January 6, 2023

VIA ELECTRONIC MAIL

Connecticut Dept. of Energy and Environmental Protection
Bureau of Energy and Technology Policy
10 Franklin Square
New Britain, CT 06051
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Re: Environmental Advocates' Written Comments for 2022 CES Technical Session 7 – Methane/Natural Gas Distribution Planning and Policies

Dear Bureau of Energy and Technology Policy:

Thank you for the opportunity to submit comments for the 2022 Comprehensive Energy Strategy (CES) Technical Session 7. Conservation Law Foundation, Save the Sound, Sierra Club, Acadia Center, Eastern CT Green Action, Connecticut Citizen Action Group, and People's Action for Clean Energy are public interest organizations that are working to align Connecticut's energy policies with the state's statutory climate commitments and decarbonize the electric sector, transportation sector, and buildings sector, which are the three major sources of Connecticut's greenhouse gas (GHG) emissions. We appreciate the opportunity to provide these joint comments and look forward to engaging further in development of the 2022 CES.

1) **Methane, in the form of natural gas, often has been portrayed as a "bridge to the future" – as an interim solution to help society transition away from the most carbon-intensive fossil fuels (esp. coal and petroleum) as it develops a path to a fully decarbonized energy system. In your view, is this strategy one that Connecticut should continue to pursue? Why or why not? If so, for how long, for which end uses, and why those specific end uses?**

Connecticut should explicitly reject methane gas as a decarbonization strategy in the 2022 CES. State regulators have recognized that expanding reliance on natural gas is a flawed strategy from both a climate and consumer perspective, explicitly rejecting the characterization of natural gas as a "bridge fuel"[1] and accelerating the termination of incentives to expand reliance on natural gas for heating.[2] The outdated concept of methane gas as a "bridge fuel" rests on the assumption that switching to gas *from other fossil fuels* is beneficial from a climate perspective because burning gas generates fewer carbon emissions than burning coal or oil.[3] But

[1] Gregory B. Hladky, "Lamont administration weighing major shifts on regional power grid, natural gas," Hartford Courant (Jan. 15, 2020), https://www.courant.com/news/connecticut/hc-news-trinity-environmental-summit-20200115-q6iewwqw6bb7degdhnfnrt4ony-story.html..
[2] PURA Docket No. 21-08-24, Final Decision (Apr. 27, 2022).
[3] U.S. Energy Information Administration, *How much carbon dioxide is produced when different fuels are burned?*, https://www.eia.gov/tools/faqs/faq.php?id=73&t=11.

gas is mostly methane, an extremely potent greenhouse gas that contributes significantly to climate change.[4] Methane is 84 times more potent than carbon dioxide in the first 20 years after its release,[5] and is still 28-36 times as potent after 100 years.[6] When methane leakage is fully accounted for, the purported climate benefits of gas largely disappear.[7] Moreover, these leakage rates are underestimated in existing inventories,[8] which suggests that the climate impacts of gas are even greater than currently estimated.

There is growing consensus that all fossil fuels, *including methane gas*, must be rapidly phased out to meet scientifically supported GHG reduction goals and avert catastrophic global warming.[9] But this shift is not happening fast enough, as the gas industry and other proponents of gas continue spreading false claims about gas being a "clean" fuel. Contrary to this misleading narrative, methane gas is not a more climate friendly alternative to other fossil fuels. The UN Global Methane Assessment concludes that methane is "responsible for about 30 percent of [global] warming since pre-industrial times" and that "[u]rgent steps must be taken to reduce methane emissions this decade."[10]

Moreover, the misconstrued notion of gas as a "bridge fuel" implicitly assumes that zero-carbon sources of energy are not currently a viable alternative. That is not the case. In the buildings sector, electrification is increasingly acknowledged as a cost-effective decarbonization strategy.[11] Meanwhile, the cost of gas heating has increased in recent years, as PURA noted when it ended Connecticut's gas expansion program in 2022.[12] Gas prices have been especially volatile over the past year due to geopolitical events in Eastern Europe and the resulting energy crisis, which have contributed to price spikes in Connecticut and across New England.[13]

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[4] U.N. Environment Programme, *Global Assessment: Urgent steps must be taken to reduce methane emissions this decade* (May 6, 2021), https://www.unep.org/news-and-stories/press-release/global-assessment-urgent-steps-must-be-taken-reduce-methane ("Rick Duke, Senior Advisor to the U.S. Special Presidential Envoy on Climate Change, said: 'Methane accounts for nearly one-fifth of global greenhouse gas emissions and . . . it is by far the top priority short-lived climate pollutant that we need to tackle to keep 1.5˚C [of warming] within reach.'").

[5] U.N. Economic Commission for Europe, *Methane Management: The Challenge*, https://unece.org/challenge.

[6] U.S. EPA, *Greenhouse Gas Emissions: Understanding Global Warming Potentials*, https://www.epa.gov/ghgemissions/understanding-global-warming-potentials.

[7] *See, e.g.*, Nicholas Kusnetz, *Is Natural Gas Really Helping the U.S. Cut Emissions?* (Jan. 30, 2020), https://insideclimatenews.org/news/30012020/natural-gas-methane-carbon-emissions/.

[8] Maryann R. Sargent, *Majority of US Urban Natural Gas Emissions Unaccounted for in Inventories*, https://www.pnas.org/content/118/44/e2105804118 (measured methane leakage around Boston and estimated total supply chain losses of 3.3 to 4.7% for natural gas consumed in urban areas, which significantly increases the climate impacts of natural gas compared to existing U.S. EPA estimates); Ramon A. Alvarez, *Assessment of Methane Emissions from the U.S. Oil and Gas Supply Chain*, Science, Vol 361, Issue 6398 (July 13, 2018) (finding that supply chain emissions were approximately 60% higher than the U.S. EPA inventory estimate).

[9] *See* Nina Chestney, Reuters, *End new oil, gas and coal funding to reach net zero, says IEA* (May 18, 2021), https://www.reuters.com/business/environment/radical-change-needed-reach-net-zero-emissions-iea-2021-05-18/.

[10] U.N. Environment Programme, *Global Assessment: Urgent steps must be taken to reduce methane emissions this decade* (May 6, 2021), https://www.unep.org/news-and-stories/press-release/global-assessment-urgent-steps-must-be-taken-reduce-methane

[11] *See, e.g.*, Sherri Billimoria *et al.*, Rocky Mountain Institute, The Economics of Electrifying Buildings, 20 (June 2018), https://rmi.org/wp-content/uploads/2018/06/RMI_Economics_of_Electrifying_Buildings_2018.pdf.

[12] PURA Docket No. 21-08-24, Final Decision, 12-14 (Apr. 27, 2022).

[13] Scott Disavino & Laura Sanicola, Reuters, *Frigid winter? New Englanders will pay through frozen noses for oil and gas* (Nov. 2, 2022), https://www.reuters.com/business/energy/frigid-winter-new-englanders-will-pay-through-

Continuing to expand gas use is also incompatible with state climate and energy policy, as PURA concluded in winding down the System Expansion Plan.[14]

In the electric sector, gas must be phased out in favor of zero-carbon energy sources like wind and solar, coupled with complementary technologies and programs like energy efficiency, storage, and demand response programs. Like California, Connecticut should commit to meeting its electricity demand *without* any new fossil gas-fired resources.[15] Like New York,[16] Connecticut should develop a plan for replacing the state's gas-fired power plants with zero-carbon sources of generation on a timeline consistent with state climate goals.[17] The transition away from gas in the electric sector will not happen overnight. New transmission lines are urgently needed to support increased renewable deployment, especially for offshore wind,[18] and continued operation of the Millstone nuclear plant will be an important source of zero-emission baseload generation. But planning for this transition is essential to ensure that gas-fired plants are retired as quickly as possible while still meeting electricity demand and maintaining grid reliability.

Continuing to build new gas infrastructure is fundamentally at odds with climate action because it would lock in decades of additional gas use—and the associated GHG emissions that contribute to climate change. If this infrastructure is built, there is a huge risk that it will be used for the rest of its useful life and prevent Connecticut from meeting state climate goals. Or, if this infrastructure must cease operating before the end of its useful life, Connecticut will be left with stranded assets.[19] There is substantial risk that the cost of paying for these assets will be passed on to gas ratepayers, which raises serious equity concerns. The number of gas ratepayers will decline as more people electrify their homes, and the last remaining gas customers are likely to be renters, low-income residents, and others who face barriers to home electrification. These customers can least afford to pay more for energy and should not be saddled with the costs of maintaining the gas system or paying for stranded assets.

As discussed further below, Connecticut must develop a strategic and equitable plan for winding down gas use and fairly distributing the costs associated with this transition. And the

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frozen-noses-oil-gas-2022-11-02/; Jan Ellen Spiegel, CT Mirror, *The winter energy crunch, what it costs, and what it will take to fix it* (Jan. 3, 2023), https://ctmirror.org/2023/01/03/ct-energy-winter-shortage-natural-gas/.

[14] PURA Docket No. 21-08-24, Final Decision, 15-16 (Apr. 27, 2022).

[15] California Air Resources Board, *2022 Scoping Plan for Achieving Carbon Neutrality*, 75 (Nov. 16, 2022), https://ww2.arb.ca.gov/sites/default/files/2022-12/2022-sp.pdf; Letter from Governor Newsom to CARB Chair Liane Randolph (July 22, 2022), https://www.gov.ca.gov/wp-content/uploads/2022/07/07.22.2022-Governors-Letter-to-CARB.pdf.

