BEFORE THE NEW YORK STATE
PUBLIC SERVICE COMMISSION

In the Matter of a Review of the Long-Term Gas System Plan of National Fuel Gas Distribution Corporation	)	**Case 22-G-0610**

SIERRA CLUB AND EARTHJUSTICE'S COMMENTS ON THE FINAL LONG-TERM PLAN OF NATIONAL FUEL GAS DISTRIBUTION CORPORATION

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I. Introduction

Sierra Club and Earthjustice ("Commenters") respectfully submit the following comments on National Fuel Gas Distribution Corporation's ("NFG" or "the Company") final long-term plan ("LTP"). NFG is the first of the eleven gas local distribution companies ("LDCs") in New York to submit an LTP. Consequently, the Public Service Commission's ("Commission" or "PSC") consideration of NFG's filing will set a precedent for future utility gas plans. While Commenters recognize that the long-term gas planning process is intended to be iterative, it is critical that LDCs' initial plans set them in a direction that is reasonably calculated to produce the least-cost, least-risk approach to providing reliable service while achieving the mandates of New York's Climate Leadership and Community Protection Act ("CLCPA" or "Climate Law").

In its Gas Planning Order, the Commission approved the use of an independent consultant to review and inform the Commission's evaluation of LDCs' long-term plans. The Commission expressed its expectation that this consultant will engage throughout the stakeholder process and "will help evaluate the economic and environmental tradeoffs associated with different pathways."[1] In the NFG LTP proceeding, the Commission's independent consultant, Charles River Associates ("CRA"), was robustly involved throughout the entire LTP development process, including filing initial findings on February 17, 2023, preliminary findings on May 26, 2023, and a final report on July 25, 2023 that thoroughly evaluates NFG's LTP.

As detailed below, CRA's final report strongly validates concerns raised by Sierra Club, Earthjustice, and many other stakeholders regarding NFG's LTP throughout the development process, and confirms that the final LTP must be modified or rejected. Most fundamentally, CRA's final report details how NFG's unrealistic assumptions regarding the pace of

[1] Order Adopting Gas System Planning Process, NY PSC Case No. 20-G-0131 (May 12, 2022) (hereinafter "Gas Planning Order").

electrification obscure the true cost of NFG's plan while overstating the cost of electrification-based pathways. As illustrated by the "informational scenarios" that NFG reluctantly modeled, more ambitious electrification can achieve significantly deeper—and more CLCPA-compliant—emission reductions at a higher benefit-cost ratio than NFG's proposed plan. Unfortunately, as CRA chastens, "NFG has applied its assumptions selectively *and the company often serves to hinder the forecasted pace of decarbonization efforts in Western New York*."[2] As the planet hurtles toward climate disaster, such an approach to long-term gas planning is wholly unworkable.

The Commission must reject NFG's LTP as proposed and require significant modifications. In particular:

- NFG's approach to electrification—in which no existing customers exit the gas system over the next 20 years—is incompatible with New York's Climate Law and final Scoping Plan. The Commission should require NFG to develop a plan that takes advantage of increasingly high-efficiency cold-climate air-source heat pumps ("ccASHP") to fully electrify many of its current customers and reduce the footprint of its gas distribution system. As discussed in Strategen's comments on NFG's initial LTP, attached as an exhibit to these comments, NFG's assumptions regarding the cost and effectiveness of heat pumps are unreasonable.
- At the same time, NFG's approach to alternative fuels—renewable natural gas ("RNG") and hydrogen—is fraught with unrealistic assumptions that overstate the feasibility and understate the cost of its preferred pipeline-based approach. Indeed, as described in detail in Sierra Club and Earthjustice's comments on NFG's revised LTP, attached as an exhibit

[2] Final Report: National Fuel Gas Distribution Corporation Long-Term Plan Assessment at xiv, NY PSC Case No. 22-G-0610 (July 25, 2023) (emphasis added) (hereinafter "CRA Final Report").

to these comments, NFG's asymmetric treatment of uncertainty in its modeling consistently places a thumb on the scales for pipeline fuels and against electrification, undermining the validity of NFG's modeling and the credibility of NFG's claims regarding the preferability of its pipeline-based approach.

- NFG's LTP fails to adequately consider opportunities to avoid additional investments in its pipeline network, ignoring or understating the potential for demand response, thermal energy networks, and non-pipeline alternatives ("NPAs").
- NFG's failure to consider delivered fuels as an alternative to pipelines to address any potential excess peak heating demand is arbitrary given evidence of the cost-superiority of delivered fuels to pipeline fuels in a world of significantly diminished throughput and low-carbon fuels.
- NFG's incorporation of industrial electrification into the final LTP was an important improvement, but the plan still fails to adequately address industrial decarbonization opportunities by ignoring industrial heat pumps and excluding information about industrial customer profiles needed to assess more customer-specific decarbonization options.
- NFG continues to fail to adequately address impacts to and benefits for disadvantaged communities ("DACs") in its LTP, which Commenters addressed in earlier comments. The LTP must be revised to ensure that at least 35–40% of investments are directed to benefiting these communities and that the plan does not result in disproportionate burdens to these communities, as mandated by the Gas Planning Order and the CLCPA.

Ultimately, NFG's LTP hides the true costs of its pipeline-based approach to decarbonization. Although the planning period for this initial LTP ends in 2042, by that year,

NFG's LTP achieves only a 53% reduction in greenhouse gas ("GHG") emissions from 1990 levels, far short of a proportional share of the 85% statewide reduction in greenhouse gas emissions that New York's Climate Law requires only eight years later. Obtaining incremental emission reductions using NFG's pipeline-based approach will be extraordinarily costly because the only option will be to pursue ever-greater quantities of scarce and expensive low-carbon fuels to further decarbonize NFG's fuel supply. The Commission should recognize NFG's pipeline approach as the dead end that it is and reject NFG's LTP.

II. NFG's Approach to Electrification Cannot Be Squared with the State's Climate Mandates or Scoping Plan and Renders the LTP Unapprovable

As documented by CRA, NFG's plan cannot be approved because it takes an anemic approach to electrification that is incompatible with the CLCPA's climate mandates and the Climate Action Council's final Scoping Plan. CRA explains, "[e]lectrification of heating loads such as space and water heating is the most significant opportunity for decarbonizing buildings."[3] This conclusion is robustly reinforced by the final Scoping Plan, which calls for 1–2 million efficient homes to be electrified with heat pumps by 2030 and "hundreds of thousands of additional homes and commercial buildings becoming efficiently electrified each year."[4] The Scoping Plan's 2050 vision for the buildings sector includes 85% of homes and commercial building space statewide electrified with efficient heat pump technologies and thermal energy networks.[5]

NFG's plan is sharply at odds with CRA's conclusion and with the final Scoping Plan. In contrast to the 85% of homes and commercial building space that the final Scoping Plan

[3] *Id.* at xii.
[4] N.Y. State Climate Action Council, *New York State Climate Action Council Scoping Plan* 11 (Dec. 2022), https://climate.ny.gov/resources/scoping-plan/ (hereinafter "Final Scoping Plan").
[5] *Id.*

envisions being electrified, *NFG's plan would not remove a single existing customer from its gas distribution system over the next 20 years*. This is unworkable.

In attempting to deter electrification, NFG continues to rely on assumptions that were debunked by stakeholders and CRA and that dramatically skew NFG's analysis of its plan. CRA observes that adjusting many of NFG's assumptions would improve the benefit-cost analysis for electrification. This includes:

- Assuming 100% rather than 50% of customers weatherize prior to electrifying,[6] which enables the use of smaller heat pumps and decreases electric load;
- Assuming that heat pumps sizing is calibrated to building heating needs rather than assuming all customers will rely on large 4-ton heat pumps that inflate electric load;
- Incorporating the impact of federal incentives as a benefit in a New York-based societal cost test, reflecting that incentives reduce customer costs to electrify;
- Assuming that the cost of heat pump technology will decline over time, as it has done for many years, rather than flatline; and
- Using electric and/or gas price forecasts that forecast lower electric prices or higher gas prices.[7]

Additionally, the New York State Energy Research Development Authority ("NYSERDA") takes issue with NFG's assumptions regarding electrification, observing that NFG improperly shrinks the universe of buildings eligible for electrification in its modeling by excluding non-ducted homes. NYSERDA points out that ductless ccASHP (mini-split or multi-split) "offer a technically straightforward option to convert to a highly efficient ccASHP without the need for ductwork for full-load or part-load electrification," particularly in weatherized homes, and notes that the majority of heat pumps sold in New York today are actually ductless ccASHP.[8]

NFG's unsupported efforts to avoid electrification also freight its plan with significant risk. The cost-efficacy of NFG's preferred approach necessitates retaining its gas distribution

[6] Notably, NYSERDA echoes this recommendation, urging that "NFG should assume customers do a basic weatherization package before electrifying in the LTP scenarios." Comments of the New York State Energy Research and Development Authority (NYSERDA) at 13, NY PSC Case No. 22-G-0610 (June 15, 2023).
[7] CRA Final Report at 23–24.
[8] Comments of the New York State Energy Research and Development Authority (NYSERDA), *supra* note 6, at 8.

system at scale, which depends on the unrealistic assumption that customers will choose to rely on gas and that gas system throughput will not decline appreciably. But as CRA observes, "[t]he assumption that zero existing customers will fully electrify within NFG's service territory through 2042 is unrealistic given the pace of advancements in electrification and New York State policy and law."[9]

Multiple factors support CRA's conclusion. First, electrification is becoming progressively more cost-competitive with gas, especially when taking into account the home cooling benefit of heat pumps.[10] Switching from a gas furnace to a heat pump provides a valuable additional source of highly efficient cooling, which is increasingly critical in a world of heat dome-driven heat waves. The cost-efficacy of electrification is further augmented by the Inflation Reduction Act, which as discussed below provides homeowners with thousands of dollars in incentives for heat pumps.[11]

Second, the cost of gas will increase substantially during the timeframe of NFG's LTP, further improving the operating economics of electric heat pumps over gas heating equipment. New York's climate mandates ensure that, in any pipeline-based future, gas utilities will need to move away from high-emission fossil gas toward more expensive alternative fuels. The need to transition away from fossil gas will be further reinforced by the New York Cap & Invest program currently under development by the Department of Environmental Conservation and NYSERDA, which will embed a carbon price for fossil gas for the first time. While electricity is also likely to see an increased carbon price, the New York electric grid is already relatively low-

[9] CRA Final Report at xiv.
[10] *See* Michael J. Walsh & Michael E. Bloomberg, Building Decarbonization Coal., *The Future of Gas in New York State*, 19, tbl 3 (Mar. 2023) (hereinafter "BDC Report").
[11] E.g., CRA notes that the Inflation Reduction Act provides incentives of up to $14,000 for heat pumps and related appliances. CRA Final Report at 29.

carbon, and will necessarily be trending to zero by 2040 pursuant to the CLCPA's emissions mandates[12] and the recently initiated PSC process to implement this transition.[13]

There are also considerable equity risks to NFG's mis-calibrated plan. As CRA explains, "[c]ustomers transitioning from gas to electricity could leave NFG with sizeable, stranded costs and potentially fewer customers from whom to collect those costs."[14] The cost burden on remaining gas customers "is likely to disproportionally impact low- to moderate-income customers if it is not addressed proactively."[15]

Moreover, the stranded cost risk is particularly acute under NFG's plan because the company proposed to continue to invest heavily in leak-prone pipe ("LPP") replacement. As CRA notes, "the long-term objective of significantly reducing carbon emissions will eventually require that LDCs cease any buildout of new gas infrastructure and find alternatives for the replacement of leak-prone pipe"[16] and "[n]ew capital investments with long depreciation schedules prohibit a cost-effective transition away from fossil fuel dependency."[17] As discussed in more detail in Section IV below, cost-effective alternatives to LPP replacement are readily available, including NPAs, demand response, and pipeline repairs. Indeed, "[r]epairs can safely extend the serviceable lives of gas assets to match the expected usage periods of those assets and reduce the rate base."[18] A recent study by the District of Columbia Department of Energy and

[12] Pub. Serv. L. § 66-p(2)(b) (by 2040, "the statewide electrical demand system will be zero emissions").
[13] Order Initiating Process Regarding Zero Emissions Target, NY PSC Case No. 15-E-0302 (May 18, 2023).
[14] CRA Final Report at xiii.
[15] *Id.* at xv.
[16] *Id*. at ix.
[17] *Id.*
[18] Strategen, A Review of Consolidated Edison and Orange & Rockland's Initial Long-Term Plan at 6, NY PSC Case No. 23-G-0147 (Aug. 21, 2023) (citing Bob Ackley, Nathan Phillips, Wash. D.C. Dep't of Energy & Env't, Strategic Electrification in Washington, D.C.: Neighborhood Case Studies of Transition from Gas to Electric-based Building Heating (Dec. 14, 2022), https://edocket.dcpsc.org/apis/api/Filing/download?attachId=186471&guidFileName=a9254ec8-d08f-46ed-af0e-31b28d707139.pdf.).

Environment found utility pipeline repairs to address the largest leaks in the study resulted in "the one-time cost of these repairs to ratepayers to be between one tenth and one hundredth of the cost of pipeline replacement on that street."[19]

III. The Final LTP Relies on Inaccurate Assumptions About the Cost, Availability, and GHG Benefits of Alternative Combustion Fuels, Rendering the Plan Unapprovable

The final LTP relies heavily on alternative combustion fuels, ignoring feasibility and cost constraints and their inability to achieve real GHG emission reductions. Commenters agree with CRA that future LTPs must contain more nuanced assessment of RNG and hydrogen usage[20]—and must conserve those fuels for hard-to-electrify sectors—and urge the Commission to require NFG to revise the current LTP to contain more realistic and legally defensible assumptions regarding RNG and hydrogen.

The final LTP assumes RNG availability in line with ICF's Optimistic Growth Scenario for anaerobic digestion and assumes that NFG will source 100% of the RNG produced in its territory and 2% of the RNG produced in Pennsylvania and Ohio.[21] Banking on the optimistic scenario is a risky bet: RNG is far too scarce and expensive to meet gas demand. The bioenergy feedstocks from which RNG is derived are limited; the amount of cropland needed to produce sufficient RNG to substitute for all fossil methane gas in New York would require twice the amount of cropland currently used in the state.[22] Additionally, while NFG plans to monopolize the RNG produced in its service territory and source RNG out-of-state, gas utilities will be competing with each other and other sectors for RNG. In fact, National Grid's CLCPA study

[19] Bob Ackley, Nathan Phillips, Wash. D.C. Dep't Energy Env't, *supra* note 18, at 2.
[20] *See* CRA Final Report at x, xi, 54, 57–58.
[21] Final Long-Term Plan at 67, NY PSC Case No. 22-G-0610 (July 17, 2023) (hereinafter "Final LTP").
[22] BDC Report at 28, 41.

projects sourcing over 100 trillion British thermal units ("TBtu") of RNG per year by 2040[23] and Consolidated Edison and Orange and Rockland's initial LTP anticipates sourcing nearly 50 TBtu of RNG per year by 2042.[24] Additionally, projected production costs for RNG produced in New York State range from $10 to more than $50 per million btu ("MMBtu"), as compared to $3.50 to $5 per MMBtu for fossil gas.[25] A recent Groundwork Data Report found that replacing fossil gas with RNG across New York would cost ratepayers $25 billion annually on top of current gas expenses.[26]

Even in a scenario that relies on hybrid heating with gas pipelines, high RNG costs will drive up customers' gas bills.[27] Moreover, in a hybrid scenario, per-customer costs will increase as fewer ratepayers shoulder the costs of maintaining the distribution system.[28] Because exiting the gas system requires upfront investments in energy efficiency and electrification measures, the system costs will increasingly fall to low-income ratepayers.[29] Groundwork Data's findings are supported by a report published in June by the American Council for an Energy-Efficient Economy ("ACEEE"), which studied the impacts of electrification and gas decarbonization on distribution costs nationwide.[30] ACEEE concluded that an unmanaged transition in which electrification occurs on a household-by-household basis is the costliest scenario, whereas strategic pipeline replacement with zonal electrification would reduce costs to ratepayers.[31]

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[23] *KEDNY/KEDLI and NMPC CLCPA Studies, Meeting #2 – Scenarios and Assumptions*, Slide 30 (Aug. 9, 2022), https://www.nationalgridus.com/media/pdfs/other/clcpa-study-final-presentation-materials-2nd-stakeholder-meeting-8-9-22.pdf.
[24] Gas System Long-Term Plan at 50, App. C-7, NY PSC Case No. 23-G-0147 (May 31, 2023).
[25] BDC Report at 28.
[26] *Id.* at 40.
[27] *Id.*
[28] *Id.*
[29] *Id.* at 26–27, 46–48.
[30] *See* Stephen Nadel, ACEEE, *Impact of Electrification and Decarbonization on Gas Distribution Costs* (June 2023), https://www.aceee.org/sites/default/files/pdfs/U2302.pdf.
[31] *Id*. at iv, 17, 27.

Replacing a gas distribution line and helping customers electrify could save utilities up to $1,300 per customer according to ACEEE.[32] As CRA has urged, NFG must conduct further analysis and discussion of potential bill impacts of customer migration from the gas system.[33]

Additionally, RNG almost certainly will not produce real climate benefits.[34] According to the final LTP, NFG calculated GHG emissions impacts of RNG using the California Low-Carbon Fuel Standard system, but New York State has issued its own GHG emissions accounting guidance and emissions factors.[35] The final Scoping Plan specifies that before alternative fuels are considered for the gas system, it is important to ensure that "there are demonstrated . . . GHG benefits" and that "any use of alternative fuels, including green hydrogen and renewable natural gas, does not result in increased leaks and emissions within the entire life cycle of the development and use of alternative fuels."[36] The CLCPA requires the LTP to account for the gross lifecycle GHGs associated with such fuels' production and use,[37] and NYSERDA has confirmed that combustion emissions from alternative fuels such as RNG must be accounted for when comparing emissions reductions with the CLCPA reduction mandates.[38] An accurate accounting would show that RNG does not produce real GHG benefits and will only prolong the life of a gas system that needs to be substantially downsized.

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[32] *Id*. at 17–18.
[33] CRA at xiii.
[34] NFG bizarrely claims "[t]he GHG emissions benefits of RNG are factually indisputable" despite evidence to the contrary submitted by stakeholders throughout this process. Final LTP at 38. NFG's reliance on the Bluebird Renewable Energy proceeding is misplaced; the Commission's decision to approve one RNG production project, where methane emissions already exist, does not mean that RNG provides a viable system-wide decarbonization option, especially where RNG would need to be produced in far greater quantities to support NFG's plan.
[35] Final LTP at 38; *see* N.Y. Dep't Env't Conservation, New York 2022 Statewide GHG Emissions Report: Summary Report, at App. (2022), https://www.dec.ny.gov/docs/administration_pdf/ghgappxclcpaemissfctrs22.pdf.
[36] Final Scoping Plan at 361.
[37] N.Y. Dep't Env't Conservation, New York 2022 Statewide GHG Emissions Report, *supra* note 35, at 4.
[38] NYSERDA, *Fossil and Biogenic Fuel Greenhouse Gas Emission Factors* 2, 5 (Sept. 2022), https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Publications/Energy-Analysis/22-23-Fossil-and-Biogenic-Fuel-Greenhouse-Gas-Emission-Factors.pdf.

Because RNG is chemically identical to fossil gas, [39] its leakage and combustion emits the same level of GHGs. Additionally, RNG created from intentionally produced methane always results in net GHG emissions increases because of the inevitability of methane leakage during transport.[40] Leakage is likely to be even higher when RNG is transported from out of state. Truly capturable waste methane—for example, from landfills—represents less than one percent of gas demand, and therefore, intentional cultivation of an enormous amount of RNG would be required to fully decarbonize the Companies' gas supply.[41] And even landfill methane raises climate concerns because monetizing landfill gas creates the perverse incentive to increase the amount of organic waste in landfills (and therefore demand for additional landfill space), embedding subsequent pollution rather than addressing the root cause.

Arguments that RNG produces net zero GHG emissions are premised on the assumption that it is produced using captured methane that would otherwise be emitted through other means. In reality, the vast majority of RNG is intentionally cultivated through energy-intensive processes that emit GHGs and produce the risk of fugitive methane emissions.[42] Indeed, the final LTP relies heavily on RNG produced through anaerobic digestion, which can incentivize unsustainable practices such as concentrated animal feeding operations that ultimately increase methane emissions.[43]

Additionally, the LTP would incorporate a significant amount of RNG produced out-of-state, which achieves no GHG reductions for purposes of the CLCPA. New York's GHG

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[39] Sasan Saadat, et al, Earthjustice & Sierra Club, *Rhetoric vs. Reality: The Myth of "Renewable Natural Gas" for Building Decarbonization* 16 (July 2020).
[40] Emily Grubert, *At Scale, Renewable Natural Gas Systems Could Be Climate Intensive: The Influence of Methane Feedstock and Leakage Rates*, 15 Env't Rsch. Letters 084041, at 4 (2020), https://doi.org/10.1088/1748-9326/ab9335.
[41] Saadat, et al. *supra* note 39 at 9.
[42] BDC Report at 33–34.
[43] Saadat, et al. *supra* note 39 at 9; Final LTP at 38.

emissions accounting system attributes any avoided emissions from the use of RNG to the sector that provided the RNG feedstock, and attributes net emissions to the sector in which the RNG is combusted.[44] Any emissions reductions achieved through the use of RNG produced out of state therefore cannot count towards the Companies' GHG emission reduction goals because the emissions accounting system that the State uses to measure and enforce the CLCPA's GHG emission limits only reflects emission reductions that occur in New York.[45]

The final LTP also incorrectly suggests that New York's use of a 20-year global warming potential for methane[46] could have negative implications for the state.[47] On the contrary, New York is a climate leader in acknowledging that because methane remains in the atmosphere for under two decades, a 20-year global timeline more accurately captures methane impacts than the outdated 100-year timeline.[48] To the extent that NFG insinuates that New York might be less able to access funding opportunities under the Inflation Reduction Act, this is false. Global warming potential does not affect eligibility for credits or rebates because the facts of a project do not change based on how its impact is calculated. Moreover, the model that the federal government uses to calculate GHG emission reductions is easy to use, readily available, and would place a negligible burden on energy producers in New York that might already be using the 20-year global warming potential to comply with the CLCPA. In any event, the CLCPA requires the use of a 20-year global warming potential, and so NFG's policy disagreements with the Legislature are irrelevant to its legal obligations.

[44] N.Y. Dep't Env't Conservation, New York 2022 Statewide GHG Emissions Report: Summary Report, *supra* note 35, at 4.
[45] *Id*.
[46] *See* ECL § 75-0101(2).
[47] Final LTP at 37.
[48] *See* Intergovernmental Panel on Climate Change, *Climate Change 2013: The Physical Science Basis* 714 (Thomas F. Stocker et al. eds., 2013).

Nor will hydrogen allow NFG to achieve the decarbonization required. The final LTP contains hydrogen blending beginning at relatively low levels and increasing to 15% by volume.[49] As discussed in Sierra Club and Earthjustice's comments on the initial LTP, the California Public Utilities Commission has concluded that "[t]he systemwide blending injection scenario becomes concerning as hydrogen blending approaches 5% by volume."[50] A 5% hydrogen blend would correspond to an energy contribution of less than 2%.[51] The result is that hydrogen blending would have a minimal impact, if any, on overall GHG emissions.[52] To the extent that the final LTP continues to rely on hydrogen, the Commission must require NFG to either reduce the blending percentage to safe levels or model the costs of replacing distribution infrastructure and end-use appliances to accommodate higher hydrogen blending levels.

Additionally, green hydrogen production is currently limited to demonstration projects, with projects "mostly in the single-digit MW scale."[53] The minimal green hydrogen in production should be conserved for uses that cannot be electrified. The building sector is not one of them.

