D.P.U. 20-80 Alternative Regulatory Proposal Comments

Acadia Center
Advancing the Clean Energy Future

May 6, 2022

Mark D. Marini, Secretary
Department of Public Utilities
One South Station, 5th Floor
Boston, MA 02110

Re: D.P.U. 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

Dear Secretary Marini:

Acadia Center is a non-profit research and advocacy organization committed to advancing the clean energy future. Acadia Center tackles complex problems, identifies clear recommendations for reforms, and advocates for policy changes that support a low-carbon economy across the Northeast. Acadia Center commends the Department on its investigation of the issues at play in determining the crucial question of how the fossil gas industry needs to change to enable the Commonwealth to achieve the ambitious climate goals set forth in the Global Warming Solutions Act. As an overarching theme to Acadia Center's comments, decarbonizing the economy of Massachusetts, and particularly our buildings, is not optional. We cannot fail. Nor can we afford to wait and put off decisions to future generations, especially given the rapid pace of climate change already observable in Massachusetts. The transition may be expensive – but the cost is insignificant compared to the cost of the climate crisis itself.

This transition will require all players – utilities, regulators, government, businesses, advocates, and customers – to pull together and work towards a common purpose. It requires a strong central authority to keep everyone working together, and not at cross purposes. The Department could play such a role (with some legislative amendment), as outlined in Acadia Center's Regulatory Proposal below (and our RESPECT report). Through consolidated, strategic planning that considers all fuels and a strong central authority that can make decisions in the best interests of consumers, environmental justice communities, and the climate, as well as utilities, this transition could be possible.

Fundamentally, the transition should center on technologies that we know are safe, effective, and available – in other words, electrification through air- and ground-source heat pumps and geothermal technologies. The Department should not begin to introduce gas alternatives into pipelines that serve consumers' homes and businesses without substantial additional research into safety and health impacts. This docket is not just about scenarios, regulations, costs, and carbon. It's also about how the people of the Commonwealth will be kept warm and safe by their government and trusted utilities in 2050 and beyond. We know that the use of natural gas in

homes, especially in cooking, is far more harmful to occupants' health than previously understood.[1] We know that hydrogen is a highly combustible fuel that poses a significant safety risk in the context of residential and commercial buildings.[2] The Department must, as one of its first obligations, keep consumers and the Commonwealth safe. Pursuant to the precautionary principle, it is better to wait until RNG, SNG, and hydrogen technologies' use indoors are firmly understood before we begin even pilots that allow them to be introduced in pipelines at the concentrations contemplated by the LDCs.

Acadia Center's comments address, in turn:

[1] Rocky Mountain Institute, "Health Effects from Gas Stove Pollution", 2020 https://rmi.org/insight/gas-stoves-pollution-health

[2] Energy Innovation, "Assessing The Viability Of Hydrogen Proposals: Considerations For State Utility Regulators And Policymakers", 2022 https://energyinnovation.org/publication/assessing-the-viability-of-hydrogen-proposals-considerations-for-state-utility-regulators-and-policymakers/

Modeling Concerns

Acadia Center found multiple troubling flaws in the Energy and Environmental Economics (E3) analysis that underpins the LDCs' regulatory proposals. Ultimately, the scenarios that rely heavily on alternative gases are likely to emit far more GHG emissions, cost ratepayers billions more, and be far more difficult to implement than assumed in E3's study. E3 refused to conduct sensitivity analyses related to a wide variety of stakeholder concerns including GHG accounting for methane leaks, GHG accounting for lifecycle emissions from biofuels, alternative fuels cost assumptions, and alternative fuels supply availability. E3 also refused to quantity the local economic impacts and job-creation potential of any of the scenarios examined, a decision that glosses over the fact that scenarios that rely more heavily on alternative fuels will ship more ratepayer dollars and jobs out of state.

The difference between E3's modeling assumptions and the expert consensus on topics including the GHG intensity of RNG, future availability of alternative fuel supplies, and the future cost of alternative fuels is so significant that it calls into question many of the conclusions, particularly those surrounding the Efficient Gas and Hybrid Electrification scenarios that rely heavily on RNG, hydrogen, and SNG. Using these alternative fuels in the building sector will make it harder to decarbonize the hardest-to-electrify sectors of the national economy, many of which are disproportionately concentrated in states other than Massachusetts. It will also remove one of the most viable pathways for achieving the negative emissions necessary meet state, national, and global GHG net zero emissions targets. Finally, even if RNG, SNG, and hydrogen *can* feasibly be used to perpetuate use of the LDCs' systems into the future, as a policy matter, they should not be for the reasons articulated below.

The DPU 20-80 Modeling Repeats Known Flaws in the Massachusetts Greenhouse Gas Inventory

Since they are simplified models of very complex systems, all greenhouse gas (GHG) inventories implicitly have limitations. It's important to understand the ramifications of these limitations, particularly when they cause a skewed perception of the preferred policy pathway. E3's analysis in this case repeats four concerning shortcomings of the Massachusetts Greenhouse Gas Inventory ("MA Inventory") that directly impact the 20-80 modeling and resulting conclusions and policy recommendations. The shortcomings are:

- **#1:** Failing to account for out-of-state emissions from the extraction and transmission of fuels – including natural gas, renewable natural gas (RNG), and synthetic natural gas (SNG) - that are ultimately consumed in Massachusetts.
- **#2:** Using an outdated global warming potential (GWP) value for methane and failing to consider methane emissions on the 20-year timescale that is most relevant to state's net zero emissions goal.
- **#3:** Dramatically underestimating the level of methane leaks from the natural gas system within Massachusetts.
- **#4:** Making the blanket assumption that biofuels (including RNG and biodiesel) are GHG-neutral.

When contemplating the significance of these GHG accounting issues in the MA Inventory and E3 analysis, it's important to remember that two of the alternative fuels, renewable natural gas (RNG) and synthetic natural gas (SNG), being put forward as key to decarbonizing the gas distribution system are chemically identical to natural gas. The largest component of all three fuels is methane. Due to the technical limitations of blending hydrogen into the gas system, RNG and SNG combined account for over 90% of the energy flowing through the pipes in 2050 in several of the scenarios analyzed by E3, including the Hybrid Electrification scenario.

