



Initial Gas Long-Term Plan

Executive Summary

New York State Electric & Gas
and Rochester Gas and Electric

Case 23-G-0437

October 2, 2023

Executive Summary

New York State Electric & Gas Corporation (“NYSEG”) and Rochester Gas and Electric Corporation (“RG&E”) (collectively, the “Companies”) present this Gas Long-Term Plan (“LTP”) in accordance with the New York Public Service Commission’s (“Commission” or “PSC”) May 12, 2022 *Order Adopting Gas System Planning Process* (“Gas Planning Order”).¹ The Gas Planning Order establishes a gas system planning process for natural gas local distribution companies (“LDCs”) in New York and includes, among other things, a requirement for each LDC to file a long-term plan. This LTP represents the Companies’ commitment to provide safe, reliable, and affordable energy service that delivers sustainable reductions in greenhouse gas (“GHG”) emissions while preserving customer choice to its almost 600,000 natural gas customers.²

This filing focuses primarily on the Companies’ gas businesses, while recognizing the role served by its electric distribution businesses to accommodate growth in electricity usage from the conversion of heating and other end-uses from natural gas (and other fuels) to electricity. NYSEG and RG&E’s gas LTP and supporting analyses reflect data and assumptions regarding current technology and costs, allowing the Companies to present a realistic, achievable plan that considers the on-the-ground realities and forecast uncertainties that will ultimately determine the timing and cost of meeting the State’s GHG emissions reduction targets. These real-world challenges, many of which are outside of the control of utilities, regulators, and legislators, will impact the execution of the Companies’ LTP as well as the timing and cost of the statewide decarbonization effort. Addressing these challenges should guide the actions of policy makers and utilities as they develop policies and programs to pursue opportunities and address challenges.

Avangrid’s Commitments to Reducing GHG Emissions

Avangrid, Inc., (“Avangrid”), NYSEG and RG&E’s corporate parent, has GHG emission reduction goals that align with New York’s Climate Leadership and Community Protection Act (“CLCPA”). More specifically, Avangrid has established a goal of achieving carbon neutrality in Scopes 1 and 2 emissions by 2030. This aggressive goal is consistent with Avangrid’s network platform to connect renewable energy to over 3 million customers in the Northeast, as well as Avangrid’s position as the 3rd largest wind operator in the US. Achieving Avangrid’s carbon neutrality goal will require significant actions by every Avangrid business unit including its utility subsidiaries. Recognizing this need, the Avangrid Board of Directors adopted a Climate Action Policy and a Sustainability Development Policy in February 2023.

The Climate Action Policy sets forth the following corporate commitment:

AVANGRID seeks to contribute actively and decisively to a low- carbon and sustainable future, delivering clean, low emission energy, minimizing the environmental impact of our activities and

¹ Order Adopting Gas System Planning Process (“Gas Planning Order”) issued on May 12, 2022, in Case No. 20-G-0131.

² NYSEG serves approximately 272,000 natural gas customers in 30 counties; RG&E serves approximately 323,000 natural gas companies in 7 counties.

supporting and promoting actions that address climate change. Such efforts must be compatible with social and economic growth.³

Avangrid's Sustainability Development Policy establishes specific objectives that contribute to sustainable outcomes across the businesses as well as for the communities and customers that it serves. For example, the policy calls for Avangrid to "promote access to affordable energy for low income and rural communities,"⁴ a commitment that is particularly relevant in the NYSEG and RGE service areas, which include relatively high proportions of both.

Avangrid's 2022 Sustainability Report describes the progress toward Avangrid's corporate-wide goal of achieving carbon neutrality in Scopes 1 and 2 emissions by 2030.⁵ The 2022 Sustainability Report also identifies several actions that are being taken by Avangrid's utility businesses, including NYSEG and RG&E, that will reduce the GHG emissions associated with (1) operating the existing gas infrastructure, and (2) heating and other customer energy requirements, including:

- acceleration of leak-prone pipe replacement;⁶
- investments in advanced leak detection and gas capture technologies;
- connection of renewable natural gas ("RNG") from farms, wastewater treatment facilities and landfills;
- studying the blending of green hydrogen with natural gas in distribution facilities;⁷
- facilitating the adoption of electric heat pumps and other cleaner, less-emissions-intensive heating options as part of a beneficial electrification strategy; and
- helping residential, commercial, industrial, and institutional customers increase their energy efficiency while lowering their energy costs and environmental emissions.⁸

Avangrid Renewables expects to invest \$4.3 billion by the end of 2025 to support US emissions reductions including significant growth in renewable capacity such as solar and onshore wind as well as innovation and emerging technologies such as offshore wind, green hydrogen, and storage.

Avangrid's 2023 Sustainability Report, to be published in 2024, will include a discussion of Avangrid's "Just Transition Plan" that will reflect input and progress from each subsidiary, including NYSEG and RG&E. The Just Transition Plan will support Just Transition principles and actions aligned with Avangrid's governance policies. The principles and actions will be designed to ensure that customers, communities, and workers are not left behind in the energy transition.

