BEFORE THE NEW YORK STATE
PUBLIC SERVICE COMMISSION

Proceeding on Motion of the Commission as to the Rates, Charges, Rules and Regulations of Consolidated Edison Company of New York, Inc. for Electric Service	)	**Case 22-E-0064 and**
Proceeding on Motion of the Commission as to the Rates, Charges, Rules and Regulations of Consolidated Edison Company of New York, Inc. for Gas Service	)	**Case 22-G-0065**

DIRECT TESTIMONY OF ELIZABETH A. STANTON, PHD ON BEHALF OF WE ACT FOR ENVIRONMENTAL JUSTICE AND ALLIANCE FOR A GREEN ECONOMY

May 20, 2022

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Q: Please state your name and job title.

A: My name is Elizabeth A. Stanton. I am the Director and a Senior Economist at the Applied Economics Clinic.

Q: For whom are you testifying?

I am submitting this testimony on behalf of WE ACT for Environmental Justice ("WE ACT") and the Alliance for a Green Economy ("AGREE").

Q: Have you previously testified in other jurisdictions?

A: Yes. I testified in public utility and other related dockets in Massachusetts, New Hampshire, South Carolina, District of Columbia, Florida, Pennsylvania, Indiana, Michigan, Minnesota, Louisiana, Florida, Illinois, New York Puerto Rico, South Carolina, and Vermont, and have submitted comments in several federal dockets, including comments related to U.S. Environmental Protection Agency ("EPA") regulatory proceedings.

Q: What is your educational background?

A: I received my PhD in Economics from the University of Massachusetts-Amherst in 2007. Before that, I received my Master of Arts in Economics from New Mexico State University in 2000 and a Bachelor of International Studies at the School for International Training in Brattleboro, Vermont. I have taught economics at Tufts University, the University of Massachusetts-Amherst, and the College of New Rochelle, in addition to other colleges and universities.

Q: What is your professional background?

A: I am the founder and Director of the Applied Economics Clinic, a nonprofit environmental consulting group. As a researcher and analyst with twenty years of professional experience as a political and environmental economist, I have written more than 170 reports, policy studies,

white papers, journal articles, and book chapters as well as more than 50 expert comments. I have also given oral and written testimony in public proceedings on topics related to energy, the economy, the environment, and equity. My articles were published in Ecological Economics, Climatic Change, Environmental and Resource Economics, Environmental Science & Technology, and other journals. I have also published books, including Climate Change and Global Equity (Anthem Press, 2014) and Climate Economics: The State of the Art (Routledge, 2013), which I co-authored with Frank Ackerman. I am also co-author of Environment for the People (Political Economy Research Institute, 2005, with James K. Boyce) and co-editor of Reclaiming Nature: Worldwide Strategies for Building Natural Assets (Anthem Press, 2007, with James K. Boyce and Sunita Narain). My list of publications is provided in my CV, attached as Exhibit A[1].

My recent work includes review and analysis of electric and gas sector planning in several states, Integrated Resource Plan and Demand-Side Management planning review, analysis and testimony of state climate laws as they relate to proposed capacity additions, and other issues related to consumer and environmental protection in the electric and gas sectors. In my previous position as a Principal Economist at Synapse Energy Economics, I provided expert testimony in electric and gas sector dockets, and led studies examining environmental regulation, cost-benefit analyses, and the economics of energy efficiency and renewable energy. Prior to joining Synapse, I was a Senior Economist with the Stockholm Environment Institute's ("SEI") Climate Economics Group, where I was responsible for leading the organization's work on the Consumption-Based Emissions Inventory model and on water issues and climate change in the

[1] *Curriculum vitae* of Elizabeth A. Stanton, PhD, Director and Senior Economist, Applied Economics Clinic.

western United States. While at SEI, I led domestic and international studies commissioned by the United Nations Development Programme, Friends of the Earth-U.K., and Environmental Defense Fund, among others.

Q: Please describe the Applied Economics Clinic.

A: The Applied Economics Clinic ("AEC") provides expert services for public interest groups, such as governments, nonprofits, and community groups, on topics including energy, the environment, consumer protection, and equity. AEC's products include expert testimony, modeling, policy briefs, and reports. AEC provides training to the next generation of expert witness and analysts through applied, on-the-job experience for graduate students in related fields. It works proactively to increase diversity among current and future employees.

I: SUMMARY OF TESTIMONY

Q: What is the purpose of your testimony?

A: This testimony highlights the mismatch between Consolidated Edison's planned emission reduction measures and New York State's mandated emission reduction goals. I find that decarbonization through building electrification (heat pumps, networked geothermal, and demand-side measures) can provide the emission reductions needed to attain State emission targets safely and reliably while swapping one form of gas (certified natural gas, renewable natural gas, and green hydrogen) for another cannot.

Q: Please summarize your main findings.

A: In Case Nos. 22-E-0064 and 22-G-0065**,** Consolidated Edison proposed measures for capturing more of the fugitive methane emissions released from pipeline infrastructure but fails to address the larger concern—greenhouse gas emissions released through the combustion of the fossil gas (commonly referred to as "natural gas") distributed and sold by the Company.

Stopping leaked emissions is important to New York's climate policy attainment, but these emissions should be stopped using measures that simultaneous eliminate both fugitive emissions from pipelines **and** emissions from gas combustion through building decarbonization using a combination of heat pumps, networked geothermal, and demand-side measures. Unless both types of greenhouse gas emissions (fugitive and combustion) are greatly reduced or eliminated, New York State cannot meet its climate commitments.

II: CONSOLIDATE EDISON'S PLANS INTERFERE WITH THE STATE'S CLCPA ATTAINMENT

Q: What is the CLCPA?

A: New York State's Climate Leadership and Community Protection Act ("CLCPA" or "the Climate Act"), signed on July 18, 2019, set a statewide goal to reduce greenhouse gas emissions to 85 percent below 1990 levels and achieve net-zero emissions by 2050.[2] The Climate Act also created a Climate Action Council ("CAC") that is tasked with drafting a *Scoping Plan*[3] to recommend regulatory measures and other state actions to meet these targets.[4] The CLCPA directs the New York Department of Environmental Conservation ("DEC"), informed by the CAC, to set quantitative limits on carbon dioxide ("CO_2") equivalent emissions, and to promulgate rules and regulations that will ensure that the emissions limits are not exceeded.[5]

Q: Does New York State have any greenhouse gas emission reduction targets in addition to those in the CLCPA?

[2] CLCPA § 1(4), S.B. 6599, 242d Sess. (N.Y. 2019), https://legislation.nysenate.gov/pdf/bills/2019/s6599.
[3] ECL § 75-0103; *Id.* §75-0103(11).
[4] *Id.* §75-0103(13).
[5] *Id.* § 75-0103; *Id.* §75-0103(11); ECL §75-0109(1), (2)(a).

A: Yes. New York State has a target of reducing greenhouse gas emissions by 40 percent (from 1990 levels) by 2030.[6]

Q: Which emissions does the statewide greenhouse gas emissions include?

A: The CLCPA requires (1) the total annual emissions of greenhouse gases produced within the state from anthropogenic sources, and (2) greenhouse gases produced outside of the state that are associated with (a) the generation of electricity imported into the state and (b) the extraction and transmission of fossil fuels imported into the state.[7]

Q: What are the CLCPA's stated goals for building decarbonization in New York State?

A: The CLCPA mandates the economy-wide decarbonization of New York. This goal necessarily includes the decarbonization of buildings. The CLCPA directs the CAC to specify precise plans for decarbonizing the building sector in a *Draft Scoping Plan*.

Q: What is the *Draft Scoping Plan*?

A: On December 20, 2021, the CAC released an initial framework for how the State will reduce greenhouse gas emissions and achieve net-zero emissions, increase renewable energy usage, and ensure climate justice. The Council will collect public comments on this *Draft Scoping Plan* until June 10, 2022. The Council will finalize the *Scoping Plan* by January 1, 2023, and DEC

[6] Climate Action Council, *Climate Action Plan Interim Report: Executive Summary* ES-3 (2010), https://www.dec.ny.gov/energy/80930.html.

[7] *See* ECL §75-0101(13); Order on Implementation of the Climate Leadership and Community Protection Act (Issued and Effective May 12, 2022) at 12, *Proceeding on Motion of the Commission Assessing Implementation of and Compliance with the Requirements and Targets of the Climate Leadership and Community Protection Act*, N.Y. Dep't of Pub. Serv. Case No. 22-M-0149 (May 12, 2022) (Docket No. 1), https://documents.dps.ny.gov/public/MatterManagement/CaseMaster.aspx?MatterSeq=67719&MNO=22-M-0149.

will release legally binding regulations to ensure the realization of the Climate Act's required greenhouse gas emissions reductions by January 1, 2024.

Q: What does the *Draft Scoping Plan* say about building decarbonization?

A: Chapter 12 of the Council's *Draft Scoping Plan* focuses on decarbonizing the buildings sector, primarily through heat pumps and making building envelopes more impermeable to heat and air:[8]

> *The Integration Analysis indicates that by 2050, the large majority of buildings statewide will need to use electric heat pumps for heating and cooling to meet the Climate Act requirements. This approach depends upon 100% zero-emissions electricity by 2040 and making energy efficiency improvements in all buildings, with the emphasis on improvements to building envelopes (air sealing, insulation, and replacing poorly performing windows) to reduce energy demand by 30% to 50%.*[9]

The *Draft Scoping Plan* emphasizes that heat pumps are technologically and economically feasible virtually everywhere in New York: "Specifically, electrification of space and water heating with high efficiency heat pumps is a viable, cost- effective approach to decarbonizing operations for nearly all buildings in New York."[10]

Q: Does the CAC envision a role for fossil gas as New York approaches its climate goals?

A: The CAC's *Draft Scoping Plan* recommends a "transition away from fossil gas" while "maintaining safety and reliability," as well as cost-effectiveness:[11] "By 2050, 85% of homes and commercial building space statewide should be electrified with energy-efficient heat pumps."[12]

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[8] N.Y. State Climate Action Council, *New York State Climate Action Council Draft Scoping Plan* ch. 12 (2021), https://climate.ny.gov/Our-Climate-Act/Draft-Scoping-Plan ("Draft Scoping Plan").
[9] *Id.* at 120.
[10] *Id.*
[11] *Id.* at 266.
[12] *Id.* at 122.

The *Draft Scoping Plan* focuses on building electrification as the central path to decarbonizing the sector but allows for continued use of fossil gas up to 15 percent of building sector energy demand, and suggests that biomethane, which the CAC refers to as "renewable natural gas," or green hydrogen may have a small role as a back up to electric heating.[13]

Q: How does the *Draft Scoping Plan* envision the electricity for buildings will be supplied?

A: The CLCPA requires 70 percent of New York's electricity to be supplied by renewable energy by 2030, and for New York's power sector to be carbon-neutral by 2040. Regarding electric generation for heat pumps and other building use, the *Draft Scoping Plan* calls for retirement of fossil fuel generators.[14] It also recommends a moratorium on permitting new fossil fuel power plants.[15]

Q: What are Consolidated Edison's plans for emission reductions?

A: Consolidated Edison's planned programs in response to the CLPCA's requirements primarily involve investments in the repair and maintenance of existing fossil fuel infrastructure in order to reduce leakage. These programs stand in stark contrast to alternatives that would see fossil fuel demand reduced and infrastructure decommissioned. Consolidated Edison's planned programs are:

- Capital projects
    - The Main Replacement Program and Service Replacement abandons or replaces "leak-prone" gas infrastructure in order to target fugitive emissions;[16]

[13] *Id.* at 120–21.
[14] *Id.* at 155.
[15] *Id.* at 155–56.
[16] Consolidated Edison Company of New York, Inc. Gas Infrastructure Operations and Supply Panel – Gas at 20, *Proceeding on Motion of the Commission as to the Rates, Charges, Rules and Regulations of Consolidated Edison Company of New York, Inc. for Gas Service*, N.Y. Dep't of Pub. Serv. Case No. 22-G-0065 (Jan. 28, 2022) (Docket No. 3), https://documents.dps.ny.gov/public/MatterManagement/CaseMaster.aspx?MatterSeq=67367&MNO=22-G-0065 ("GIOSP Testimony").

- Use vacuum purging technology to capture gas lost to the atmosphere during the purging of gas lines and reintroduce it distribution system;[17]
- Use natural gas detectors and leak alarms;[18]

- Other tools, processes, and programs used by Consolidated Edison to reduce natural gas emissions include:
  - Conduct monthly leak response surveys of gas mains;[19]
  - Set goals to repair 85 percent of leaks within 60 days;[20]
  - Develop a high emitter surveillance program to find leaks using advanced leak detection tools;[21]
  - Internally coat pipes to prevent odor loss;[22]
  - Burn off planned natural gas releases because the global warming potential of doing so is lower than that of methane;[23]
  - Plan to reduce damages to reduce unplanned natural gas releases.[24]
- Certified natural gas pilot program to evaluate whether certified purchases should be ramped up.[25]
- Biomethane will be procured from the Mount Vernon RNG interconnection facility, which is part of Consolidated Edison's system.[26]
- Green hydrogen research and development spending by 2030 on the deployment of "hydrogen technologies."[27]

Q: What does Consolidated Edison need to do be consistent with the CLCPA?

A: To be consistent with New York State's attainment of CLCPA goals, Consolidated Edison needs to make and execute a plan to reduce the emissions resulting from its operations and customer use of gas. By 2050, greenhouse gas emissions must be no more than a fraction (15 percent) of its 1990 levels. To help ensure that the State is on track to meet the CLCPA targets,

[17] *Id.* at 21.
[18] *Id.*
[19] *Id.* at 22.
[20] *Id.*
[21] *Id.*
[22] *Id.* at 23.
[23] *Id.*
[24] *Id.*
[25] *Id.* at 137–138.
[26] *Id.* at 49-50.
[27] *Our Clean Energy Commitment*, Consolidated Edison, https://www.coned.com/en/our-energy-future/our-energy-vision/our-energy-future-commitment (last visited May 18, 2022).

Consolidated Edison must quantify and report all greenhouse gas emissions for its fossil gas system and also assess the impacts that the specific investments, capital expenditures, programs and initiatives described in its rate filing will have on the greenhouse gas emissions from its gas system.[28]

Q: Do Consolidated Edison's emission reduction plans meet this standard?

A: No. As I discuss below, Consolidated Edison's greenhouse gas emission reduction plans rely too heavily on reducing fugitive emissions from gas transmission and distribution, ignoring that far more significant emissions that result from the utility's customer's combustion of fossil gas.