If more reasonable and scientifically accurate GHG accounting principles are used, Hybrid Electrification and other scenarios that rely heavily on RNG and SNG don't actually achieve a 90% reduction in gross statewide GHG emissions by 2050 . Without more detailed analysis related to lifecycle emissions of RNG and the GHG impacts of methane leaks along the RNG supply chain, both of which E3 failed to perform, it's difficult to determine how far short the Commonwealth will fall of its net zero goal if the LDCs rely on RNG to the extent proposed in scenario's like Efficient Gas and Hybrid Electrification. That being said, as explained in greater detail below, updates to NY State's GHG accounting for natural gas emissions revealed that 47.3% of total emissions associated with natural gas consumption in New York are the result of methane leaks along the entire gas supply chain. Research has indicated that methane leaks along the RNG supply chain are comparable, and in many cases higher, than methane leaks along the natural gas supply chain.[3] This demonstrates that any strategy relying on simply swapping out the type of methane (e.g. fossil gas to RNG) we pipe through the gas system will fall well short of the Commonwealth's net zero target.

Despite multiple requests from stakeholders during early stages of the analysis, E3 refused to include a sensitivity analysis on *any* of the underlying GHG accounting assumptions summarized above. Only by using flawed and outdated assumptions as a crutch do multiple scenarios, including the Hybrid Electrification and Efficient Gas scenarios, achieve a 90% reduction in gross GHG emissions. If the Department allows these scenarios to play out in the real environment of Massachusetts, they will be far more expensive to consumers, carbon-intensive, and damaging to the environment.

GHG Accounting Concern #1: Failing to account for out-of-state emissions from extraction and transmission of fuels (including natural gas, RNG, and SNG) that are ultimately consumed in Massachusetts.

In the case of natural gas, the MA Inventory only accounts for GHG emissions resulting from natural gas transmission and distribution losses occurring within state borders. This poses a significant concern of substantial undercounting of emissions, particularly for decarbonization scenarios that plan to continue to transmit methane in the form of RNG and SNG through the gas distribution system indefinitely.

In contrast, M.G.L. c. 21N, section 1 requires the MA Inventory to account for GHG emissions resulting from electricity transmission and distribution losses along the entire line.[4] This inconsistency between electricity and fossil fuel accounting, in addition the recent, mounting evidence indicating that methane leaks along the entire gas supply chain are much worse than they were originally thought, are two of the reasons why the New York Climate Leadership and Community Protection Act (CLCPA 2019) required adjustments to New York's GHG accounting practices to account for the emissions resulting from both the extraction and transmission of fossil fuels imported into New York:[5]

*"The statewide greenhouse gas emissions report shall also include an estimate of greenhouse gas emissions associated with the generation of imported electricity and with the **extraction and transmission of fossil fuels imported into the state which shall be counted as part of the statewide total.**"*

[3] Emily Grubert 2020 Environ. Res. Lett. 15 084041 https://iopscience.iop.org/article/10.1088/1748-9326/ab9335

[4] M.G.L. c. 21N, section 1 https://malegislature.gov/Laws/GeneralLaws/PartI/TitleII/Chapter21n/Section1

[5] New York Senate Bill S6599 ("CLCPA") https://www.nysenate.gov/legislation/bills/2019/s6599

The New York State Department of Environmental Conservation (NYSDEC) is taking what is referred to as an "upstream fuel cycle emission factor" approach to comply with the CLPCA.[6] This approach quantifies GHG emissions resulting from the extraction, processing, and transmission of fossil fuels (natural gas, coal, petroleum products) outside the state borders of New York. For example, with natural gas, this approach would account for GHG emissions associated with extraction, gathering and boosting, processing, and transmitting the fuel by using National Energy Technology Laboratory (NETL) natural gas model data and U.S. Greenhouse Gas Inventory (GHGI) emissions data.

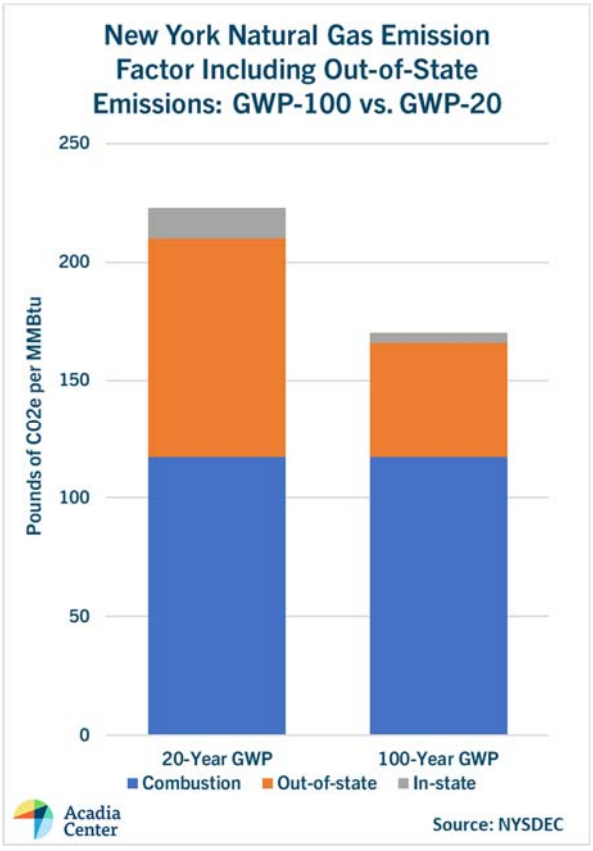
Like New York, Massachusetts should transition to a GHG accounting methodology that accounts for out-of-state emissions associated with fuel production and transmission. Failing to do so ignores the massive concerns associated with fugitive methane emissions. This change, in combination with the second GHG accounting concern described below, would have massive implications for natural gas, RNG, and SNG GHG accounting that would significantly alter the results of E3's analysis.

GHG Accounting Concern #2: Using an outdated global warming potential (GWP) value for methane and failing to consider methane emissions on the 20-year timescale that is most relevant to state's net zero emissions goal.

Both the MA Inventory and the 20-80 analysis rely on the IPCC Fourth Assessment Report 100-year methane global warming potential (GWP) value of 25. Simply put, this is outdated science. The more recent IPCC Fifth Assessment Report puts the 100-year GWP value of methane at 28. Even if one agrees that using a 100-year GWP value of methane is most appropriate for informing Massachusetts' short-term decarbonization policy (Acadia Center does not hold this opinion), by simply using a GWP from an outdated IPCC report, E3's analysis underestimates the GHG impacts of leaked methane in Massachusetts by a minimum of 10.7%.

In New York, the CLCPA required that the state's GHG accounting switch from utilization of a 100-year GWP value, like that currently used in Massachusetts, to a 20-year GWP value given that a 20-year time horizon is more relevant to the goal of net zero emissions by 2050.[7] The 20-year GWP value for methane (84) is three times greater than the 100-year value of methane (28).