IV. The Final LTP Fails to Adequately Consider Non-Infrastructure and NPA Opportunities

A. Demand Response

Commenters are pleased that NFG intends to propose a demand response pilot program "to gather the necessary information to determine the cost and effectiveness of demand response

[49] Final LTP at 68.
[50] Miroslav Penchev et al., Univ. of Cal., Riverside, *Hydrogen Blending Impacts Study Final Report* 4 (July, 18, 2022), https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M493/K760/493760600.PDF.
[51] BDC Report at 29.
[52] *Id.*
[53] Int'l Renewable Energy Agency, *Green Hydrogen Cost Reduction: Scaling up Electrolysers to Meet the 1.5°C Climate Goal* 18 (Dec. 2020), https://irena.org/-/media/Files/IRENA/Agency/Publication/2020/Dec/IRENA_Green_hydrogen_cost_2020.pdf.

programs."[54] However, Commenters disagree with NFG's conclusion that it is "premature to include demand response" in its modeling.[55] The Commission,[56] Staff of the Department of Public Service[57] and Charles River Associates[58] have concluded that demand response programs are proven tools for reducing and managing customer energy consumption. Further, the Gas Planning Order requires utilities to "show how other scenarios would meet the forecasted need, in the entirety or in part, through demand response, electrification, and energy efficiency programs."[59] Commenters previously stated that by ignoring the Commission's direction and not including demand response programs in either scenario, NFG missed opportunities to demonstrate potential energy savings and cost reductions in its LTP.[60] NFG has reviewed National Grid's recent rate case for demand response and conducted initial outreach with National Grid.[61] Commenters commend NFG's interest in exploring the benefits, but were disappointed that NFG neglected to include a demand response pilot program in its final LTP.

While investigating and reviewing demand response programs from NFG's sister utilities in New York State, NFG suggests that because it does not have the "same demand growth and gas supply constraint concerns as other downstate utilities"[62] and has access to more upstream pipeline capacity, reducing gas consumption during peak demand is not a matter of great concern. While NFG may not suffer from the same supply and demand constraints as other

[54] Final LTP at 84.
[55] *Id.*
[56] Gas Planning Order at 11–12
[57] Department of Public Service explained in its Staff Gas System Planning Process Proposal that demand-side management programs "should be integrated into planning processes, both geographically targeted in the context of replacing avoidable projects in a specific area of the distribution system, and system-wide to reduce overall demand and the need for infrastructure investment. *See* Staff Gas System Planning Process Proposal at 13, NY PSC Case No. 20-G-0131 (Feb 12, 2021).
[58] CRA Final Report at 58.
[59] Gas Planning Order at 11–12.
[60] Corrected Sierra Club and Earthjustice Comments on NFG's Initial LTP at 31–32, NY PSC Case No. 22-G-0610 (Apr. 4, 2023) (hereinafter "Comments on Initial LTP").
[61] Final LTP at 84.
[62] *Id*.

utilities in the state, a robust demand response program can reduce emissions in an area while still getting the maximum economic value from existing energy resources. Demand response programs optimize energy consumption by promoting more transparency with respect to the costs of energy.[63] The Department of Energy explains that demand response programs effectively shift consumption by end-users away from peak demand periods, which can improve an energy system's reliability and achieve overall emissions reductions to meet energy efficiency goals.[64] NFG must recognize and adopt the goals of the CLCPA, the Gas Planning Order, and the Scoping Plan, which are to not only prevent moratoria but also to effectively plan in a transparent manner, and consider gas and infrastructure alternatives while reducing costs and emissions.

B. Thermal Energy Networks

In addition to supporting decarbonization programs and goals as discussed above, electrification programs can also reduce supply-side constraints. As Commenters previously explained, to properly plan for aggressive emissions reductions, NFG must dramatically scale up network geothermal solutions and develop an electrification goal every three years.[65] NFG's final LTP fails to provide sufficient consideration to thermal energy networks and still mistakenly assumes it is limited to only developing one thermal energy network pilot, per PSC Case No. 22-M-0429. The only thermal energy network project which is included in the Company's final LTP will not be initiated until 2027.[66] After 2027, the Company plans to construct only one

[63] Dep't of Energy, *DOE Announces Up to $10 Million in Funding to Develop Natural Gas Demand Response Pilot Program* (Sept. 9, 2021), https://www.energy.gov/fecm/articles/doe-announces-10-million-funding-develop-natural-gas-demand-response-pilot-program.
[64] *Id*.
[65] Comments on Initial LTP at 33.
[66] Final LTP at 34, 66. The Company is currently developing geothermal and TENs pilot projects that are approved in Case No. 22-M-0429. Following a competitive request for proposal process, the Company has engaged an engineering firm to complete a TENs site selection study of its service territory in the fall of 2023, including a focus on opportunities in DAC areas. Following completion of the study, the Company will select one or more sites suitable for further development and ensure that at least one site is located in and will benefit a DAC community.

neighborhood TENs project per year and has yet to identify any site locations for the intended projects.[67] While it is encouraging to learn that NFG is engaging with an engineering firm to complete an additional thermal energy network site selection study and will also focus on opportunities in DAC areas,[68] the Company must aggressively scale up proposals for thermal energy networks, explore new opportunities and develop new geothermal network pilots that will lead to aggressive gas reductions in NFG's supply and demand forecasts.

C. Non-Pipeline Alternatives

Commenters and other stakeholders proposed alternative scenarios that NFG should model to assess decarbonization options. However, NFG should have significantly modified the scenarios in the LTP by aggressively scaling up its NPA program, deferring the LPP program and other capital-intensive investments in the gas system in favor of more active leak detection, methane capture, and selective repair of the most consequential leaks in order to minimize the costs to the remaining gas customers. As NFG recognizes, the Commission directed all utilities to identify the locations of specific segments of their LPP that "could be abandoned in favor of NPAs and where infrastructure projects may be needed in the near future to maintain reliability."[69] The Commission encouraged utilities to take a "neighborhood approach" and develop "a comprehensive program that simultaneously removes leaking or leak-prone infrastructure and employs programs such as weatherization and demand response along with electrification."[70] The Climate Action Council, Staff, and the Commission have all emphasized

[67] Final LTP at 66.
[68] *Id.* at 35.
[69] Gas Planning Order at 39.
[70] *Id*.

the importance of identifying strategic opportunities to retire existing pipelines as demand declines, when repairing and replacing LPP.[71]

As CRA explains in its assessment of the Company's LTP, new capital investments with long depreciation schedules, such as the LPP replacement program, prohibit a cost-effective transition away from fossil fuel dependency.[72] However, NFG mistakenly assumes that because the Company does not project any pipeline capacity or delivery constraints, NPAs are not needed to close the gap to meet demand.[73] NFG misses the point of the use of NPAs. Both the Gas Planning Order and CRA explain that NPAs reduce and eliminate the buildout of new infrastructure, bring benefits to DACs, facilitate the downsizing of the gas system, and reduce costs for customers.[74] NPAs are not limited to supply or demand constraints. NFG must adopt a new paradigm for planning its NPA program, one that incorporates creative thinking. NFG's two-prong approach that directs smaller capital cost projects to undergo an expedited, standardized review and for larger capital cost projects to undergo a comprehensive review is still woefully inadequate.[75] Neither approach incorporates a neighborhood approach—as is directed by the Commission [76]—considers repairs over replacement, or prioritizes DACs.

LPP replacement costs could be reduced or deferred by strategically targeting certain neighborhoods for electrification. Ramping up NPAs will allow the decommissioning of specific gas lines and could mitigate the cost increases for the remaining gas customers. NFG's strategic long-term planning should begin now, before the cost impacts balloon, and should include

[71] Scoping Plan at 358; Gas Planning Order at 39.
[72] CRA Final Report at ix.
[73] Final LTP at 84–85.
[74] CRA Final Report at x; Gas Planning Order at 6, 36–37, 39.
[75] Final LTP at 86.
[76] Gas Planning Order at 39.

innovative financial structures, community or neighborhood targeting, and region-specific decarbonization solutions.

V. NFG's "Informational Scenarios," which Incorporate Greater Electrification than the Company's Plan, Reinforce the Inadequacy of the Proposed LTP

The informational scenarios NFG modeled highlight the inadequacies of the company's LTP and affirm the need for modifications to the plan. Based on prodding from stakeholders including Sierra Club and Earthjustice,[77] NFG agreed to model several additional scenarios that incorporate more robust electrification, though the Company subsequently clarified that the modeling would be solely "for informational purposes."[78] It then relegated these more heavily electrification-oriented scenario modeling and results to an appendix to the LTP and devoted the bulk of the appendix to attempting to discredit the assumptions used to develop the scenarios.

Notably, all three of the "informational scenarios" achieved far deeper emission reductions than NFG's plan—65–71% reduction from 1990 levels as compared to a 53% reduction—*at a higher benefit-cost ratio*.[79] Yet as CRA observed, "[d]espite all three scenarios having a higher benefit-cost ratio than NFG's LTP and identifying opportunities for additional decarbonization, NFG did not present detailed cost-benefit analysis for each assumption as part of their assessment regarding adoption of assumptions from the Informational Scenarios into the LTP."[80] CRA therefore explained that it "agrees with [Sierra Club and Earthjustice]'s suggestion that NFG use the scenarios for more than just informational purposes."[81]

It also bears noting that, while NFG identifies the costs of the informational scenarios as higher than the cost of its LTP, this conclusion is driven entirely by NFG's calculation of

[77] Comments on Initial LTP at 39–42.
[78] Final LTP at App. K-2.
[79] *Id.* at App. K-6, K-7.
[80] CRA Final Report at vi.
[81] *Id.* at 22.

incentive costs for weatherization and heat pumps.[82] But to the extent any of these incentive costs come from federal incentives, they should not have been included as a cost in the cost-benefit analysis, which relies on a New York-based societal cost test. For example, as noted above, the federal Inflation Reduction Act includes incentives of up to $14,000 for heat pumps and related appliance upgrades.[83] As CRA explains, "[f]ederal incentives represent a transfer from all U.S. taxpayers to New York State residents, and therefore, should reduce costs to NY residents when using a New York State societal cost test."[84] CRA therefore concludes that: "[t]he BCA calculation should include federally funded incentives for weatherization and electrification as a benefit,"[85] and that "[a]bsent this reduction, NFG is currently underestimating benefits to consumers for heat pumps used in the calculation of the BCA."[86] The benefit-cost ratio for the informational scenarios is likely even greater than what NFG calculated, reinforcing the arbitrariness of NFG's disregard for the results of the informational scenario modeling.

VI. The Final LTP's Failure to Consider Delivered Fuels Renders it Unapprovable

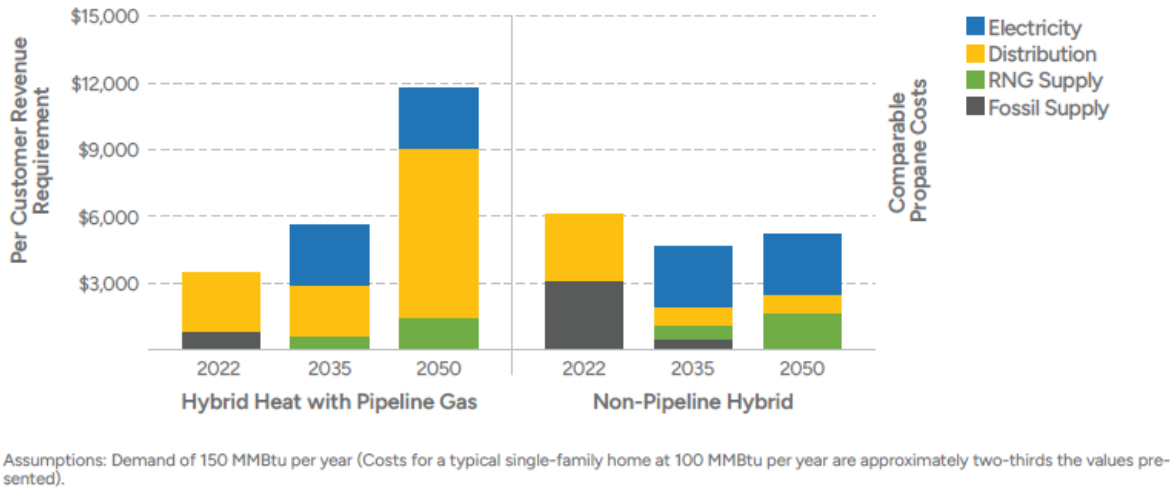
NFG inexcusably disregards the potential for delivered fuels to serve as a more flexible and cost-effective backup energy source should cold climate heat pumps require supplemental peak heating capacity.[87] As CRA recognizes, "[t]here may be circumstances where these alternate fuels would be desirable for certain customers as use of backup fuel to allow the

[82] Final LTP at App. K-4, tbl. K-1, App. K-7, tbl. K-2.
[83] CRA Final Report at 29.
[84] *Id.* at 31.
[85] *Id*.
[86] *Id.*
[87] SC-DR-1-28 (attached as Exhibit 3) ("The Company did not consider any options that would involve using propane, oil, or any other fuels as backup heat, except natural gas (blended with RNG and hydrogen)."). *See also* Final LTP at 33, n.37.

retirement of segments of leak-prone pipe and/or strategic downsizing of the natural gas system."[88]

Indeed, Groundwork Data's Future of Gas report directly compares the long-term economics of hybrid heating approaches using pipeline gas (RNG) and delivered fuels (renewable propane), demonstrating the superiority of delivered fuels to pipelines in providing any needed backup in a low-throughput, decarbonized gas future (see Figure 1 below).

Figure 1: Comparison of Revenue Requirement from the Hybrid Heat with Pipeline Gas Scenarios with Equivalent Costs of a Non-Pipeline Hybrid Strategy[89]

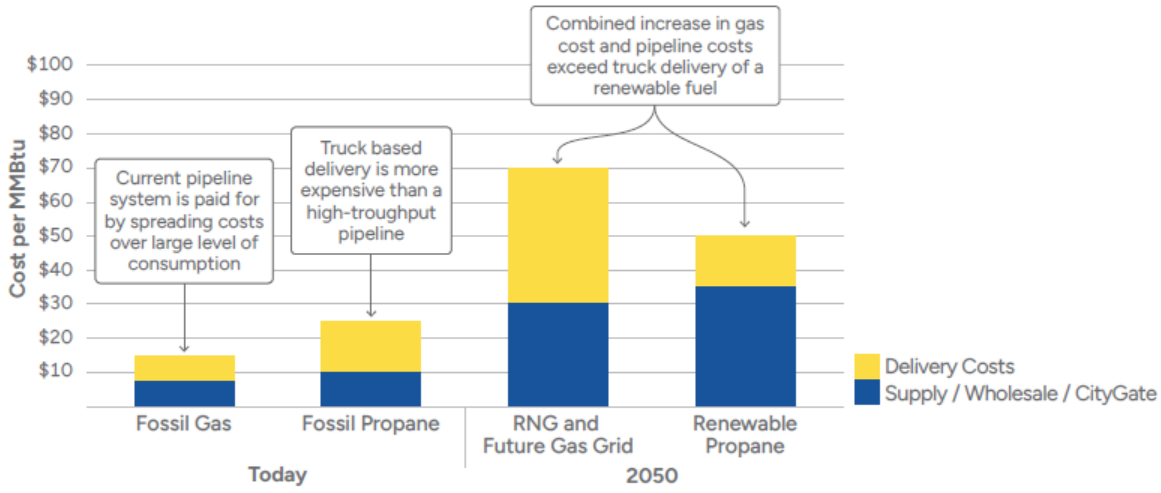


Assumptions: Demand of 150 MMBtu per year (Costs for a typical single-family home at 100 MMBtu per year are approximately two-thirds the values presented).

As Figure 1 illustrates, while today pipeline delivery of fossil gas has lower delivery and commodity costs than propane, that will not remain the case throughout the duration of NFG's LTP. In order to deliver gas at low costs, "[p]ipeline networks depend on economies of scale of both customers and throughput."[90] Declining customer counts and gas throughput will reverse the current cost advantages of pipeline fuel delivery (see Figure 2 below).

[88] CRA Final Report at 71.
[89] BDC Report at 48, fig. 11.
[90] *Id.* at 48.

Figure 2: Changes in Supply and Delivery Costs Eliminate the Historical Cost Advantage of Pipeline Gas[91]



Source: Today's cost estimates are approximated from current prices (EIA). Future supply prices are based off estimates of renewable fuel costs. Future pipeline gas delivery costs are based on the above section analysis. Future propane delivery costs are assumed to be equivalent to today's costs.

As Groundwork Data explains, "commodity costs of RNG and renewable propane or its analogues are more on par with each other than fossil methane gas and fossil propane," erasing the fuel cost advantage that pipeline gas currently holds, and "[a]ny premium that propane commodity costs have over methane or hydrogen are small relative to future costs associated with pipeline delivery of methane or hydrogen,"[92] which as Figure 2 shows, are far higher than truck delivery of renewable fuels.

NFG's complete failure to consider delivered fuels as an alternative to retention of its full gas pipeline system to provide any residual peak heating needs is irrational and arbitrary and renders NFG's plan unapprovable.

[91] *Id.* at 49, fig. 12.
[92] *Id.* at 48.

VII. The Final LTP Fails to Sufficiently Consider Industrial Decarbonization Measures

Commenters appreciate NFG's inclusion of industrial electrification in the final LTP, an improvement from the initial LTP, which only considered energy efficiency and alternative combustion fuels in the industrial sector.[93] However, the final LTP still falls short by excluding industrial heat pumps ("IHPs")[94] and failing to include information about industrial customer profiles that would allow stakeholders and the Commission to assess potential decarbonization options.

As NFG explains, industrial customers are large businesses that manufacture or process goods or materials[95] and its industrial customers generally include iron and steel mills, hazardous waste disposal facilities, flour mills, and power generation facilities.[96] The industrial sector accounts for more than 25% of the nation's energy use and energy-related carbon dioxide emissions[97] and 9% of New York State's emissions.[98]

NFG concluded in its final LTP that only industrial furnace users could be electrified and inappropriately excluded IHPs.[99] NFG's conclusions are based on its biased analysis of its own audit, in which it contacted and queried its own customers about decarbonization pathways.[100] In lieu of probing the results from that audit, in which it only spoke with 24 out of its roughly 430 industrial customers, NFG simply determined that hydrogen and RNG were better options for

[93] *See* Final LTP at 65; Initial Long-Term Plan at 50, NY PSC Case No. 22-G-0610 (Dec. 22, 2023).
[94] Final LTP at 34.
[95] *Id.* at 11.
[96] *Id.* at 15.
[97] Ed Rightor et al., ACEEE, *Industrial Heat Pumps: Electrifying Industry's Process Heat Supply* vii, 1 (Mar. 2022), https://www.aceee.org/sites/default/files/pdfs/ie2201.pdf.
[98] Final Scoping Plan at 257.
[99] Final LTP at 65–66.
[100] *See* Final LTP at 34, n.38 ("'National Fuel Gas Corporate Informational Filing' submitted on June 15, 2022 in Case Nos. 20-G-0131 and 22-M-0149 includes a detailed discussion of the opportunities and challenges facing National Fuel's industrial customers as they explore actions that they can take to reduce emissions.").

high-heat processes.[101] NFG failed to provide any cost assumptions for IHPs or compare IHP costs to the projected costs of RNG, hydrogen, or any other decarbonization method. It is therefore difficult to assess which pathway is the better option.

The industrial sector has several pathways to decarbonization, including electrification.[102] Currently on the market, there are a multiple types of IHPs that can provide heat up to about 160º C (covering roughly 44% of industrial process heat needs), and products are in development to raise this temperature ceiling to about 200º C (covering roughly 55% of industrial process heat needs).[103] Even moderate deployment of IHPs in industrial groups with high process heating demands, such as pulp and paper, chemicals, and food manufacturing will lead to significant GHG emissions reductions.

To better understand the limitations and potential options or opportunities to electrify the industrial sector within its service territory, NFG should separate its industrial customers into subsectors such as (1) food manufacturing including dairy and meat processing; (2) automotive; (3) chemical; (4) power generation; (5) textile; (6) pulp and paper; (7) cement; (8) asphalt; (9) stone; (10) wood processing; (11) steel: primary or secondary. Some sectors are already poised to electrify even while for others, electrification might only become viable over the course of the

[101] National Fuel Gas Distribution Corporation Informational Filing at 4, NY PSC Case Nos. 20-G-0131 & 22-M-0149 (June 15, 2022); Final LTP at 15.
[102] *See e.g.,* Ed Rightor et al. & ACEEE, *supra* note 97; M. Jibran S. Zuberi et al., Lawrence Berkeley Nat'l Lab'y, *Electrification of U.S. Manufacturing with Industrial Heat Pumps* (Oct. 2022), https://www.globalefficiencyintel.com/electrification-of-us-manufacturing-with-heat-pumps; Iwona Cameron et al., Ricardo Energy & Env't, *Decarbonisation Road Map for the European Food and Drink Manufacturing Sector* (Jul. 2021), https://www.fooddrinkeurope.eu/wp-content/uploads/2021/09/Decarbonising-the-European-food-and-drink-manufacturing-sector_v2.pdf.
[103] Ed Rightor et al. & ACEEE, *supra* note 97 at vii, 2.

LTP's planning horizon. For example, a Southern California air regulator recently adopted a zero-emission standard for commercial ovens.[104]

Identifying the industrial customers by subsector will allow NFG, stakeholders, and the Commission to determine viable and cost-effective options to electrify and reduce their GHG emissions. Industrial heat for manufacturing processes, from boilers in particular, is a significant source of emissions and because of the heterogeneity of the manufacturing sector and the variety of different production methods on a process level, it is important for NFG to assess, develop, and identify the optimal industrial decarbonization pathways for its customers.

The final LTP must identify which subsectors of its industrial customers would be suited for IHPs, identify specific barriers associated with side-scale applications of IHPs and provide a plan to address those challenges, and identify other necessary targeted actions, including further research, development, demonstration and deployment. The Commission should therefore not approve the final LTP in its current form.

VIII. The Final LTP Fails to Adequately Invest in and Assess Impacts on Disadvantaged Communities

The final LTP fails to discuss the impacts on disadvantaged communities in NFG's service territory or direct at least 35–40% of the benefits of investments to disadvantaged communities as required by the Gas Planning Order and the CLCPA.[105] Commenters agree with CRA that the final LTP falls far short of NFG's obligation to ensure that at least 35–40% of the benefits of clean energy and energy efficiency investments accrue to DACs.[106] The final LTP also fails to ensure that DACs will not be disproportionately burdened and fails to assess utility

[104] *See* Maria Gallucci, *New California Rule Will Cut Carbon from Baking Cheetos, Chips and More*, Canary Media (Aug. 8, 2023) https://www.canarymedia.com/articles/clean-industry/new-california-rule-will-cut-carbon-from-baking-cheetos-chips-and-more.
[105] *See* Gas Planning Order at 39–40; ECL § 75-0117.
[106] CRA Final Report at 92–93.

bill impacts, in violation of Section 7(3) of the CLCPA and the Gas Planning Order.[107] As discussed below, the final LTP will prolong and exacerbate disproportionate health and economic burdens on DACs, and therefore, cannot be approved.

The Gas Planning Order directs utilities to identify DACs in their service territories, assess the impacts on those communities of any proposed projects, and explain how the utilities will ensure that an appropriate portion of the benefits of any NPAs will accrue to those communities.[108] Like the initial and revised LTPs, the final LTP states that NFG does not have any proposed projects that will disproportionately impact DACs, even though it is planning to perform pipeline replacement projects in DACs.[109] Those projects will inevitably have greater impacts in the communities in which they will take place than in others, and as NFG recognizes, it must assess those impacts.[110]

The final LTP also incorrectly asserts that "disadvantaged communities will see emissions benefits from RNG and hydrogen blended into the system to serve customers."[111] Burning these alternative fuels will not reduce pollutants in ratepayers' homes and will not achieve meaningful GHG emissions. RNG, like fossil natural gas, is mostly methane and its combustion produces local pollutants such as nitrogen oxides (NOx) that cause and exacerbate asthma, impair lung function, and can lead to premature death.[112] Hydrogen combustion

[107] Gas Planning Order at 45.
[108] *Id*. at 39–40.
[109] Final LTP at 88.
[110] *Id*.
[111] *Id*.
[112] Sasan Saadat, et al, *supra* note 39 at 16. NOx is a pollutant that damages heart and respiratory function, impairs lung growth in children, and leads to higher rates of emergency room visits and premature death. Further, the state's Department of Health has identified the reduction of air pollution, including ozone, as a key indicator to drive improvements in asthma rates and public health outcomes throughout the state. The New York State Prevention Agenda 2019-2024 notes the "extensive evidence" linking ozone with respiratory and cardiovascular illness and death and establishes a goal to "reduce exposure to outdoor air pollutants," with an emphasis on vulnerable groups. *See* N.Y. State Dep't of Health, New York's State Health Improvement Plan: Prevention Agenda 2019–2024, 72–73 (updated June 30, 2023), https://www.health.ny.gov/prevention/prevention_agenda/2019-

produces up to six times as much NOx as methane combustion, and can therefore pose an even greater threat to human health.[113] Moreover, the use of RNG and hydrogen does not necessarily reduce overall GHG emissions, and can result in increased emissions. As discussed above and in Sierra Club and Earthjustice's comments on the initial LTP, RNG almost certainly produces no real climate benefits,[114] and RNG created from intentionally produced methane always results in net GHG emissions increases because of the inevitability of methane leakage during transport.[115] Leakage is likely to be even higher when RNG is transported from out of state. NFG's plan to rely on RNG produced from anaerobic digestion projects in New York State, Pennsylvania, and Ohio[116] will therefore not result in significant, if any, GHG emissions. Moreover, unless NFG invests in replacing pipes to accommodate higher concentrations of hydrogen, the company can only plan to blend up to 1.7% by Btu (5% by volume), which will achieve minimal GHG cuts.[117] NFG cannot treat the plan to combust alternative fuels in ratepayers' homes as a boon to disadvantaged communities; on the contrary, reliance on these fuels will only exacerbate existing health disparities.

