td>Combined Heat and Power (CHP)</td>
<td>Also known as cogeneration. A system that involves the recovery of waste heat from power generation to form useful energy like useable steam. Combined heat and power is also the production of electricity and thermal energy in a single integrated structure.</td>
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<tr>
<td>common trench</td>
<td>A trench containing two or more utilities.</td>
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<td>Compressed natural gas (CNG)</td>
<td>Natural gas in high-pressure surface containers that is highly compressed (though not to the point of liquefaction). CNG is used extensively as a transportation fuel for automobiles, trucks and buses in some parts of Italy, New Zealand, and in Western Canada, and has recently begun to penetrate some regions of the United States. Small amounts of natural gas are also transported overland in high-pressure containers.</td>
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<tr>
<td>ConSplit</td>
<td>A trenchless technology used to replace and up-size steel pipes with plastic pipe.</td>
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<tr>
<td>corrosion</td>
<td>Destruction of a metal by chemical or electrochemical reaction with its environment.</td>
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<tr>
<td>coupling</td>
<td>A sleeve-type fitting used to connect two pipes of similar or different materials, providing insulation or continuity.</td>
</tr>
<tr>
<td>cubic feet (CF)</td>
<td>The most common unit of measurement of gas volume. It is the amount of gas required to fill a volume of one cubic foot under stated conditions of temperature, pressure, and water vapor.</td>
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<tr>
<td>cured-in-place lining (CIPL)</td>
<td>A “trenchless” pipe rehabilitation method that can seal existing pipe leaks and prevent future leakage due to corrosion, joint failure, or third-party damage.</td>
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<tr>
<td>dekatherm (Dth)</td>
<td>Measurement unit for heat: 10 therms, 1,000,000 BTU. The typical measurement of the “burn ability” or heating value of natural gas and the unit at which most natural gas is purchased.</td>
</tr>
<tr>
<td>delivery rate</td>
<td>Portion of the customer bill which is set to recover the Company’s revenue requirement, which represents annual delivery revenues required to cover operating expenses and earn a return on the Company’s net investment to provide service.</td>
</tr>
<tr>
<td>demand side management (DSM)</td>
<td>The term for all activities or programs undertaken by a Load-Serving Entity or its customers to influence the amount or timing of energy they use.</td>
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<tr>
<td>distributed generation (DG)</td>
<td>Electricity generating apparatus sited with a customer as opposed to a centralized station. DG is designed to serve some or all of the electricity needs of a customer by leveraging fuel sources ranging from natural gas, to waste water, to renewable fuels such as solar and wind.</td>
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<tr>
<td>Distribution Integrity Management Program (DIMP)</td>
<td>A federally-mandated program that sets standards for integrity management programs for distribution pipeline operators.</td>
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<tr>
<td>distribution system</td>
<td>Gas distribution mains and services</td>
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<tr>
<td>emergency response</td>
<td>A response to a gas leak or other unplanned event that is capable of disrupting operations, threatens life, and/or creates major damage.</td>
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<tr>
<td>energy efficiency (EE)</td>
<td>Actions or technologies that provide reductions in energy consumption at the customer level, while maintaining equal or greater quality of service.</td>
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<td>Energy Efficiency Portfolio Standard (EEPS)</td>
<td>In May 2007, the EEPS proceeding was initiated by the New York State Public Service Commission (PSC) as part of the overall effort to reduce New York’s electricity use by 15 percent from forecasted 2015 levels. Subsequently, the PSC established and approved efficiency targets for the State’s investor-owned electric utilities and NYSERDA.</td>
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<tr>
<td>Energy Service Companies (ESCOs)</td>
<td>Energy suppliers that sell electricity and/or natural gas to business and residential customers.</td>
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<td>Enterprise Risk Management (ERM)</td>
<td>A process, by which the company identifies, monitors and mitigates risks. Our risk management program has three primary objectives: 1) systematic risk mitigation; 2) proper allocation of resources; and 3) enhanced communication and transparency.</td>
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<tr>
<td>firm customer</td>
<td>Service offered to customers (regardless of Class of Service) under schedules or contracts that anticipate no interruptions.</td>
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<tr>
<td>gate station</td>
<td>A location where gas changes ownership, from one party to another, neither of which is the ultimate consumer.</td>
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<tr>
<td>greenhouse gas (GHG)</td>
<td>Gases in the atmosphere that absorb and emit radiation within the thermal infrared range. The main greenhouse gases in the Earth’s atmosphere are water vapor, carbon dioxide, methane, nitrous oxide and ozone.</td>
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<tr>
<td>hedging</td>