The figure to the right shows how these two simple changes to GHG accounting principles in New York (accounting for out-of-state emissions and using 20-year



[6] NYSDEC Technical Conference: Oil and Gas Emissions Accounting webinar: https://meetny.webex.com/recordingservice/sites/meetny/recording/c70b87ddede64ec891f87fde6803080c/playback

[7] New York Senate Bill S6599 ("CLCPA") https://www.nysenate.gov/legislation/bills/2019/s6599

GWP values) increased the natural gas emission factor 84% from 121.3 lbs. CO_2e/MMBtu to 222.7 lbs. CO_2e/MMBtu.[8] Because RNG is chemically identical to natural gas and because the RNG supply chain has been shown to be as, if not more, leak-prone than the natural gas supply chain[9], these same GHG accounting updates also have *massive* implications for RNG.

GHG Accounting Concern #3: Dramatically underestimating the level of methane leaks from the natural gas system within Massachusetts.

Regardless of the GWP value for methane that is used, both the MA Inventory and E3's analysis dramatically underestimate the amount of methane leaking from the gas system in Massachusetts. **A long-term study by Harvard scientists released in 2021 found six times more methane leaking into the air around Boston than reported in the MA Inventory.**[10] The study also observed no changes in the level of methane emissions in the Boston area over a period of 8 years despite significant efforts over that time period to slow the rate of methane leaks in the gas system. Of the six cities studied in the analysis, Boston had the highest natural gas leak rate (4.7%) from "well pad to urban consumer". Using 20-year GWP values, if just 3% of consumed natural gas is lost to the atmosphere as methane, the GHG impact of natural gas is equivalent to that of coal.

It's worth noting that the Harvard study assumed that only 2.2% of natural gas is lost to the atmosphere during production and transmission of the fuel. There are troubling signs that this may be an extremely low estimate. **For example, a 2022 study out of Stanford focused on the Permian Basin in New Mexico, one of the most expansive and highest-producing gas regions in the world, found that more than 9% of all methane produced in the region is being leaked into the atmosphere.** This is nearly 6.5 times EPA's national estimate of gas production leak rate.[11] It's also worth noting the study did not suffer from small sample size - it covered almost 14,000 square mile and over 26,000 wells.

GHG Accounting Concern #4: Making the blanket assumption that biofuels (including RNG and biodiesel) are GHG-neutral.

The assumption that biofuels, including RNG, are GHG-neutral hinges on ignoring many of the lifecycle emissions from RNG. One of the key limitations of the MA GHG Inventory and 20-80 analysis is that lifecycle emissions from RNG are not included. This is a gross simplification of a complex issue, as the EPA's Renewable Fuel Standard demonstrates (see figure below).[12] The EPA analyses examined the production of a number of different types of biofuels using various feedstocks. The results vary considerably, but the overwhelming majority of biofuels show some level of positive net GHG emissions, with some biofuels exceeding the lifecycle emissions of conventional fossil fuels like gasoline and diesel.

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[8] New York State Department of Environment Conservation 2021 Statewide GHG Emissions Report, Appendix A, Table A1, page 17

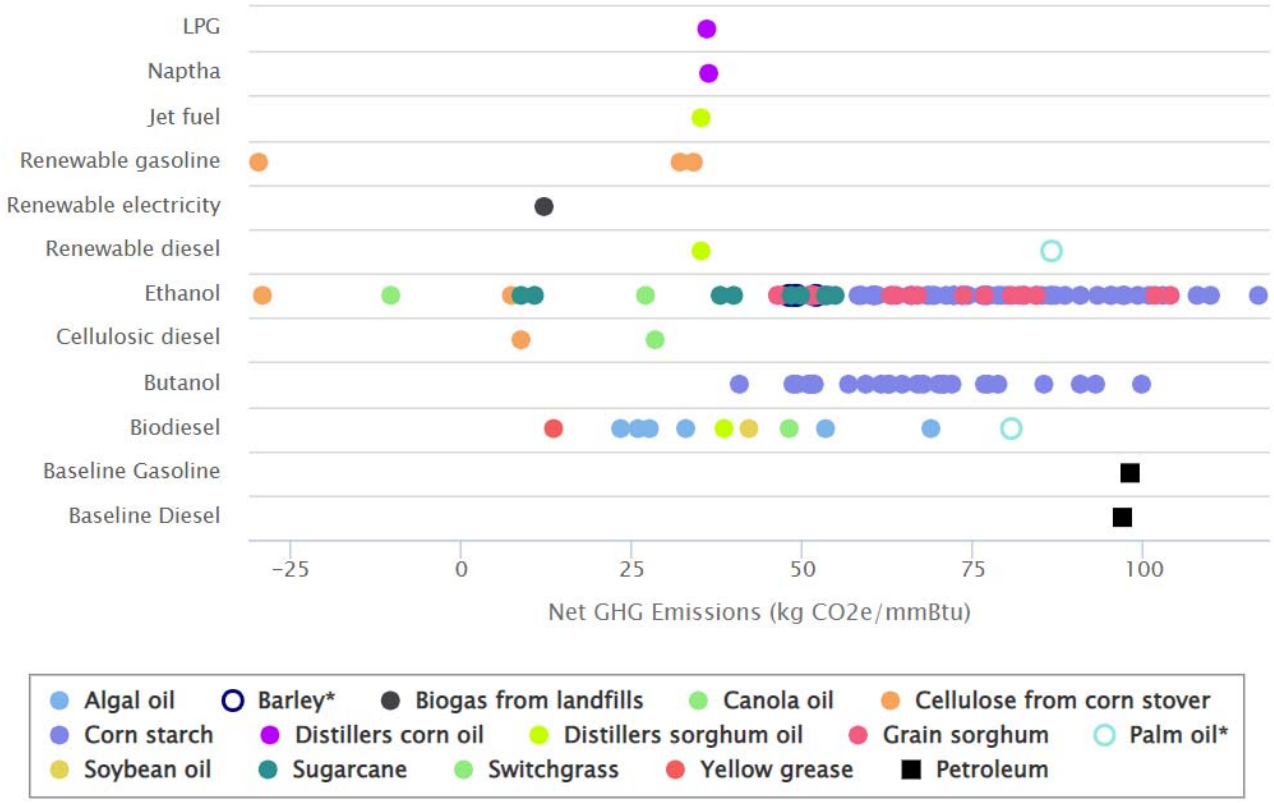
[9] Emily Grubert 2020 Environ. Res. Lett. 15 084041 https://iopscience.iop.org/article/10.1088/1748-9326/ab9335

[10] Sargent et al., 2021. Proceedings of the National Academy of Sciences 118 (44) e2105804118 https://www.pnas.org/doi/10.1073/pnas.2105804118

[11] Chen et al., 2022 Environ. Sci. Technol. 2022, 56, 7, 4317–4323 https://pubs.acs.org/doi/10.1021/acs.est.1c06458

[12] EPA "Lifecycle Greenhouse Gas Results" https://www.epa.gov/fuels-registration-reporting-and-compliance-help/lifecycle-greenhouse-gas-results

EPA Renewable Fuel Standard Program Lifecycle GHG Emissions by Feedstock and Fuel Type[13]



This issue of lifecycle GHG emissions from biofuels gets thornier in the particular case of RNG, where methane leaks along the entire RNG supply chain pose massive GHG concerns. When analyzing the GHG impacts of RNG, it's important to consider the two general categories of RNG: 1) RNG derived from "intentionally produced" methane and 2) RNG derived from "waste methane".