[16] New York State Climate Action Council, *New York State Climate Action Council Scoping Plan*, 225-30 (Dec. 2022), https://climate.ny.gov/-/media/project/climate/files/NYS-Climate-Action-Council-Final-Scoping-Plan-2022.pdf.

[17] Carbon capture and storage (CCS) technology continues to be discussed as a potential strategy to continue operating gas-fired power plants and other industrial operations while capturing their emissions. However, this technology continues to be extremely expensive and has not reliably captured *and permanently stored* the carbon that is produced. Connecticut should not count on CCS to help achieve state climate goals, though CCS may play some role in decarbonization *if* the economic and technological challenges are satisfactorily resolved.

[18] The New England States Regional Transmission Initiative aims to address this problem. New England States Regional Transmission Initiative, https://newenglandenergyvision.com/new-england-states-transmission-initiative/.

[19] *See* Heather Payne, *The Natural Gas Paradox: Shutting Down a System Designed to Operate Forever*, 80 Md. L. Rev. 693 (2021), https://digitalcommons.law.umaryland.edu/mlr/vol80/iss3/4.

state should not approve new investments in gas infrastructure except when unavoidable (*e.g.*, for safety reasons). This approach is consistent with state climate goals and will minimize the risk of stranded assets. Connecticut has already dug a very deep, very expensive hole by investing heavily in gas over the past decade. Now that the alarming cost and climate implications of this strategy are clear, the state must avoid making further investments in gas and instead focus on phasing out gas on a timeline consistent with state climate commitments.

2) How should Connecticut's energy policy handle any tradeoffs between methane's climate/environmental impacts and the reliability and resilience benefits it can be understood to offer?

Connecticut's, and the region's, reliance on methane gas should be properly viewed as a threat to reliability, rather than a benefit. New England's overreliance on methane/natural gas has been identified as a problem for the winter reliability of the electricity grid and a threat to energy security in New England due to competing demand for power generation and heating, compounded by inadequate storage and pipeline capacity.[20]

While investing in expanded pipeline infrastructure and increased regional imports of liquified natural gas (LNG) have been proposed as approaches to addressing the problem of winter reliability, such approaches do nothing to solve the price volatility of natural gas and increases the risk of customers being required to pay for the stranded costs of obsolete gas infrastructure as renewables and battery storage solutions continue to increase their share of the regional power generation portfolio.[21] As noted by FERC, even with anticipated natural gas production increases outpacing domestic winter demand, "the continued growth in net exports… will place additional pressure on natural gas prices this winter."[22] Moreover, in a global energy market expanding gas capacity does not ensure gas availability when needed since LNG deliveries will go to international markets with the highest price.[23] Finally, pipeline capacity constraints in New England are limited to the winter season and only threaten reliability during periods of extreme cold; for the majority of the year, the existing pipelines have excess capacity.[24] Addressing this limited seasonal constraint through the buildout of gas capacity means inefficiently over-building the system beyond what is needed the majority of the time.

[20] FERC, Winter Energy Market and Reliability Assessment 2022-2022 (Staff Report) (Oct. 20, 2022, updated Oct. 25, 2022), https://www.ferc.gov/media/report-2022-2023-winter-assessment#.
[21] Rachel Morison, "Gas Is The New Coal With Risk of $100 Billion in Stranded Assets," Bloomberg News (Apr. 17, 2021), https://www.bloomberg.com/news/articles/2021-04-17/gas-is-the-new-coal-with-risk-of-100-billion-in-stranded-assets?srnd=premium-asia#xj4y7vzkg.
[22] FERC, Winter Energy Market and Reliability Assessment 2022-2022 (Staff Report) at 1 (Oct. 20, 2022, updated Oct. 25, 2022), https://www.ferc.gov/media/report-2022-2023-winter-assessment#.
[23] *See, e.g.*, Amanda Gokee, "Energy costs could keep climbing amid ongoing market volatility," New Hampshire Bulletin (Dec. 7, 2022) ("A tanker full of liquefied natural gas heads to New England's largest electricity generator. Then, it abruptly changes course, abandoning its North American contract for a higher bidder in Europe."), https://newhampshirebulletin.com/2022/12/07/energy-costs-could-keep-climbing-amid-ongoing-market-volatility/; Marianna Parraga, "More U.S. LNG heads to Europe despite output constraints," Reuters (Oct. 3, 2022), https://www.reuters.com/business/energy/more-us-lng-heads-europe-despite-output-constraints-2022-10-03/.
[24] FERC, Winter Energy Market and Reliability Assessment 2022-2022 (Staff Report) at 37 (Oct. 20, 2022, updated Oct. 25, 2022), https://www.ferc.gov/media/report-2022-2023-winter-assessment#.

Continued investment in renewable energy generation, expanding battery storage capacity, and transitioning building heating loads to heat pumps, on the other hand, solves multiple problems simultaneously. While this strategy is essential for meeting Connecticut's climate obligations, it also addresses winter reliability concerns by reducing the current demands on the existing natural gas system for both power generation and heating. Additionally, while global demand will continue to drive the price of natural gas, reducing our own reliance on gas will help to insulate Connecticut consumers from price increases and volatility driven by geopolitical events and other factors outside our control, such as the war in Ukraine.

Accordingly, rather than stranding investments in new gas infrastructure, that investment should be devoted to building out the regional transmission grid in a manner that supports the deployment of renewable generation at the necessary scale and in a manner that actually enhances grid reliability and resilience.

3) To what extent should Connecticut pursue reductions in the carbon intensity of distributed methane? Which of the following methods for doing so are promising, which are not, and why?

A key consideration is whether strategies to reduce the intensity of methane risk prolonging the use of methane. Alternative fuels are expensive, often have less climate benefit than anticipated due to leaks, and have widely varying levels of lifecycle emissions that are poorly understood and accounted for in GHG inventories. Maintenance of gas infrastructure will also be expensive. Rather than making huge investments in replacing aging pipelines and associated infrastructure, the state should focus on non-pipeline alternatives and electrification, while limiting its pipeline investments to highest-value applications (*e.g.*, where replacements are critically needed due to safety concerns or where alternative options are not feasible).

a) Substitution with renewable natural gas, hydrogen, and/or synthetic gas

Deployment of alternative fuels including green hydrogen and RNG should be limited to hard-to-decarbonize applications that cannot easily or cost-effectively be electrified, and any buildout of infrastructure should focus on those applications. Such hard-to-decarbonize end uses include high-heat industrial processes, aviation, maritime, chemical feedstocks, and long-haul trucking. Connecticut should not invest in infrastructure to distribute hydrogen and RNG to buildings through the gas distribution system.

i. Renewable natural gas (RNG)

There is no viable pathway to decarbonize the buildings sector using RNG because of the limited quantity of the resource that is available, its high cost, and its lack of emissions reduction benefits when injected into a leak prone distribution system. The available supply of RNG cannot meet the needs of the end uses currently served by gas at anywhere near today's volumes.[25] The optimistic scenario from the American Gas Foundation (AGF) and ICF International finds that potential RNG supply would meet only 12% of current U.S. gas demand

[25] Abigail Lalakea Alter, Sherri Billimoria, and Mike Henchen, RMI, Overextended: It's Time to Rethink Subsidized Gas Line Extensions, Rocky Mountain Institute, December 2021, p. 11.

by 2040.[26] There is a limited supply of RNG available for use in Connecticut, and availability is unlikely to increase due to limited supply and due to demand from competing hard-to-electrify sectors in which RNG will be critical. New England has minimal biogas potential. Five of the six New England states, including Connecticut, rank among the twelve states with the least biogas potential.[27] Massachusetts also has limited biogas potential,[28] with one study finding that Massachusetts' annual RNG potential could displace just 10% of its fossil gas demand.[29] Nationally, it is estimated that biogas potential could replace just 5% of fossil gas consumption in the electric sector.[30] Other studies estimate that RNG could meet around 12%[31] or 14%[32] percent of the United States' total gas demand in a high resource potential scenario, with estimates of environmentally sound biogas being as low as 2-5%.[33] In CES Technical Session #6, Mike Henchen of RMI noted that "RNG potential estimates in Connecticut are just 2-4% of statewide gas demand and 6-12% of buildings' demand."[34] Moreover, only 40% of the state's RNG potential could be met through anaerobic digestion—with thermal gasification from various sources, mostly municipal solid waste, accounting for the other 60%.[35] This is deeply concerning from a climate perspective because thermal gasification involves creating new methane that would not otherwise exist, which can then leak and contribute to climate change. There are also serious environmental and environmental justice concerns associated with gasification.

