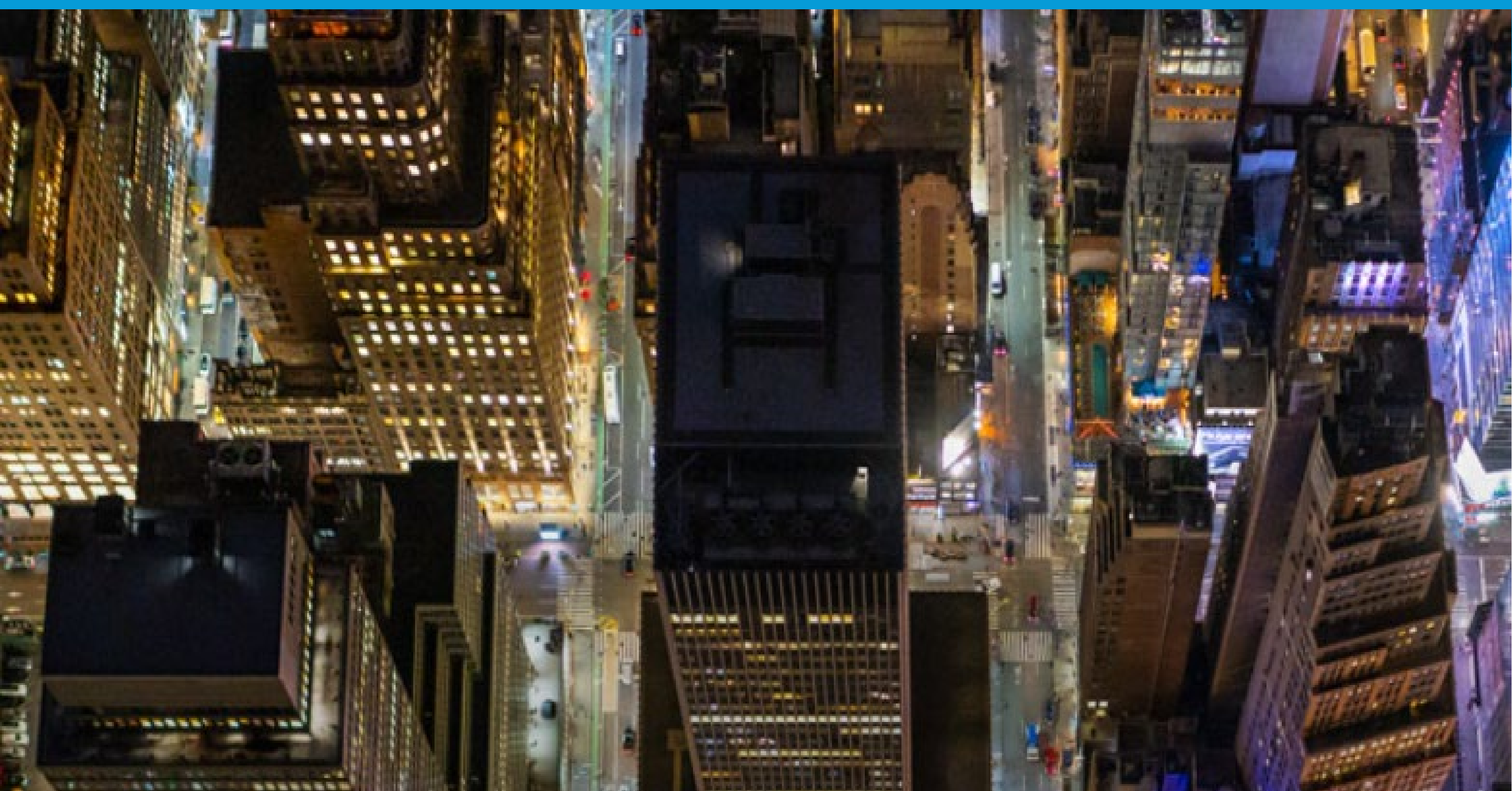
conEdison, inc.

Long-Range Plan

Our District Steam System



A Comprehensive View of Our Steam System through 2050

About this Long-Range Plan

This document and the statements and analysis contained within are based on information available as of April 2021.

Executive Summary

The Consolidated Edison Company of New York, Inc. (CECONY) operates a district steam energy system serving over 1500 buildings representing up to 3 million people who work, live, and visit New York City. Steam is an essential piece of our integrated energy system and strengthens New York City's energy resiliency by reducing peak electric demand and providing a low carbon alternative to onsite fossil gas or oil. Our steam system is considered one of the cleanest energy sources available in the market today.

Even as we continue to invest in and operate our steam system for reliable, safe, and secure energy delivery, the world around us is evolving. Key emerging trends include shifts in customer and stakeholder expectations, a changing climate, clean energy legislation, technological advancement, and equity and environmental justice reform.

Customers and stakeholders today expect greater comfort, convenience, choice, and control in all aspects of their lives, including in energy solutions. Climate change is leading to severe weather and increasing the potential for extreme events such as devastating Nor'easters and dramatic cold spells. In response, New York State and New York City want to achieve net-zero greenhouse gas (GHG) emissions by 2050. They aim to do this through policy and market enablement, as well as supporting resilience efforts to prepare energy production and delivery systems for a changing climate. At the same time, technological improvements are expected to improve the viability of low-to-zero carbon gaseous fuel alternatives to fossil natural gas. The world is also paying close attention to equity and environmental justice matters and many of our customers and stakeholders want action now.

We welcome this call to action. Con Edison, Inc., our parent company, has deepened its **Clean Energy Commitment,** reflecting its strategy to lead New York to net-zero GHG emissions 2050. This commitment builds on past activities as a climate leader, outlined in our **Sustainability Report**, and boldly expands on that work, providing actionable metrics and targets for us to meet in the future.

Specifically, this commitment calls for us to reduce our company's carbon footprint with a focus on **decarbonizing our steam system**. Decarbonizing our steam system means transforming our energy supply. Specifically, CECONY is:

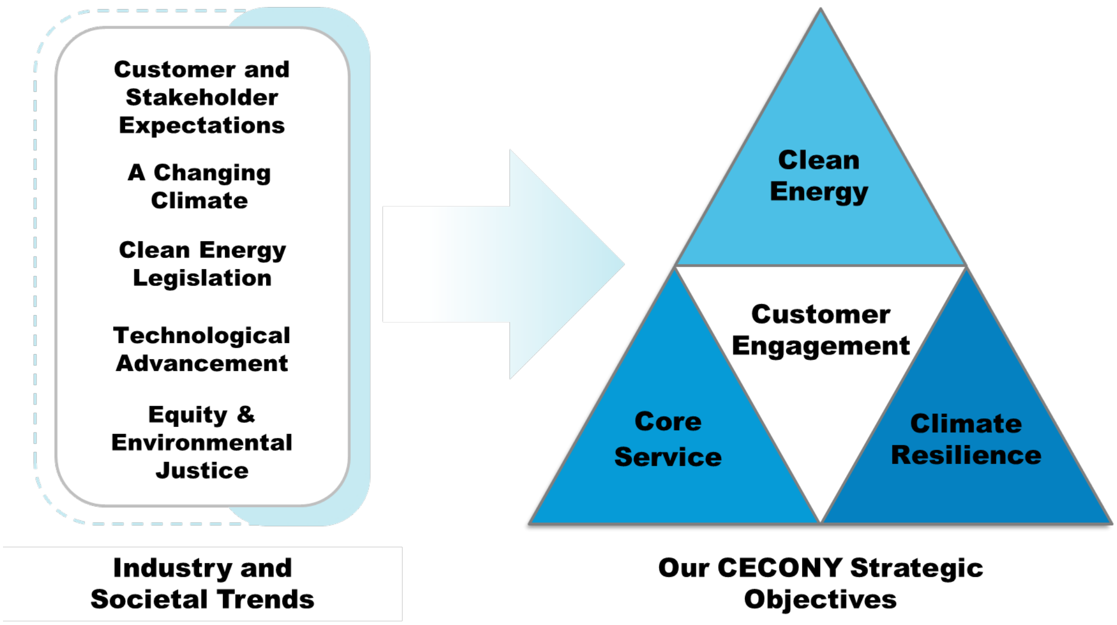
- Building a low-to-zero carbon gaseous fuels portfolio
- Supporting the electrification of steam boilers with clean energy
- Assessing carbon capture and other methods to support a net-zero GHG emissions future
- Enabling a fundamental change in energy consumption by supporting energy efficiency for our customers and the transition of current hard-to-electrify[1] oil and gas customers onto our steam system
- Managing rate impacts by selecting the lowest cost decarbonization solutions and implementing them over time

[1] Our definition of hard-to-electrify buildings include those buildings that are either prohibitively expensive to retrofit with electric building heating technologies, inclusive of available subsidies, or are technically impractical to retrofit with electric building heating technologies due to the engineering or design characteristics of the building.

This Long-Range Plan articulates the strategies, actions, and investments necessary to deliver our comprehensive strategic objectives in four key areas:

- **Clean Energy:** Economy-wide net-zero GHG emissions in our service territories by 2050
- **Climate Resilience:** Increased resilience of our energy infrastructure to adapt to climate change
- **Core Service:** World-class safety, reliability, and security, while managing the rate impacts and equity challenges of the energy transition
- **Customer Engagement:** Industry-leading customer experience and facilitation through the energy transition

Figure 1. How Industry and Societal Trends Impact our Strategic Objectives



To deliver on these strategic objectives, we anticipate investing approximately $1.5 billion over the next 10 years. Beyond 10 years, we will need to continue investing across our steam system to ultimately achieve economy-wide net-zero GHG emissions by 2050. Given some degree of uncertainty in the trajectory of technology, policy, and customer adoption, we will build flexibility into our planning and in future long-range plans.

Considering this uncertainty, we studied several scenarios to reach net-zero GHG emissions by 2050. We then selected three pathways that inform our decarbonization strategy and that represent a range of possible solutions. The pathways depict energy futures ranging from full electrification supported by our steam system (including building heating) to a mix of electrification and low-to-zero carbon gaseous fuels, such as renewable natural gas (RNG) and hydrogen. Each pathway relies on significant increases in adoption of energy efficiency and a transition away from fossil fuel use to clean electricity, clean steam, and/or low-to-zero carbon gaseous fuels in buildings. Our strategy and plans maintain optionality and flexibility based on signposts (indicators to ramp up or down specific programs or actions based on technological and policy shifts) to achieve the future value our societies, communities and customers expect. Each of these pathways is detailed in Table 1.

Table 1. Representative Steam System Pathways

	Full Electrification	Targeted Electrification	Hybrid Consumption
Steam Building Heating	Decarbonized steam supports building heating in our service territory not covered by electric[2]	Decarbonized steam supports building heating in our service territory not covered by electric and/or not covered by on-site combustion of low-to-zero carbon gaseous fuels[3]	Decarbonized steam supports building heating in our service territory not covered by electric and/or not covered by on-site combustion of low-to-zero carbon gaseous fuels[4]
Gaseous Fuel Usage	170 TBtu of gaseous fuels are used for electric and steam generation (100% low-to-zero carbon); no gaseous fuels are used for buildings as the gas distribution system is decommissioned	250 TBtu of gaseous fuels are used across all sectors (100% low-to-zero carbon)	296 TBtu of gaseous fuels are used across all sectors (70% low-to-zero carbon)

For additional information about CECONY's combined building heating approach, please refer to the **Integrated Long-Range Plan**.

In all pathways, we expect our steam sales volumes to modestly decline and will plan system needs accordingly. However, we project that our steam system will continue to play an important role in supporting our customers' needs through 2050, as the energy transformation progresses. Maintaining the steam system provides benefits such as lowering costs of the overall clean energy transition, providing fuel diversity, and effectively meeting the reliability requirements of the entire bulk power system. We expect this value will continue well into the future.

These representative pathways help us understand what investments are prudent no matter what the future holds, such as initiatives to accelerate energy efficiency and to support new steam system connections for hard-to-electrify customers. They also support the research and piloting of new technologies (e.g., low-to-zero-carbon gaseous fuels) as they become viable and necessary to achieve net-zero GHG emissions by 2050.

As a regulated utility with a customer-first business model, we are well-suited to make these investments. In the nearly one and a half centuries we have operated our steam system, we have repeatedly evolved our business. We will continue to serve our customers with safe, secure, and reliable energy while mitigating cost increases in the face of industry and technology change.

Our long-range plans and analysis are based on clean energy policies as of April 2021. However, New York State, New York City, and local municipalities continue to enact nation-leading clean energy policies and may develop future legislation. We continue to closely monitor and help shape this rapidly evolving landscape to create beneficial outcomes for our customers

[2] In this pathway, 100% of total building heating demand is served by electricity and/or steam

[3] In this pathway, between 70%-80% of total building heating demand is served by electricity and/or steam

[4] In this pathway, between 50%-60% of total building heating demand is served by electricity and/or steam

and stakeholders. We will review and appropriately modify our plans and supporting strategies, as necessary.

CECONY is experienced and well-positioned to support our customers and provide value throughout the clean energy transition, but we cannot do it alone. We will collaborate with customers, regulators, policymakers, capital providers, and other stakeholders to achieve this future with the principles of equity and environmental justice in mind.

Clean Energy

New York State and New York City have passed nation-leading legislation—the **Climate Leadership and Community Protection Act** (CLCPA) and the **Climate Mobilization Act** (CMA)—that target economy-wide net-zero GHG emissions by 2050. These policies and regulations create objectives that involve various stakeholders and numerous paths to achievement.

We have considered the objectives of this legislation and find they align with our own views of a clean energy future. By decarbonizing the steam system, we can reduce our use of fossil natural gas and provide a low-carbon alternative for hard-to-electrify buildings in support of the CLCPA and CMA.

We have developed a strategy to help achieve economy-wide net-zero GHG emissions in our service territories by 2050 and have already significantly decarbonized our steam system. Since 1990[5] and 2005[6] we have achieved 61% and 53% GHG reductions from our steam combustion emissions, respectively. We are proud that these investments support the 40% economy-wide GHG emissions reduction by 2030 goal and will continue to pursue further decarbonization efforts to enable lower total CECONY-wide (electric, gas, and steam) energy emissions. An overview of our ongoing efforts to support steam system decarbonization is included in Figure 2.

Figure 2. Steam Clean Energy Strategies

Transform the Energy Supply			Enable a Fundamental Change in Energy Consumption	
Decarbonize our steam system generation through various technologies.			Transform how our **customers consume** energy by supporting efficiency and new steam connections.	
Build a **low-to-zero carbon gaseous fuels** portfolio	Support the **electrification of boilers** with clean energy	Support **other methods** to de-carbonize our steam system	Support **energy efficiency** at steam generation facilities, distribution facilities, and customer premises	Encourage **new steam system** connections for hard-to-electrify customers

Transform the energy supply includes research, analysis, and pilots in clean technology. Opportunities we are pursuing include hydrogen, electric boilers, and carbon capture. We will continue to assess the viability of these opportunities and invest in technologies that provide a cost-effective decarbonization option.

Enable a fundamental change in energy consumption includes working closely with our gas and electric colleagues to target hard-to-electrify customers that would benefit from transitioning

[5] The CLCPA requires an 85% reduction in GHG emissions by 2050, using 1990 as a benchmark year.

[6] The CMA requires an 40% reduction in GHG emissions of buildings by 2030, using 2005 as a benchmark year.

to steam from oil or on-site fossil gas combustion. Additionally, we will be reviewing energy efficiency options with these potential new customers as well as our existing customer base. . We will pursue these customers and provide them with helpful information on what energy choices are available.

Over the next several decades, our steam infrastructure will continue to serve a supporting role in our integrated energy system by offsetting incremental electric demand and providing an alternative fuel source to support system resiliency. Steam is an integral component of achieving our economy-wide decarbonization goals and we will continue to work toward creating a net-zero GHG emissions system.

Climate Resilience

Since experiencing the impact of Superstorm Sandy, we have invested over $116 million in storm hardening of our steam system . While we have already made significant changes to harden our system against storms, we acknowledge that climate change is intensifying, and continued vigilance is needed to keep our system operating reliably and resiliently in the future.