An example of "intentionally produced methane" is converting agricultural residues (e.g. corn stalks remaining after harvest) to methane through a process known as gasification, and an example of "waste methane" is methane released by a landfill as organic material decays. E3 relies on both types of RNG across multiple scenarios in their analysis. As Dr. Emily Grubert, a professor of Environmental Engineering at Georgia Tech, points out in her research, we know that RNG systems leak methane, just like natural gas systems, only potentially at even higher rates. **When we *intentionally* produce methane, *any* methane leaks along the RNG supply chain result in a net increase in GHG emissions.**[14] In other words, if our goal is to minimize GHG emissions, we shouldn't be intentionally producing *any* methane that we know will leak.

[13] EPA "Lifecycle Greenhouse Gas Results" https://www.epa.gov/fuels-registration-reporting-and-compliance-help/lifecycle-greenhouse-gas-results

[14] Emily Grubert 2020 Environ. Res. Lett. 15 084041 https://iopscience.iop.org/article/10.1088/1748-9326/ab9335

For RNG produced using "waste methane", claims of GHG-neutrality are based on a flawed comparison against the worst possible alternative – that is, allowing methane released from sites like landfills to go directly into the atmosphere. That is unlikely to occur in a setting where GHG emissions are regulated, however, as the best option from a GHG perspective, by a wide margin, is to capture the biogas and combust it in a combined heat and power facility that produces both electricity and useful heat. This on-site combustion efficiently converts methane to CO_2 (a far less potent GHG), while simultaneously avoiding downstream methane emissions associated with upgrading, transporting, and distributing RNG. It also has the critical benefit of serving as a "firm" electricity generation resource to compliment a future grid with a high penetration of intermittent renewable electricity resources.

If combined heat and power at a particular site is not a viable option, even just burning the methane on site (a process known as flaring) is better from a GHG perspective than RNG production because it avoids downstream methane leaks along the RNG supply chain, as research by Dr. Grubert highlights.[15] For RNG produced form waste methane to actually be beneficial from a GHG perspective, leak rates along the supply chain would need to be about 1%, but we know they're much higher than that – typically ranging from 2.8% to 4.8% but observed to be as high as 15.8%.[16]

The E3 report openly acknowledges that treating RNG as emissions-neutral is problematic:

"In this Study, the Consultants have assumed that renewable fuels have a net-zero GHG impact, consistent with the Massachusetts GHG inventory. This contrasts to other states, such as New York, that have adopted a lifecycle approach to accounting GHG impacts of renewable fuels. ***The Consultants recognize that treating renewable fuels as having net-zero emissions is a simplification of the complex carbon flux associated with these fuels****, as is further detailed in Appendix 1. As such, pathways that rely more heavily on renewable fuels bears the risks related to GHG accounting methods changing over time."*[17]

"As a result, ***treating renewable fuels as having net-zero carbon emissions may overestimate their decarbonization potential****, especially considering that emissions accounting frameworks in the Commonwealth may evolve.* ***Such an overestimation increases the risk of not meeting the Commonwealth's decarbonization goals****, especially under those economy-wide transitions that rely on high levels of renewable fuels, such as the Efficient Gas Equipment pathway."*[18]

Despite this acknowledgement in the report, the consultants ignored multiple requests from stakeholders to consider net GHG emissions from RNG in their modeling. They also ignored requests from stakeholders to

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[15] Ibid.

[16] Ibid.

[17] Energy and Environmental Economics Inc. (E3) The Role of Gas Distribution Companies in Achieving the Commonwealth's Climate Goals Independent Consultant Report DRAFT, at 48 (2022) https://thefutureofgas.com/content/downloads/2.15.22%20-%20DRAFT%20Independent%20Consultant%20Technical%20Report%20-%20Part%20I%20(Decarbonization%20Pathways).pdf (emphasis added).

[18] Energy and Environmental Economics Inc. (E3) The Role of Gas Distribution Companies in Achieving the Commonwealth's Climate Goals Independent Consultant Report DRAFT, at 184 (2022) https://thefutureofgas.com/content/downloads/2.15.22%20-%20DRAFT%20Independent%20Consultant%20Technical%20Report%20-%20Part%20I%20(Decarbonization%20Pathways).pdf (emphasis added).

address the other three GHG accounting concerns described above (out-of-state emissions, GWP values for methane, methane leak levels within Massachusetts). The fact that E3's analysis just repeated the same mistakes as the MA Inventory without even conducting any sort of sensitivity analysis brings into question the validity of the overall modeling outputs, and the regulatory proposals based upon them.

E3's Analysis Dramatically Underestimates Future Competition for Limited Biomass Resources Needed to Produce RNG

Some forms of *truly sustainable* biofuels, like biogas captured from a landfill or wastewater treatment plant or liquid biofuels produced from crop trimmings left after harvest, can play a role in achieving economy-wide net zero emissions – however, relying on the nation's limited supply of sustainable biomass feedstocks to produce RNG for the gas system does not come without a *massive* opportunity cost. The biomass feedstocks required to produce RNG for use in buildings can be used to produce a variety of fuels that will be critical for decarbonizing various hard-to-electrify sectors including shipping, aviation, heavy-duty trucking, chemical/fertilizer production, high-heat industrial end uses, and "clean firm" power generation.[19]

As a nation, we won't have enough biomass to decarbonize buildings, never mind decarbonizing buildings *and* the hardest-to-electrify sectors. This is one of the reasons that none of the five decarbonization pathways modeled in the Princeton Net-Zero America (NZA) Project found it cost effective to use biomass to produce biofuels for use in residential and commercial buildings, instead prioritizing these fuels for hard-to-electrify sectors.[20]