³ *Avangrid Climate Action Policy, February 16, 2023, p. 1.*

⁴ *Avangrid Sustainable Development Policy, February 16, 2023, p. 3.*

⁵ *Avangrid 2022 Sustainability Report, "Our ESG Goal Scorecard - 2022 Results and 2025/2030 Goals", p. 7.*

⁶ *The Joint Proposal in Case 22-E-0317, et. al., reflects an agreement to continue NYSEG and RG&E's accelerated leak-prone pipe replacement over the next 3 years, albeit at a slower rate in recent years as the Companies' are nearing the end of their program.*

⁷ *NYSEG and RG&E are monitoring blending pilot projects in other jurisdictions.*

⁸ *Avangrid 2022 Sustainability Report, p. 33.*

Policy Guidance

Under New York Public Service Law, gas and electric utilities have the obligation to provide service that is “safe and adequate and in all respects just and reasonable.”⁹ The CLCPA establishes New York state-wide goals to reduce GHG emissions from a 1990 baseline by 40 percent by 2030 and 85 percent by 2050.¹⁰ In addition, the CLCPA requires state agencies to take actions to ensure that: (1) at least 35 % of benefits from energy program spending (e.g., energy efficiency and electrification) be directed to disadvantaged communities (“DACs”), with a goal of 40% and (2) their decisions will not “disproportionately burden disadvantaged communities”.¹¹ Policy makers are also responding to evidence of the impact of climate change in New York, including an increase in the frequency and severity of storms, by placing greater emphasis on the resilience of energy networks and the reliability of energy supply on the coldest and hottest days of the year.¹²

The Commission is pursuing several regulatory initiatives that are aligned with the CLCPA, including a gas planning proceeding initiated in March 2020. The resulting Gas Planning Order established a gas system planning process for natural gas LDCs in New York, with a requirement that planning be performed in a manner that is consistent with the CLCPA.¹³ The process established in the Gas Planning Order requires each LDC to file a long-term plan every three years¹⁴ plus annual updates on May 31st in the interim years. The three-year cycle is designed to provide for future comprehensive updates to reflect new information and insights that inform the long-term plan. Therefore, while the Companies’ LTP necessarily incorporates a 20-year forecast of many data inputs and assumptions, the focus should be on whether the Companies’ three-year action plan is reasonable given current facts and circumstances.

Implications of Policy Guidance for the LTP

There is considerable variation among LDC service areas within New York. Each LDC long-term plan must be tailored to account for service area-specific characteristics including customer energy profiles, the proportion of customers served within DACs, the regional economy, utility infrastructure and supply portfolios, and local weather conditions.

More generally, long-term natural gas plans must strike a balance between accommodating uncertainties regarding future determinants of energy demand and supply over the 20-year term of the plan and the need to take actions to make meaningful progress in reducing GHG emissions and contribute learning that will improve the efficiency and effectiveness of the long-term plan. The three-year long-term plan cycle prescribed in the Gas

⁹ *New York Public Service Law – PBS §65.1.*

¹⁰ *The Commission has acknowledged that “the CLCPA contains no mandates or guidelines directly related to emissions associated with the State’s gas distribution system or gas supplied by utilities.” (Case No. 22-M-0149, Order Assessing Implementation of and Compliance with the Requirements and Targets of the CLCPA, Public Service Commission, May 12, 2022, p. 23).*

¹¹ *CLCPA § 75-0117 Investment of funds, p. 16; CLCPA §7 Climate change actions by state agencies, p. 19.*

¹² *See, for example, “Climate Change Vulnerability Study, New York State Electric & Gas Corporation and Rochester Gas and Electric Corporation,” Case 22-E-0222, September 22, 2023.*

¹³ *The Gas Planning Order noted that the CLCPA “does not impose specific requirements on the State’s gas distribution system, rationally, meeting the CLCPA’s emissions reduction targets for the entire economy will require emissions reductions from the gas distribution system.” Gas Planning Order, p. 4.*

¹⁴ *The Companies’ LTP is the third such filing, following National Fuel Gas (December 22, 2022) and Consolidated Edison/Orange & Rockland (May 31, 2023).*

Planning Order is designed to provide for future comprehensive updates that reflect new information and insights including advances in technology and other important drivers.

This LTP includes modeling of specific actions related to decarbonizing the natural gas business (“decarbonization actions”) and produces an estimate of the GHG emissions reductions and cost impacts resulting from each decarbonization action and for the overall collection of actions. The Companies have modeled six main decarbonization actions: (1) weatherization, (2) building electrification, (3) industrial customer programs (including carbon capture), (4) thermal energy networks (“TENs”) that employ geothermal technology, (5) blending of renewable natural gas (“RNG”), and (6) blending of green hydrogen with pipeline gas for delivery to customers. The quantitative analysis of these efforts provides projections of GHG emissions reductions, natural gas bill impacts, and other implementation costs based on the assumed adoption rate of each decarbonization action.

Other integral elements of the LTP include refining the process to identify and implement non-pipe alternatives (“NPA”) and developing programs that address the needs of DACs and low- and moderate- income (“LMI”) customers. Notably, NYSEG and RG&E’s gas service areas include 80 and 86 DACs, respectively, including many rural communities. This LTP provides an opportunity to consider how to make progress in addressing environmental justice priorities and the needs of LMI customers, located within and outside of DACs.

