Note

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I. Executive Summary

Con Edison provides comfort and convenience to the people of New York City and Westchester County through our gas delivery system. We manage a large, complex, underground gas transmission and distribution system designed to rigorous reliability and safety standards to serve residential, commercial and in-city generation customers. Con Edison’s gas service territory includes Manhattan, the Bronx, sections of Queens, and most of Westchester County. It serves approximately 1.1 million firm customers and 650 large-volume interruptible customers.

Mission

The Company’s mission is to provide safe, reliable energy services at a cost our customers can afford and in a way that minimizes environmental impacts. We strive to provide a workplace that allows employees to realize their full potential, to improve the quality of life in the communities we serve, and to yield a fair return to our investors. To achieve our mission, we maintain a robust delivery system with the latest technologies, offer products and services that allow customers to manage their usage and costs, and work with other stakeholders to achieve clean energy goals. Our strategy for continuing to meet these goals is detailed in this Gas Long-Range Plan (GLRP), a strategic framework and roadmap that will guide our investments and programs for the next 20 years.

This GLRP assumes the natural gas landscape may look significantly different by 2038. We expect major changes in three areas: technological advances, government policy and customer expectations. Recognizing these changes, we structure our long-term planning with three strategic priorities: public and employee safety, operational excellence and customer experience. The Company works to maintain safety through a strategy of prevention, detection, and response. That strategy is integrated into our planning and operations processes—notably our Main Replacement program and our AML-enabled natural gas detectors. We continue to embed a culture of safety by focusing on inclusion and excellence in human performance via personal accountability, open communications and training.

To maintain safe, reliable delivery of natural gas, Con Edison develops plans for the optimal future state of the gas distribution and transmission system. We take into account projected demand, the potential impact of coastal flooding, and both physical and cyber security threats. Pipeline Safety Management is a systematic approach to managing risk and measuring safety performance by adopting standards that foster continuous improvement. We seek to reduce the risk of events that can result in property damage or impact public safety. To achieve operational excellence, we draw upon the talents, experience and dedication of our employees and apply new technologies to improve our internal processes. We seek to enhance our customers’ experience by placing customer interests at the forefront of every decision we make. Our customers want affordable clean energy, convenience, comfort, choice and control over their usage. These preferences drive customization of services and energy solutions. We use digital platforms and analytics to provide our customers with up-to-date information, convenience, choice and control. We must do all of this in a cost-effective manner.
Strategy

Our strategy includes investments in infrastructure and managing the supply portfolio to procure adequate natural gas for our customers. We invest in new technologies including a first of its kind natural gas detector that will take advantage of our Advanced Metering Infrastructure network to alert us to possible leaks in homes and businesses and a work-management system that will help us reduce costs and improve public safety. Our 20-year capital investment over the life of this plan is approximately $22B.

The way energy is supplied to and consumed by our customers is changing dramatically as a result of clean energy policy, fast-evolving technology and customer desire for greater control. This transformation compels energy companies to re-think their role in generating, transmitting, and delivering energy to customers.

Con Edison is committed to being an integral partner in achieving New York State and New York City policy goals. Energy policy encompasses many environmental, economic, and security debates occurring at all levels of government. Policymakers – particularly those at the state and municipal levels – want clean, safe, reliable, resilient and affordable energy. These goals are driving policy changes in key areas:

- Climate change and clean energy targets
- Utility regulation
- Standards for resiliency and security

Environmental Stewardship

Policy changes – some already in place and others still to come - will encourage reduced greenhouse-gas emissions and a de-carbonized electric generation supply. The emissions from space heating have decreased from 1990 levels because of enhanced energy efficiency and oil-to-gas conversions. Improvements in heating equipment efficiency and building envelopes will further reduce emissions from combustion of natural gas. The enhanced cost competitiveness of electric heating technology and increased adoption of solar, wind and other renewables will be required to help NYS and NYC meet their long-term environmental goals.

Natural gas is cleaner, less expensive and more efficient than other fossil fuels. It provides fuel diversity, resource flexibility and grid resiliency. Natural gas heats more than half the households in NYS and as an alternative to heating oil, has helped NYC achieve the cleanest air in decades. Natural gas will remain a cost-effective, viable, long-term fuel that will help enable a low-emissions and renewable energy future as it replaces fuel oil for heating and oil for electric generation.
Ensuring Adequate Supplies

Con Edison procures pipeline capacity and storage contracts to safely and reliably meet its customers’ needs and manage its system. The Company relies on firm supply and storage, supplemented by liquefied natural gas (LNG) and short-term delivered services, to meet customer demand for natural gas. As demand rises, the Company will pursue additional capacity through traditional methods, while also recognizing the challenges in developing new pipelines given recent policy goals to reduce or eliminate the use of fossil fuels. In parallel, Con Edison is pursuing non-traditional supply-side (e.g., compressed natural gas, renewable natural gas) and demand-side (e.g., energy efficiency, demand response, alternative technologies, such as geothermal and air-source heating) solutions to meet customer demand.

Given the near-term regional supply constraints, the Company will pursue multiple pathways to mitigate adverse customer impact. The Company’s planning is based on the assumption that temporary moratoriums will be necessary in our service territory and will remain until more pipeline capacity becomes available or reduced demand is realized through non-traditional supply, demand side solutions and the use of alternative new technologies to meet customer needs. The timeline to develop projects that will alleviate these constraints is uncertain. The Company has called a temporary moratorium in most of Westchester County, and will continue to monitor the supply and demand balance in other parts of its service territory. The Company will continue to pursue traditional and non-traditional solutions to enable adequate supplies to be maintained and resolve the need for temporary moratoriums.

In addition to our planning case, we are considering uncertainties in our planning assumptions and examining alternative outcomes. Analyzing planning uncertainties will ensure the company is flexible and prepared for changes in the energy landscape. The elements of our GLRP—our strategy, investment planning and stakeholder engagement—will put Con Edison in a position to support a safe, clean, resilient, prosperous and sustainable future for the residents and businesses in our region.
Con Edison manages a large, complex, underground gas transmission and distribution system designed to rigorous reliability and safety standards. Our system’s infrastructure resides alongside many other utilities, making construction and operation challenging and expensive. The gas system consists of more than 4,300 miles of gas pipelines, transporting more than 300 million Dth (dekatherms) of natural gas annually. Gas is transported from interstate transmission pipelines, through gate stations, into Con Edison-owned transmission pipelines, through key regulator stations into backbone systems, and then finally into our distribution network to supply our customers.

**Con Edison Vision**

The Con Edison Gas Operations vision statement is: “We will be industry best-in-class in safety, quality, compliance and customer experience.” We strive to articulate how we are achieving this vision in our long-range plans.

The Company’s NYC and Westchester County service territory is a densely populated, largely urban environment and home to one of the world’s largest commercial hubs. Gas Operations serves a wide range of residential, small business, large commercial and energy-generation customers that purchase natural gas for a variety of uses. Individual homes and multifamily dwellings depend on natural gas for space heating, water heating and cooking. Con Edison has approximately 650,000 residential cooking gas customers and 290,000 residential heating customers. These include the largest cooperative housing development in the world and the largest public housing authority in North America.

Commercial enterprises, including the many Fortune 500 companies in our region, purchase natural gas for heating, combined heat and power generation, food preparation and transportation. Con Edison serves about 80,000 commercial heating customers, an additional 70,000 commercial non-heating customers, and 650 large-volume, dual-fuel, interruptible customers that include in-city electric and steam generation plants.

Reliable gas service is critical to these generation plants and to our electric and steam customers, since most of NYC’s in-city electric generation and steam capacity relies on natural gas as a primary or backup fuel. To continue meeting these needs, we will upgrade our natural gas infrastructure in ways that both enhance reliability, safety and satisfy the future needs of our customers.

The density of our region compounds the importance of the safe, reliable operation of our gas system. We use the lessons learned from gas industry and Con Edison system incidents to continue reducing risk. With the harsh Northeast winters and nine million people living and working in the area, it’s essential to provide reliable heating and cooking service. Gas outages can affect many customers at once, and restoration of service is a meticulous process that requires us to inspect and test the integrity of customer-premise piping before turning on service in order to ensure customer and public safety.

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 a highly-efficient energy source and is the cleanest fossil fuel available to fulfill our area’s energy needs. We support the environmental goals of NYS and NYC, and make it a priority to minimize emissions from leaks on our system.

We believe the energy needs of NYC and Westchester County will continue to grow and change. While appliance and building codes and standards will require more efficient gas-fired applications and reduce per-capita gas consumption, we believe overall gas demand will increase in order to facilitate the integration of intermittent energy resources.

Con Edison’s strategy seeks 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. We respect the environment, seek a culture of safety and compliance, and support the diversity and development of our employees.

**Gas Transmission**

Con Edison’s gas transmission system consists of 94 miles of 6-inch to 36-inch diameter cathodically-protected steel mains, operating at pressures ranging from 125 psig to 350 psig, in Manhattan, Queens, the Bronx and Westchester County. The transmission system is supplied by seven gate stations and the distribution system is directly supplied by four additional gate stations in northern Westchester. Gas flows seasonally through the two transmission pressure systems by way of a regulator station during the heating season and a compressor station during the summer.

Con Edison’s transmission system is also part of a larger regional network called the New York Facilities (NYF) System. The NYF System is operated by Con Edison and National Grid. Con Edison is connected to National Grid at two bi-directional metering station interconnects. Of note, gas supply constraints that affect the region impact the NYF system and therefore both the Con Edison and the National Grid systems.

**Gas Distribution**

Our gas distribution system consists of more than 4,300 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, transport gas from transmission to distribution systems. Most of these supply mains are large-diameter and underground below major roadways. The remainder of the distribution system consists of smaller-diameter mains, operating at a variety of pressures, as per Figure 2-1 below.

Emanating from the distribution mains, approximately 375,000 gas services connect the distribution system to customer premises.
As of the beginning of 2019, 20 percent of the mains are cast iron, 22 percent are unprotected steel, 52 percent are plastic and 5 percent are protected steel. Approximately 73 percent of the services are plastic, 16 percent are unprotected steel, 7 percent are protected steel, and 4 percent are copper.
Design Specifications

Con Edison’s gas transmission and distribution systems are designed to meet or exceed the requirements of federal gas codes (49 CFR Part 192), state gas codes (16 NYCRR Part 255) and other local laws and regulations. Con Edison’s gas transmission and distribution systems are also governed by other federal, state, city and local laws and regulations.