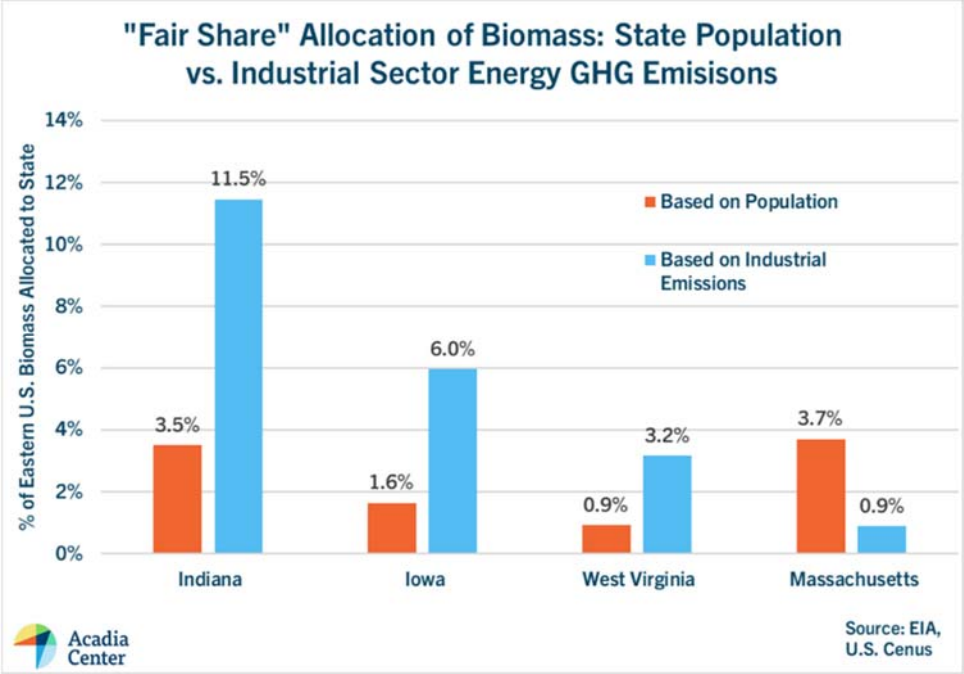
Policies promoting the use of RNG in buildings will both 1) Use limited biomass resources that should instead be diverted to the hardest-to-electrify sectors of the U.S. economy and 2) Drive up the cost of these limited biomass resources, making it even more challenging for the hardest-to-electrify sectors to achieve decarbonization.

E3's model attempts to account for these opportunity costs by modeling competition for biomass feedstocks across the heating, industrial, and transportation sectors *within* Massachusetts. However, E3's model does a poor job of accurately predicting competition for biomass resources across states. E3's approach allocates a "fair share" of biomass resources to each state strictly based on that state's population. For example, since Massachusetts makes up 3.7% of the Eastern U.S. population, E3's model assumes that Massachusetts can responsibly use 3.7% of all Eastern U.S. biomass.

[19] Clean firm power generation is zero-carbon power that can be relied on whenever it is needed for as long as it is needed and serves to compliment intermittent renewable energy resources including wind and solar.

[20] Princeton University Net-Zero America Potential Pathways, Infrastructure, and Impacts Final Report. Slides 30-34. https://netzeroamerica.princeton.edu/the-report

This population-weighted approach fails to account for the critical point that states with a disproportionate concentration of hard-to-electrify sectors, like heavy industry, will need more biomass to achieve carbon neutrality. A simplified example of this dynamic is shown in the figure here.



The orange columns show an allocation of biomass energy resources based on state population, as E3 has assumed. The blue columns show an allocation of biomass based on current industrial sector emissions in each state.

As an example, Indiana's population is lower than that of Massachusetts, yet industrial energy demand in Indiana is nearly *13 times* higher than industrial energy demand in the Commonwealth.[21] Allocating a "fair share" of biomass to states based on industrial sector energy consumption would result in bioenergy resources for Massachusetts being significantly more constrained than E3's model assumes.

In Massachusetts, notice how this tweak to biomass allocation reduces the amount of biomass, and thus RNG, available to Massachusetts by over 75%. If E3 allocated biomass resources based on industrial emissions in each state, the scenarios that rely heavily on RNG would simply fall apart due to a lack of RNG supply. The population-based allocation E3 assumed is very convenient if one is trying to make the case that RNG will be plentiful in Massachusetts, but not-so-convenient for industry-heavy states like Indiana that get shortchanged by this approach.

Acadia Center brought up this major issue several times in the early stages of E3's analysis, but the response from E3 then was similar to the explanation in the report now: "*Other ways to allocate biomass availability to Massachusetts were also considered, and were found to result in similar percentages.*"[22] However, 0.9% of Eastern U.S. biomass and 3.7% of Eastern U.S. biomass are not "similar percentages." It appears that none of these "other ways" considered by E3 were based on the near-universal consensus among experts that alternative fuels should be prioritized for the hardest-to-electrify sectors.

Who will benefit if the Commonwealth achieves net zero emissions by 2050 but in doing so directly makes it harder for other states, regions, and countries to achieve net zero emissions? The answer is nobody.

States with heavy concentrations of industry, like Indiana, already face the most challenging path to achieving decarbonization without states with relatively light concentrations of industry, like Massachusetts, competing for

[21] U.S. Energy Information Administration (EIA) "Energy-Related CO_2 Emission Data Tables," Table 3

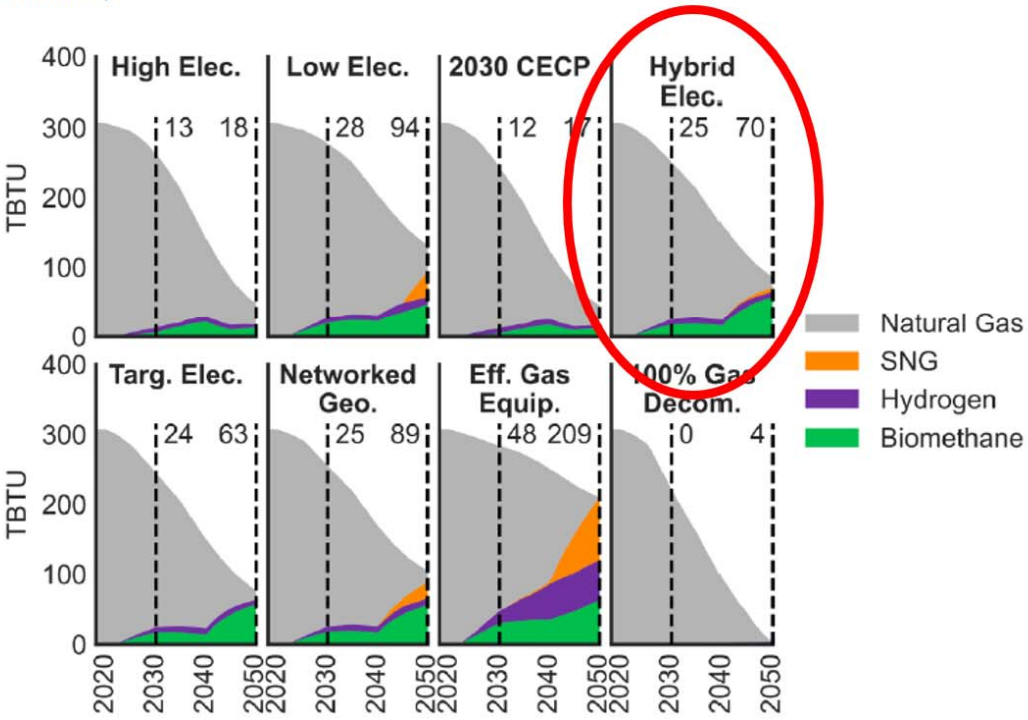
[22] Independent Consultant Report, Appendix 1, page 17