Q: Can you compare Consolidated Edison's planned emission reductions from reduced fugitive emissions to the entire amount of greenhouse gases emitted by the Company's gas utility business?

A: No. Consolidated Edison does not make its gas utility emissions publicly available, making it impossible for stakeholders and policymakers to gauge the effects of alternative utility programs on New York's greenhouse gas inventory and CLCPA attainment.

III: HEAT PUMPS, NETWORKED GEOTHERMAL AND DEMAND-SIDE MEASURES ARE FEASIBLE ALTERNATIVES TO FOSSIL GAS

Q: What are the end uses for fossil gas in buildings and what feasible alternatives exist that will reduce greenhouse emissions to a minimum of 15 percent of 1990 levels by 2050?

[28] To comply with the CLCPA, the PSC is now requiring all utilities in future rate filings to include an assessment of the greenhouse gas emissions impacts of each specific investment, capital expenditure, program and initiative that is included in their rate filings. Order on Implementation of the Climate Leadership and Community Protection Act (Issued and Effective May 12, 2022) atOrder on Implementation of the Climate Leadership and Community Protection Act, Docket 22-M-0149, Issued and Effective May 12, 2022 at 16.

A: Fossil gas is used in buildings primarily for space and water heating, with some use for other appliances such as gas dryers, cooking stoves and fireplaces. Feasible, safe and reliable alternatives to fossil gas both (1) provide some or all of the same energy services as fossil gas; and (2) have the potential to substantially reduce New York State's greenhouse gas emissions. These feasible, safe, and reliable alternatives include heat pumps, networked geothermal and demand-side measures.

1. HEAT PUMPS

Q: Can electric heat pumps help New York decarbonize buildings, replace the use of fossil gas, and meet its climate goals?

A: Yes. Electric heat pumps electrify heating and cooling systems while also increasing system efficiency relative to other kinds of heating and cooling systems, thereby reducing emissions; as New York lowers its electric emissions rates by adding renewables, heat pump emission reductions will grow. New York State Energy Research and Development Authority's ("NYSERDA") 2019 analysis of residential heat pump potential and economics found that one-third of New York's greenhouse gas emissions result from heating and cooling buildings.[29] Emissions reduction opportunities in New York can come both from replacing fossil-fuel-based heating systems and from using less electricity than electric resistance heating systems, even while the grid is still powered in part with by fossil-fuel-based generation sources.

[29] NYSERDA, Rep. No. 18-44, *New Efficiency: New York Analysis of Residential Heat Pump Potential and Economics* 1 (2019), https://www.nyserda.ny.gov/-/media/Files/Publications/PPSER/NYSERDA/18-44-HeatPump.pdf ("NYSERDA Residential Heat Pump Analysis").

NYSERDA calculates that the annual net-fuel savings from the installation of heat pumps are greatest when consumers make the switch from gas or oil heating, though savings can still be made from switching from electric resistance heating (see Table 1).[30]

Table 1. Annual net site energy savings per installation (MMBtu)

Sector	Technology	Vintage	Geography	CF Gas Heat	CF Oil Heat	CF Electric Heat
Single Family	ASHP	Existing Building	NYC/LI/HV	65	78	45
			Upstate	81	98	55
		New Construction	NYC/LI/HV	63	77	42
			Upstate	80	97	53
	Minisplit	Existing Building & New Construction	NYC/LI/HV	26	31	18
			Upstate	32	39	22
	GSHP	Existing Building & New Construction	NYC/LI/HV	75	89	54
			Upstate	94	112	67
Small Multifamily	ASHP	Existing Building	NYC/LI/HV	101	121	69
			Upstate	127	152	86
		New Construction	NYC/LI/HV	95	116	63
			Upstate	120	146	79
	Minisplit	Existing Building & New Construction	NYC/LI/HV	51	61	35
			Upstate	65	78	44
	GSHP	Existing Building & New Construction	NYC/LI/HV	113	133	80
			Upstate	142	168	100

Reproduced from: NYSERDA Residential Heat Pump Analysis at 26 tbl.6-4.

Ground-source heat pumps (also known as geothermal heat pumps) provide the largest median annual net-energy savings: 103.5 MMBtu, 122.5 MMBtu, and 73.5 MMBtu for changes from gas, oil, and electric resistance heating systems respectively. Air-source heat pumps provide the second largest median annual energy net-savings: 88, 107, and 59 MMBtu respectively for changes from gas, oil, and electric heating systems.

Q: What are electric heat pumps and how do they work?

[30] *Id.* at 26.

A: Electric heat pumps are a mechanism for providing both heating and cooling to a building. There are two major types: air-source pumps and ground-source pumps. Air-source heat pumps exchange heat between a building and the surrounding air, whereas ground-source heat pumps exchange heat between a building and the earth. In New York, air-source heat pumps are recommended because they are designed for cold temperatures like those experienced in New York. A heat pump system requires electricity to operate but uses less energy than an electric resistance heating system (such as a space heater or electric baseboard heating).

A 2019 NYSERDA study, *New Efficiency: New York Analysis of Residential Heat Pump Potential and Economics,* found that in New York State, heat pumps produce heat substantially more efficiently than oil, gas, or electrical resistance do. Reviewing Department of Energy ("DOE") Technical Reference documents and consulting with New York stakeholders, NYSERDA found that air-source heat pumps, which are the cheapest up front and easiest-to-install variety of heat pump, produce heat with a Coefficient of Performance ("COP") the percent of heat output to energy input) of 300 percent, compared to only 76, 66, and 100 percent for fossil gas, fuel oil, and resistance electric heating, respectively.

The Coefficient of Performance compares the units of heating or cooling provided by a system to the amount of energy the system uses; a ratio of 200 percent would mean 2 units of heating or cooling are provided for every 1 unit of electric energy used. This means that air-source heat pumps are a minimum of three-times more efficient than fossil gas, fuel oil, or resistance electric systems. Ground-source heat pumps offer an even greater heating COP: 415 percent.[31]

Q: Are heat pumps cost effective?

[31] *Id.* at 23 tbl.6-1.

A: Yes, heat pumps are cost effective. Research from the Applied Economics Clinic—of which I am an author—found that in Massachusetts, heat pump operational costs will be less expensive than gas furnaces by the mid to late 2020s[32] and that lifetime costs of heat pump ownership (including equipment costs, operational costs of heating and cooling, and savings from not running other equipment) are more economic than heating with fossil gas and cooling with window air conditioning units, but only if state and utility incentives are removed from new gas equipment purchases.[33]

In 2016, New York City ordered the creation of a pre-feasibility screening tool to determine the viability of ground-source heat pumps systems in buildings across the City.[34] The study assessed the cost of different heat pump systems by comparing their payback periods across boroughs and heat pump system types—the time required to recoup heat pump investments.[35] Longer payback periods indicate less cost effective projects.[36] The longest payback periods, and therefore the least cost effective, are projected for lots in Manhattan and the Bronx (see Table 2).[37] Brooklyn, Queens, and Staten Island see faster payback periods because of more available outdoor drilling

[32] Tanya Stasio et al., Applied Econ. Clinic, *Decarbonizing Building Heat in Massachusetts* 25 (2022), https://static1.squarespace.com/static/5936d98f6a4963bcd1ed94d3/t/624b0a84c9794d56d374dc[…]0/HEET+Decarbonizing+Gas_Report_AEC_23Mar2022+%281%29.pdf; Joshua Castigliego et al., Applied Econ. Clinic, *Inflection Point: When Heating with Gas Costs More* (2021), https://aeclinic.org/publicationpages/2021/01/13/inflection-point-when-heating-with-gas-costs-more.

[33] Ricardo Lope et al., Applied Econ. Clinic, *Home Heat Pumps in Massachusetts* 2–4 (2019), https://aeclinic.org/publicationpages/2019/5/29/home-heat-pumps-in-massachusetts.

[34] Goldman Copeland, *Geothermal Screening Webtool Pre-Feasibility* 1 (2018), https://www1.nyc.gov/assets/ddc/geothermal/Geothermal%20Screening%20Webtool%20Pre-Feasibility.pdf.

[35] *Id.* at 3; *Id.*, App. A at 2.

[36] *Id.* at 21.

[37] *Id.* at 3.

areas and lower building loads.[38] Sites achieving payback times of less than 12 years are automatically recommended by the pre-feasibility study for a full feasibility study on ground-source systems.[39] The report recommends only considering further study for ground-source with payback periods of 25 years or less.[40] The U.S. Energy Information Administration ("EIA") estimates a life expectancy for residential ground-source heat pumps of between 8 and 21 years.[41]

Table 2. Payback periods for heat pump systems across New York City boroughs

Borough	Payback Period	Closed Loop		Standing Column Well		Open Loop	
		# of Lots	% of Lots	# of Lots	% of Lots	# of Lots	% of Lots
Manhattan	< 12 Years	8402	20%	0	0%	73	0%
	< 25 Years	438	1%	10286	24%	6	0%
	≥ 25 Years	33846	79%	32400	76%	42607	100%
Bronx	< 12 Years	68908	77%	0	0%	365	0%
	< 25 Years	2103	2%	6227	7%	4	0%
	≥ 25 Years	18674	21%	83458	93%	89316	100%
Brooklyn	< 12 Years	203626	74%	0	0%	69788	25%
	< 25 Years	4322	2%	3106	1%	176	0%
	≥ 25 Years	68872	25%	273803	99%	206945	75%
Queens	< 12 Years	267253	82%	0	0%	200703	62%
	< 25 Years	11407	4%	3601	1%	43	0%
	≥ 25 Years	45508	14%	320567	99%	123422	38%
Staten Island	< 12 Years	111904	90%	11	0%	51708	42%
	< 25 Years	0	0%	51356	41%	0	0%
	≥ 25 Years	11885	10%	72422	59%	72081	58%

Reproduced from: Goldman Copeland at 3 tbl.1.

Q: Are residential heat pumps a feasible heating source for New York State?

A: Heat pumps are a feasible heating source for New York State, providing safe reliable energy services to homes and businesses.

[38] *Id.*
[39] *Id.* at 21.
[40] *Id.*
[41] U.S. Energy Info. Admin., *Assumptions to the Annual Energy Outlook 2022* 7 (2022), https://www.eia.gov/outlooks/aeo/assumptions/pdf/residential.pdf.

According to a 2020 presentation made to the DEC by the New York Geothermal Energy Organization, 50 to 60 percent of existing homes could be served by a ground-source heat pump borehole that is less than 500 feet deep; 90 to 95 percent could be served by a borehole that goes up to 750 feet deep.[42] Among larger (commercial) buildings, 100 percent of larger buildings could benefit from ground-source boreholes up to 500 feet deep.[43] For buildings that cannot install ground-source heat pumps, air-source heat pumps are usually feasible.

Q: What is the deployment plan for heat pumps in New York State?

A: In January 2022, Governor Hochul announced a plan to achieve 1 million electrified homes and 1 million electrification-ready homes by 2030 (out of a total of 7.4 million New York households[44]) and promised to direct the Department of Public Service (DPS) to ensure gas utilities minimize investments in new gas infrastructure and to promote alternatives to fossil gas to minimize gas demand.[45] The *Draft Scoping Plan* suggests the following metric for assessing progress by 2030:

> *By 2030, one to two million energy-efficient homes should be electrified with heat pumps; and heat pumps should provide space heating and cooling for 10% to 20% of commercial space statewide. Heat pumps should become the majority of new purchases for space and water heating by the late 2020s.*[46]

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[42] Bill Nowak, NY-GEO, *Ground Source Heat Pump Drilling Regulations Discussion* 10 (2020), https://ny-geo.org/blogs/geo-news/ny-geo-drilling-group-meets-with-dec.

[43] *Id.*

[44] American Community Survey. 2020. 5-Year Estimates: S1101 "Households and Families".

[45] NYSERDA, *Governor Hochul Announces Plan to Achieve 2 Million Climate-Friendly Homes by 2030* (Jan. 5, 2022), https://www.nyserda.ny.gov/About/Newsroom/2022-Announcements/2022-01-05-Governor-Hochul-Announces-Plan-to-Achieve-2-Million-Climate-Friendly-Homes-By-2030.

[46] N.Y. State Climate Action Council, *Draft Scoping Plan* 121 (2021), https://climate.ny.gov/-/media/Project/Climate/Files/Draft-Scoping-Plan.pdf.

For 2050, the *Draft Scoping Plan* argues, "by 2050, 85% of homes and commercial building space statewide should be electrified with energy efficient heat pumps."[47] In April 2022, the Governor announced $10 million in funding towards the goal of delivering carbon neutral multifamily buildings in New York State.[48] In December 2018, New York's Public Service Commission ("Commission") issued an order as part of Case 18-M-0084 requiring utilities to provide a minimum of 5 trillion British thermal units (TBtu) of site energy savings from heat pumps by 2025.[49] This target was later reduced to 2.7 TBtu in a proposal by New York's electric utilities as part of their plans for achieving the order.[50] NYSERDA's 2019 white paper projects 120,000 heat pumps will have been installed by 2025, resulting in 7.5 TBtu of site energy efficiency savings.[51]

Q: Could the amount of electricity available limit the potential for heat pump deployment in New York?

A: Over time, building electrification will impact on the "shape" (timing) of New York's electric load but I am not aware of any evidence that the state's generation and transmission and

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[47] *Id*. at 122.

[48] *Governor Hochul Announces $10 Million in Funding Available in Round Three of $40 Million Buildings of Excellence Competition*, Gov. Kathy Hochul (Apr. 7, 2022), https://www.governor.ny.gov/news/governor-hochul-announces-10-million-funding-available-round-three-40-million-buildings.

[49] NYSERDA Residential Heat Pump Analysis at S-1; Order Adopting Accelerated Energy Efficiency Targets at 1, *In the Matter of a Comprehensive Energy Efficiency Initiative*, N.Y. Dep't of Pub. Serv. Case 18-M-0084 (Dec. 13, 2018) (Docket No. 77), https://documents.dps.ny.gov/public/MatterManagement/CaseMaster.aspx?MatterCaseNo=18-M-0084.

[50] Order Authorizing Utility Energy Efficiency and Building Electrification Portfolios Through 2025 at 8, 19, *In the Matter of a Comprehensive Energy Efficiency Initiative*, N.Y. Dep't of Pub. Serv. Case 18-M-0084 (Jan. 16, 2020) (Docket No. 207), https://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7B06B0FDEC-62EC-4A97-A7D7-7082F71B68B8%7D.