RNG is expensive to produce or procure, and its consumer price is approximately three times the price of fossil gas.[36] Further, the infrastructure costs associated with RNG are substantial and huge investments would be needed to ramp up supply, which is limited. All three of New England's current RNG projects had high startup costs,[37] and new facilities would likely

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[26] *Renewable Sources of Natural Gas: Supply and Emissions Reduction Assessment*, American Gas Foundation and ICF International, December 2019, https://www.gasfoundation.org/wp-content/ uploads/2019/12/AGF-2019-RNG-Study-Full-Report-FINAL-12-18-19.pdf.
[27] National Renewable Energy Laboratory (NREL), *Biogas Potential in the United States*, 3 (Oct. 2013), https://www.nrel.gov/docs/fy14osti/60178.pdf.
[28] *Id.*
[29] National Grid, *Renewable Gas - Vision for a Sustainable Gas Network*, 2 (2010), https://www9.nationalgridus.com/non_html/NG_renewable_WP.pdf.
[30] National Renewable Energy Laboratory (NREL), *Biogas Potential in the United States*, 3 (Oct. 2013), https://www.nrel.gov/docs/fy14osti/60178.pdf.
[31] The American Gas Foundation found that in a "high resource potential scenario", 4,510 trillion Btus of RNG would be available in 2040. American Gas Foundation, *Renewable Sources of Natural Gas: Supply and Emissions Reduction Assessment*, 2 (2019), https://gasfoundation.org/2019/12/18/renewable-sources-of-natural-gas/. Assuming, as reported by the EIA, the US used 31.5 quadrillion btus of gas in 2020, that amounts to about 12% of current US gas demand. U.S. Energy Information Administration. *Natural Gas Explained*, https://www.eia.gov/energyexplained/natural-gas/use-of-natural-gas.php.
[32] Philip Sheehy *et al.*, *Exploring renewable natural gas as a decarbonization strategy* (2021) https://www.icf.com/insights/energy/renewable-natural-gas-decarbonization-strategy.
[33] Natural Resources Defense Council, *A Pipe Dream or Climate Solution? The Opportunities and Limits of Biogas and Synthetic Gas to Replace Fossil Gas*, 5 (2020), https://www.nrdc.org/resources/pipe-dream-or-climate-solution.
[34] Mike Henchen, RMI, *Low Carbon Fuels' Limited Role in Building Decarbonization*, Slide 55 (Nov. 4, 2022), https://portal.ct.gov/-/media/DEEP/energy/ConserLoadMgmt/Master-Slide-Deck_TM-6_Alt-Fuels_PM.pdf.
[35] *Id.*
[36] Programs Manual – Vermont Gas Systems, 10 (Aug. 20, 2019), https://www.vermontgas.com/wp-content/uploads/2018/09/VGS-RNG-Manual-Final-V-1.01.pdf.
[37] University of New Hampshire, *Cogeneration and EcoLine*, https://www.unh.edu/sustainability/operations/energy/ecoline (landfill RNG project cost $49 million); Elizabeth

face steep cost hurdles as well. The production and procurement costs for RNG vary widely. It costs between $3.00 and $30.00 per MMBtu to produce RNG.[38] At its cheapest, RNG production can cost less than fossil gas, which ranges from $2.52 to $4.37 per MMBtu.[39] However, RNG production estimates often exclude the cost of removing siloxanes from RNG produced with consumer waste, so lower costs may not be feasible.[40] Importing RNG is also costly: imported RNG costs between $12 and $25 per Mcf, while imported fossil gas costs $3 per Mcf.[41] If Connecticut increases its use of RNG, it would be costly whether the gas is produced in-state or imported from elsewhere.

The emissions reduction benefits of RNG relative to fossil gas vary greatly depending on the feedstock. Emissions must be carefully examined in determining whether different sources of RNG will have a net positive environmental impact. Evaluation of the climate impacts of RNG must consider the energy required to produce it, whether the source creates new methane where none or little would have existed otherwise, and how much methane leaks during production, transmission and distribution.[42] Due to the very limited quantity of RNG that will be available in Connecticut, transmission will be particularly challenging, as RNG would need to be transmitted from the midwest. Given these constraints, the Natural Resources Defense Council assessed the ecologically sound supply of RNG at about half the AGF's estimate, just 3%–7% of current U.S. gas demand.[43] The limited supply of climate-beneficial biogas must be deployed to address hard to decarbonize sectors of the economy, ideally where it can be burned onsite for heat or electricity to avoid leakage from transportation through the pipeline system.

RNG is essentially methane and is just as harmful from a climate perspective as fossil gas when it leaks into the atmosphere. Injecting RNG into a leaking gas distribution system would not provide significant emissions reductions benefits relative to fossil gas, because the gas leaking from the system would still be methane—a highly potent greenhouse gas with a 20-year global warming potential 84 times that of carbon dioxide.[44] The region's aging gas distribution system is significantly leak prone and leakage rates are currently vastly underestimated in existing inventories. A recent Harvard University study of methane leaks from the distribution

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Gribkoff, VT Digger, *Partners Hail Groundbreaking of Salisbury Biodigester* (Aug. 20, 2019) https://vtdigger.org/2019/08/20/partners-hail-groundbreaking-of-salisbury-biodigester/ (Goodrich Farm project cost $20 million); Summit Natural Gas Maine, *Summit Announces Renewable Natural Gas Initiative*, (May 23, 2019), https://summitnaturalgasmaine.com/SummitAnnouncesRenewableNaturalGasInitiative (Summit Maine project projected to cost $20 million).

[38] Rebecca Gasper & Tim Searchinger, World Resources Institute, *The Production and Use of Waste-Derived Renewable Natural Gas as a Climate Strategy in the United States*, 24 (Apr. 2018), https://www.wri.org/publication/renewable-natural-gas.

[39] *Id.* at 23.

[40] Gregory Von Wald *et al.*, *Biomethane in California Common Carrier Pipelines: Assessing Heating Value and Maximum Siloxane Specifications*, 70 (June 2018), https://ccst.us/wp-content/uploads/2018biomethane.pdf.

[41] Vermont Public Service Board, Docket No. 8667, Petition of Vermont Gas Systems, Prefiled Testimony of Thomas Murray on Behalf of Vermont Gas Systems, 8-9:21-1 (Oct. 23, 2015).

[42] Merrian Borgerson, "A Pipe Dream or Climate Solution?" NRDC, p. 6, June 2020, https://www.nrdc.org/sites/default/files/pipe-dream-climate-solution-bio-synthetic-gas-ib.pdf

[43] *Id.* at 5.

[44] Environmental Defense Fund, Methane: The other important greenhouse gas, https://www.edf.org/climate/methane-other-important-greenhouse-gas.

system in Boston, MA found a leak rate of 4.7% from well pad to urban consumer.[45] The study observed no changes in the level of methane emissions in the city over a period of eight years, despite a concerted effort over that time to improve leakage from the system.[46] Similarly, a 2019 study of methane leaks in Hartford, CT estimated 4.3 methane leaks per road mile, up from 3.4 methane leaks per road mile observed in 2016.[47] The study also found 3.6 leaks per road mile in Danbury. These increases were observed despite significant investment from utilities to replace leaking gas lines.[48] Another study found that national supply chain emissions for methane were approximately 60% higher than the U.S. EPA inventory estimate.[49] Such high leakage rates significantly increase the climate impacts of natural gas compared to existing estimates. A recent study concluded that because methane leaks along the entire RNG supply chain are so significant, simply flaring landfill gas at its point of origin results in lower GHG emissions than transporting it for other uses through pipes.[50]

ii. Green hydrogen

Hydrogen is not a viable pathway to decarbonization for the buildings sector due to the scarcity of green hydrogen, the large amounts of renewable energy required to produce it, the high costs and safety concerns associated with hydrogen, the inability to utilize hydrogen in existing gas infrastructure and appliances, the nascent state of hydrogen research and development, and diminishing climate benefits when hydrogen is injected into a leaking distribution system. Replacing fossil gas in the buildings sector with green hydrogen makes little sense where the clean electricity that would be used to produce green hydrogen via electrolysis can directly support the desired end use via electrification, as green hydrogen production is a highly inefficient use of clean energy resources. For end uses that can be electrified directly, including buildings and most forms of transportation, it is far more efficient and cost-effective to use electricity directly (*e.g.*, to power electric vehicles and electric heat pumps) rather than using it to produce green hydrogen.[51] Green hydrogen should be reserved for end uses that are much more challenging to electrify, such as aviation, high-heat industrial end-uses, shipping, and chemical feedstocks. Diversion of limited hydrogen supplies away from these sectors for use in buildings would make achieving both state and national climate targets more difficult.

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[45] Maryann R. Sargent, *Majority of US Urban Natural Gas Emissions Unaccounted for in Inventories*, https://www.pnas.org/content/118/44/e2105804118 (measured methane leakage around Boston and estimated total supply chain losses of 3.3 to 4.7% for natural gas consumed in urban areas, which significantly increases the climate impacts of natural gas compared to existing U.S. EPA estimates). *See also* Ramon A. Alvarez, *Assessment of Methane Emissions from the U.S. Oil and Gas Supply Chain*, Science, Vol 361, Issue 6398 (July 13, 2018) (finding that supply chain emissions were approximately 60% higher than the U.S. EPA inventory estimate).

[46] *Id.*

[47] Tim Keyes, et al, *Connecticut Mobile Methane Leaks Survey and Analysis Results* (Apr. 1, 2019), https://static.wixstatic.com/ugd/66f28e_7e62af04d87a40568aafff9327695532.pdf.

[48] Connecticut Natural Gas, which serves the Hartford area, replaced 37 miles of aging pipes in 2016 and Eversource, which serves Danbury, has replaced more than 175 miles of gas lines in Connecticut since 2012.

[49] Ramon A. Alvarez, et al., *Assessment of methane emissions from the U.S. oil and gas supply chain*, SCIENCE (June 21. 2018), https://www.science.org/doi/full/10.1126/science.aar7204.

[50] Emily Grubert, "At scale, renewable natural gas systems could be climate intensive: the influence of methane feedstock and leakage rates," 2020 *Environmental Research Letters* 15 084041, https://iopscience.iop.org/article/10.1088/1748-9326/ab9335/pdf.

[51] Cara Bottorff, Sierra Club, *Challenges with Alternative Fuels and Strategies for Optimal Use*, Slide 63 (labeled Page 65) (Nov. 4, 2022), https://portal.ct.gov/-/media/DEEP/energy/ConserLoadMgmt/Master-Slide-Deck_TM-6_Alt-Fuels_PM.pdf (estimating that "Green hydrogen is 20-40% less efficient than using renewables directly").