and using biomass feedstocks to produce RNG for unnecessary usage in a sector (buildings) that is relatively easy to decarbonize via electrification. The Commonwealth has a moral imperative to ensure that the path it pursues to achieve net-zero emissions does not directly conflict with the efforts of other states (and in the bigger picture, heavily industrialized countries) to achieve net-zero emissions. The scenario modeling efforts simply ignore this critical dynamic.

E3's Analysis Dramatically Underestimates the Price of Obtaining Large Quantities of RNG in the Coming Decades

In multiple scenarios analyzed by E3, including the Hybrid Electrification Scenario, once the supplies of RNG are exhausted and the blending limitations of hydrogen in the gas system are reached, the only remaining fuel available to further reduce[23] the GHG intensity of the gas system is synthetic natural gas (SNG). You can see this dynamic at play in Figure 15 of the Independent Consultant Report in four scenarios (including Hybrid Electrification and Efficient Gas) that completely exhaust RNG resources according to the parameters established in the model.[24]

Figure 15. Gas throughput and composition over time (TBTU). Chart portrays cases with optimistic renewable gas assumptions. High hydrogen demand in the Efficient Gas scenario is a result of dedicated hydrogen pipelines to commercial buildings and industry.



It's important to note that the figure above is using E3's "optimistic renewable gas assumptions" that assume "*Biomethane is sourced through both anaerobic digestion and gasification. Lower hydrogen and SNG costs are driven by optimistic electrolyzer costs.*"[25] A version of the above figure using E3's "conservative renewable gas

[23] Assuming lifecycle emissions associated with RNG production and methane leaks along the entire gas supply chain don't partially or fully negate GHG-reduction benefits.

[24] Independent Consultant Report, Figure 15, page 50. Red highlight added to highlight Hybrid Electrification scenario.

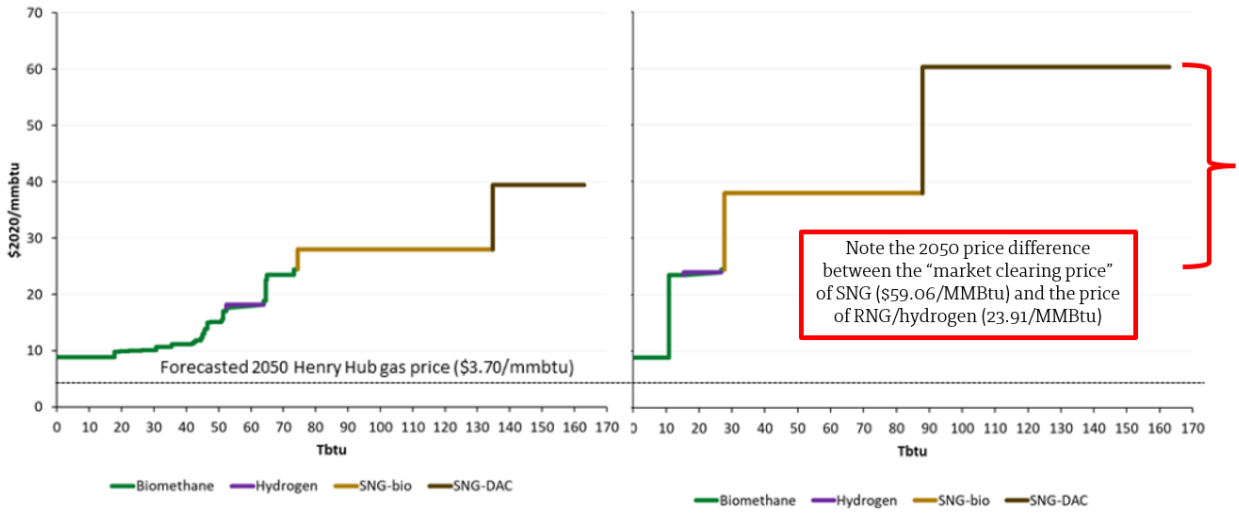
[25] Independent Consultant Report, Appendix 1, page 18

assumptions" was not made available by E3. However, if this figure did exist it would show a significantly heavier reliance on SNG across scenarios, as RNG supplies would be exhausted much earlier. This is a result of the conservative assumptions ruling out the use of biomass gasification (a form of "intentionally produced methane") to produce RNG.

Data provided by E3 for the Efficient Gas Scenario demonstrates the stark difference in reliance on SNG between scenarios assuming optimistic vs. conservative renewable gas assumptions. Under optimistic assumptions, SNG makes up 54% of total energy delivered through the gas distribution system by 2050 in the Efficient Gas Scenario, but under conservative assumptions SNG makes up 83% of the total by 2050.[26] The same data was not provided for the Hybrid Electrification scenario, but one would see a similar dynamic at play.

This point is important to understand because SNG will be dramatically more expensive to produce than RNG over the coming decades. Production of SNG relies on three separate incredibly expensive processes: 1) Green hydrogen production via electrolysis, 2) Direct air capture of CO_2, and 3) Methanation which converts hydrogen and CO_2 to SNG. **Despite RNG and SNG being chemically identical - they're both just methane - E3's analysis assumes the market clearing price of SNG has no impact on the price paid by LDCs to obtain RNG and hydrogen.** See Figure 9 from the Independent Consultant Report[27] depicting renewable gas supply curves in 2050 in the Efficient Gas scenario.

Figure 9. Renewable gas supply curves in 2050 for optimistic and conservative Efficient Gas scenario.