We partnered with Columbia University to perform an industry-leading **Climate Change Vulnerability Study** to understand current climate risks and project future risks on our steam system. We identified several specific risks:

- **Heat waves:** Heat waves may lead to a higher chance of device failure and shorten equipment lifespan, and cause a spike in air conditioning demand that is supported by the steam system
- **Heavy precipitation:** Heavy precipitation can cause water intrusion to our steam infrastructure, disrupting service
- **Sea level rise and storm surge:** Sea level rise and storm surge can likewise cause water intrusion into our steam assets, disrupting service
- **Cold spells:** Dramatic cold spells can cause a significant increase in demand, which requires us to operate our steam system close to or at peak capacity
- **Extreme weather events:** Events such as hurricanes, tornadoes, and Nor'easters may disrupt steam generation through physical damage or service disruption

As a result of the study, we are implementing our **Climate Change Implementation Plan** through a variety of initiatives, including the following examples from our Prevent, Mitigate and Respond framework:

Prevent: Harden Infrastructure

- Executing our steam distribution infrastructure condition program to rebuild and rehabilitate steam structures to prevent water intrusion
- Conducting a complete risk assessment of the entire steam distribution network using our state if the art modeling software. Areas of the system identified as "high risk" during storm conditions will be investigated, reviewed, and remediated using various strategies.

- Upgrade to FEMA +5 standards to account for projected climate change in our service territories

Mitigate: Minimize Disruptions

- Replace main valves throughout our system to isolate steam system outages during a climate event

Respond: Reduce Recovery Timeframe

- Implement a Steam Advanced Metering Infrastructure (AMI) to improve our visibility and ability to respond to events quickly and comprehensively
- Continuous review and improvement our storm response plans based on recent storm experiences

Core Service

Providing energy to the New York City economy is CECONY's core responsibility. We are committed to providing safe, secure, and reliable steam service while managing rate impacts and providing equity and value to low- and moderate-income communities. The key components of our Core Service strategic objective are included in Figure 3.

Figure 3. Key Components of Core Service

Enhancing safety is always a top priority. Accordingly, we have enterprise-wide safety programs that are designed to minimize safety incidents. Safety is also rolled into our Steam Risk Mitigation program. For example, our Steam Distribution Infrastructure Condition program involves rebuilding and rehabilitating deteriorated steam structures to prevent water intrusion, improving the safety of our distribution infrastructure.

Enhancing security is critical as we transition to a more digitally enabled energy system. We have a dedicated cybersecurity team that identifies, prevents, and mitigates cyber threats from internal and external sources. We also physically protect our critical energy generation and distribution assets from external threats.

Enhancing reliability is a baseline expectation. We are proud of our commitment to ongoing steam system reliability. Initiatives under our Steam Risk Mitigation program focus on adequate system maintenance, staff training, and continuous system monitoring. Our geographic information system (GIS) upgrade will include a full mapping of the steam system, which will facilitate faster outage response times, reduce system risks, and improve our ability to monitor and optimize steam generation.

Managing the rate impact of the transition is imperative to minimize the financial burden associated with this clean energy on our steam customers. We will consider new, innovative approaches, alternative funding sources, and policy tools to manage rate impacts (e.g., cross-commodity subsidization, securitization, trust fund, government grants). As we reduce the use of fossil fuels and increase deployment of innovative decarbonization technologies on our system, we are exploring ways to mitigate long-term rate impacts and avoid undue burden on existing and future customers.

Enabling an equitable transition means making sure that historically disadvantaged communities are not disproportionately burdened by the energy transition and that they benefit from clean energy. We are reviewing opportunities in our service territory to partner with low- and moderate income buildings & campuses to offer a cost competitive alternative to electrification.

Investing in our diverse, inclusive, and talented workforce is central to our success. It makes the company stronger and helps us lead the industry on every level, from maintaining our best-in-class reliability to achieving a sustainable future for our company and making sure every employee feels respected, included, and heard. Furthermore, we know that technology will play a key role in building a resilient, reliable district steam system that delivers 100% clean energy. Our employees will need strong technical skills to operate, monitor and maintain advanced energy infrastructure. We provide continuous state-of-the-art training and development to our employees in a wide variety of areas, including technical and operations training, as well as strengthening leadership competencies.

Customer Engagement

We will deliver increased value through a dynamic customer experience that meets evolving expectations and enhanced engagement. This includes informing customers of their best energy options and serving as a trusted advisor. We view Customer Engagement as a core element of our strategic objectives and the connection point that makes Clean Energy, Core Service, and Climate Resilience possible.

As part of the energy transition, hundreds, if not thousands, of large building owners will have to make energy decisions that align with GHG emission targets and the realities of climate change. Making these decisions is challenging. There can be a lack of energy data to inform how and when customers use energy. There are also significant upfront costs for clean energy solutions. Our Customer Engagement strategy is designed to support customer decision-making with impactful services and tools, including:

- An AMI program that will provide customers with an improved customer experience. While our largest customers currently have access to the monthly energy data, an AMI program will provide a higher level of detailed energy use data as well as an improved user interface. Moreover, this program will allow all of our customers to access that level of information.
- Our CECONY energy efficiency program, designed to offset some of the high upfront costs of building envelope and controls upgrades
- Onsite building energy audits for existing customers to identify energy efficiency opportunities and strategies

- Energy option comparisons for both new and existing buildings, providing customers with the latest information so they can make fully-informed decisions

Our customers expect us to continue delivering our Core Services while improving the customer experience. They want to easily interact with us. They expect CECONY to secure their private data and information, to quickly inform them about leaks or other safety concerns, and to communicate frequently and proactively in the event of an outage. Accordingly, we continue to invest in programs to improve our customers' experience.

Cost-Effectiveness

Significant utility and customer investments will be required to achieve the clean energy future expected by our communities and customers. In addition to the core safety, reliability, security, and improved customer experience that we are providing, CECONY's future investments will provide enhanced climate resilience and GHG emissions reductions. A recent New York State Energy Research & Development Authority (NYSERDA) analysis estimates that societal benefits due to avoided GHG emissions and improved health will outweigh the costs needed to achieve net-zero GHG emissions by 2050.[7]

To deliver these objectives, we anticipate investing approximately $1.5 billion in our steam system through 2031. We anticipate that many of these investments will provide customers a cost-effective way to comply with City emissions limits. In addition, we will prioritize energy solutions and investments that provide multiple benefits.

We are focused on mitigating cost increases by pursuing operational and capital efficiency and effectiveness. We also continue to advocate for cost-based rates that provide customers with price signals and promote efficient use of the delivery system.

The Road Ahead

We are committed to meeting expectations for steam delivery and to meaningfully advancing progress toward societal goals and combatting climate change. These ongoing actions will deliver value for our customers and society, but they require significant investment.

Our steam utility is well-positioned to support this transition. Utility investments are a cost-effective way to meet societal objectives, and we are focused on driving the effectiveness and efficiency of our operations and capital investments through:

- Continued operational improvement and business cost optimization
- Ongoing investment in clean technology to further decarbonize our steam system
- Implementing solutions that focus on cost-effectiveness, including converting customers to steam that are otherwise hard-to-electrify, along with energy efficiency measures
- Driving toward a more integrated energy system where we can provide customers with the best energy options, whether it be steam, electrification, or low-to-zero-carbon gaseous fuels

[7] Supporting reports by NYSERDA and the New York State Climate Action Council can be found **here** and **here**, respectively.

- Advocating for policy that offers flexibility in achieving net-zero GHG emissions
- Investing in our diverse, inclusive, and talented workforce

We look forward to working with our customers, stakeholders, and regulators as we lead this transition toward a clean energy and climate resilient future. Ultimately, this transition is about the people and communities that we serve, and we are proud to be a primary energy provider for New York City. For more information about building electrification and energy efficiency, please refer to our **Integrated Long-Range Plan**. For further information about our electric and gas systems, please refer to the **Electric Long-Range Plan** and **Gas Long-Range Plan**, respectively.

1. Background

Since their debut in 2010, our Long-Range Plans have articulated the strategies, actions, and investments needed to deliver value to our customers. Today, these Long-Range Plans continue to evolve as a strategic framework and roadmap that guide our programs and investments through 2050. The Integrated Long-Range Plan takes a comprehensive approach across our electric, gas, and steam businesses.

Our commodity-specific plans, including the Electric Long-Range Plan, the Gas Long-Range Plan, and the Steam Long-Range Plan, provide additional details about initiatives that support our strategic objectives within each business. In each plan, we describe the strategy in the context of the commodity, as well as the tangible capital and operational investments we are making in the respective systems.

In this chapter, we provide a history and overview of our steam system today, along with some of the accomplishments of which we are proud.

1.1 Our History

Our steam system has provided service to customers in the borough of Manhattan for the past 140 years. This system has gone through several evolutions to reduce its environmental impact, making it more resilient, reliable, and safer over time. During the late 1960s and early 1970s, we converted all generating stations from coal to lower sulfur oil. During the 1980s and into the 2010s, we modified our systems to include gas-firing capability, including the 59th Street and 74th Street generating stations that were made fully gas-capable in 2013.

Today, the system contains 105 miles of steam mains and six generating stations[8] primarily using natural gas for production. About 60% of produced steam comes from steam-electric cogeneration. Cogeneration makes steam using the heat produced as a byproduct from electric power-generating facilities that otherwise would be wasted. Our steam system brings economic, environmental, and operational benefits to building owners and operators. Table 2 summarizes these benefits.

Table 2. Benefits Our Steam System Brings to Customers

Economic	Environmental	Operational
• Saves valuable square footage that would otherwise be occupied with building equipment • Avoids the need for tall stacks for flue gas release • Is a cost effective energy option due to lower upfront and maintenance costs[9]	• Enables building owners to gain points toward LEED certification • Eliminates onsite building emissions, such as GHGs and local pollutants	• Reduces onsite maintenance of building heating equipment • Enables economies of scale as centralized upgrades to our system produce benefits across multiple customers

[8] This number includes our steam purchase contract with Brooklyn Navy Yard Cogeneration Partners (BNYCP)

[9] Our steam rates have declined in real terms since our last rate case in 2013, as we have not had a rate increase since then

There are 47 district energy systems in the State of New York, but we are the largest—not only in the state but also in the country. We have about 1,550 customer accounts servicing up to 3 million people who work, live, and visit New York City. Our customer base is a diverse group of residential, commercial, and industrial customers, including museums, hospitals, education facilities, and other special use customers. As of 2020, commercial office buildings and multi-family residential buildings constitute up to 37% and 34% of our customer accounts, respectively. Some of the most famous New York City landmarks use steam as an energy source, such as the Empire State and Chrysler Buildings. Steam is used for many purposes, including building heating, domestic hot water, air conditioning, sterilizing equipment in hospitals, humidity control in museums, food processing, and dry cleaning. Our customers primarily use steam for building heating, hot water, and air conditioning[10]. We also provide steam service to the City of New York government, which includes New York City Housing Authority campuses.

Figure 4. Steam System Map

Our service territory runs from 96th Street on the Upper West Side to 89th Street on the Upper East Side, down to Battery Park (see Figure 4). We expect to maintain the existing steam system at roughly the same size and geographic footprint in perpetuity. Included in this figure is our steam tunnel that connects our steam system with the Brooklyn Navy Yard Cogeneration Partners (BNYCP).

Generation

As of 2020, our steam system generating plants (denoted in Figure 4 with stars) have a total capacity of 11,425 Mlb/hr., 27% higher than the existing peak demand of 8,356 Mlb/hr. We maintain a certain level of reserve capacity to replace capacity in the event of unexpected equipment failure or to provide additional capacity when demand is higher than projected to prevent system pressures from going below the required operating range. This reserve also allows us to perform scheduled maintenance throughout the year, accept new customers and increase existing service to current customers. This reserve capacity has been an asset for customers switching to steam from more polluting fuels such as heating oil or natural gas, especially those that cannot readily switch to electric building heating.

This capacity consists of steam-electric plants, steam-only plants, and capacity supplied under our long-term contract with the BNYCP. Our four largest steam supply units can generate over 700 MW of electricity. Three of these four units are steam-electric cogeneration units.

Distribution

Distribution is the essence of our steam system and must be meticulously maintained to continue serving our customers. Because our steam is used for things such as food processing and medical sterilization, preserving the integrity and purity of our distribution system is critical to our customers. Geographically, the steam system's distribution grid (denoted in green in Figure 4) consists of four main areas:

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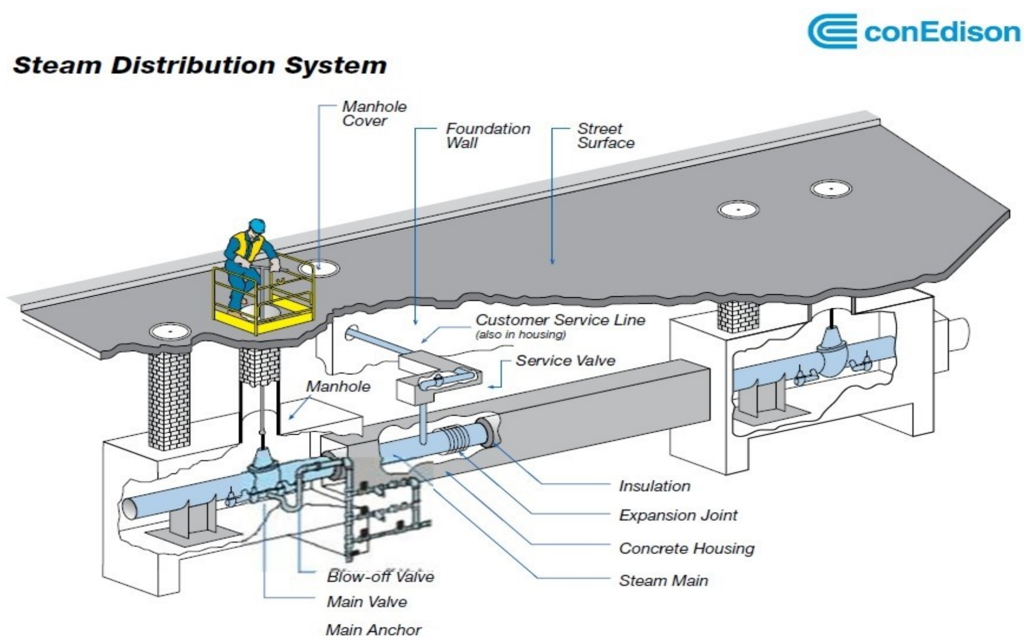
[10] As of 2021, our steam system offsets up to 240 MW of coincident peak electricity demand as it powers almost 500,000 tons of air conditioning capacity in the summer months

- Midtown, accounts for approximately 59% of peak demand
- Downtown, accounts for approximately 21% of peak demand
- Upper West Side, accounts for approximately 7% of peak demand
- Upper East Side, accounts for approximately 13% of peak demand

Our Steam Distribution system consists of many different pieces of equipment, including manholes, valves, pipes, insulation, and other components (Figure 5).

Figure 5. Cutout Example of Our Steam Distribution System



1.2 Our Accomplishments

We are proud of the evolution of our steam system and the important changes we have made. As a result of focused investments and efforts to continuously improve our steam system operations, we have achieved a breadth of accomplishments in recent years. We highlight our achievements across safety, reliability, and security, storm hardening and response, sustainability, and customer experience within this section.

1.2.1 Safety, Reliability, and Security

We have a long record of providing world-class safety, reliability, cybersecurity, and physical security as evidenced by regional and national recognitions. Examples of these achievements include:

- Achieved a company-wide average Occupational Safety and Health Administration (OSHA) incidence rate[11] of <1.5 from 2012 to 2021

[11] An incidence rate of injuries and illnesses may be computed from the following formula: (Total # of OSHA Recordable injuries and illnesses X 200,000) / Employee total hours worked = OSHA Incidence rate.

- Delivered steam within the normal pressure range for over 99.9% of the time between 2016 and 2020
- Internally inspected 6,391 feet of steam mains since 2019, including 3,965 feet of mains in 2021 alone using high temperature cameras and a state-of-the-art smart robot to identify areas to target replacements and upgrades for improved reliability and safety

We continue to improve the safety, reliability, and security of our system due to the capital and operational investments we have made.