Furthermore, as discussed in Sierra Club and Earthjustice's comments on NFG's initial and revised LTPs and above in Section III, a hybrid plan that maintains the current gas distribution system will increase cost burdens for low-income ratepayers.[118] Because the final

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2024/docs/ship/nys_pa.pdf; *see also Nitrogen Dioxide & Health*, Cal. Air Res. Bd., https://ww2.arb.ca.gov/resources/nitrogen-dioxide-and-health (visited Sept. 5, 2023).

[113] Mehmet Salih Cellek & Ali Pinarbasi, *Investigations on Performance and Emission Characteristics of an Industrial Low Swirl Burner While Burning Natural Gas, Methane, Hydrogen-Enriched Natural Gas and Hydrogen as Fuels*, 43 Int'l J. Hydrogen Energy 1194, 1205 (2017), https://www.sciencedirect.com/science/article/abs/pii/S0360319917319791.

[114] Comments on Initial LTP at 35.

[115] Emily Grubert, *supra* note 40, at 4.

[116] Final LTP at 67, 70.

[117] *See* Comments on Initial LTP at 15–16, 36 (citing Miroslav Penchev et al., Univ. of Cal., Riverside, *supra* note 50, at 4.).

[118] Comments on Initial LTP at 34–35; Comments on Revised LTP at 13–17.

LTP continues to rely on partial electrification with gas as a backup, NFG must assess the utility bill impacts to customers, including analyzing whether they disproportionately impact DACs.

The Commission cannot approve the final LTP until NFG ensures that at least 35–40% of the benefits of clean energy and energy efficiency spending accrue to DACs and that DACs will not experience disproportionate health, economic, or other burdens.

IX. Conclusion

For these reasons, Sierra Club and Earthjustice respectfully urge the Commission to reject the final LTP as proposed and direct NFG to revise the LTP to address the deficiencies discussed above and in compliance with the Gas Planning Order and the CLCPA.

Respectfully submitted,

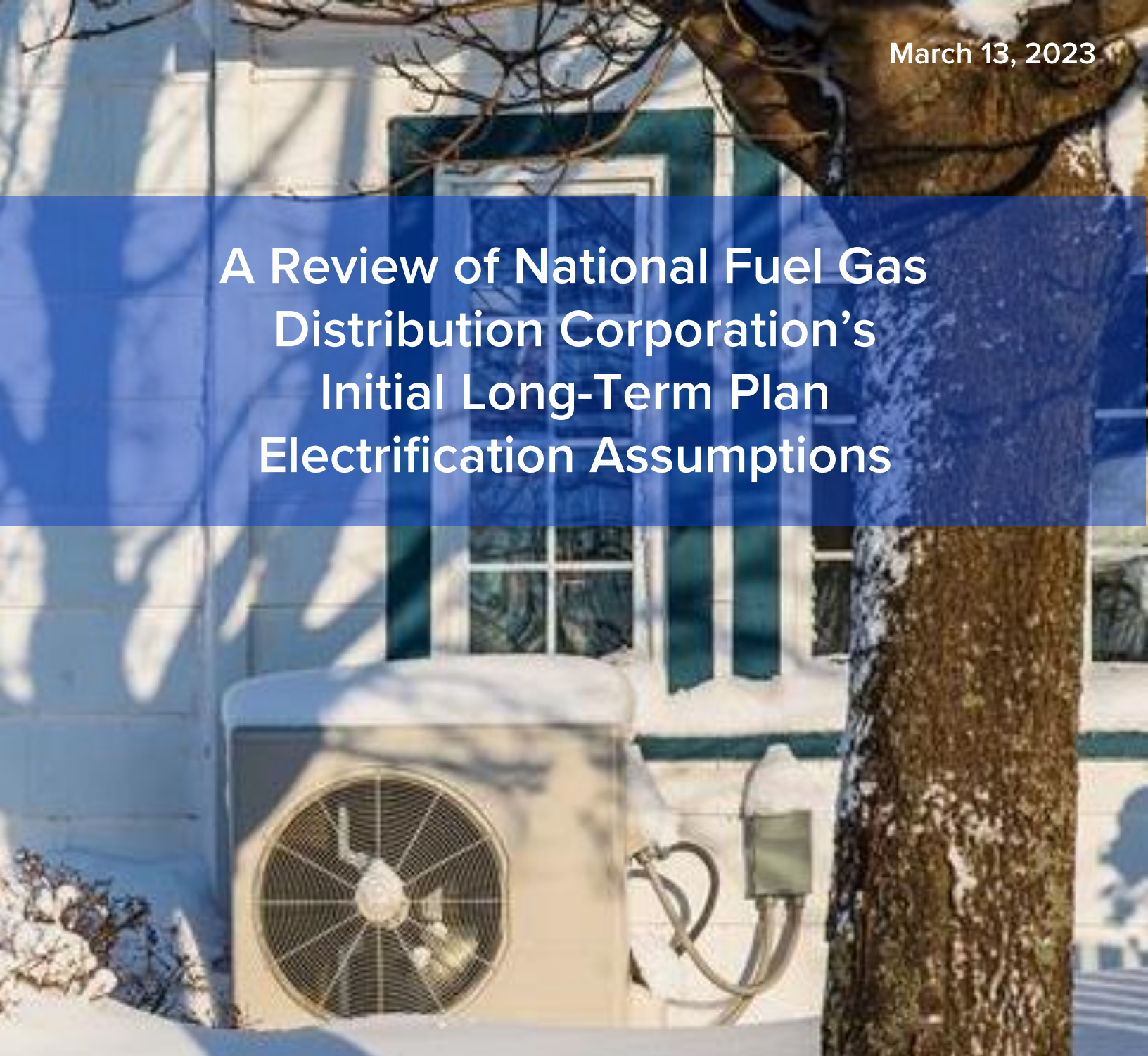
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Exhibit 1

March 13, 2023

A Review of National Fuel Gas Distribution Corporation's Initial Long-Term Plan Electrification Assumptions



Prepared by:

STRATEGEN

Prepared for
Sierra Club and Earthjustice

Introduction

Strategen Consulting has prepared these comments on National Fuel Gas Company's ("NFG" or "the Company") initial Long-Term Plan ("LTP") on behalf of its clients, Sierra Club and Earthjustice. Sierra Club and Earthjustice asked Strategen to review the Company's electrification assumptions and subsequent outcomes of the modeling in the LTP. Specifically, Strategen reviewed the Company's technological and cost assumptions for various electrification technologies, cost basis for the crossover temperature for heat pumps, and electrification adoption curves. Strategen then proposed several recommendations for adjustments that NFG could make in this proceeding, or future LTPs, to better represent the technical capacity and emission reduction potential of electrified heating systems.

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Background

In July 2019, New York State passed the Climate Leadership and Community Protection Act (CLCPA), which set ambitious climate requirements to reduce economy-wide greenhouse gas emissions 40% by 2030 and no less than 85% by 2050 from 1990 levels.[1] In May 2022, the New York Public Service Commission ("Commission") issued the *Order Adopting Gas System Planning Process* ("Gas Planning Order"),[2] which requires each gas distribution company to file a 20-year Long-Term Plan to show, among other things, that the gas utility's planning is consistent with the CLCPA mandates.

On December 22, 2022, NFG filed its Initial Long-Term Plan with the Commission. NFG is the first gas utility in New York to file a LTP with the Commission. In the context of the CLCPA emissions reduction targets, the Company's LTP outlined several measures to support reduction of their Scope 2 and 3 emissions over the next 20 years, including methane leak reduction, energy efficiency, heat electrification, and low-carbon fuels like renewable natural gas (RNG) and green hydrogen. The LTP includes three preliminary scenarios. First, the Company determined a "Reference" scenario, which represents business-as-usual forecasts without accounting for the impacts of the CLCPA.[3] The Company also examined two alternative "no infrastructure" scenarios: a "Supply-Constrained Economy (SCE) Scenario" that assumed supply chain and other economic constraints prevented rapid uptake of decarbonization measures, and an "Aggressive Scenario" that assumed decarbonization measures were deployed more quickly.[4]

[1] NYSERDA, "Progress to Our Goals." New York's Climate Leadership and Community Protection Act (CLCPA), Accessed March 9, 2023, https://climate.ny.gov/our-impact/our-progress/.
[2] New York State Public Service Commission, "Order Adopting Gas System Planning Process," Case 20-G-0131, Proceeding on Motion of the Commission in Regard to Gas Planning Procedures (issued May 12, 2022) (Hereinafter "Gas Planning Order").
[3] *Id* at 24, 29.
[4] *Id.* at 24-25.

The Aggressive scenario achieved 63% reductions in carbon emissions from a 1990 baseline by the end of the LTP, compared to a 43% reduction in the SCE scenario.[5] The emission reductions were primarily due to the Aggressive scenario's greater use of air source heat pumps than the reference or SCE scenarios. For example, the Aggressive scenario assumed that in the residential sector, 48% of furnaces and 42% of boilers were replaced by cold climate air source heat pumps by 2042. By contrast, the SCE scenario assumed only 24% of furnaces (and no boilers) were replaced with hybrid heating systems equipped with standard air source heat pumps that switch to gas back-up when temperatures fell below 30 degrees.

Despite the increased emission reductions created by the Aggressive scenario, NFG declined to adopt it, citing the high installation costs of cold climate air source heat pumps. Instead, NFG proposed a fourth "in-between" scenario that assumed 48% of residential furnaces were replaced by hybrid systems by 2042 (boiler conversions were excluded as being too expensive). This proposed "LTP scenario" would achieve emission reductions of 34% by 2030[6] and 51% by 2042.[7] NFG's proposed rate of emission reductions would put the utility out of line with its proportional share of the CLCPA emission reduction targets. Moreover, the rate of emission reductions in NFG's LTP scenario cannot be readily extended to rapidly achieve the deeper greenhouse gas reductions mandated by the CLCPA in 2050.

Summary of Recommendations

NFG's selected emission reduction pathway was heavily influenced by the Company's assumptions around the cost, deployment rate, and technical performance of heat pump technologies. In its assessment of the LTP, Strategen identified several areas where adjustments to the underlying assumptions could provide a more accurate and effective representation of the ability for heat electrification technologies to reduce NFG's emissions in its service territory.

The type of heating system a customer chooses to replace an aging gas furnace or water heater is driven by several factors, most notably the upfront and operating costs of each system. Upfront and operating costs are specific to each furnace or water heater technology. More specifically, the operating costs of each technology depend on the price of the fuel (e.g., electric or gas rates) and the assumed performance and efficiency of the technology.

Consequently, reasonably forecasting the capabilities and costs of heat pumps and gas and electricity prices is critical to developing and comparing scenarios in a meaningful way. As

[5] National Fuel Gas Distribution Corp., "Initial Long-Term Plan," Figures V-1–V-4 at 47-56, December 22, 2022, https://www.nationalfuel.com/wp-content/uploads/documents/NFGDC-Initial-Long-Term-Plan-22-G-0610-12.22.22.pdf. Unless otherwise noted, all emission reductions are relative to the 1990 baseline.
[6] Charles River Associates, "Initial Findings Report: National Fuel Gas Distribution Corporation Initial Long-Term Plan Assessment" New York State Public Service Commission, Case 22-G-0610, In the Matter of a Review of the Long-Term Gas System Plan of National Fuel Gas Distribution Corporation (Issued February 17, 2023) (Hereinafter "Charles River Associates Report").
[7] NFG, "Initial Long-Term Plan," Figures V-1 to V-4 at 47-56.

NFG has indicated in its LTP,[8] the gas rates, in particular, have the potential to increase significantly, both from the introduction of higher-cost fuels like RNG and hydrogen and through load reduction from electrification, which will increase delivery costs for customers that remain connected to the gas system. As a result, it's important to consider these future fuel cost changes when assessing customers' decisions around which type of heating equipment they will opt to install in the future.

In these comments, Strategen examines the key inputs and assumptions the Company relied on in its LTP modeling and offers recommendations for improvements in this and future LTPs. Most of Strategen's recommendations can be incorporated into this Initial LTP. In some circumstances, the utility may need more time for its analysis. Strategen's full recommendations are summarized in Table 1 and described in more detail in the subsequent comments. In Table 2, Strategen presents three alternative scenarios for the Company to model in this LTP so as to better inform the Commission as it considers the Company's LTP.

Unless otherwise specified, all recommended adjustments are focused on NFG's residential customer class, and all references to "heat pumps" refer to air source heat pumps. Any references to temperature degrees are in Fahrenheit unless otherwise stated.

Table 1: Strategen's Recommendations for Improving NFG's LTP Electrification Assumptions

Assumption	LTP Assumption	Strategen Recommendation for LTP
Heat Pump Adoption Rate	1. Uses an adoption ramp rate originally developed for weatherization retrofits, with some modifications.	1. Use separate replacement rates for AC units and gas furnaces/boilers, with customers considering installing hybrid heat pump systems when replacing either equipment. 2. Separate electrification ramp rate for new customers assuming 100% installation of all-electric heating systems after 2025 and 2028 consistent with the recommendations in the final Scoping Plan.
Heat Pump Technical Capabilities	1. Static efficiencies with no improvements over the planning horizon. 2. Assumes cold climate heat pumps performance does not	1. Align cold climate COP values with manufacturer-provided range. 2. Assume heat pump COPs improve at least in line with NREL's "Moderate Advancement" scenario.[9]

[8] NFG, "Initial Long-Term Plan Appendix B: Modeling of Scenarios"," at B-3, December 22, 2022, https://www.nationalfuel.com/wp-content/uploads/documents/NFGDC-Initial-Long-Term-Plan-Appendices-A-J-22-G-0610-12.22.22.pdf.

[9] Caitlin Murphy, et al., "Electrification Futures Study: Scenarios of Power System Evolution and Infrastructure Development for the United States," National Renewable Energy Laboratory, 2021, https://www.nrel.gov/docs/fy21osti/72330.pdf.

	meet manufacture performance ratings.	
Heat Pump Installation Costs	1. No cost reductions due to technology improvements over the planning horizon. 2. No utility, state, or federal incentives.	1. Assume installed costs for 4-ton cold climate heat pumps do not exceed $19,200, or roughly the cost of a 5-ton heat pump in NYSERDA's analysis. 2. Factor available rebates into heat pump costs. 3. Include annual decreases in heat pump capital costs aligned with the NREL "Moderate Advancement" scenario. 4. Assume that houses will weatherize prior to installing heat pumps, reducing heating need by 38%. 5. Assume that the installed costs of thermal energy networks fall by 25% over the plan's 20-year period.
Heat Pump Crossover Temperatures	1. Furnace operates exclusively when average heating degree days ("HDD") totals are 35 or greater. The Company assumes that a heat pump will never run on days in which the average temperature is below 30 degrees.	1. Assume installation of cold climate heat pumps in hybrid configurations starting at least in 2030, with installation costs in line with those detailed in the NYSERDA report[10] and incorporating any relevant rebates or technology improvement assumptions. 2. Model cold climate heat pump operation on an hourly rather than daily basis across the year and assume heat pumps operate down to 15 degrees from 2030-2035, and down to -5 degrees from 2035-2042.
Electricity Cost Increases	1. Relies on NREL study to forecast electricity supply costs and Niagara Mohawk's	1. Use NREL's "All options" scenario projections for retail cost increases as the default scenario for future

[10] NYSERDA, "New Efficiency: New York; Analysis of Residential Heat Pump Potential and Economics," January 2019, https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Publications/PPSER/NYSERDA/18-44-HeatPump.pdf

	most recent 4-year capital plan to forecast electricity delivery costs. 2. Annual increases of 1.5% Compounded Annual Growth Rate ("CAGR") for supply costs and 5.3% CAGR for delivery costs.	growth in both supply and delivery costs for electricity. 2. In future LTPs, work directly with regional electric utilities to develop more informed forecasts of how electrification investments will impact transmission and distribution costs.
Electric Sector Emissions	1. Declining CO_2e emission resulting in 242 CO_2e lbs/MWh in 2030 and 181 lbs/MWh in 2042.[11]	1. Assume electricity sector meets CLCPA legislative requirements, reaching zero GHG emissions by 2040.
Alternative Heat Pump Technologies	1. Did not consider industrial heat pumps or air-to-water heat pumps in decarbonization options.	1. In future LTPs, consider and include industrial heat pumps and electrification of boiler system via air-to-water heat pumps.

Scenario Modeling

We recommend that the Company model additional scenarios in this LTP. All scenarios should adopt the recommendations in Table 1, as well as additional adjustments outlined in Table 2; details of the scenario inputs are provided in the Appendix to these comments. Given the recent release of the New York Climate Action Council's Final Scoping Plan ("Scoping Plan"), it's prudent for the Company to be prepared to implement the policy changes that this plan proposed. This Scoping Plan was designed to provide direct guidance to New York's Department of Environmental Conservation, which is required by January 1, 2024 to promulgate regulations that "[r]eflect, in substantial part, the findings of the scoping plan,"[12] creating a high likelihood that the proposed policies will be implemented in the future. These policies would significantly impact electrification rates in NFG's service territory, which would have substantial effects for both emission reductions and gas rates in the Company's service territory. Consequently, Scenario One is designed to meet the specific building standards recommended in the Scoping Plan.

1. **Scenario 1: Climate Action Council Scoping Plan:** In this scenario, NFG complies with the express recommendations established by the Climate Action Council in their

[11] NFG, "Initial Long Term Plan Appendix D," Table D-22 at D-20, December 22, 2022, https://www.nationalfuel.com/wp-content/uploads/documents/NFGDC-Initial-Long-Term-Plan-Appendices-A-J-22-G-0610-12.22.22.pdf.
[12] ECL § 75-0109(2)(c).

Final Scoping Plan.[13] The scenario aligns with policies likely to be adopted by the NY Department of Environmental Conservation and other state agencies reflecting the findings of New York's Scoping Plan. These include:

   a. Installation of fossil fuel combustion equipment is prohibited in new single-family and low-rise residential homes after 2025, and in multi-family and commercial buildings after 2028.
   b. Installation of fossil fuel combustion equipment is prohibited in existing single-family residential homes after 2030, and in multi-family and commercial buildings after 2035. 4-ton cold climate pumps are installed for all existing residential customers. Appendix A provides ramp rates modeling this scenario's electric appliance adoption.

2. **Scenario 2: Hybrid Scenario:** In this scenario, NFG reaches 85% electrification by 2050 through hybrid configurations with furnace backups (e.g. heat pump systems with furnace back-ups). In accordance with the thermal load analysis in New York State Energy and Research and Development Authority's ("NYSERDA") "Analysis of Residential Heat Pump Efficiency Potential and Economics" report,[14] 3-ton cold climate heat pumps are installed for all existing customers according to the ramp rate provided in the attached Appendix. The crossover temperature at which furnaces activate should be dictated by the revised assumptions in Table 2 and should be similar to Strategen's recommendations in Table 1. New single-family residential and multi-family/commercial buildings continue to switch to 100% all-electric after 2025 and 2028 respectively, due to underlying economics.

3. **Scenario 3: All-electric:** In this scenario, NFG reaches 85% electrification by 2050 with electric resistance as backup. 4-ton cold climate heat pumps are installed for all existing customers according to the ramp rate provided in the Appendix. New single-family residential and multi-family/commercial buildings continue to switch to 100% all-electric after 2025 and 2028 respectively, due to underlying economics.

Table 2: Shared Assumptions for All Three Scenarios (details provided in the Appendix)

Assumption	Alternative Scenario Inputs
Heat Pump Technical Capabilities	Use median manufacturer COP specs for cold climate heat pumps. Assume 1% annual performance improvement across all temperatures.
Heat Pump Installation Costs	Include Federal heat pump rebates and utility rebates. Assume 1% annual cost reduction.

[13] New York State Climate Action Council, " Scoping Plan," (December, 2022) https://climate.ny.gov/-/media/project/climate/files/NYS-Climate-Action-Council-Final-Scoping-Plan-2022.pdf.
[14] NYSERDA, "New Efficiency: New York."

Heat Pump Crossover Temperatures	Model cold climate heat pump operation on hourly data (from Columns B and C of SC-DR-1-14 Attachment 1 [attached as Exhibit 1]) rather than on daily basis across the year.
Electric Sector Emissions	Assume electricity sector meets CLCPA legislative requirements. Apply linear reductions to 2030 and 2040 targets.
Electricity Cost Increases	Use NREL's "All options" scenario projections for retail cost increases as the default scenario for future growth in both supply and delivery costs for electricity.

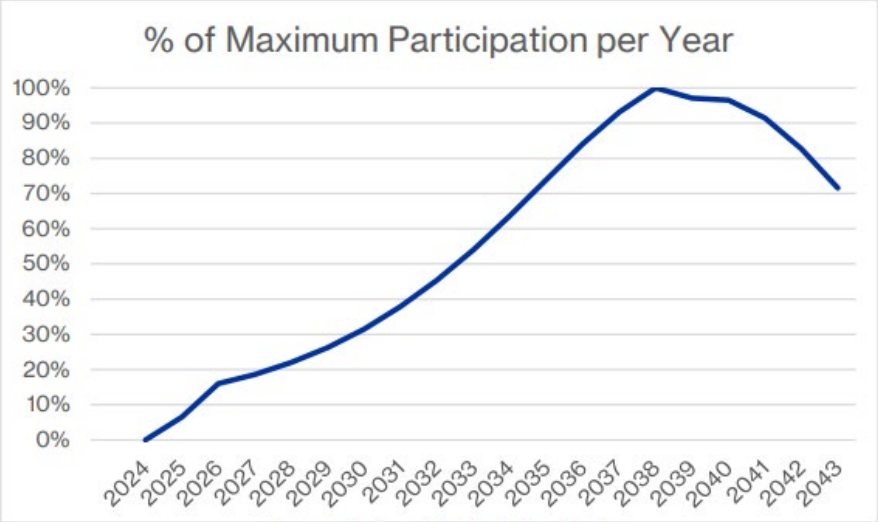
Heat Pump Adoption Rate

Description of NFG Assumptions

In its LTP scenario, NFG assumes heat pump adoption progresses in line with its "Electrification Customer Participation Ramp Rate," which is based on a ramp rate for residential weatherization developed by its consultant, Cadmus.[15] This ramp rate is based on assumptions that Cadmus developed for customer participation in NFG's weatherization programs, which NFG then used to forecast heating and cooling electrification. This ramp rate identifies a percentage of customers that are expected to install air source heat pumps (either standard or cold climate, depending on the scenario) in each year.

[15] Camus, "Residential Weatherization Potential Study Report," November 2, 2022, https://www.nationalfuel.com/wp-content/uploads/documents/NFGDC-Initial-Long-Term-Plan-Appendices-A-J-22-G-0610-12.22.22.pdf (attached as Appendix F to "Initial Long-Term Plan").

Figure 1: NFG LTP Heat Pump Adoption Rate[16]



Source: Cadmus Weatherization Study

In addition, NFG assumes that customers only install air source heat pumps (either hybrid or all-electric) when their current furnace is ready to be replaced. Based on expected furnace lifespans, NFG assumes that around 4.55% of residential customers replace their furnace every year.[17] The weatherization ramp rate is applied to this sub-set of customers that replace their furnaces every year. In other words, if the ramp rate says that 8% of customers install heat pumps in 2026, and 4.55% of customers replace their furnaces in 2026, then NFG is assuming that ~0.36% (i.e. 4.55% * 8%) of customers with furnaces would install air source heat pumps in that year. NFG assumes that customers with AC units replace them at the same time as their furnaces, and that customers who install heat pumps instead are able to avoid the cost of a new AC unit.