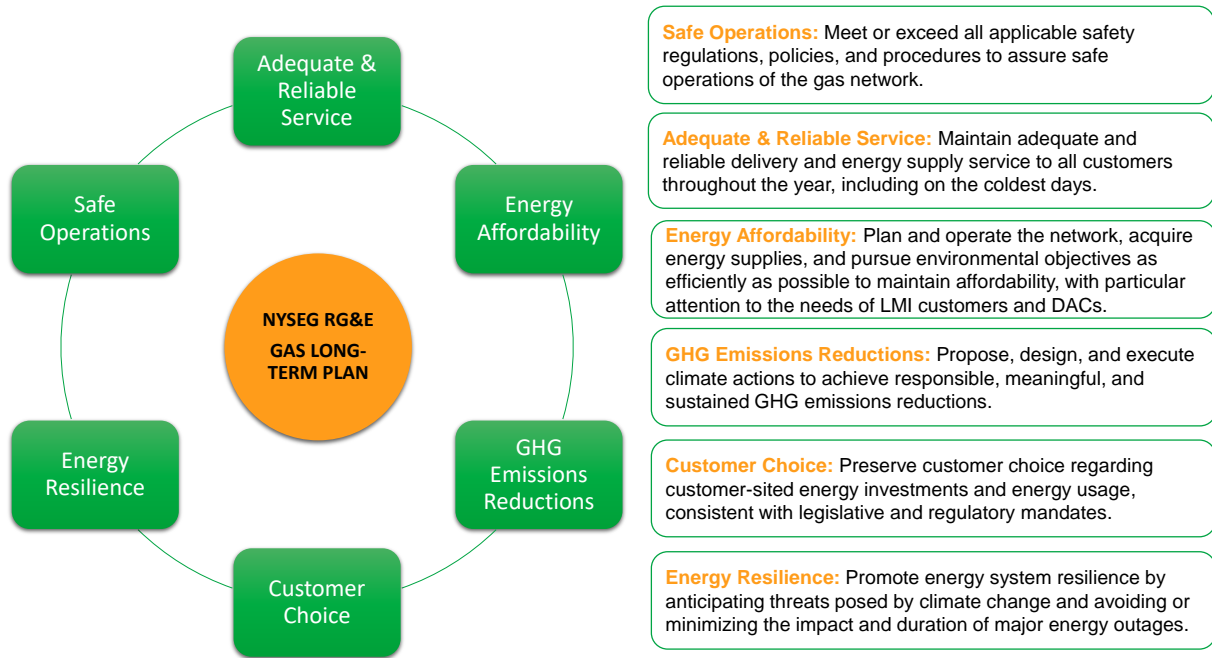
Other integral elements of the LTP also include implementing various pilot programs and conducting research to gain additional insights into the benefits and costs of decarbonization actions, including potential rate design and tariff alternatives.

Finally, as noted above, the LTP must consider “on-the-ground” realities. The assumptions reflected in the quantitative assessment and the design of other elements of the LTP must be consistent with these realities. The decarbonization of the energy sector will require hundreds of thousands of the Companies’ customers, and millions of customers across New York to make decisions regarding their energy equipment and use profiles. These potential conversions and the associated impacts on natural gas and electricity infrastructure will need to occur building-by-building, street-by-street, and neighborhood-by-neighborhood. The overlapping of affiliated and non-affiliated natural gas and electric utilities will present planning, investment, and operational challenges. The timing and cost of the transition will also depend on the responsiveness of equipment manufacturers and local contractors over the 20-year LTP period and beyond. Chapter IV describes this transition in practical terms including what will be required from unregulated participants (including building owners, HVAC contractors and manufacturers, and financial institutions) and communities.

Guiding Principles

The development of any long-term plan begins with establishing a clear vision of the desired outcomes for the Companies’ customers and communities served. Figure ES-1 presents the Guiding Principles that the Companies used to develop and evaluate their LTP. The LTP must reflect a judicious balance among the collection of principles as well as address each principle on its own.

Figure ES-1: NYSEG and RG&E's Guiding Principles



Some principles are absolute requirements, with "Safe Operations" as the best example for an LDC. With respect to the other principles, a balancing is required resulting in an LTP that provides safe, reliable, and affordable energy service that delivers sustainable reductions in GHG emissions while preserving customer choice.

The "Adequate & Reliable Service" principle applies to the mix of energy sources that customers rely on. This principle takes on a particularly critical role when considering the electrification of heating due to the potential consequences of an extended electric outage that coincides with extremely cold temperatures. NYSEG and RG&E's customers frequently experience cold temperatures for prolonged periods of time, reinforcing the importance of adequate and reliable service.

The "Customer Choice" principle reflects the Companies' awareness of the strong preferences of both residential and business customers to make their own decisions with respect to end-use equipment and energy usage. Mandates that restrict choice are likely to be met with opposition, particularly if they are accompanied by meaningful customer expense or inconvenience. This is an example of an "on-the-ground reality" that could shape the path to decarbonization.

These LTP Guiding Principles are consistent with Commission approvals of proposed rate case settlements as they relate to the CLCPA. The Commission has found that a rate settlement complies with the CLCPA's emissions reduction goals to the extent it "appropriately balance[s] the interests in reliability, public safety, and reasonable rates with emission reductions and clean energy objectives" and serves as "an important step in the ongoing process of achieving the CLCPA's greenhouse gas limits, one that will be built upon in future rate cases and other

Commission proceedings.”¹⁵ Additionally, the Joint Proposal in the Companies’ current rate case (Case 22-E-0317, et. al.) (“Joint Proposal”) includes several provisions that will contribute to emissions reductions in a manner that is consistent with the CLCPA and actions proposed in this LTP. These include specific program enhancements, pilots, and investments that are identified along with other LTP action items.¹⁶ The Joint Proposal also provides funding for investments throughout NYSEG and RG&E’s service areas, including DACs, that will improve the reliability and resiliency of the system, enhance safety, and result in reduced GHG emissions. Finally, with direct relevance for gas planning and the LTP, the Companies have agreed to “structuring their gas planning with the objective of achieving a zero-net increase in billed gas use, normalized for temperature, in their service territories” over the three-year term of the agreement.¹⁷

Natural Gas Decarbonization Actions

The quantitative assessment of Companies’ LTP focuses on six specific decarbonization actions that can reduce GHG emissions associated with the Companies’ natural gas businesses:

- **Weatherization** – Installing weatherization measures (such as insulation) at residential, commercial, and municipal customer premises will reduce energy use, and therefore reduce GHG emissions. In many instances, weatherization will become an element of a customized clean energy solution for individual commercial and industrial customers.
- **Building Electrification** – Electrifying natural gas heating systems by installing air source heat pumps (“ASHP”) and electrifying other gas appliances will reduce natural gas use and increase electric use, providing a net decrease in GHG emissions, assuming the use of traditional natural gas and that electric generation has low GHG emissions. Building electrification for residential, commercial, and municipal customers is modeled. Two heating electrification options are considered for residential customers: full electrification using cold-climate heat pumps (“ccASHP”) to provide heat throughout the winter, and hybrid heating using a standard ASHP to provide heat during shoulder periods and mild winter days coupled with a gas furnace to provide heat on cold winter days.
- **Industrial Customer Programs** – The industrial sector is generally recognized as the most challenging sector to decarbonize, particularly with respect to process loads that require extremely high temperatures and for facilities that face internal and external competition. However, some industrial customers that are part of larger, global entities with decarbonization commitments that are aligned with the Paris Agreement may be more likely to invest in GHG emissions reduction activities. Three sub-actions are modeled for industrial customers: increasing the efficiency of natural gas use in process loads, electrifying space heating, and employing carbon capture.¹⁸

¹⁵ *Case 20-E-0380, et al. – Proceeding on Motion of the Commission as to the Rates, Charges, Rules and Regulations of Niagara Mohawk Power Corporation d/b/a National Grid for Electric Service, Order Adopting Terms of Joint Proposal, p. 83 (Jan. 20, 2022) (“Niagara Mohawk Rate Order”).*

¹⁶ *For example, the Joint Proposal includes commitments to implement energy efficiency and electric heat pump programs and continue aggressive leak repair practices along with other commitments related to climate change.*

¹⁷ *Joint Proposal, Case 22-E-0317, et al., Appendix M.*

¹⁸ *NYSEG and RG&E will also engage with industrial customers to discuss other potential decarbonization solutions including the direct use of RNG, LNG, and hydrogen.*

- **TENs** – GHG emissions could also be reduced by replacing natural gas heating systems with ground source heat pumps served by underground geothermal networks, however TENs face siting and other development challenges. Generic TENs projects are modeled based on information from the Companies’ three geothermal pilot programs.
- **RNG** – Using RNG as a substitute for natural gas eliminates the GHG emissions from the biogas feed source that would have otherwise been emitted to the atmosphere. Therefore, replacing traditional natural gas with RNG will reduce GHG emissions. The Companies assume that they will procure RNG from within their service territories and a proportional share of the RNG from Pennsylvania and Ohio. All RNG is assumed to be from existing sources and transported via pipeline.
- **Green Hydrogen¹⁹** – Replacing traditional natural gas with green hydrogen eliminates GHG emissions associated with combustion of natural gas, but additional study is required to understand the amount of hydrogen that can be safely blended into the natural gas distribution network. Hydrogen may also be a viable option for direct use for industrial process loads.

Many individual decarbonization actions and other elements of the LTP will require changes to business practices, new or modified customer programs, as well as adjustments to regulatory policies.

Impact of Building Electrification on Electric Infrastructure and Rates

Gas long-term plans must consider the impact of decarbonization on the level of electric investments required, the timing of those electric investments, and the resulting impact on electricity rates. The potential conversion from natural gas (and other fuels) to electricity for heating and achieving the CLCPA’s clean energy goals will require significant investment in every electric segment: generation, transmission, and distribution.

The CLCPA’s clean energy goals will require significant investment in zero-emission generation and the necessary transmission to deliver clean energy to load centers. For example, \$44 billion of customer funding has already been committed to implement clean energy objectives,²⁰ and it is estimated that these costs could add approximately \$400 million to NYSEG’s electric revenue requirement and \$180 million to RG&E’s electric revenue requirement by 2043. These investments will be necessary, regardless of the gas LTP and the approach to building electrification.

In addition, a central, if not the most critical decision to be informed by the Companies’ LTP, is the relative impact of hybrid heating vs. full electrification solutions. The costs and benefits associated with these building electrification approaches will significantly impact the overall LTP as well as the necessary build-out of the electric system. Full electrification of heating loads (i.e., using ccASHP with electric resistance backup for cold winter days)

¹⁹ “Green Hydrogen” is produced by splitting water into its hydrogen and oxygen elements using electrolysis that is powered by renewable energy sources (e.g., wind and solar energy).

²⁰ Case 22-M-0149, Proceeding on Motion of the Commission Assessing Implementation of a Compliance with the Requirements and Targets of the Climate Leadership and Community Protection Act (CLCPA Compliance Proceeding), New York State Department of Public Service First Annual Informational Report on Overall Implementation of the Climate Leadership and Community Protection Act, July 20, 2023.

will require substantial investments to increase capacity on the electric system to accommodate the additional peak load on cold winter days. For example, the Companies estimate that approximately \$34 billion (in \$2022 dollars) of investment in NYSEG and RG&E's electric transmission and distribution infrastructure would be required by 2050 to meet approximately 6,160 MW in projected winter peak demand growth.²¹

The Companies' LTP relies on these data as inputs to the projection of high-level, order of magnitude, system-wide electricity costs and rate impacts that are important cost components of the Companies' gas decarbonization actions. It is clear, however, that a location-specific analysis will be required that considers the current and projected loading on individual substations and circuits to fully understand the actual cost on the electric system. Electric distribution utilities' planning functions will need to incorporate location-specific incremental capacity requirements from building electrification in their planning processes, along with the many other drivers of electric infrastructure investments.