[51] NYSERDA Residential Heat Pump Analysis at 67.

distribution investments will fail to keep up with either the pace of this shift or increasing demand. The main limitation on heat pump deployment is the upfront cost of purchasing new equipment and the public and utility incentives available to offset those costs.

Q: What heat pump incentive programs does Consolidated Edison offer?

A: The New York Clean Heat program incentivizes contractors and customers to reduce the cost of air source heat pumps and ground source heat pumps and to support building envelope upgrades.[52] The program is run by New York's electric utilities using common program rules.[53] In 2021, Consolidated Edison spent almost $100 million on the Clean Heat Program, amounting to about 600,000 MMBtu in energy savings—almost six times the utility's targeted savings for the year.[1] Over the past two years, Consolidated Edison has already met 50 percent of its cumulative 2020 to 2025 Clean Heat Program spending targets and 73 percent of its savings targets.[1] Moreover, the Company projects it will meet the entirety of its cumulative savings target by the end of 2022. In fact, due to Consolidated Edison's high customer interest in heat pump incentives, the Company is requesting additional funding to support the program.[1] Consolidated Edison proposes to launch its Heating Electrification Make-Ready program on top of the Clean Heat Program to offset costs of behind-the-meter upgrades required to electrify space and water heating and to prepare buildings for full electrification.[54] The Company plans to spend $76.6 million over three years to provide financial incentives and education through this

[52] Consolidated Edison Company of New York, Inc. Customer Energy Solutions Panel at 30, N.Y. Dep't of Pub. Serv. Case No. 22-G-0065 (Jan. 28, 2022) (Docket No. 2) & Case No. 22-E-0064 (Jan. 28, 2022) (Docket No. 3), https://documents.dps.ny.gov/public/MatterManagement/CaseMaster.aspx?MatterSeq=67367&MNO=22-G-0065.

[53] *Id.*

[54] *Id.* at 31.

program.[55] Consolidated Edison argues that there are transition costs that add $700 to $2,500 to project costs of those seeking to electrify: electric service upgrade costs, replacing circuit breaker panels, adding sub-panels—all of which the Clean Heat Program does not cover.[56] The Electrification Make-Ready program will help cover these costs. Consolidated Edison anticipates this program will support 3,000 multi-family homes and commercial buildings, as well as 8,000 homes between 2023-2025.[57]

Q. Are other utilities in New York State offering or proposing similar incentives or programs to encourage deployment of heat pumps to rate payers within their service territories?

A. Yes. All of the investor-owned utilities in New York participate in the Clean Heat Program and offer incentives for heat pumps. Additionally. National Grid, in Case 19-G-0309 and 19-G-0310, The Brooklyn Union Gas Company d/b/a National Grid NY ("KEDNY") and KeySpan Gas East Corporation d/b/a National Grid ("KEDLI"), recently issued a report on the cost of new gas customer connections, as well as a proposal for potential financial incentives for residential customers to encourage the expansion of electric heating in New York.[58] For new gas service requests, Public Service Law § 31(4), 16 NYCRR § 230.2 and a utilities' tariff provide an allowance of up to 100 feet of certain main and service facilities to residential and non-residential applicants.[59]

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[55] *Id.* at 32–33.
[56] *Id.* at 33–34.
[57] *Id.* at 36.
[58] National Grid: Gas Customer Connection Costs & Electrification Incentives Report at 2, N.Y. Pub. Serv. Comm'n Case Nos. 19-G-0309 (May 12, 2022) (Docket No. 320) & 19-G-0310 (May 12, 2022) (Docket No. 314), https://documents.dps.ny.gov/public/MatterManagement/CaseMaster.aspx?MatterCaseNo=19-G-0309.
[59] *Id.* at 3.

National Grid examined the costs for gas connection facilities and determined the average service cost to connect a typical new residential customer. National Grid is proposing two residential electrification incentives, one for individual customers and another that would apply to multiple customers when an entire area electrifies.[60] The incentives would be available to fund eligible electrification costs for customers who adopt either air-source or ground-source heat pumps that meet the performance standards of the energy efficiency programs offered by the electric utilities serving the customer.[61] The incentive amounts would represent the average avoided cost of the meter and service installation and would be provided to cover electrification costs after other rebates or incentives have been applied.[62]

Q: What policies are other states or jurisdictions pursuing to advance the deployment of heat pumps?

A: In 2021, the Washington State Building Code Council adopted a code that requires heat pump space and water heating for all new buildings, with exceptions provided to allow for electric resistance heating for smaller loads and as supplemental heating, as well as for fossil fuel auxiliary heating under certain conditions.[63]

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[60] *Id*. at 5.
[61] *Id*. at 5.
[62] *Id.* at 6.
[63] Emily Pontecorvo, *First All-Electric Heating Mandate for Buildings Passes in Washington State*, Grist ((Apr, 26, 2022), https://grist.org/buildings/washington-state-requires-electric-heat-pumps-buildings/; Wash. State Bldg. Code Council, WSR 22-02-076, *Proposed Rulemaking CR-102 (December 2017) (Implements RCW 34.05.320)* 3 (2022), https://sbcc.wa.gov/sites/default/files/2022-01/WSR_22_02_076_Full_WSEC_C_CR102.pdf ; Wash. State Bldg. Code Council, Log No. 103, *Washington State Energy Code Development Standard Energy Code Proposal Form Code Section # C403.1.4, C407, C503.4.1, C503.4.6* 8–9 (2021), https://sbcc.wa.gov/sites/default/files/2021-09/103_TFinal_Heat_Pump_Space_Heating_082721.pdf.

In 2019, Maine launched a program referred to as the '100,000 Heat Pump Challenge' committing to a goal of installing 100,000 heat pumps in homes and businesses over a five-year period coupled with a rebate system to improve the accessibility of energy upgrades.[64] For reference, Maine's population is 7 percent that of New York.

In 2021, California's Energy Commission established a building code—the first building code of its kind in the nation— making electric heat pumps the standard for energy efficient space and water heating in homes and businesses.[65] Starting in January 2023, the new code applies this standard to new single- and multi-family residences and to businesses.[66]

Massachusetts utilities' 2022-2024 *Three-Year Energy Efficiency Plan* allocates a total budget of $3.94 billion towards electric heat pump incentives.[67]

2. NETWORKED GEOTHERMAL

Q: Can networked geothermal help New York decarbonize buildings, replace the use of fossil gas, or meet its climate goals?

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[64] *Weatherization and Intergovernmental Programs Office Project Map – Maine*, U.S. Dep't of Energy (Jan. 7, 2022), https://www.energy.gov/eere/wipo/articles/weatherization-and-intergovernmental-programs-office-project-map-maine.

[65] Press Release, Nat. Res. Def. Council, *California Passes Nation's First Building Code that Establishes Pollution-free Electric Heat Pumps as Baseline Technology; Leads Transition off of Fossil fuels in New Homes* (Aug. 11, 2021), https://www.nrdc.org/media/2021/210811-0#:~:text=SACRAMENTO%20%E2%80%93%20The%20California%20Energy%20Commission,gas%20in%20favor%20of%20electric.

[66] Cal. Energy Comm'n, *2022 Building Energy Efficiency Standards Summary* 10 (2021), https://www.energy.ca.gov/sites/default/files/2021-08/CEC_2022_EnergyCodeUpdateSummary_ADA.pdf.

[67] Press Release, Mass. Dep't of Pub. Utils., *DPU Approves Massachusetts' Nation-Leading Three Year Energy Efficiency Plan: Plan Will Deliver Over $9 Billion in Benefits to Residents and Businesses* (Feb. 2, 2022), https://www.mass.gov/news/dpu-approves-massachusetts-nation-leading-three-year-energy-efficiency-plan.

A: Yes. Networked geothermal produces emissions savings in buildings by electrifying and providing safe and reliable heating using electricity instead of fossil fuel combustion for heating. According to a study by the non-profit Home Energy Efficiency Team (HEET) on the feasibility of replacing gas infrastructure in Massachusetts with shared ground-source heat pumps underneath public streets, the replacement of gas boilers and furnaces with networked geothermal would reduce greenhouse gas emissions from heating and cooling by 60 percent.[68] Emissions would decline further as more renewable generation is added to the electric supply.[69]

Q: What is networked geothermal and how does it work?

A: Networked geothermal heating is a system of shared ground-source heat pumps, which exchange heat between the ground and buildings to provide heating and cooling.[70] Networked geothermal systems have been installed in university, hospital, or military base "campuses," central business districts, or underneath public right of ways, such as roads or highways.[71] Networked geothermal (or "district heating" with heat pumps) systems operate at greater efficiency than if each individual building had a stand-alone heat pump system because distribution losses are minimized, and heating and cooling can balanced among multiple buildings' needs.[72] While typical district heating systems rely on fossil fuels and/or "combined

[68] HEET & Burohappold Eng'g, *Geo Micro District Feasibility Study* 3 (2019), https://heet.org/wp-content/uploads/2019/11/HEET-BH-GeoMicroDistrict-Final-Report-v2.pdf.
[69] *Id.*
[70] *Networked Geothermal Energy*, Eversource, https://www.eversource.com/content/general/residential/about/sustainability/renewable-generation/geothermal (last visited May 16, 2022); HEET & Burohappold Eng'g at 6.
[71] Pace Energy & Climate Ctr., Pace U., *Overcoming Legal and Regulatory Barriers to District Geothermal in New York State* at S-2 (2021), https://www.nyserda.ny.gov/-/media/Files/Publications/Research/Clean-Power-Innovation/21-22-Overcoming-legal-and-Regulatory-Barriers-to-District-Geothermal-in-NY.ashx.
[72] *Id.* at 2.

heating and power" systems to operate, these networked geothermal systems operate with ground-source heat pumps, making it possible to provide cooling as well as heating.[73]

Q: Are there any networked geothermal systems installed or proposed in New York?

A: Yes. NYSERDA has allocated a $22.5 million budget for its "Community Heat Pump Systems Program," which has already accepted three rounds of winning projects for funding and will continue receiving applications until 2023.[74] One project, located in Utica, explores the use of district-style heat pumps in a cluster of eight buildings including a public library, school, and commercial office buildings.[75] The project will consist of a central thermal building housing the heat pumps, from which hot and cold water will be distributed to end-use buildings.[76]

In addition, the May 2022 *Geothermal District Energy Study* by New York utilities NYSEG and RG&E identifies three pilot sites that are "ideal" for networked geothermal; the top-ranked site is a plaza in Norwich containing a mix of residential and nonresidential buildings, as well as several large parking lots that can house boreholes.[77] The plaza contains a grocery store, the cooling-dominant load of which will offset the heating-dominant loads of surrounding neighborhoods.

In its KEDLI territory, National Grid has already installed one demonstration networked geothermal project. National Grid proposed to expand its REV demonstration district geothermal

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[73] *Id.* at 3–4.

[74] NYSERDA, *Community Heat Pumps Systems* (2022), https://portal.nyserda.ny.gov/CORE_Solicitation_Detail_Page?SolicitationId=a0rt0000017lyygAAA.

[75] NYSERDA, *Neighborhood in City of Utica* (June 2022), https://bi.nyserda.ny.gov/CommunityHeatPumpsPDFFiles/City_of_Utica.pdf.

[76] *Id.*

[77] LaBella Assocs. et al., *Geothermal District Energy Study* 38–39 (2022), https://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={A623A433-67E5-4871-B8F9-A967418D214A}.

project, but DPS Staff opposed the project in their direct testimony, and it was not included in the final Joint Proposal.[78] Similarly, in its Upstate Niagara Mohawk territory, National Grid proposed a district geothermal project and Department of Public Service ("DPS") Staff testified against the cost effectiveness of the proposal, which would not have been socialized across all gas customers like other gas utility assets.[79] Staff also opposed in their direct testimony a REV demonstration project by Orange & Rockland.[80]

Q: What policies are other states or jurisdictions pursuing to advance the deployment of networked geothermal systems?

[78] The Brooklyn Union Gas Company d/b/a National Grid NY and Keyspan Gas East Corporation d/b/a National Grid Direct Testimony of the Future of Heat Panel at 50, N.Y. Pub. Serv. Comm'n Case Nos. 19-G-0309 (Apr. 30, 2019) (Docket No. 4) & 19-G-0310 (Apr. 30, 2019) (Docket No. 4), https://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={93364C13-24A5-4AD5-8314-3C07119C11BE}; Prepared Testimony of: Staff Efficiency and Sustainability Panel at 52, N.Y. Pub. Serv. Comm'n Case Nos. 19-G-0309 (Aug. 30, 2019) (Docket No. 38) & 19-G-0310 (Aug. 30, 2019) (Docket No. 37),https://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={38637732-2D07-45BA-93C9-79556E983C20}.

[79] Niagara Mohawk Power Corporation d/b/a National Grid Direct Testimony of the Future of Heat Panel at 29–30, *Proceeding on Motion of the Commission as to the Rates, Charges, Rules and Regulations of Niagara Mohawk Power Corporation d/b/a National Grid for Gas Service*, N.Y. Pub. Serv. Comm'n Case No. 20-G-0381 (July 31, 2020) (Docket No. 2), https://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={A652A486-4F25-40E1-B980-1885035A0AC0}; Prepared Testimony of: Staff Efficiency and Sustainability Panel (SESP) at 53, N.Y. Pub. Serv. Comm'n Case Nos. 20-G-0381 (Nov. 25, 2020) (Docket No. 36) & 20-E-0380 (Nov. 25, 2020) (Docket No. 48), https://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={54E2EB1A-Cases 20-E-0380 & 20-G-0381. F8B3-4E45-835F-EA13E7416198}.

[80] Prepared Testimony of Sean P. Isakower & Michael O'Donnell at 7, *Proceeding on Motion of the Commission as to the Rates, Charges, Rules and Regulations of Orange and Rockland Utilities, Inc. for Electric Service*, N.Y. Pub. Serv. Comm'n Case No. 21-E-0074 (May 28, 2021) (Docket No. 33), https://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7bFC7C17B2-D8AB-4927-90F8-608EEB70E277%7d.

A: Geothermal developers operating on federal land in California pay royalties and lease payments to the U.S. government, which funds California's Geothermal Resources Development Account.[81] The California Energy Commission Geothermal Program has access to 30 percent of the funds in the Geothermal Resources Development Account, and these funds go toward the development of geothermal in the state.[82] Some of this funding has been used to install geothermal district heating systems at three school campuses and a medical center in Modoc County.[83]

3. DEMAND-SIDE MEASURES

Q: Can energy efficiency help New York decarbonize buildings, replace the use of fossil gas, or meet its climate goals?