Finally, NFG assumes that no customers with boilers electrify their heating systems. As customers with boilers represent 23% of their total gas customers, this significantly reduces their expected speed of heat pump adoption in their service territory.

Assessment of NFG Assumptions

Repurposing weatherization ramp rates assumptions for electrification adoption may not be justified. First, the households that benefit most from energy efficiency may not be the best candidates for electrification. For example, old homes are more likely to have inferior insulation and simple efficiency investments can greatly reduce fuel use in those homes. The reverse is true for electrification; households that do not substantially benefit from efficiency measures, such as those with newer homes and a tighter housing envelope, could be the first to electrify. The benefit-cost ratio of an electrification upgrade in a new home is more likely to exceed the

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[16] NFG, "Initial-Long Term Plan Appendix A:Modeling of Decarbonization Actions," Figure A-2 at A-7, December 22, 2022, https://www.nationalfuel.com/wp-content/uploads/documents/NFGDC-Initial-Long-Term-Plan-Appendices-A-J-22-G-0
610-12.22.22.pdf.

[17] SC-DR-1-21 (attached as Exhibit 2).

benefit-cost ratio of an efficiency upgrade. Thus, using weatherization ramps rates as a proxy for electrification may not be appropriate.

Second, NFG's analysis relies on a set of assumptions that might be relevant to weatherization but are not relevant to electrification. Although not specifically stated, NFG appears to assume that the weatherization achievable potential is 85% of total potential. While this may be a reasonable assumption for weatherization, it is not for electrification. Then, NFG applies this ramp rate to a reduced pool of eligible participants by "assum[ing] that customers in old homes or heating with boilers do not electrify."[18] This approach results in the installation of hybrid systems in only 33% of residential household over the next two decades.[19] Thus, in 2042, NFG forecasts that two thirds of residential customers will still use natural gas as their sole source of heating.

Third, NFG assumes a slow ramp rate for new residential and small commercial customers. In the SCE scenario, 16% of new residential customers adopt hybrid HVAC systems in 2030, and only 41% by 2042.[20] It is unclear why a ramp rate, and such a slow one, is necessary for new customers. New construction does not face the costs challenges associated with retrofits for existing homes and buildings. Installation of all-electric heat pumps in new homes allows customers to avoid paying for a new gas line extension to their house, a substantial avoided cost that does not appear to be included in NFG's model. These assumptions are also in conflict with New York's Scoping Plan, which proposes the adoption of building codes that prohibit fossil fuel combustion equipment in new residential and commercial buildings past 2028.[21]

Fourth, NFG also assumes that transitions to hybrid solutions occur upon construction of new buildings or replacement of old furnaces.[22] This assumption underestimates the number of opportunities that NFG's customers will have to retrofit their HVAC systems. Specifically, because heat pumps are an efficient provider of cooling as well as heating, customers replacing their cooling appliances will have a compelling opportunity to install a hybrid heat pump system rather than a new AC unit. NFG's modeling correctly identifies that a heat pump installation will allow a customer to avoid the costs of a new AC unit, but it assumes furnace and AC retrofits occur at the same time. In practice, this is unlikely to be the case, as AC and furnace equipment have different average lifespans (as identified by NFG).[23]

By assuming that heat pumps are installed only when furnaces are replaced,[24] NFG significantly underestimates the number of heat pump installations that could take place in any given year. By way of example: assuming that furnace and AC replacements happen at the same time means that, over a 20-year period, the average customer would only have one opportunity to install a heat pump, i.e., when both their furnace and AC units are replaced. In

[18] NFG, "Initial Long-Term Plan Appendix A.".
[19] SC-DR-1-21 (attached as Exhibit 2)
[20] SC-DR-1-22 (attached as Exhibit 3).
[21] New York State Climate Action Council, "Scoping Plan."
[22] NFG, "Initial Long-Term Plan Appendix A."
[23] NFG, "Initial Long-Term Plan Appendix A," Table A-11 at A-11.
[24] SC-DR-1-24 (attached as Exhibit 4).

reality, because most AC and furnace replacements will happen separately, most customers will have two opportunities to install a heat pump over a 20-year period – the first when their AC is replaced, and the second when their furnace is replaced.

Because NFG's projections for heat pump adoption are tied directly to the number of these "intervention points" that occur each year, increasing the number of intervention points would subsequently increase the speed at which heat pumps are installed in their service territory over the length of the LTP. Around two-thirds of NFG's NY customers have central AC systems,[25] an optimal configuration for a heat pump replacement. In addition, NFG's LTP appendix indicates that AC lifespans are 7-31% shorter than gas furnaces, meaning that they would be replaced on a more frequent basis.[26] Based on these inputs, a more precise assessment of potential intervention points over the planning horizon can be developed to provide a more accurate adoption rate.

Finally, NFG's ramp rate ignores state-specific targets for heat pump adoption. As Charles River Associates ("CRA") pointed out in its evaluation of the Company's LTP, the state of New York has set very specific goals for heat pump adoption, envisioning 85% of residential and commercial homes being electrified by 2050.[27] NFG's ramp rate – which, as discussed, is based on weatherization rates and not directly connected dynamics in the heat pump market – is not on track to reach this goal, as it only achieves a 33% adoption rate for residential customers and 24% adoption rate for small commercial customers by 2042 (ramping up from a starting point of zero).[28] It's probable that future state policy will support this goal, either in the form of additional customer rebates or building code changes, presenting a significant possibility that gas use in NFG's service territory falls faster than expected.

These types of building code changes are already being proposed in new construction. Washington state has already passed legislation requiring all-electric new construction for residential, multi-family, and commercial buildings.[29] In 2022, New York nearly passed the All-Electric Building Act, which would require all new construction under seven stories to be all-electric by 2024;[30] a version of this Act is currently included in NY Governor Kathy Hochul's

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[25] JRB Insights "2021 Residential Market Study" National Fuel Gas Distribution Corporation, 31, 2021, https://www.nationalfuel.com/wp-content/uploads/documents/NFGDC-Initial-Long-Term-Plan-Appendices-A-J-22-G-0610-12.22.22.pdf (attached as Appendix H to "Initial Long-Term Plan").
[26] NFG, "Initial Long-Term Plan Appendix A," Table A-20 at A-15.
[27] Charles River Associates Report at 32.
[28] SC-DR-1-21 (attached as Exhibit 2).
[29] Tom DiChristopher, "Washington State to Require Electric Heating in Building Code Update," S&P Global, April 25, 2022, https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/washington-state-to-require-electric-heating-in-building-code-update-69960737; Maria Gallucci, "Heat Pumps Now Required for New Homes in Washington State," Canary Media, November 8, 2022, https://www.canarymedia.com/articles/heat-pumps/heat-pumps-now-required-for-new-homes-in-washington-state.
[30] Kate Lisa, "200 Organizations Push Hochul to Electrify New Buildings in Executive Budget Proposal," Spectrum News 1, December 5, 2022, https://spectrumlocalnews.com/nys/central-ny/politics/2022/12/06/hundreds-push-hochul-to-electrify-new-buildings-in-executive-budget-proposal.

Executive Budget proposal.[31] In December 2022, New York's Scoping Plan proposed all-electric new construction, signifying that an all-electric mandate may be imminent.[32] An all-electric mandate would require heat pumps with resistance backup rather than hybrid systems, which NFG models in its "Aggressive Scenario" for residential customers only. The mandate would also require an accelerated ramp rate, beyond what is forecast in either the SCE or Aggressive scenario.

Strategen Recommendations

Given that electrification rates are a significant factor in the LTP's projections for both emission reductions and gas distribution rates,[33] the Company should consider electrification scenarios in line with both state goals and a more nuanced view of customer decision points. As such, Strategen recommends the following adjustments:

Assumption	Adjustment in Current LTP	Adjustments in Future LTPs
Heat Pump Adoption Rate	1. Use separate replacement rates for AC units and gas furnaces/boilers, with customers considering installing hybrid heat pump systems when replacing either equipment. 2. A separate electrification ramp rate for new customers assuming 100% installation of all-electric heating systems after 2025 and 2028 consistent with the recommendations in the final Scoping Plan	1. Develop end-use-specific electrification ramp rates that take into account specific factors impacting heat pump adoption (rather than weatherization programs).

Heat Pumps Technical Capability

Description of NFG Assumptions

Heat pump manufacturer specifications provide values to determine the Coefficient of Performance (COP), which measure the efficiency of the unit, at different temperatures. The ratio measures the amount of energy the unit consumes to operate relative to output of the unit. A higher COP value indicates higher efficiency. For example, a COP of 2.5 means that heat pumps can produce 2.5 times more energy than they are drawing from the grid. As a

[31] Food & Water Watch, "NY Gov Budget Proposal Includes Landmark Gas Ban In New Buildings," February 1, 2023, https://www.foodandwaterwatch.org/2023/02/01/ny-gov-budget-proposal-includes-landmark-gas-ban-in-new-buildings/.
[32] New York State Climate Action Council, "Scoping Plan."
[33] NFG, "Initial Long-Term Plan Appendix B,"

comparison, furnaces typically operate at between 80 and 90% efficiency (equivalent to a COP of 0.8-0.9).[34]

NFG used the LG LUU480HHV cold climate air source heat pump in its evaluation of technical performance.[35] For the specific model NFG uses, the manufacturer provides a range of values, denoted in Table 3.

Table 2: Cold Climate Heat Pump Manufacturer COP Specs[36]

Temperature	COP Min	COP Max
47°F	2.93	3.98
17°F	2.38	2.98
5°F	2.11	2.49

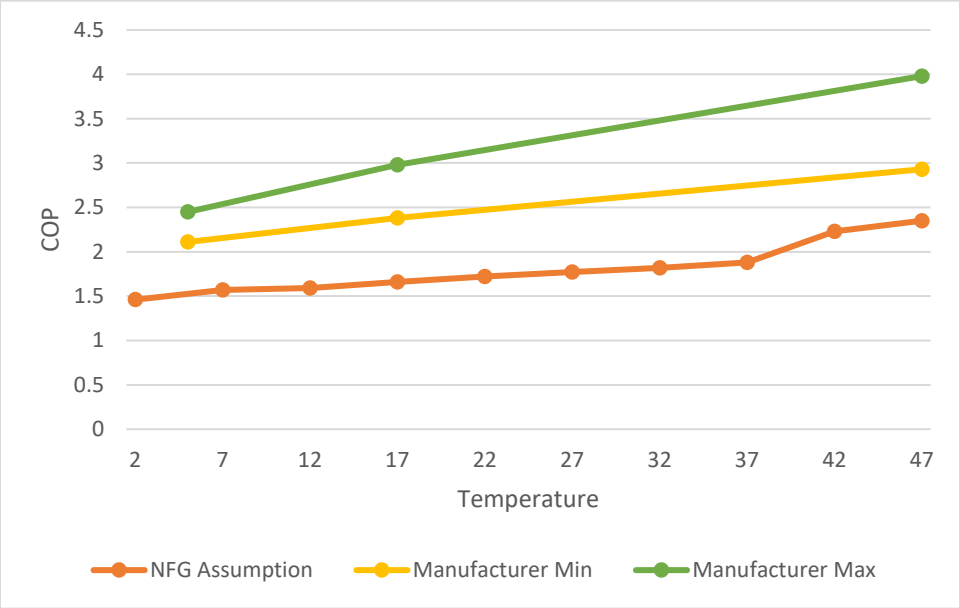
As temperatures decline, heat pump performance dips. The drop in efficiency and maximum heating potential creates concerns about the ability of heat pumps to adequately heat homes in cold climates.

Assessment of NFG Assumptions

In its assessment of cold climate heat pump performance, NFG uses COP values outside the range provided by the manufacturer. NFG assumes a COP below 2 when temperatures fall anywhere below approximately 40 degrees Fahrenheit.[37] Not only is this performance assumption below the manufacturer minimum performance at 17-degree Fahrenheit, but it is also below the minimum at 5 degrees. Moreover, the assumptions do not meet minimum Energy Star criteria for cold climate heat pumps; to earn that designation, cold climate heat pumps must be able to reach a COP of greater than 1.75 at 5 degrees Fahrenheit.[38] As a result, NFG's assumption significantly undervalues the technical performance of cold climate heat pumps compared to manufacturer estimates. This critical assumption diminishes the relative benefits of electrification (modeled in the "Aggressive" scenario) and minimizes the role that heat pumps serve in hybrid configurations (modeled in the "SCE" scenario).

[34] U.S. Department of Energy, "Furnaces and Boilers: Energy Saver," accessed March 9, 2023, https://www.energy.gov/energysaver/furnaces-and-boilers.
[35] SC-DR-1-14 (attached as Exhibit 5).
[36] Cold Climate Air Source Heat Pump Product List, "LG," Northeast Energy Efficiency Partnerships, accessed March 9, 2023, https://ashp.neep.org/#!/product/33647/7/25000///0.
[37] SC-DC-1-14, Attachment 1
[38] Energy Star, "Heat Pump and Central Air Conditioners Key Product Criteria," accessed March 9, 2023, https://www.energystar.gov/products/heating_cooling/heat_pumps_air_source/key_product_criteria.

Figure 2: Comparison of Cold Climate Heat Pump COP Estimates



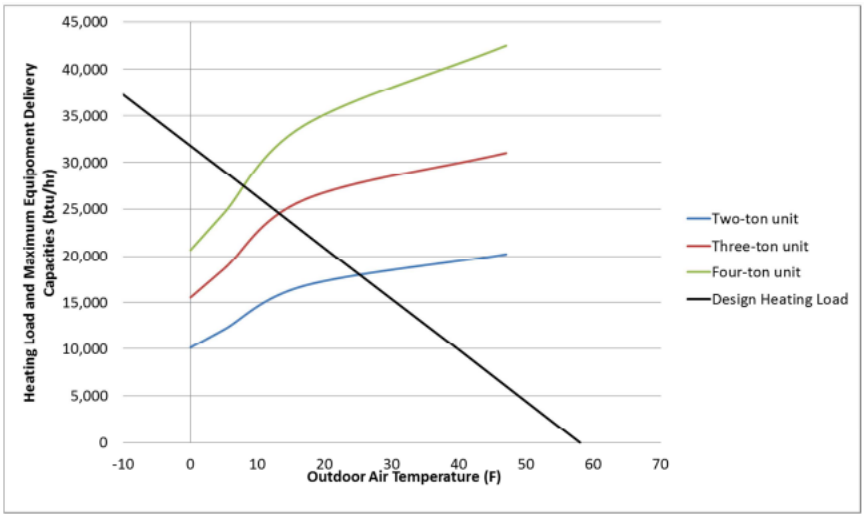
Heat pump heating systems with furnace (or electric resistance) backups are commercially available and proven methods to heat homes in cold climates. Nordic countries have some of the highest per capita use of heat pumps, despite frigid winters. Norway leads adoption rates with an estimated 1.3 million heat pumps[39] across roughly 2.5 million households.[40] With electric resistance as a backup, heat pump adoption rates rapidly increased in Norway over the last two decades, signifying that they are capable of providing primary heating capabilities in cold climates.[41]

Cold climate heat pumps have proven to be highly efficient, even at low temperatures. Cadmus, who also developed NFG's energy efficiency potential study, conducted a study in Vermont in which the COP remained above 2.5 until 18 degrees Fahrenheit.[42] Cadmus's findings largely matched the manufacturers' average COP specifications down to 14 degrees Fahrenheit. Another study in Minnesota measured the capabilities of heat pumps to serve the full heating needs of a home. Figure 3 demonstrates that a three-ton unit can fully accommodate household heating needs until temperatures as low as 14 degrees Fahrenheit, and a four-ton unit until 5

[39] Habibollah Sadeghi, et al., "Current Status of Heat Pumps in Norway and Analysis of Their Performance and Payback Time," Sustainable Energy Technology & Assessments 54, at 3, December 2022, https://www.sciencedirect.com/science/article/pii/S2213138822008773.
[40] Helgi Library, "Number of Households in Norway," last updated July 20, 2022, https://www.helgilibrary.com/indicators/number-of-households/norway/.
[41] Habibollah Sadeghi, et al.
[42] John Walczyk, The Cadmus Group, "Evaluation of Cold Climate Heat Pumps in Vermont," Vermont Public Service Department, November 3, 2017, https://publicservice.vermont.gov/sites/dps/files/documents/Energy_Efficiency/Reports/Evaluation%20of%20Cold%20Climate%20Heat%20Pumps%20in%20Vermont.pdf.

degrees Fahrenheit.[43] NFG modeled its scenarios using a four-ton unit, similar to that of the Minnesota study.

Figure 3: Ability of Heat Pumps to Meet Heating Load in Minnesota[44]



Furthermore, NFG assumes no technological improvement in its LTP and thus no change in heat pump performance over the next two decades. This is an unreasonable assumption that is incongruous with historical development of heat pump technology, which has steadily improved over the last fifty years. A 2001 National Renewable Energy Laboratory ("NREL") report on Air Source heat pumps detailed a performance "one-and-a-half to two times greater than those available 30 years ago."[45] And over the last twenty years, heat pump efficiencies have continued to rise. In 2001, the most efficient models available had a Heating Seasonal Performance Factor (HSPF) between 8 and 10.[46] Now, models must achieve at least an 8.1 HSPF rating for ducted systems and an 8.5 HSPF rating for non-ducted systems to qualify for the Energy Star label.[47] The specific model NFG uses in its analysis has a 10.5 HSPF.[48]

The ability of heat pumps to accommodate cold weather heating needs will only increase as public and private funding accelerate technological innovation. The US Department of Energy ("DoE") launched a Residential Cold Climate Heat Pump Challenge in 2021 to seek more efficient cold climate heat pumps. Trane, a manufacturer, recently announced that its newest prototype exceeded DoE targets by performing at temperatures as low as -23 degrees

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[43] Ben Schoenbauer, Center for Energy and Environment, et al. "Cold Climate Air Source Heat Pump." Minnesota Department of Commerce, Figure 8, November 1, 2017, https://www.mncee.org/sites/default/files/report-files/86417-Cold-Climate-Air-Source-Heat-Pump-%28CARD-Final-Report-2018%29.pdf.
[44] *Id.*
[45] "30 years ago" being 1970; National Renewable Energy Laboratory, "Air-Source Heat Pumps," U.S. Department of Energy, 3, June, 2001, https://www.nrel.gov/docs/fy01osti/28037.pdf.
[46] *Id.*, at 4.
[47] Energy Star, "Heat Pump Equipment and Central Air Conditioners Key Product Criteria," accessed March 9, 2023, https://www.energystar.gov/products/heating_cooling/heat_pumps_air_source/key_product_criteria.
[48] Cold Climate Air Source Heat Pump Product List, "LG."

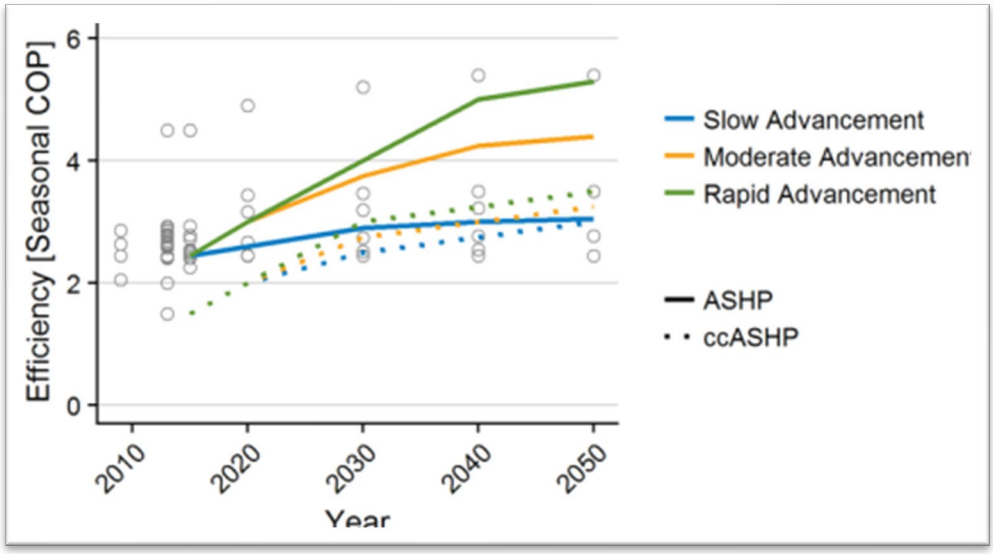
Fahrenheit.[49] A number of countries in the European Union have also invested public funds into early-stage development. The benefits are evident; sales have grown by an average of 20% from 2019 to 2021.[50]

Seeking to benefit from the rise in heat pump demand, manufacturers are investing in research and development ("R&D"). For example, in April 2020, Carrier, one of the largest heat pump manufacturers, announced a new, $16-million R&D center to focus on sustainable heating solutions.[51] In aggregate, the European Commission estimates that EU investment in heat pumps, including repurposing and building new factories, will total 3.3 billion Euro between 2022 and 2025.[52]

As a result of past and continued investments, innovation is already exceeding expectations. A 2017 NREL report modeled residential heat pump efficiencies and forecasted significant efficiency gains in both warm and cold climates. The "Slow Advancement" scenario modeled a COP of 3 at -13 degrees Fahrenheit by 2050, in accordance with DoE goals.[53] Given the recent Trane breakthrough and other investments and achievements in heat pump efficiency gains, the "Moderate Advancement" or even "Rapid Advancement" scenarios, depicted in Figure 4, already appear far more likely.

[49] "Trane Passes Heat Pump Challenge," Cooling Post, November 4, 2022, https://www.coolingpost.com/world-news/trane-passes-heat-pump-challenge/.
[50]Lorcan Lyons et al., "Heat Pumps in the European Union: Status Report on Technology Development, Trends, Value Chains and Markets" Publications Office of the European Union, 10, November 3, 2022, https://publications.jrc.ec.europa.eu/repository/handle/JRC130874. .
[51]"Carrier to Invest $16 Million in Research & Development Center of Excellence in Italy," Carrier, April 4, 2022, https://www.carrier.com/commercial/en/eu/news/news-article/carrier-to-invest--16-million-in-research---development-center-of-excellence-in-italy.html.
[52] Lyons et al., at 3.
[53] Jadun et al., "Electrification Futures Study: End-Use Electric Technology Cost and Performance Projections Through 2050," National Renewable Energy Laboratory, 2017, https://www.nrel.gov/docs/fy18osti/70485.pdf.

Figure 4: NREL Modeled Heat Pump Efficiency Gains[54]



Strategen Recommendations

NFG's LTP undervalues the ability of heat pumps to meet heating demands in Western New York and should be adjusted to incorporate more accurate measures of current and future heat pump performance. COP values have significant implications on the recommended usage of heat pumps. Cold climate heat pumps are likely to be less energy intensive, capable of providing buildings with primary heating at lower temperatures and produce fewer emissions per MWh than NFG forecasts. Therefore, Strategen recommends that NFG make the following adjustments in its LTP.

Assumption	**Adjustments in Current LTP**	**Adjustments in Future LTPs**
Heat Pump Technical Capabilities	1. Align cold climate COP values with manufacturer-provided range. 2. Assume heat pump COPs improve at least in line with NREL's "Moderate Advancement" scenario.[55]	1. Continue to evaluate heat pump efficiency changes over time and adjust according to latest data.

[54] *Id.*, at 42.
[55] Murphy, et al.,

Heat Pump Installation Costs

Description of NFG Assumptions

NFG's LTP assumes exclusively hybrid heating installations for residential customers. Fully electric retrofits are considered in the modeled "Aggressive Scenario" but not adopted in the LTP. NFG's forecasted cost considerations are the driver of this approach; the Aggressive Scenario reduced 40% more emissions by 2042 but at more than double the projected cost.[56] To support this conclusion, NFG relied on cost data from a study conducted by the engineering firm CJ Brown Energy. CJ Brown provides first cost and annual usage estimates for several technology types, including hybrid systems, full electrification with an air source heat pump, and full electrification with a ground source heat pump. However, the report's cost estimates for cold climate heat pumps in all-electric scenarios are lacking in details and citations. There are no annotations detailing the size of the appliances, the home square footage size that they are fitted for, assumptions related to electrification upgrades (such as panels and wiring), or usage patterns.