1.2.2 Storm Hardening and Response

Uninterrupted service is paramount to our customers, and we are continuously improving our storm hardening and response efforts to mitigate potential service interruptions. Our investment in hardening measures across the steam system since 2012 include $65 million invested to secure our district steam generating assets and $21 million to secure our distribution system against flooding, water intrusion, and other damage.

Our recent investments in hardening measures across our steam system are included in Figure 6.

Figure 6. Steam System Investments

Submersible pumps at steam generation stations

Remote operating valves throughout our distribution system

Flood protection barriers at electric & steam co-generation sites

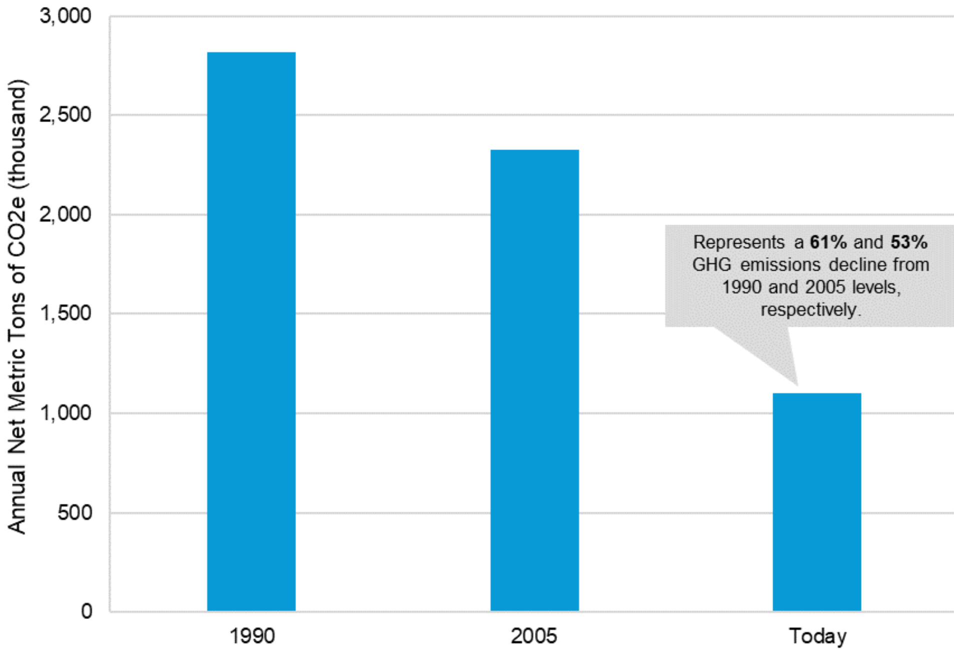
1.2.3 Sustainability

We have a longstanding commitment to sustainability that benefits our customers and the communities we serve. Our sustainability investments include:

- Transitioned steam generation plants to primarily burning natural gas which contributes to fewer greenhouse gases and criteria pollutants emitted, with fuel oil used only as a back-up during natural gas supply constraints
- Implemented several capital projects to comply with state and federal air pollution control regulations
- Efficiency measures throughout our generation and distribution system

These investments have helped us achieve 61% and 53% GHG reductions from our steam combustion emissions, respectively, since 1990 and 2005. Figure 7 shows our emissions reductions in this area.

Figure 7. Our Steam System's Net GHG Emissions, 1990-Today[12]



1.2.4 Customer Experience

We strive to improve our customers' experience with our services, offering them high levels of comfort, convenience, choice, and control. We have achieved many milestones in improving our steam-specific customer experience:

- Established a customer service program that offers monthly and annual seminars to educate customers on safety and maintenance
- Developed an energy audit program that helps customers better understand their energy footprint

As a result of our commitment to improving the customer experience, CECONY has continued positive long-term trends in Customer Experience metrics, including above average JD Power Customer Satisfaction scores.

[12] Calculated using New York City **Local Law 97** methodology.

2. Industry and Societal Trends

To develop our long-range plan, we monitor industry and societal trends that may impact the future of our steam system. We have identified five critical industry and societal trends that will affect how our business may evolve over time:

Changing customer and stakeholder expectations include greater demand for choice, convenience, and control. Our customers expect seamless experiences and journeys with easy-to-use apps and interactions.

A changing climate will have direct ramifications to district steam systems. These effects are already having an impact on utility asset design specifications and system operations to adapt to weather and climate conditions.

Clean energy legislation, such as the **Climate Leadership and Community Protection Act** (CLCPA) and the **Climate Mobilization Act** (CMA), and potential future legislation will continue to affect the role our energy delivery infrastructure plays in the energy transition, our investments, and the energy choices our customers make.

Technological advancements such as electric boilers and low-to-zero-carbon gaseous fuels will make the clean energy transition possible. We will monitor advancements in technology and their impact on the path to decarbonization.

Equity and environmental justice are at the forefront of the clean energy transition. Any change in our energy systems must consider the impact to historically disadvantaged and low-income communities and enable these communities to enjoy the benefits of clean energy.

2.1 Customer and Stakeholder Expectations

Customers and stakeholders increasingly expect more from their energy provider, including intuitive user experiences and quick answers to their questions. Customers rely on their energy provider to provide reliable and increasingly resilient energy, to respond swiftly to service interruptions, and to be a trusted advisor. Many of the largest commercial and residential buildings throughout Manhattan are steam customers. These property owners/managers are well informed and perceptive. They actively manage their energy usage and thoroughly understand their buildings and the energy options that are available to them.

Good utility practices require a continuous monitoring of customer experience through satisfaction surveys and external metrics such as those provided by J.D. Power,[13] Escalent,[14] and App Store[15] reviews. This feedback helps utilities proactively align programs with evolving customer expectations. Overall, across the industry, utilities are seeing customers' expectations evolve in four key areas:

- **Choice:** District energy customers want to be able to choose the decarbonized energy solution that fits their needs.

[13] J.D. Power is a data analytics and intelligence company that releases business rankings.

[14] Escalent is a market research firm that releases business rankings and surveys of company performance.

[15] Includes customer reviews on mobile applications through Apple's App Store and Google's Android Store. As of June 2021, our mobile app has a 4.8/5 rating on Apple and a 4.8/5 rating on Android.

- **Convenience:** District energy customers expect a convenient and seamless experience when interacting with their energy provider
- **Comfort:** District energy customers want their tenants to feel comfortable in their homes and businesses
- **Value:** District energy customers want value for the price they pay for energy; value includes cleaner, more resilient, and reliable service. Based on economic evaluations, many customers would see a significate cost benefit to using a centralized district energy system for decarbonization.

As a result of these evolving expectations, we anticipate that customers will drive a major shift in when, where, and how energy is used.

2.2 A Changing Climate

There is broad consensus that the climate is changing. Communities around the globe, specifically in the New York metro area, have already seen the impacts of climate change in the form of increased heat waves, more intense storms, sea level rise, and unpredictable cold spells. Under current projections for the CECONY-specific service territory, we expect the following climate conditions by 2050:

- **Twenty-three days per year** where temperatures exceed 95°F, representing a six-fold increase compared to historical averages
- **Five-day precipitation** totals exceeding **11.8 inches,** representing a 17% increase compared to historical averages
- **Sea level rise** of almost 2 feet, significantly increasing the risk of flooding in our low-lying communities
- **More extreme events** such as Nor'easters and hurricanes like Superstorm Sandy and Hurricane Ida

Because these climate risks are already affecting energy systems, we have proactively performed a **Climate Change Vulnerability Study** to understand current climate risks and to project future risks to our energy systems. As part of this study, we reviewed the likely steam system impacts of these climate risks. A high-level summary of these risks is included in Figure 8.

Figure 8. Climate Risks and Potential Impact on Our Steam System

	Ambient Temperature/ Heat Waves	Precipitation, Sea Level Rise, and Storm Surge	Extreme Events
Expected Weather Trends in Our Service Territory	• Warmer seasons on average • Extreme cold spells	• Flooding risk due to heavy rainfall • Higher than average humidity • General sea level rise that extends flooding and storm surge areas	• Hurricanes • Tornadoes • Nor'easters • Other extreme weather events
Implications to Energy Systems	• Increase in peak demand	• Potential for water intrusion	• Potential for storm damage on infrastructure

2.3 Clean Energy Legislation

Legislators have responded to the threat of climate change, as described in Section 2.2, through their passage of the **Climate Mobilization Act** (CMA) and **Climate Leadership and Community Protection Act** (CLCPA). These policymakers note that scientific consensus points to unabated GHG emissions as the driver of climate change, and that further GHG emissions will amplify extreme weather and sea level rise. Table 3 describes aspects of the ambitions and goals of the CLCPA and CMA that are applicable to our steam system.

Table 3. CMA and CLCPA Requirements

CMA (New York City Law)	CLCPA (New York State Law)
• **Local Law 97:** Buildings over 25,000 square feet must significantly reduce emissions	• **185 TBtu** end-use energy reduction by **2025** • **Net-zero** GHG emissions economy-wide by **2050** • **35%-40%** of clean energy benefits accrue to **disadvantaged communities**

Our plans and analysis are based on clean energy policies as of April 2021 and reflective of the policies and goals outlined in Table 3. However, we recognize New York State, New York City, and local municipalities continue to enact nation-leading clean energy policies and may develop additional future legislation.

For example, New York City legislators recently passed **Local Law 154 of 2021**, which generally bans new fossil-fuel service connections for buildings under seven stories beginning in 2024, and new fossil-fuel service connections for buildings greater than seven stories beginning in 2027. The law does carve out special end-use applications for natural gas.

CECONY is supportive of these initiatives and is well positioned to help achieve these goals. We continue to closely monitor and help shape this rapidly evolving landscape to create beneficial outcomes for our customers and stakeholders. We will continue to review and modify our plans and supporting strategies as necessary.

2.4 Technological Advancement

Rapid advances and innovations in energy technologies are helping utilities operate reliable energy systems in the 21st century and offer clean energy options to customers. Table 4 provides an overview of these technologies as applicable to our steam business. Beyond the technologies listed below, there are various information technology (IT) innovations that affect how utilities and energy providers operate. Please refer to the **Integrated Long-Range Plan** for an overview of these IT advancements.

Table 4. Innovative Clean Technologies

Technology	Description	Value of Technology
Low-to-Zero Carbon Gaseous Fuels	Gaseous fuels with a lower GHG impact than natural gas that could supplement our gas delivery system (e.g., green hydrogen)	Greatly reduces or eliminates GHG emissions from energy generation facilities
Electric Boilers	Electric technology that generates steam without fuel combustion; this technology can be paired with energy storage to optimize renewable energy.	Transforms dedicated steam plants into net-zero GHG emission generators and balances the electric grid when there is excess electricity production from renewables
Carbon Capture and Storage	Technology that absorbs carbon from point-sources (such as steam boilers) or directly from the air to offset carbon emissions from other activities	Reduces GHG emissions from the source and supports economy-wide net-zero GHG emissions goals
Building Envelope and Insulation	Technology that reduces the total energy requirements of a building by improving thermal insulation	Reduces energy consumption, GHG emissions, customer energy costs, and capital costs for building heating/cooling equipment
Advanced Metering Infrastructure (AMI)	Digital meters that remotely and continuously read customer energy usage information	Provides customers with valuable consumption information and enables demand response capabilities

2.5 Equity and Environmental Justice

Equity and environmental justice are at the forefront of the clean energy transition conversation. Environmental justice has recently become a priority for policy makers not only at a state level, but also at the federal level. The Biden Administration's Executive Order 12898 directs all federal agencies to address the disproportionally high public health impacts to vulnerable communities, namely through the Justice40 initiative. At the state level, the CLCPA has advanced the discussion and focused on providing equitable benefits from clean energy investments to disadvantaged communities.

Importance of Disadvantaged Communities in CLCPA

"Climate change especially heightens the vulnerability of disadvantaged communities, which bear environmental and socioeconomic burdens as well as legacies of racial and ethnic discrimination. Actions undertaken by New York state to mitigate greenhouse gas emissions should prioritize the safety and health of disadvantaged communities, control potential regressive impacts of future climate change mitigation and adaptation policies on these communities and prioritize the allocation of public investments in these areas."

New York's CLCLPA acknowledges the need to dedicate attention and benefits to these communities through establishing the Climate Justice Working Group and including stipulations that disadvantaged communities should receive no less than 35% of the overall benefits of spending on clean energy and energy efficiency programs, projects, or investments.

The Climate Justice Working Group began in 2020 and, as of this writing, is in the process of establishing criteria to identify "disadvantaged communities." While the Public Service Commission has historically focused on low- and moderate-income customers for energy efficiency and other programs, the definition for disadvantaged communities is expected to be broader, considering aspects of geography, public health, environmental hazard, and socioeconomics. In doing this, investments can be directed, and benefits measured, at a community level rather than at an individual level. Table 5 provides working definitions for low-and moderate-income and disadvantaged communities as well as their populations in our service territory. We are following the actions of the Working Group to more clearly understand the population for which this applies in our territory and expand our programs accordingly.

Table 5. Communities with Equity and Environmental Justice Focus

	Low- and Moderate-Income (LMI)	Disadvantaged Communities
Current Criteria	Households earning up to 80% of the area or state median income, whichever is greater, are qualified as low- and moderate-income for energy efficiency and electrification programs. To qualify for bill discount programs, low-income households must receive other governmental benefits such as food or housing assistance. The thresholds for receiving governmental public assistance typically exclude moderate-income customers.	**Draft definition:** The Climate Justice Working Group (CJWG) and the New York State Energy Research and Development Authority (NYSERDA) have a draft definition of disadvantaged communities according to various interim criteria such as areas having low to median incomes, public health vulnerabilities, climate change risks, and environmental burden. CJWG will issue a draft methodology that outlines the criteria and parameters for definitions of “Disadvantaged Communities” in January 2022.
Population in CECONY Service Territory	Approximately 440,000 low-income households (those receiving assistance programs) and 1.3 million moderate-income households. [16]	**Population in our service territory:** To be determined based on the final definition provided by CJWG. Based on initial geographical estimates using the NYSERDA interim disadvantaged community definition, there are 855,000 low-moderate income households outside of disadvantaged communities and 900,000 low-moderate income households residing within disadvantaged communities in our service territory.

[16] As of the date of release of this document.

3. Our Strategies

We are committed to meeting societal goals and our customer expectations. As articulated in the previous section, we have analyzed industry and societal trends in-depth and researched the range of potential policies, technologies, and customer adoption levels to reach net-zero GHG emissions by 2050 in New York City. Additionally, we benchmark our district steam system against other similar district energy systems locally and internationally to gain insights on best practices and potential future strategies, including decarbonization. Informed by these analyses, we developed this Steam Long-Range Plan to articulate the strategies, initiatives, and investments needed to advance our commitment and our four strategic objectives:

- **Clean Energy:** Economy-wide net-zero GHG emissions in our service territories by 2050
- **Climate Resilience:** Increased resilience of our energy infrastructure to adapt to climate change
- **Core Service:** World-class safety, reliability, and security, while managing the rate impacts and equity challenges of the energy transition
- **Customer Engagement:** Industry-leading customer experience and facilitation through the energy transition

As the main energy provider of New York City, we are positioned to be a leader in this energy transition. In the following section, we describe our pathways analysis, which helps inform our steam system planning. Further, we describe our investments to support clean energy, our investments in climate resilience in anticipation of future climate challenges, our continued commitment to a foundational core of safety, security, and reliability while managing the energy transition, and the value and enablement we are delivering to our customers throughout. Our strategies to achieving these objectives are highlighted in Table 6.