A: Yes. Energy efficiency measures reduce electric and direct fossil fuel use; this reduced energy use in turn lowers greenhouse gas emissions. New York has a cumulative annual energy savings target of 185 Tbtu between 2015-2025, which was established by Governor Cuomo in 2018.[84] NYSERDA estimated that this would amount to a greenhouse gas emissions reduction of 22 million metric tons of CO_2-equivalent ("CO2e") annually by 2025.[85] The Acadia Center's 2018 *Assessing New York's Proposed 'New Efficiency' Initiative* report estimated that New York's

[81] *Geothermal Grant and Loan Program*, Cal. Energy Comm'n, https://www.energy.ca.gov/programs-and-topics/programs/geothermal-grant-and-loan-program (last visited May 17, 2022).
[82] *Id.*
[83] Darryl Anderson & Brian Brown, Cal. Energy Comm'n, CEC-300-2020-009, *Modoc Joint Unified School District Geothermal Expansion Project* (2020), https://www.energy.ca.gov/publications/2020/modoc-joint-unified-school-district-geothermal-expansion-project.
[84] NYSERDA, *New Efficiency: New York Factsheet* (2021), https://www.nyserda.ny.gov/-/media/Files/Publications/New-Efficiency-Fact-Sheet.ashx.
[85] NYSERDA, *New Efficiency: New York* 6 (2018), https://www.nyserda.ny.gov/about/publications/new-efficiency.

existing energy efficiency programs will save about 143 Tbtus[86] As of 2020, New York's cumulative energy efficiency savings (since 2010) totaled 16 TBtu[87] Consolidated Edison's had achieved a little over 500,000 MMBtu in annual savings from its efficiency programs as of 2021.[88] If New York continues increasing cumulative savings at its recent trend, it will fall short of its goals.

Q: What are demand-side measures?

A: Demand-side measures reduce annual electric use and/or reduce peak demand via customer efficiency and load shifting. Demand-side measures include energy efficiency programs (building shell improvements, efficient appliances), demand response, smart thermostats, and interruptible rates.

Q: What demand-side measures are included in Consolidated Edison's existing programs?

A: According to its *2021 Annual Report*, Consolidated Edison plans to invest $1.5 billion into energy efficiency programs, amounting to about 20 Tbtu of annual energy savings by 2025.[89] To

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[86] Acadia Ctr., *Assessing New York's Proposed 'New Efficiency' Initiative* 2 (2018), https://acadiacenter.org/resource/assessing-new-yorks-proposed-new-efficiency-initiative/.

[87] *See* U.S. Energy Info. Admin, *Annual Electric Power Industry Report, Form-861 Detailed Data Files* (2015–2020), *https://www.eia.gov/electricity/data/eia861/;* N.Y. Indep. Sys. Operator, *Gold Book Baseline Forecast Tables* (2022), https://www.nyiso.com/documents/20142/30338270/2022-Gold-Book-Baseline-Forecast-Tables.xlsx/58cf502f-046d-935e-16a7-b53fa23cf7a7; CLCPA at 9.

[88] Con Edison 2021 System Energy Efficiency Plan (SEEP) Annual Report, *In the Matter of a Comprehensive Energy Efficiency Initiative*, N.Y. Dep't of Pub. Serv. for Case 18-M-0084 (Mar. 31, 2022) (Docket No. 445), https://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7BD39F03C2-F872-4979-B8EA-52ABE33C1527%7D.

[89] Con Edison, *2021 Annual Report* (2021), https://investor.conedison.com/static-files/ee446afe-7d16-444d-a345-23bf524a8cf3; Con Edison, *Integrated Long-Range Plan* 37 (2022), https://cdne-dcxprod-sitecore.azureedge.net/-/media/files/coned/documents/our-energy-future/our-energy-projects/integrated-long-range-plan.pdf?rev=869f851682a74d74a6043a6ad3d590e1&hash=82C202FFFE5B07BABB2B418643ACC07D.

achieve this goal, the Company plans to tackle barriers to increased energy savings including lack of awareness, faulty price signals, lack of access to financing, and technical barriers.[90]

Q: Do gas energy efficiency programs help New York meet its climate goals?

A: Yes. Gas sector energy efficiency savings directly reduce the consumption of gas and the release of greenhouse gas emissions from the building sector.

Q: Do gas demand response programs help New York meet its climate goals?

A: Gas demand response programs do not typically reduce emissions; instead, these programs shift the timing of gas use. Gas demand response programs, however, can help avoid costly infrastructure investments.

Q: Are gas energy efficiency measures cost effective?

A: Yes. Energy efficiency is the least expensive energy resource. A recent study from Laurence Berkeley National Laboratory (LBNL) analyzed program data from gas efficiency program data in more than a dozen states (including New York), reviewing data that represents 50 to 70 percent of all gas efficiency spending in the United States. LBNL found an average cost of saved gas of $0.40 per therm.[91] As a rough, imperfect comparison, the NYMEX energy future price for fossil gas for June 2022 is approximately $0.84 per therm.[92]

Q: What is its potential for deploying demand-side measures in New York?

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[90] Con Edison, *Integrated Long-Range Plan* (2022), https://cdne-dcxprod-sitecore.azureedge.net/-/media/files/coned/documents/our-energy-future/our-energy-projects/integrated-long-range-plan.pdf?rev=869f851682a74d74a6043a6ad3d590e1&hash=82C202FFFE5B07BABB2B418643ACC07D.

[91] Steven R. Schiller et al. *Cost of saving natural gas through efficiency programs funded by utility customers: 2012-2017*, Lawrence Berkeley Nat'l Lab'y 5 (2020), https://eta-publications.lbl.gov/sites/default/files/cose_natural_gas_final_report_20200513.pdf.

[92] *Today in Energy: Daily Prices- Prompt Month Energy Futures*, U.S. Energy Info. Admin. (May 20, 2022), https://www.eia.gov/todayinenergy/prices.php

A: A 2021 NYSERDA study, *Assessment of Energy Efficiency Potential in New York State Multifamily Buildings*, projected that cumulative cost-effective saving potential between 2021-2030 is 62 TBtu, or 26 percent of total 2030 sales, but could feasibly be as high as 91 TBtu, or 38 percent of 2030 sales.[93] These savings include electricity, fossil gas, fuel oil and propane, and district steam.[94]

NYSERDA's last major study of energy efficiency potential in New York in 2014 estimated that New York could achieve savings equivalent to 45 percent of electric consumption, 32 percent of fossil gas consumption, and 53 percent of petroleum consumption by 2030 in the absence of market and social barriers.[95] However, given those barriers, the achievable potentials were 18, 11, and 20 percent respectively as a percentage of 2030 electricity, gas, and petroleum consumption.[96]

In 2018, modeling by Optimal Energy, Inc. found that New Yorkers could save more than $7.7 billion through more ambitious energy savings targets and improved building energy codes and appliance standards, avoiding over 15 million tons of CO_2.[97] The study also found that if utilities raised their electric savings targets incrementally, they could increase customer energy savings

[93] Taylor Bettine et al., *Assessment of Energy Efficiency Potential in New York State Multifamily Buildings* at ES-2 (2021), https://www.nyserda.ny.gov/-/media/Files/Publications/building-stock-potential-studies/Assessment_of_EE_Potential_in_NYS_MF_Buildings_June2021.pdf.

[94] *Id*.

[95] NYSERDA, *Energy Efficiency and Renewable Energy Potential Study of New York State Volume 1: Study Overview* 35 (April 2014), https://www.nyserda.ny.gov/about/publications/ea-reports-and-studies/eere-potential-studies.

[96] *Id*.

[97] Optimal Energy Inc., *Analysis of Energy Efficiency Savings Targets in New York State* 14 (2018), https://assets.nrdc.org/sites/default/files/optimal-energy-analysis-of-energy-efficiency-savings-targets-in-new-york-state_2018-04-05.pdf?_ga=2.2207024.1459228408.1653007593-194693632.1653007592.

by 300 percent, from 1 percent of sales in 2018 to 3.15 percent of sales in 2025.[98] Optimal Energy finds that the most effective energy efficiency policy includes fossil gas savings. Establishing an energy efficiency target of 1.65 percent of sales for fossil gas, which is higher than the 2018 target of 0.37 percent, would reduce demand by 66,047 billion British thermal units.[99]

Q: Are there barriers to achieving demand-side savings?

A: Yes. A 2021 joint-report by NYSERDA, New York Power Authority ("NYPA"), and DEC notes that several barriers prevent the uptake of energy efficiency measures:[100]

- Old building stocks increase the cost of upgrades;
- Multifamily and rental housing splits incentives for investment among multiple parties;
- The community may lack physical infrastructure necessary for sufficient upgrades.

The report also notes that communities or individual customers may face specific disadvantages that prevent them from taking up demand-side measures:[101]

- Low-income households and unbanked populations may lack the capital to finance improvements;
- Communities may lack trust in the program or service provider, particularly due to negative historical interactions with government agencies;

[98] *Id*. at 5.
[99] *Id*. at 9.
[100] NYSERDA, et al., *New York State Disadvantaged Communities Barriers and Opportunities Report*, Report No. 21-35, 13 (2021), https://climate.ny.gov/-/media/Project/Climate/Files/21-35-NY-Disadvantaged-Communities-Barriers-and-Opportunities-Report.pdf.
[101] *Id*. at 14–16.

- Communities may be stopped from participating due to insufficient data on their needs, insufficient program design, harsh eligibility criteria and application requirements, and insufficient program resources.

These are barriers that can be mitigated through policy.

Q: How do New York's policies on demand-side measures compare to those of other states or jurisdictions?

A: New York ranks highly compared to other states. ACEEE's 2020 "State Efficiency Scorecard"—which compares policies and programs to reduce efficiency using common metrics across states—ranks New York's policies fifth in the nation.[102] California is first, followed by Massachusetts, Vermont, and Rhode Island in descending order.[103]

Consolidated Edison's commercial demand response programs include a pilot to test the energy efficiency and demand response potential of domestic water heater control devices in single family homes in Westchester, NY. The pilot found annual energy savings of 14.3 therms and a 38 percent reduction in gas usage in response to a demand response event.[104]

The Company's demand response programs also include a commercial system relief program that aims to reduce peak demand by having customers reduce energy use during an assigned call window and a distribution load relief program.[105]

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[102] Am. Council for an Energy-Efficient Econ. ("ACEEE"), *The State Energy Efficiency Scorecard* (2020), https://www.aceee.org/state-policy/scorecard.

[103] *Id*.

[104] Con Edison 2021 System Energy Efficiency Plan (SEEP) Annual Report at 70, 77, *In the Matter of a Comprehensive Energy Efficiency Initiative*, N.Y. Dep't of Pub. Serv. for Case 18-M-0084 (Mar. 31, 2022) (Docket No. 445), https://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7BD39F03C2-F872-4979-B8EA-52ABE33C1527%7D

[105] Con Edison, *Commercial Demand Response (Rider T) Program Guidelines* 5 (2022), https://www.coned.com/-/media/files/coned/documents/save-energy-money/rebates-incentives-tax-credits/smart-usage-rewards/smart-usage-program-guidelines.pdf?la=en.

IV: FALSE ALTERNATIVES TO FOSSIL GAS ARE INFEASIBLE, COSTLY, AND HAVE LIMITED EMISSION REDUCTION BENEFITS

Q: Are all technically possible alternatives to fossil gas feasible and successful at limiting greenhouse gas emissions to 15 percent of 1990 levels?

A: No. Several fossil gas alternatives are offered by Consolidated Edison and other gas utilities that are not feasible, or do not provide sufficient greenhouse gas emissions, or both. These non-solutions are sometimes called "false alternatives".

Q: What "false alternatives" to fossil gas exist?

A: False alternatives to fossil gas include certified natural gas, biomethane (which the Company calls "renewable natural gas"), and green hydrogen.

1. CERTIFIED NATURAL GAS

Q: What is certified natural gas?

A: S&P Global defines certified natural gas (or "CNG") as "gas that has been verified by an independent third party to have been produced in a manner consistent with certain environmental, social and governance standards."[106] Different certification programs exist, some of which address environmental, social, and governance considerations across the fossil gas supply chain, while others cover solely upstream methane and fossil gas emissions.[107]

[106] Kelsey Hallahan & Emmanuel Corral, *Certified Natural Gas: Midstream Sector Begins Embracing Concept, Standards*, S&P Global (Oct. 14, 2021, 3:04 PM), https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/natural-gas/101421-certified-natural-gas-midstream-sector-begins-embracing-concept-standards.

[107] *What Is Certified Natural Gas?*, Bridger Photonics, https://www.bridgerphotonics.com/blog/what-is-certified-natural-gas (last visited May 19, 2022).

Companies seek to procure CNG as a way of addressing their shareholders' or consumers' goals to reduce climate impacts. According to Washington Gas claims, "Certified natural gas offers a practical, cost-effective and near-term option to reduce greenhouse gas (GHG) emissions to combat climate change."[108]

Pursuing certification requires gas suppliers to demonstrate cleaner practices and reduced emissions. Descriptions of the mechanism by which, or the extent to which, emissions reductions occur are often vague. For instance, Washington Gas' fact sheet on CNG states, without further explanation:

> *With the necessary government policy and regulatory support, certified natural gas can be blended into existing gas supply and is expected to result in a 2 - 4 percent GHG reduction by 2032.*[109]

To the best of my knowledge, there is no consistent CNG certification process established by federal or state regulatory bodies. Different CNG certifiers offer different levels of reporting. For example, OGMP 2.0—a reporting framework created by the Climate and Clean Air Coalition, a voluntary partnership of governmental, intergovernmental, and nongovernmental organizations aimed at reducing climate pollution—has five levels of possible reporting, including a requirement that emissions tracking include measurements of both site and source-level methane emissions.[110] In contrast, the Equitable Origin (EO100) certification process does not include

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[108] Wash. Gas & AltaGas, *Certified Natural Gas* 2 (2020), https://washingtongasdcclimatebusinessplan.com/wp-content/uploads/2020/03/Fact-Sheet_Certified-Natural-Gas_vFINAL.pdf.

[109] *Id.*

[110] *The CCAC Oil & Gas Methane Partnership*, Climate and Clean Air Coalition, https://www.ccacoalition.org/en/activity/ccac-oil-gas-methane-partnership (last visited May 20, 2022).

methane emissions tracking or reduction; instead, it evaluates companies along five other principles, including Indigenous people's rights and climate change impacts.[111]

Q: Who certifies CNG?