NFG also provides installation cost assumptions for geothermal networks, or "thermal energy networks," which are interconnected underground loop systems capable of providing heat to multiple homes. These installation costs were based on a Cadmus report that assessed costs for a thermal energy network installed to serve a 33-home cluster in the City of Batavia, NY.[57] The Company noted in an in-person meeting that the Cadmus system was scaled up to serve a representative 50-home neighborhood in their service territory, reporting per-home costs of around $54,341 (for existing home retrofits) and $71,626 (for new homes).[58] They did not include any future cost improvements for geothermal technology in their installed cost estimates.

Assessment of NFG Assumptions

Most studies that quantify heat pump retrofit costs provide a range due to the variability in local labor costs and specifications related to the house or building. For example, a recent NREL study offers a range of $7,000 to $20,000 with an average cost of $15,000 for the total cost of residential cold climate heat pumps.[59] The NREL study captures the total costs, including other household upgrades necessary for the installation. The CJ Brown report does not mention if it includes panel or wiring costs in its estimates. Based on NFG's assumption that customers in older homes do not electrify, NFG might assume no additional upgrades costs, in which case the

[56] "Initial Long-Term Plan," at 53.

[57] Memorandum from Jeremy Koo, Sean Brennan and Elissa Slocum, Cadmus, to Brian Welsch, National Fuel Gas Company re: Net-Zero Community Model with Networked Geothermal Heat Pumps, 4 (November 9, 2022) https://www.nationalfuel.com/wp-content/uploads/documents/NFGDC-Initial-Long-Term-Plan-Appendices-A-J-22-G-0610-12.22.22.pdf (attached as Appendix I to "Initial Long-Term Plan").

[58] NFG, "Initial Long Term Plan Appendix A," at A-26

[59] Jal Desai and Kevin Wu, "Cold Climate Air Source Heat Pumps (ccASHPs) Technology" National Renewable Energy Laboratory, 12, July 2022, https://www.nrel.gov/docs/fy22osti/83290.pdf.

CJ Brown estimate falls outside NREL's range altogether. The relatively low labor costs in western New York further call into question the CJ Brown estimate.[60]

An alternative cost estimate is provided by NYSERDA in their 2019 report, *New Efficiency: New York; Analysis of Residential Heat Pump Potential and Economics.* This report provided installed cost estimates for air and ground source heat pumps in different regions of New York, which were developed through a review of regional rebate databases and validated through conversations with stakeholders. Based on this extensive analysis, NYSERDA reports that a 3-ton heat pump installed in an existing single-family home in Western New York would cost around $12,368, and that a 5-ton heat pump installed in a new single-family home would cost $17,522. Given that these figures don't incorporate any cost declines over the past five years, it seems unlikely that the cost of a 4-ton heat pump installed in 2023 would be much higher than $17,000, or around $19,200 adjusted for inflation.[61] This would be about one-third higher than the cost of a 3-ton heat pump in 2018, or roughly the cost of a 5-ton heat pump installed in a new building.[62]

In addition, NFG does not include rebates and incentives as part of its cost estimates. The Inflation Reduction Act, passed in 2022, allocates hundreds of millions of dollars for heat pump tax credits and establishes a framework for residential and commercial heat pump rebate programs.[63] Customers of all income groups are eligible for tax credits or rebates. The LTP also does not include gas or electric utility subsidies, which are neither opaque nor speculative.[64] NFG is aware of these incentives; the CJ Brown study cites National Grid's existing heat pump incentives, which include a $1,000 rebate per 10,000 BTU.[65] By selectively omitting utility incentives, it would appear NFG was ignoring at least $4,000 per cold source heat pump in *existing* utility rebates.[66]

NFG also doesn't consider future reductions in heat pump costs, stating that, "it would be speculative to assume specific cost and technology improvements over the course of the 20-

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[60] Buffalo HVAC salaries rank above only 11 average state HVAC salaries; "HVAC Technician Salary in Buffalo, NY" Intuit, accessed March 9, 2023, https://mint.intuit.com/salary/hvac-technician/buffalo-ny#:~:text=in%20Buffalo%2C%20NY%3F-,The%20average%20salary%20for%20a%20hvac%20technician%20in%20Buffalo%2C%20NY,bonuses%2C%20tips%2C%20and%20more; "HVAC Technician Salary: U.S. Guide State by State" Housecall Pro, January 6, 2021, https://www.housecallpro.com/resources/working-in-the-trades/how-much-does-an-hvac-technician-make-in-every-state/.

[61] Bureau of Labor Statistics, "CPI Inflation Calculator," accessed March 9, 2023, https://data.bls.gov/cgi-bin/cpicalc.pl.

[62] NYSERDA's analysis assumes that heat pumps installed in existing buildings retain a gas furnace to meet peak heating need, but that heat pumps installed in new buildings are sized to meet the full heating need. *See* NYSERDA, "New Efficiency New York," at 15, 20.

[63] "Text - H.R.5376 - 117th Congress (2021-2022): Inflation Reduction Act of 2022" Congress.gov, Library of Congress. 16 August 2022.

[64] SC-DR-1-9(c) (attached as Exhibit 6).

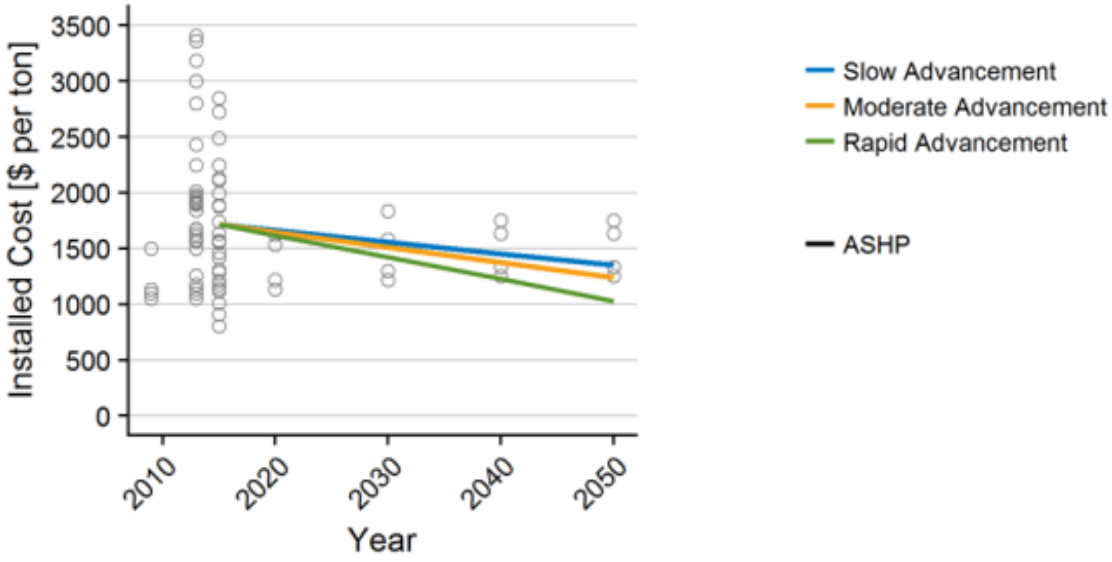
[65] National Grid's service territory overlaps that of NFG in western New York; "Save on Central and Mini-split Air Source Heat Pump Systems," National Grid, accessed March 9, 2023, https://www.nationalgridus.com/services-rebates?r=10&page=1.

[66] NFG assumes the model LG LUU480HHV ccHP. Its 48,000 BTU capacity is eligible for $4,000 in rebates. SC-DR-1-14 (attached as Exhibit 7).

year plan."[67] This is an erroneous omission, as the very purpose of a LTP is to better understand the utility's potential transition pathways under a range of unknown futures. Necessarily, the utility must make dozens of assumptions in its LTP, including future demand, the price of natural gas, and the cost of energy efficiency measures. NFG's unwillingness to consider future cost and technology improvements is also inconsistent with several other assumptions in the LTP. For example, NFG assumes significant availability of RNG and declining costs over the planning horizon, decreases in hydrogen prices, and increases in electricity rates. Ignoring potential improvements in heat pump technology thus risks biasing NFG's LTP against electrification and undervaluing potential emission reductions from heat pumps.

The rapid adoption of heat pumps and R&D, boosted by the IRA, will further reduce capital costs of heat electrification. Similar to forecasted COP improvements, NREL modeled cost declines across multiple technology scenarios.[68] While heat pump installation costs will continue to vary widely, if capital cost decreases mirror COP improvements, heat pumps will become more affordable. Moreover, policy support, coupled with cost reductions from R&D, will likely render heat pumps far more cost competitive than NFG projects. NREL's Electrification Futures Study also provided several forecasts for future reductions in installed costs for air source heat pumps, which are described in more detail in Figure 5 below.

Figure 5: NREL Modeled Heat Pump Cost Reductions[69]



NFG's decision not to include technology improvements for heat pumps is a particularly significant issue for geothermal systems, which have larger projected cost reductions than air source heat pumps. The Cadmus report that is referenced for NFG's cost projections acknowledges that the experts they interviewed stated that future installation costs could drop

[67] CRA-DR-1-13(c) (attached as Exhibit 8).
[68] Paige Jadun, et al., "Electrification Futures Study."
[69] *Id.*

by 20% to 30% per ton due to "greater economies of scale, streamlining, and increased learning and familiarity."[70] These are in line with projected cost improvements by NYSERDA's 2019 heat pump study, which assumed a 25% reduction in installed costs for geothermal heat by 2025, reflecting "the level of cost reduction that NYSERDA would expect the market to deliver over time within the context of a supportive policy framework."[71]

Interestingly, the NYSERDA study cites significantly lower costs for geothermal heat pumps in 2019, in the range of $34,000 for single-home geothermal heat pumps in Western NY.[72] This is surprising because thermal energy networks, which share infrastructure between several houses, are typically able to achieve cost savings compared to single-home geothermal heat pumps. The discrepancy may be because NFG's current plan includes the cost of this shared infrastructure in its "per-home" cost estimate, which can be misleading because in most thermal energy network projects, the shared infrastructure capital cost is added to the utility's rate base and recovered over a longer time period.[73]

This arrangement allows the shared infrastructure cost for thermal energy networks to be recovered through rates paid by the customers connected to the infrastructure, making it more a component of operating costs than initial capital costs. Although it's probably beyond the scope of NFG's current LTP to model this type of rate structure, this should be considered for future LTPs, as it significantly changes the economic viability of thermal energy networks. As a representative example, the Cadmus geothermal report identifies that the capital costs for non-shared infrastructure (i.e. the geothermal heat pump itself, as well as site-specific materials and labor) to be closer to $20,852 – less than NFG's assumed installation cost for a cold climate air source heat pump.[74]

NFG's assumptions for heat pump installation costs inputs may also have been impacted by their assumption that heat pumps were installed prior to any sort of weatherization or energy efficiency retrofits on customers' homes.[75] This could cause NFG to overestimate the installation costs in two ways. First, it would require customers to purchase larger ASHPs, as non-weatherized homes require more BTUs of heating capacity than homes that have been weatherized to more effectively retain heat. Second, it would increase estimates of heat pump operating costs over time. Heat pump installers recommend that customers first implement weatherization and other energy efficiency measures prior to installing a heat pump.[76] For NFG to assume that all customers would install ASHPs prior to these efficiency measures would be to

[70] NFG "Initial Long-Term Plan Appendix I" at 3.
[71] NYSERDA, "New Efficiency: New York" at 22.
[72] *Id.*
[73] Consolidated Edison Co. of New York, "Updated Proposal for Utility Thermal Energy Networks Pilot Projects" New York State Public Service Commission, Case 22-01458, Proceeding to Implement the Utility Thermal Energy Network and Jobs Act (Issued January 9, 2023).
[74] NFG "Initial Long-Term Plan Appendix I" at 6.
[75] SC-DR-1-25 ("When determining the installed costs for an air source heat pump, the Company assumed the installation of heat pump would occur before the customer weatherized their home.").
[76] Thom Dunn "A Heat Pump Might Be Right for Your Home. Here's Everything to Know" N.Y. Times, December 2, 2022, https://www.nytimes.com/wirecutter/guides/heat-pump-buying-guide/.

assume that all customers would act counter to installer recommendations and their own economic interests.

In the appendix to its LTP, NFG indicated that the most cost-effective energy efficiency measures (excluding window sealing and attic insulation) could reduce annual gas demand for standard income customers by 40.8 Mcf per year.[77] Based on an assumed annual gas use of 106 Mcf,[78] this would be around a 38% reduction in heating load. Building this assumed load reduction into the company's modeling could reveal significant cost savings, as heat pumps could be sized to meet smaller loads and their operating costs would be correspondingly reduced.

Finally, new construction provides an immediate, cost-effective opportunity for residential all-electric HVAC systems. An analysis by RMI shows that heat pumps are often less costly than hybrid systems in new single-family homes and across a range of climates, even in cold climate likes NFG's service territory, driven by the fact that[79] all-electric construction allows customers to avoid the cost of gas line extensions to new homes. Because of this difference, it's advisable that the costs of heat pump installations in new homes be calculated separately from existing homes.

Strategen Recommendations

By not accounting for existing incentives or technological improvement for heat pumps, NFG's LTP likely overestimates heat pump capital costs and installation costs throughout the planning horizon. Strategen recommends that NFG's alternative scenario make the following adjustments:

Assumption	Adjustments to Current LTP	Adjustments to Future LTPs
Heat Pump Installation Costs	1. Assume installed costs for 4-ton cold climate heat pumps do not exceed $19,200, or roughly the cost of a 5-ton heat pump in NYSERDA's analysis. 2. Factor available rebates into heat pump costs. 3. Include annual decreases in heat pump capital costs aligned with the NREL "Moderate Advancement" scenario.	1. Incorporate capital cost of shared infrastructure into operating costs for thermal energy networks, rather than capital costs. 2. Continue to evaluate and adjust impact of efficiency improvements on heating need and heat pump sizing. 3. Continue to evaluate heat pump efficiency changes over time and adjust according to latest data.

[77] NFG "Initial Long-Term Plan Appendix A," Table A-6 at A-5.
[78] NFG "Initial Long-Term Plan Appendix B" B-8.
[79] Claire McKenna, et al., "All-Electric New Homes: A Win for the Climate and the Economy," Rocky Mountain Institute, October 15, 2020, https://rmi.org/all-electric-new-homes-a-win-for-the-climate-and-the-economy/.

	4. Assume that houses will weatherize prior to installing heat pumps, reducing heating need by 38%. 5. Assume that the installed costs of thermal energy networks fall by 25% over the plan's 20-year period.	

Hybrid Heat Pump Cross-Over Temperatures

Description of NFG Assumptions

NFG's modeling assumes that hybrid heat pump systems "cross over," or switch, to furnace heat when temperatures fall below 30 degrees. NFG breaks down temperatures into three seasons: winter, shoulder, and summer. The LTP assumes no heat pump usage during the winter season, a total of 76 days, measured as days with HDD values of 35 or greater.[80] NFG established an average daily temperature of 30 degrees Fahrenheit as a delimiter for heat pump use and assumes that on any day in which the average temperature is 30 degrees or below, the heat pump is not used.

Assessment of NFG Assumptions

While heat pumps become less cost effective at lower temperatures due to decreased efficiencies, assuming an average temperature of 30 degrees as a cut-off point is not based on a technical imperative for heat pumps to turn off at 30 degrees. As discussed above, heat pumps are capable of effectively heating indoor spaces at temperatures much lower than this cut-off point. In addition, even assuming a 30-degree cut-off point, there could be significant fluctuation in heat pump use throughout the day. A 35 HDD could have a daytime high temperature of 45 and overnight low of 15. Although furnaces may be necessary for supplemental heating during overnight lows depending on the capabilities of the heat pump, the heat pump could still provide primary power during the warmer periods of the day.

The 30-degree cut-off point seems to have been a simplifying assumption on the Company's part, likely connected to the assumption that customers installing hybrid heat systems would opt for cheaper "standard" heat pumps that are less efficient at lower temperatures. The Company assumes that the only customers installing cold climate heat pumps will be those who are fully electrifying their heating systems. This creates a false binary, as it is entirely possible that customers installing hybrid heat systems may opt to install cold climate heat pumps that will allow them to minimize their gas usage, reserving gas heat only for "peak" heating needs that occur relatively infrequently.

To allow for more accurate representations of heat pump usage across a range of temperature options, NFG should use hourly weather data to model this crossover point. More

[80] NFG "Initial Long-Term Plan Appendix A," at A-9

granular analysis will enable more accurate emissions calculations and allow modeling of different crossover temperatures as heat pump performance improves. For example, future LTPs could reflect heat pump efficiency gains that enable lower hybrid crossover temperatures and result in greater heat pump usage rates. NFG already models the number of expected hours at different temperatures,[81] indicating that this recommendation is a reasonable improvement to NFG's process.

Accurately modeling the future cost of gas and electricity will be critical to correctly estimating the cross-over temperature. It is likely that NFG will need to decarbonize its gas to comply with the CLCPA's deep GHG reduction mandates. Consequently, in the future, the alternatives will not be electric heat pump and gas furnace powered by fossil gas, but rather electric heat pump and gas furnace powered by much more expensive RNG. Moreover, if the gas system throughput declines, as would be expected with increased electrification, gas rates will need to further increase to recover system costs over a smaller number of therms.

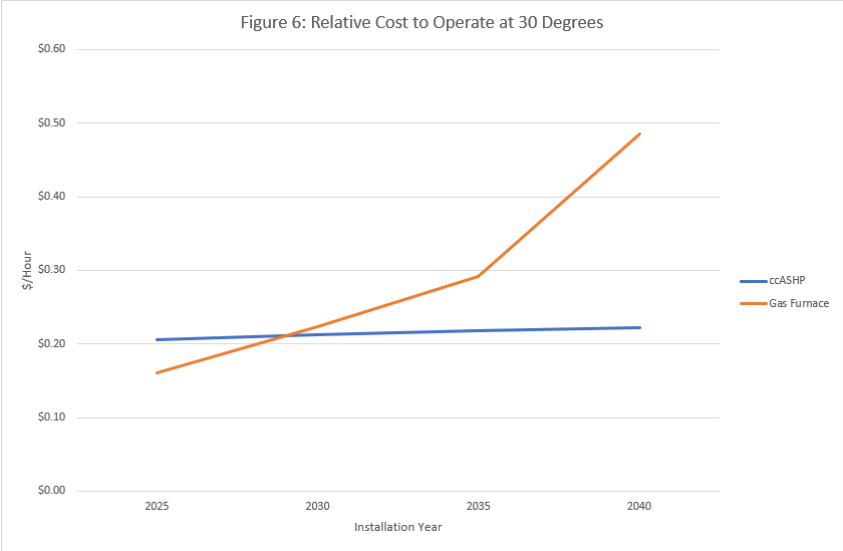
In addition, although installing cold climate heat pumps in hybrid configurations would cost more than installing "standard" heat pump systems, it likely costs less than NFG's current assumptions around cold climate heat pump costs. NFG assumes that all-electric cold climate heat pump systems need to be oversized or outfitted with back-up electric resistance heat to supply 100% of heating load at all times of the year, acknowledging in discovery that their heat pumps used in their all-electric scenario were oversized by 25%.[82]

By contrast, installing a cold climate heat pump that does not need to operate during "peak" heating periods can significantly reduce upfront costs by avoiding any need to oversize the system. This is illustrated by NYSERDA's 2018 study on residential heat pump potentials, which determined that a 3-ton heat pump could provide close to 95% of the annual heating need for a residence in Western NY.[83] Inflated to 2022 dollars, the estimated installed cost of this heat pump would be roughly 37% lower than NFG's assumed installation cost for an all-electric heat pump system. Even including the cost of installing a new gas furnace, a hybrid heating system with cold climate heat pumps would still be around three-quarters of NFG's assumed cost for an all-electric system.

This is an important situation to consider because, as gas rates increase over time with the introduction of RNG/hydrogen and growing use of electrified heating systems, customers will have a greater incentive to install cold-climate heat pumps to minimize their gas purchases. Based on Strategen's analysis, assuming moderate improvements in heat pump efficiencies, it will become cost-effective for customers that have installed cold climate heat pumps after 2030 to operate them down to 15 degrees in 2035, and down to as low as -5 degrees in 2040. The figure below shows that, while the operating costs for gas furnaces on a per-hour basis will increase over time, operating costs for new cold climate heat pumps will stay relatively static, as improvements in efficiency will offset increases in electricity costs.

[81] SC-DR-1-14, Attachment 1 (attached as Exhibit 1).
[82] SC-DR-1-14 (attached as Exhibit 7).
[83] NYSERDA, "New Efficiency: New York."

Figure 6: Cost to Operate a Cold Climate Heat Pump and a Gas Furnace at 30 Degrees (Strategen Analysis)



The above analysis also assumes no adjustments in rate design in Western NY, which, given trends in the state's electricity sector, Strategen views as unlikely. The expanded adoption of time-of-use (TOU) rates in Western NY would substantially decrease the cost of operating heat pumps at lower temperatures, which usually occur overnight in off-peak times. As an example, Niagara Mohawk currently offers a voluntary TOU rate that has about a seven-cents difference between on- vs. off-peak costs.[84] If customers opted into this rate plan, and this differential held constant over time, it would become cost-effective for customers to operate cold climate heat pumps down to 20 degrees as early as 2030, and down to -5 degrees as early as 2035.

The introduction of more specialized rate plans can further improve incentives for operation of heat pumps at lower costs. For example, in the Canadian province of Quebec, the local electric utility HydroQuebec collaborated with the gas utility Energyr to develop a "dual-fuel" rate for customers that install heat pumps with natural gas back-up systems. This rate is tied to outdoor temperatures, with electricity prices remaining low until temperatures drop under 10 degrees Fahrenheit.[85] These types of rate plans take better advantage of the technical parameters and emission reduction potential of modern-day heat pumps, encouraging customers to install cold climate heat pumps and allowing them to maximize savings when they do.

Strategen Recommendations

Given New York's stringent climate targets and constraints on the amount of natural gas use that can be replaced with RNG and hydrogen, future state policy and rate design should – and likely will – incentivize customers to operate heat pumps across the full range of

[84] "Service Rates" National Grid, accessed March 9, 2023, https://www.nationalgridus.com/Upstate-NY-Home/Rates/Service-Rates.
[85] "Rate DT – Dual Energy for Residential and Agricultural Customers" Hydro Quebec, accessed March 9, 2023, https://www.hydroquebec.com/residential/customer-space/rates/rate-dt-how-it-works.html.

temperatures they are able to accommodate. To incorporate this into their modeling, NFG should develop an alternative scenario that makes the following adjustments:

Assumption	Adjustments in Current LTP	Adjustments in Future LTPs
Heat Pump Crossover Temperatures	1. Assume installation of cold climate heat pumps in hybrid configurations starting at least in 2030, with installation costs in line with those detailed in the NYSERDA report and incorporating any relevant rebates or technology improvement assumptions. 2. Model cold climate heat pump operation on an hourly rather than daily basis across the year and assume heat pumps operate down to 15 degrees from 2030-2035, and down to -5 degrees from 2035-2042.	1. Continue to evaluate economic crossover temperatures over time based on changes in rate design and latest data on heat pump efficiency improvements

NFG Electricity Cost Projections

Description of NFG Assumptions

NFG based its electricity cost projections for the alternative scenarios on two data points. Their projections for electricity supply costs were based on NREL's "Accelerated Demand Electrification" (ADE) scenario in their 2022 report, *Examining Supply-Side Options to Achieve 100% Clean Electricity by 2035*.[86] Their projections for electricity delivery costs were based on Niagara Mohawk's expected expenditures on upgrades related to decarbonization initiatives over the next four years (2023-2027). The company combined projections for these two components of electricity rates to develop a projection for the per-kWh cost of electricity in their service territory, which forecast that electricity rates would reach 40 cents/kWh by 2042.