E3 dedicated explained their decision to have the price of SNG not impact the price of RNG or hydrogen in any way by stating:

"The cost of renewable gas in each pathway is based on the market clearing price of the above supply curves each year. That is, if 60 Tbtu of biomethane would be needed from the Efficient Gas pathway (Figure 9), hydrogen sets the market clearing price of ~$17/MMBtu for all 60 Tbtu in the optimistic case. ***An exception is made for SNG,***

[26] Percentages calculated by Acadia Center using data from Independent Consultant Report Appendix 4, worksheet "Renewable Fuels Supply Curve." Similar data for the Hybrid Electrification scenario was not made available.

[27] Independent Consultant Report, Appendix 1, page 20. A similar figure for the Hybrid Electrification scenario was not made available.

which is modeled as a separate market, with utilities procuring resources through bilateral market contracts."[28]

The basic laws of economics suggest that the markets for all three of these fuels – RNG, hydrogen, and SNG – will be interconnected because all three fuels will serve similar roles in (theoretically) decarbonizing a number of end uses, across multiple industries, that currently rely on fossil fuels. E3 acknowledged this dynamic when they made the assumption that the most expensive, marginal unit of either RNG or hydrogen would set the market clearing price. However, in the case of SNG, E3 made the exact opposite assumption – assuming the market for SNG is completely separate from the market for RNG, despite them being chemically identical and used interchangeably.

Take the example of the Efficient Gas scenario with conservative renewable gas assumptions (see figure above and table below). **E3 is assuming that, in 2050, the LDCs are simultaneously obtaining SNG at a cost of $59.06/MMbtu and RNG and hydrogen at a cost of $23.91/MMbtu.[29] Why would Producer A sell RNG to the LDCs at 40% of the price that Producer B is selling chemically-identical SNG to the LDCs?** Producer A is just leaving money on the table – this isn't how markets actually work. E3 attempts to justify this modeling decision by mentioning that the LDCs will enter bilateral market contracts for SNG, but this explanation doesn't hold up. Even if the LDCs did enter bilateral contracts for SNG, what is to prevent suppliers of RNG from raising their prices to match the prices of SNG agreed upon in the bilateral contracts? E3 dedicated one sentence in the entire report to this critical modeling decision.

In the Efficient Gas scenario, if E3 took the correct approach of having the most expensive unit of SNG set the market clearing price for all three alternative fuels, the per unit cost of the LDCs obtaining RNG and hydrogen would increase 147% from the price E3 is currently assuming. The price of obtaining SNG-Bio (SNG produced using CO_2 from biorefineries) would increase 59%. As summarized in the table below, **E3's decision to treat SNG as a separate market in the Efficient Gas Scenario underestimates the cost of the LDCs obtaining alternative fuels in the Efficient Gas scenario by $2.29 billion *per year* in 2050.**

Comparing Total Annual Fuel Costs in 2050 in the Efficient Gas Scenario Using "Conservative Renewable Fuel" Assumptions: E3 Approach (SNG as Separate Market) vs. Alternative Approach (SNG Sets Market Clearing Price)[30]

	E3 Analysis: SNG As Separate Market			Alternative: SNG Sets Market Clearing Price		
Fuel Type	Price ($million/TBtu)	Cumulative Quantity (TBtu)	Total Cost ($million)	Price ($million/TBtu)	Cumulative Quantity (TBtu)	Total Cost ($million)
RNG/Hydrogen	$23.91	27.7	$663	$59.06	27.7	$1,637
SNG-Bio	$37.24	60.3	$2,246	$59.06	60.3	$3,561
SNG-DAC	$59.06	75.0	$4,429	$59.06	75.0	$4,429
TOTAL	**N/A**	**163.0**	**$7,338**	**N/A**	**163.0**	**$9,627**
					Total Annual Fuel Cost Difference ($million):	**$2,289**

It's worth noting that a similar analysis can't currently be conducted for the Hybrid Electrification scenario because E3 hasn't provided the data to stakeholders. Nonetheless, it's safe to say that all scenarios that exhaust

[28] Independent Consultant Report, Appendix 1, page 20

[29] Independent Consultant Report, Appendix 4, "Renewable Fuels Supply Curve" worksheet

[30] Raw data for table from Independent Consultant Report, Appendix 4, "Renewable Fuels Supply Curve" worksheet

RNG supplies (and are thus reliant on SNG) significantly underestimate the true cost of obtaining RNG and hydrogen. **It's also important to consider that even under scenarios where Massachusetts *does not* procure any SNG but other states *do* procure SNG, SNG would still set the market clearing price for RNG and hydrogen imported to Massachusetts.** As we know, markets for imported fuels are not confined to individual states.

Acadia Center and other stakeholders brought up this major issue several times in the early stages of E3's analysis, but E3 made the unilateral decision to continue treating SNG as a completely separate market from RNG and hydrogen. This flawed decision dramatically skews the analysis in favor of scenarios that rely heavily on hydrogen, RNG, and SNG as a means for decarbonizing the building sector in the Commonwealth.

E3's Analysis Doesn't Quantify the Local Economic Impacts of Various Scenarios

The Massachusetts Decarbonization Roadmap Study found that pathways that invested in local energy resources, including renewable electricity generation and energy efficiency, created more jobs and demonstrated greater economic benefits by keeping money local than the pathways more reliant on imported energy. For example, the "All Options" pathway from the Roadmap (which emphasized deep electrification and broad renewable electricity buildout) had 17% higher economic "output" (the broadest measure of economic activity) in Massachusetts per dollar invested than the "Pipeline Gas" pathway (which relied heavily on imported alternative fuels).[31,32]

However, quantifying the local economic and jobs impact of various scenarios was deemed out of scope in E3's analysis. This is extremely problematic when you step back and think through some of economic ramifications of the various scenarios posed by E3. **Scenarios that rely heavily on hydrogen, including the Efficient Gas and Hybrid Electrification scenarios, are assumed to import all hydrogen from Pennsylvania in the E3 analysis.** Importing hydrogen from Pennsylvania was found to be the most cost-effective option, largely because Massachusetts, and New England more broadly, do not have naturally occurring, cost-effective geological features (e.g. salt caverns) capable of storing hydrogen.[33] In the E3 analysis, hydrogen production in Pennsylvania was assumed to entail large investments in hydrogen electrolyzers in Pennsylvania, dedicated on-shore wind capacity in Pennsylvania to power those electrolyzers, underground storage in Pennsylvania, and a 400-mile hydrogen pipeline from Pennsylvania to New England. In other words, it would create many jobs in Pennsylvania, but very few in Massachusetts.