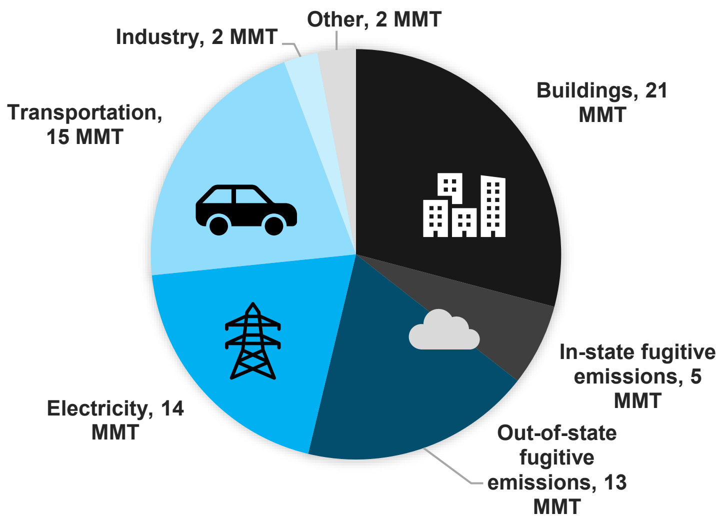
Table 6. Strategies to Support Our Strategic Objectives

Clean Energy	Climate Resilience	Core Service	Customer Engagement
Transform the Energy Supply • Build a low-to-zero carbon gaseous fuels portfolio • Support the electrification of boilers with clean energy • Support other methods to reduce steam system emissions **Enable a Fundamental Change in Energy Consumption** • Support energy efficiency at steam generation facilities, distribution facilities, and customer sites • Encourage new steam system connections for hard-to-electrify customers	• **Prevent**: Harden energy infrastructure • **Mitigate**: Minimize disruptions • **Respond**: Reduce recovery timeframes	**Execute our managed risk portfolio program:** • Enhanced Safety • Enhanced Security • Enhanced Reliability **Manage the transition for our customers:** • Manage rate impacts of transition • Enable an equitable transition	• Continue to improve the customer experience • Facilitate customer energy choices

3.1 Representative Pathways

To achieve the net-zero GHG emissions goals, we must understand the sources of emissions and the solutions required to reduce them. Based on our analysis, in New York City, the main sources of GHG emissions are buildings, transportation, electricity generation, and fugitive methane emissions, as shown in Figure 9. [17]

Figure 9. GHG Emissions across New York City, 2019 ($MMTCO_2e$)[18]



No single set of clean energy solutions exists to address these GHG emissions. In fact, many combinations of solutions could achieve 2050 goals. We will remain open to considering all decarbonization solutions that may advance societal goals and increase value to customers. Further, we will continue to provide customers with a choice for their clean energy solutions, and advocate for policies and solutions that are cost-effective and reflect the value of clean energy.

We expect technology to improve and costs to decline such that some decarbonization solutions that are cost-prohibitive today will become cost-effective in the future. These solutions are at different levels of maturity and the pace and cost of adoption is uncertain, as is the emergence of policy over the next 30 years. We identified three representative pathways to capture a wide range of potential futures so that we remain flexible until a pathway emerges (see Table 7). Each pathway differs in technology breakthroughs required and expected relative cost in achieving the clean energy transition. Each pathway assumes that carbon offsets are needed to meet net-zero after direct GHG emissions reductions targets are met.

[17] As the GHG emissions accounting methodology continues to evolve at city and state levels, these emissions estimates are subject to change. As such, they may not fully align with the most recent draft emissions factors released by the New York State Department of Environmental Conservation.

[18] This figure and value includes National Grid's gas service territory.

Table 7. Representative Pathways for Our Steam System

	Full Electrification	Targeted Electrification	Hybrid Consumption
Steam Building Heating	Decarbonized steam supports building heating in our service territory not covered by electric[19]	Decarbonized steam supports building heating in our service territory not covered by electric and/or not covered by on-site combustion of low-to-zero carbon gaseous fuels[20]	Decarbonized steam supports building heating in our service territory not covered by electric and/or not covered by on-site combustion of low-to-zero carbon gaseous fuels[21]
Gaseous Fuel Usage	170 TBtu of gaseous fuels are used for electric and steam generation (100% low-to-zero carbon); no gaseous fuels are used for buildings as the gas distribution system is decommissioned	250 TBtu of gaseous fuels are used across all sectors (100% low-to-zero carbon)	296 TBtu of gaseous fuels are used across all sectors (70% low-to-zero carbon)
Impact to Natural Gas Distribution System	The natural gas distribution system is fully decommissioned except for gas pipelines that supply dedicated steam and cogeneration facilities	The natural gas distribution system is partially decommissioned and prioritized for gas customers, requiring us to source alternative energy sources for many steam generation plants	The natural gas distribution system is kept intact and prioritized for gas customers, requiring us to source alternative energy sources for many steam generation plants
Technology Required to Decarbonize Steam Generation	This pathway would require a dedicated hydrogen pipeline and technology that converts hydrogen to steam *And/or* Low-to-zero carbon gaseous fuels transported through the existing gas distribution system *And/or* Electric boilers *And/or* Carbon capture technology	This pathway would require a dedicated hydrogen pipeline and technology that combusts hydrogen fuel to generate steam *And/or* Electric boilers	This pathway would require a dedicated hydrogen pipeline and technology that combusts hydrogen fuel to generate steam *And/or* Electric boilers
Comparative Total System Cost: Customer	$$$$$	$$$	$$
Comparative Total System Cost: Utility Infrastructure	$$$$$	$$$$	$$$
Comparative Total System Cost: R&D[22]	$	$$	$$

[19] In this pathway, 100% of total building heating demand is served by electricity and/or steam

[20] In this pathway, between 70%-80% of total building heating demand is served by electricity and/or steam

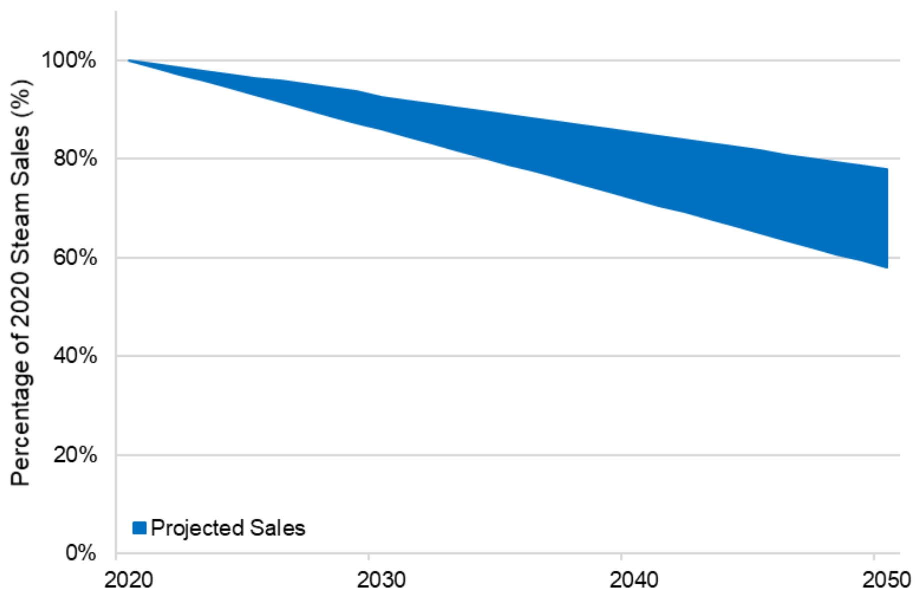
[21] In this pathway, between 50%-60% of total building heating demand is served by electricity and/or steam

[22] Societal research and development (R&D) for the Targeted Electrification and Hybrid Consumption pathways requires advancement in low-to-zero carbon gaseous fuel technologies, including technologies to develop the fuels at scale, transport the fuels, and consume the fuels for heat or power. While building heating electrification technologies exist, adopting them for all end-use cases will result in a larger total cost impact across our entire system even if R&D costs are lowered in the "Full Electrification" pathway.

The representative pathways analysis takes an integrated view of the investments and technologies to be made to the total system (defined as the collective CECONY steam, gas, and electric systems) to achieve net-zero GHG emissions by 2050. Accordingly, the pathways analysis incorporates various trade-offs, such as prioritizing the gas distribution system for on-premises building combustion over steam generation and vice versa. As such, the Full Electrification representative pathway is the highest cost from a total system perspective but may not necessarily be the highest cost from a standalone steam system perspective. Given the complex and interdependent nature of CECONY's steam, gas, and electric system assets, we must continue to assess these trade-offs as we evolve our systems over time. We will continue to advocate for technology-neutral policy that allows us to optimize across our total system assets and provides the greatest benefit for the lowest cost.

In all three of these representative pathways, we expect steady declines in overall steam sales corresponding with greater customer adoption of energy efficiency, the rise of electrification, a generally warmer climate, and varying changes in peak demand due to anticipated extreme warm or cold spells. Figure 10 shows the ranges of our view on projected sales across the steam system.

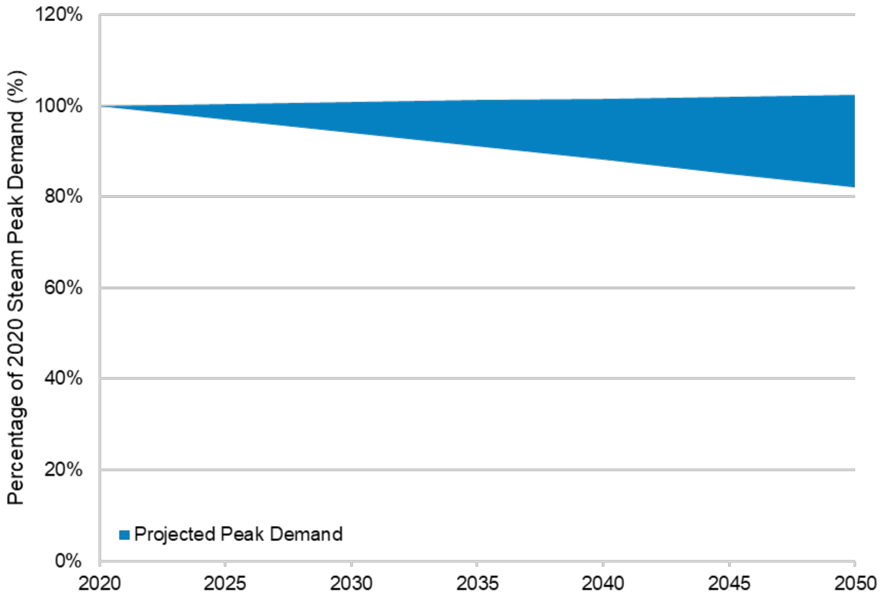
Figure 10. Projected Steam Sales through 2050



The steam infrastructure will continue to serve a supporting role in our integrated energy system over the next several decades by offsetting incremental electric demand and providing an alternative fuel source in support of system resiliency. As such, we expect to maintain the steam system at roughly its current size and footprint, in perpetuity.

We anticipate peak demand will remain at or near current levels, as shown in Figure 11. As we continue down the path to decarbonization and gain a better understanding of its impact to our steam system, we will also investigate potential peak mitigation strategies to help improve system efficiency.

Figure 11. Projected Steam Peak Demand through 2050



Our peak demand projections are largely affected by varying levels of building electrification, energy efficiency, and adoption of new customers as shown in Table 8. In the figures below, "Post Electrification" refers to anticipated customer demand shifted from the steam system to electric building heating, whereas "Post Energy Efficiency" refers to energy efficiency measures applied to buildings that use our steam system. Refer to our **Integrated Long-Range Plan** for a detailed discussion about the cross-cutting electrification and energy efficiency programs.

Table 8. Peak Demand Assumptions

Pathway	Today's Peak Demand	Post Electrification	Post Energy Efficiency	New Customers	2050 Peak Demand
Full Electrification	100%	-21%	-24%	+27%	= 82%
Targeted Electrification	100%	-21%	-16%	+39%	= 102%
Hybrid Consumption	100%	-21%	-16%	+31%	=94%

Our pathway study highlights the need to be flexible in our programs and cognizant of technology, policy, and customer changes that may impact the optimal strategy to decarbonization. We will continuously review signposts (indicators to ramp up or down specific programs or actions based on technological and policy shifts) and adjust our programs accordingly to deliver on our targets. We will do so by monitoring regulatory changes, reviewing technology cost decline curves, and monitoring broader industry and societal trends.

Although our pathways analysis shows three distinct futures, the pathways follow similar trajectories through 2030. As such, we have clarity on the near-term investments that will help us prepare for these multiple possibilities. Examples of these near-term investments include supporting total system energy efficiency and continuing to enhance safety, security, resilience, and reliability.

We will refine our investment strategy to reflect how policy, customer expectations, and technology evolve. This includes ramping up investments that bring additional value, scaling down investments that have reached maturity, and discontinuing investments that no longer serve our customers and stakeholders.

3.2 Clean Energy

While we have already reduced GHG emissions through clean investments across the system, we remain vigilant in observing the market and planning for actions we can take to further transform our steam system. Our parent company, Con Edison, recently released its **Clean Energy Commitment**, which highlights our commitment to delivering clean energy to customers, stakeholders, and communities (Figure 12).

Figure 12. Our Clean Energy Commitment

OUR CLEAN ENERGY COMMITMENT

We will take a leadership role in the delivery of a clean energy future for our customers. We will do that by investing in, building, and operating reliable, resilient, and innovative energy infrastructure, advancing electrification of heating and transportation, and aggressively transitioning away from fossil fuels to a net-zero economy by 2050.

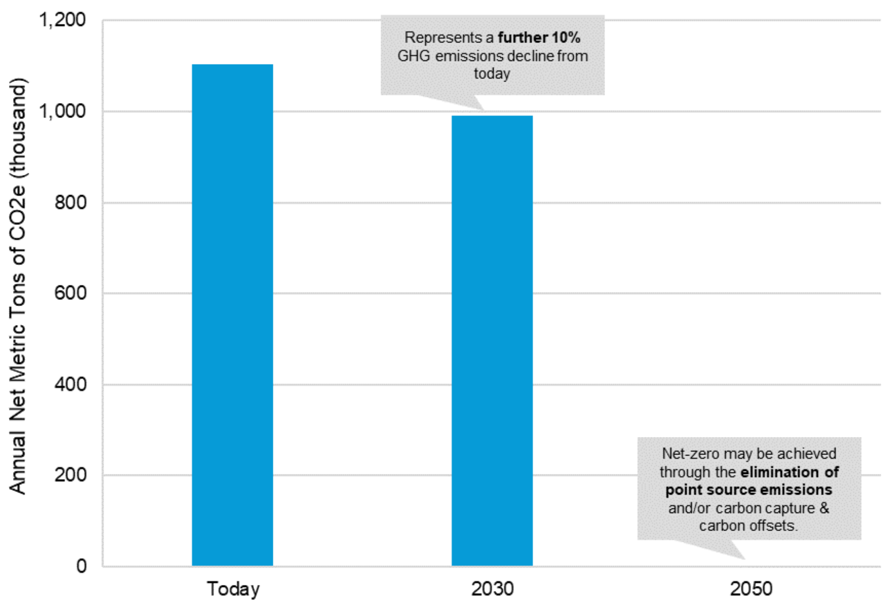
One element of this commitment specifically focuses on our steam system, stating:

> *"Reduce the carbon footprint of our steam system (about 85% of our Scope 1 emissions) via energy efficiency; low-to-zero carbon gaseous fuels; electrification of boilers with clean energy; carbon capture and sequestration; carbon offsets; among other methods."*

Accordingly, our goal is to evolve our energy systems to support an economy-wide 40% GHG emissions reduction from 1990 levels by 2030 and ultimately net-zero GHG emissions by 2050. While steam is considered one of the lowest-carbon resources available to our customers today, we plan to continue reducing GHG emissions by 10% through 2030,[23] as per Figure 13.

[23] In addition to the 61% and 53% GHG emissions decline already achieve from 1990 and 2005 levels, respectively.

Figure 13. Future Steam System Net GHG Emissions[24]



As part of this energy transition, thousands of building owners in New York City will have to make clean energy decisions in support of their tenants. This includes a massive scale up of technologies to supply clean energy, as well as significant shifts in customers consumption of energy.