A: According to *S&P Global*, there are presently three major certification standards for CNG: Project Canary's TrustWell standard; Equitable Origin's EO100 standard; and RMI and SYSTEMIQ's MiQ standard.[112]

Q: What domestic infrastructure exists to produce CNG?

A: *S&P Global* reports that several companies in the United States, predominantly in Appalachia and the Gulf Coast, have recently received or are in the process of applying for certification for their CNG production.[113] In 2018, New Jersey Resources entered into an agreement with Southwestern Energy to purchase its gas, which was certified by Project Canary's TrustWell standard.[114] EQT, the largest domestic gas producer, announced a pilot program to certify two well pads with Project Canary in January 2021, and another deal in April 2021 with MiQ and Equitable Origin to certify 100 percent of its production in Marcellus, amounting to 4 billion cubic feet per day (Bcf/d).[115] In addition, Seneca Resources, Northeast Natural Energy, Chesapeake Energy, and Southwestern Energy signed agreements in 2021 to certify their gas supplies in Appalachia, totaling 6.1 Bcf/d of certified gas production.[116] ExxonMobil has also announced a plan in partnership with MiQ to certify its gas production in the Permian Basin in

[111] *EO100 Standard for Responsible Energy Development*, Equitable Origin, https://energystandards.org/responsible-energy-development/ (last visited May 20, 2022).
[112] Hallahan and Corral.
[113] *Id.*
[114] *Id.*
[115] *Id.*
[116] *Id.*

New Mexico, amounting to roughly 200 million cubic feet of gas per day.[117] The certification processes are projected to make 12.3 Bcf/d of CNG (14 percent of U.S. gas production) available to customers by Quarter 2 of 2022, according to reporting by S&P Global.[118]

Q: What is the potential for procurement of CNG in New York?

A: Supplier Kinder Morgan submitted an application to the Federal Energy Regulatory Commission ("FERC") for the incorporation of CNG into its Tennessee Gas Pipeline, which would have provided CNG to the Northeast region including New York; however, FERC recently denied the plan.[119]

Q: Is Consolidated Edison proposing procurement of CNG?

A: Yes. In its *Gas Infrastructure, Operations and Supply Panel* testimony, Consolidated Edison discusses a prospective pilot project during the rate period in which it proposes to purchase up to $800,000 per year of CNG more than what it spends on the traditional supply[120], or 1 to 3 percent of the Company's expected firm customer gas sales.[121]

> *The Company is proposing a pilot program designed to allow for the procurement of certified gas, during the rate period, limited to an annual cost above traditional supplies of $800,000 per year.*[122]

Q: What are concerns with the use of CNG?

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[117] *ExxonMobil to Certify Natural Gas, Help Customers Meet Environmental Goals*, ExxonMobil (Sept. 7, 2021), https://corporate.exxonmobil.com/News/Newsroom/News-releases/2021/0907_ExxonMobil-to-certify-natural-gas-help-customers-meet-environmental-goals.

[118] Hallahan and Corral.

[119] Leticia Gonzales, FERC Squashes Kinder's Certified Natural Gas Proposal, but Door Open for New Filing, *Natural Gas Intelligence* (May 6, 2022), https://www.naturalgasintel.com/ferc-squashes-kinders-certified-natural-gas-proposal-but-door-open-for-new-filing

[120] GIOSP Testimony at 137.

[121] Con Edison Response to City of New York Interrogatory 56, attached as Exhibit B.

[122] GIOSP Testimony at 137.

A: Even with the proposed certification program in place, the Company estimates that only 1 to 3 present of firm customer sales would be certified.[123] The other 97 to 99 percent of the utility's sales will not be "certified to have followed the best environmental practices" (per the language of the CLCPA).[124]

Incorporating such a small percentage of gas certified to adhere to "best environmental practices" into the Company's network will not meaningfully contribute to the attainment of New York State's decarbonization goals. Even if certified, fossil gas has a greenhouse gas impact almost identical to that of non-certified fossil gas. Washington Gas' *Certified Natural Gas* fact sheet concedes that CNG can offer, at best, a 4 percent reduction in greenhouse gas emissions.[125] Consolidated Edison's $800,000 per year of spending would reduce 4 percent of the emissions of 1 to 3 percent of its gas.

2. RENEWABLE NATURAL GAS

Q: What is renewable natural gas ("RNG")?

A: Renewable natural gas, or RNG, is biomethane: treated biogas that can be used as a substitute for fossil gas.[126] Raw biogas has a methane content between 45 and 65 percent, with the main other constituent being CO_2. Biomethane is treated by removing CO_2, moisture, oxygen, nitrogen, and contaminants (including volatile organic compounds (VOCs), hydrogen sulfide, ammonia, and siloxanes), typically has a methane content of at least 95 percent, and can be

[123] Con Edison Response to City of New York Interrogatory 56, Exhibit B.
[124] CLCPA Panel at 46.
[125] Wash. Gas & AltaGas at 2.
[126] Renewable Natural Gas, EPA (Mar. 30, 2022), https://www.epa.gov/lmop/renewable-natural-gas.

injected into existing fossil gas distribution pipelines.[127] Biomethane is produced from diverted waste stream feedstocks, which can include landfill gas, animal manure, food waste, wastewater, or agricultural waste.[128]

Q: Does the use of biomethane eliminate greenhouse gas emissions?

A: No. All biomethane is methane and therefore emits the same amount of conventional air pollutants and greenhouse gases as fossil gas when leaked from pipes or combusted.[129]

Q: Does the use of biomethane in place of fossil gas reduce emissions?

A: It depends: biomethane's emission reduction potential depends on the source of the biomass feedstock used to make it, how that feedstock would have otherwise been used, and the amount of methane leaked during production, transport, and combustion.[130] The biogas used to produce biomethane can be sourced from existing waste streams (including food, agricultural, and

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[127] Stifel Equity Rsch., *Energy & Power—Biofuels: Renewable Natural Gas: A Game-Changer in the Race for Net-Zero* 8 (2021), https://static1.squarespace.com/static/53a09c47e4b050b5ad5bf4f5/t/62043b66de19b74d326663f8/1644444522166/2021NStifel+RNG+Analysis.pdf.; Olumide Awe et al., *A Review of Biogas Utilisation, Purification and Upgrading Technologies*, 8 Waste and Biomass Valorization 267 (2017), https://link.springer.com/article/10.1007/s12649-016-9826-4; Stephanie Taboada et al., *Quantifying the Potential of Renewable Natural Gas to Support a Reformed Energy Landscape: Estimates for New York State*, 14 Energies 3834 (2021), https://doi.org/10.3390/en14133834

[128] Kristi Moriarty et al., Nat'l Renewable Energy Lab'y, NREL/TP-5400-75776, *2017 Bioenergy Industry Status Report* 39–40 (2020), https://www.nrel.gov/docs/fy20osti/75776.pdf; Derrick Whitfield et al., Stifel Equity Rsch., *Energy & Power* at 9.

[129] Union of Concerned Scientists, *The Promises and Limits of Biomethane as a Transportation Fuel* 4 (2017) https://www.ucsusa.org/sites/default/files/attach/2017/05/Promises-and-limits-of-Biomethane-factsheet.pdf; Sasan Saadat et al., Earthjustice & Sierra Club, *Rhetoric vs. Reality: The Myth of "Renewable Natural Gas" for Building Decarbonization*, July 2020. https://earthjustice.org/sites/default/files/feature/2020/report-decarb/Report_Building-Decarbonization-2020.pdf.

[130] Argonne Nat'l Lab'y, Energy Sys. Div., *Waste-to-Wheel Analysis of Anaerobic-Digestion-Based Renewable Natural Gas Pathways with the GREET Model* (2011), https://publications.anl.gov/anlpubs/2011/12/71742.pdf.

municipal waste), capturing methane emissions that would have been released into the atmosphere otherwise.[131]

ECL 75-0107 requires biogenic emissions (like those generated in the production of methane) to be treated equivalently to non-biogenic emissions in the State's greenhouse gas inventory. Similarly, ECL 75-0107(13) requires upstream (Scope 2) emissions from sources located outside of the State borders associated with imported electricity and fossil fuels to be included in the State's greenhouse gas inventory.

The National Renewable Energy Laboratory (NREL) notes that for biogas to qualify as a renewable fuel under the EPA's Renewable Fuel Standard, it must meet a 60 percent emission-reduction threshold relative to the fuel being replaced.[132] Based on estimates from the consulting firm ICF, relative to biomethane produced from animal manure, food waste, wastewater, and landfill gas feedstocks can meet the emissions reduction criteria, but other biomethane fuel sources such as municipal solid waste, energy crops, and agricultural residue may not offer notable emissions reductions relative to fossil gas.[133] Research from the American Gas Foundation finds that biomethane sourced from landfills, wastewater sludge, agricultural residue, forestry and forest product residue, energy crops, municipal solid waste, or beef/poultry manure create positive greenhouse gas emissions and therefore is not a zero-emission fuel (see).[134]

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[131] EPA, EPA 456-R-20-001, *An Overview of Renewable Natural Gas from Biogas* (2020), Available at: https://www.epa.gov/sites/default/files/2020-07/documents/lmop_rng_document.pdf.
[132] Moriarty et al. at 3.
[133] ICF, *Renewable Sources of Natural Gas: Supply and Emissions Reduction Assessment* 72 tbl.41 (2019), https://gasfoundation.org/wp-content/uploads/2019/12/AGF-2019-RNG-Study-Full-ReportFINAL-12-18-19.pdf.
[134] *Id.*

Table 3. Rage of lifecycle emission factors for biomethane (g/MJ)

RNG Feedstock	New England	Mid-Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific
Landfill gas	18 - 26	15 - 21	28 - 34	28 - 32	22 - 26	26 - 28	26 - 31	21 - 32	13 - 29
Animal manure									
Dairy	-304 - -294	-308 - -300	-292 - -285	-292 - -286	-299 - -294	-294 - -292	-294 - -288	-300 - -286	-310 - -290
Swine	-404 - -394	-408 - -400	-392 - -385	-392 - -386	-399 - -394	-394 - -392	-394 - -388	-400 - -386	-410 - -390
Beef / Poultry	36 - 36	31 - 31	46 - 46	44 - 44	36 - 36	38 - 38	42 - 42	44 - 44	41 - 41
Water resource recovery facilities	18 - 26	15 - 21	28 - 34	28 - 32	22 - 26	26 - 28	26 - 31	21 - 32	13 - 29
Food waste	-97 - -82	-104 - -91	-79 - -68	-79 - -70	-90 - -82	-83 - -79	-83 - -73	-91 - -70	-108 - -76
Agricultural residue	25 - 55	25 - 55	25 - 55	25 - 55	25 - 55	25 - 55	25 - 55	25 - 55	25 - 55
Forestry and forest product residue	25 - 55	25 - 55	25 - 55	25 - 55	25 - 55	25 - 55	25 - 55	25 - 55	25 - 55
Energy crops	25 - 55	25 - 55	25 - 55	25 - 55	25 - 55	25 - 55	25 - 55	25 - 55	25 - 55
Municipal solid waste	25 - 55	25 - 55	25 - 55	25 - 55	25 - 55	25 - 55	25 - 55	25 - 55	25 - 55
P2G / Methanation	0	0	0	0	0	0	0	0	0

Reproduced from: ICF, Renewable Sources of Natural Gas: Supply and Emissions Reduction Assessment 72 tbl.41 (2019), https://gasfoundation.org/wp-content/uploads/2019/12/AGF-2019-RNG-Study-Full-ReportFINAL-12-18-19.pdf.

Importantly, producing and transporting biomethane also entails the same risk of upstream and distribution network methane leakage as fossil gas. Methane emissions are much more potent than CO_2; their 20-year global warming potential is over 80 times that of CO_2.[135] Therefore, substantial methane leaks from the biogas life cycle can negate any potential climate benefit.[136] An article published in the journal *Energies* found that sourcing biomethane from landfills might create more methane emissions than it avoids:

> *Unfortunately, managing organic wastes through landfills is not environmentally sound, as small amounts of fugitive methane emissions cause GHG impacts that outweigh the potential environmental benefits from RNG production.*[137]

Q: Is biomethane produced in New York?

A: Yes: As of 2022, there are 173 operating biomethane projects in the United States but only two of these projects are in New York—Seneca Meadows Landfill in Waterloo, a 17.6-MW generation facility that converts landfill gas to biomethane, and Boxler Dairy Digester in

[135] *Carbon Dioxide Emissions Coefficients*, U.S. Energy Info. Admin. (Feb. 9, 2022), https://www.eia.gov/environment/emissions/co2_vol_mass.php.
[136] Rebecca Gasper & Tom Searchinger, *The Production and Use of Renewable Natural Gas as a Climate Strategy in the United States* 4 (2018), https://files.wri.org/d8/s3fs-public/production-use-renewable-natural-gas-climate-strategy-united-states.pdf.
[137] Taboada et al. at 10.

Varysburg, which uses dairy manure to produce about 305,000 MMBtu of biomethane per year.[138] Two additional biomethane projects have been permitted but not yet constructed in New York—American Organic Energy has announced plans to build a food digester facility on Long Island, and National Grid is upgrading 60 percent of its produced biogas to biomethane at a New York City wastewater treatment plant (Newtown Creek).[139]

Q: Have gas utilities widely integrated biomethane into their distribution systems?

A: No—to date, very few U.S. gas utilities have successfully implemented the use of biomethane in their gas distribution systems.[140] Summit Natural Gas of Maine[141] and DTE Energy of Michigan[142] have both introduced some biomethane into their distribution systems through voluntary programs, while SoCalGas of California[143] offers customers the opportunity for biomethane to be delivered through its distribution system. Dominion Energy has partnered with

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[138] *Landfill Methane Outreach Program: Renewable Natural Gas*, EPA (March 30, 2022), https://www.epa.gov/lmop/renewable-natural-gas; *Aria Energy Completes Expansion of RNG Project at Seneca Meadows Landfill*, Globe Newswire (Nov. 2, 2016), https://www.globenewswire.com/news-release/2016/11/02/885712/33898/en/Aria-Energy-Completes-Expansion-of-RNG-Project-at-Seneca-Meadows-Landfill.html; *Brightmark to Expand Western New York Dairy Biogas Project*, BusinessWire (Feb. 20, 2020), https://www.businesswire.com/news/home/20200220005517/en/Brightmark-to-Expand-Western-New-York-Dairy-Biogas-Project.

[139] Taboad et al. at 9.