The Con Edison system is designed to meet the demand requirements of all firm customers based on the forecasted peak day demand under design weather criteria.

The purpose of these design criteria is to govern key reliability, safety and system integrity conditions in order to provide adequate supply to our customers on the coldest days.

The company’s design criteria include specifications for operating pressures, pipeline material, main replacement conditions, regulator stations, tunnels and service connections, as well as contingency procedures.
3. Industry Evolution

Natural gas is America’s most abundant fuel and is projected to be able to meet the country’s energy needs for the next 100 years (AGA). In the planning horizon, natural gas is viewed as an efficient, low-cost heating solution that provides societal benefits like fuel diversity, resource flexibility and grid resiliency. Further, as boilers become more efficient and building envelopes improve, reduced emissions from the use of natural gas will contribute to the achievement of clean energy goals.

Today, natural gas accounts for approximately 30 percent of both primary energy consumption and electric generation in the United States (eia.gov). In NYS, natural gas accounts for nearly 40 percent of electric generation. Natural gas is also a preferred fuel for residential and commercial heating and can reduce carbon emissions compared to other fossil fuels.

Demand for Gas Trending Upward

Concerns about climate change have led to the retirement of many coal-fueled electric generation plants in the United States, resulting in an increased reliance on natural gas as the cleaner and more reliable alternative. In 2016, natural gas fueled more electric generation than coal for the first time ever.

Figure 3-1: Electric Generation Fuel Source Trend

The supply of natural gas, especially in the United States, has risen steadily since 2005. The U.S. Energy Information Administration (EIA) estimates that the United States has about 200 trillion cubic feet of proven shale gas reserves available. As a result of the increased supply, the price of natural gas has decreased roughly 50 percent since 2005 (eia.gov).

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Figure 3-2: Natural Gas Price Trend

![Graph showing the natural gas price trend from 1990 to 2018.](source)

Source: Energy Information Administration (EIA)

Annual energy costs for residential customers using natural gas have been lower than the cost of propane, fuel oil or electricity since 2010—and are projected to stay low through 2037. See Figure 3-3 below.

Figure 3-3: Cost of Energy

![Graph showing the cost of energy from 2008 to 2036.](source)

Source: American Gas Association (AGA)
Environmental Challenges

Transformation across the value chain is an opportunity for energy companies to re-define the future of energy and their role in generating, transmitting and delivering it to customers. After more than a decade of growth from the U.S. shale gas revolution, the natural gas industry faces challenges such as adapting to aggressive clean energy policies, technology advances, cost declines and consumer energy choice.

The evolution of federal, state and local policy is set to influence the future of the energy industry and how utilities serve their customers. New York State’s clean energy strategy is multi-pronged. It addresses greenhouse gas (GHG) emissions, renewable resources, energy efficiency and energy storage (NYSERDA). As a result, the viability of natural gas midstream pipeline development projects in NYS is uncertain.

Clean Energy Goals

In 2015, the state announced its New York State Energy Plan, which sets three clean energy goals to achieve by 2030:

1. A 40-percent reduction in GHG emissions from 1990 levels (40x30)
2. A 50-percent portion of renewables in the electric generation energy mix
3. A 23-percent decrease in energy consumption in buildings from 2012 levels

Further, the State has set a goal to achieve an 80-percent reduction in GHG emissions by 2050 from 1990 levels (80x50).

NYC’s clean energy policies are in line with the State’s, and even more stringent in some areas. For GHG emissions reduction, NYC has set a more aggressive target than the State: a 40-percent reduction by 2030 and an 80-percent reduction by 2050 from 2005 levels (as opposed to the State’s 1990 benchmark). NYC phased out #6 heating oil at the end of 2015. Additionally, the City plans to phase out #4 heating oil by 2030.

The Company has been a longtime supporter of clean energy policies. Con Edison has been and will continue to be a part of the solution. Since 2005, the Company has reduced its carbon footprint (carbon dioxide, methane, and sulfur hexafluoride) by 48 percent. This reduction equates to taking more than 500,000 cars off the road each year. The Company has converted more than 7,600 large buildings from oil to cleaner natural gas, which helped NYC achieve its cleanest air in 50 years (Sustainability Report).
Initiatives to Reduce Energy Usage

In NYS, natural gas remains the most cost effective and preferred energy source for home heating. It is used in approximately 60 percent of households, followed by fuel oil (25 percent) and electricity (10 percent) (eia.gov).

Most U.S. homes rely for heat on furnaces or boilers. Furnaces heat air and distribute the heated air through the house using ducts. Boilers heat water and provide either hot water or steam for warmth. Older furnace and boiler systems have efficiencies in the range of 56 percent to 70 percent, while modern conventional heating systems can achieve efficiencies of better than 95 percent. Energy efficiency investments and a high-efficiency heating system can lower natural gas use and result in lower emissions and customer bills.

Con Edison’s energy efficiency plan is to work with customers proactively to manage their energy needs and costs. We coordinate with regulatory and other agencies to develop, offer, and refine programs that promote efficient end-use behavior and technologies that reduce per-unit energy use.

Because of our direct relationship with our gas customers, we are positioned to partner with them to reduce energy usage. The electric Energy Efficiency Portfolio Standard (EEPS) programs have gained momentum and led to relationships and awareness at the community and customer level. The Company will build upon this momentum and improve gas programs in ways that help customers cost-effectively increase fuel cost savings and help achieve energy-load and emission-reduction goals.

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 these programs for the benefit of our customers will be a priority.

Con Edison developed the Smart Solutions for Natural Gas Program, an innovative, multi-solution strategy to decrease gas usage and procure alternative resources. This program has the potential to be a model for utilities to engage customers as a resource in helping to manage the natural gas system (including upstream pipeline capacity needs). We will incent increased customer participation in energy efficiency programs, and offer more demand response opportunities while we explore alternative supply-side solutions, and develop, renewable heating and cooling assets. The program is discussed further in the section 5.

Customers have choices to meet their heating needs. In our region, most customers have four options: natural gas, heating oil, propane or steam. Propane is used mainly in the northern areas of our service territory where natural gas is not available. Electric heating is less prevalent than in other areas of the country due to colder climates and higher heating demands. NYS provides incentives for the adoption of electric heating or steam heating where infrastructure permits to achieve greenhouse gas reductions.
One possible application for electric heating is an air-source heat pump that transfers heat between a house and the outside air. While highly efficient, this heating solution has historically worked best for moderate heating and cooling needs. However, with recent advances in compressor technology, newer cold climate air source heat pumps (ccASHPs) can match and deliver heating demands in single-digit temperatures or potentially lower. Still, there are cost, sizing, and refrigerant challenges when it comes to ASHP applications. The Company continues to evaluate the feasibility and impact on infrastructure of these and other alternative heating solutions, as technology improves, costs decline and clean energy policy incents customer participation.

Con Edison, as part of the Peak Demand Collaborative with the Public Service Commission (PSC), explored geothermal heat pumps for customer heating and cooling needs. The collaborative found that, in general, the company’s natural gas service territory has bedrock with good thermal conductivity but cost, interference, permitting and land access are challenges (dps.ny.gov).

Safety

In addition to developments in clean energy policy, there is a renewed focus on safety following a series of natural gas distribution events and transmission pipeline leaks across the country. The Pipeline and Hazardous Materials Safety Administration (PHMSA) is working to finalize a Safety of Gas Transmission and Gathering Pipelines rulemaking. A notice of proposed rulemaking was recently published, indicating pending changes to integrity management requirements, verification of maximum allowable operating pressure (MAOP), records for material verification, repair criteria and the expansion of integrity management beyond high consequence areas. These changes would impact CECONY’s Gas assets. Replacement of approximately 35 miles of existing transmission pipelines will be required to meet this standard and reduce system risk.

While focusing on our responsibility to meet our customers’ need for safe and reliable natural gas, Con Edison supports the clean energy programs of NYS and NYC. The Company is committed to working with policymakers and stakeholders to develop solutions that will support a cost-effective, safe, and reliable transition to a low-emissions future. Though the Company believes natural gas will remain a preferred heating solution, it has begun analyzing alternative planning outcomes. These are further discussed in section 6.0.
Con Edison recognizes the importance of securing adequate supply to reliably serve our customers. A substantial portion of our planning is dedicated to this business requirement.

The demand for natural gas for any end-use purpose is sensitive to its availability and price. Given the improvements in resource availability the past decade, wellhead gas prices are not expected to rise dramatically during the 20-year planning period. However, until the necessary infrastructure is constructed, gas prices will likely continue to exhibit short-term volatility comparable to historical patterns.¹

As shown in Figure 4-1, since 2011, Con Edison’s citygate cost of gas is projected to continue to hold a competitive advantage for natural gas on an average annual basis compared to New York Harbor prices for No. 2 oil. Delivering this price advantage to our customers depends on our ability to procure supply ahead of winter peaking times.

In order to maintain reliable gas supply and service we depend upon adequate pipeline capacity and storage contracts to deliver gas to our citygates. 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.

Figure 4-1: Con Edison’s Citygate Cost of Gas for Firm Customers Versus No. 2 Oil²

Source: Historical Annual Prices for NYH No.2 - US EIA and Henry Hub; Con Edison Energy Management

¹ Volatility could be restrained by changes, such as increased gas storage, more long-term pipeline contracts or government regulation.
² Comparison of Con Edison’s citygate 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.
Diversification of Con Edison’s Natural Gas Supply

Con Edison’s gas supply portfolio consists of storage and transportation capacity diversified by production regions. The company’s sources include the Gulf Coast, Canadian gas, and the Northeast (mostly Pennsylvania). In addition, Con Edison has access to storage fields in the Gulf Coast and the Northeast, where gas is injected during off-peak periods and withdrawn during high-demand periods to meet customer needs.

The map in Figure 4-2 shows Con Edison’s existing sources of natural gas.

Figure 4-2: Con Edison’s Gas Supply Sources

Con Edison also uses its LNG facility to maintain adequate supply. This facility provides gas peaking supply services, as well as supply for an operational contingency, which increases reliability and potentially mitigates short-term price volatility. LNG is further discussed in section 5.

The near-term compounded annual growth rate for our firm peak demand is forecasted to be 1.1 percent over the next five years and 0.5 percent over the next 20 years. Currently, firm supply capacity remains constant, creating challenges to meet demand.