Quantitative Assessment – The Role of Scenarios

The quantitative analysis of the gas decarbonization actions employs a bottom-up approach reflecting (1) incremental equipment cost and incremental energy bills per participating customer or incremental cost per unit of RNG or hydrogen and (2) incremental benefits (e.g., decreased emissions per participating customer or decreased emissions per unit of RNG or hydrogen) for each decarbonization action. There is considerable uncertainty regarding the future costs and benefits associated with each of the six gas decarbonization actions, as well as the customer adoption trends for actions that involve customer choice. There are also fundamental questions as to the potential contribution of individual decarbonization actions over the twenty-year period. To address these uncertainties, the LTP is informed by scenario analyses that compare the GHG emissions reductions and costs of alternative portfolios of actions when compared to a "Reference Case" that does not consider any future decarbonization actions. For purposes of this LTP, the Companies developed four scenarios:

- **CLCPA Full Electrification Scenario:** This scenario includes a collection of decarbonization actions (timing, participation rates, and effectiveness for each action) that puts the Companies on the path toward achieving the CLCPA final target of 85% reduction in GHG emissions from 1990 levels by 2050. This scenario assumes that achieving GHG emissions reductions of 65% from 1990 levels by 2043 will be sufficient to reach the 85% reduction goal by 2050. Residential customers are assumed to install ccASHP (supplemented with electric resistance heat for cold days) to heat their homes with electricity every day of the year, thus increasing the winter electric peak and necessitating additional electric infrastructure buildout. Boilers and furnace-based heating systems are converted for all customers. Non-Residential customers are also assumed to install ccASHP to replace furnaces and boilers.
- **CLCPA Hybrid Heating Scenario:** This scenario is also specified to achieve GHG emissions reductions of 65% from 1990 levels by 2043. Residential customers are assumed to install hybrid heating systems (i.e., standard ASHP paired with gas furnaces) that allow for heating with gas furnaces on the coldest days of the year, thus reducing the winter electric peak and requiring less electric buildout. Only furnace-based

²¹ *Natural Gas and Grid Modernization Study, Appendix N, Special Study #5, filed on May 17, 2022 in Case 19-E-0378, et. al., Exhibit 7.*

heating systems are converted for all customers. Non-Residential customers are assumed to install ccASHP to replace furnaces.

- **Delayed Achievement Full Electrification Scenario:** This scenario includes a collection of decarbonization actions with lower adoption rates that result in delays in achieving the CLCPA emissions reductions goals. This scenario is specified to achieve 50% GHG emissions reductions from 1990 levels by 2043. Both residential and non-residential customers fully electrify using ccASHP (with resistance heat) to replace furnaces and boilers.
- **Delayed Achievement Hybrid Heating Scenario:** This scenario is also specified to achieve 50% GHG emissions reductions from 1990 levels by 2043. Residential customers are assumed to electrify using hybrid heating systems (standard ASHP paired with a gas furnace), and non-residential customers fully electrify using ccASHP to replace furnaces.

As shown in Table ES-1, each of the scenarios are comprised of varying levels of the six decarbonization actions.

Table ES-1: Specification of CLCPA and Delayed Achievement Scenarios

	Action	CLCPA Scenario 65% GHG emissions reduction by 2043	Delayed Achievement Scenario 50% GHG emissions reduction by 2043
1	Weatherization	<ul style="list-style-type: none"> • Residential: 100% of max achievable savings; all measures • Commercial: 0.5% load reduction/year • Municipal: 1% load reduction/year 	<ul style="list-style-type: none"> • Residential: 50% of max achievable savings; all measures • Commercial: 0.25% load reduction/year • Municipal: 0.5% load reduction/year
2	Electrification	<ul style="list-style-type: none"> • Full Electrification: Install ccASHP to electrify furnaces and boilers at a pace necessary to hit target GHG emissions reductions • Hybrid Heating: Install hybrid heating to electrify residential furnaces (not boilers), install ccASHP to electrify commercial and municipal furnaces (not boilers) at a pace necessary to hit target GHG emissions reductions 	
3	Industrial Customer Programs	<ul style="list-style-type: none"> • Energy Efficiency of Process Load: 0.5% process load reduction/year • Electrify Space Heating: furnace/heater and boiler conversions to ccASHP at a pace necessary to hit target emissions reductions • Carbon Capture: (large customers) 0.5% carbon capture/year 	<ul style="list-style-type: none"> • Energy Efficiency of Process Load: 0.25% process load reduction/year • Electrify Space Heating: furnace/heater (not boiler) conversions to ccASHP at a pace necessary to hit target emissions reductions • Carbon Capture: (large customers) 0.25% carbon capture/year
4	TENS	<ul style="list-style-type: none"> • One 24-home + 9 business project/year starting in 2028 	<ul style="list-style-type: none"> • One 24-home + 9 business project every other year starting in 2028
5	RNG	<ul style="list-style-type: none"> • Optimistic Growth Scenario, 100% of RNG produced in LDC territory; 2% of RNG produced in PA and OH 	<ul style="list-style-type: none"> • Achievable Deployment Scenario, 100% of RNG produced in LDC territory; 1% of RNG produced in PA and OH
6	Hydrogen	<ul style="list-style-type: none"> • 2028 start, blend incremental 1.25%/year 	<ul style="list-style-type: none"> • 2030 start, blend incremental 1%/year

The four scenarios are designed to provide insights with respect to the relative benefits and costs of full electrification (with ccASHP) versus hybrid heating (standard ASHP with natural gas backup). The results for key GHG emission and cost metrics are presented in Table ES-2.