To enable this shift, we have developed initiatives around two main strategies: **Transforming the Energy Supply** and **Enabling a Fundamental Change in Energy Consumption**. These strategies build on our long history of supporting dramatic reduction in system-wide emissions through co-generation, converting to lower emitting energy sources, and efficiency upgrades to generation and distribution. Table 9 summarizes these Clean Energy approaches.

Table 9. Approaches to Achieve Clean Energy

Strategy	Sub-Strategy	Approach
Transform the Energy Supply	**Build a low-to-zero carbon gaseous fuels portfolio**	• Continue researching and analyzing how we may use low-to-zero carbon gaseous fuels on our steam system
	Support the electrification of boilers with clean energy	• Continue investigating how we may implement electric boilers (powered by clean energy) to reduce steam system GHG emissions
	Support other methods to reduce our steam system GHG emissions	• Continue researching how we may use geothermal wells to reduce our fuel usage by preheating feedwater • Continue researching and analyzing how we may use carbon capture and sequestration and other methods to reduce our steam system GHG emissions • Deliver near-term emissions reductions through replacement of back-up fuel oil

[24] Calculated using NYC **Local Law 97** (LL97) methodology.

Strategy	Sub-Strategy	Approach
Enable a Fundamental Change in Energy Consumption	**Support energy efficiency at steam generation facilities, distribution facilities, and customer premises**	• Support energy efficiency at steam generation facilities, distribution facilities, and customer sites • Support energy efficiency on customer premises
	Encourage new steam system connections for hard-to-electrify customers	• Encourage new steam system connections for those customers that are hardest to electrify

Align Our Actions to Climate Policy

3.2.1 Transform the Energy Supply

There are three key actions as part of our strategy to transform our energy supply and achieve net-zero GHG emissions by 2050:

- Build a low-to-zero carbon gaseous fuels portfolio
- Support the electrification of boilers with clean energy
- Support other methods to reduce our steam system GHG emissions

3.2.1.1 Build a Low-to-Zero Carbon Gaseous Fuels Portfolio

While all pathways are possible, we see continued value for our steam system Low-to-zero carbon gaseous fuels could be a viable decarbonization solution and could potentially be supplied through the existing distribution system or dedicated infrastructure. Using existing assets could be significantly more cost-effective than converting all customers to electric building heating. Alternatively, dedicated hydrogen infrastructure can support our cogeneration and dedicated steam facilities in converting to low-to-zero carbon gaseous fuels.

As such, we are prudently investing in building a low-to-zero carbon gaseous fuels portfolio. This includes:

- Securing language in our last rate case that allows renewable natural gas (RNG) producers to connect to our gas distribution system, thereby enabling our steam system to consume low-to-zero carbon gaseous fuels. We envision this as a short-term measure in the early stages of our clean energy journey.
- Participating in a variety of industry groups to research the impact that low-to-zero carbon gaseous fuels may have on our system

Low-to-Zero Carbon Gaseous Fuels

Low-to-zero carbon gaseous fuels have significant potential to reduce GHG emissions in our service territory. To better understand these solutions, we have worked collaboratively with peer utilities and other stakeholders (e.g., **Pathways to Carbon Neutral NYC** and **The Role of Gas Networks in a Low-Carbon Future**). Through our collaboration, research, and analysis, we have identified two low-to-zero carbon gaseous fuels on which our plans focus: hydrogen & RNG.

Hydrogen

Hydrogen is a lower-carbon alternative fuel to natural gas. Because hydrogen fuel does not include methane, there are no GHG emissions resulting from transportation or combustion. The full decarbonization potential depends on the process used for production. We are focused on green hydrogen, which is produced using dedicated or otherwise curtailed renewable electricity, and blue hydrogen, which is produced with natural gas and paired with carbon capture.

Hydrogen can either be blended into the system with RNG or fossil gas, or it can be used as a complete replacement. However, because the chemical composition is different from natural gas, upgrades may be required to existing infrastructure and equipment across the supply chain that feeds our steam production and electric/steam cogeneration plants.[25] We are continuing to research and study the extent of these upgrades in our service territory. Today, the market for hydrogen is immature and costs are over ten times more than fossil gas. As the market matures and there is more understanding around the value that hydrogen can provide, we expect costs to decline. Across our pathways, we explore the use of hydrogen as a blend in our steam system and as a complete replacement.

Green Hydrogen
Green hydrogen uses renewable electricity to separate hydrogen from water molecules to produce a fuel. Because it is produced using renewable electricity, green hydrogen does not emit CO_2 during production and is considered a non-emitting fuel. In addition to being used as a clean alternative to fossil gas for combustion in steam boilers, green hydrogen can be used as a storage medium for excess renewable energy.

Hydrogen Research, Analysis, and Studies
We have joined a number of industry working groups such as the Low-Carbon Resources Initiative with the Electric Power Research Institute (EPRI) and Gas Technology Institute and a Guidehouse Hydrogen Consortium to further explore hydrogen as a fuel source. We also joined the Institute for Gas Innovation and Technology with Stony Brook University. These industry working groups allow us to continue to share with and learn from leading organizations. Through those learnings, we will be able to better understand how to incorporate hydrogen successfully and safely into our steam system. There is a need to coordinate with multiple parties, including other utilities and consumers in the areas that we serve. Joining these working groups enables us to better collaborate as future hydrogen infrastructure will need to be shared and a robust market ecosystem will have to be developed with multiple different players.

If advanced, this could have the co-benefit of decarbonizing our steam generation and cogeneration units.

Hydrogen Pipeline & Hub
Hydrogen could potentially transform our cogeneration facilities into net-zero GHG emissions for electric and steam, while eliminating GHG emissions from dedicated steam generation plants.

The continuous supply of hydrogen at a reliable rate is one of the biggest challenges to powering our systems with hydrogen. As part of our internal gas studies, we analyzed different routes and sizes of hydrogen pipeline infrastructure that would need to be built to sufficiently power our electric and steam cogeneration plans and dedicated steam boilers. We are actively investigating whether our equipment and storage systems can operate with hydrogen or a hydrogen blend safely and efficiently. In addition, we are

[25] Initial studies from other regions indicate that hydrogen can be blended up to 20% by volume without needing to upgrade infrastructure.

actively investigating the development of a hydrogen hub along with other parties including on-site electrolyzers to manufacture green hydrogen within our service territory.

Renewable Natural Gas

RNG is a pipeline compatible gaseous fuel derived from biomass feedstocks (i.e., animal manure, food waste, landfills, and water resource recovery facilities) that could be used as a direct drop-in into our steam boilers and electric & steam co-generation units. Although both RNG combustion and fossil gas combustion would emit CO_2, leading industry sources agree that RNG has lower lifecycle GHG emissions than fossil natural gas. RNG also has other benefits, including local air quality and fuel diversity benefits.

RNG Interconnection

CECONY secured language in our last rate case that allows RNG producers to connect to our system. We are open to facilitating these interconnections to integrate RNG to our system and meet customer needs. This initiative can potentially lower GHG emissions and will help us understand the impact of RNG on our distribution system, which in turn feeds our steam units. This could also help us secure additional supply.

The role of our steam system will depend on the development of low-to-zero carbon gaseous fuels over the next 30 years. The supply availability and cost of these fuels are currently uncertain, particularly for use in our system. Further, the market is immature, and there remain many barriers including upstream infrastructure and alignment on emissions accounting methodology. As such, our plans do not include wide adoption of these fuels until after 2030. However, in the near term, we are supporting the development of these fuels and are working toward adopting them as they become available.

3.2.1.2 Support the Electrification of Boilers with Clean Energy

Electric Boilers

This initiative would replace some or all fossil fuel steam generation boilers with electric power boilers. If powered with renewable energy, this technology could transform our dedicated steam plants into net-zero GHG emission generators. Electric boilers, when paired with energy storage, could also be used to balance the electricity grid when there is excess electricity production from large amounts of renewables, such as at 2 p.m. on a sunny day. We have reviewed the technologies available to replace our fossil boilers with electric as part of our analysis. Electric boiler technology has been around for almost 100 years and uses the conductive and resistive properties of water to carry electric current and generate steam. As of 2020, the largest commercially available design has a capacity of 150,000 pounds of steam per hour.

If the expected peak demand continues at the current rate, it will require 59 boilers (54 primary and 5 for standby) to reliably meet our customers’ total steam energy needs. We continue to evaluate the viability of a partial system conversion as well.

The current limitation to adopting electric boilers is the capacity of our electric system to supply the large amount of electricity needed to power the system. As such, we are still assessing the technical viability of electric boilers, including the ability to support electric balancing during times of peak renewable electric generation. If deemed viable, we will pursue a pilot project to retrofit an existing plant with electric boiler technology and determine how the technology could work on our system.

Energy Storage

This initiative would look to store either thermal or electric energy during non-peak times for use during peak times. This technology could further enable renewable deployment by providing storage during times when renewable generation exceeds electric demand. Separately, this could add resiliency during outage events. We are evaluating several potential energy storage technologies that could be paired with our system. For example, we are reviewing the potential of lithium-ion batteries that could be paired with electric boilers to support additional resiliency and further enable steam generation with renewable energy. We see a potential for intaking abundant renewable energy during off-peak steam times and storing it to enable operation during peaks. We will continue to perform research on energy storage as a viable supplement to our steam generation system.

3.2.1.3 Support Other Methods to Reduce Steam System GHG Emissions

We will reduce GHG emissions in the near-term by converting from No.4 fuel oil to No.2 fuel oil. We have also researched and analyzed various other technologies, such as carbon capture and waste heat recovery, that could support us in reducing steam system GHG emissions (Table 10).

Table 10. Other Technologies Supporting Reductions in GHG Emissions

Technology	Description	Potential Value
No. 2 Fuel Oil	Convert our back-up fuel oil for various steam generation and electric & steam co-generation plans from No. 4 to No. 2.	This fuel emits less GHG and local pollutants than No. 4 fuel oil.
Certified Gas Pilot	Proposed a certified gas pilot to purchase certified gas for our distribution system (that feeds our co-generation and steam plans).	This fuel emits less out-of-state fugitive methane emissions, as the producers are required to get a third party certification for improved practices to reduce methane emissions during production.
Carbon Capture	Design a carbon capture system that removes CO_2 from the flue gas.	This technology can directly capture GHG emissions from our steam operations and help us reduce GHG emissions from the source.
Waste Heat Recovery	Use waste heat from third-party operators near our steam generation facilities to preheat feedwater and reduce fuel usage.	This technology may enable us to reduce our fuel consumption by identifying additional sources of waste heat beyond our cogeneration facilities that can contribute to steam generation.
Deep Geothermal	Install a deep well to provide heat to the steam plants to boost the temperature of incoming water.	The increased water temperature reduces the required heat input, reducing the fuel demand and subsequent GHG emissions.
Hot Water Systems	Install hot water loops on the steam system that use waste heat from condensate to service additional hot water customers.	This technology increases system efficiency by providing service to more customers with less energy input.

No. 2 Fuel Oil

This initiative converts our backup fuel from No. 4 oil to No. 2 oil significantly ahead of New York City regulatory requirements (in the 2023-2024 timeframe versus a regulatory deadline of 2030). This initiative will help us decarbonize our steam system, improve local air quality, and provide a backup fuel for the long term.

Certified Gas Pilot

This initiative is led by our gas colleagues and includes a pilot project to procure certified gas (CG) with lower emissions at the wellhead.[26] The CG would feed into our gas system that supplies our cogeneration and dedicated steam plants. As part of our rate filing, we intend to propose pilot funding for a CG program similar to our Orange and Rockland (O&R) proposal.[27] We see CG as a quick and effective way to reduce our out-of-state fugitive methane emissions. If we can execute a successful pilot, we could scale the program to help animate the market and push additional natural gas producers to implement technology and operations measures that reduce their wellhead methane emissions.

Carbon Capture

We performed an in-depth analysis on our systems to understand the best method for removing CO_2 from the flue gas, how to implement the technology at our generation stations, and the preferred locations for implementation based on physical limitations. Factors considered included unit operation, dispatch, access to transport, and neighborhood impacts. All locations would require significant electrical upgrades to power any of the systems. The biggest challenge in employing carbon capture is handling, transporting, and sequestering the gas. In our analysis, we identified potential routes for a CO_2 pipeline that would run across the East River. This analysis assumes a viable pipeline if CO_2 can be exported from New York City for sequestration at a total cost of $30/ton. We will continue to assess the viability of carbon capture on our system, as well as the potential of using the captured CO_2 for other purposes to support a circular economy and/or improve the economic viability of the technology.

Waste Heat Recovery

We are analyzing the viability of using third-party waste heat to support the preheating of our feedwater. This includes identifying buildings or operations near our facilities that operate at a scale sufficient to support steam generation. We will continue to analyze this as an option.

Deep Geothermal

We are investigating the feasibility of installing a deep (as much as 6 km deep) well to provide heat to the steam plants to boost the temperature of incoming water. To capture the Earth's inner heat, water or fluid is pumped down into the Earth and carries out heat on the downstream side. The heat treated water goes through the steam generating process and can contribute to as much as a 150°F increase in water temperature. The increased water temperature would reduce the required heat input to generate steam.

Hot Water Systems

We are evaluating the feasibility of installing hot water loops on the steam system that use waste heat from condensate to serve additional hot water customers. This closed loop system would use heat exchangers to take advantage of waste heat sources and supply energy to new customer buildings. The greatest challenge with this concept is logistics. We would need to determine how the loop is installed, obtain long-term customer commitments, and get approvals from regulators.

[26] The wellhead refers to the natural gas well where natural gas is directly extracted from the resource, such as underground or undersea.

[27] Orange and Rockland (O&R) is a Con Edison-owned regulated utility that operates electric and gas infrastructure in northern New Jersey, Orange County, New York, and Rockland County, New York.

3.2.2 Enable a Fundamental Change in Energy Consumption

In 2019, buildings in New York City accounted for more than 20.8 $MMTCO_2e$ of GHG emissions. This contributed to over 29% of the total GHG emissions in our service territory. Primarily, this is through the combustion of onsite fossil fuels like fuel oil or fossil natural gas for building space and water heating. As such, decarbonizing buildings is critical to reaching net-zero GHG emissions by 2050.

We recognize that achievement of ambitious policy goals will require our customers to make changes in consumption including adopting energy efficiency and new steam service connections for existing gas and/or oil customers. We intend to support this fundamental change on our steam system through the approach outlined in Figure 14.

Figure 14. Enabling a Fundamental Change in Energy Consumption

	GHG Emissions Impact	2030 Strategy to Decarbonize Buildings	
Buildings	Contributed approximately **29%** to New York City GHG emissions in 2019. *Approx. 21 $MMTCO_2e$*	**Energy Efficiency**	**Support energy efficiency at steam generation facilities, distribution facilities, and customer sites**
		New Steam Connections	**Encourage new steam system connections for hard-to-electrify customers**

3.2.2.1 Support Energy Efficiency at Steam Generation Facilities, Distribution Facilities, and Customer Premises

Energy Efficiency at Steam Generation and Distribution Facilities

We have identified various initiatives to support continued energy efficiency at our steam generation and distribution facilities, such as:

Station Pressure Reduction

This initiative, expected to be complete in 2022, could reduce seasonal pressure limits, improving the reliability of our system and the fuel consumption at our steam generation plants. This initiative would reduce GHG emissions and improve the reliability of our generating assets, as well as increase available capacity.

Leak Elimination Program

This program involves identifying pipe and valve leaks on our steam distribution system and making the requisite upgrades to reduce or eliminate leaks. This program improves system energy efficiency while improving safety.

Anchor Replacement Program

Anchors help to keep the steam pipe in place to withstand forces from thermal expansion and pressure thrust. This initiative replaces old and degraded anchors, which will improve system efficiency by actively preventing leaks or failures, as well as improving system safety and reliability.

Energy Efficiency at Customer Sites

Energy efficiency is a critical solution to reduce end-use energy consumption for our steam customers. Moving forward, deeper energy efficiency retrofits such as building envelope upgrades will be required to reduce building heating demand and systemwide steam peaks. These efforts require more planning, are more disruptive, and can be 10 times more expensive than traditional energy efficiency measures. We will look to build more specific solutions to support our customers in reducing steam-system specific consumption on their premises. Currently, we support steam customers reducing their steam consumption through our cross-commodity energy efficiency programs that target building envelope upgrades and controls.