Although the ADE scenario assumes significant electrification of the U.S. economy, it is not designed to meet an emission reduction target similar to the one NY established in the CLCPA. NFG states that NREL's report "projects that by 2035, the U.S. average $/MWh generation system cost for its [ADE] case will be 6% greater than the EIA AEO 2021 reference case."[87] They note that NREL assumes this increase will happen over four years starting in 2030, which they equate to compound annual growth rate (CAGR) of around 1.5%. They then

[86] Paul Denholm, et al. "Examining Supply-Side Options to Achieve 100% Clean Electricity by 2035," National Renewable Energy Laboratory, 2022, https://www.nrel.gov/docs/fy22osti/81644.pdf
[87] NFG "Initial Long-Term Plan Appendix B," at B-6.

apply this 1.5% CAGR to the supply portion of their electricity price forecast for all scenarios in their LTP after 2030.

To determine their forecast for electricity delivery costs, NFG referenced Niagara Mohawk's February 2022 Capital Investment Plan, specifically identifying the capital investments connected to electric vehicles, the CLCPA Phase 1 Supplemental filing, and the Smart Path Connect program. Because these investments increase as a percentage of NIMO's base investment levels at a CAGR of 5.3%, they apply a 5.3% CAGR to delivery costs in their electric price forecast out to 2042[88]. As the Company revealed in discovery, the majority of these cost increases were the result of transmission investments connected to the Smart Path Connect program and other CLCPA-related investments.[89] A portion of NIMO's investments were labeled as "distribution," which NFG noted on a call was likely connected to distribution-level upgrades in response to load growth from electrification.

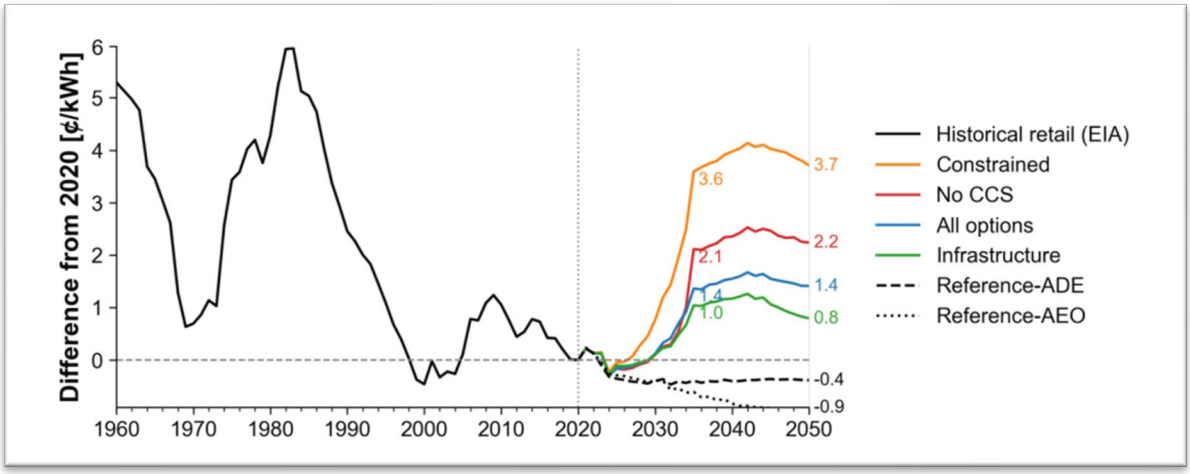
Assessment of NFG Assumptions

NFG's assumptions around distribution delivery costs are concerning because investments in a four-year period can be idiosyncratic, particularly when they include large capital projects like the Smart Path Connect program. More effective estimates could likely be developed in collaboration with regional electric transmission and distribution companies, who should have more detailed forecasts for how capital projects connected to decarbonization will ultimately affect their rates. In addition, when considering distribution system upgrades related to EVs and other electrification technologies, it's inaccurate to use growth rates in capital expenditures as a proxy for electricity rate growth because adoption of these technologies will also increase the volume of electricity sales, reducing the impact of system upgrades to customer bills on a per-kWh basis.

The NREL report that NFG referenced for their supply cost assumptions provides evidence that their long-term estimates for transmission costs may be exaggerated. The modeling in this report takes into account transmission costs for connecting generation in remote areas to load pockets and provides several scenarios that make different assumptions about cost impact of transmission investments. Even in NREL's "Constrained" scenario, which achieves 100% clean electricity by 2035 in an environment where new transmission investments face higher costs and constraints, retail electricity rates are forecasted to increase by only 4.5 cents/kWh over the reference AEO scenario. In scenarios with more moderate assumptions around transmission costs (such as the "All Options" scenario), impact to retail prices over the AEO scenario are around 2.3 cents/kWh.

[88] SC-DR-1-16 Attachment 1 - CONFIDENTIAL
[89] *Id.*

Figure 7: Impact to Retail Electricity Rates from Different 100% Clean Energy Scenarios[90]



Strategen Recommendations

Strategen agrees with the Company that the NREL report is a credible source, but NFG has not adequately taken advantage of the report's analysis. As described above, the report provides direct analysis of the impact of a 100% clean energy target on retail electricity rates, inclusive of transmission costs. To better align their electricity cost forecasts with this analysis literature, Strategen recommends that NFG's alternative scenario use NREL's "All options" scenario projects for retail cost increases as the default scenario for future growth in both supply and delivery costs for electricity.

Because the Company's analysis of NIMO's capital investments in distribution and EV-related infrastructure doesn't take into account expected load growth, there is not enough information at the moment to understand how these decarbonization measures, like electrification, would affect distribution costs. In future LTPs, NFG should work directly with regional electric utilities to develop a stronger understanding of their more detailed forecasts and assumptions around how capital investments related to electrification will ultimately impact their rates.

Assumption	Adjustments to Current LTP	Adjustments to Future LTPs
Electricity Cost Increases	1. Use NREL's "All options" scenario projections for retail cost increases as the default scenario for future growth in both supply and delivery costs for electricity.	1. In future LTPs, work directly with regional electric utilities to develop more informed forecasts on how electrification investments will impact transmission and distribution costs.

[90] Denholm, et al., "Examining Supply Side Options," at 62.

Electric Sector Emissions

Description and Assessment of NFG Assumptions

NFG assumes 242 lbs of CO_2e per MWh in 2030, 3% greater than in 1990, and 181 lbs of CO_2e emissions per MWh in 2042, only 30% less than in 1990.[91] This would put New York's electric sector emissions out of compliance with the state's Climate Leadership and Community Protection Act and Clean Energy Standard (CES),[92] which stipulates that renewable sources must power 70% of electricity demand by 2030 and that the grid must be zero emissions by 2040.[93] Thus, in accordance with the CLCPA and CES, the full load of any electrified asset will be non-emitting by 2040.[94]

Strategen Recommendations

NFG's current LTP undervalues the role and capabilities of heat pumps by assuming minimal the failure of New York's electric utilities to meet legal requirements. In this LTP, Strategen recommends NFG modify its alternate scenarios to estimate grid emissions using the New York CLCPA and CES targets, which mandate a 70% emissions reduction by 2030 and zero emissions by 2040.

Alternative Electrification and Back-Up Technologies

Description and Assessment of NFG Assumptions

NFG's decision to omit potential technological improvements for heat pump technologies has impacts beyond the failure to account for future cost improvements for air and ground source heat pumps. It also provides an unnecessarily limited view of where heat pumps can provide benefits. With a view towards long-term technological improvements, there are opportunities for heat pumps to reduce energy use in the industrial space, and potentially additional electrification for houses with gas boilers.

NFG current LTP assumes that industrial electricity use falls at a steady rate based on participation in energy efficiency programs, with a 0.5% reductions in process emissions starting in 2024 scaling up to 10% in 2042.[95] These inputs were developed in reference to a report by Guidehouse that considered the potential for energy efficiency to reduce emissions from the industrial sector, alongside low-carbon fuels like RNG and hydrogen.[96] However, this report did not consider the possibility of using industrial heat pumps for low-heat industrial processes, potentially omitting a major opportunity for electrification to further support regional decarbonization.

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[91] NFG "Initial Long-Term Plan Appendix D," at D-20.
[92] "Clean Energy Standard," NYSERDA, accessed March 9, 2023, https://www.nyserda.ny.gov/All-Programs/Clean-Energy-Standard.
[93] PSL, §66-P, April 23, 2021.
[94] *Id.*
[95] NFG, "Initial Long Term Plan," at 50.
[96] NFG, "Initial Long-Term Plan Appendix G," 32, December 22, 2022, https://www.nationalfuel.com/wp-content/uploads/documents/NFGDC-Initial-Long-Term-Plan-Appendices-A-J-22-G-0610-12.22.22.pdf.

Although heat pumps are often discussed primarily as solutions in the residential and commercial sectors, industrial heat pumps can also provide process heat for low-temperature industrial needs. A research report by the American Council for an Energy-Efficient Economy (ACEEE) noted that several commercially available heat pumps can reach temperatures of 160 degrees Celsius, a range that would cover 44% of existing heat needs.[97] These industrial heat pumps can save up to 32% of the source energy for process heat and can have extremely short paybacks (2-3 years) in situations where electricity has a cost advantage over natural gas,[98] as could occur over the course of the LTP based on NFG's projections for electricity and gas costs.

For houses with gas boilers, NFG's current scenarios assume that mini-split heat pump systems will be the only option customers have to electrify. Due to the higher cost of these systems, NFG's LTP scenario assumed no customers with boilers were electrified. This discounts the possibility of decarbonization measures using hydronic systems and air-to-water heat pumps to electrify boiler-based systems. Tests of these types of systems are underway in New York,[99] and although existing data may be insufficient to allow for modeling in this particular LTP, future iterations of NFG's plan should consider changing technological and cost parameters for these types of technologies.

There are also gaps in the types of technologies that NFG considered to provide back-up heat for air source heat pumps. As has been demonstrated in these comments, cold climate heat pumps can operate below 0 degrees Fahrenheit, with ratings as low as -12 degrees. Maine, which has an aggressive target of installing 100,000 new heat pumps in the next 3 years and is one of the coldest states in the country, is finding that cold climate heat pumps are suitable in its climate.[100] Nordic countries have some of the highest heat pump adoption rates in the world. Even in NFG's relatively cold climate service territory, it appears likely that cold climate heat pumps can meet the vast majority of heating needs.

Nevertheless, the Scoping Plan recognizes that in New York's coldest regions, such as NFG's service territory, supplemental heat may be necessary.[101] As a practical matter, many customers choose to leave their existing furnace or heating source in place after installing a cold climate heat pump. Homeowners may choose to maintain or even add a new supplemental heat for a variety of reasons, including: ensuring a secondary heating source to withstand power outages, unfamiliarity and concern with the capabilities of heat pumps, or a need for supplemental heat due to extreme cold conditions and an inefficient building envelope. Recognizing that, in certain circumstances, backup heating may be adopted does not undermine or negate the substantial benefits of widespread adoption of air or ground source heat pumps.

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[97] Ed Rightor et al., "Industrial Heat Pumps: Electrifying Industry's Process Heat Supply," American Council for an Energy Efficient Economy, vii, 2, March 2022, https://www.aceee.org/sites/default/files/pdfs/ie2201.pdf.
[98] *Id.*
[99] "Air-to-Water Heat Pumps in Homes with Boilers," Heat Smart Tompkins, 2022, https://www.solartompkins.org/atwproject.html.
[100] Sarah Shemkus, "in Maine, Heat Pumps Are Proving Themselves Even Against Extreme Cold," The Maine Monitor, December 24, 2022, https://www.themainemonitor.org/in-maine-heat-pumps-are-proving-themselves-even-against-extreme-cold/.
[101] New York State Climate Action Council, "Scoping Plan," at 176.

Even for buildings with a secondary heating source, the heat pump would be used to meet heating needs for the vast majority of the year.

There are several types of back-up heating systems: electric resistance, electric boilers, wood stoves, and furnaces that burn oil, natural gas, or propane. Propane is a widely available fuel that has many of the same properties as natural gas. Namely, it is a fossil fuel that can be combusted to create heat, and consequently emits greenhouse gases. On a relative basis, heating with propane is more expensive than natural gas. In many parts of the country where the natural gas distribution system does not extend, residences and commercial businesses use propane for heating and cooking. Propane distribution, unlike natural gas distribution, is generally not regulated by public utility commissions. Propane is generally distributed via trucks or customer vehicles and stored on premises in tanks that are either owned by the customer or leased by a propane company. In most circumstances, propane can be used in natural gas end-use appliances with relatively minor modifications to the appliance.

New York state should continue to try to limit the use of propane to achieve its emission reductions goals. However, due to the relative flexibility of the propane distribution system, it may end up being the primary back-up fuel source over the next couple of decades. There is a concern that widespread adoption of building and transportation electrification may put undue stress on the electric system during peak periods. Should this concern be realized in the coming decades, propane may prove to be a cheaper, more flexible fuel than natural gas for providing backup fuel. Propane, unlike natural gas, does not need an extensive network of pipes to bring fuel to customers. If, in the coming years, the state and the commission determine that the electric grid needs support on the coldest days of the year, propane may be surgically deployed, without the need to maintain an expansive gas distribution system.

Strategen Recommendations:

The long planning horizon for gas utility LTPs provides an opportunity – and indeed, an imperative – for NFG to consider future improvements in technology cost and availability when considering potential decarbonization pathways. The Company's LTP already does this for RNG and hydrogen production equipment, but currently stops short of doing this for alternative heat pump technologies. Strategen recognizes that limitations in time and available data may preclude NFG from incorporating these potential technology improvements at this time. However, it recommends that future iterations of this LTP consider and include potential electrification opportunities outside of the current options, particularly for industrial heat pumps and electrification of residential and commercial boiler systems.

Appendix A: Inputs for Alternate Scenarios

Scenario 1:

4-ton cold climate heat pump with electric resistance backup – Existing small residential customers

Year	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Ramp Rate	5%	10%	15%	20%	40%	60%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

- Ramp rate applies to all HVAC systems, including boilers.
- Mini-splits replace boilers.

Scenario 1:

Existing large multi-family and commercial customers

Year	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Ramp Rate	5%	10%	15%	20%	25%	30%	35%	40%	50%	60%	75%	100%	100%	100%	100%	100%	100%	100%	100%

- Ramp rate applies to all HVAC systems, including boilers.
- Mini-splits replace boilers.

Scenario 2: 3-ton cold climate heat pump with gas backup – Existing customers

Year	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Ramp Rate	5%	10%	15%	20%	25%	30%	40%	50%	55%	60%	**65%**	70%	75%	80%	85%	90%	90%	90%	90%

- Ramp rate applies to all HVAC systems, including boilers.
- Mini-splits replace boilers.
- Assume extra 5% jump in 2030 and 2031 prior to expiration of IRA credits.

Scenario 3: 4-ton cold climate heat pump with electric resistance backup – Existing customers

Year	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Ramp Rate	5%	10%	15%	20%	25%	30%	40%	50%	55%	60%	**65%**	70%	75%	80%	85%	90%	90%	90%	90%

- Ramp rate applies to all HVAC systems, including boilers.
- Mini-splits replace boilers.
- Assume extra 5% jump in 2030 and 2031 prior to expiration of IRA credits.

Scenario 2 & 3 Shared Assumptions

New Customer ramp rate (all-electric) - Residential

Year	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Ramp Rate	50%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

New Customer ramp rate (all-electric) – Small Commercial

Year	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Ramp Rate	20%	40%	60%	80%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Cold Climate Heat Pump Technical Performance

Temperature (F)	(2.5)	2.5	7.5	12.5	17.5	22.5	27.5	32.5	37.5	42.5	47.5
COP Estimate	2.06	2.2	2.36	2.54	2.68	2.81	2.93	3.06	3.19	3.31	3.44

- 1% annual COP improvement in newly installed heat pumps across all temperatures starting in 2023.[102]

Cold Climate Heat Pump Costs

- $3,000 per heat pump Federal rebate.[103]
- $1,000 per ton utility rebate.[104]
- 1% heat pump cost decline starting in 2023 (applied before incentives).[105]

Heat Pump Crossover Temperatures

- Model cold climate heat pump operation on hourly temperature data[106] rather than according to HDDs.
- Calculate annual hybrid crossover temperature points to reflect economical rational decision making based on electricity rates, gas rates, and heat pump COPs. For simplicity, Strategen recommends assuming heat pumps operate down to 15 degrees from 2030-2035, and down to -5 degrees from 2035-2042.

Electricity Sector Emissions

Year	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
CO_2E lbs/MWh	293	256	219	182	145	108	71	63	56	49	42	35	28	21	14	7	0	0	0

[102] Consistent with NREL Moderate Advancement Scenario; Jadun et al., "Electrification Futures Study."
[103] Strategen does not assume the maximum available funding. The Inflation Reduction Act funding depends on household income, plus rebate programs do not extend to the LTP end date. Strategen assumes that all households can access $2,000 in heat pump credit and a subset of households will receive greater rebates.
[104] National Grid, "Save on Central."
[105] Consistent with NREL Moderate Advancement Scenario; Jadun, et al., "Electrification Futures Study."
[106] SC-DR-1-14 Attachment 1, Columns B and C (attached as Exhibit 1).

Electricity Cost Increases

- Assume cost increases to retail electricity rates are in line with NREL's "All options" scenario but assuming that 100% clean electricity target is achieved in 2040 rather than 2035 (in line with CLCPA goals). This would entail an increase in electricity rates of 2.3 cents/kWh over NFG's Reference scenario by 2040.[107] Strategen proposes the following cost increase schedule for simplicity.

Year	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Increase over Reference (cents/kWh)	0	.14	.29	.43	.58	.72	.86	1.01	1.15	1.29	1.44	1.58	1.73	1.87	2.01	2.16	2.30	2.44	2.59

[107] Delholm, et al., "Examining Supply-Side Options" at 62.

Exhibit 2

BEFORE THE NEW YORK STATE
PUBLIC SERVICE COMMISSION

In the Matter of a Review of the Long-Term Gas System Plan of National Fuel Gas Distribution Corporation	)	**Case 22-G-0610**

SIERRA CLUB AND EARTHJUSTICE'S COMMENTS ON THE REVISED LONG-TERM PLAN OF NATIONAL FUEL GAS DISTRIBUTION CORPORATION

June 15, 2023

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Sierra Club and Earthjustice ("Commenters") respectfully submit the following comments on National Fuel Gas Distribution Corporation's ("NFG" or "the Company") revised long-term plan ("LTP"). In comments on NFG's initial LTP, Commenters raised a host of concerns regarding NFG's assumptions and modeling approach for developing its plan and offered numerous recommendations. While NFG has incorporated a limited number of those recommendations into the revised draft, the changes between the initial and revised LTPs are highly circumscribed. The most fundamental critiques raised in Commenters' initial filing—which go to the heart of the prudence and viability of NFG's proposed LTP—remain unaddressed or are relegated to "informational scenarios" tucked in an appendix to the document that NFG devotes more words to disavowing than describing. Ultimately, however, the large majority of the recommendations identified in Commenters' initial filing were supported by Staff's independent consultant, Charles River Associates ("CRA"), which provided an extensive critique of NFG's LTP and planning approach in its May 26, 2023, Preliminary Findings Report.

The following comments identify key areas of ongoing concern with NFG's revised LTP. They are intended to supplement but not fully retread Commenters' initial comments, which are re-attached as an exhibit to this filing.[1] For the reasons set forth below and in our initial comments, the revised LTP cannot be approved. Issues that must be addressed include:

- Asymmetric treatment of uncertainty: Through the assumptions it uses to underpin the LTP, NFG skews the results in favor of pipeline-based solutions and against

[1] Comments of Sierra Club and Earthjustice on the Initial Long-Term Gas System Plan of National Fuel Gas Distribution Corporation, PSC Case No. 22-G-0610 (Mar. 13, 2023) [hereinafter "Initial Comments"] (attached as Exhibit A).

electrification, invalidating the results of its modeling and the justification for its proposed LTP;

- Failure to assess non-pipeline alternatives ("NPAs") and consider targeted retirement of leak-prone pipes ("LPPs") as required by the Gas Planning Order: By treating LPP replacement as unavoidable even in high electrification scenarios and functionally ignoring opportunities for NPAs, NFG fails to comply with the Gas Planning Order and overstates the relative benefits of its LTP;
- Inconsistency with the requirements of the Climate Leadership and Community Protection Act ("CLCPA") regarding disadvantaged communities: NFG's plan fails to assess impacts in disadvantaged communities or ensure that at least 35% of the benefits of NPAs accrue to those communities as required by the CLCPA;
- Inconsistency with the greenhouse gas ("GHG") reduction requirements of the CLCPA: Based on its anemic GHG reductions through 2042 and lack of a viable pathway to deeper GHG reductions in the following years, NFG has failed to develop a plan that is consistent with the State's mandate of at least 85% GHG reduction and goal of achieving net zero GHG emissions by 2050.

These concerns, and the issues raised in Commenters' initial comments, must be satisfactorily addressed before the Commission can approve a final LTP from NFG.

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I. CRA'S PRELIMINARY FINDINGS SUPPORT COMMENTERS' CRITIQUES OF NFG'S LTP

On May 26, 2023, CRA submitted preliminary findings regarding NFG's LTP. CRA evaluated comments submitted by stakeholders, including by Commenters and their consultant, Strategen, and offered a number of critiques and recommendations. Overall, CRA's filing lends strong support to the critiques identified by Commenters and demonstrates that the LTP cannot be approved as currently drafted. While not exhaustive, we highlight the following areas of important concurrence between our critique and CRA's comments:

- Non-pipeline alternatives: CRA supports Commenters' critique of NFG's deficient treatment of NPAs, noting that "[i]t is clear from the Gas Planning Order that NPAs should be a central component to the gas planning process."[2] CRA explains that NFG's "proposed approach does not address the issues raised by Stakeholders regarding the need for a more specific plan and pilot projects that would allow NFG to evaluate the viability of various NPA approaches."[3] CRA goes on to "recommend[] that NFG develop a more specific plan for incorporating NPAs into the LTP, piloting projects to test the viability of avoiding [leak-prone pipe replacement], and developing NPA options for disadvantaged communities."[4]
- Leak-prone pipe replacement: Relatedly, CRA supports Commenters' critique of NFG's approach to LPP replacement. CRA recommends that NFG "utilize a neighborhood approach in its LPP evaluation process as suggested by Staff, endorsed by the

[2] Charles River Associates, Preliminary Findings Report: National Fuel Gas Distribution Corporation Long-Term Plan Assessment, New York State Dep't of Pub. Service, 13 (May 26, 2023) [hereinafter "CRA Preliminary Findings"].
[3] *Id.* at 15.
[4] *Id.*

Commission, and requested by the Stakeholders."[5] CRA further recommends that NFG include targeted electrification (a.k.a., targeted network replacement) as an alternative to LPP replacement "for all scenarios."[6]

- Additional modeled scenario treatment and assumptions: CRA shares Commenters' concern about NFG's treatment of the newly-added "informational" scenarios, concurring with our recommendation[7] that the additional modeled scenarios be more than just "informational" and relegated to an appendix, and recommending that "NFG should adopt certain aspects of these scenarios if they contribute to reducing emissions without unreasonably adding to cost."[8] CRA also supports universal application to all scenarios of modeling assumptions that NFG restricted to the "informational scenarios."[9]
- Electric sector forecasting: CRA supports Commenters' recommendation to build compliance with CLCPA requirements into the LTP modeling. While CRA acknowledges that complying with the CLCPA's requirements will be challenging, it observes that "the CLCPA is currently New York State law" and concludes that, "[f]or planning purposes, NFG should assume that CLCPA targets are met when forecasting electric sector emissions."[10] NFG currently limits the assumption that New York will comply with the CLCPA's electric sector mandates to its "informational" scenario modeling.
- Electrification: CRA finds that "[e]lectrification of heating loads such as space and water heating is the most significant area of opportunity for decarbonizing buildings"[11] and

[5] *Id.* at 18.
[6] *Id.* at 42.
[7] Earthjustice and Sierra Club, Comments Regarding NFG's Proposed Informational Scenarios (Apr. 28, 2023).
[8] CRA Preliminary Findings at 27.
[9] E.g., *id.* at 37 (electric sector forecasting); *id.* at 48 (cold climate heat pump cost trends).
[10] *Id.* at 37.
[11] *Id.* at 38.

shares Commenters' conclusion that "[s]ome level of electrification is possible for all building types in the NFG operating territory . . . ."[12] In its revised LTP, NFG continues to limit electrification to buildings of certain vintage that heat with gas furnaces.[13]

- Weatherization: CRA also concurs with Commenters' critique that weatherization should precede heat pump installation to optimize sizing of heat pumps.[14] Consistent with our initial comments, CRA recommends that: "weatherization programs should be incorporated into heat pump replacement program consideration as a means of reducing the required size of a heat pump and reducing heating and cooling demand."[15] NFG only models weatherization preceding electrification in the "informational" scenarios.[16]
- Cold climate heat pumps: CRA agrees with Commenters' recommendation to include cold climate heat pumps as an option for customers who utilize a hybrid heating system approach.[17] Indeed, CRA "recommends that NFG organize, propose, and administer pilot programs to test both hybrid options (cold-climate and standard heat pump) and model this into the LTP."[18] In addition, CRA recommends that "a pilot with cold climate heat pumps and electric resistance backup should be performed to allow evaluation of the effectiveness of this as an alternative."[19]

[12] *Id.*
[13] Nat'l Fuel Gas Distribution Corp., Revised Long-Term Plan, NY PSC Case No. 22-G-0610, 51 at tbl. V-2, app. A at A-18 (May 22, 2023) [hereinafter Revised LTP] ("It is assumed that customers in old homes or heating with boilers do not electrify.").
[14] CRA Preliminary Findings at 39.
[15] *Id.* at 49.
[16] Revised LTP app. K at K-2.
[17] CRA Preliminary Findings at 42.
[18] *Id.* at 43.
[19] *Id.*

- Heat pump cost trends: NFG assumes no improvements in heat pump costs over time. CRA shares Commenters' and Strategen's critique of this assumption and "finds it reasonable to assume moderate cost reductions for heat pump technologies over time."[20]
- Heat pump performance: NFG assumes coefficients of performance ("COP") for cold-climate air source heat pumps that are below both manufacturer specifications and below minimum federal Energy Star® requirements. CRA agrees with Commenters that assumptions regarding minimum COPs for cold-climate heat pumps must be increased and "recommends NFG adjust COP values such that the cold climate heat pumps are eligible to achieve Energy Star® status."[21] This would require increasing the minimum COP by nearly 20%: from 1.46–1.57 at five degrees up to 1.75.[22]
- Future gas prices due to customer migration: CRA shares Commenters' concern about the impact of customer migration on future gas prices. CRA recommends that: "NFG should conduct further analysis and discussion in the final LTP of the potential impacts of customer migration from the gas system over time on customer rates and bills."[23]
- Disadvantaged communities: NFG supports Commenters' critiques regarding disadvantaged communities, recommending that NFG identify all disadvantaged communities and "provide details about how the specific decarbonization measures modeled in the LTP impact disadvantaged communities, including the level of investment in disadvantaged communities for each specific measure."[24]

[20] *Id.* at 48.
[21] *Id.*
[22] *Id.*
[23] *Id.* at 67.
[24] *Id.* at 71.