To address the gap between peak demand and pipeline capacity, the Company will pursue a suite of supply-side and demand-side solutions, including facilitating development of alternative new technologies. These solutions include non-traditional methods (e.g., Smart Solutions program described in section 5), procurement of additional capacity from existing capacity holders, becoming a shipper on new interstate pipeline projects to our citygates in Westchester and NYC and increasing capabilities of existing infrastructure.
Supply Constraints

The amount of natural gas supply from interstate pipelines to the Company’s service area is limited, and we currently forecast that in most of Westchester County it will be insufficient to continue to connect new firm customers. Interruptible service remains available. As a result, the Company has issued a temporary moratorium on new applications for gas service in most of Westchester County. The Company is exploring a variety of options to address the supply and demand imbalance on peak winter days, including: efficient alternatives to reduce existing demand, providing interruptible service for large buildings, alternative technologies to provide heating or supply, and/or potential pipeline solutions.

The Company is in discussions with multiple pipeline developers for potential projects that would meet federal, state and local requirements. These projects would maximize the use of existing infrastructure in order to reduce environmental impacts while increasing the amount of pipeline capacity to our service territory.

The construction and operation of pipelines, should that occur, includes a variety of risks that interstate pipeline companies work to address. Those risks include working in a densely developed area such as the New York metropolitan region, as well as the co-location of critical infrastructure projects, such as electric and gas distribution facilities. These risks are considered through the sitting process. Additional challenges include opposition to new pipeline projects by several stakeholders as the energy sector moves toward the clean energy future, which the Company supports.

The Transco Northeast Supply Enhancement pipeline project is designed to expand the existing Transco natural gas pipeline system and increase gas deliveries to National Grid, which is the only shipper on this project. The project was denied required permits in 2018. Transco re-applied and the status is pending. This project will impact the local and regional market for natural gas supply, including the Con Edison territory. Con Edison continues to monitor the supply and demand imbalance in its service territory. While we continue to develop clean heating alternatives, we must continue to take the steps needed to provide reliable service to all of our customers through the clean energy transition, which may include additional temporary moratoriums.
Alternative Solutions

Con Edison is developing innovative ways to meet demand. One initiative is the Smart Solutions for Natural Gas Customers program which is designed to provide alternative solutions to meet the shortfall of interstate pipeline capacity to our service area, and to address customer needs for heat, hot water and cooking. It also includes a market solicitation for non-pipeline alternative solutions, which will provide a pathway for the advancement of new technologies and facilitate new abilities to engage with and deliver services to customers. Examples could include electrification of heating through geothermal and air source heating technologies, or localized natural gas storage and renewable gas alternatives. This program is described in detail in section 5.
Growth in firm gas volumes for residential and commercial uses has resulted from the economic and environmental benefits of natural gas versus other fuels. Since 2011, this traditional growth was bolstered by the NYC Clean Heat program which dramatically increased the number of buildings converting from oil to gas. As seen in Figure 5-1 below, Con Edison’s adjusted volume from firm gas demand grew at a 2.7 percent Compound Annual Growth Rate (CAGR) between 2007 and 2017.

**Figure 5-1: Historical Sales Volume**

The near-term compounded average annual growth rate for delivered firm natural gas volume is forecasted to be 1.3 percent over the next five years and approximately 0.6 percent over the next 20 years. This delivered volume forecast is illustrated in Figure 5-2.
End-user Oil-to-Gas (OTG) Conversions

Customers have choices to meet their heating needs. Within our service territory, customers primarily choose among natural gas, heating oil, electricity, steam or propane.

Since the launch of the Clean Heat Regulation in 2011, many oil users in NYC have converted to natural gas service. We have converted nearly 4,400 of the approximately 7,000 No. 4 and No. 6 oil users in our NYC portion of the service territory to natural gas. An additional 3,200 large buildings have converted to gas from No. 2 oil. By 2030, we anticipate converting an extra 500 heavy heating oil customers in NYC, reducing particulate matter by the equivalent of 182,000 cars off the road.

Distributed Generation

Distributed generation (DG) refers to a class of Distributed Energy Resources (DER) that include an electric generating system on customer premises. That system reduces the amount of power the customer needs from the utility or an energy services company (ESCO). Distributed generation can make a customer a producer of energy if their production exceeds their consumption. The excess power their system produces can then flow back into the grid and be available for other customers.
The most common DG technologies in the Con Edison service area are combined heat and power (CHP) systems, which are fueled by natural gas, and solar photovoltaic (PV) generation. Natural gas-fueled CHP technologies not only produce electricity onsite, but also offer the customer the benefit of using the heat byproduct to create steam or hot water for space heating and eliminate the need for oil-fired boilers. Customers adding distributed generation typically have higher demand for natural gas, requiring Con Edison to procure additional supply.

Con Edison or its customers have been installing DG systems since the 1980s. There are currently over 120 CHP project requests pending development, representing about 100 megawatts (MW) of electric capacity. More than half the potential gas usage from CHP systems is in Manhattan, with several large projects planned in other boroughs.

Gas-fired CHP can meet the needs of a wide range of residential, commercial and industrial users. It is most beneficial for customers with large, consistent thermal and electric consumption (e.g., hospitals). The adoption of CHP can help the Company defer investments in its electric transmission and distribution systems.

There are signs that the trend of gas-fired DG growth will continue as seen in Figure 5-3 below. Based on expected projects, historic adoption rates, market trends—including increased interest in fuel cells, and stable spark spread—we forecast approximately 450 MW of grid-connected CHP capacity by 2038. Of that total, approximately 330 MW meet performance criteria in order to be included in the system forecast. DG and CHP are forecasted to add 50 MDMtday to peak demand over 20 years.

Figure 5-3: Projected CHP Distributed Generation Capacity
Using this forecast, Gas Operations can better plan the infrastructure investments it will need to serve these gas-fired DG assets. NYS’s Reforming the Energy Vision (REV) proceeding seeks to use the electricity output of DG to offset the need for building additional substation and local distribution system equipment. REV also seeks to stimulate growth in the market for DG installers, thereby creating jobs. The use of CHP and fuel cells to achieve REV goals means a corresponding rise in the forecast for future gas consumption and a need for more high-pressure gas distribution infrastructure. In addition to REV, several other ongoing and future programs will positively affect the gas outlook.

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

**Energy Efficiency Plan**

Con Edison works with customers to manage their energy needs and costs. We cooperate with regulatory and other agencies to develop, offer and continually refine energy efficiency programs that help customers reduce usage and save money. We will build on our relationships with our gas customers to improve gas energy efficiency programs in a way that improves the customer experience, helps customers save and contributes to meeting environmental goals.

The Company will continue building upon its Energy Efficiency Transition Implementation Plan (ETIP) to grow its energy efficiency offerings and achievements through the programs that support our Smart Solutions initiative. The included programs span all customer segments, including commercial, multifamily and residential.

**Smart Solutions Program**

As a result of high rates of customer growth and uncertainty regarding the construction of new interstate pipeline infrastructure, the Company filed a petition in September 2017 with the NYS PSC proposing a portfolio of alternative solutions to address customer heating needs. Called Smart Solutions for Natural Gas Customers, the petition requested approval of four non-traditional methods of meeting customer heating needs and cost recovery for a potential cost-sharing arrangement for pipeline project development costs. The non-traditional approaches were comprised of 1) a Non-Pipeline Request for Proposal (RFP), 2) an enhanced energy efficiency program, 3) a gas demand response program and 4) a gas innovation project for business innovation for renewable thermal technologies.
**Non-Pipeline RFP**

The Company issued a Non-Pipeline RFP in December 2017. Responses were received in March 2018 to reduce peak-day gas demand or provide alternative peak-day supplies. The company received proposals for demand-side reductions using energy efficiency, demand response and electrification of heating, as well as proposals for alternative supply measures like renewable gas, compressed natural gas (CNG) and liquefied natural gas (LNG) trucking. Con Edison will seek to implement all demand-side and supply-side proposals that an evaluation committee approves. We will need the NYS PSC to approve cost recovery. In September 2018, the Company submitted a filing with the Commission requesting funding support for a specific portfolio of projects. After PSC action, the Company expects to continue to develop additional competitive market solicitations to continue to develop new alternative options for customers.

**Enhanced Energy Efficiency**

The Company proposed in its September 2017 petition to double the goals and funding for its gas energy efficiency program. On July 12, 2018, the PSC approved the increased energy efficiency program with modifications, which included increasing the goals and of $60 million budget over three years.

**Gas Demand Response Pilot**

The Company proposed in its September 2017 petition to develop a new gas demand response pilot. The Gas Demand Response Pilot consists of: a performance-based pilot for commercial and industrial customers, and a direct load control pilot for residential customers with Wi-Fi-enabled thermostats. On August 9, 2018, the PSC approved the Gas Demand Response Pilot, including the requested $5 million, three-year budget.

**Gas Innovation Project**

Our September 2017 petition requested $10 million to test innovative business ideas that will increase access to renewable thermal technologies, such as geothermal heat pumps and air-source heat pumps. The Company issued a Request for Information (RFI) to the marketplace in June 2018, and received responses by August 2018. After evaluating the responses, the Company submitted in December 2018 a proposed Implementation Plan, including a refined budget, with the PSC to support three selected projects.

**Supply Uncertainty**

At this time, there is substantial uncertainty about the Company’s ability to meet its customers’ peak day supply needs. As a result, Con Edison intends to continue to advance both traditional and non-traditional efforts to meet our customers’ supply needs.
Meeting Natural Gas Demand

The natural gas peak demand forecast is a major determinant of the required investment in transmission and distribution infrastructure. Con Edison develops a 20-year peak demand forecast to determine the adequacy of our transmission and distribution infrastructure 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 delivered to firm customers, measured in thousands of dekatherms (MDt). The peak-demand forecast is a projection of the maximum amount of gas that Con Edison’s firm gas customers need at a single point in time, measured in thousands of dekatherms per day (MDt/day). The peak demand forecast determines our infrastructure investment because we must build to reliably meet that peak, even if it is an infrequent occurrence. For the Con Edison natural gas system, firm gas peak demand occurs in the winter when customers need reliable gas service for heating.

Economic conditions, along with environmental energy policy and regulation, influence customer fuel choices and usage. Con Edison’s gas system will likely 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, and natural gas vehicles) also affect customer gas consumption.

For this Gas Long-Range Plan, we developed a base case for peak demand. This case is the basis for all initiatives and assumptions in the plan. The 20-year firm CECONY Gas peak demand forecast is projected at 0.5 percent compound annual growth rate. We expect a reasonable number of oil-to-gas conversions in the next five years, with a 1.1 percent compound annual growth rate over that period.