Table ES-2: Scenario Results

	Cost per GHG Emission Reduction (\$/MT CO2e)	2043 GHG Reduction (% vs. 1990)	Total Cost 2024-2043 (NPV \$M)	2043 Electric Winter Peak Demand Impact (MW)
	(a)	(b)	(c)	(d)
NYSEG				
CLCPA-Full Electrification	\$ 704	-65%	\$ 6,759	879
CLCPA-Hybrid Heating	\$ 618	-65%	\$ 6,032	434
Delayed-Full Electrification	\$ 714	-50%	\$ 4,781	662
Delayed-Hybrid Heating	\$ 580	-50%	\$ 3,919	313
RG&E				
CLCPA-Full Electrification	\$ 775	-65%	\$ 7,813	1,302
CLCPA-Hybrid Heating	\$ 622	-65%	\$ 7,288	568
Delayed-Full Electrification	\$ 809	-50%	\$ 5,781	1,041
Delayed-Hybrid Heating	\$ 579	-50%	\$ 4,828	406

The cost per GHG emission reduction metric (column (a)) reflects the cost efficiency of achieving decarbonization and is a weighted average of the cost efficiency for each decarbonization action that comprise the scenario. The calculation reflects an NPV over the 20-year period of both numerator (total costs) and denominator (carbon dioxide equivalent emissions reductions).

The total costs (column (c)) are the sum of the incremental costs that are incurred as a result of the decarbonization actions including up-front customer equipment and installation costs, ongoing energy bills (gas and electric), and gas commodity costs.²²

As shown in Table ES-2, the full electrification scenarios have higher cost per GHG emission reduction, higher total costs, and higher winter peak demand impacts than the hybrid heating counterpart for both the CLCPA and Delayed Achievement scenarios and both companies. In addition, as expected, the Delayed Achievement Scenarios have materially lower total costs than the CLCPA Scenarios (on the order of 30% lower).

Recommended LTP

Consistent with the Guiding Principles, the Companies’ LTP strives to provide safe, reliable, and affordable energy service while delivering sustainable GHG emissions reductions and preserving customer choice throughout the plan period. The cost of each decarbonization action as well as the collection of actions that comprise a scenario are major considerations in developing the LTP. The alternative scenarios provide insights with respect to the contribution of individual decarbonization actions on key outcomes and inform the development of an LTP that achieves a balance between GHG emissions reductions and the cost of achieving them. The LTP was developed by

²² Total costs would also include any natural gas system costs that may become stranded as a result of decarbonization policy actions, should there be any.

starting with the CLCPA Hybrid Heating Scenario. Hybrid heating was selected as the preferred approach due to reliability of energy service implications if residential customers are reliant on electricity to heat their homes during cold winter days, the significantly lower total cost, and improved overall cost per GHG emissions reduction associated with hybrid heating compared to full electrification. Many of the decarbonization actions are specified as in the CLCPA-Hybrid Heating Scenario although a few meaningful changes to some actions were adopted to improve the overall efficiency of the LTP and reduce total costs. Table ES-3 summarizes the assumptions and reasoning for the Recommended LTP.

Table ES-3: Specification of Recommended LTP

	Action	Recommended LTP
1	Weatherization	<ul style="list-style-type: none"> • Same as CLCPA Scenario, except eliminate replacing windows from residential standard income weatherization program because of high cost per GHG emissions reduction
2	Electrification	<ul style="list-style-type: none"> • Residential: Install hybrid heating to electrify residential furnaces (not boilers) at a pace that reaches a max of 75% of customers choosing to electrify at end-of-equipment life, because it is likely that a certain proportion of customers will not convert without a mandate • Commercial: Install ccASHP to electrify furnaces (not boilers) at a pace that reaches a max of 30% of customers choosing to electrify at end-of-equipment life, because high cost per GHG emissions reduction and competitive pressures will likely discourage commercial conversions • Municipal: Install ccASHP to electrify furnaces (not boilers) at a pace that reaches a max of 50% of customers choosing to electrify at end-of-equipment life, because high cost per GHG emissions reduction and budget constraints will likely discourage municipal conversions
3	Industrial Customer Programs	<ul style="list-style-type: none"> • Energy Efficiency of Process Load and Carbon Capture: Same as CLCPA Scenario • Electrify Space Heating: Install ccASHP to electrify furnaces (not boilers) at a pace that reaches a max of 30% of customers choosing to electrify at end-of-equipment life, because high cost per GHG emissions reduction and competitive pressures will likely discourage industrial conversions
4	TENs	<ul style="list-style-type: none"> • Same as CLCPA Scenario
5	RNG	<ul style="list-style-type: none"> • Same as CLCPA Scenario
6	Hydrogen	<ul style="list-style-type: none"> • Same as CLCPA Scenario

Taken together, the decarbonization actions included in the Companies’ LTP will make substantial contributions toward achieving New York’s decarbonization goals. As shown in Table ES-4, the LTP for NYSEG achieves a 58% reduction in GHG emissions by 2043 at a total cost of \$4.1 billion, which is \$2.6 billion less than the CLCPA – Full Electrification Scenario. The Recommended LTP for RG&E achieves a 51% reduction in GHG emissions by 2043 at a total cost of \$3.8 billion, which is \$4.0 billion less than the CLCPA – Full Electrification Scenario.