[140] Affidavit of Elizabeth Stanton On Behalf of the Office of the People's Counsel for the District of Columbia at 16, *Merger Application of AltaGas Ltd. And WGL Holdings, Inc.*, D.C. Pub. Serv. Comm'n Formal Case No. 1142 (June 26, 2020), https://static1.squarespace.com/static/5936d98f6a4963bcd1ed94d3/t/5efe10acb415005eed82ba38/1593708717567/1142+-+CBP+-+Standalone+Stanton+Aff+and+Ex.pdf.

[141] Summit Utils., *AGA ESG/Sustainability Reporting* 2 (2019), https://www.summitutilitiesinc.com/Documents/SUI%20AGA%20ESG%20Reporting%20Metrics.pdf.

[142] *DTE CleanVision: Natural Gas Balance*, DTE Energy, https://solutions.dteenergy.com/dte/en/Products/DTE-CleanVision-Natural-Gas-Balance-LVL-1/p/NATURAL_GAS_BALANCE_LEVEL_1 (last visited May 19, 2022).

[143] *Understanding Renewable Natural Gas*, SoCalGas, https://www.socalgas.com/sustainability/renewable-gas/understanding-renewable-natural-gas (last visited May 19, 2022).

Smithfield Foods and Vanguard Renewables to produce biomethane from farms in multiple states with goal of adding it to gas distribution.[144]

Q: Does Consolidated Edison have a proposed source of biomethane fuel?

A: According to Consolidated Edison's *Gas Infrastructure, Operations and Supply Panel* testimony, the Consolidated Edison will source biomethane from the Mount Vernon RNG interconnection facility within its own service territory.

> *In response to a request for proposals ("RFP"), a vendor has proposed a facility that will produce RNG from food waste within Con Edison's service territory. Con Edison will install equipment to support the interconnection to this RNG facility, which will consist of metering, gas quality measurement, odorant measurement and remote shutdown.* [145]

The Company anticipates receipt of up to 1,000 dekatherms of biomethane per day,[146] or, annually, 1/10th of 1 percent of the gas transported in the Company's pipes.[147] Consolidated Edison forecasts a total estimated cost of this biomethane procurement of $1.5 million in 2023.[148] Consolidated Edison does not specify how much biomethane would be sourced, but does note that "[t]his interconnection is the first of its kind supplying the Consolidated Edison system and opens the door for other similar interconnections in the future"[149] and that "[t]he RNG will be produced at the site in an anaerobic digestion facility."[150] The Company has not quantified the greenhouse gas emissions that would result from capturing and using the waste-related methane proposed, and has no plans to purchase any renewable

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[144] *Renewable Natural Gas*, Dominion Energy, https://www.dominionenergy.com/projects-and-facilities/renewable-natural-gas (last visited May 19, 2022).
[145] GIOSP Testimony at 50.
[146] Con Edison Response to WE ACT_AGREE Interrogatory 42(a), attached as Exhibit C.
[147] GIOSP Testimony at 25.
[148] *Id.* at 50.
[149] *Id.*
[150] Con Edison Response to WE ACT_AGREE Interrogatory 9, attached as Exhibit D.

energy credits or other environmental attributes associated with the methane used by the RNG facility.[151]

Q: Could biomethane replace fossil gas in New York?

A: Not significantly. Researchers at Stony Brook University found that New York State currently produces less than 10 percent of its total technical potential for biogas given available waste source feedstocks, and under 4 percent of its total technical potential for biomethane. However, even if the state were to produce 100 percent of its total potential biogas and convert it all to biomethane, the biomethane would only provide roughly 6 percent of the State's total fossil gas demand (equal to roughly 40 billion cubic meters).[152]

Q: Are there cost concerns associated with the use of biomethane?

A: Yes. The costs of biomethane are likely to dwarf those of fossil gas, per unit of energy, due to high capital and operating costs and the costs of constructing new infrastructure.[153] Even the cheapest biomethane is projected to cost twice or more the price of fossil gas; ICF estimates that the most expensive biomethane will cost at least 10 times the price of fossil gas.[154] In contrast, studies by the Brattle Group and Applied Economics Clinic have found that efforts focused on converting to electric heat pumps were significantly less expensive than both biomethane and a fossil gas/ biomethane blend.[155]

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[151] Con Edison Response to WE ACT_AGREE Interrogatory 21, attached as Exhibit E.
[152] Taboada et al. at 11.
[153] Anneliese Dyer et al., *The Feasibility of Renewable Natural Gas in New Jersey*, 13 Sustainability 1618, 12, 16–18, https://doi.org/10.3390/su13041618.
[154] ICF, *Opportunities for Evolving the Natural Gas Distribution Business to Support the District of Columbia's Climate Goals* (2020), https://sustainability.wglholdings.com/wp-content/uploads/Technical-Study-Report-Opportunities-for-Evolving-the-Natural-Gas-Distribution-Business-to-Support-DCs-Climate-Goals-April-2020.pdf.
[155] Jürgen Weiss & Dean Murphy, Brattle Group, *Heating Sector Transformation in Rhode Island: Pathways to Decarbonization by 2050* (2020), https://www.brattle.com/insights-

Q: Are there safety concerns associated with the use of biomethane?

A: Yes. Research from the National Fire Protection Association finds that the biomethane is no less likely than fossil gas to unintentionally ignite and cause explosions, presenting potential threats to homes, schools, and businesses. In addition to the threat of gas explosions, the U.S. EPA finds that biomethane causes harms due to poor indoor air quality.[156]

3. GREEN HYDROGEN

Q: What is green hydrogen?

A: Green hydrogen is hydrogen produced from electrolysis of water using electricity from renewable sources,[157] and can be stored for a long time and combusted for energy. According to the International Renewable Energy Agency ("IRENA"), the efficiency of green hydrogen production is low: As much as 30-35 percent of energy used to produce green hydrogen is lost during electrolysis.[158]

Q: Does green hydrogen reduce net emissions?

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events/publications/heating-sector-transformation-in-rhode-island-pathways-to-decarbonization-by-2050/; Stasio et al. at i.

[156] Richard Campbell, Nat'l Fire Prot. Ass'n, *Structure Fires in Schools* (2020), https://www.nfpa.org/News-and-Research/Data-research-and-tools/Building-and-Life-Safety/Structure-fires-in-schools; Daniel Glick & Jason Plautz, *The Rising Risks of the West's Latest Gas Boom*, High Country News (Oct. 19, 2018), https://www.hcn.org/issues/50.18/energy-industry-how-site-workers-and-firefighters-responding-to-a-2017-natural-gas-explosion-in-windsor-colorado-narrowly-avoided-disaster; *Introduction to Indoor Air Quality*, EPA (Dec. 16, 2021), https://www.epa.gov/indoor-air-quality-iaq/introduction-indoor-air-quality.

[157] Yahya Anouti et al., strategy&, *The Dawn of Green Hydrogen* 3 (2020), https://www.strategyand.pwc.com/m1/en/reports/2020/the-dawn-of-green-hydrogen/the-dawn-of-green-hydrogen.pdf.

[158] Int'l Renewable Energy Agency, *Green Hydrogen: A Guide to Policymaking* 13 (2020), https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2020/Nov/IRENA_Green_hydrogen_policy_2020.pdf

A: Green hydrogen reduces net CO_2 emissions but leads to emissions of indirect greenhouse gases, which I will explain below. Hydrogen production from the electrolysis of water requires an energy input; if this energy comes from renewable resources (i.e., if the hydrogen is "green"), then the hydrogen production process is free of carbon dioxide emissions.

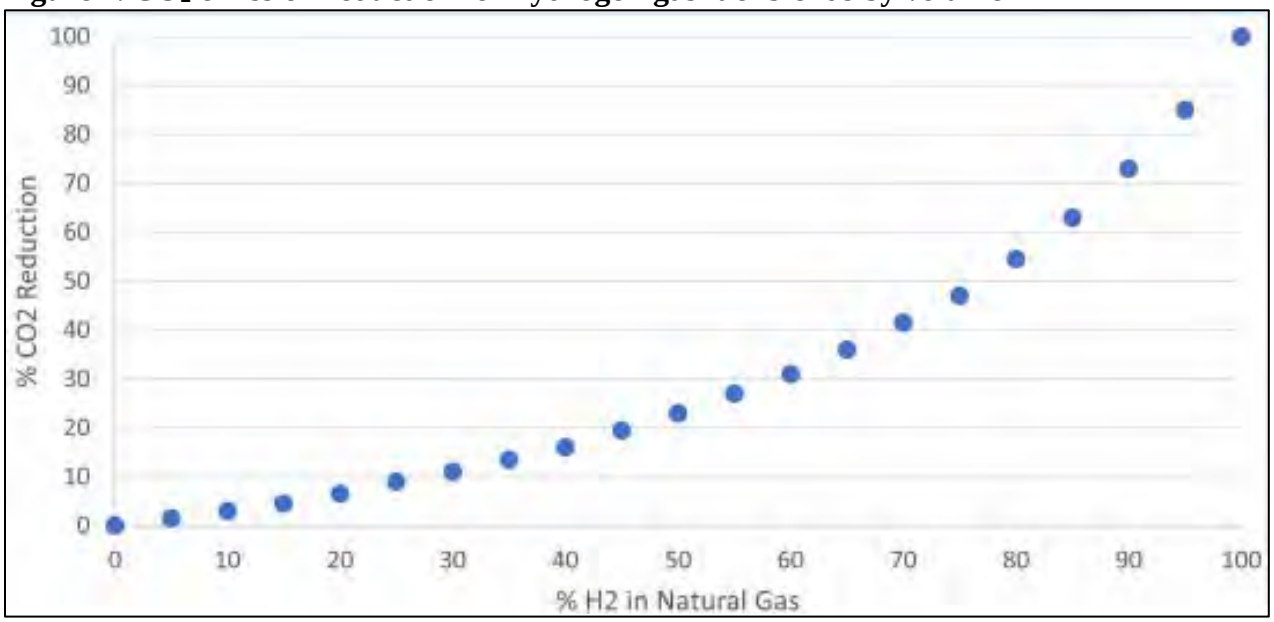
The emission reductions achieved from blending hydrogen (from any energy source) with gas are non-linear; that is, 10 percent hydrogen in a fuel blend does not lead to a 10 percent emission reduction because the difference between fossil gas and hydrogen's volumetric density leads to less hydrogen in the fuel blend on a heat input basis (see Figure 1).[159] Even increasing the hydrogen blend share to 50 percent achieves less than 25 percent emission reductions.[160] Only when hydrogen fuel is 100 percent of a fuel mix does green hydrogen result in zero CO_2 emissions.[161]

[159] Jeffrey Goldmeer, GE Power, *Power to Gas: Hydrogen for Power Generation* 9 (2019), https://www.ge.com/content/dam/gepower/global/en_US/documents/fuel-flexibility/GEA33861%20Power%20to%20Gas%20-%20Hydrogen%20for%20Power%20Generation.pdf.

[160] Elec. Power Rsch. Inst., *Technology Insights Brief: Hydrogen-Capable Gas Turbines for Deep Decarbonization* 2 fig.1 (2019), https://www.epri.com/research/products/000000003002017544.

[161] Mehmet Salih Cellek, & Ali Pınarbaşı, I*nvestigations 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, https://doi.org/10.1016/j.ijhydene.2017.05.107.

Figure 1. CO_2 emission reduction for hydrogen-gas fuel blends by volume



Reproduced from: Elec. Power Rsch. Inst., Technology Insights Brief at 2 fig.1.

Q: Is green hydrogen a zero-emission fuel source?

A: No. Green hydrogen is not a zero-emission fuel source: Even if hydrogen is produced with 100 percent renewable energy, green hydrogen combustion has been found to emit nitrous oxide (NO_x) and any leaked hydrogen itself is an indirect greenhouse gas (these gases cause reactions in the atmosphere that produce direct greenhouse gases). A 2018 study in the *International Journal of Hydrogen Energy* found that burning hydrogen produces up to six times the NO_x emissions of methane, which is the largest constituent of fossil gas, because hydrogen's high flame temperature results in a high rate of thermal nitrogen monoxide (NO).[162] Both hydrogen and NO_x are indirect greenhouse gases that lead to ozone formation in atmosphere.

Q: What domestic infrastructure exists for the transport and production of green hydrogen?

[162] *Id.*

A: As of December 2020, there were 1,608 miles of hydrogen pipeline in the United States (compared to over 300,000 miles of fossil gas transmission pipeline), over 90 percent of which lay along the Gulf Coast.[163] Nearly all existing shipments of hydrogen take place in dedicated hydrogen pipeline infrastructure.[164] Most existing hydrogen-specific infrastructure serves refineries and ammonia plants along the Gulf Cost.[165] According to reporting by Reuters, as of July 1, 2021, upwards of 24 U.S. energy firms, including Dominion Energy and Sempra Energy, had begun producing or testing hydrogen in pipelines designed for fossil gases.[166]

Q: Are there safety concerns with the use of green hydrogen?

A: Yes, the existing gas pipeline system cannot ensure the safe transport of hydrogen fuel. A study conducted by the Gas Technology Institute for NREL shows that, since hydrogen is the smallest of all molecules, it is three times more likely to leak from existing steel or iron pipelines than fossil gas and methane;[167] estimates from the Congressional Research Service estimate that about 10 percent of hydrogen produced will leak in the processes of production, storage, and transport.[168] Hydrogen is less dense than gas as well, and research published in the journal *Gases* finds that hydrogen necessitates larger and thus costlier infrastructure for the same volume of

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[163] Paul Parfomak, Cong. Rsch. Serv., R46700, *Pipeline Transportation of Hydrogen: Regulation, Research, and Policy* 5 (2021), https://crsreports.congress.gov/product/pdf/R/R46700.
[164] *Id.*
[165] *Id.*
[166] Stephanie Kelly & Scott Disavino, *U.S. Natgas Companies Put Hydrogen to the Test*, Reuters (July 1, 2021), https://www.reuters.com/business/sustainable-business/us-natgas-companies-put-hydrogen-test-2021-07-01/.
[167] Zhongquan Zhou& Daniel Ersoy, Gas Tech. Inst., *Review Studies of Hydrogen Use in Natural Gas Distribution Systems* 17 (2010), https://www.nrel.gov/docs/fy13osti/51995.pdf.
[168] *Id.*; Parfomak at 3; Traey K Tromp et al., *Potential Environmental Impact of a Hydrogen Economy on the Stratosphere*, 300 Science 1740 (2003), https://doi.org/10.1126%2Fscience.1085169.

energy delivery.[169] Blending hydrogen into gas pipeline systems can lead to risk of infrastructural degradation and explosions without equipment upgrades, and according to law firm Morgan Lewis, there are no safety codes for a gas-hydrogen blend.[170] Blending hydrogen into the system may embrittle existing steel pipes as well.