Green hydrogen is produced using only renewable energy sources to power the electrolysis of water. Currently, electrolysis of water accounts for less than 0.1% of hydrogen production.[52] Globally, less than 0.02% is produced from electrolysis powered purely by renewable electricity."[53] And while production of green hydrogen is likely to increase significantly in coming years, the availability of renewable resources needed to produce green hydrogen will remain a limiting factor. Currently, fossil gas generates 53% of electricity in the New England regional grid.[54] Renewable generation and storage dominate the interconnection queue,[55] but there are questions about how quickly these resources can be integrated into the grid due to factors that are hindering the urgently needed expansion of transmission infrastructure and market reforms that would accelerate the deployment of renewables in the region.

Decarbonizing the grid while maintaining reliability and keeping up with increased electricity demand is already a major challenge. Using electricity to produce green hydrogen would further increase demand and make it harder for New England states to decarbonize the grid and meet their state climate goals. The Massachusetts 2050 Energy Pathways Report found that green hydrogen is unlikely to scale until there are sufficient surplus quantities of renewable electricity for cost-effective production, which the report projected would occur in the 2040s at the earliest.[56] And even in such a scenario, the report found that green hydrogen was likely to be cost-effective only in difficult-to-electrify sectors, with electrification still being more cost-effective in the buildings sector.[57]

There are also significant safety and infrastructure concerns associated with hydrogen due to its higher flammability and leakage rates.[58] Upgrading existing gas infrastructure and appliances to safely transport and use hydrogen in the building sector would require enormous investments, which do not make economic sense given the need to prioritize hydrogen for hard-to-decarbonize applications. While costs are likely to decline over time given the substantial investment in green hydrogen production and deployment, such a massive overhaul of existing infrastructure would take many years, at a time when emissions reductions must be achieved as quickly as possible. Use of green hydrogen in the building sector does not make sense from a cost perspective and would not reduce emissions at the speed and scope needed to meet state climate goals.

Further, hydrogen can cause pipe embrittlement and cannot safely be transported through many existing gas pipelines.[59] While estimates may vary by distribution system, hydrogen cannot

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[52] International Energy Agency, *The Future of Hydrogen: Seizing Today's Opportunities*, 42 (2019), https://iea.blob.core.windows.net/assets/9e3a3493-b9a6-4b7d-b499-7ca48e357561/The_Future_of_Hydrogen.pdf.
[53] Sara Gersen & Sasan Saadat, Earthjustice, *Reclaiming Hydrogen for a Renewable Future*, 7 (Aug. 2021), https://earthjustice.org/sites/default/files/files/hydrogen_earthjustice_2021.pdf.
[54] ISO-New England, *Resource Mix*, https://www.iso-ne.com/about/key-stats/resource-mix.
[55] ISO-New England, *Generator Interconnection Queue*, https://irtt.iso-ne.com/reports/external.
[56] Buildings Sector Report: A Technical Report of the Massachusetts 2050 Decarbonization Roadmap Study, 5 (2020), https://www.mass.gov/doc/building-sector-technical-report/download.
[57] *Id.* at 103.
[58] Sara Gersen & Sasan Saadat, Earthjustice, *Reclaiming Hydrogen for a Renewable Future*, 19 (Aug. 2021), https://earthjustice.org/sites/default/files/files/hydrogen_earthjustice_2021.pdf.
[59] *Id.*

be blended into the gas distribution system at high volumes. An empirical study of hydrogen blending conducted this year by the California Public Utilities Commission found that a "systemwide blending injection scenario becomes concerning as hydrogen blending approaches 5% by volume."[60] In Connecticut, over 50% of gas mains are made of steel or iron, which cannot be used to transport a high level of hydrogen.[61] Upgrading or replacing these pipelines so they could be safely used for hydrogen would be enormously expensive: "[b]uilding a hydrogen pipeline can cost up to 68% more per mile than a conventional fossil gas pipeline."[62] Using truck or rail transport would also be expensive because hydrogen must be highly compressed, making these options realistic only for smaller volumes of hydrogen.[63]

In addition, there are limits on how much hydrogen can be used in home appliances like furnaces and boilers. Appliances that were designed for methane gas cannot safely accommodate a high level of hydrogen.[64] Most equipment can only use a blend of up to 25% hydrogen.[65] Such a low level of hydrogen blending has limited emissions benefits (even assuming green hydrogen is used), because the remaining 75% of fuel would still be methane. Replacing the equipment so it can accommodate higher levels of hydrogen would be more costly than simply switching to an electric heat pump because there are so many associated infrastructure upgrades needed to safely transport and use high levels of hydrogen to heat buildings. And, as Mike Henchen of RMI noted during Technical Session #6, using hydrogen to heat buildings "would require significantly more energy input than heating with an electric heat pump" because producing green hydrogen and using it for heating is much less efficient than using electricity directly.[66]

Numerous other technical and practical barriers impede the safe and cost-effective deployment of hydrogen at scale and especially in the buildings sector. Hydrogen is an indirect greenhouse gas with a 100-year global warming potential 5.8 times greater than carbon dioxide.[67] Recent research suggests that on shorter (and more relevant) time scales, the global warming potential for hydrogen is far higher: 19 to 38 for 20-year global warming potential and 34 to 66 for 10-year global warming potential.[68] Hydrogen cannot provide substantial

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[60] California Public Utilities Commission, Rulemaking No. R.13-02-008, Hydrogen Blending Impacts Study: Final Report (July 18, 2022).

[61] Mike Henchen, RMI, *Low Carbon Fuels' Limited Role in Building Decarbonization*, Slide 53 (Nov. 4, 2022), https://portal.ct.gov/-/media/DEEP/energy/ConserLoadMgmt/Master-Slide-Deck_TM-6_Alt-Fuels_PM.pdf.

[62] Sara Gersen & Sasan Saadat, Earthjustice, *Reclaiming Hydrogen for a Renewable Future*, 19 (Aug. 2021), https://earthjustice.org/sites/default/files/files/hydrogen_earthjustice_2021.pdf (citing Julien Dumoulin-Smith et al., US Alternative Energy, Bank of America, at 4 (June 28, 2021).

[63] *Id.*

[64] *Id.* at 27; Jairo Duran, *Safety Issues to Consider When Blending Hydrogen with Natural Gas* (Feb. 17, 2021), https://processecology.com/articles/safety-issues-to-consider-when-blending-hydrogen-with-natural-gas.

[65] Jeff St. John, Green Tech Media, *Green Hydrogen in Natural Gas Pipelines: Decarbonization Solution or Pipe Dream?* (Nov. 30, 2020), https://www.greentechmedia.com/articles/read/green-hydrogen-in-natural-gas-pipelines-decarbonization-solution-or-pipe-dream.

[66] Mike Henchen, RMI, *Low Carbon Fuels' Limited Role in Building Decarbonization*, Slide 51 (Nov. 4, 2022), https://portal.ct.gov/-/media/DEEP/energy/ConserLoadMgmt/Master-Slide-Deck_TM-6_Alt-Fuels_PM.pdf.

[67] Derwent, R., Simmonds, P., O'Doherty, S., Manning, A., Collins, W. and Stevenson, D. 2006. "Global Environmental Impacts of the Hydrogen Economy." Int. J. of Nuclear Hydrogen Production and Applications. 1(1): 57-67. Available at: http://agage.mit.edu/publications/global-environmental-impacts-hydrogen-economy.

[68] Ilissa B. Ocko & Steven P. Hamburg, Climate consequences of hydrogen leakage, Atmospheric Chemistry & Physics (preprint, discussion started Feb. 18, 2022), available at https://acp.copernicus.org/preprints/acp-2022-91/acp-2022-91.pdf.

greenhouse gas reductions in the buildings sector because it leaks easily due to its small molecular size—leakage rates for hydrogen are expected to be 1.3-2.8 times greater than those for methane.[69] Further, hydrogen has a substantially lower energy density than methane, which means that far greater quantities must be combusted to generate the same energy or heat. The lower energy density of hydrogen means that even if you could blend up to 20% by volume, that's still less than 7% by energy, so hydrogen will have at most a negligible impact on decarbonizing buildings. Hydrogen also has a far lower heat content than methane gas: only approximately 30 percent,[70] meaning that despite the expense and complexity, blending hydrogen into methane gas streams at low concentrations does very little to improve total greenhouse gas emissions. Lastly, hydrogen is not safe in buildings, both because it is explosive and because its combustion contributes to significant air pollution.[71]

Blue hydrogen, which is produced from fossil fuels with carbon capture, is not a climate solution as it does not achieve the requisite greenhouse gas emission reductions to support Connecticut's climate commitments. The proposed federal definition, allowing 4 kilograms of CO2e per kilogram of hydrogen on a lifecycle basis and less than 2 kilograms of CO2e per kilogram of hydrogen at the point of production, would likely include blue hydrogen. Relying on blue hydrogen rather than green hydrogen would eviscerate the intended climate benefits of hydrogen and would increase total greenhouse gas emissions relative to burning fossil fuels for heating. Professors Bob Howarth and Mark Jacobson recently studied the emissions implications of blue hydrogen and found that the greenhouse gas footprint of blue hydrogen is 20 percent *greater* than burning natural gas or coal for heat and 60 percent *greater* than burning diesel oil for heat.[72] The authors assumed captured carbon dioxide could be stored indefinitely without any leakage, an extremely charitable assumption given the completely unproven validity of long-term carbon dioxide storage. The results showed an increase in emissions over burning fossil fuels because while blue hydrogen reduces direct carbon dioxide emissions (albeit incompletely), it increases fugitive emissions of methane, a far more potent greenhouse gas. In fact, due to this methane leakage, total carbon dioxide equivalent emissions from blue hydrogen were only 9-12 percent lower than gray hydrogen.[73] The authors further tested the robustness of their conclusions against different assumed leakage rates and found that the conclusion held even assuming a low methane leakage rate of 1.54 percent.[74] The authors also tested the rigor of their conclusions assuming blue hydrogen is produced using a combination of natural gas and 100