The base case considers increased energy efficiency, smart solutions, as well as a temporary moratorium for most of Westchester County for firm gas service (interruptible service remains available). The peak-demand components that are projected to increase the base case forecast are: large new construction, small residential construction, new business from distributed generation, steam, oil-to-gas conversions, and transfers from interruptible to firm service. The peak demand components that are projected to decrease the forecast include Con Edison and NYSERDA energy efficiency programs, smart solutions, natural conservation from organic energy efficiency, and the temporary Westchester moratorium.

Capital Project Planning

NYC is one of the most densely-populated, urban environments in the world. We use customer-aggregation and work-coordination strategies to minimize disruption to the community. To accommodate new demand, we will maintain and reinforce our transmission and distribution systems by installing regulator stations, replacement mains, new mains and service lines to customer properties.
Maintaining and reinforcing our system to meet new demand will require significant investment. System reinforcement requires trenching in the streets, resulting in high costs for excavation, construction and restoration. Many of our transmission and distribution programs manage risk and enhance safety while reinforcing our system.

Transmission System Reinforcement Projects

Gas Operations plans large transmission projects to improve safety and reliability as a part of its system reinforcement to support growth. The transmission replacement projects will also involve re-connecting or replacing a number of main connections to feed Con Edison regulator stations and commercial and industrial customers. These projects will be constructed with piping with higher-yield strength and more ductility than the existing transmission main. More information regarding transmission programs can be found in section 8.

Distribution 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 serve growing demand.

There are three ways that we reinforce our distribution system for increased demand:

- Install new district regulator stations where possible. Where there is a higher-pressure main nearby, we can install a regulator station and associated main ties and 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 distribution reinforcement work projects designed to accommodate current and future demand.

Environmental Concerns

Con Edison is committed to improving the collateral environmental impact of our gas system infrastructure. Our aggressive main replacement program will not only improve safety by reducing gas leaks, but will also reduce methane emissions, benefitting the environment. We are dedicated to working with new technologies to better quantify gas leaks so that we can prioritize leak repairs in a way that most reduces methane emissions. The Company surveys its distribution mains monthly and transmission mains three times a year. We have made significant investments to enhance natural gas detection technologies.

We are participating in collaborative climate change studies that will help us identify, anticipate and plan for environmental trends that may impact our system.
Environmental Performance

The Company is committed to keeping the New York area safer, cleaner and sustainable for people who live, work and visit the region. 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 partnership that encourages natural gas companies to adopt proven, cost-effective technologies and practices to improve operating efficiency and reduce methane emissions. Nearly all distribution-sector methane emissions are due to non-hazardous leaks. The Company has reduced its backlog of non-hazardous leaks by 69% over the last five years.

Con Edison also participates in the EPA’s Natural Gas STAR Methane Challenge. This program is a flexible, voluntary partnership that allows the EPA to collaborate with partners to promote and track ambitious, transparent commitments to voluntarily reduce methane emissions beyond regulatory requirements and to recognize partners for their progress. The commitments by CECONY and Orange & Rockland Utilities (O&R) focus on two natural gas distribution system “Best Management Practices” (BMPs) for reducing methane leakage: a) cast iron and unprotected steel main replacement, and b) replacement of services of the same materials. To be eligible to participate in the Methane Challenge, participating companies must commit to replace a specific percentage of the total cohort of cast iron and unprotected steel mains. CECONY’s commitment is to replace 4% of its mains and O&R’s commitment is to replace 6.5% of its much smaller cohort of such mains. These commitments are already more ambitious than the minimum requirements to participate as a Methane Challenge Partner and will increase further with targets set forth in our planned Main Replacement Program.

Since 2005, the Company has reduced its carbon footprint (carbon dioxide, methane, and sulfur hexafluoride) by 48 percent. This reduction equates to taking more than 500,000 cars off the road. The Company has converted more than 7,600 large buildings from oil to cleaner natural gas, which helped NYC achieve its cleanest air in 50 years. More than 560 tons of fine particulate matter have been avoided through oil-to-gas conversions, which is equivalent to taking 1.8 million cars off the road (Sustainability Report).

In the past decade, we have greatly reduced emissions of SF6 (sulfur hexafluoride), a greenhouse gas with a warming potential more than 22,000 times higher than carbon dioxide. SF6 is a non-toxic, non-flammable gas that can remain in the atmosphere for up to 3,200 years. There is no viable alternative to SF6, which is a highly efficient insulating medium and arc extinguisher used throughout the energy industry in different types of equipment, including high-voltage breakers and gas-insulated switchgear. But limiting SF6 emissions is imperative for a cleaner environment.

In accordance with a 1999 Memorandum of Understanding between the U.S. Environmental Protection Agency and Con Edison, we agreed to reduce SF6 emissions by five percent annually from a 1996 baseline. In 2016, we released about 96 percent less SF6 than in 1999. Our reductions in SF6 emissions have resulted from maintenance programs that address SF6 gas leaks and targeted replacement of our equipment. To further limit SF6 emissions, our Fix-It-Now team makes rapid repairs a priority and emphasizes best management practices for gas handling (Sustainability Report).
Climate Change

The Company is formally studying the risk that climate change poses to our energy-delivery systems, and is looking to identify ways to further enhance system resiliency. The study is using the latest climate science to project weather scenarios for the New York region out to the year 2080. Once we understand the potential impacts, we will create a portfolio of solutions, such as revised design standards and operating processes, to provide the resiliency we need to protect our equipment and customers. The study is scheduled to be completed by December 2019 and will include chapters addressing temperature, humidity, precipitation, sea level, major events and multi-hazards.
Renewable energy policy, technology advances (energy efficiency, demand response), evolving customer preferences and other factors are changing the ways energy is generated, supplied and used by our customers. Our base planning case details our approach and provides a roadmap to achieve our vision over the next 20 years. In this section, we describe planning uncertainties and identify key signposts that will help us navigate material changes in our operating environment.

Gas Constraints – Assumptions and Drivers

The Company will continue to monitor customer demand and the supply available to meet that need coming into its service area from interstate pipelines. We expect gas supply constraints to continue. Continued policies to reduce or eliminate fossil fuels while developing renewable energy sources results in uncertainty in procuring adequate supply.

Given these assumptions, Con Edison is examining alternative outcomes where additional capacity is not available. In this case, the Company would increase efficiency measures, including accelerating the Smart Solutions program, and solicit additional non-traditional supply/demand side solutions while continuing to reliably serve existing customers. Temporary moratoriums, such as the one in place for most of Westchester County, would limit the ability for new customers to access firm service, although interruptible gas service will remain available on non-peak days. Additionally, new customers who would otherwise meet their heating needs with natural gas will opt for other solutions such as electric heating or steam in Manhattan, or interruptible gas service.

Policy – Assumptions and Drivers

Policy uncertainty reflects NYS and NYC clean energy goals, mandates, and standards that have the potential to impact the traditional natural gas business. The most aspirational of these goals is NYC’s 80x50 initiative. To achieve the 80-percent reduction of greenhouse gas emissions by 2050 and 40 percent by 2030, multiple objectives must be met at the Company level and at the market level with customer preference and costs. These include increased energy efficiency of both electric and gas, an electric generation mix that is primarily renewables, and significant electrification of transportation and heating. We are working with various stakeholders including state and city agencies, and peer utilities to develop pathways to achieve these ambitious goals.
Signposts

Given these uncertainties, the following factors will guide Con Edison's adjustments to our base-case, long-range plan:

- Policy Development: NYS and NYC policy and goals driving consumer behavior in the heating market
- Effectiveness of the Company's Smart Solutions for Gas program
- Ability to site new pipelines to increase the supply
- Economics of electrification
- Significant advancement in technologies such as:
  - High efficiency gas heat pumps
  - Advancements in carbon capture
In this section, we describe the system design strategies that Con Edison uses to manage our planned capital infrastructure investments. Two major categories account for most of our investments: Risk Management and System Reliability Improvement.

To improve its performance, the Company evaluates risk on an enterprise level and has a comprehensive approach to risk mitigation. Our strategy includes enhanced prevention, detection and response. Our Pipeline Safety Management personnel identify industry best practices and incorporate them into our Transmission and Distribution Integrity Management Programs (TIMP/DIMP). These programs help us examine risks in our system through data analytics, root cause analysis, open communication and standardization. We use the information to guide the enhancement of our programs and the creation of new programs.

The Company invests toward an optimal future state for the gas distribution and transmission systems that includes greater reliability, reduced impacts of coastal flooding and reduced risk of events that can result in property damage or impact public safety. This section outlines the expected benefits of these investments, along with some details on the programs in the gas capital infrastructure plan.

**Pipeline Safety Management Program**

The American Petroleum Institute’s Recommended Practice (API RP 1173) lays out the elements of an effective and holistic gas pipeline safety management system for pipeline operators. Satisfaction of this standard requires that our daily activities follow a Plan-Do-Check-Act cycle, which permits continuous improvement and feedback loops to all of our existing practices, procedures and management systems. This standard is then cascaded into our DIMP and TIMP program.

The Distribution Integrity Management Program (DIMP) enhances safety by identifying and reducing distribution pipeline integrity risks through system analysis and by monitoring potential threats identified by regulators, gas associations and peers. Risk analysis is an ongoing process of understanding what factors affect the degree of risk posed by threats. This understanding helps us prioritize remediation. DIMP routinely analyzes system trends down to the performance of asset classes. We address the priority risks and threats by enhancing programs or creating new programs. For example, DIMP has identified leaks on small-diameter steel and cast-iron mains as our primary system risk. We are addressing this through our Main Replacement program described further in this section.

The Transmission Integrity Management Program (TIMP) enhances safety by identifying, reducing, and mitigating threats to the transmission pipeline system. The program’s regulatory goal is to identify, prioritize, repair and validate the integrity of transmission pipelines that could, in the event of a leak or failure, affect populated areas. Pending TIMP regulations related to MAOP validation has accelerated the replacement of the transmission system that operates above 20 percent specified minimum yield strength (SMYS). Risks are anticipated to be reduced as new pipelines will be operating substantially below 20 percent SMYS.
Developing the Gas Infrastructure Plan

The Company has always placed a priority on identifying and mitigating risk and has implemented a formal Enterprise Risk Management (ERM) process. Our ERM process identifies, analyzes, integrates, evaluates, manages, monitors and communicates risks across the Company. Through collaborative risk assessment, ERM has become embedded in Con Edison’s planning and budgeting. As part of the annual ERM cycle, each group identifies operational and administrative risks, and assesses their severity and likelihood.