In sum, CRA's preliminary conclusions reinforce numerous concerns raised by Commenters that must be addressed before an LTP can be approved.

II. NFG'S ASYMMETRIC TREATMENT OF UNCERTAINTY IS FATAL TO APPROVAL OF ITS LTP

Uncertainty is an inherent feature of long-term planning. Because many inputs that will affect the cost and feasibility of NFG's LTP and alternative decarbonization approaches are not knowable with certainty today, it is critical that NFG make reasonable assumptions that do not improperly favor particular fuels or strategies. NFG claims that its "LTP and associated analysis is based on data and assumptions of what actions are feasible in light of current technology and costs."[25] But this is not correct. NFG's treatment of uncertainty in its revised LTP is, at best, asymmetric. Uncertainties regarding the cost, availability, and safety of preferred approaches, such as increased reliance on alternative pipeline fuels, are consistently resolved in favor of those approaches. Uncertainties regarding the cost and feasibility of electric and non-pipeline-based technologies and approaches are resolved against electrification. At the same time, NFG's modeling treats New York law as mere policy preferences when NFG does not endorse legal requirements, but treats policy preferences as immutable law when those policies support NFG's preferred planning approach. NFG's lopsided planning approach renders its revised LTP unapprovable.

NFG's asymmetric assumptions regarding pipeline versus non-pipeline based decarbonization approaches are unacceptable. NFG's revised LTP continues to utilize assumptions that heavily favor alternative gaseous fuels such as hydrogen and renewable natural gas ("RNG") while disfavoring electrification-based approaches.

[25] Revised LTP at 2–3.

NFG assumes highly favorable estimates regarding the availability of RNG for planning purposes despite significant uncertainty about RNG production and availability. NFG based its RNG assumptions in its LTP not on ICF/NYSERDA's Achievable Deployment projections for its service territory, but instead on ICF/NYSERDA's Optimistic Growth scenario,[26] which is more than 25% higher. This amounts to more than 10 million Mcf of assumed RNG by 2040[27] despite the fact that Achievable Development projections are under 8 million Mcf through 2042[28] and currently there is *no* available RNG production in NFG's service territory.[29] For RNG availability outside of New York, NFG uses the American Gas Foundation's "Optimistic Growth" scenario for RNG development and assumes the company would be able to obtain 50% of what NFG characterized as its "pro rata" share of RNG in both Pennsylvania and Ohio based on that "optimistic" forecast.[30]

Likewise for hydrogen, NFG's assumptions resolve uncertainties in favor of greater feasibility, ignoring safety concerns and potential costs that would be incurred if its assumptions are not borne out. For example, NFG claims that "[c]urrent technology and the current composition of the U.S. gas distribution system suggests that approximately 5-10% (by Btu) hydrogen can be blended into natural gas systems."[31] On a volumetric basis, the would be equivalent to 15 to 30% hydrogen blending. NFG provides no citation or support for this claim, however, and it is in direct tension with recent research conducted by the California Public Utilities Commission. As Commenters previously identified, the California Public Utilities

[26] *Id.* at 52*; Id.* app. A at A-31, tbl. A-35.
[27] Revised LTP app. A at A-31–A-32.
[28] *Id.* app. A at A-31, tbl. A-3.
[29] *Id.* app. A at A-31.
[30] *Id.* app. A at A-32.
[31] *Id.* at 60.

Commission last year completed a hydrogen blending feasibility study that concluded that a "systemwide blending injection scenario becomes concerning as hydrogen blending approaches 5% by volume" (less than 2% by Btu content[32]).[33] At best, the ability to blend hydrogen up to 5% by Btu content (15% by volume) is uncertain. Yet NFG chooses to resolve this uncertainty in favor of its preferred approach, ignoring the potential safety concerns and significant potential costs if pipes or end use appliances need to be replaced to accommodate the higher hydrogen blend.[34]

At the same time, NFG's revised LTP utilizes assumptions that continue to disfavor non-pipeline approaches. For heat pump performance, despite the fact that heat pump coefficients of performance have "steadily improved over the last fifty years,"[35] NFG assumes that they will exhibit no improvement over the next twenty years.[36] NFG also assumes 20% higher electric rates in its Aggressive Scenario and in two of the three "informational" scenarios.[37] The collective effect of these skewed assumptions favoring alternative fuels and disfavoring electrification improperly biases NFG's entire LTP and undermines its legitimacy.

NFG also asymmetrically applies laws and policies, treating the former as discretionary and the latter as mandatory where it furthers NFG's interests. For example, in modeling electric sector emissions, NFG ignores the CLCPA's requirement that, by 2040, "the statewide electrical

[32] Michael J. Walsh & Michael E. Bloomberg, Building Decarbonization Coal., *The Future of Gas in New York State* 29 (Mar. 2023) [hereinafter "BDC Report"].
[33] Cal. PUC, R.13-02-008, Hydrogen Blending Impacts Study 4 (July 18, 2022), https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M493/K760/493760600.PDF.
[34] Additional concerns regarding NFG's modeling of hydrogen are included in Section IV(C), *infra*.
[35] Strategen, A Review of National Fuel Gas Distribution Corporation's Initial Long-Term Plan Electrification Assumptions, NY PSC Case No. 22-G-0610, at 15 (Mar. 13, 2023) [hereinafter "Strategen Comments"].
[36] *See* Revised LTP app. K at K-2 (relegating assumption of a 1 percent/year efficiency increase for air-source heat pumps and mini splits to the informational scenarios despite CRA's observation that assumed cold climate ASHP COP should be immediately increased by *20%* to comply with minimum Energy Star® performance requirements).
[37] Revised LTP at 41, app. B at B-7, app. K at K-3.

demand system will be zero emissions,"[38] a requirement the Public Service Commission ("Commission" or "PSC") recently initiated a process to implement.[39] It relegates modeling of these required emission reductions to its informational scenarios and disavows them, claiming that the emission reductions in the informational scenarios "could be overstated" because they incorporate this assumption.[40] Yet for modeling LPP replacement, NFG bootstraps a policy preference for replacing LPP into an immutable requirement[41] while ignoring the Commission's direct request to avoid LPP replacement through pursuit of NPAs.[42] The effect of treating LPP repair and replacement costs in NFG's service territory as unavoidable, even in more heavily electrified scenarios, is to inflate the cost of these electrification scenarios by at least a billion dollars,[43] incorrectly and irrationally disfavoring electrification-based approaches.

Finally, NFG's treatment of economy-wide cap-and-invest is arbitrary and inappropriate. The final Scoping Plan for implementing the CLCPA "recommends implementation of an economywide cap-and-invest program that would ensure the Climate Act's emission limits are met while providing support for clean technology market development."[44] The final Scoping Plan further explains that "[u]tilities and other distributors of heating fuels would have a compliance obligation equal to the carbon content of the fuels they distribute."[45] On June 1,

[38] Pub. Serv. L. § 66-p(2)(b).
[39] NY Public Service Commission, *Order Initiating Process Regarding Zero Emissions Target*, NY PSC Case No. 15-E-0302 (May 18, 2023).
[40] Revised LTP app. K at K-8.
[41] Revised LTP at 37 ("The Company, pursuant to Commission *guidance*, is *required* to replace all leak-prone pipes by 2035.") (emphasis added).
[42] *See* NY Public Service Commission, *Order Adopting Gas System Planning Process*, NY PSC Case No. 20-G-0131, at 39 (May 12, 2022) [hereinafter "Gas Planning Order"] (requiring utilities to identify in annual reports "the locations of specific segments of LPP that could be abandoned in favor of NPAs" and encouraging utilities to develop a program "that simultaneously removes leaking or leak-prone infrastructure and employs programs such as weatherization and demand response along with electrification.")
[43] Initial Comments at 10.
[44] New York State Climate Action Council, Scoping Plan, at 20 (Dec. 2022), https://climate.ny.gov/resources/scoping-plan/ [hereinafter "Scoping Plan"].
[45] *Id.* at 342.

2023, the New York Department of Environmental Conservation and NYSERDA kicked off the process of developing the contours of the cap-and-invest program, announcing a series of webinars and workshops this month, an initial comment deadline of July 1, 2023, and an intention to finalize the regulations implementing the program by the end of the year.[46] It is unreasonable for NFG to ignore the development of a cap-and-invest program in its LTP. While the details of the program are still in development, the broad contours are fixed by the CLCPA, and the overarching effect will be to render fossil gas and RNG more expensive and electricity—which must achieve zero emissions by 2040—less expensive. NFG could have conducted sensitivity analyses to assess the impact of a price on the carbon content of its fuel; yet NFG declined to do so.

NFG's systematically lopsided treatment of uncertainty in favor of pipeline fuels and against electrification renders its revised LTP unapprovable.

III. THE REVISED LTP FAILS TO PLAN FOR A MANAGED DOWNSIZING OF THE GAS SYSTEM

The revised LTP acknowledges that as ratepayers leave the gas system the costs borne by remaining customers will increase, and yet fails to plan for a phased approach that will address those costs or avoid stranded assets. NFG concludes that "the Aggressive Scenario has a much greater 2042 gas bill increase for customers that do not participate in electrification compared to the SCE Scenario (151% vs. 45%) due to a combination of a more substantial decline in throughput and higher levels of RNG and hydrogen blending compared to the SCE Scenario," and therefore, that a hybrid scenario that continues to rely on the gas distribution network is

[46] *See* NY Dep't Env't Conservation & NYSERDA, Cap-and-Invest: Pre-Proposal Stakeholder Outreach Overview of New York Cap-and-Invest (June 1, 2023), https://capandinvest.ny.gov/-/media/Project/CapInvest/Files/NYCI_Overview-Webinar.pdf.

preferable.[47] This conclusion ignores the possibility of replacing LPPs with NPAs, thereby relieving customers of the cost of maintaining the distribution system at its current size or of deferring LPP replacement and other capital-intensive investments in the gas system in favor of more active leak detection, methane capture, and selective repair of the most consequential leaks.

NFG declined to model targeted network retirement in its revised LTP.[48] NFG instead plans to evaluate pipe retirement based on project-specific circumstances and consider NPAs on a project-by-project basis "*if* circumstances indicate that it may be possible to abandon segments that would otherwise need to be replaced."[49] NFG's decision to consider retirement and NPAs only on a case-by-case basis runs afoul of the Commission's clear instruction to identify segments of LPP that could be abandoned in favor of NPAs.[50] Rather than waiting for "circumstances [to] indicate" that a particular segment should be retired, NFG should take the opportunity offered by the LTP to determine opportunities that exist over the next twenty years to replace LPPs with NPAs.[51]

Additionally, NFG's revised LTP remains shortsighted by planning for only a 54% reduction in GHGs from 1990 levels by 2042,[52] and will inevitably lead to skyrocketing costs in the following eight years. Across all sectors, the CLCPA requires that by 2050 GHG emissions be reduced 85% from 1990 levels, with the goal of achieving net zero emissions. ECL §§ 75-0107(1), 75-0109(4)(a)–(b), (f); CLCPA § 4. The limited use of offsets that the CLCPA does permit must be constrained to sectors that cannot be electrified or in which GHG emissions

[47] Revised LTP at 46–47.
[48] *Id*. at 26.
[49] *Id*. at 26, 67 (emphasis added).
[50] Gas Planning Order at 39.
[51] NFG incorrectly asserts that it is required to replace LPPs by 2035. Revised LTP at 37. On the contrary, the Gas Planning Order specifically directs utility to identify segments of LPPs that could be abandoned. Gas Planning Order at 39.
[52] Revised LTP at 52.

cannot otherwise be zeroed out. As a result, New York State cannot afford to continue emitting GHGs in sectors that can readily electrify, such as residential and commercial buildings, and at least some of the industrial sector. Reducing NFG's GHGs 85% from 1990 levels—let alone zeroing them out—in the eight years between 2042 and 2050 under NFG's plan will either lead to ballooning utility bills as NFG relies increasingly on RNG and hydrogen to decarbonize its fuel supply, stranded assets as ratepayers abandon a system that has absorbed billions of dollars of investment, or both. NFG's shortsighted plan ignores the inevitable costs to ratepayers of high gas throughput scenarios that will need to achieve much deeper reductions in carbon intensity of the piped fuel, largely through prohibitively expensive RNG. Moreover, as discussed above, New York's forthcoming cap-and-invest program will place a price on the carbon content of NFG's gas and increase the cost of fossil methane as well.

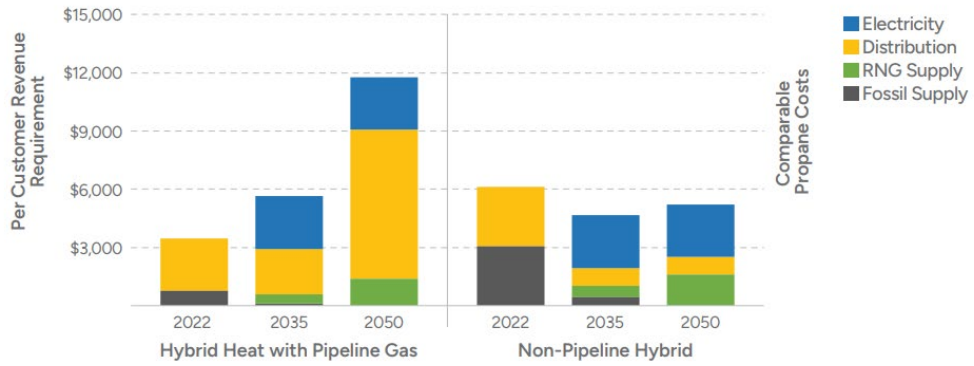
As detailed in a recent report by Groundwork Data, continued reliance on pipeline gas in New York State would lead to rapidly rising utility bills as ratepayers continue to shoulder the costs of the distribution system in addition to the high costs of RNG necessary to comply with the CLCPA GHG limits.[53] Groundwork Data also concluded that a hybrid scenario would lead to increasing utility bills for low-income ratepayers as the most affluent customers invest in electrification and remaining ratepayers are saddled with the costs of maintaining the distribution system.[54] By contrast, a managed transition that moves away from pipeline gas in phases through targeted pruning—and frontloads investments in low- to moderate income ("LMI") households and disadvantaged communities—will avoid ballooning costs and minimize burdens to ratepayers.[55]

[53] BDC report at 41–44.
[54] *Id*. at 22, 46–51.
[55] *Id*. at 53–54.

Groundwork Data's findings are supported by a report published this month by ACEEE, which studied the impacts of electrification and gas decarbonization on distribution costs nationwide.[56] ACEEE concluded that an unmanaged transition in which electrification occurs on a household-by-household basis is the costliest scenario, whereas strategic pipeline replacement with zonal electrification would reduce costs to ratepayers.[57] Replacing a gas distribution line and helping customers electrify could save utilities up to $1,300 per customer, according to ACEEE.[58]

To the extent that full electrification is not feasible, propane rather than gas can serve as a backup, thereby obviating the need to pour investments into a system that serves increasingly few customers.[59] As shown by the chart below, a hybrid scenario that relies on pipeline gas leads to skyrocketing costs to ratepayers by 2050, whereas a hybrid scenario that relies on a non-pipeline fuel for backup does not.

Figure 1: Comparison of revenue requirement from the Hybrid Heat with Pipeline Gas scenarios with equivalent costs of a Non-Pipeline Hybrid strategy[60]



Assumptions: Demand of 150 MMBtu per year (Costs for a typical single-family home at 100 MMBtu per year are approximately two-thirds the values presented).

[56] *See* Stephen Nadel, *Impact of Electrification and Decarbonization on Gas Distribution Costs*, Am. Council Energy Efficient Econ., (June, 2023) [hereinafter ACEEE Report].
[57] *Id*. at iv, 17, 27.
[58] *Id*. at 17.
[59] *See* Initial Comments at 11–12.
[60] BDC Report at 48.

Consistent with the lopsided approach to this revised LTP discussed above, NFG stacked the deck in favor of a hybrid approach by assuming in the Aggressive Scenario that the distribution system must be maintained in order to deliver RNG and hydrogen.[61] The final LTP should contain a robust analysis of non-pipeline alternatives as discussed in Section V(A) below, consider propane or other non-pipeline options for backup heat, and acknowledge the need to achieve much deeper emission reductions—and potentially zero out—emissions by 2050 and the implications this has for the years immediately following this LTP.

IV. THE REVISED LTP CONTAINS FLAWED COST ASSUMPTIONS

A. NFG Mistakenly Assumes the Feasibility Challenges with Electrification Outweigh the High Financial Costs to Maintain the Current Gas Distribution System.

In the revised LTP, NFG assumes that electrifying its building sector will face many feasibility challenges to ensuring the safety and reliability of its system.[62] Despite a growing number of studies that have found electrification to be the lowest-cost route to decarbonize,[63] NFG assumes it will face daunting resource and development challenges (i.e. building new electric infrastructure, converting heating and cooling systems in existing buildings and developing a trained workforce) and then unreasonably concludes that decarbonizing its system with the use of RNG and hydrogen is more practical and economical.[64] But while overstating the feasibility concerns with electrification, NFG inexplicably fails to address the following implications of its preferred plan, which will challenge the viability of a pipeline-based future: (1) the number of gas customers that will inevitably leave the gas distribution system due to competition from electrification alternatives; (2) the large capital investments necessary to

[61] Revised LTP at 43.
[62] *Id.* at 29.
[63] ACEEE Report at iv.
[64] Revised LTP at 29, 47.

simply maintain its current distribution system that is prone to leaking, posing both a public health and an environmental safety risk; (3) the costs for remaining gas customers which will increase as fixed costs are spread over fewer customers, and; (4) the cost implications of increased reliance on lower-GHG fuels to customers that will be necessitated by the CLCPA's emission mandates.

NFG fails to fully illustrate that as buildings, transportation, and industrial customers are electrified in its service territory, gas sales and the number of gas customers will inevitably decrease. Despite a decrease in gas customers, NFG still intends to replace its distribution mains and service lines—with service lives exceeding 75 years—every year until 2034. NFG's revised LTP plans on replacing approximately 110 miles of pipe per year through 2034 and projects that it will expend $90 million in FY 2023 and $113 million in FY 2034.[65] ACEEE recently reported that NFG would spend approximately $740,000 per mile, not including additional costs such as taxes, operations and maintenance, and a regulated rate of return which NFG will seek to recover from ratepayers.[66] The declining customer base and use of gas lines will affect the calculation of depreciation for these assets, yet NFG intends to continue making capital investments to maintain its gas system (including gas processing, storage, distribution, and peaking facilities) and these upgrades will cost billions of dollars.[67] NFG underestimates the true costs to rate payers in the Reference and SCE Scenarios and must incorporate these costs in the final LTP.

Replacement of aging gas pipes and infrastructure is quite costly. ACEEE found that utility costs per customer ranged from an increase of 15% under a scenario assuming minimal

[65] *Id*. at 38.
[66] ACEEE Report at 18; BDC Report at 16.
[67] ACEEE Report at 2.

pipeline replacement and went up to a 106% increase if many older gas pipes were replaced.[68] While replacement of old pipes incrementally improves safety and reduces emissions, it dramatically drives up the cost for ratepayers. As more of NFG's customers electrify, the costs on a per-customer basis increase even more. A recent study by Davis and Hausman (2022) of UC Berkeley's Haas School of Business revealed that if 50% of gas customers leave the system, the average customer bill will increase about 60%.[69] And, if 75% of gas customers leave the system, the average customer bill will increase by 150%.[70] The UC Berkeley study only examined one variable—the number of remaining customers on the system—and did not evaluate other factors such as replacement and repairs of aging infrastructure, which would likely contribute to an even higher bill increase.[71] In its final LTP, NFG should consider providing an estimate of how many of its 740,000[72] customers will have transitioned off the gas system, by when, how many customers will remain on the system to pay for the planned capital expenditures, and how those bills will increase for the remaining customers.

NFG states it is committed to gas system safety, but the high costs of gas system replacements must be managed and reduced where possible. Pipe replacement costs could be reduced or deferred by ramping up NPAs at a neighborhood scale where possible, in lieu of repairing and replacing pipes. Strategically targeting certain neighborhoods for electrification and NPAs would allow the decommissioning of specific gas lines and could mitigate the cost increases for the remaining gas customers. Commenters previously requested that NFG identify and consider available NPAs, per the Gas Planning Order, and take a "neighborhood approach"

[68] *Id.* at iv.
[69] *Id.* at 2.
[70] *Id.*
[71] *Id.* at 3.
[72] Revised LTP at 6.

when developing a comprehensive and strategic plan when decommission leaking or leak-prone infrastructure.[73] Instead, NFG again assumes it will replace and repair all LPPs in its service territory and chooses to not include targeted network retirement in its modeling.[74]

B. NFG Continues to Underestimate the Cost of Renewable Natural Gas.

NFG relies on RNG and hydrogen to partially decarbonize its gas supply and ignores the feasibility and cost barriers that will prevent NFG from achieving the emissions reductions required by CLCPA. As Commenters previously explained, RNG is far too scarce and expensive to meet the gas demand.[75] Projected production costs for RNG produced in New York State range from $10 to more than $50 per MMBtu, as compared to $3.50 to $5 per MMBtu for fossil gas.[76] ACEEE found that not only is RNG expensive, but that the average utility cost per customer in an RNG scenario would increase by about a factor of four (300%).[77] Because NFG assumes that only a small fraction of its gas would be replaced with lower carbon alternatives in all of its modeled scenarios, it largely ignores the significant cost implications of reliance on these fuels to achieve the deeper decarbonization required by the CLCPA by 2050. NYSERDA also looked at various methods for producing RNG and estimated the cost to produce it in 2040.[78] Individual pathways ranged from $11-35 per MMBtu, with most of those pathways above $20 per MMBtu.[79] Moreover, these estimated costs for RNG do not include any investments that NFG would need to enable its gas distribution system to safely deliver RNG.