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[69] Fotis Rigas & Paul Amyotte, Myths and Facts about Hydrogen Hazards, 31 Chem. Eng'r Transactions 913, 914 (2013), available at https://www.aidic.it/cet/13/31/153.pdf.
[70] Ulf Bossel & Baldur Eliasson, Energy and the Hydrogen Economy, at 5, https://afdc.energy.gov/files/pdfs/hyd_economy_bossel_eliasson.pdf ("at any pressure, the volumetric energy density of methane gas exceeds that of hydrogen gas by a factor of 3.2 (neglecting non-ideal gas effects)").
[71] Collins, Leigh, 'Hydrogen in the home would be four times more dangerous than natural gas': government report, (RechargeNews.com, last updated August 2, 2021), available at https://www.rechargenews.com/energy-transition/hydrogen-in-the-home-would-be-four-times-more-dangerous-than-natural-gas-government-report/2-1-1047218; Reclaiming Hydrogen at 18 (citing Cellek Mehmet Salih & Ali Pınarbaşı, Investigations on Performance and Emission Characteristics of an Industrial Low Swirl Burner While Burning Natural Gas, Methane, Hydrogen-Enriched Natural Gas and Hydrogen as Fuels, 43 Int'l J. of Hydrogen Energy 1994, 1205 (Jan. 11, 2018), https://www.sciencedirect.com/science/article/abs/pii/S0360319917319791) (finding that burning pure hydrogen would emit more than six times more nitrogen oxides than burning methane).
[72] Howarth & Jacobson, How green is blue hydrogen? Energy Sci. & Eng'r (July 2021).
[73] *Id.*
[74] *Id.*

percent zero emissions renewable energy—while retaining assumptions that captured carbon dioxide can be stored indefinitely without leakage—and found that total greenhouse gas emissions were still nearly half those from combusting natural gas as a fuel.[75]

The emissions associated with blue hydrogen are in addition to other challenges, including achieving high rates of carbon capture in practice[76] and the cost per ton of capturing the carbon.[77] Large amounts of energy are required to operate the CCS project and to transport and store the captured carbon,[78] which creates additional potential sources of emissions. Captured carbon is often used in fertilizer production and oil/gas recovery, both of which increase downstream greenhouse gas emissions, further undermining the intent of capturing carbon in the first place.

b) *Infrastructure changes/upgrades*

Given the significant limitations discussed above that indicate RNG and hydrogen are not viable decarbonization strategies for the buildings sector, Connecticut should not invest in infrastructure upgrades to the gas distribution system to supply hydrogen and RNG to buildings. Instead, Connecticut should focus on targeted electrification of the gas distribution system to prune parts of the system that are aging and leak prone, rather than expending ratepayer funds to repair or replace those pipes. In this way, Connecticut can begin strategically phasing out gas infrastructure. Infrastructure for distribution of RNG and hydrogen should only be considered for hard-to-decarbonize applications that cannot easily or cost-effectively be electrified.

Connecticut's gas infrastructure is leak-prone and aging, and the investment required to replace this infrastructure to accommodate alternative gasses would be astronomical. There are 8,395 miles of gas main in Connecticut—1,087 miles of which are leak-prone cast iron and 120 miles of which are leak-prone bare steel.[79] Data from New York shows that the average cost per mile to replace leak-prone pipe ranges from $1.3 million per mile for a less urban service territory and $8.7 million/mile for a service territory in NYC.[80] Connecticut is likely on the lower

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[75] *Id.*

[76] Carbon capture projects associated with hydrogen production to date have achieved onsite carbon dioxide capture rates below 70 percent, far below the blue hydrogen industry goal of 95 percent. David Schlissel et al., *Blue Hydrogen: Technology Challenges, Weak Commercial Prospects, and Not Green*, IEEFA (Feb. 2022), at Slides 18-20, available at Blue-Hydrogen-Presentation_February-2022.pdf (ieefa.org).

[77] These costs have been in excess of $63/ton for capture rates below 85 percent, and substantially higher for higher capture efficiency. *Id.* at Slide 26. These are more than double the costs that would be required to make carbon capture financially viable.

[78] Schmelz William J., Hochman Gal and Miller Kenneth G. 2020, Total cost of carbon capture and storage implemented at a regional scale: northeastern and midwestern United States Interface, Focus.102019006520190065http://doi.org/10.1098/rsfs.2019.0065; 2019 DOE Integrated Carbon Capture and Storage in the Louisiana Chemical Corridor, https://www.lsu.edu/ces/publications/2019/doe_carbonsafe_02-18-19.pdf.

[79] "Gas Distribution Pipeline Miles by Material," US DOT Pipeline and Hazardous Materials Safety Administration Portal Data for 2021 (available data as of January 5, 2023), https://portal.phmsa.dot.gov/analytics/saw.dll?Portalpages&PortalPath=%2Fshared%2FPDM%20Public%20Website%2F_portal%2FPublic%20Reports&Page=Infrastructure.

[80] New York State Public Service Commission, Case 20-E-0380 & 20-G-0381: CLCPA Study. Recent filings indicate an average pipe replacement cost of $1.324 million/mile for Niagara Mohawk (46.26 miles at a total cost of $61.25 million),

end of that spectrum, which would still mean there are $1 billion in leak-prone pipe replacement costs outstanding in the state. Rather than making costly infrastructure upgrades based on the false promise of alternative fuels, Connecticut should invest that money in targeted electrification efforts.

c) *Methane demand response*

Implementing gas demand response programs could reduce emissions while Connecticut is in the process of phasing out gas heating. By reducing gas demand, such programs could avoid further expansion of gas supply, pipelines, and infrastructure. However, funding for gas demand response programs should not divert funding away from investments in heat pumps and building electrification, which should be prioritized as more effective means of reducing emissions. Further, state energy efficiency programs should incentivize fuel switching away from reliance on gas, as the most recent Conservation and Load Management Plan recognized by committing to phase out gas infrastructure incentives by 2024.[81]

d) *Methane source standards and/or certifications*

There is no long-term role for distributed methane in Connecticut's decarbonized future. While addressing production standards for methane may be helpful in the near-term, Connecticut should not lose sight of the necessity to ultimately phase out methane distribution on a time scale consistent with the GWSA and should be careful not to invest significant resources that may prolong reliance on a fuel that will soon become obsolete. Further, even with meaningful production standards for methane, the gas would still contribute to climate change through leaks from the local distribution system and from household infrastructure, and through combustion.

4) Should Connecticut engage in a planned phaseout of the methane/natural gas distribution system?

a) *If so, why, how, and on what time scale? How should the state handle the thorny issues of costs, stranded assets, safety, consumer equity, and workforce equity?*

Continued reliance on methane in the buildings sector is incompatible with Connecticut's decarbonization mandates, necessitating a planned phaseout of methane distribution in the state. The 2022 CES should provide a clear directive that the state's policy is a planned phaseout of the methane distribution system and should direct PURA to initiate a comprehensive future of gas docket to plan for that transition. As explained in response to Question 3, *supra*, because alternative fuels such as RNG and hydrogen cannot serve as a viable decarbonization strategy for

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https://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7BEB6B4FE5-DADB-44B4-A485-A669E0D97CBF%7D, $2.193 million/mile for KEDLI (106.3 miles at a total cost of $233.161 million), https://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7BF43738D9-77F7-4E71-8223-71BB53C6A575%7D, and $8.721 million/mile for KEDNY (14.7 miles at a total cost of $128.207 million), https://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7BF43738D9-77F7-4E71-8223-71BB53C6A575%7D.

[81] CT DEEP, *Final Determination: Approval with Conditions of the 2022-2024 Conservation and Load Management Plan* at 5 (June 1, 2022), https://portal.ct.gov/-/media/DEEP/energy/ConserLoadMgmt/DEEP-Determination---2022-2024-CLM-Plan.pdf.

the gas distribution system, they cannot be used as a rationale for continued reliance on gas distribution infrastructure.

Connecticut has established mandatory GHG emissions reduction targets in the GWSA, requiring the state to reduce GHG emissions by 10 percent below 1990 levels by 2020, 45 percent below 2001 levels by 2030, and 80 percent below 2001 levels by 2050.[82] According to Connecticut's most recent greenhouse gas inventory, emissions from the buildings sector account for 37.2% of the state's greenhouse gas emissions.[83] With approximately 36% of Connecticut households relying on gas heating, Connecticut cannot achieve these reductions without transitioning off of methane in the buildings sector.[84] The time scale for the phaseout of the methane distribution system should be dictated by the emissions reductions necessary to meet the targets outlined in the GWSA.