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

- Defining system design criteria to meet regulatory requirements and our own performance standards
- Using the demand forecast to determine transmission system design criteria to meet safety, reliability, and system integrity standards
- Optimizing capital investment to achieve system capacity, reliability and integrity requirements
- Monitoring and managing system performance

Gas distribution and transmission events have been identified as among the most significant risks for the Company. Con Edison has a comprehensive approach to risk mitigation through enhanced prevention, detection and response as shown in the figure below.

Figure 7-1: Prevent, Detect, Respond Process
Preventing a Gas Event

Damage to gas lines during excavation by contractors is a leading cause of natural gas pipeline failures and accidents. The underground depth of distribution mains varies. Inadvertently striking one of these gas pipes endangers public safety, can cause customer outages and result in high repair costs or fines.

Proper construction practices are the first line of defense against these accidents. We provide a robust training program that incorporates both a classroom and hands-on approach to learning the skills required to provide high quality workmanship. Additionally, our field forces strictly adhere to our construction specifications which have been put in place to ensure work is completed in compliance with all regulatory standards and further contribute to the quality of workmanship. Lastly, our Quality Control department conducts random sampling and inspects the quality of the Company’s construction work in progress to identify any gaps that may exist and will work with the necessary groups to close those gaps.

Con Edison mails an annual brochure to nearly 30,000 excavators. It includes a detachable visor card with natural gas safe-digging information. The Company has a member on the board for each of the One Call Centers and sponsors One Call Center programs, such as excavation safety seminars, 811 national campaigns and statewide calendars. We have also begun holding external outreach sessions with excavators to reinforce proper safety expectations and safe digging practices. The Company participates in the NYC Department of Design and Construction Safety Forum by providing compliance training to resident engineers, field inspectors, quality assurance personnel and contractors. We benchmark with other utilities to identify and implement industry best practices for damage prevention.

Our cyber and physical security programs are important measures. We work with federal, state, and city agencies and maintain vigilance in our own corporate information technology and emergency preparedness groups to keep up to date on the threat landscape. We perform drills to test readiness or defense, and train our key personnel to raise awareness and practice deterrence. The Company deploys preventive cyber security technologies and continuously monitors high-value control networks. The cyber team is dedicated to responding to and investigating security threats, as well as creating controls to prevent future incidents. Layers of isolation, alarms and a 24/7 cyber and physical security control center help us identify and mitigate threats.

Detecting a Gas Leak

The detection of gas leaks through state-of-the-art technology and public awareness is critical to our comprehensive approach to risk management and public safety. Through detection programs, we determine vulnerabilities on our system. We then identify the best way to remediate and eliminate any potential hazard. As per Code of Federal Regulation (CFR) 49 Part 192, the Company is required to perform annual leak surveys on all distribution and transmission mains. Con Edison goes beyond this standard. We survey distribution mains monthly and transmission mains three times a year.
We are making significant investments in natural gas detection technologies. One technology is comprised of leak detection equipment that employs Cavity Ring-Down Spectroscopy. This equipment’s sensitivity and proprietary algorithms detect natural gas leaks farther from the source than traditional survey equipment. Con Edison plans to continue using this technology for various applications such as pre-paving surveys and quality control prior to and after main replacement work. Upon further test and deployment, the Company may determine additional special-use cases for this technology.

The Company is investing in residential methane detection. We are leading an effort to promote industry first improvements and legislation for the widespread adoption of residential methane detectors (RMDs) by consumers as a means of enhancing the safe delivery of natural gas to our customers. Con Edison distributed approximately 60,000 RMDs in 2018, 60 percent of which went to low-income customers. We are working with the NYC Department of Buildings to develop guidelines that can be used to promote the use of RMDs across New York City and enable implementation of NYC Local Law 157, the standards for installation and maintenance of natural gas detectors.

Con Edison has developed Natural Gas Detectors (NGDs) that build upon our Advanced Metering Infrastructure (AMI) to communicate with Con Edison’s Gas Emergency Response Center (GERC). These AMI-enabled NGDs are designed to detect natural gas and send an alarm directly to the GERC. The GERC will then contact the fire department and dispatch an emergency response crew as shown below. The Company will pilot this program in 2019 and upon its successful completion the Company plans to install these AMI enabled NGDs at over 300,000 locations near gas service points of entry. This will help us prevent gas leaks from developing into a potentially hazardous condition.

**Figure 7-2: Response Protocol**
Technology is a great asset in gas safety but public awareness is essential. Con Edison employs multiple channels to educate members of the public about gas leaks and how they should respond if they suspect a gas odor. Because natural gas is odorless, mercaptan, which smells like rotten eggs, is added.

The Company has revamped its Public Awareness Program (PAP). It initiated a multi-lingual “Smell Gas, Act Fast” campaign with messaging to reinforce the importance of people calling 911 or 1-800-75-CONED any time they suspect a gas odor. Our program reaches customers through direct mail, youth outreach efforts, advertising, digital initiatives on gas safety and community events.

Con Edison participates in an annual Northeast Gas Association media campaign that uses radio, TV and online media to deliver gas safety messages on pipeline safety, emergency response and damage prevention. This campaign covers 20 Northeast media markets and typically airs more than 6,600 TV and radio spots, delivering the message to 35 million people. Con Edison analyzes statistics on gas emergency calls and conducts customer awareness studies, focus groups, and social media monitoring to continually evaluate our gas safety education programs.

Con Edison is in regular contact with emergency officials, including fire departments, police departments, and emergency management agencies. We offer programs for emergency officials including training sessions and/or drill exercises and tests, videos, and the Multiple Resource Response Event (Code MuRRE) protocol, which is an alert to field personnel for high hazard conditions requiring a heightened response by both Company and fire department personnel. The Company is looking to improve its training of fire department first responders by conducting more drills, hands-on activities and workshops. We work with these responders to review emergency processes and procedures.

Con Edison e-mails a letter to more than 300 public officials every year highlighting important gas safety information that should be shared with constituents. Our list includes city and county managers, building code enforcement departments, permitting departments and public works officials. 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 ongoing.

Responding to a Gas Leak

A prompt response is crucial in preventing reported leaks. Our enhanced outreach and education efforts have successfully raised awareness of the urgent need to report suspected gas odors. This is evident in the dramatic increase in gas odor calls since 2014. These calls come from the public, Con Edison workers, contractor crews and others. Multiple scans of the system contribute to finding additional outside leaks. Despite the increase of leak calls, the number of outstanding year-end leaks has significantly decreased and we continue to maintain a 30-minute response rate of approximately 90 percent, better than the 75 percent goal set by our state regulator and in the top quartile of the state. We are committed to maintaining our high performance in emergency response.
As shown in Figure 7-3 below, the year-ending leak inventory in 2018 was 250\(^1\), with the vast majority being non-hazardous Type 3 leaks. We continue to exceed the targets established by our regulators by fixing leaks in a timely manner and eliminating the highest-emitting Type 3 leaks.

**Figure 7-3: Outside Leak Backlogs (2014-2018)**

The average leak repair time has decreased substantially as shown in Figure 7-4 below. Leak repairs account for a large portion of our O&M costs, totaling approximately $40 million to $50 million per year.

\(^1\) This number does not include follow up surveys conducted in early 2019
During an incident or emergency, timely isolation of the gas system allows us to make safe any affected areas thus minimizing the danger to first responders and the public while reducing the delay in recovery operations. Con Edison has approximately 51,500 valves on its mains and 414,000 valves on its services. Because much of our distribution system is low-pressure cast iron, and installation of these mains in the late 1800s and early 1900s did not include isolation valves, much of our low-pressure system cannot be isolated without excavating to the main to cut and physically blocking the flow of gas. Isolation valves are installed through our Isolation Valve program and through the normal course of business, such as in our Main Replacement program. In 2017, Con Edison began installing isolation valves at locations that permit area isolation of critical customers in the case of an emergency. We are targeting approximately 520 critical customers, requiring the installation of approximately 1,000 valves for quicker area isolation. These customers include, but are not limited to: universities, hospitals, nursing homes, day-care centers and customers on life-sustaining equipment. The installation of these valves will permit faster containment during a potential gas event and mitigate the possible impacts to critical customers.

To minimize potential impacts to the gas transmission and distribution systems, maintain supply to firm gas customers and protect the public, we install remote operated valves (ROVs) at strategic locations on the gas transmission system. The program involves installing new ROVs, or converting existing transmission valves to operate as ROVs. Prioritization of ROV installations is based on the number of customers that would be negatively impacted by an emergency isolation within the existing ROV configuration. The ROV program includes the installation of at least one retrofit or new ROV per year, at an approximate cost of $3.5 million per valve.
System Reliability Improvement

Our design criteria plan for the future of the gas distribution and transmission system prioritizes system reliability, reduced impact of coastal flooding and reducing the risk of events that threaten public and employee safety. The Company performs network analysis modeling studies annually to identify areas with declining reliability. Con Edison then makes capital investments to reinforce the system by installing and upsizing gas mains, installing regulator stations and upgrading mains to higher operating pressures. Upsizing gas mains provides system flexibility and the opportunity to adjust to contingency conditions and supply limitations.

The Winter Load Relief program addresses areas on the system where the failure of a single component could result in a large-scale outage during the winter peak-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 days.

Our Gas Reliability Improvement program identifies vulnerabilities and determines the prioritization of projects. It 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 or reliability concerns for the next winter. Together, these programs fall under Distribution Programs, included in the 20-year capital budget.

Another crucial element of improving reliability is the Company’s liquefied natural gas (LNG) plant. The plant provides gas for peak times and may be used to save money for customers when conventional natural gas is expensive. The LNG plant will become even more important in a supply-constrained environment. Critical components of the plant are obsolete and the original equipment manufacturers are unavailable to provide parts and services. In order to bring the plant up to standard, we plan to invest more than $100 million the next five years. This investment will permit us to continue to deliver affordable natural gas to our customers when they need it most and that we continue to provide services for gas peaking, unplanned upstream gas system interruptions and gas-price volatility. During the heating season, the LNG plant can supply all the LNG stored in the tank at 10 million cubic feet per hour over four days. This amounts to about 15 percent of the daily supply needed to meet customer demand on peak winter days.

The investment is critical to plant safety and enhances our customer consumption experience. One investment will be a new nitrogen refrigeration cycle that will allow the plant to inject more quickly, increasing its fill rate to twice that of the original design capacity. The plant’s original nitrogen refrigeration cycle does not have sufficient capacity to cool natural gas to a fill rate of 6-million standard cubic feet a day. This investment will allow the company to fill the tank in 6 months, supporting full withdrawal for peaking and providing stability for pricing when needed.