In addition to the energy efficiency support, we are assessing the viability of a steam-specific energy efficiency program that will include various measures to directly reduce steam usage at our customers' premises. These programs may include but are not limited to:

- Steam trap maintenance programs or central monitoring
- Steam room, equipment, and piping insulation
- Condensate reuse and heat capture
- Steam pressure reduction valve station upgrades
- Steam air conditioning chiller incentive programs

We will evaluate the applicability of these programs and continue to develop them. Certain steam customers are eligible for incentives if they participate in controls or building envelope energy efficiency programs in the existing commercial and industrial program.

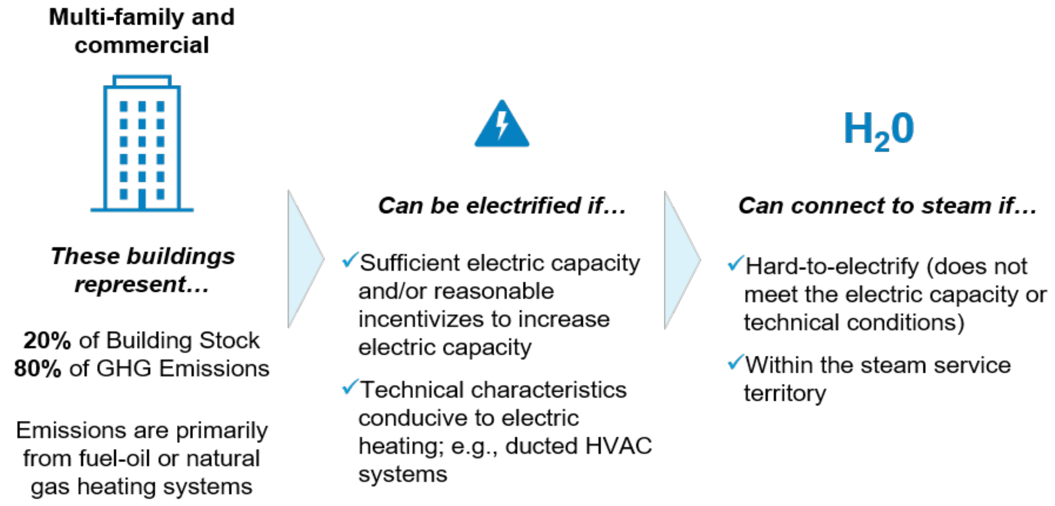
3.2.2.2 Encourage New Steam System Connections for Hard-to-Electrify Customers

Our steam system generating capacity is 27% higher than the existing peak demand and 25%-40% higher than the predicted future peak demands. This reserve enables us to accept new customers and increase existing service to current customers. This reserve capacity is also an asset for customers that wish to switch to steam from more carbon intensive fuels such as heating oil or natural gas, especially if they cannot readily switch to electric building heating.

We will work closely with our gas and electric colleagues to appropriately target hard-to-electrify customers that would benefit from transitioning to steam from oil or gas. Our initial analysis identified approximately 6,000 large buildings operating on oil or gas near steam mains that could be customers. Of these buildings, over 1,000 would have a net-zero cost connection. We will need to aggressively target and pursue these customers to provide them with information on what energy choices are available and best for them to pursue, whether that is electric or steam.

We are revamping our new business strategy to target these customers with education efforts and further developing market intelligence. This program should help additional customers to decarbonize while counteracting some of the system attrition we expect from electrification and reduced energy use from ongoing energy efficiency. Our strategy will be to first pursue the oil fueled space and water heating customers. A summary of where new steam system connections fits into our broader decarbonization approach for buildings is included in Figure 15.

Figure 15. Encouraging New Steam System Connections



3.2.3 Align Our Actions with Climate Policy

We are committed to supporting New York City in achieving climate policy targets. As the primary energy provider for this territory, we have a leading role in moving the market and supporting our customers and constituents in achieving these goals. As far as the CMA, CLCPA, and additional New York State and New York City targets and laws are concerned, we have identified the strategies to support each target applicable to our steam system in Table 11.

Table 11. Aligning Our Actions with Climate Policy

Area	Specific Target	How the Steam System Will Support
CMA	**Local Law 97**: Buildings over 25,000 square feet must significantly reduce GHG emissions *Including specific sub-targets by 2024 & 2030*	**Build a low-to-zero-carbon gaseous fuels portfolio –** Low-to-zero carbon gaseous fuels enable us to deliver cleaner energy to our customers **Support the electrification of boilers with clean energy –** electric boilers and energy storage will enable us to deliver cleaner energy to our customers **Support other methods to reduce steam system GHG emissions –** these methods will enable us to deliver cleaner steam to our customers **Support energy efficiency at steam generation, distribution facilities, and customer sites –** improves efficiency at our facilities and incentivizes end-use energy efficiency, among other GHG emission reduction measures
CLCPA	**Net-zero** economy-wide GHG emissions by **2050**	**Build a low-to-zero-carbon gaseous fuels portfolio –** Low-to-zero carbon gaseous fuels enable us to deliver cleaner energy to our customers **Support the electrification of boilers with clean energy –** electric boilers and energy storage will enable us to deliver cleaner energy to our customers **Support other methods to reduce steam system GHG emissions –** these methods will enable us to deliver cleaner steam to our customers
NYS: New Efficiency New York	**185 TBtu** end use energy reduction by **2025**	**Encourage new steam system connections for hard-to-electrify customers –** provide customers with the information they need on cleaner and cost-effective energy choices **Support energy efficiency at steam generation, distribution facilities, and customer sites –** improves efficiency at our facilities and incentivizes end-use energy efficiency, among other GHG emission reduction measures

We are working in concert with existing customers and potential new customers to support them in adhering with **Local Law 97**, specifically to help them avoid penalties associated with their emissions thresholds. We will continue to de-carbonize our steam system and we anticipate a further 10% GHG emissions reduction by 2030 in addition to the 53% GHG emissions reduction that we have already achieved since 2005. As described, this includes a focus on system improvements and efficiency, as well as various pilot projects in low-to-zero carbon fuels and electrification.

We are further assessing the impact of New York City's December 2021 enactment of **Local Law 154 of 2021** on our business strategy and initiatives going forward. Our understanding of the legislation is as follows:

- Legislation prohibits combustion emitting more than 25 kg of CO_2 per MMBtu of energy within a building, triggered by when an application is submitted for either new construction or gut renovation thresholds, as established by the New York City Department of Buildings.
- The law provides various exceptions, including for those where combustion is required such as laboratories, laundromats, hospitals, crematoriums or commercial kitchens and those fuels burned occasionally not connected to service lines (such as propane for outdoor grills). There are additional exceptions for power and/or steam generation by utilities (e.g., CECONY), and management of food waste and sewage.
- There is an implementation timeline with key dates beginning in 2023 through 2028, which includes additional adoption time for affordable housing units given the financial and technical constraints of such buildings.

We expect that this will have a major impact on our current and future customers. Our steam strategy is aligned with providing customers with the information they need to adopt clean, cost-effective energy options, including switching from on-site fossil natural gas combustion to centralized district energy, if they cannot reasonably convert to electric building heating.

3.3 Climate Resilience

As described in Section 2.2, we engaged in a 3-year **Climate Change Vulnerability Study** to identify the climate risks to our territory and consequently the risks to our steam system. The critical risks identified to our steam system are included in Table 12 below.

Table 12. Critical Risks from Climate Events

Ambient Temperature	Heavy Precipitation, Sea Level Rise, and Storm Surge	Extreme Events
More **intense cold** snaps and more **intense heat waves**	Sea level will **rise 2 feet** by 2050	More frequent **Nor'easters** and **hurricanes**
Drastic regional cold and heat spikes will increase demand and strain supplies	Water may infiltrate our pipes and other equipment, potentially causing outages or damage	Storms may physically damage our pipes and other equipment, potentially causing outages

The **Climate Change Vulnerability Study** highlighted the need to incorporate future climate projections when planning assets and engineering our system to address future risks and to maintain system reliability. We have partnered with our stakeholders to create the **Climate Change Implementation Plan** to adapt to these identified risks while applying our three guiding strategies (Figure 16).

Figure 16. Strategy to Address Climate Risks

Prevent	Mitigate	Respond
Harden energy infrastructure and assets against **projected climate conditions** to **prevent outages**	**Modify** system design and flexibility to **mitigate disruptions** to customer service	**Operational improvements** to reduce recovery timeframe in **response to extreme weather**

The **Climate Change Implementation Plan** is a comprehensive plan to maintain and enhance the resiliency and reliability of our steam system in a changing climate. It includes the application of Climate Change Planning and Design Guidelines to our specifications and procedures and management through a dedicated resilience group with executive oversight. By reviewing our specifications and procedures against anticipated changes to climate conditions, we better understand how to proactively adapt our planning, operations, and emergency response. Using these strategies, we have identified a portfolio of investments that collectively help prevent, mitigate, and respond to the identified climate risks. These specific investments, in concert, support a more climate resilient steam system that stands up to anticipated future climate events. These investments are summarized in Table 13 below.

Table 13. Initiatives to Address Climate Risks

Prevent	Mitigate	Respond
• Continue our **steam distribution infrastructure condition program** to rebuild and rehabilitate steam structures • Rebuild **manholes** throughout our system • **Upgrade** facilities to FEMA+5 guidelines • Use an advanced **Kongsberg model** to support resilience event simulations	• Replace **main valves** throughout our system to isolate steam system outages during a climate event	• Continue developing our **remote monitoring system** to help identify leaks and problem areas in real time • Continue investing in our **GIS** system to help us pinpoint outage areas and improve operational response to outages • Additional **operational programs** to support swift response

Climate Change Planning & Design Guideline

Many of these initiatives are already in progress, and customers are seeing the benefits. We need to employ both new solutions and build upon current efforts to deliver excellent service in unprecedented weather conditions. We are committing up to $30 million on these climate resiliency investments over the next 10 years. The bulk of this dedicated system investment will go toward accounting for climate change in our asset design and construction.

As we move forward, we will continue to work closely with New York City to develop an integrated approach that recognizes the interplay between different infrastructure (such as seawalls, sewage systems, and rain gardens) that may affect our ability to deliver energy to our customers during climate events. An example of this includes the East Side Coastal Resiliency Project, which aims to build coastal protection on Manhattan's East Side from East 25th Street to Montgomery Street.[28]

A strategic portfolio of investments will help to prevent, mitigate, and respond to ongoing climate risks. Further information about initiatives designed to prevent, mitigate, and respond is provided below.

3.3.1 Prevent: Harden Energy Infrastructure

Hardening existing energy systems to withstand extreme weather events and prevent outages requires adding or replacing system components with upgraded equipment to prevent damage to our system.

Steam Distribution Infrastructure Condition Program

This program involves rebuilding and rehabilitating deteriorated steam structures to prevent water intrusion and installing sump pumps in cases where the water infiltration into structures cannot be remediated or gravity drained to an adjacent sewer. This initiative improves the system's ability to withstand flooding events and reduces the risk of water hammer events. Additionally, this enhances system reliability.

Manhole Rebuild Program

This program involves rebuilding or replacing deteriorated manholes. Steam manholes have a 10- to 30-year life depending on roadway traffic and subsurface conditions (particularly ground water). Replacement allows for additional drainage and condensate removal in the event of water infiltration and improves the ability for our employees to safely maintain the steam system.

FEMA+5

This program includes upgrade our steam production facilities and coastal sections of the steam distribution network to FEMA +5 standards to account for projected climate change. Originally, we updated our design guidelines to FEMA +3 after Superstorm Sandy. With new research and analysis on future climate projections, we will review all assets for the FEMA +5 criteria and determine what investments need to be made to the production facilities as well as the distribution network.

Kongsberg Model

The Kongsberg Model is a large-scale three-dimensional computational flow dynamics model of the 91-mile steam distribution system. This two-phase model can simulate the movement of steam in the system and detect condensate conditions within the pipe that may lead to a water hammer steam pipe rupture. This is the first time that such a model was ever built. The model was recently commissioned into service and is being validated continuously with field

[28] Additional details about the East Side Coastal Resiliency project can be found **on their website: https://www1.nyc.gov/site/escr/index.page .**

measurement devices. Over the next 5 years, the model shall gradually be put into meaningful operations and planning use. This model could improve steam's response to potential water hammer events, improving system resiliency, preventing outages, and improving safety.

3.3.2 Mitigate: Minimize Disruptions

When extreme weather impacts our infrastructure, we mitigate disruption to our customers with investments that bolster flexibility to safely and proactively isolate vulnerable infrastructure and provide redundant supply.

Main Valve Replacement Program

This initiative includes replacing valves that are used for isolating steam mains during outages so that work can be safely performed. If a valve is defective, additional valves must be closed for work to be performed, increasing the affected area. This allows us to isolate specific areas of the steam system for repairs and maintenance, reducing the total impact of an outage and improving our employees' ability to maintain system reliability.

3.3.3 Respond: Reduce Recovery Timeframe

Rapid and comprehensive response to extreme events is paramount to providing excellent customer service. This includes improving our ability to respond to outages from future climate events.

Remote Monitoring System

This system uses monitoring to continuously observe system steam trap functionality and water levels. This includes obtaining temperature and water-level data in select locations to allow for early warning of water infiltration or steam trap malfunctions. This initiative will improve our ability to proactively identify and fix leaks or other problems, improving resiliency and reliability.

Geographic Information System (GIS) Upgrade

This software upgrade will map our steam infrastructure in detail and provide real-time visibility into asset performance. Benefits include more effective emergency planning and responses, enhanced employee and public safety, increased asset management and mapping efficiency, and reduced operational costs.

Additional Programs

We recognize that our ability to respond is crucial to customers, and we are continuously improving our ability to respond in the face of extreme climate events, including:

- Enhancing event response guidelines and rigorously testing response planning
- Coordinating with stakeholders to determine additional system functionality needed to further improve storm response efforts
- Procuring additional utility vehicles and utilizing contractor resources to expedite emergency crew mobilization for faster restoration

3.4 Core Service

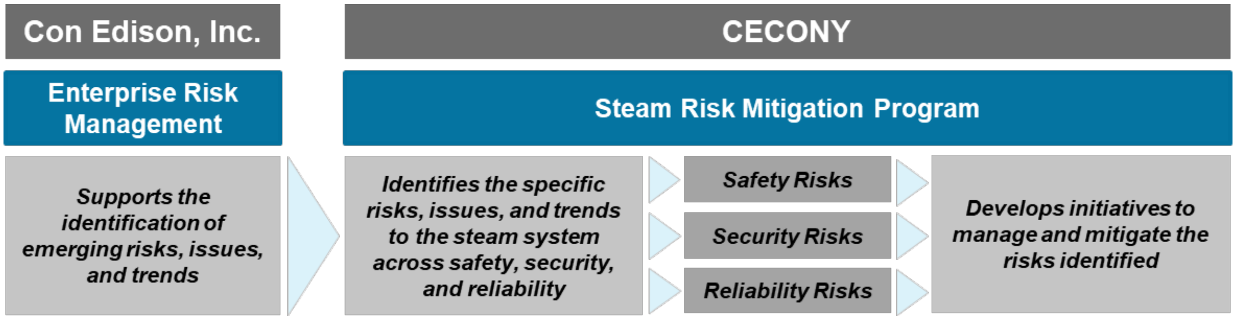
We recognize our role in enabling the New York City economy with safe, secure, and reliable energy service. We will continue to enhance this foundational core while managing the energy transition in an equitable and cost-effective manner. We have defined five sub-strategies to continue delivering safety, security, and reliability while supporting a managed transition. These Core Service strategy components are shown in Figure 17.

Figure 17. Key Components of Core Service

3.4.1 Enterprise Risk Management and Steam Risk Mitigation Program

To continue delivering on our Core Service, we need to understand the risks to our system and effectively manage those risks. Con Edison established the Enterprise Risk Management (ERM) program to help protect the company's long-term value for its customers, the communities it serves, and its shareholders. The risk management team, operated at the Con Edison level, works closely with senior management and employees within CECONY to identify and mitigate risks to our steam system. An overview of how ERM supports the identification and mitigation of risks to our steam system is shown in Figure 18.