The methane distribution system contributes to climate change through combustion of methane, which generates carbon dioxide emissions, as well as through fugitive emissions of methane, a potent greenhouse gas with a 20-year global warming potential 84-87 times greater than carbon dioxide.[85] When methane leakage is fully accounted for, the purported climate benefits of gas relative to heating oil and propane largely disappear.[86] Moreover, leakage rates are underestimated, as discussed in Section 3(a)(i), *supra*, which suggests that the climate impacts of gas are even greater than currently estimated. The UN Global Methane Assessment concludes that methane is "responsible for about 30 per cent of [global] warming since pre-industrial times" and that "[u]rgent steps must be taken to reduce methane emissions this decade."[87]

The Connecticut Greenhouse Gas Emissions Inventory tracks the state's progress toward meeting the GWSA targets, and the most recent review of GHG emissions reveals that the state is not on track to meet its 2030 and 2050 GWSA targets and that building sector emissions have been on an upward trajectory.[88] According to the most recent greenhouse gas inventory, buildings sector GHG emissions increased from 2017 to 2018 due to "an increase in residential and commercial emissions from combustion of fossil fuel for heating. This included . . . a 9.8 percent increase in emissions [relative to 2017] from use of natural gas. Commercial emissions

[82] Conn. Gen. Stat. § 22a-200a(a).
[83] CT DEEP, *2018 Greenhouse Gas Emissions Inventory*, 7 (2021), https://portal.ct.gov/-/media/DEEP/climatechange/GHG_Emissions_Inventory_2018.pdf at 5 (the residential sector accounts for 18%, the commercial sector accounts for 10.3%, and the industrial sector accounts for 8.9% of the state's greenhouse gas emissions).
[84] U.S. Energy Information Administration, *Connecticut Energy Profile Overview*, https://www.eia.gov/state/?sid=CT.
[85] United States Environmental Protection Agency, Understanding Global Warming Potentials. https://www.epa.gov/ghgemissions/understanding-global-warming-potentials.
[86] *See, e.g.*, Nicholas Kusnetz, *Is Natural Gas Really Helping the U.S. Cut Emissions?* (Jan. 30, 2020), https://insideclimatenews.org/news/30012020/natural-gas-methane-carbon-emissions/.
[87] U.N. Environment Programme, *Global Assessment: Urgent steps must be taken to reduce methane emissions this decade* (May 6, 2021), https://www.unep.org/news-and-stories/press-release/global-assessment-urgent-steps-must-be-taken-reduce-methan.
[88] CT DEEP, *2018 Greenhouse Gas Emissions Inventory*, 7 (2021), https://portal.ct.gov/-/media/DEEP/climatechange/GHG_Emissions_Inventory_2018.pdf.

increased 10.8 percent for use of natural gas."[89] The inventory notes that only "modest reductions in residential sector emissions have been attained" from the 1990 baseline, while "emissions in the commercial and industrial sectors have increased since 1990."[90]

In noting that the state is not on track to meet its emissions reduction targets under the GWSA, due in part to increased residential and commercial building emissions from both heating oil and gas, the Connecticut greenhouse gas inventory states that "electrification of home heating, decarbonization of thermal technologies, and improved weatherization . . . will be critical to significantly reduce GHG emissions in this sector."[91] The Governor's Council on Climate Change came to a similar conclusion in 2018 when it concluded that "Connecticut must significantly increase deployment of RTT [renewable thermal technologies] in residential and commercial buildings" to meet its emissions reduction targets.[92] In addition, the Yale Center on Climate Change and Health has found that even relatively efficient natural gas appliances *must* be replaced by electric alternatives if Connecticut is to meet its greenhouse gas reduction goals.[93] Indeed, the emissions associated with air-source or ground-source electric heat pumps are significantly less than the emissions from reliance on gas.[94] And the emissions associated with using electricity to run an electric heat pump—which are already lower than emissions from gas heating—are further decreasing as the electric sector is decarbonized.[95]

Connecticut's former policy of gas expansion was in effect for years until PURA discontinued the gas expansion plan in April 2022, finding that it was inconsistent with Connecticut's climate and energy goals.[96] This is a step in the right direction, as is the decision to phase out incentives for gas appliances in the most recent Conservation and Load Management Plan. However, simply ending state subsidies and incentives for gas does not undo the effects of these pro-gas policies. A comprehensive plan is needed to dismantle the state's reliance on gas heating and reduce building sector emissions. Governor Lamont recognized this need in Executive Order 21-3, in which he directed DEEP to align the 2022 CES with the GWSA and specifically to reconsider the state's gas expansion policy.[97] (The Executive Order predated the PURA decision in Docket No. 21-08-24, which ended the gas expansion plan).

Connecticut must plan for the transition away from fossil fuel heating to full-scale electrification of the buildings sector. An increasing number of states have dockets planning for

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[89] *Id*. at 6.
[90] *Id.* at 2.
[91] *Id.* at 7.
[92] Governor's Council on Climate Change, *Building a Low Carbon Future for Connecticut: Achieving a 45% GHG Reduction by 203*0, 36 (December 18, 2018). https://portal.ct.gov/-/media/DEEP/climatechange/publications/BuildingaLowCarbonFutureforCTGC3Recommendationspdf.pdf
[93] Cheyenne Liberti, Laura Bozzi & Robert Dubrow, Yale Center on Climate Change and Health, *Natural Gas Policy and Public Health in Connecticut: A Yale Center on Climate Change and Health Issue Brief* at 7 (July 2021).
[94] Richard Faesy, Energy Efficiency Board Technical Consultant, Heat Pumps in Northeast Energy Efficiency Programs for the Connecticut Department of Energy and Environmental Protection, 37 (Nov. 18, 2021), https://portal.ct.gov/-/media/DEEP/energy/ConserLoadMgmt/20211118-CLM-Technical-Meeting.pdf (showing that heat pumps produce significantly fewer greenhouse gas emissions than gas heating).
[95] RMI, The Impact of Fossil Fuels in Buildings, at 11.
[96] PURA Docket No. 21-08-24, Final Decision, 15-16 (Apr. 27, 2022).
[97] Gov. Lamont, E.O. 21-3, 2-4 (Dec. 2021), https://portal.ct.gov/-/media/Office-of-the-Governor/Executive-Orders/Lamont-Executive-Orders/Executive-Order-No-21-3.pdf.

the future of gas in line with state climate goals, including Massachusetts,[98] Rhode Island,[99] California,[100] Oregon,[101] Washington,[102] Nevada,[103] Colorado,[104] and Minnesota.[105] Connecticut must join these states in transitioning away from gas heating, which is necessary to ensure that decarbonization strategies can be identified and implemented with sufficient lead time to comply with the GWSA and to ensure a just and equitable transition to decarbonization.

Notably, there is broad support for a future of gas docket. The Office of Consumer Counsel, PURA's Office of Education, Outreach, and Enforcement, Yankee Gas (Eversource), and environmental advocates have all recommended that PURA open a docket on the future of gas.[106] PURA has not yet initiated such a docket, finding "that it may be more appropriate for PURA to evaluate the findings from [the 2022 CES]" first.[107] However, PURA indicated that it could "always act on its own motion or on the motion of a third party to open a PURA docket" on the future of gas if "circumstances arise that indicate PURA should open a docket prior to finalization of the most recent CES."[108]

A gas planning docket should chart a path for a planned phase out of the gas distribution system, strategically targeting sections of the system for electrification. Such a docket is also necessary to address affordability and equity concerns for ratepayers. Costs to gas ratepayers will increase in coming years as rising infrastructure costs coincide with declining demand due to greater energy efficiency and the state's transition away from fossil fuels.[109] Those costs will be spread among fewer customers as a growing number of households with the means to do so convert to more economical electric appliances to avoid increased gas expenses, leaving low-income ratepayers with an even higher energy burden.[110] A planning docket is needed to ensure that, as the number of gas customers declines as the state electrifies its buildings sector, customers who already bear the highest energy burdens are not left to cover increasing distribution rates as the LDCs' revenue requirement is spread over a diminishing customer sales base.

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[98] Docket No. 20-80, Investigation by the Department of Public Utilities on its own Motion into the role of gas local distribution companies as the Commonwealth achieves its target 2050 climate goals.
[99] Docket No. 22-01-NG, Investigation Into the Future of the Regulated Gas Distribution Business in Rhode Island in Light of the Act on Climate.
[100] Docket No. R2001007, Order Instituting Rulemaking to Establish Policies, Processes, and Rules to Ensure Safe and Reliable Gas Systems in California and Perform Long-Term Gas System Planning.
[101] Docket No. UM 2178, Natural Gas Fact Finding Per EO 20-04 PUC Year One Work Plan.
[102] Docket No. 210553, Examination of energy decarbonization impacts and pathways for electric and gas utilities to meet state emissions targets.
[103] Docket No. 21-05002, Investigation Regarding Long-Term Planning For Natural Gas Utility Service In Nevada.
[104] Docket No. 21M-0395G, Commission Review of the Regulation of Gas Utilities and Docket No. 21R-0449G Proposed Amendments to the Commission's Rules Regulating Gas Utilities, 4 Code of Colorado Regulations 723-4, Relating to Gas Utility Planning and Implementing SB 21-264 Regarding Clean Heat Plans and HB 21-1238 Regarding Demand Side Management.
[105] Docket No. 21-565, In The Matter Of A Commission Evaluation Of Changes To Natural Gas Utility Regulatory And Policy Structures To Meet State Greenhouse Gas Reduction Goals.
[106] PURA Docket No. 21-08-24, Final Decision, 21 (Apr. 27, 2022).
[107] *Id.*
[108] *Id.*
[109] Carmelita Miller, et al., The Greenlining Institute, Equitable Building Electrification: A Framework for Powering Resilient Communities (Sept. 2019).
[110] *Id.* at 9.