Table ES-4: GHG and Cost Metrics – LTP

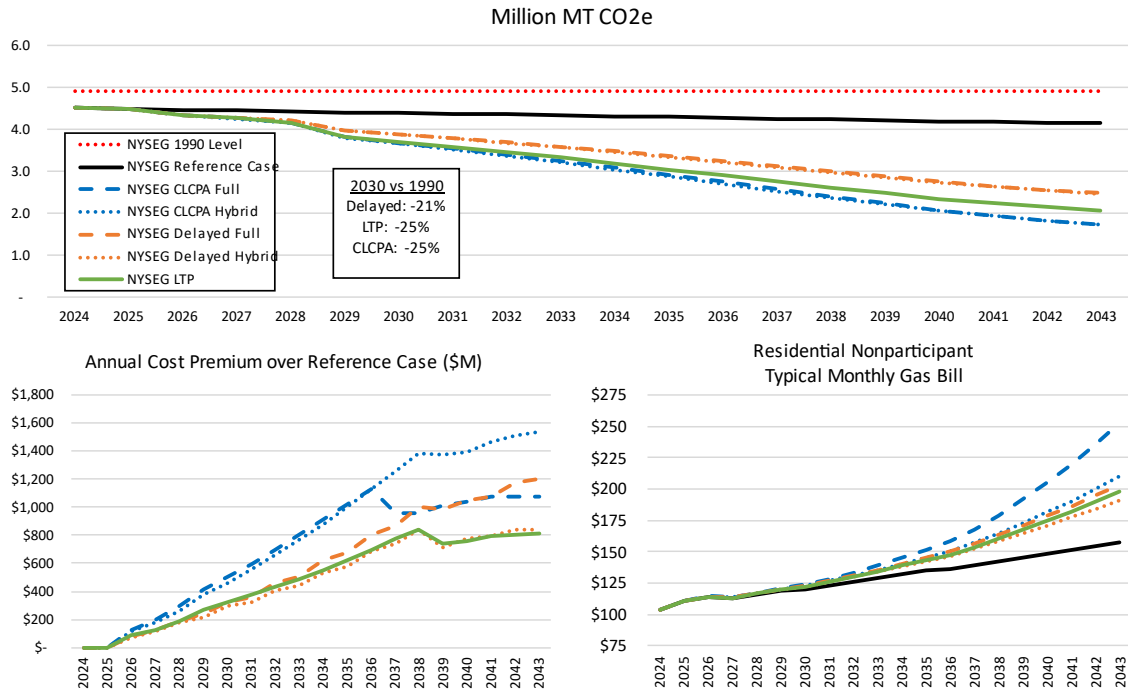
	Cost per GHG Emission Reduction (\$/MT CO2e)	2043 GHG Reduction (% vs. 1990)	Total Cost 2024-2043 (NPV \$M)	2043 Electric Winter Peak Demand Impact (MW)
NYSEG	\$ 475	-58%	\$ 4,095	291
RG&E	\$ 475	-51%	\$ 3,811	316

Full electrification versus hybrid heating represents a major distinction that will have a significant impact on reliability as well as on electric system planning. Full electrification presents concerns about the reliability of heat due to the potential for electric outages during cold winter days and no natural gas backup. In addition, full electrification will require significant investment in the electricity sector (generation, transmission, distribution, and behind-the-meter), if widely adopted. Hybrid heating results in a meaningful reduction in the use of natural gas thus providing GHG emissions benefits, while also acting as an electricity demand response option by eliminating electric use for heat on cold days, lowering costs significantly.

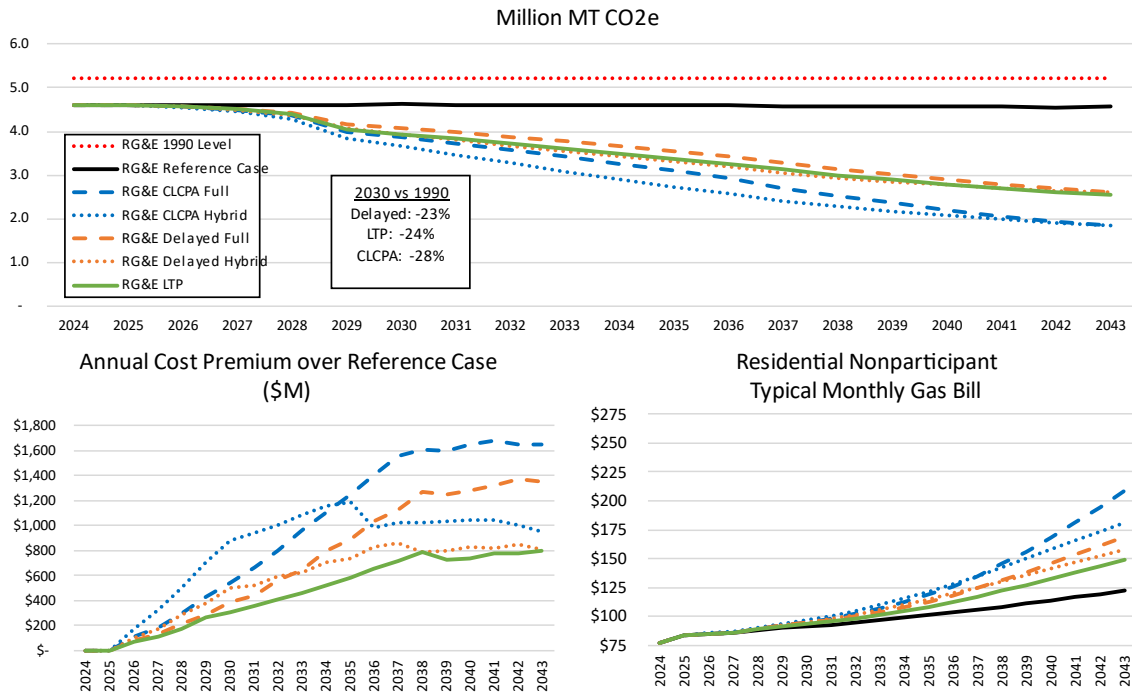
The cost advantage of the LTP over the CLCPA–Full Electrification Scenario is primarily attributable to the impact of the hybrid heating approach, including avoiding electric capacity investments that would be required for the full electrification alternative. The LTP also represents a more cost-effective approach compared to all of the scenarios with cost per emissions reductions of \$475/MT CO2e for both NYSEG and RG&E.