Figure 18. How ERM Supports Our Steam Risk Mitigation Program



The ERM program is designed to focus on managing relevant and material risks to the company's strategy and operations and to recognize emerging issues and trends that may shape future risk exposure. Based on the framework, ERM has designed the cadence of its risk identification and assessment review cycle to align with the annual business planning and budgeting process (Figure 19).

Figure 19. ERM Framework

Our ERM team reviews newly identified and existing risks, assesses the adequacy of the existing controls and mitigations in place to address these risks, and proposes new or modified mitigations. These new mitigations are, in turn, planned for and funded through the annual budget process. In addition, the company's capital optimization process is designed to directly evaluate a project or program on its risk mitigation benefits. Lastly, ERM partners with cost managers in Finance Planning and Analysis to develop dashboards that communicate the magnitude and allocation of risk mitigation expenditures to management.

The composition of our corporate risk profile is reflective of the business mix, which largely consists of four categories: Safety and Environment, Operations, Strategic, and Regulatory and Compliance.

These corporate risks are monitored quarterly by the risk owners and reported to senior management through an assessment of key risk indicators and through the auditing process. In addition, these risks are shared annually to the board of directors with additional reporting from risk owners throughout the year. These risks are then communicated to the CECONY teams, which work with the ERM team to identify the specific risks applicable to the relevant commodity system. Our Steam Risk Reduction program takes these relevant risks and identifies specific projects, programs, or initiatives to address them.

Steam Risk Mitigation Strategy

Our programs for risk mitigation within the steam system embody the elements of our Core Service as we invest in a clean and resilient steam system. The ability to manage and mitigate risk is critical, as the evolution of our infrastructure further serves as a foundation to the clean energy future. We have identified the risks that can specifically impact our steam system in Figure 20.

Figure 20. Steam Risk Mitigation Program

Steam Risk Mitigation Program					
Safety Risks		Security Risks		Reliability Risks	
Public	Employee	Physical	Cyber	Operational	Asset

These risks inform our Core Service programs and initiatives, which are further described in the following sections.

3.4.1.1 Enhanced Safety

Our programs are designed to minimize safety incidents for our employees and to promote public safety for the customers and stakeholders that interact with our steam system.

We have identified the following focus areas to continue improving safety:

Public safety – Preventing serious injuries and fatalities associated with our system

- Educate the public on steam safety and what to do in the event of an emergency
- Ongoing operational programs such as leak detection, rapid repair, and damage prevention
- Proactively replace problematic equipment with modern, safer alternatives to protect against public harm caused by failing equipment

Employee safety – Creating an interdependent zero harm culture

- Promote a first-class safety culture by supporting employees to use their voice to participate in safety every day, every task, and every job
- Focus on high hazard injury prevention by proactively identifying and addressing unseen hazards and making improvements to protocols and processes prior to injury
- Use and develop tools by leveraging data and thorough job briefings to drive toward a zero-accident workplace

From a capital investment perspective, we are committed to the following initiatives to continue improving safety:

Safety Initiatives

Please refer to Section 3.3.1 for additional details about our Kongsberg Model, and Manhole Rebuild Program initiatives and Section 3.3.3 for additional details about our Remote Monitoring System initiative.

3.4.1.2 Enhanced Security

Our security programs identify potential internal and external threat risks, and we implement controls, procedures, and processes to mitigate them. Our mitigation measures tie into our security platform, all coordinated through our 24/7 Security Operations Center (SOC).

Physical Security

Corporate Security's core mission is to provide and execute a comprehensive security program that allows for a proactive partnership with both our operating and support organizations along with external law enforcement, and governmental and regulatory agencies. To meet our mission, we have incorporated processes to protect critical infrastructure. These processes encompass a wide array of functional responsibilities, including policies and procedures, investigative and tactical response, cyber forensic investigations, electronic security systems, physical security measures, central station monitoring, compliance with governmental and regulatory initiatives and standards, security awareness training, and regular interaction with law enforcement at every level.

Examples of how we incorporate comprehensive security processes to protect our employees, the public, and physical assets include:

- Our Corporate Security team routinely performs critical facility site assessments to identify opportunities to reinforce the physical security measures at these sites. Security measures have prevented unauthorized entry and allow for early detection if there are breaches in the perimeter.
- Penetration testing is also routinely done to ensure that physical security practices are adhered to.

Cybersecurity

Cybersecurity is one of the biggest risks for organizations of all types. It is an even bigger factor for organizations operating critical infrastructure and managing sensitive data. While utilities have avoided a catastrophic attack on the grid to date, cyber incidents and cyber-probing have increased for years and present a clear warning sign of the potential for future harm.

Our cybersecurity program is managed at the enterprise level by the IT Security group. The program uses a framework combining defense-in-depth (multiple security layers) with defense-in-breadth (multiple tools at each layer). IT Security intends to increase cybersecurity capabilities by growing the cybersecurity organization, advancing new technologies, and increasing process maturity.

The utility needs to manage sensitive customer data, such as Personal Identifiable Information (PII) and financial information, to ensure that customer trust is upheld.

We recently expanded our use of next-generation intrusion detection and prevention tools to further protect our customers' personal information. We also provide regular cyber threat training to our employees, which is particularly important because our steam and other systems are considered critical infrastructure. We are committed to mitigating the risks of data loss and service disruption, while continuing with digitization initiatives that support customer engagement by providing access to necessary system and customer information. In addition to mitigating the threat of data breaches and cyber threats, our security framework also allows for enhanced automation, remote control, and data acquisition. We are investing in cybersecurity programs through 2026 to effectively manage these risks.

3.4.1.3 Enhanced Reliability

We are proud of our commitment to ongoing steam system reliability. Many of our core programs are focused on maintaining high levels of reliability by maintaining our system, training our staff, and continuously monitoring the system.

Steam Main Assessment and Inspection Program

As part of the Steam Flatiron Action plan, the Steam Operations and Engineering teams have developed a Steam Main Inspection and Assessment Program. The assessment portion of the program uses existing system information to determine if there are any vulnerabilities in the distribution network. If areas of concern are identified, visual internal pipe inspections are conducted using a specially designed steam pipe inspection robot. These inspections are reviewed and evaluated by the engineering team. In addition to inspections, an assessment team has determined that pre-1906 piping should be replaced due to the lower strength of the material used at the time of construction. The Operations team is in the process of replacing these sections of piping with six replacement locations completed and three additional pending.

Smart Robot

To inspect our steam infrastructure safely and accurately, we deploy our steam main inspection smart robot to perform internal visual inspections and to measure remaining wall thickness in steam pipes. The smart robot enables routine detailed steam pipe inspections, improving system safety, and providing better customer service by informing customers of steam conditions. We will continue to upgrade the pairing software to better operate the robot and perform qualitative analysis of the inspection data.

Other Initiatives

Please refer to Section 3.2.2 for additional details about our Leak Elimination Program, Station Pressure Reduction initiative, and Anchor Replacement Program.

Please refer to Section 3.3.2 for additional details about our Main Valve Replacement Program, Section 3.3.3 for additional details about our Remote Monitoring System initiative, and Section 3.3.1 for additional details about our Kongsberg Model.

3.4.2 Manage Transition

We understand that we need to continue to enhance our foundation of Core Service while we undergo the energy transition. We want to support an equitable transition by managing rate impacts and providing the benefits of a clean and resilient energy system to all our customers and stakeholders.

3.4.2.1 Manage Rate Impacts of Transition

Rate design for service should be based on the costs to support customer use of our steam system. Such rates should provide customers with price signals that promote the efficient use of the delivery system.

As we move towards greater efficiency and encourage customers to reduce consumption, we will need to modify our current business model to ensure the longevity of the steam system. One way this could be accomplished is through a revenue decoupling mechanism, similar to the electric and gas system. This will reduce the volatility of revenue on the business and will best position to Company to execute on this plan and move towards the decarbonized future.

With future investments in the decarbonization of our system as well as preparations for the impact of weather, electrification, and energy efficiency, we need to also be mindful of bill impacts on customers. While the bill impacts due to these various changes are still uncertain, our decisions will need to ensure that steam service remains a viable business model going forward.

We will continue to provide cost-effective service to our steam customers and work toward an integrated customer experience where steam can be one of many energy options for our Manhattan customers.

3.4.2.2 Enable an Equitable Transition

We are sensitive to the needs of our disadvantaged and low- to moderate- income communities and want to ensure that they are not disproportionately burdened by the clean energy transition. Additionally, these communities should fully participate in the benefits of a clean energy economy. Therefore, our clean energy programs, such as our CECONY-wide Energy Efficiency incentives, have specific low- to moderate- income targets and funding. Please refer to the **Integrated, Electric, and Gas Long-Range Plans** for more specific details about how we support Energy Efficiency and Building Heating Electrification for low- to moderate- income customers.

Enabling an equitable transition is particularly challenging for these communities, as our analysis indicates that these customers tend to live in older, less-efficient buildings that are less conducive to building heating electrification. Some of these buildings overlap with the CECONY Steam territory and can be viable candidates for steam energy service. We see the steam system as a way for these tenants to share the benefits of no on-site combustion and cleaner energy if the buildings they occupy cannot reasonably be electrified.

3.4.3 Employees

Our people represent the heart and engine of our company. We are more than 14,000 employees coming from many backgrounds, ethnicities, ages, and races and we bring different skills, experiences, and viewpoints to the workplace. Our diversity is central to our success; it makes the company stronger and helps us lead the industry on every level, from maintaining our best-in-class reliability to achieving a sustainable, clean energy future for our company.

We aim to make sure every person here feels respected, included, and heard. Making sure our workplace is inclusive and respectful means our people can bring their best and do their best—and helps us attract and retain the best talent. By regularly examining and improving our hiring process and retention policies, we are making Con Edison a better place to build careers, thereby building an even better Con Edison.

In a decade in which change will come faster than ever, ensuring that our workforce has the right skills, knowledge, and capabilities is essential to achieving our clean energy goals.

We know that technology will play a key role in building a resilient, reliable steam system of the future that delivers 100% clean energy. Our employees will need strong technical skills to operate, monitor and maintain a range of technically advanced energy infrastructures. This means stepping up our focus on STEM fields, including continuing to attract strong engineering and computer science graduates. Generating successful partnerships with customer advocacy groups, regulators, governmental partners, and other stakeholders means attracting and retaining employees that are customer-oriented, flexible, innovative, strategic, calculated risk-takers, and that are learning agile. It also means focusing on other important skills such as financial acumen, project management, data analytics and marketing. Other competencies critical to the vision include cross-cultural communication, collaboration, and empathy to address environmental, equity and social justice issues associated with the clean energy transition.

Our goal includes relying on our existing workforce to develop many of the job skills and requirements that will be needed. Through in-person and remote training options, we provide continuous state-of-the-art training and development to our employees in a wide variety of areas, including technical training in electric, gas, steam, and field operations, as well as strengthening leadership competencies. These programs ensure employees work safely, effectively, efficiently, and in a way that is compliant with our policies, procedures, and regulatory expectations, and embodies continuous improvement.

We know achieving this future will require an evolution in how we deploy and develop our workforce and we are committed to ensuring our employees are prepared, highly skilled, and adaptable to advance this transition for our customers and society.

3.5 Customer Engagement

To deliver customer value, we need to deliver on our strategic objectives of Clean Energy, Climate Resilience, and Core Service. This strategy is only achievable if we provide the right information, data, and messages to help our customers make informed energy choices that align with their tenants' lifestyles. We must continue improving their experiences, such as enabling access to self-service applications.

Our customer engagement programs are designed to improve the customer experience, provide customers with the right data and tools, and further integrate the journey across our electric, gas, and steam businesses. We strive to connect our customers with the latest intelligent technology so that they can reap the benefits of greater access and understanding of their energy usage. Additionally, customer and company software help us better identify customer outages and reduce response times during those events.

To support our continued ability to improve the customer experience, we are investing in:

- CSS improvements and a customer relationship management (CRM) upgrade that makes common transactions easier to navigate.
- GIS system upgrades to enable us to monitor the steam system in real time and provide better information to customers about outages and steam system operation.

To facilitate customer energy choices, we are investing in:

- Tools, data, and analysis to support better customer understanding of their energy usage, including our smart meter hardware conversion and steam AMI program.

- Steam information campaigns to teach local building owners and operators about **Local Law 97** (LL97) and how the steam system could support alignment with these regulations.

- A customer energy choice program, which would support new and existing customers with reviewing their energy options with regards to LL97. As a joint effort with our Energy Efficiency group, we will review buildings, their proximity to steam infrastructure, and potential incentives available.

3.5.1 Continue to Improve the Customer Experience

Our customer experience initiatives include a portfolio of projects designed to provide customer value. These projects create an impactful customer outcome and provide accurate information for informed decision making around energy choices. We aim to create a unified customer journey that allows greater visibility across our commodity systems and enables us to empathize with our customers' needs.

GIS Upgrade
Please refer to Section 3.3.3 for additional details about our GIS Upgrade.

3.5.2 Facilitate Customer Energy Choices

We aim to reduce pain points in the many decisions and changes that our steam customers will make in the future on behalf of their tenants, especially as they relate to clean energy. Identified points of friction include:

- Lack of knowledge or information about clean energy solutions
- Significant upfront costs for energy efficiency and building heating electrification retrofits
- Lack of contractors to perform energy efficiency and building heating electrification retrofits
- Lack of insight or data behind energy usage patterns and energy options
- Lack of knowledge about applicable laws and regulations, such as **LL97**

These customer challenges require us to integrate the end-to-end experience, no matter what system the customer is connected to. We will do this by:

- Enabling the customer to make the best energy choices in alignment with the state's climate goals. Examples include providing incentives to reduce the upfront costs of energy efficiency upgrades and working with New York City building permit agencies to better integrate incentive programs.
- Serving as a trusted advisor to the customer by building a comfort level and mutual respect.
- Creating an energy products and services marketplace through contractor and ecosystem relationships. An example includes collaborating with NYSERDA to integrate workforce training programs to align with the needs of the clean energy transition.
- Managing the costs of the energy transition by recognizing cost-effective considerations.

This strategy is the impetus behind large-scale customer investments such as our CSS enhancement, which allows us to aggregate, collect, and analyze data across our customers' various utility services. It will enable us to provide personalized recommendations and insights, thereby reducing friction.

Facilitating our customers' ability to make informed energy choices is complementary to our customer experience initiatives in support our Customer Engagement strategic objective. Our main investments in facilitating customer choice include:

Smart Meter Hardware Conversion

This initiative replaces customer meter hardware with improved meters. The new Vortex meter has significantly improved measurement accuracy and provides enhanced remote metering and data analysis capabilities. This initiative will unlock additional steam customer data capabilities, including more accurate metering and remote analysis capabilities.

Steam Advanced Metering Infrastructure

AMI is a tool that will support many objectives for us and our steam customers. For example:

1) Safety - Steam AMI will give us additional insights into potential issues within the distribution grid through customer trap monitoring. Moreover, it will immediately alert us to any issues with our equipment located within the customer meter room.

2) Customer Experience – Steam AMI will allow for better customer experience, as it will provide additional more granular detail to customers. After implementation, this data will be available to all customers through a seamless portal.

3) Customer Programs – Steam AMI will allow us to introduce additional customer programs, such as steam demand response and energy efficiency.

4) Operational Efficiency – Steam AMI will allow us to automate meter reading, resulting in increased efficiency and savings for our customers.

Energy Efficiency

Please refer to Section 3.2.2 for additional details about our energy efficiency programs.

Steam Information Campaigns

We have listened to our customers who are mainly building owners and/or operators. They thoroughly understand **LL97**[29] and have existing relationships with many energy service providers. We engage with these customers to discuss LL97 and the steam system's potential future role. These customers typically have limited access to significant capital funding and could benefit from low upfront cost solutions to decarbonize.