The second investment will be in the withdrawal-process equipment (vaporizers), electrical motor control center and high-tension vault substation system. The upgrades to balance of plant equipment and fire detection and protection will improve the plant’s safety. These upgrades will allow the LNG Plant to remain an...
important resource, while enhancing the reliability and safety. The plant will continue to be a reliable source and an inexpensive in-city supply that we can use to reduce supply risks for the firm customer.

**Gas Infrastructure Plan Overview**

At our current investment trajectory, we will invest about $1.1 billion annually or $22 billion during the 20-year 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 our five-year business plan) to reflect future price level changes.

**Figure 7-5: 20-year Gas Capital Expenditure Forecast ($000)**

To better serve our customers, the Company invests a significant amount of capital into its distribution system. Figure 7-5 shows, distribution programs are the largest component of our infrastructure plan, comprising 50 percent of the $21.8 billion, 20-year infrastructure investment. These expenditures reduce risk, sustain system integrity, accommodate customer demand and maintain safety and reliability. One of our largest risk mitigation programs and capital investments is the Main Replacement program discussed below. Con Edison has approximately 1,800 miles of cast iron and unprotected steel in a small geographic footprint. We have accelerated this program so that in the next 20 years, we will replace this entire inventory at a cost of $8.3 billion.

About 25 percent of our small-diameter cast-iron mains are in Manhattan, where excavation is more expensive than in other boroughs. While Westchester County main replacement costs may be lower, it accounts for half of the inventory in the program. The primary benefit of replacement is the decrease in leaks, thereby lowering risk from non-hazardous leaks and reducing emissions.
Replacing about 40 percent of the distribution system requires establishing priorities. Con Edison analyzes project areas based on risk score for mains and services. We have a new risk-prioritization model that optimizes the removal of gas mains and vintage services. *Vintage service* is defined as an unprotected (pre-1972) steel service. The model prioritizes these assets by calculating a relative risk score for each pipe segment. The individual risk scores are then aggregated into project risk scores. These scores are created by analyzing gas pipe condition parameters (e.g., diameter and age), leak history and adjacent pipe failures. This new model includes internal and external data not previously incorporated, such as Company inspection results, environmental factors, building data, etc. The integration of these data sources will result in an up-to-date, accurate analysis. The Company plans to accelerate replacement of vintage pipe in the [FEMA 100 Year Flood Zone](#). Replacing this pipe will help to harden our gas distribution system against future storms.

The Company uses a geographic approach to bundle related work streams and takes advantage of coordination opportunities with other large projects undertaken by Con Edison, NYC, municipalities and third parties. This approach limits the impact of construction on communities and neighborhoods thus benefitting the customer.

As we accelerate our replacement of leak-prone main, the service replacements will increase. Vintage services, in particular, are being targeted in conjunction with main replacement projects. Our investments also replace services that have been identified as being the source of an active leak. For these services, replacement is the most prudent means to clear a gas leak and make the condition safe. About 20 percent of [incoming outside leaks](#) result in a service replacement.

**Transmission Programs**

The Company selects transmission main projects that support safe, reliable gas service to its customers at reasonable rates. Transmission mains are larger in diameter and operate at greater pressures than distribution mains. These mains are typically welded steel pipe and are coated and cathodically protected. As a result of stringent construction practices, large components and extensive subsurface interference, the installation cost can be 10 times more than that of distribution mains. Con Edison will continue to employ a risk-based approach to replace segments of the gas transmission system strategically.

Once the Pipeline and Hazardous Materials Safety Administration (PHMSA) finalizes the Safety of Gas Transmission and Gathering Pipelines rule (discussed in section 3), the Company will be required to replace approximately 35 miles of gas transmission main within the next 15 years. These mains are the highest-priority transmission mains as per the rule’s criteria. The Company will replace transmission mains where it will improve the reliability of the system. The transmission system, with the exception of [radial systems](#), will be able to withstand the loss of one gate station during peak hour demand without causing customer outages. The projects will maximize supply flexibility and deliverability and help us meet the needs of our firm customer base and electric generator requirements.

Replacing transmission mains with larger-diameter mains gives the Company flexibility and the opportunity to take the gas into its system when it is available and move it to where supply may be limited now, or in the
future. All new replacement transmission piping will be made of material that permits the pipe to operate below 20 percent SMYS. This reduces the risk associated with these pipes and provides long-term savings of the costs associated with maintaining older infrastructure. The new pipes do not meet regulatory definition of transmission pipe, and will be identified as distribution piping operating above 125 psig.

Customer Connections

New Business investments include the installation of new gas mains and/or services to provide gas to new customers or existing customers with increased load. Most jobs are small, requiring a single service and in some cases, a short main extension. In areas where natural gas is available, builders continue to request natural gas for heating, cooking and other needs. New Business installations remain a significant part of our plans to address continued gas demand requests.

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

We will continue to construct distribution regulator stations to accommodate demand. We believe we will need this investment to support increases in demand due to oil conversions, distributed generation and natural gas vehicles.

Public Improvement

In an area as congested as Greater New York, Con Edison’s gas infrastructure must co-exist with other utility facilities, including telephone, cable, sewer and water systems. When a municipal agency performs work within its public right of way, the presence of our facilities can affect the work. Under these circumstances, the Company is legally bound to accommodate the municipal activity and protect its assets.

If a municipality performs work, such as installing new or upgraded water mains near a Con Edison gas main or service, Con Edison must bear the cost of replacing, supporting and protecting its affected facilities. Often the facilities replaced have many years of useful life left, but we have little control over the amount or timing of public improvement investments being made by the City and other municipalities. Gas infrastructure relocations have increased significantly in recent years and are anticipated to continue at higher than historical levels.

As with all of our work, we seek 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 the large number of City projects. These can be considered one-time opportunities to install the correct-size facilities to accommodate anticipated demand growth. We collaborate with the other entities to benefit from common project elements. For instance, working in a common trench can reduce costs and disruption. Through the term of the long-range plan, we forecast expenditures of $2.8 billion for public improvement projects.
Gas Technology

Taking a prospective view of gas technology, we believe certain projects will significantly affect the way we do business. These projects include Mobility, GIS, and the continued implementation of the gas work and asset management system known as Gas Central. Combined, these projects require a capital investment of approximately $70 million over the 20-year planning horizon. This investment will help Gas Operations achieve greater operating efficiencies and adapt to evolving regulatory requirements.

Within Gas Operations, it is essential to provide complete, traceable and verifiable information for all gas-carrying assets. Our current practices are paper-centric, opening the opportunity for human error and contributing to the risk of incomplete or inaccurate records. Our assets must be traceable and our work practices transparent for us to address upcoming regulations respond to regulatory and legal inquiries. Failure to comply could lead to penalties and increase the risk to public safety. Gas Operations believes it must use the most current technology available to address these risks.

Gas Central will provide a central repository for all work and asset data related to Con Edison’s gas facilities. This system will improve resource scheduling, work bundling and customer experience. This project will yield strategic benefits that support corporate and Gas Operations goals and objectives.

Some examples are:

- Providing new tools for improved, transparent cost management
- An integrated view of financial and operations data, resulting in more effective risk-mitigation strategies
- Increased transparency
- More effective trending and analysis
- Improved operations efficiencies
- Enhanced compliance through refined asset management
- An enhanced customer experience through more accurate and timely information about work flow and job status
- Application of consistent processes and performance metrics

The new system will collect real-time data through mobile technology in the field, allowing Gas Operations to provide complete, traceable and verifiable records for its assets. Better and timely record-keeping will lead to increased efficiencies in crew routing, where we can use geospatial location and consider real-time traffic conditions. In addition, while the business has always operated in a stringent regulatory environment, the implementation of stricter integrity-management regulations has given rise to a new set of requirements that the existing operating model, supporting systems, and processes would be challenged to meet. The new system will enhance our ability to comply with these increasingly stringent pipeline safety and recordkeeping regulations, including the ability to meet new regulations for material and component traceability.
Furthermore, it will allow for tighter management of public safety protocols for asset inspection and surveillance programs. Finally, it will permit the prioritization of work through condition-based analysis that balances safety, resources and cost-effectiveness.

The Mobility project is a joint effort between Gas and Electric. The gas scope contemplates an interface that allows field personnel to receive, acknowledge and act on incoming work requests. It will also include a drawing tool that will let field personnel document leak migration patterns, the basis for the categorization of gas leaks, and propel appropriate leak management procedures. The tool will capture location and unit information on newly-installed, replaced or abandoned assets. The project supports the more efficient allocation of resources due to better tracking of labor availability and more transparent cost management. The mobility solution will improve our response to emergent events and allow for greater data-capture in the field.

The GIS upgrade will transition the existing Mains & Services (M&S) maps from a legacy system to a new ESRI GIS mapping system. This project will increase visibility though the consolidation of maps, as electric and gas facilities will be available on one map as opposed to multiple sources.
Cost is a key factor in our customer’s experience of our services. Although Con Edison has improved our customers’ experience, we must do more as customer expectations evolve. The customer expects us to provide world-class, reliable service at a reasonable cost. In order to maintain competitive pricing for our products, annual increases in customer bills must be mitigated. We must be proactive in monitoring and controlling our expenses. Accordingly, the Company is reviewing all parts of its business with the goal of operating as efficiently and cost-effectively as possible. We anticipate that in this initiative will substantially benefit customers in the next several years. Our responsibility to our customers includes being effective cost managers.

Impact on the Customer Bill

The infrastructure projects and programs mentioned in earlier sections will reduce risk and provide the high reliability and safety our customers expect. The infrastructure plan that supports these projects and programs lets us make certain projections regarding customer bills.

We strive to hold down customer bills and have outlined in this document several programs initiatives designed to monitor our infrastructure costs and help us work with customers to manage their energy usage. While we will continue to make every effort to keep our transmission and distribution costs down, it is important to convey that market and policy forces outside our control impact what customers pay. In particular, the composition, availability, and affordability of the gas supply will change during the 20-year planning horizon. Total customer bills include Con Edison’s tariff charges for delivery, supply, taxes, and regulatory fees. See Figure 8-1 below.

Figure 8-1: 2017 Residential Customer Bill
As the operator of delivery systems, we collect all the customer charges, which are on a monthly bill, and remit payments as required to appropriate parties. In 2017, delivery charges represented approximately 37 percent of the residential heating customer gas bill. The remaining 63 percent was for supply, and taxes and fees imposed by various suppliers and government agencies. As a proxy for our gas customers’ bill, we look at a typical residential customer with constant monthly consumption of approximately 100 therms over the planning period.