Q: Is 100 percent green hydrogen fuel currently feasible to transport in existing gas pipeline systems?

A: No, 100 percent hydrogen is not currently feasible to transport in existing fossil gas pipeline systems. There are serious technical barriers to green hydrogen deployment, starting with the infrastructure investments necessary to transport hydrogen using existing gas pipelines. Operators including Southern California Gas Company and San Diego Gas & Electric Company have begun or proposed projects to blend hydrogen in gas pipelines, citing the claim that up to 20 percent hydrogen concentrations by volume can be handled by existing pipelines.[171] However, a recent study by the National Renewable Energy Laboratory ("NREL")—the Department of Energy's primary laboratory for renewable energy and energy efficiency research and development—recommends that injection of hydrogen into current fossil gas pipelines be limited to 15 percent of total gas volume (85 percent methane content), but that feasibility varies by

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[169] Abhubakar Abbas et al., *An Investigation into the Volumetric Flow Rate Requirement of Hydrogen Transportation in Existing Natural Gas Pipelines and Its Safety Implications*, 1 Gases 156 (2021), https://doi.org/10.3390/gases1040013.

[170] Melaina et al., Blending Hydrogen into Natural Gas Pipeline Networks; St. John, Green Hydrogen in Natural Gas Pipelines; Kirstin Gibbs & Arjun Ramadevanahalli, *Considerations for Transporting a Blended Hydrogen Stream in Interstate Natural Gas Pipelines*, Morgan Lewis (June 11, 2021), https://www.morganlewis.com/pubs/2021/06/considerations-for-transporting-a-blended-hydrogen-stream-in-interstate-natural-gas-pipelines.

[171] Parfomak at 6; Joint Application Of Southern California Gas Company (U 904 G), San Diego Gas & Electric Company (U 902 G), Pacific Gas And Electric Company (U 39 G), And Southwest Gas Corporation (U 905 G) Regarding Hydrogen-Related Additions Or Revisions To The Standard Renewable Gas Interconnection Tariff, Cal. Pub. Util. Comm'n (Nov. 20, 2020), https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M351/K622/351622423.PDF.

location.[172] According to the Congressional Research Service, in the U.S. pipeline infrastructure's current state, no more than 20 percent of the volume of gas it carries can be hydrogen.[173] Above a 25 percent hydrogen concentration, equipment must be upgraded to be resistant to hydrogen explosions and "unplanned ignition".[174] Embrittlement risk can be mitigated through specialty steels or by restricting hydrogen concentrations in methane mixtures when transporting hydrogen with fossil gas.[175] Pipeline conversions to carrying pure hydrogen involve various technical modifications such as: "modifying compressors, valves, seals, meters, and other components; replacing pipeline segments or reworking welds with compatible materials; modifying leak detection systems; and installing new controls to monitor and manage hydrogen flows."[176]

Q: Is the use of green hydrogen for heating buildings more efficient than existing energy sources?

A: No, the limited research available suggests that green hydrogen is not more efficient than existing energy sources for heating buildings. Research from the Energy Transition Commission, a global organization of members from energy companies, financial institutions, and environmental NGOs, finds that hydrogen heating is 5 to 6 times less efficient, in terms of heat

[172] M. Melaina et al, Nat'l Renewable Energy Lab'y, *Blending Hydrogen into Natural Gas Pipeline Networks: A Review of Key Issues* 31 (2013), https://www.nrel.gov/docs/fy13osti/51995.pdf; Jacek Jaworski et al., *Study of the Effect of Addition of Hydrogen to Natural Gas on Diaphragm Gas Meters*, 13 Energies 3006 (2020), https://www.mdpi.com/1996-1073/13/11/3006.
[173] Parfomak at 4.
[174] Jeff St. John, *Green Hydrogen in Natural Gas Pipelines: Decarbonization Solution or Pipe Dream?*, gtm (Nov. 30, 2020), https://www.greentechmedia.com/articles/read/green-hydrogen-in-natural-gas-pipelines-decarbonization-solution-or-pipe-dream.
[175] Parfomak at 3–4.
[176] *Id.* at 7.

energy produced per energy input compared to using an electric heat pump, because of the energy-intensity of the hydrogen production.[177]

Q: Are there safety concerns with the use of green hydrogen?

A: Yes, the existing gas pipeline system cannot ensure the safe transport of hydrogen fuel. A study conducted by the Gas Technology Institute for NREL shows that, since hydrogen is the smallest of all molecules, it is three times more likely to leak from existing steel or iron pipelines than fossil gas and methane;[178] estimates from the Congressional Research Service estimate that about 10 percent of hydrogen produced will leak in the processes of production, storage, and transport.[179]

Q: Are there more efficient uses for the limited available supply of green hydrogen than the decarbonization of the building sector?

A: Yes: According to the International Renewable Energy Agency ("IRENA")—an intergovernmental organization promoting the adoption of renewable energy sources— the lowest priority use of hydrogen is residential heating, due to the distributed nature of the application and the relative technological maturity of building electrification as opposed to hydrogen-based clean energy solutions.[180] IRENA recommends hydrogen policy be targeted toward more mature and centralized technology applications, which may be harder to decarbonize with other technologies.[181] Reporting from Bloomberg NEF suggests the most

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[177] Energy Transitions Comm'n, *Making the Hydrogen Economy Possible: Accelerating Clean Hydrogen in an Electrified Economy* 16 (2021), https://energy-transitions.org/wp-content/uploads/2021/04/ETC-Global-Hydrogen-Report.pdf.

[180] Int'l Renewable Energy Agency, *Geopolitics of the Energy Transformation: The Hydrogen Factor* 30 (2022), https://www.irena.org/publications/2022/Jan/Geopolitics-of-the-Energy-Transformation-Hydrogen.

[181] *Id.*

efficient use of green hydrogen may be in the sectors that are toughest to decarbonize, such as manufacturing, which are the least expensive applications of hydrogen; for costlier sectors like power generation and space and water heating, electrification is preferable.[182] In addition, research from the Regulatory Assistance Project finds that it takes about five times more wind or solar energy to heat a home using green hydrogen compared to heating with heat pumps.[183]

Q: Is green hydrogen cost-effective?

A: No: it is not cost-effective when compared to fossil gas or to building electrification. Green hydrogen is costlier than fossil gas, per thousand cubic feet, according to global estimates and U.S. Energy Information Administration ("EIA") data.[184] Research from IRENA concludes that the high costs of green hydrogen are the result of production, transport, conversion, and storage costs as well as a lack of to-scale deployment.[185] IRENA also finds that green hydrogen production costs are 2-3 times higher, in dollars per kilogram, than corresponding costs for "grey" hydrogen (i.e. hydrogen extracted from fossil gas using steam-methane reforming), due largely to a lack of dedicated infrastructure and inefficient production processes.[186]

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[182] BloombergNEF, *Hydrogen Economy Outlook: Key Messages* 2, 6 (2020), https://assets.bbhub.io/professional/sites/24/BNEF-Hydrogen-Economy-Outlook-Key-Messages-30-Mar-2020.pdf

[183] Jan Rosenow, *Heating Homes with Hydrogen: Are We Being Sold a Pup?*, Regul. Assistance Project (Sept. 30, 2020), https://www.raponline.org/blog/heating-homes-with-hydrogen-are-we-being-sold-a-pup/.

[184] Anouti et al.; BloombergNEF, *Hydrogen Economy Outlook*; LAZARD, *LAZARD's Levelized Cost of Hydrogen—Version 2.0* 12 (2021), https://www.lazard.com/media/451895/lazards-levelized-cost-of-hydrogen-analysis-version-20-vf.pdf; Hydrogen Council, *Hydrogen Decarbonization Pathways: Potential Supply Scenarios* (2021), https://hydrogencouncil.com/wp-content/uploads/2021/01/Hydrogen-Council-Report_Decarbonization-Pathways_Part-2_Supply-Scenarios.pdf; Int'l Renewable Energy Agency, *Green Hydrogen*; *Natural Gas Prices*, U.S. Energy Info. Admin. (Apr. 29, 2022), https://www.eia.gov/dnav/ng/ng_pri_sum_dcu_nus_a.htm.

[185] Int'l Renewable Energy Agency, *Geopolitics of the Energy Transformation.*

[186] Int'l Renewable Energy Agency, *Green Hydrogen* at 14, 17.

V: CONSOLIDATED EDISON'S PIPELINE UPGRADES RISK STRANDED ASSETS AND EXTENDED GREENHOUSE GAS EMISSIONS

Q: What are Consolidated Edison's proposed investments in the gas distribution system?

A: In its *Gas Infrastructure, Operations and Supply Panel* ("GIOSP") testimony, Consolidated Edison proposes a total investment of $1.4 billion in gas distribution system upgrades between 2023 and 2025 that have the stated intention of reducing methane emissions associated with gas leaks (see Table 4). (This cost allocation provides emission reduction from 2023 to 2025 only; it does not provide the full 75 percent reduction in fugitive emissions discussed below.) The largest gas capital investments—by far—are Consolidated Edison's proposals to replace 255 miles of leak prone gas pipeline (including "12-inch and smaller cast iron, wrought iron, and unprotected steel mains"[187]) and to install advanced metering in buildings.[188]

Table 4. Consolidated Edison's proposed gas distribution system upgrades

Program	Investment	Goal
Main & Service Replacement Program	$1.3 billion	Replace 255 miles of leak prone pipe between 2023-2025
Advanced Metering Infrastructure: Natural Gas Detection Devices and Leak Alarms	$106 million	Install gas detectors where the gas pipe enters a building to detect leaks more quickly
Methane Capture Technology	$3 million	Mitigate methane emissions on larger volume pipe replacements
Advanced Leak Detection and Response	$1.5 million	Conduct monthly leakage surveys of gas mains and aim to repair 85 percent of leaks within 60 days
Total investment	**$1.4 billion**	

Data source: GIOSP Testimony at 37, 38, 55 and 93.

Q: Does Consolidated Edison claim that its proposed investments to the gas distribution system are consistent with the state's decarbonization goals?

[187] GIOSP Testimony at 27.
[188] GIOSP Testimony at 27, *37, 38, 55 and 93.*

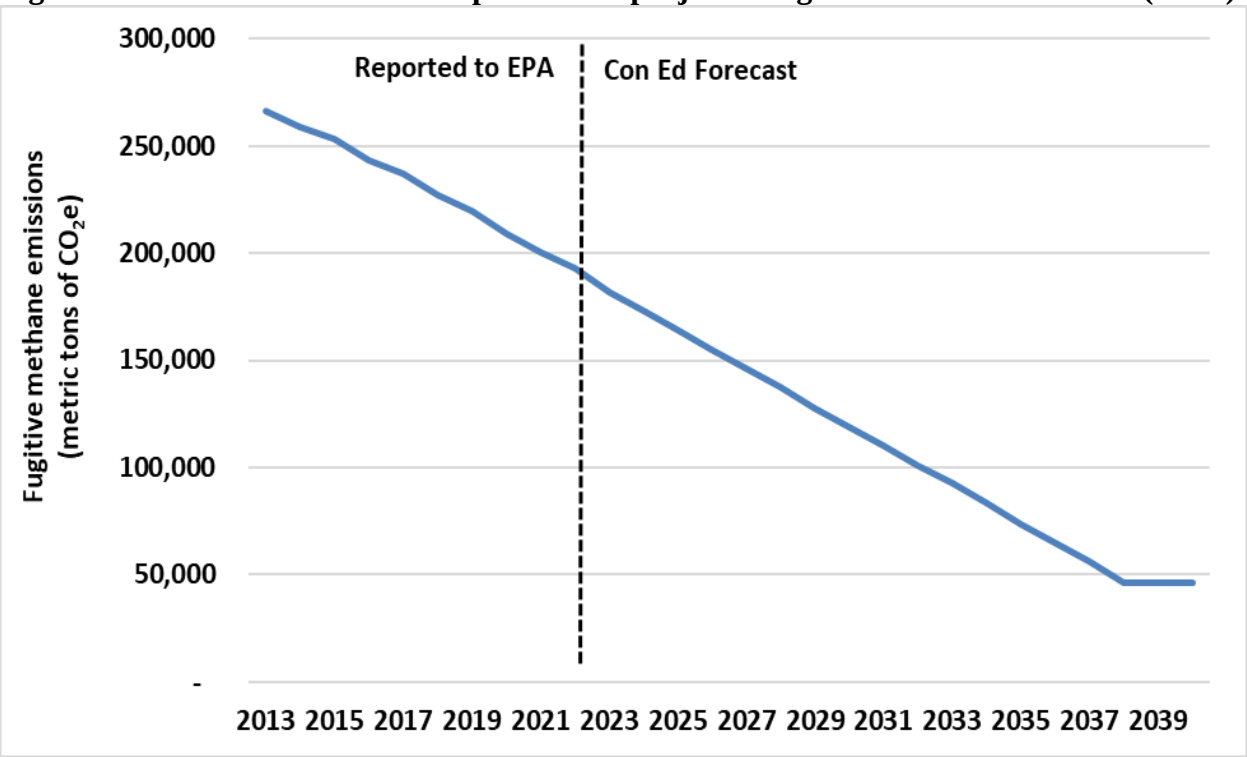
A: Yes, Consolidated Edison claims that its proposed investments in its gas distribution system are consistent with the state's goals to decarbonize the gas system by 2050 and will reduce greenhouse gas emissions—methane emissions, in particular[189]—by replacing leak-prone pipelines,[190] enhancing gas leak detection by installing new gas leak infrastructure and conducting monthly leakage surveys,[191] and introducing methane capture technology at construction sites.[192]

Q: Does Consolidated Edison provide emissions projections for upcoming years? If so, what are they?

A: Yes, Consolidated Edison provides fugitive methane emissions data (i.e. methane from gas leaks) for its distribution main replacement program, including historical data as reported to the U.S. Environmental Protection Agency (EPA) between 2013 and 2022 and forecast data between 2023 and 2040 (see Figure 2). The utility forecasts that its total fugitive methane emissions will decrease from approximately 182,000 metric tons CO_2e in 2023 to approximately 46,000 metric tons in 2040 (a 75 percent decrease).

[189] *Id.* at 13.
[190] *Id.* at 14, 26.
[191] *Id.* at 19, 22.
[192] *Id.* at 38.

Figure 2. Consolidated Edison's reported and projected fugitive methane emissions (CO_2e)



Data source: GIOSP Testimony at 37 tbl.1.