Some of our customers are still in the process of learning about LL97 and the impact to their building operations. We will continue to engage with these customers to inform them about the benefits of steam and how a conversion to the steam system may align with decarbonization. The challenge with these customers is that decisions tend to go through cooperative or tenant boards and the information provided needs to address varied perspectives.

[29] **Local Law 97** (sometimes known as LL97) is the provision under the CMA that requires buildings >25,000 square feet to reduce emissions 40% by 2030, using a 2005 benchmark

4. Investments to Deliver Value

Our strategic objectives of advancing Clean Energy, Climate Resilience, Core Service, and Customer Engagement will provide valuable benefits to our customers, the economy, and society. While steam is already considered one of the cleanest options to our customers, by 2030, our plans will enable a further 10% reduction in GHG emissions from today's levels. It sets us on a path to achieving net-zero GHG emissions by 2050. Recent NYSERDA analyses estimate that societal benefits due to avoided GHG emissions and improved health will outweigh the costs needed to get to net-zero GHG emissions by 2050.[30] Additionally, various forums point to the significant number of green jobs that will be created through enacting clean policies.

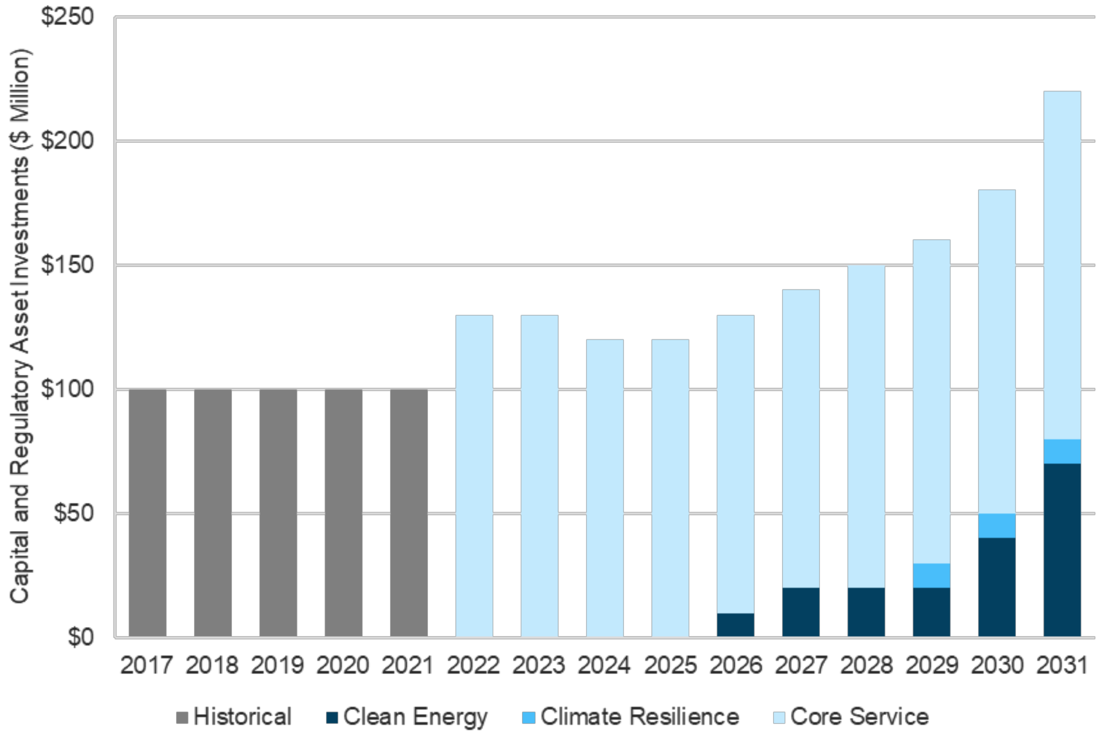
From a climate resilience perspective, our plans will mitigate and respond to current and projected climate risks such as heat waves, extreme weather events, sea level rise, and storm surge. They help prevent outages, minimize customer impact, and restore service faster in the event an outage occurs. Our core programs will provide continued safety and reliability, in addition to being more operationally efficient. At the customer level, our IT programs improve customer experience and engagement, providing them with more choice, control, and convenience.

To unlock these benefits and achieve policy goals and customer needs, we have identified steam system investments of approximately $1.5 billion through 2031. The investments needed for Customer Engagement are included in each of these categories.

We include our expected capital expenditures through the next 10 years in Figure 21, which will be further refined in preparation for future rate filings. The figure represents our best estimate of what is necessary to support 2030 GHG emissions goals, continue delivering our core services, and adapt our system to a changing climate. We will seek regulatory approval for investments during subsequent rate cases and proceedings.

[30] Supporting reports by NYSERDA and the New York State Climate Action Council can be found **here** and **here**, respectively.

Figure 21. Steam Capital and Regulatory Asset Investments (2017 – 2031)



Many of the investment dollars are allocated toward the latter part of the decade to account for maturity of decarbonization options in terms of both technology and policy. Examples of near-term initiatives providing decarbonization benefits include our No. 2 oil conversion that reduces emissions from our backup fuels, station pressure reduction that improves the reliability of our generating assets, and our remote monitoring reliability program that proactively identifies leaks and other issues.

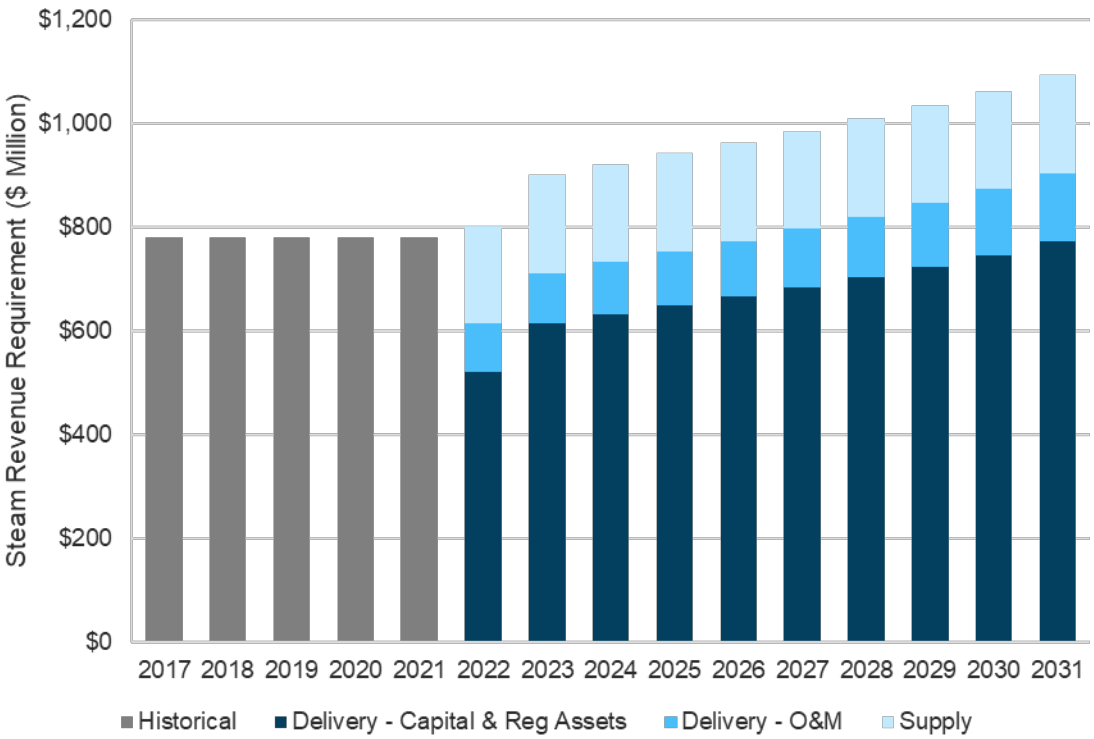
4.1 Cost-Effectiveness

Customer costs are expected to increase to fund required investments. We estimate that the identified utility investment plan will increase the steam revenue requirement—a proxy for overall customer costs—by approximately 4% per year through 2031[31] (see Figure 22). This cost estimate is based on assumptions that can change and excludes items such as deferred costs the company is entitled to recover, and increased costs resulting from changes in state policy and unanticipated events. This estimate will be further refined in preparation for future rate filings. Some of these investments will offset costs currently incurred by customers. For example, costs for heating oil and/or natural gas will be eliminated for customers moving to steam building heating technologies. The estimated capital costs associated with electrifying these buildings must also be taken into consideration, as centralized investments on the steam system would be a more cost-effective solution for a large portion of our customer base. This is supported by numerous independent studies.

[31] Revenue requirement estimates based on identified investment plan and financial assumptions derived from other company filings, outcomes, and prior experience.

Cost-effectiveness is an important consideration to keep expenses manageable for our customers. Our efforts to maintain cost-effectiveness includes prioritizing lower cost solutions that deliver GHG emissions reductions, providing resilience of our existing infrastructure to extreme weather impacts, and delivering on operational efficiency to mitigate cost increases. Additionally, centralizing our decarbonization efforts maximizes impact. We have analyzed various models that all support a centralized strategy to steam decarbonization investments, rather than a building-by-building approach for specific areas of our service territory.

Figure 22. Steam Revenue Requirement (2017 – 2031)



4.2 Low- and Moderate-Income Customers

Given the operations of our steam system and that we generally deliver steam at the building level, we typically interact with building owners and management companies rather than individual low-income tenants, . We are committed to identifying and evolving future programs to support low-income customers with steam service.

Our future initiatives include new and expanded program offerings providing incentives for energy efficiency in low- and moderate-income buildings, partnerships with the New York City Housing Authority, and engagement with stakeholders and regulators to align incentives of building owners with those of tenants.

We will continue to evolve our programs with these considerations in mind. We will also need to have outreach with environmental justice groups and other stakeholders as we grow and learn from work in these areas.

See our **Integrated, Electric, and Gas Long-Range Plans** for further discussion on our low- and moderate-income customer programs.

4.3 Rate Design

An important consideration for delivering a cost-effective energy transition and mitigating needed investments is rate design. Rate design for steam service should be based on the costs to support customer use of the steam system. Such rates should provide customers with price signals that promote efficient use of the delivery system.

As we move towards greater efficiency and encourage customers to reduce consumption, we will need to modify our current business model to ensure the longevity of the steam system. One way this could be accomplished is through a revenue decoupling mechanism, similar to the electric and gas system. This will reduce the volatility of revenue on the business and will best position to Company to execute on this plan and move towards the decarbonized future.

With future investments in the decarbonization of our system as well as preparations for the impact of weather, electrification, and energy efficiency, we need to also be mindful of bill impacts on customers. While the bill impacts due to these various changes are still uncertain, our decisions will need to ensure that steam service remains a viable business model going forward.

We will continue to provide cost-effective service to our steam customers and work toward an integrated customer experience where steam can be one of many energy options for our Manhattan customers.

5. The Road Ahead

As we move toward a cleaner, more resilient future that maintains our foundational core and brings value to our customers, we cannot forget who we serve. Ultimately, this evolution is about our stakeholders and improving their communities and experiences.

As referenced throughout this document, we have done a significant amount of research and analysis on what it will take to support this future. We have shared with you our **Climate Change Vulnerability Study**, our **Climate Change Implementation Plan**, our view on how we can achieve a net-zero GHG emissions steam system by 2050, and other details. We know what we must achieve, and we have credible paths to get there:

- **Clean Energy:** Economy-wide net-zero GHG emissions in our service territories by 2050
- **Climate Resilience:** Increased resilience of our energy infrastructure to adapt to climate change
- **Core Service:** World-class safety, reliability, and security, while managing the rate impacts and equity challenges of the energy transition
- **Customer Engagement:** Industry-leading customer experience and facilitation through the energy transition

We will manage shifts in demand and a significant reduction in emissions, while continuing to provide safe, secure, and reliable service to our customers. We will need to educate potential customers on the immediate decarbonization benefits of steam and how it can be an attractive option where building heating electrification is not practical. We will pursue initiatives in electric boiler systems and low-to-zero carbon gaseous fuels to evaluate viability and practicality.

Supporting our strategic objectives will deliver value to our customers and society, but it will require significant investment. We are well-positioned to enable these changes and partner with stakeholders to enact meaningful change. Utility investments are a cost-effective means to meeting societal objectives, and we are determined to seek out cost-effective benefits through:

- Continued **operational improvements**
- Focus on investments that deliver on **multiple strategic objectives**, such as investments in our steam production equipment

Beyond the utility, the clean energy future will require cooperation, collaboration, and innovation from many different parties and market participants. To support the market buildout, we will continue to advocate for technology-neutral policy that:

- Enables us to be flexible in our pursuit of net-zero GHG emissions in New York City by 2050
- Allows us to amplify the advantages of our steam system
- Provides customers cost-effective options in adopting clean energy solutions

We acknowledge there is more work to be done with respect to equity and environmental justice. We are committed to evolving our programs and will also reach out to environmental justice groups and other stakeholders as we grow and learn from work in these areas.

Industry and societal trends in policy, technology, and customer adoption are uncertain. To account for this uncertainty, we look to our pathway framework that allows for flexibility to achieve net-zero GHG emissions by 2050. Signposts will continuously inform our strategy and help us plan for maximum efficiency of operations and optimal allocation of resources. An overview of our analysis of potential signposts is included in Table 14.

Table 14. Signposts by Representative Pathway

	Full Electrification	Targeted Electrification	Hybrid Consumption
Policy Signposts	Policies **mandate** electrification in New York City.	Policies **mandate** or **strongly support** electrification in New York City.	Policies support **decarbonization** while being technology-agnostic in New York City.
Technology Signposts	Electric boiler technology **rapidly declines** in cost and improves in quality.	Electric boiler technology **declines as expected** in cost and improves in quality; **low-to-zero carbon gaseous fuels** are viable in **specific use cases.**	**Electric boiler technology** and **low-to-zero carbon gaseous fuels** decline in cost as expected; **low-to-zero carbon gaseous fuels** are viable as a direct fuel source for hard-to-electrify buildings.
Customer Signposts	Customers **rapidly adopt** electric building heating technologies; some new customers for steam due to technical or financial constraints; greater losses from customer energy efficiency.	Most customers **rapidly adopt** electric building heating technologies; many customers **opting for steam** due to technical or financial constraints; moderate losses from customer energy efficiency.	Customers have more energy source options; many customers continue to adopt **steam** building heating technology due to various benefits; moderate losses from customer energy efficiency.

When it comes to policy, we understand that New York State, New York City, and local municipalities continue to enact nation-leading clean energy rules and may continue to develop future legislation. Accordingly, our long-range plans and analysis are based on clean energy policies as of April 2021.

We will highlight additional details in a forthcoming Steam Rate Case. Concurrently, we have released **Integrated, Electric, and Gas Long-Range Plans** that provide insight into our overall and commodity-specific views of each system. We will also be releasing a 10-Year IT Strategic Plan, which describes the important investments we are making in technology to achieve strategic objectives of Clean Energy, Climate Resilience, Core Services, and Customer Engagement. We look forward to working with our many stakeholders, regulators, customers, and constituents to bring this future into reality.

Acronyms and Abbreviations

AMI: advanced metering infrastructure

BNYCP: Brooklyn Navy Yard Cogeneration Partners

Btu: British thermal unit or units

CCS: carbon capture and storage

CECONY: Consolidated Edison Company of New York, Inc.

CG: Certified Gas (pilot)

CIS: customer information system

CLCPA: Climate Leadership and Community Protection Act

CMA: Climate Mobilization Act

CO_2: carbon dioxide

CO_2e: carbon dioxide equivalent

CRM: customer relationship management

CSS: customer service system

ERM: Enterprise Risk Management

GHG: greenhouse gas

GIS: geographic information system

kg: kilogram(s)

km: kilometer(s)

Mlb: thousand pounds of steam

MMT: million metric tons

MW: megawatt(s)

MWh: megawatt-hour(s)

NYSERDA: New York State Energy Research & Development Authority

O&M: operations and maintenance

O&R: Orange and Rockland

RNG: renewable natural gas

SNG: synthetic renewable natural gas

TBtu: trillion British thermal units

TCO_2e: tons of CO_2e

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