<td>Any method of minimizing the risk of price changes. Since the movement of cash prices is usually in the same direction and about in the same degree as the movement of the present prices of futures contracts, any loss (or gain) resulting from carrying the actual merchandise is approximately offset by a corresponding gain (or loss) when the contract is liquidated.</td>
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<tr>
<td>Henry Hub</td>
<td>A pipeline interchange, located in Vermilion Parish, Louisiana, which serves as the delivery point of natural gas futures contracts.</td>
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<tr>
<td>hydraulic fracturing</td>
<td>Also known as <em>hydrofracking</em> or simply <em>fracking</em>. A process used to extract natural gas from previously impermeable shale. The process utilizes millions of gallons of water, sand, and chemicals injected at high-pressure into horizontally drilled wells, some as far as 10,000 feet below the surface. The pressure causes the shale to 'crack'. These cracks or fissures are held open by the sand particles and chemical properties, which then allow the natural gas to escape from the shale to the well.</td>
</tr>
<tr>
<td>incoming leaks</td>
<td>Gas leaks reported to or by the company.</td>
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<tr>
<td>infrastructure</td>
<td>The network of transmission and distribution piping systems. Generally, large distribution gas mains are laid in principal streets with smaller laterals extending along side streets and connected at their ends to form a grid.</td>
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<tr>
<td>interference</td>
<td>Occurs when an existing facility must be located, identified, removed and reinstalled at a new location in order to accommodate and/or provide space for a new city, or other municipal facility.</td>
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<tr>
<td>interruptible customer</td>
<td>Low-priority service offered to customers under schedules or contracts that anticipate and permit interruption on short notice, generally in peak-load seasons, by reason of the claim of firm service customers and higher priority users. Gas is available at any time of the year if the supply is sufficient and the supply system is adequate.</td>
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<tr>
<td>interstate</td>
<td>With respect to natural gas companies, the transporting and sale of gas for resale across state lines.</td>
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<tr>
<td>leak</td>
<td>An unintended hole, crack, break, or the like, through which gas escapes a pipe or fitting.</td>
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<tr>
<td>liquefied natural gas (LNG)</td>
<td>Natural gas that has been liquefied by reducing its temperature to minus 260 degrees Fahrenheit at atmospheric pressure. It remains a liquid at minus 116 degrees Fahrenheit and 673 psig. In volume, it occupies 1/600 of that of the vapor at standard conditions.</td>
</tr>
<tr>
<td>main replacement prioritization model</td>
<td>Software used by the company to prioritize cast iron and unprotected steel main segments by calculating a relative condition and risk score for each pipe segment, using factors such as main condition parameters, previous failure history, the physical area surrounding the main, and certain risk factors.</td>
</tr>
<tr>
<td>main replacement program</td>
<td>The replacement program that uses the main replacement prioritization computer model to prioritize mains requiring replacement based on factors such as leak history, soil condition, age and material of pipe.</td>
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<tr>
<td>maximum allowable operating pressure (MAOP)</td>
<td>The maximum pressure at which a pipeline or segment of a pipeline may be operated.</td>
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<tr>
<td>megawatt (MW)</td>
<td>Unit of power equal to one million watts.</td>
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<tr>
<td>meter</td>
<td>An instrument for measuring and indicating or recording the volume of gas that has passed through it.</td>
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<tr>
<td>methane (CH4)</td>
<td>The chief constituent of natural gas. Pure methane has a heating value of 1012 Btu per cubic foot.</td>
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<tr>
<td>natural gas</td>
<td>A naturally-occurring mixture of hydrocarbon and non-hydrocarbon gases found in porous geologic formations beneath the earth's surface, often in association with petroleum. The principal constituent is methane.</td>
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<tr>
<td>natural gas vehicle (NGV)</td>
<td>A vehicle that is equipped to operate using natural gas as fuel.</td>
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<tr>
<td>NYSERDA</td>
<td>New York State Energy Research and Development Authority is a public benefit corporation created in 1975. Currently, NYSERDA is primarily funded by New York State rate payers through the System Benefits Charge (SBC). These funds are allocated towards energy efficiency, programs, research and development initiatives, low-income energy programs, and other activities. In addition, NYSERDA is involved in energy efficiency through the energy efficiency portfolio standard proceedings, and through a Request for Proposals process, is the central procurement administrator for renewable energy sources in New York State.</td>
</tr>
<tr>
<td>OSHA incidence rate</td>
<td>The main performance metric in the area of employee safety. The incidence rate is a normalizing indicator that captures the number of recordable injuries/illnesses per standard unit of 100 full-time equivalent employees (each working 2,000 hours per year). It is dependent upon the number of recordable injuries/illnesses experienced and the number of productive hours worked, which includes all straight time, compensable overtime, training hours, and restricted duty hours for both weekly and management employees. The formula for calculating the incidence rate is: Number of Recordable Incidences x 100 x 2000 / Total Number of Productive Hours Worked.</td>