[73] Initial Comments at 10.
[74] Revised LTP at 26.
[75] Initial Comments at 34.
[76] BDC Report at 28.
[77] ACEEE Report at iv.
[78] *Id.* at 20–21.
[79] *Id.* at 21.

Relying on RNG, by blending it into the gas pipes, to decarbonize the system will lead to costlier future investments in infrastructure in addition to replacing LPPs. Because NFG's revised LTP expressly relies on the use of only one process, anaerobic digestion,[80] NFG would need to interconnect anaerobic digestion facilities within its service territory and procure additional volumes of RNG to meet NFG's projected gas demand. NFG neglected to include any cost assumptions for interconnection facilities or procurement programs. In any scenario that relies on hybrid heating with gas pipelines, high RNG costs will inevitably drive-up customers' gas bills. In the final LTP, NFG must explain how these additional increased costs, which will be shouldered by the remaining gas customers, will compare to the cost of full electrification.

C. NFG's Modeling Overstates the Potential Use and Ignores the High Costs and Safety Risks of Hydrogen.

NFG's revised LTP includes hydrogen blending as a decarbonization action in its quantitative model and therefore in both the SCE and Aggressive Scenarios. Despite Commenters demonstrating clear safety risks for blending hydrogen and the high cost of green hydrogen, NFG incorrectly assumes hydrogen is a preferred option. NFG claims its existing gas distribution infrastructure is capable to transport and store RNG and hydrogen.[81] It states that current technology and composition of the nation's gas distribution system suggest that approximately 5-10% (by Btu) hydrogen can be blended into the natural gas distribution system.[82] NFG ignores and fails to address the associated costs that would be needed to accommodate the targeted 5% hydrogen blending rate. Not only are current pipeline materials

[80] Revised LTP at 25.
[81] *Id.* at 60.
[82] *Id.*

not demonstrated to be able to safely accommodate blends of even 2% hydrogen by Btu,[83] but existing end-use appliances are not manufactured to burn hydrogen and might require replacement with higher blend concentrations. Moreover, aside from the safety risks associated with revised LTP, NFG limits its analysis to simply the cost of hydrogen per Btu. NFG estimates, based on 2021 data by ICF, that the price of hydrogen will decrease from $24.02 per MMBtu in in 2023 to $12.40 per MMBtu in 2040.[84] Other analysts do not necessarily share ICF's view. As recently as February 2023, CRU projected that green hydrogen will remain above $3/kg (~$23.50/MMBtu) through 2050,[85] more than double ICF's 2040 estimate. At the same time, the U.S. Energy Information Administration estimated in 2020, that the price of natural gas will remain below $4 per MMBtu through 2040.[86] In the final LTP, NFG will need to be more transparent with the steep price tag of hydrogen, especially when factoring in the loss of the federal tax credits for hydrogen, which will expire in 2032.[87]

Additionally, transporting hydrogen is expensive due to its low energy density, which means that large amounts of space are required to hold a relatively modest amount of hydrogen energy.[88] By way of comparison, to have hydrogen replace the energy supply of fossil gas in the global economy would require building three to four times more storage and pipeline

[83] Cal. PUC, *supra* note 32, at 107.
[84] Revised LTP, app. A at A-35 (citing ICF, *Examining the Current and Future Economics of Hydrogen Energy*, (Aug. 13, 2021)).
[85] Lize Wan & Paul Butterworth, Energy From Green Hydrogen Will Be Expensive, Even in 2050, CRU (Feb. 24, 2023), https://sustainability.crugroup.com/article/energy-from-green-hydrogen-will-be-expensive-even-in-2050#:~:text=Taking%20these%20costs%20into%20account,(real%202022)%20in%202050 (finding green hydrogen will not drop below $3/kg or approximately $80/MWh). $80/MWh is equal to $23.44/MMBtu. U.S. Dep't of Energy, Hydrogen Data, https://www.nrel.gov/docs/gen/fy08/43061.pdf ($80/MWh * 1 MWh/3.6 GJ * 1.055 GJ/MMBtu = $23.44/MMBtu).
[86] U.S. Energy Info. Admin., *Annual Energy Outlook 2020 with Projections to 2050* at 48 (Jan. 2020), https://www.eia.gov/outlooks/aeo/pdf/AEO2020%20Full%20Report.pdf
[87] ACEEE Report at 21.
[88] Susan Saadat & Sara Gersen, *Reclaiming Hydrogen for a Renewable Future* 18 (Aug. 2021), https://earthjustice.org/wp-content/uploads/hydrogen_earthjustice_2021.pdf

infrastructure.[89] NFG omitted discussion of any measures that would presumably be needed for additional pipeline infrastructure to accommodate hydrogen blending and therefore the cost assessments are based on inaccurate and flawed assumptions. In the final LTP, NFG must incorporate the additional costs to safely store, transport, and blend into the current distribution system.

Precaution is needed to safely transport and store hydrogen, at each stage of handling and processing. As Commenters explained in their initial comments, because hydrogen is the smallest and lightest molecule in the universe, containing it is more challenging than containing other gases. Hydrogen's size and energy density also make it incompatible with generic pipeline materials and compressor designs.[90] Hydrogen can cause "embrittlement" in pipes and its higher flammability and leakage rates create safety risks.[91] Natural gas pipelines do not have systems for detecting leaks of hydrogen,[92] and therefore, NFG will need to invest in additional technology to detect hydrogen leakage in addition to methane. Due to hydrogen's size and the risk of causing embrittlement to the gas system's pipes, NFG must update its cost assumptions and determine how hydrogen will increase the rate of pipe replacement and repair.

NFG must incorporate these cost assumptions into its final LTP to assess which scenario and method will lead to a plan that will achieve a balance between GHG emissions reductions

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[89] *Id.*
[90] *See* U.S. Dep't of Energy, Hydrogen Production and Distribution, https://afdc.energy.gov/fuels/hydrogen_production.html; *see also* Christopher Findlay, *What's your purpose? Reusing Gas Infrastructure for Hydrogen Transportation*, Siemens Energy (Sept. 11, 2020), https://www.siemensenergy.com/global/en/news/magazine/2020/repurposingnatural-gas-infrastructure-for-hydrogen.html ("If the share of hydrogen exceeds 40 percent, the compressors [on a methane gas pipeline] will need to be replaced.").
[91] Sasan Saadat & Sara Gersen, *supra* note 88, at 19. S.
[92] *Id.*

and the cost of achieving them while preserving reliability of its energy system for all of its customers, including members of disadvantaged communities.

V. THE REVISED LTP FAILS TO ADEQUATELY INVEST IN AND ASSESS IMPACTS ON DISADVANTAGED COMMUNITIES

The revised LTP fails to discuss the impacts on disadvantaged communities in NFG's service territory or direct at least 35% of investments to disadvantaged communities as required by the Gas Planning Order and the CLCPA.[93] The Gas Planning Order directs utilities to identify disadvantaged communities in their service territories, assess the impacts on those communities of any proposed projects, and explain how the utilities will ensure that an appropriate portion of the benefits of any NPAs will accrue to those communities.[94] Like the initial LTP, the revised LTP states that NFG does not have any proposed projects that will disproportionately impact disadvantaged communities, even though it is planning to perform pipeline replacement projects in disadvantaged communities.[95] Those projects will inevitably have greater impacts in the communities in which they will take place than in others, and NFG should assess those impacts.

Nor does the revised LTP "explain how [NFG] will ensure that an appropriate portion of the benefits of any proposed NPAs . . . accrue to disadvantaged communities" as instructed by the Gas Planning Order.[96] As discussed above, NFG refuses to discuss NPAs in this LTP, asserting that its annual reports will instead identify segments that might be replaced with NPAs.[97] In so doing, NFG falls short of the requirement that an LTP explain how at least 35% of the benefits of NPAs will accrue to disadvantaged communities and fails to provide information

[93] *See* Gas Planning Order at 39–40; ECL § 75-0117.
[94] Gas Planning Order at 39–40.
[95] Revised LTP at 68.
[96] Gas Planning Order at 40.
[97] Revised LTP at 67.

that would allow stakeholders and the Commission to accurately assess the LTP's impacts on disadvantaged communities.

Moreover, the revised LTP, like the initial LTP, points to NFG's proposed weatherization project for LMI customers as evidence of benefits to disadvantaged communities.[98] As CRA explained, NFG's reliance on this proposal is misleading for two reasons: the LMI spending on weatherization accounts for only 14% of decarbonization spending incremental to the reference case, far short of the 35% required; and not all LMI customers live in disadvantaged communities, so the two populations cannot be treated as interchangeable.[99]

Perhaps even more misguidedly, the revised LTP asserts that "disadvantaged communities will see emissions benefits from RNG and hydrogen blended into the system to serve all customers."[100] But burning these alternative fuels will not reduce pollutants in ratepayers' homes and will not achieve meaningful GHG emissions reductions. RNG, like fossil natural gas, is mostly methane and its combustion produces local pollutants such as nitrogen oxides ("NOx") that cause and exacerbate asthma, impair lung function, and can lead to premature death.[101] Hydrogen combustion produces up to six times as much NOx as methane combustion, and can

[98] *Id*. at 68.
[99] CRA Preliminary Findings at 70.
[100] Revised LTP at 68.
[101] Sasan Saadat et al., *Rhetoric vs. Reality: The Myth of "Renewable Natural Gas" for Building Decarbonization,* 16 (July, 2020), https://earthjustice.org/wp-content/uploads/report_building-decarbonization-2020.pdf. NOx is a pollutant that damages heart and respiratory function, impairs lung growth in children, and leads to higher rates of emergency room visits and premature death. Further, the State's Department of Health has identified the reduction of air pollution, including ozone, as a key indicator to drive improvements in asthma rates and public health outcomes throughout the state. The New York State Prevention Agenda 2019-2024 notes the "extensive evidence" linking ozone with respiratory and cardiovascular illness and death and establishes a goal to "reduce exposure to outdoor air pollutants," with an emphasis on vulnerable groups. *See* N.Y. State Dep't of Health, *New York's State Health Improvement Plan: Prevention Agenda 2019-2024,* 72–3 (updated Sept. 2, 2021) https://www.health.ny.gov/prevention/prevention_agenda/2019-2024/docs/ship/nys_pa.pdf; *see also Nitrogen Dioxide & Health*, Cal. Air Res. Bd., https://ww2.arb.ca.gov/resources/nitrogen-dioxide-and-health (visited June 3, 2023).

therefore pose an even greater threat to human health.[102] Moreover, the use of RNG and hydrogen does not necessarily reduce overall GHG emissions, and can result in increased emissions. As detailed in Commenters' comments on the initial LTP, RNG almost certainly produces no real climate benefits,[103] and RNG created from intentionally produced methane always results in net GHG emissions increases because of the inevitability of methane leakage during transport.[104] Leakage is likely to be even higher when RNG is transported from out of state. NFG's plan to rely on RNG produced from anaerobic digestion projects in New York State, Pennsylvania, and Ohio will therefore not result in significant, if any, GHG emission reductions.[105] Moreover, unless NFG invests in replacing pipes to accommodate higher concentrations of hydrogen, the company can only safely plan to blend up to 1.7% by Btu (5% by volume), which will achieve minimal GHG cuts.[106] NFG cannot treat the plan to combust alternative fuels in ratepayers' homes as a boon to disadvantaged communities; on the contrary, reliance on these fuels will only exacerbate existing health disparities.

Finally, as discussed above, a hybrid plan that maintains the current gas distribution system will increase cost burdens for low-income ratepayers. To the extent the final LTP continues to rely on partial electrification with gas as a backup, NFG must assess those burdens, including analyzing whether they disproportionately impact disadvantaged communities, as well

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[102] Mehmet Salih Cellek & Ali Pinarbasi, *Investigations on Performance and Emission Characteristics of an Industrial Low Swirl Burner While Burning Natural Gas, Methane, Hydrogen-Enriched Natural Gas and Hydrogen as Fuels*, 43 Int'l J. of Hydrogen Energy 1194, 1205 (2018), https://www.sciencedirect.com/science/article/abs/pii/S0360319917319791.
[103] Initial Comments at 35.
[104] Emily Grubert, *At Scale, Renewable Natural Gas Systems Could be Climate Intensive: The Influence of Methane Feedstock and Leakage Rates*, 15 Env't. Rsch. Letters 3 (2020), https://doi.org/10.1088/1748-9326/ab9335.
[105] Revised LTP at 25, 52, 60.
[106] *See* Initial Comments at 15, 36 (citing Cal. PUC, R.13-02-008, Hydrogen Blending Impacts Study 4 (July 18, 2022)).

as assessing the impacts of NFG's other proposals and ensuring that at least 35% of the benefits of NPAs accrue to disadvantaged communities.

VI. THE FINAL LTP SHOULD CONSIDER ELECTRIFICATION OF BOILER-BASED HEATING SYSTEMS

The revised LTP doubles down on NFG's assumption that homes heated by boilers are too costly to electrify.[107] Homes heated by boilers represent 23% of NFG's service territory, and the revised LTP leaves significant potential emission cuts on the table by excluding those homes from electrification.[108] As Commenters discussed in comments on the initial LTP, alternatives to mini-split heat pumps, including hydronic systems and air-to-water heat pumps, are feasible for unducted homes.[109] It is unreasonable to assume that boiler-based heating systems will be too costly to electrify through the twenty-year period covered by the LTP. NFG should reconsider excluding boiler-based heating systems from electrification in the final LTP and monitor trends in heat pump alternatives for unducted buildings going forward.

VII. COMMENTERS OBJECT TO NFG'S CHARACTERIZATION AND TREATMENT OF ITS "INFORMATIONAL" SCENARIOS

NFG's revised LTP appends three new "informational" scenarios that the company characterizes as having been "defined jointly by CRA, Staff, and stakeholders and reviewed at a stakeholder meeting on April 26, 2023."[110] The company explains that it is providing the appendix with the additional scenarios "for informational purposes only and does not endorse these informational scenarios, the associated underlying assumptions, or results."[111] Moreover,

[107] Revised LTP at 51.
[108] *Id.* app. A at A-17.
[109] Strategen Comments at 30.
[110] Revised LTP app. K at K-2.
[111] *Id*.

after briefly describing the scenarios, assumptions, and results—which achieve significantly deeper GHG emissions reductions with a higher benefit-cost ratio than NFG's LTP or either of NFG's self-selected scenarios[112]—NFG devotes the bulk of the text of Appendix K to "observations" disparaging the scenarios and their assumptions. Commenters object to both NFG's characterization of the scenarios as having been "jointly" defined by a group that includes stakeholders and to NFG's dismissive treatment of the scenarios in the LTP.

NFG's "informational" scenarios were not developed "jointly" with stakeholders and are substantively different from scenarios requested by stakeholders. In our initial comments, Commenters offered detailed recommendations on additional scenarios to run, including assumptions to incorporate into those scenarios. While NFG's "informational" scenarios incorporate certain assumptions recommended by Strategen and are similar to certain modeling scenarios recommended by Strategen, there are important distinctions. And while NFG did present its informational scenarios to stakeholders at a meeting and accept written comments on the scenarios, it declined to make any changes to the proposed scenarios in response to comments from Sierra Club and Earthjustice.[113] Most concerningly, none of the modeled "informational" scenarios explores the possibility of using cold-climate heat pumps in a hybrid context to capture a larger fraction of the heating load than is proposed in the current draft LTP.[114] As discussed above, CRA specifically concurs on this point and "recommends that NFG organize, propose, and administer pilot programs to test both hybrid options (cold-climate and

[112] *Id*. app. K at K-7; *Id.* at 64.
[113] Earthjustice and Sierra Club, Comments Regarding NFG's Proposed Informational Scenarios *supra* note 7.
[114] *See* Strategen Comments at 7 (recommended scenario #2); Earthjustice and Sierra Club, Comments Regarding NFG's Proposed Informational Scenarios *supra* note 7, at 1 (recommending modeling a "scenario that pairs cold-climate air-source heat pumps (ccASHPs) with gas backup and utilizes a substantially lower crossover temperature than the currently proposed 30 degrees Fahrenheit").

standard heat pump) and model this into the LTP."[115] Moreover, as noted by Commenters in our initial comments, recent analysis for the City of Minneapolis—which has an even colder climate than Western New York—found that based on today's cold climate heat pump technology, heat pumps could reliably handle heating load for temperatures above five degrees Fahrenheit, corresponding to approximately 80% of Minneapolis home heating in a year.[116]

In addition, consistent with CRA's critique, it is procedurally inappropriate for NFG to relegate its additional scenario modeling to an appendix to its LTP and decline to use the results to influence the LTP. As CRA explains, "NFG should adopt certain aspects of these scenarios if they contribute to reducing emissions without unreasonably adding to cost."[117] The benefit-cost analysis was greater for all three of the "informational" scenarios than any selected by NFG, while achieving substantially deeper GHG reductions,[118] suggesting that elements of those scenarios should be incorporated into NFG's LTP. And as noted above, CRA also supports universal application of modeling assumptions that NFG restricted to the "informational scenarios."[119]

VIII. THE REVISED LTP STILL FAILS TO ASSESS INDUSTRIAL ELECTRIFICATION OPPORTUNITIES

In its modeling, NFG significantly understates the potential for emissions reductions from its system through incorrect assumptions pertaining to electrifying and decarbonizing its industrial customers. NFG erroneously assumes that energy efficiency of the process load and

[115] CRA Preliminary Findings at 43.
[116] Katie Jones, et al., *Minneapolis 1-4 Unit Residential Weatherization and Electrification Roadmap*, Center for Energy and Env't, 7 (Feb. 2023), https://www.mncee.org/sites/default/files/2023-02/Minneapolis%201-4%20Unit%20Residential%20Weatherization%20and%20Electrification%20Roadmap_Final%20%281%29.pdf.
[117] CRA Preliminary Findings at 27.
[118] Revised LTP at 64; Revised LTP app. K at K-6, K-7.
[119] E.g., CRA Preliminary Findings at 37 (electric sector forecasting); *id.* at 48 (cold climate heat pump cost trends).

the potential use of hydrogen and RNG are the most cost competitive ways to reduce GHG for its industrial users[120] and ignores the advantages of industrial heat pumps ("IHP"). As NFG explains, industrial customers are businesses that manufacture or process goods or materials[121] and its industrial customers generally include iron and steel mills, hazardous waste disposal facilities, flour mills and power generation facilities.[122] The industrial sector accounts for more than 25% of the nation's energy use and energy-related carbon dioxide emissions[123] and 9% of New York State's emissions.[124]

Despite comments from stakeholders,[125] NFG naively concluded in its revised LTP that there were competitive challenges related to achieving GHG emissions reductions for its large industrial customers and inappropriately assumed that electrification was too expensive and difficult.[126] NFG's conclusion is based on its own audit and biased analysis when it contacted and queried its own customers about decarbonization pathways.[127] In lieu of probing the results from its own audit, where it only spoke with 24 out of the 430 customers, NFG simply determined that hydrogen and RNG were potential better options.[128] Because NFG failed to provide any cost assumptions for IHPs and did not compare those projected costs to the use of

[120] Revised LTP at 25.
[121] *Id.* at 7.
[122] *Id.* at 12.
[123] Ed Rightor et al, *Industrial Heat Pumps: Electrifying Industry's Process Heat Supply,* ACEEE, vii (Mar., 2022), https://www.aceee.org/sites/default/files/pdfs/ie2201.pdf
[124] Scoping Plan at 257.
[125] Initial Comments at 29.
[126] *See* Revised LTP at 25 n.29 ("National Fuel Gas Corporate Informational Filing" submitted on June 15, 2022 in Case Nos. 20-G-0131 and 22-M-0149 includes a detailed discussion of the opportunities and challenges facing National Fuel's industrial customers as they explore actions that they can take to reduce emissions.")
[127] *Id.*
[128] *Id.* ("National Fuel Gas Corporate Informational Filing" at 7-10, submitted on June 15, 2022 in Case Nos. 20-G-0131 and 22-M-0149 includes a detailed discussion of the opportunities and challenges facing National Fuel's industrial customers as they explore actions that they can take to reduce emissions.")

RNG or hydrogen[129] or the projected GHG reductions for various pathways for decarbonization, it is difficult to assess which is the better option.

The industrial sector has several pathways to decarbonization, including electrification.[130] Currently, on the market, there are multiple types of IHPs that can provide heat up to about 160º C (covering roughly 44% of industrial process heat needs), and products are in development to raise this temperature ceiling to about 200º C (covering roughly 55% of industrial process heat needs).[131] Even moderate deployment of IHPs in industrial groups with high process heating demands, such as pulp and paper, chemicals, and food manufacturing will lead to significant GHG reductions.

To better understand the limitations and potential options or opportunities to electrify the industrial sector within its service territory, NFG should separate its industrial customers into subsectors such as (1) food manufacturing: dairy, meat processing, beer, canned vegetable and fruit processing, cane sugar refining, beet sugar, corn wet-milling, and soybean oil; (2) automotive; (3) chemical; (4) power generation; (5) textile; (6) pulp and paper; (7) cement; (8) asphalt; (9) stone; (10) wood processing; and (11) steel: primary or secondary. Identifying the industrial customers by subsector will allow NFG and stakeholders to determine viable and cost-effective options to electrify and reduce its GHG emissions. Industrial heat for manufacturing processes, from boilers in particular, is a significant source of emissions and because of the heterogeneity of the manufacturing sector and the variety of different production methods on a

[129] *Id.,* app. A at A-25.
[130] *See e.g.,* Ed Rightor et al.*, supra* note 121; Jibran Zuberi et al., *Electrification of U.S. Manufacturing with Industrial Heat Pumps*, Global Efficiency Intelligence, (Oct. 2022), https://www.globalefficiencyintel.com/electrification-of-us-manufacturing-with-heat-pumps; Iwona Cameron et al., *Decarbonisation Road Map for the European Food and Drink Manufacturing Sector*, (Jul. 2021), https://www.fooddrinkeurope.eu/wp-content/uploads/2021/09/Decarbonising-the-European-food-and-drink-manufacturing-sector_v2.pdf.
[131] Ed Rightor et al., *supra* note 121, at vii.

process level, it is important for NFG to assess, develop, and identify the optimal industrial decarbonization pathways for its customers.

The final LTP should identify which subsector of NFG's industrial customers would be best suited for IHPs, identify specific barriers associated with side-scale applications of IHPs, and then provide a plan for how NFG will address these challenges, and identify the targeted actions needed, including further research, development, demonstration and deployment.

IX. CONCLUSION

As Consolidated Edison Company of New York, Inc. and Orange & Rockland Utilities, Inc. recognize in the recently released draft of their initial LTP, meeting the CLCPA mandates will require "us to reimagine our gas delivery system between now and 2050" and "all pathways that achieve State decarbonization goals will result in significant change to the natural gas business and the [utilities'] delivery infrastructure."[132] Unfortunately, NFG's revised LTP ignores this reality and insists on investing in a system that will soon become prohibitively expensive to maintain at its present scale. Commenters urge NFG to acknowledge and more accurately incorporate the true costs of continued reliance on pipeline fuels, reconsider the feasibility of cold-climate heat pumps and electrification of unducted homes, and take the opportunity to plan for a managed transition through targeted LPP retirement and strategic NPAs. For the reasons discussed above and in Commenters' initial comment filing, NFG's current LTP cannot be approved.

[132] Consolidated Edison, Gas System Long-Term Plan, NY PSC Case No. 23-G-0147 at 2, 4 (May 31, 2023).

Respectfully submitted,

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Exhibit 3

NATIONAL FUEL GAS DISTRIBUTION CORPORATION
NEW YORK DIVISION
INITIAL LONG-TERM PLAN DATA REQUESTS

SC-DR-1-28

Question:

Did the Company consider any other potential options for backup heat in developing its scenarios (e.g. electric resistance heat, propane furnaces)? If so, why were these options not ultimately included?

Response:

As explained in Table IV-5, the Aggressive Scenario includes full electrification, which would require cold-climate heat pumps given the cold temperatures experienced in National Fuel's service territory. As explained on page 55 of the LTP, cold-climate heat pumps use built-in electric resistance heating to supplement the heat pump's ability to keep a home warm. The Company did not consider any options that would involve using propane, oil, or any other fuels as backup heat, except natural gas (blended with RNG and hydrogen) as explained in the Company's filing.