A planning docket is also necessary to determine how much additional LDC investment in the gas system is prudent in the next 30 years to ensure a safe and reliable gas distribution system as statewide gas demand declines. Additional expansion of the gas distribution system will likely result in ratepayers funding stranded infrastructure, posing significant risk to gas customers. As utilities are forced to reduce and eventually eliminate gas sales in order to comply with the GWSA and as the state pursues decarbonization by decreasing gas demand and increasing building electrification, the number of gas customers will decrease, which in turn will reduce the usefulness or the need for gas system assets, resulting in stranded infrastructure.[111] With this in mind, utilities should spend ratepayer funds in a way that is consistent with the need to reduce and ultimately cease burning fossil fuels rather than on investments that will increase total fixed system costs. Ratepayers will also bear the burden of continuously increasing costs to safely operate and maintain the system as infrastructure ages.[112] Those costs will be spread among fewer customers as a growing number of households convert to more economical electric appliances to avoid increased gas expenses.[113]

The 2022 CES should direct PURA to open a future of gas docket[114] and should provide clear direction that the purpose of the docket is to plan for a managed transition off the gas distribution system. A clear statement from DEEP in the CES that Connecticut no longer supports gas expansion and instead recognizes the need to rapidly transition away from gas heating and electrify in line with the GWSA would provide PURA with the direction it has been awaiting to commence with a future of gas proceeding.

To address workforce equity, workforce development opportunities should be established that will help facilitate an equitable transition to a clean energy economy. To that end, Connecticut should focus on creating opportunities for populations that face systemic discrimination and/or are underrepresented in the workforce, including women, minorities, and formerly incarcerated individuals. Career pathways should be made available to people who currently work in the fossil fuel industry, such as heating oil dealers, gas station owners, and contractors who install gas or oil heating equipment. These workers have strong incentives to oppose a transition away from fossil fuels, so policies that realign their incentives with Connecticut's climate and energy policies would be helpful.

Gas workers will be particularly well suited to transition to working on district heating systems and networked geothermal. This strategy can utilize the existing workforce at gas

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[111] Andy Bilich, et al., Environmental Defense Fund, Managing the Transition—Proactive Solutions for Stranded Gas Asset Risk in California, 2019, https://www.edf.org/sites/default/files/documents/Managing_the_Transition_new.pdf.

[112] California Energy Commission, Energy Research and Development Division, Natural Gas Distribution in California's Low-Carbon Future, Draft, October 2019, p. iii, https://ww2.energy.ca.gov/2019publications/CEC-500-2019-055/CEC-500-2019-055-D.pdf ; Carmelita Miller, et al., The Greenlining Institute, Equitable Building Electrification: A Framework for Powering Resilient Communities, p. 9 (September 2019).

[113] Carmelita Miller, et al., The Greenlining Institute, Equitable Building Electrification., at 9.

[114] PURA is the appropriate venue for a future of gas proceeding. Other states that are considering the future of gas have proceedings before their respective public utility commissions, and Connecticut should also take this approach. PURA has the regulatory authority, staffing, and technical expertise needed for a future of gas proceeding. The 2022 CES will provide policy guidance to PURA, as provided under Conn. Gen. Stat. § 16-2(m), and DEEP should be an active participant in a future of gas docket, along with the Office of Consumer Counsel.

distribution companies because these workers already have expertise that is relevant to networked geothermal (*e.g.* drilling, laying underground pipes, etc.). This set of skills would likely also translate well to wastewater thermal projects. Developers should identify existing gaps and work with the state to develop training programs that are needed to prepare the workforce for implementing these decarbonization strategies.

5) Should Connecticut seek to phase out the use of methane as an energy source within the state?

a) If so, why, how, and on what time scale? How should the state handle the thorny issues of costs, stranded assets, safety, consumer equity, and workforce equity?

Yes, Connecticut should plan to phase out methane as an energy source within the state on a time scale consistent with the GHG reduction requirements in the GWSA. This phaseout should encompass all uses of methane gas as an energy source, including (1) heating buildings (discussed in response to Question 4, *supra*), (2) electric generation, and (3) all other uses of gas, such as industrial processes.[115] We focus on phasing out methane gas for electric generation in our response to this question.

State and regional approaches to decarbonizing the electric sector include renewable portfolio standards, the Regional Greenhouse Gas Initiative (RGGI), other cap-and-trade or cap-and-invest programs like those in California and Washington, state-level procurement of clean energy resources, and subsidies for clean electric generation. There are ongoing regional discussions in New England about a regional Forward Clean Energy Market (FCEM) or carbon price,[116] along with other market reforms that could better align regional electricity markets with state climate goals. Massachusetts is leading efforts to advance a regional FCEM, as discussed in the Commonwealth's recently issued Clean Energy and Climate Plan for 2050.[117] Connecticut should evaluate the specific market design recently published by DOER and continue to engage in discussions about whether this design will facilitate rapid decarbonization while also enabling the states to protect vulnerable communities and promote economic development. Connecticut should continue participating in these discussions and advocate for changes that most effectively facilitate regional grid decarbonization. State pressure on ISO-NE and FERC will also be critical to ensure that these regional and federal decision makers facilitate, rather than impede, progress in decarbonizing New England's electric grid.

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[115] The 2018 GHG Inventory does not break down industrial emissions by fuel type or end use, though it implies that most of these emissions are attributable to heating. It's unclear how many emissions are attributable to industrial processes.

[116] ISO-NE favors a regional carbon price, but the states have not endorsed this approach. Jan Ellen Spiegel, CT Mirror, *The winter energy crunch, what it costs, and what it will take to fix it* (Jan. 3, 2023), https://ctmirror.org/2023/01/03/ct-energy-winter-shortage-natural-gas/.

[117] Massachusetts Executive Office of Energy and Environmental Affairs, *Clean Energy and Climate Plan for 2050*, 68 (Dec. 2022), https://www.mass.gov/doc/2050-clean-energy-and-climate-plan/download ("Massachusetts is leading an effort to design a preliminary approach for a New England FCEM. The proposal will include details such as the products that can be traded in the FCEM, potential buyers and sellers, financial structures, regulatory integration, and the tracking of clean energy attributes. DOER is releasing a straw approach in late 2022.").

It is increasingly clear that current approaches to electric sector decarbonization are not sufficient to phase out gas-fired generation in New England or elsewhere.[118] States are beginning to grapple with this problem. Many states have policies that facilitate grid decarbonization, and some are beginning to develop plans for phasing out gas generation in line with climate goals. In Illinois, the Climate and Equitable Jobs Act (CEJA), enacted in 2021, requires 100% clean energy generation by 2045, and will require all gas-fired plants in the state to reduce all CO_2e and copollutant emissions to zero down by that year. In Massachusetts, the Electric Generator Emissions Limits regulations establish a declining limit on carbon dioxide emissions from large power plants physically located in Massachusetts, and applies to 24 large fossil fuel-fired power plants, aiming to decrease emissions from 9.15 million metric tons of CO_2 in 2018 down to 1.8 in 2050.[119] California has committed to meeting its growing electricity demand without adding any *new* gas-fired resources,[120] but has not yet figured out how to retire its existing gas plants.

New York has made significant progress in committing to phase out gas generation in line with state climate goals, although the state's plans for achieving this are still being developed. The Climate Action Council recently finalized a scoping plan that explains how New York can achieve the emissions reductions required under the state Climate Leadership and Community Protection Act.[121] The plan recognizes that "Achieving a 100% zero-emission power grid will require phasing out the use of fossil fuel for power generation."[122] To that end, the state must establish a "detailed process . . . to ensure that the fossil fuel generators are gradually and safely retired while still maintaining reliability."[123]

New York is already developing "a blueprint to guide the retirement and redevelopment of New York City's oldest and most-polluting fossil fuel facilities and their sites by 2030."[124] The blueprint will be completed in 2023 and will "include detailed analysis and planning to address the impacts on communities and workers."[125] Starting in 2024, the New York Public Service Commission (PSC) "will conduct biannual reviews of the renewable energy program and electric system resource mix."[126] The scoping plan recommends that the PSC "evaluate options to retire and/or repurpose existing fossil fuel electric generation facilities" in this review process.[127] The 2022 CES should recommend that similar processes be undertaken in Connecticut.

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[118] In New England, for example, clean energy policies were extremely effective at closing coal plants across the region. But much of that coal generation was replaced with gas generation, which now accounts for around half of the region's electricity. Replacing gas generation with renewable sources, storage facilities, and complementary strategies like energy efficiency and demand response programs is a critical next step for the region.
[119] 310 CMR 7.74.
[120] California Air Resources Board, *2022 Scoping Plan for Achieving Carbon Neutrality*, 75 (Nov. 16, 2022), https://ww2.arb.ca.gov/sites/default/files/2022-12/2022-sp.pdf; Letter from Governor Newsom to CARB Chair Liane Randolph (July 22, 2022), https://www.gov.ca.gov/wp-content/uploads/2022/07/07.22.2022-Governors-Letter-to-CARB.pdf.
[121] New York State Climate Action Council, *New York State Climate Action Council Scoping Plan* (Dec. 2022), https://climate.ny.gov/-/media/project/climate/files/NYS-Climate-Action-Council-Final-Scoping-Plan-2022.pdf.
[122] *Id.* at 225 (emphasis added).
[123] *Id.* at 227.
[124] *Id.* at 229.
[125] *Id.* at 229-30.
[126] *Id.* at 229.
[127] *Id.* (emphasis added).