**Delivery Charges**

The delivery rate represents the cost of transporting energy from the point-of-supply to the Con Edison system, and to the end customer. This rate covers costs to build and maintain our transmission and distribution assets and to 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 recover the costs of those investments over time through accounting charges and earn a return on the capital we have invested in the assets that provide service.

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

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

**Taxes and Fees**

Customers typically pay a Gross Receipts Tax (GRT) on supply and delivery, and a sales tax. Also included in bills are taxes paid by Con Edison, such as income and property taxes, which represent 70 percent of total taxes and fees paid by the Company. In total, taxes make up approximately 31 percent of our customer gas bill.

The customer bill includes fees collected for external entities. The System Benefits Charge finances programs, such as energy efficiency, that have been determined by the Public Service Commission to be inadequately addressed by New York’s competitive energy markets. These fees comprise approximately 2 percent of the customer’s bill.

**Supply Charges**

Supply costs are a major component of our customers’ bills. Although Con Edison does not own significant sources of supply, we purchase natural gas on behalf for our full-service customers and pass those costs along without a profit or loss.
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. 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 charges for the cost of storing and delivering the gas to Con Edison for redelivery to customers when they need it. In 2017, total supply costs represented 30 percent of the average residential heating bill.

The Company charges a nominal fee, known as the Merchant Function Charge (MFC), for competitive functions that have been unbundled from base rates, and may be avoided by any customer purchasing gas transportation service only.

Figure 8-2 below depicts what might comprise the customer bill over the planning period.

![Figure 8-2: Customer Bill Forecast](image)

The Gas Long-Range Plan projects a customer bill compounded annual growth rate (CAGR) of 4.1 percent over the planning horizon. The projection includes the requested capital project and program investments in the current rate case.

There is upward pressure on the delivery and taxes and fees portions of the bill. Delivery increases are due to increased capital expenditures to manage system risk (e.g., accelerated main replacement), while increases in income and property taxes occur as our rate base grows.
Property Tax Implications

We have additional opportunities to lower the tax component of customer bills. Con Edison lobbies state and local New York’s state and local governments to reform utility taxation because taxes on utilities are regressive. Con Edison customers in NYC and Westchester County pay a plethora of taxes, assessments that function like taxes, and fees.

Customers pay Con Edison’s taxes. Property taxes are the Company’s largest tax expense, 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” add to our customers’ bills. Property taxes finance local governments and public schools. The money from property taxes are often the major revenue source for municipalities and as a result, they rely on our taxes to provide the services their citizens need and want.

Con Edison remains concerned about the high property taxes in our region and their impact on customer bills. The Company meets with representatives of the NYC Department of Finance and NYC’s Legal Department to discuss property tax issues. We try to settle litigation and discuss legislative initiatives in these meetings. We are working with other gas utilities in the state and the staff of the Public Service Commission to make the replacement small-diameter cast iron and unprotected steel mains exempt from property taxes. Our proposal is to continue the assessment on the retired pipe, and treat the 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 the property.
- Pursue eliminating the “Pegging Law,” which unfairly taxes certain 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 (not on Company-owned real estate).

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

- Economic obsolescence
- Functional obsolescence
- Identification of property that could be moved from taxable to non-taxable status

Our plan focuses on ensuring that our gas service remains reasonably priced for our customers. We continue to review our cost-management processes to maintain this focus and provide our employees with skills and tools to effectively track and manage costs.
Business Cost Optimization for a Sustainable Company

In New York, the utility business model is being rewritten as sales growth flattens or declines and new products and services become available. To best compete in the energy business and serve our customers, the Company must reduce its costs.

Large organizations add activities and costs over time. Healthy organizations periodically perform a thoughtful and thorough review of their costs to confirm that they are efficient and productive. We will do the same to remain a thriving, sustainable company. Our Business Cost Optimization (BCO) initiative identifies methods of reducing operations, maintenance and capital costs throughout every department within Con Edison and Orange & Rockland Utilities. Our goal remains to improve the way we work in order to optimize O&M and capital costs. The BCO program was implemented with a long-term and sustainable cost management process in mind.

Continued focus on spending is critical to the success of our business. The results of this effort will strengthen the Company and help it be sustainable.
Con Edison’s role in the customer experience expands beyond the customer bill. We not only need a safe, reliable system with wise investments in infrastructure improvements and expansion, we need to adapt and meet the changing expectations of our customers. These expectations include engagement on platforms customers prefer, including mobile applications and social media.

An example of adapting to meet customer preferences is the development of our Digital Customer Experience (DCX) program. DCX is designed to deliver an improved online experience for customers through a redesign of the customer interface, including the www.coned.com external website, the mobile website, the My Account portal and the mobile app. The Company’s platforms evolve to meet our customer’s changing expectations.

In addition to direct contact with customers, we maintain an active dialog with community-based organizations, civic leaders, advocacy groups, concerned citizens and public officials.

To benchmark our performance, we participate in J.D. Power and Associates surveys of residential and business customers for gas and electric utilities. We participate in industry association benchmarking, such as studies sponsored by the American Gas Association and the Northeast Gas Association. We conduct customer satisfaction surveys and monitor our information and education programs to gauge their effectiveness. Con Edison has an online community that provides feedback on various issues and topics. Some of the feedback we have received includes:

- Customers see gas as a long-term option for heating and will continue to convert when their existing oil and propane fired boilers reach end-of-life.
- Despite the increased awareness of the importance of gas safety, customers have not abandoned conversion projects.
- Delay in the restoration of street, sidewalk and private property after construction is the most frequent complaint.
- Customers want increased access to information.

**Government Relations, Regional and Community Affairs**

Con Edison participates in regular meetings and calls with the NYC Mayor’s Office, first-responder agencies (such as Emergency Management and police and fire) and other offices and agencies in our services area. The Company collaborates with the City on its sustainability efforts.

Operation of the gas system also requires that Con Edison maintain partnerships with City agencies for permitting purposes. The Company meets regularly with NYC DOT to manage construction and reduce potential impacts to local communities, especially for the accelerated gas main replacement work we have been performing the past several years. Additionally, we coordinate and share with NYC DOB information on the gas inspection and reconnection process and illegal piping.
Communities We Serve

We work with community partners, including customers, elected officials, community boards, municipal officials, public agencies and community groups to educate them about our gas system. We maintain strong working relationships with them.

The Company engages the communities we serve through an employee-led effort. We support local nonprofits through funding and volunteer events. Employees get a calendar of events where they can volunteer. We have a matching gifts program. Both of these initiatives empower employees to support the organizations and causes in our service area that they care about most. A number of Con Edison employees sit on boards of nonprofit organizations.

Employee Engagement

Through internal and external communications and partnerships, Con Edison engages its employees by promoting diversity and inclusion, providing opportunities for employees to support community partners, and educating employees on aspects of their work. We keep our employees abreast of corporate strategy, changes in the industry, the employees’ role in the Company’s success, and how they can collaborate among departments.

Diversity and Inclusion

Con Edison incorporates diversity and inclusion into everything we do. The Company highlights the diversity of its employees through employee communications. Our Corporate Affairs department helps publish the annual corporate diversity report, which illustrates our strengths. The Company receives external diversity and inclusion awards. Corporate Affairs promotes these awards, as well as the Company’s own internal awards.

Con Edison uses its website, social media, tower lighting and non-profit partners to highlight its commitment to diversity. The Company helps to recruit and develop a diverse workforce through charitable grants for technical education programs, Society of Women Engineers recruitment events, hiring of veterans and other efforts.
Education and Training

Training is among our most beneficial investments. The Learning Center is a corporate education facility where we train and test employees in skills they need to safely and productively perform their work. The Learning Center includes classrooms and hands-on labs for real-life learning. Instructors are a combination of former field, office, line personnel and external subject matter experts. The curriculum includes courses in two general categories: skills training and leadership development.

Skills Training

Rapid changes in our industry will require an evaluation of methods to provide the service our customers want, maintain reliability and work safely. Improving our infrastructure and the increasing monitoring and control of our system will require processing and analyzing large volumes of data — from customer demand and pressure flow analysis to condition-based maintenance. Managing the customer experience will be transformed by the availability of new information. This will create an exponential increase in customer service requirements to explain and make the data easily understood and actionable by customers. The skills needed to handle these requirements continue to change. Con Edison is helping our workforce meet these challenges.

The Learning Center offers digital, physical, mobile and virtual media. Integrating these learning technologies into the classroom will help narrow the gap between skills training and real-world performance. Courses for new employees in Gas Construction and Gas Distribution Services provide comprehensive block training and testing. These courses span five to eight weeks and use a mix of TLC and Gas Technology Institute (GTI) course material. Throughout the course, students receive classroom lectures and practice hands-on application of skills.

Leadership Development

It is important to consistently recruit and develop our Company's future leaders. Our Leadership Development curriculum includes workshops and programs to meet the needs of potential leaders, emerging leaders and seasoned leaders. The goal is to enhance their ability to coach, engage and challenge their teams toward success. Our career management resources provide guidance in assessing skills, identifying goals and creating and implementing customized development plans for employees at all levels. With a focus on preparing employees to successfully lead the Con Edison of tomorrow, our priority is to enhance business acumen, communication skills, and strategic and analytical thinking to drive results. This involves open discussions with activities and case studies on topics such as accountability, active listening, feedback and continuous improvement practices.
10. Conclusion

Our 20-year GLRP presents CECONY’s multifaceted, flexible plan for fulfilling the Company’s goal of continuing to provide our gas customers with safe, reliable service while giving them access to new products and services and the information they need to manage their usage. This plan will guide our decisions on investments, training, and technology adoption, thus improving the customer experience and other programs and initiatives. The long-term planning efforts detailed in the plan are built on three strategic priorities to ensure future success: public and employee safety, operational excellence and customer experience.

As described in this plan, CECONY will strategically invest in new technologies and capabilities that expand our ability to manage and operate the system. Initiatives to support efficient use of natural gas and core infrastructure will enable us to continue providing safe and reliable natural gas to customers. To ensure the success of these investments, the GLRP details CECONY’s plans to engage with our stakeholders, including state regulators, municipal officials, customers, employees, community groups and others. Further, the Company is acutely aware of the impact increasing energy costs have on our customers, and will work to manage our costs to keep bills affordable.