Q: What is the cost per ton of CO_2e reduction of Consolidated Edison's gas main and service replacement program?

A: Consolidated Edison's costs of reducing emissions via pipeline replacement is far more expensive than any other emission mitigation method. Given Consolidated Edison's proposed capital investment, mileage of pipeline to be replaced, and projected methane emission reductions—between 2023 and 2025, it is spending $1,068 to $1,458 per ton of CO_2e reduced (see Table 5). For comparison, McKinsey and Company's estimated abatement costs for a very wide range of decarbonization measures includes measure costs per ton of CO_2 reductions from -$350 per metric ton up to $750 per metric ton; almost all measures' costs fall below $200 per

metric ton.[193] (A negative cost of emissions abatement indicates that a measure returns more benefits that its costs.)

Table 5. Gas main and service replacement program costs

Main & Service Replacement Program				
Year	Capital investment (millions $)	Pipeline replaced (miles)	Single year methane reduction (metric tons CO_2e)	Dollars per metric ton CO_2e
2023	$404.8	85	10,831	$1,068
2024	$425.2	85	8,664	$1,402
2025	$442.2	85	8,664	$1,458
TOTAL	**$1,272**	**255**		

Data source: GIOSP at 35, 37, 38, 55 and 93; my calculation assumes a 35-year lifetime of pipeline infrastructure[194] and, therefore, 35 years of emissions reductions at a constant level.

Q: Are Consolidated Edison's projected emission reductions from its gas main and service replacement program consistent with other sources?

A: Yes. According to Consolidated Edison, between 2023 and 2025, the utility's gas main and service replacement program achieves nearly 520,000 tons CO_2e of methane emission reduction (see Table 5 above). Consolidated Edison does not specify how its methane emission reduction forecast was developed, nor does it distinguish between emissions reductions by pipeline material (i.e. cast iron or unprotected steel) or type (i.e. main versus service pipelines). According to the NYSERDA, methane emissions from leaky pipeline materials range between 2.4 and 4.6 metric tons per mile—similar to the 4.4 metric tons claimed by Consolidated Edison (see Table 6).

[193] *Net Zero or Bust: Beating the Abatement Cost Curve for Growth*, McKinsey & Co., https://www.mckinsey.com/business-functions/operations/our-insights/net-zero-or-bust-beating-the-abatement-cost-curve-for-growth (last updated Apr. 13, 2021).

[194] Internal Revenue Serv. *Internal Revenue Manuals: Part 4. Ch. 41. Oil and Gas Industry, Section 1. Oil and Gas Handbook* Exhibit 4.41.1-28(b) (2013), https://www.irs.gov/irm/part4/irm_04-041-001.

Table 6. Estimated methane emission reductions per mile of gas pipeline according to Consolidated Edison and NYSERDA

Main & Service Replacement Program							
Year	ConEd			NYSERDA			
				Cast iron		Unprotected steel	
	Pipeline replaced (miles)	Methane reduction (metric tons, MTs)	Methane reduction per mile (MTs)	Methane reduction (MTs)	Methane reduction per mile (MTs)	Methane reduction (MTs)	Methane reduction per mile (MTs)
2023	85	377	4.4	391	4.6	205	2.4
2024	85	378	4.4	391	4.6	205	2.4
2025	85	378	4.4	391	4.6	205	2.4
TOTAL	255	1,133	4.4	1,172	4.6	616	2.4

Data sources: GIOSP at 35, 37; Jonathan Dom & Hannah Derrick, Abt Associates, New York State Oil and Gas Methane Emissions Inventory: 2018-2020 Update 19 (2021), https://www.nyserda.ny.gov/-/media/Files/Publications/Energy-Analysis/NYS-oil-gas-sector-methane-inventory-2018-2020.ashx.

Note: NYSERDA emission reduction factors (per mile) are the average of emission factors for gas main and service pipelines.

Q: Do investments in New York's gas distribution system have the potential to extend the lifetime of the system?

A: Yes. According to the U.S. Department of Energy, investment in upgrades do extend the potential life of pipeline systems:

> *New pipeline materials have the potential to increase the lifetime of existing [gas] networks, reduce leaks, and eliminate the need for cathodic protection.*[195]

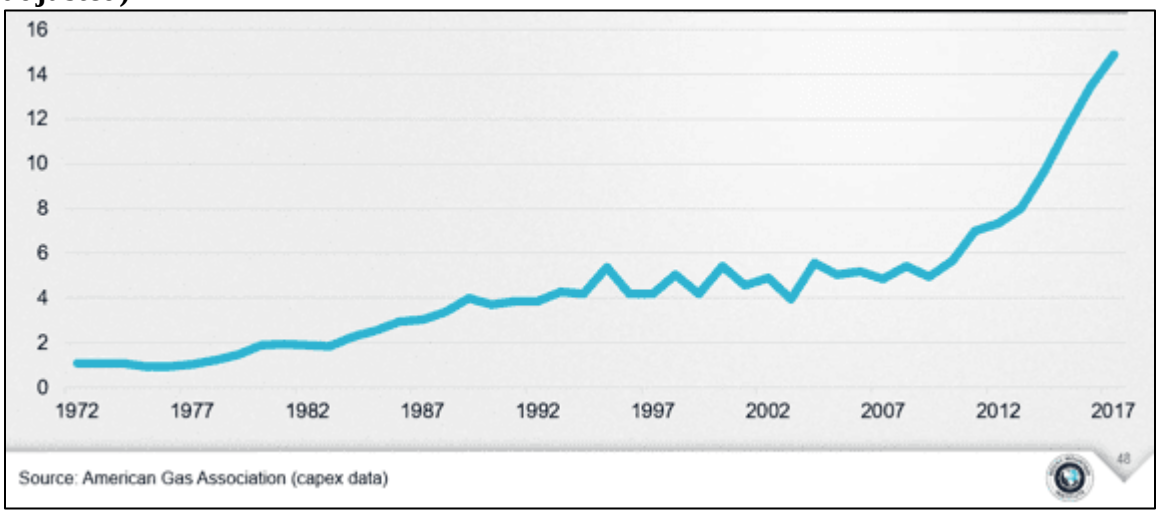
The Rocky Mountain Institute's ("RMI") 2020 article on the United States' gas system age and spending finds that capital investments in the U.S. gas distribution system have tripled between 2009 and 2017, from about $5 billion per year to $15 billion per year (see Figure 3), and that

[195] U.S. Dep't of Energy, *Quadrennial Technology Review 2015, Chapter 7: Advancing Systems and Technologies to Produce Cleaner Fuels* 9 (2015), https://www.energy.gov/sites/default/files/2016/04/f30/QTR2015-7E-Natural-Gas-Delivery-Infrastructure.pdf.

many new gas assets are likely to be retired before the end of their useful lifetime due to climate and emission reduction commitments:

> *The rate at which old pipes are replaced with new pipes has also increased, continuing investment in new assets expected to be in service well beyond the timeframe of mid-century greenhouse gas commitments which may require their retirement.*[196]

Figure 3. U.S. gas distribution system expenditures, 1972-2017 (billions $, inflation-adjusted)



Reproduced from: Henchen & Kroh, A New Approach to America's Rapidly Aging Gas Infrastructure.

Q: What is a stranded asset?

A: As defined in Llyod's of London's *Emerging Risk Report 2017*, stranded assets are "assets that have suffered from anticipated or premature write-downs, devaluation or conversion to liabilities."[197]

Q: Is there a risk that pipeline segments repaired or replaced by Consolidated Edison in the next few years will become stranded assets in the future as CLCPA is implemented?

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[196] Mike Henchen and Kiley Kroh, *A New Approach to America's Rapidly Aging Gas Infrastructure*, Rocky Mountain Inst. (Jan. 6, 2021), https://rmi.org/a-new-approach-to-americas-rapidly-aging-gas-infrastructure/.

[197] Oxford Univ. Smith Sch. of Enter. and Env't, *Emerging Risk Report 2017, Stranded Assets: the Transition to a Low Carbon Economy* 4 (2017), https://assets.lloyds.com/assets/pdf-stranded-assets/1/pdf_stranded-assets.pdf.

A: Yes. According to the Internal Revenue Service's *Oil and Gas Handbook*, gas distribution lines put into service after April 11, 2005 have a useful lifetime of 35 years and should be depreciated over a 20 year-period.[198] If Consolidated Edison replaces 85 miles of gas pipelines in 2023, 2024 and 2025, the capital investment cost of those pipelines (about $5 million per mile, per spending and miles repaired in Table 5) will be recovered through customer rates through 2045 and the pipelines themselves will end their useful lifetime between 2058 and 2060. To comply with the CLCPA, New York State must reduce its total greenhouse gas emissions by at least 40 percent (from 1990 levels) by 2030 and at least 85 percent by 2050. That means that polluting gas infrastructure may need to be retired before the end of its useful lifetime (i.e. become a stranded asset) for New York State to meet its ambitious emission reduction goals. Consolidated Edison expects steep, continued methane emission reductions from its gas main and service replacement program after 2025, suggesting that the company will continue investing in new gas infrastructure in the post-2025 period and further exacerbating its risk of stranded assets (see Figure 2 above). The company also claims that it will accelerate methane emissions reductions by "simplifying" its gas distribution system:

> *We are increasing our efforts to simplify the gas distribution system, which will serve to accelerate our methane emissions reduction. Simplification projects allow us to abandon leak-prone assets that will not be required in the long-term….*[199]

Consolidated Edison may seek to blend CNG, biomethane, and green hydrogen into its pipelines to extend their useful life, but—for the reasons discussed above—those fuels are "false alternatives": They are not feasible, not safe, not reliable, and they do not provide sufficient greenhouse gas emission reductions.

[198] Internal Revenue Serv., *Internal Revenue Manuals*.
[199] GIOSP Testimony at 36.

Q: Will Consolidated Edison's proposed investments in repairs to and maintenance of the pipeline system make it more difficult for the State to achieve its goal of cutting economy-wide greenhouse gas emissions by 40 percent of 1990's levels before 2030 and by 85 percent before 2050?

A: Yes. An emission reduction action—like Consolidated Edison's gas main and service replacement program may move New York State incrementally closer to meeting its clean energy and emission reduction goals in the next decade while creating a larger problem in the 2030s and 2040s. Upgrades to gas pipelines result in fewer gas system leaks lowering near-term emissions, but extend the lifetime of the existing gas system for decades to come—while available alternatives like heat pumps and networked geothermal would eliminate those emissions. Consolidated Edison's future emissions must be understood in the context of a comparison to alternative investments (a large increase in emissions compared to electric heat pumps) and not in comparison to their own past emission from leaky infrastructure. Pipeline upgrade actions result in somewhat lower emissions than the status quo but do not prepare the state for a zero emissions grid in 2050 and an 85 percent reduction in total emissions in 2050. Instead, pipeline upgrades leave rate payers on the hook for paying off investments in assets that must necessarily become stranded over time. For that reason, substantial investments that extend the lifetime of New York State's polluting gas distribution system do not have a positive or successful role to play in meeting CLCPA requirements.

Q: Are there alternative uses of Consolidated Edison's proposed gas distribution system investment funds?

A: Yes, given an appropriate regulatory pathway, Consolidated Edison could instead invest in demand-side measures, networked geothermal or other building electrification measures as an

alternative to gas system investments. Gas assets can be retired when all customers that relied on them have been shifted to utilize electric alternatives.[200] In the GIOSP testimony, Consolidated Edison acknowledges that it must reorient its business practices in order to prepare for lower gas demand as a result of greater building electrification to meet the state's CLCPA requirements.[201]

Q: Are investments in heat pumps, networked geothermal, or demand-side measures likely to become stranded?

A: No. Investments in heat pumps, networked geothermal, and demand-side measures will all remain viable throughout their lifetimes. These decarbonization measures are consistent with CLCPA goals.

VI: RECOMMENDATIONS AND CONCLUSIONS

Q: What steps must Consolidated Edison take to facilitate compliance with the CLCPA?

A: The CLCPA provides clear goals for the State and its energy providers: Greenhouse gas emissions must fall 40 percent (with respect to 1990 levels) by 2030 and 85 percent by 2050. Small, tentative, and incremental measures will not accomplish this goal. Switching from combustion of emitting gas to another will not accomplish this goal. Focusing on fixing gas leaks rather than stopping gas combustion will not accomplish this goal. Consolidated Edison must decarbonize through deep efficiency improvements and building electrification. Nothing else will do.

Q: What are feasible, safe, and reliable alternatives to fossil gas for New York States' space heating, water heating, and gas appliances?

A: Heat pumps, networked geothermal, and demand-side measures are:

[200] Henchen & Kroh, *A New Approach*.
[201] GIOSP Testimony at 35.

- feasible to deploy,
- safe and reliable, and
- able to reduce building-sector emissions to zero as electric supply is decarbonized.

Electrification paired with energy efficiency will meet the State's climate goals. The Company should look to what other gas utilities are doing—both in New York and around the country—to scale up deployment of viable alternatives to fossil gas. Consolidated Edison should expand its investment in programs to decarbonize via electrification and improve building efficiency.

Q: Are so-called "low-carbon fuels" feasible, safe, and reliable?

A: No. CNG, biomethane, and green hydrogen are not feasible, do not provide sufficient greenhouse gas reductions, are not save, and are not reliable. These false alternatives cannot provide New York State with the emission reductions needed to attain its CLCPA goals.

Q: What do Consolidated Edison's proposed pipeline upgrades accomplish?

A: Consolidated Edison's proposed pipeline upgrades accomplish very little in terms of greenhouse gas reduction, and nothing that would not also be accomplished by building electrification. The Company's pipeline upgrades and repairs are expensive, do not provide sufficient greenhouse gas reductions, and lead to stranded assets.

Q: What are your recommendations to the CommissionC in the matter of Case Nos. 22-E-0064 and 22-G-0065?

A: Consolidated Edison's future emissions must be understood in the context of a comparison to alternative investments (a large increase in emissions compared to electric heat pumps and efficiency measures) and not in comparison to their own past emissions from leaky infrastructure. The Commission should reject the Company's application, requiring a resubmission that includes:

1. Transparent reporting of the utility's gas distribution system and customer emissions, both historical and projected through 2050 with and without emission reductions from proposed programs.
2. Program offerings that put the company on a trajectory to a minimum 40 percent reduction (with respect to 1990) in emissions from utility's gas distribution system and customer emissions by 2030 and 85 percent reductions by 2050.

Q. Does this conclude your testimony?

A. Yes.