Figure ES-2 is a graphical representation of the LTP relative to the Reference Case and the four scenarios. These graphs demonstrate that, taken together, the LTP (shown as a solid green line) compares favorably to the four scenarios (shown as dotted and dashed blue and orange lines) in the areas of GHG emissions reductions, annual costs, and typical residential bills over time.

Figure ES-2: Annual Emissions and Cost Metrics
NYSEG



RG&E



Other Elements of the LTP

Other important elements of the Companies' LTP that were not included in the quantitative modeling include the approach to DACs and LMI customers and NPAs.

DACs and LMI Customers:

The Companies serve approximately 200,000 gas customers in 166 DACs. The DACs include both urban and rural communities. The Companies also have gas LMI customers that do not reside within DACs. A foundational aspect of Avangrid's "Just Transition" is respectful engagement with communities (including DACs) and constituencies (including LMI customers) with the objective of making a positive impact. Positive impacts include economic development, community investments, employment opportunities, improvements in public safety, and creation of a clean energy future. This also includes avoiding investments that disproportionately burden DACs.

NYSEG and RG&E are currently pursuing positive outcomes for DACs and LMI customers through several policies and programs including:

- Explicit consideration of DACs when prioritizing capital investments.
- Explicit consideration of DACs as part of the NPA processes. Three of the Companies' existing larger NPA projects are located within DACs.²³
- Procurement practices that result in 85% of vendor companies meeting sustainability standards based on a 43-factor ESG score.
- Continuation of the Residential Methane Detection Program that distributes devices to low-income customers to alert customers of the presence of methane in their homes, accompanied by safety outreach and education.

NPAs:

The Companies are committed to building a robust and diverse portfolio of NPA projects that will grow over time as new opportunities emerge to address traditional natural gas system needs through cost-effective and innovative NPA solutions. The Companies are gaining experience in what may be the most challenging step in the process: negotiating and finalizing contracts with winning bidders that provide a sufficient level of reliability at a final cost that is acceptable from the perspective of the Companies and customers, the NPA provider, and by inference, the financial entity or entities that provide financial backing for the NPA provider.

Notwithstanding this experience, as part of the Joint Proposal, the Companies have agreed to continue to evaluate future gas projects, including leak-prone main replacement projects, for the applicability of NPAs.²⁴

²³ *Boswell Hill and Winney Hill for NYSEG, Ridgeway Avenue for RG&E.*

²⁴ *Joint Proposal, Case 22-E-0317, et al., Appendix M.*

Addressing Uncertainty

The LTP represents a 20-year perspective on a challenging future that will be characterized by continued evolution of policies, economic and environmental trends, and technological innovation. As such, most of the LTP's key drivers are subject to some level of uncertainty, including:

- Customer acceptance of building heating modernization related to fuel sources, equipment technologies, and conservation;
- Regulatory actions related to the CLCPA legislation and emission reduction targets that may impact the gas distribution system over the next 20 years;
- Continued evolution of New York energy policy and Commission regulatory requirements (e.g., allowing the cost of RNG and hydrogen to be recovered by utilities, and policies to mitigate up-front cost barriers associated with installing equipment at customer premises to enable decarbonization);
- Technology advancement including the viability, scalability, and cost of several different technologies related to: heat pumps, RNG, hydrogen, TENS (including district geothermal), and carbon capture and storage; and
- Market conditions including workforce training and availability, supply-chain issues, inflationary pressures, investor initiatives, and global energy instability.

The three-year LTP cycle prescribed in the Gas Planning Order provides for future comprehensive updates that reflect new information related to all of these uncertainties.

Implementation Actions

The Companies will pursue numerous actions in the next 3-years to develop capabilities and implement specific aspects of its LTP in the areas of customer programs, investments, learning, DACs and LMI customers, and engagement. These include actions that have been agreed to by the Companies, Staff, and other signatories to the Joint Proposal.

A. Customer Programs

- 1) Implementing new and modified programs that enable comprehensive, integrated solutions that reduce emissions
- 2) Continuing the residential methane detection program (*Joint Proposal*)
- 3) Continuing the geothermal program (*Joint Proposal*)

B. Investments

- 1) Continuing the Leak-Prone Main replacement program (*Joint Proposal*)
- 2) Funding to modernize gate and regulatory stations, increasing resilience and reducing methane emissions (*Joint Proposal*)

C. Learning

- 1) Piloting non-residential and air source heat pumps (*Joint Proposal*)
 - 2) Monitoring advances in technology related to heat pumps
 - 3) Piloting certified natural gas procurement with quantification of emissions benefits (*Joint Proposal*)
 - 4) Piloting coordinated planning in areas where the Companies serve both natural gas and electricity customers
 - 5) Monitoring the progress of NPAs within New York and other jurisdictions
 - 6) Monitoring the evolution of the RNG and hydrogen markets
- D. Disadvantaged Communities and LMI Customers
- 1) Reflecting DAC status when identifying NPA opportunities and evaluating NPA proposals (*Joint Proposal*)
 - 2) Expanding reporting obligations related to the marketing of energy efficiency and building electrification programs within DACs (*Joint Proposal*)
 - 3) Expanding eligibility for Energy Affordability programs (*Joint Proposal*)
- E. Engagement
- 1) Engaging with communities to collaborate on initiatives that contribute to the achievement of their decarbonization goals
 - 2) Engaging with industrial customers regarding current energy profiles, the potential for industrial heat pumps and other clean energy solutions for industrial processes that rely on natural gas
 - 3) Engaging with non-affiliated electric companies that overlap with the Companies' natural gas service areas to consider opportunities for coordinated planning

These implementation actions are consistent with and reinforce the Guiding Principles. Specifically, almost all these actions contribute to reducing GHG emissions and the majority contribute to reducing costs associated with GHG emissions reductions and thereby contribute to the Energy Affordability principle.