This plan is designed to be flexible, to help the Company navigate today’s challenges while preparing for changes in the energy landscape. Elements of our GLRP—our strategy, investment planning and stakeholder engagement—will put Con Edison in position to support a safe, clean, resilient, prosperous and sustainable future for the residents and businesses in our service territory.
The following terms are found throughout this document. For clarification, explanations are provided for your reference.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tbody>
<tr>
<td>16 NYCRR Part 255</td>
<td>A NYS code that prescribes minimum safety requirements for the design, fabrication, installation, inspection, testing and operation and maintenance of gas transmission and distribution systems. These include gas gathering lines, gas pipelines, gas compressor stations, gas metering and regulating stations, gas mains, service lines, and gas storage equipment of the closed-pipe type fabricated or forged from pipe or fabricated from pipe and fittings. It includes gas storage lines not covered by 49 CFR 192.</td>
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<tr>
<td>49 CFR Part 192</td>
<td>A Federal code that prescribes minimum safety requirements for pipeline facilities and the transportation of gas.</td>
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<tr>
<td>Advanced Metering Infrastructure (AMI)</td>
<td>Systems that measure, collect, and analyze energy usage, while communicating with utility metering devices, either on request or on a schedule. These systems include hardware, software, communications, consumer energy displays and controllers, customer associated systems, meter data management software, and supplier business systems.</td>
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<tr>
<td>assets</td>
<td>Items of value owned by or owed to a business. Utility assets are classified on the balance sheet as: Utility Plant, Other Property and Investments, Current and Accrued Assets, and Deferred Debits.</td>
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<tr>
<td>building envelope</td>
<td>The physical separator between the conditioned and unconditioned environment of a building, including the resistance to air, water, heat, light, and noise transfer.</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 sewage. It has relatively good corrosion characteristics but is less ductile than the piping used today.</td>
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<tr>
<td>catholically-protected 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>citygate</td>
<td>The point at which a distribution gas company receives gas from a pipeline company.</td>
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<tr>
<td>Class of Service</td>
<td>Service classification is a parameter used to group customers receiving similar types of gas service (e.g., residential, commercial, etc.).</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 usable steam.</td>
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<td>common trench</td>
<td>A trench containing two or more utilities.</td>
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<tr>
<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, Western Canada, and has recently begun to penetrate some regions of the United States. Small amounts of CNG are transported overland in high-pressure containers.</td>
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<tr>
<td>compressor station</td>
<td>Any permanent combination of facilities (such as a special turbine, motor or engine) that supplies the energy to move gas at increased pressure from other lower-pressure systems.</td>
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<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>dekatherm (Dth)</td>
<td>A measurement unit for heat: 10 therms or 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>delivered services</td>
<td>Products offered by third parties that have firm contractual rights to pipeline capacity and are willing to sell the capacity, bundled with natural gas commodity, for short durations (15 or 30 days). Delivered services do not include long-term renewal options.</td>
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<tr>
<td>delivery rate</td>
<td>The portion of the customer bill that has been set to recover Con Edison’s revenue requirement, which represents the annual delivery revenues required to cover operating expenses and earn a return on the company’s net investment to provide service.</td>
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<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>direct load control</td>
<td>A remotely-controllable switch that can turn power to a load or appliance on or off. Such a device could be used to regulate the amount of power that a load can consume. Direct load control devices can be operated by a utility or third-party energy provider to reduce a</td>
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<tr>
<td>distributed generation (DG)</td>
<td>Electricity generating apparatus sited at a customer’s location 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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<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, threatening life and/or creating 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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<tr>
<td>Energy Efficiency Portfolio Standard (EEPS)</td>
<td>In May 2007, the EEPS proceeding was initiated by the NYS 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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<tr>
<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>
</tr>
<tr>
<td>FEMA 100-year flood zone</td>
<td>FEMA flood zones are geographic areas that the Federal Emergency Management Agency has defined according to varying levels of flood risk. Each zone reflects the severity or type of flooding in the area. 100 year flood zone are areas with a 1 percent annual chance of flooding.</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>
</tr>
<tr>
<td>fuel cell</td>
<td>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.</td>
</tr>
<tr>
<td>full-service customer</td>
<td>Service provided to customers (regardless of Class of Service, under schedules or contracts) by the company and not by an ESCO or third party.</td>
</tr>
<tr>
<td>gas service</td>
<td>A distribution line that transports gas from a common source of supply to a customer.</td>
</tr>
<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>
</tr>
<tr>
<td>Geographic Information System (GIS)</td>
<td>A system designed to capture, store, manipulate, analyze, manage, and present spatial or geographic data.</td>
</tr>
<tr>
<td>geothermal heat pump</td>
<td>Also known as a ground source heat pump (GSHP), a central heating and/or cooling system that transfers heat to or from the ground. It uses the earth all the time, without any intermittency, as a heat source (in the winter) or a heat sink (in the summer).</td>
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<tr>
<td>greenhouse gas (GHG)</td>
<td>These are gases which allow direct sunlight to reach the Earth’s surface unimpeded. The main greenhouse gases in the earth’s atmosphere are water vapor, carbon dioxide, methane, nitrous oxide and ozone.</td>
</tr>
<tr>
<td>heat sink</td>
<td>A device or substance for absorbing excessive or unwanted heat.</td>
</tr>
<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 (product) is approximately offset by a corresponding gain (or loss) when the contract is liquidated.</td>
</tr>
<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>
</tr>
<tr>
<td>High Consequence Areas (HCAs)</td>
<td>A location that is specially-defined in pipeline safety regulations as an area where pipeline releases could have greater consequences to health and safety or the environment.</td>
</tr>
<tr>
<td>incoming outside leaks</td>
<td>Gas leaks reported to or by the company.</td>
</tr>
<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>
</tr>
<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>
</tr>
<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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<td>Term</td>
<td>Definition</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>
</tr>
<tr>
<td>leak</td>
<td>An unintended hole, crack, break or the like, through which gas escapes a pipe or fitting.</td>
</tr>
<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>Load-Serving Entity</td>
<td>Industry term for what most people would call a utility, or an electric company. This is a company or other organization that supplies load (electricity) to a customer.</td>
</tr>
<tr>
<td>Main Replacement program</td>
<td>The gas main replacement program that uses software to prioritize 12-inch and smaller cast iron, wrought iron and unprotected steel requiring replacement based on a variety of factors.</td>
</tr>
<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>
</tr>
<tr>
<td>megawatt (MW)</td>
<td>A unit of power equal to one million watts</td>
</tr>
<tr>
<td>metering station</td>
<td>A custody transfer point designed to measure the transfer of natural gas using a flow meter.</td>
</tr>
<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>
</tr>
<tr>
<td>midstream pipeline</td>
<td>A transport system used to move crude oil from production sites to refineries and deliver the various refined products to downstream distributors. Natural gas pipeline networks aggregate gas from natural gas purification plants and deliver it to downstream customers, such as local utilities.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</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>
</tr>
<tr>
<td>natural gas vehicle (NGV)</td>
<td>A vehicle that is equipped to operate using natural gas as fuel</td>
</tr>
<tr>
<td>New York State Energy Research and Development Authority (NYSERDA)</td>
<td>A public benefit corporation created in 1975 and currently primarily funded by utility ratepayers through the System Benefits Charge (SBC) on their bills. 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. NYSERDA is the central procurement administrator for renewable energy sources in NYS.</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>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. Propane contains approximately 2,500 Btu per cubic foot.</td>
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<td><strong>Term</strong></td>
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<tr>
<td>psig</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>The NYS 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>radial system</td>
<td>A type of system where there is only one source or one path from the source for a group of customers. The loss of this one source or path will result in an outage for that group of customers.</td>
</tr>
<tr>
<td>Reforming the Energy Vision (REV)</td>
<td>NYS’s comprehensive energy strategy 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 the state.</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>renewable gas</td>
<td>A mixture of different gases produced by the breakdown of organic matter in the absence of oxygen. Biogas can be produced from raw materials such as agricultural waste, manure, municipal waste, plant material, sewage, green waste or food waste.</td>
</tr>
<tr>
<td>renewable heating and cooling (RHC)</td>
<td>The generation of energy from renewable technologies and resources to serve end-use applications</td>
</tr>
<tr>
<td>right of way</td>
<td>The legal right, established by usage or grant, to pass along a specific route through grounds or property belonging to another.</td>
</tr>
<tr>
<td>service line</td>
<td>A gas pipe that starts at the gas main in the street and 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>
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<tr>
<td>shale gas</td>
<td>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.</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>siting process</td>
<td>The process of determining the optimal location for a pipeline after all impact factors are taken into consideration.</td>
</tr>
<tr>
<td>specified minimum yield strength (SMYS)</td>
<td>The stress point at which a material begins to deform plastically.</td>
</tr>
<tr>
<td>spark spread</td>
<td>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.</td>
</tr>
<tr>
<td>spot market</td>
<td>Also known as cash market, it is a public financial exchange in which financial instruments or commodities are traded for immediate delivery. It contrasts with a futures market, in which delivery is due at a later date.</td>
</tr>
<tr>
<td>storage</td>
<td>Facilities or a portion of a facility 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>thermal conductivity</td>
<td>The property of a material to conduct heat. Heat transfer occurs at a lower rate in materials of low thermal conductivity than in materials of high thermal conductivity. Correspondingly, materials of high thermal conductivity are widely used in heat sink applications and materials of low thermal conductivity are used as thermal insulation. The thermal conductivity of a material may depend on temperature.</td>
</tr>
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<tr>
<td>Transmission Integrity Management Program (TIMP)</td>
<td>A federally-mandated program which specifies how pipeline operators must identify, prioritize, assess, evaluate, repair and validate the integrity of gas transmission pipelines that could, in the event of a leak or failure, affect High Consequence Areas (HCAs) within the United States.</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 psig are treated as transmission pipelines, regardless of SMYS.</td>
</tr>
<tr>
<td>transportation service</td>
<td>Full-service customers acquire their gas from Con Edison. Transportation customers acquire their gas from third-party marketers.</td>
</tr>
<tr>
<td>Type 3 leak</td>
<td>This is a leak that is not immediately hazardous at the time of detection and can be reasonably expected to remain that way. However, Type 3 leaks are reevaluated during the next required leakage survey or annually, whichever is less.</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>uprating</td>
<td>An increase in the maximum allowable operating pressure of a system pipeline.</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>
</tr>
<tr>
<td>volatility</td>
<td>A term indicating how much and how quickly the value of an investment, market, or market sector changes.</td>
</tr>
<tr>
<td>wellhead gas price</td>
<td>The price less transportation costs charged by the producer for natural gas.</td>
</tr>
</tbody>
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