Commentators have noted that integrating state climate targets into integrated resource planning at the state or utility level and requiring such plans to include a timeline for phasing out gas generation can facilitate electric sector decarbonization.[128] As New York recognizes, planning is critical to ensure that gas generation is phased out on a timeline consistent with climate targets without compromising grid reliability. Equity must also be considered in this analysis and should play a central role as states determine how to equitably decarbonize the grid. For example, a state could prioritize retiring the most polluting plants first, or those located in environmental justice communities. New York's blueprint for retiring the dirtiest generators in New York City, discussed above, is one approach that Connecticut should consider emulating.

In the 2022 CES, Connecticut should commit to developing a plan to phase out gas (and other fossil fuel) generation in line with state climate goals. New York's approach to this issue, as described in its climate scoping plan, provides a valuable example that Connecticut should consider. In addition, Connecticut should follow California's lead by not approving any new gas-fired power plants (or other fossil fuel plants) in the state. The 2022 CES should recommend that such a commitment be established pursuant to legislation or executive order. Codifying this commitment is preferable because executive orders can easily be revoked by future governors, whereas legislation is much more durable and would signal a stronger commitment.

The 2022 CES should also recommend a 100% zero carbon in-state generation target to complement the state's 2040 zero carbon supply target. Because Connecticut is a net energy exporter, using only 73% of the electricity it generates,[129] the state could end up in a scenario where it has ensured its electric supply is 100% zero carbon, but would still have several fossil fuel plants operating in the state for export to surrounding states. Those fossil fuel plants would continue to create in-state localized pollution and would be a significant source of greenhouse gas emissions still operating within the state.

While supporting the development of clean energy resources in neighboring jurisdictions may provide the opportunity to purchase energy and renewable energy credits to satisfy a presumptive zero-carbon supply target, we must ensure that the direct health and economic benefits of retiring local, in-state dirty generating facilities and replacing them with clean –in state generation are realized. This is consistent with the state's goal of ensuring that our clean energy future is realized in a manner that meaningfully addresses inequities caused by reliance on fossil fuels, and that the results maximize equitable outcomes.[130]

6) Should Connecticut adjust or change its current natural gas planning processes, funding, and/or requirements?

Connecticut must adapt its gas planning processes to be consistent with the GWSA and with a phased transition off the gas system. DEEP should provide clear direction to set the state

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[128] Steve Weissman & Réna Kakon, Center for Sustainable Energy, *Phasing Out the Use of Fossil Fuels for the Generation of Electricity*, 6 (Mar. 2017), https://energycenter.org/sites/default/files/docs/nav/research/Phasing_Out_Fossil_Fuels.pdf.
[129] CT DEEP, *2020 Integrated Resources Plan* at 118 (Oct. 2021).
[130] *Id*. at 128-129.

on a path toward electrification and set a transition timeline for utilities to provide regulatory certainty.

a) If so, what changes do you recommend? And how would you recommend going about changing current planning processes?

The starting point for the development of any planning process should be establishing a consensus that the role of natural gas in Connecticut will shrink over the next few decades and that the state must accelerate the transition to electrification. This is a necessary corollary of the state meeting its greenhouse gas reduction obligations as well as addressing existing winter reliability challenges. The inevitability of a reduced role for natural gas suggests several fundamental principles that should be incorporated into any gas planning framework.

First, a moratorium on expansion of the gas distribution system is necessary. Prior to and during the development of a comprehensive plan for phasing out the gas distribution system, the state should adopt a moratorium on any further expansion of the gas system. Connecticut took an important first step in this direction when PURA ordered the cessation of the System Expansion Plan incentive program.[131] However, this is only a small step towards what is needed. Moving forward, the LDCs' investment in the gas distribution system should be limited to addressing health, safety, and service issues related to existing infrastructure and customers.

Establishing a moratorium on gas expansion presents legal and practical issues which must be addressed in the planning process. For example, utilities in Connecticut have a "duty to serve" meaning that they may not unreasonably refuse to provide service to potential customers at reasonable rates.[132] Modification to the duty to serve that aligns with shrinking the gas system must be adopted.[133] Addressing climate change necessitates that "prudent decisions around utility service going forward may have to allow the utility to stop serving some customers, or never start serving them in the first place."[134]

Second, any gas system upgrades should be evaluated through a non-pipes alternative framework, to ensure replacements are only approved if it can be demonstrated that the upgrade would be to address health, safety, and service issues and that the investment to maintain that part of the gas system is cost-effective relative to efficient full electrification alternatives. Such analysis should incorporate accounting of societal benefits including: the value of the deferred or avoided traditional projects; the value of avoided gas commodity purchases; the value of other avoided energy-related costs that a participating customer might otherwise incur (e.g., reduced cooling costs achieved through insulation); and the value of reduced GHG emissions. Societal costs incorporated in the analysis should include: the costs of running NPA programs; incentives paid to customers to adopt demand reduction measures; and, the associated post-incentive incremental costs incurred by the participating customers.

[131] PURA Docket No. 21-08-24, Final Decision (Apr. 27, 2022).
[132] Conn. Gen. Stat. §16-20 (b).
[133] *See* Heather Payne, *Unservice: Reconceptualizing the Utility Duty to Serve in Light of Climate Change*, 56 U. RICH. L.Rev. 603, 605-606 (2022).
[134] *Id.* at 606.

Third, as discussed in section 4a, *supra*, as existing customers transition from gas to electrification, the shrinking customer base means that current utility expenditures necessary to maintain the system safely and reliably will be spread over fewer customers. The potential rate increase implications of this must also be addressed through a planning process. There is also a risk that gas infrastructure will become a stranded cost with additional financial implications for the utilities and their shrinking base of customers. A future of gas docket to plan for these challenges as well as to plan for a managed transition off of the gas system would help ensure these challenges can be addressed.

Fourth, implementation of all-electric building codes and zero-emission appliance standards will help enable Connecticut's transition off of the gas system. Connecticut can look to neighboring New York's Climate Action Council Scoping Plan, finalized in December 2022, which lays out the state's roadmap for meeting its Climate Leadership and Community Protection Act climate mandates and calls for phasing out gas from new construction by 2025 for most buildings (single-family, and low-rise residential of 3 stories or less) and 2028 for remaining buildings (high-rise residential and commercial buildings). The final scoping plan also calls for zero-emission appliance standards for residential heating, cooling and hot water appliance replacements beginning in 2030 and for other appliance replacements beginning in 2035.[135] Connecticut should adopt similar measures to set it on the appropriate path toward building decarbonization.

Fifth, the overall structure of utility distribution planning and regulatory oversight should be adapted to meet the current moment. Distribution utilities have a financial interest in the outcomes of their planning decisions, creating significant conflict of interest. Further, utility planning is siloed between electric and gas utilities, which causes overspending, reduced reliability and resilience, and increased climate pollution. Lastly, current planning processes ignore equity and environmental justice. To remedy these issues, Connecticut should conduct independent and comprehensive distribution system planning, as laid out in Acadia Center's RESPECT framework,[136] that incorporates meaningful stakeholder input, including voices that have been ignored to date. The CES should recommend PURA require coordination between electric and gas distribution companies—even if they have different corporate parents—on long-term planning issues to help overcome the planning silos that result in inefficient investments and a delayed transition away from gas towards electrification. Comprehensive planning should consider supply- and demand-side resources, as well as climate requirements, environmental justice and localized pollution impacts, and the need to transition off natural gas and electrify end uses across the state.

7) What public process would you recommend Connecticut undertake for further exploring the issues raised in questions 1-6 above?

DEEP should provide further opportunities for the public to engage in the CES process, including comments on draft conclusions and on upcoming white papers. In particular, the white

[135] New York State Climate Action Council. 2022. "New York State Climate Action Council Scoping Plan." climate.ny.gov/ScopingPlan
[136] Amy Boyd & Oliver Tully, Acadia Center, RESPECT (Reforming Energy System Planning for Equity and Climate Transformation)**,** November 2021, https://acadiacenter.org/work/respect/.

paper on building thermal decarbonization should explore these issues and DEEP should provide opportunities for public comment and dialogue on the white paper.

In addition, the CES should recommend that PURA open a future of gas proceeding with the clear directive that the purpose of the proceeding is to plan for a managed retirement of the gas distribution system consistent with the GWSA. To the extent modeling is needed in that process, it must be conducted by a truly independent consultant not engaged or funded by the utilities. PURA should play an active oversight role in overseeing the overall direction of the modeling and key input assumptions. That process must include ample opportunities for stakeholder dialogue and a process by which experts can present testimony and answer questions. Technical sessions involving small groups of experts to allow for discussion of technical details is also necessary. For issues for which there is significant variation or disagreement in the research, sensitivity analyses must be conducted to understand the effect those variables have on the outcome of the modeling.

Further, accurate assumptions are necessary as inputs to modeling conducted. Connecticut must ensure that any modeling: (1) accounts for out-of-state emissions from the extraction and transmission of fuels including natural gas, renewable natural gas, and synthetic natural gas that are ultimately consumed in CT; (2) uses an accurate global warming potential value for methane and considers methane emissions on the 20-year timescale that is most relevant to state's decarbonization targets; (3) accurately estimates the level of methane leaks from the natural gas system within the state; and (4) does not make the blanket assumption that biofuels are greenhouse gas neutral, as emissions from these fuels vary based on feedstock. DEEP must also ensure that its greenhouse gas inventory processes are updated so that these mistakes are not replicated throughout the state's greenhouse gas accounting system.

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