</tr>
<tr>
<td>Part 255</td>
<td>New York State code which prescribes minimum safety requirements for the design, fabrication, installation, inspection, testing and operation and maintenance of gas transmission and distribution systems, including gas gathering lines, gas pipelines, gas compressor stations, gas metering and regulating stations, gas mains, service lines, gas storage equipment of the closed pipe type fabricated or forged from pipe or fabricated from pipe and fittings, and gas storage lines not covered by 49 CFR 192.</td>
</tr>
<tr>
<td>peak hour</td>
<td>The one hour of maximum system deliveries of gas during a year. Peak hour data is used to, among other things; as the basis for load requirement during system design.</td>
</tr>
<tr>
<td>peak demand</td>
<td>The highest rate at which gas is delivered to or by a system, expressed in cubic feet or therms or multiples thereof, for a designated period of time.</td>
</tr>
<tr>
<td>photovoltaic (PV) system</td>
<td>A system that employs solar panels composed of a number of solar cells to supply usable solar power.</td>
</tr>
<tr>
<td>pipeline capacity</td>
<td>The maximum quantity of gas that can be moved through a pipeline system at any given time based on existing service conditions such as available horsepower, pipeline diameter(s), maintenance schedules, regional demand for natural gas, etc.</td>
</tr>
<tr>
<td>Pressure Control</td>
<td>Organization within Con Edison which is responsible for the maintenance and operation of the Company’s gas pressure reduction equipment.</td>
</tr>
<tr>
<td>propane</td>
<td>A gas, the molecule of which is composed of three carbon and eight hydrogen atoms. Propane is present in most natural gas and is the first product refined from crude petroleum. It has many industrial uses and may be used for heating and lighting. Contains approximately 2,500 Btu per cubic foot.</td>
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<tr>
<td>pslg</td>
<td>Pound-force per square inch gauge, a unit of pressure relative to atmospheric pressure at sea level.</td>
</tr>
<tr>
<td>Public Service Commission (PSC)</td>
<td>Public Service Commission. The New York Public Service Commission is the New York state government agency that regulates and oversees the electric, gas, water, and telecommunication industries in New York as part of the Department of Public Service.</td>
</tr>
<tr>
<td>regulator station</td>
<td>A device that maintains a gas pressure in the downstream piping less than its inlet pressure, regardless of the rate of flow in the line or the change in upstream pressure.</td>
</tr>
<tr>
<td>Risk Priority Number (RPN)</td>
<td>Quantifies the relative priority of risks across the company. For each identified enterprise risk an assessment is performed of the severity, likelihood and controllability through assigning a value from 2 - 10 for each component. These component factors are then multiplied to produce a risk priority number.</td>
</tr>
<tr>
<td>service line</td>
<td>A distribution line that transports gas from a common source of supply to a customer. A service line ends at the outlet of the customer meter or at the connection to a customer's piping, whichever is further downstream, or at the connection to customer piping if there is no meter.</td>
</tr>
<tr>
<td>shale gas</td>
<td>An emerging type of unconventional natural gas deposit. The gas is distributed throughout the low permeability shale formations rather than accumulating in a more permeable reservoir.</td>
</tr>
<tr>
<td>signpost</td>
<td>An indicator that provides a clue of some obstacle or feature that lies ahead. In this plan, those indicators are derived from learnings of what has occurred in the past combined with reasonable forecasts of events foreseen for the future of the gas business.</td>
</tr>
<tr>
<td>SMYS</td>
<td>Specified minimum yield strength.</td>
</tr>
<tr>
<td>storage</td>
<td>Storage facilities or a portion of storage facilities that are leased to others for the purposes of storing gas.</td>
</tr>
<tr>
<td>tariff</td>
<td>A gas company schedule detailing the terms, conditions and rate information applicable to various types of natural gas service. This document is filed with and approved by the Federal Energy Regulatory Commission (FERC) or a state regulatory body.</td>
</tr>
<tr>
<td>therm</td>
<td>A unit of heating value equivalent to 100,000 British thermal units (Btu).</td>
</tr>
<tr>
<td>transmission pipeline</td>
<td>A gas pipeline that operates at a hoop stress of 20 percent or more of SMYS (Federal definition). In the Con Edison gas system, all pipelines which operate at pressures over 125 pslg are treated as transmission pipelines, regardless of SMYS.</td>
</tr>
<tr>
<td>trenchless technologies</td>
<td>No-dig techniques used for underground pipeline and utility construction for replacement, rehabilitation, renovation, repair, inspection, leak detection, etc., with minimum excavation from the ground surface.</td>
</tr>
<tr>
<td>unprotected steel</td>
<td>Pipe that has not been cathodically protected to prevent corrosion from soil conditions.</td>
</tr>
<tr>
<td>valve</td>
<td>A mechanical device for controlling the flow of fluids and gases; types such as gate, ball, globe, needle, and plug valves are used.</td>
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<td>Explanation</td>
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<tr>
<td>volatility</td>
<td>A term indicating how much and how quickly the value of an investment, market, or market sector changes.</td>
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</tbody>
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