Sending money and jobs out of state is also a staple of scenarios, including the Efficient Gas and Hybrid Electrification scenarios, that rely heavily on RNG. **E3's model assumes the vast majority of RNG consumed in the Commonwealth is imported from outside of New England.** This is largely result of biomass resource availability in New England being, on a per capita basis, about 25% that of the national average according to E3's analysis (0.63 dry tons per person per year in New England vs. 2.47 nationally).[34] In summary, in the E3 analysis, a reliance on both hydrogen and RNG means sending large amount of ratepayer dollars and job out of state.

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[31] Massachusetts Decarbonization Roadmap, Economic and Health Impacts Report, Table 3, page 13 https://www.mass.gov/doc/economics-and-health-impacts-report/download

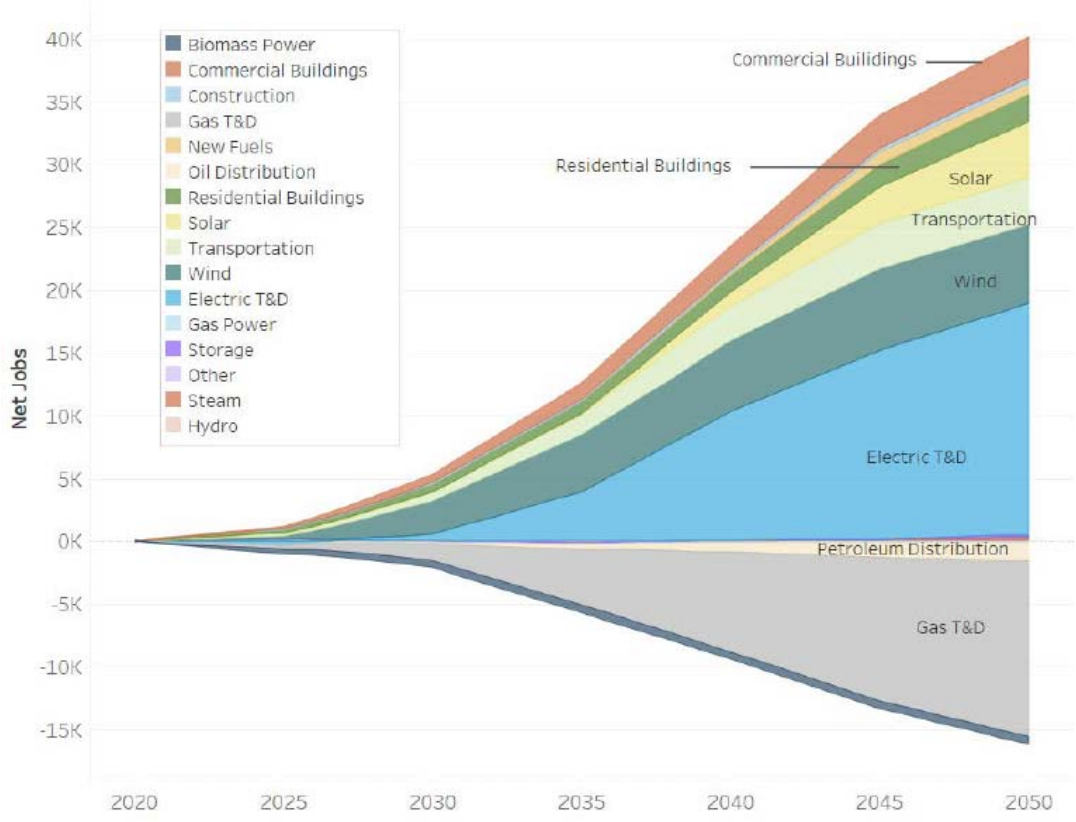
[32] It's worth noting that the "Pipeline Gas" pathway in the MA Roadmap made much more significant investments in energy efficiency upgrades than the "Hybrid Electrification" scenario evaluated by E3.

[33] Independent Consultant Report, Appendix 1, page 18

[34] Independent Consultant Report, Appendix 1, page 16

Alternatively, scenarios like High Electrification, Networked Geothermal, and 100% Gas Decommissioning, do a better job of keeping money local by investing more aggressively in energy efficiency, local renewable electricity generation, and electricity system transmission and distribution buildout. The job-creation benefits of the MA Roadmap's "All Options" pathway, which relies heavily on building electrification, are demonstrated below.

Net Change in Directly Created Jobs by Year for the Massachusetts Decarbonization Roadmap All Options Pathway[35]



It's worth noting that the Hybrid Electrification assumes the least substantial investment in building shell retrofits of any scenario investigated by E3. With that assumption comes fewer jobs in the local energy efficiency industry. The downside of this approach – fewer local jobs making our buildings more efficient – just simply isn't captured in the E3 analysis. Scenarios that place a larger emphasis on the utilization of heat pumps also leverage locally available resources, heat in the Commonwealth's air and ground, and renewable energy gathered from the sun and wind for usable energy. Again, the downside of a continued reliance on imported energy is just simply not quantified in the E3 analysis. Acadia Center, and other stakeholders, requested multiple times throughout the 20-80 modeling process that E3 quantify the local economic and jobs impacts of various scenarios, but E3 denied this request.

[35] Massachusetts Decarbonization Roadmap, Economic and Health Impacts Report, Figure 7, page 14 https://www.mass.gov/doc/economics-and-health-impacts-report/download

E3's Analysis Doesn't Address the Last 10% of Emissions and Thus Ignores Tradeoffs Between Biomass as a Feedstock for Biofuels vs. Biomass as a Source of Negative Emissions

There is scientific consensus among experts that negative emissions, accomplished through either CO_2 removal (CDR) or carbon capture and storage (CCS), will be needed to achieve global climate targets by 2050 and beyond. From the IPCC Sixth Assessment Report summary document:

*"Global net zero CO_2 emissions are reached in the early 2050s in modelled pathways that limit warming to 1.5°C (>50%) with no or limited overshoot, and around the early 2070s in modelled pathways that limit warming to 2°C (>67%). **Many of these pathways continue to net negative CO2 emissions after the point of net zero**."* [36]

The Massachusetts Executive Office of Energy and Environmental Affairs (EEA) acknowledged this need for negative emissions when it set a target of 85% reduction of gross emissions by 2050. This gross emissions reduction target relies on the assumption that the last 15% of gross emissions will be "netted out" via sequestration.

Both the Massachusetts Roadmap and the D.P.U. 20-80 scenario analysis conducted by E3 modeled a 90% reduction in gross emissions by 2050 and assumed the final 10% of emissions would be netted out by sequestration, but neither modeling effort has conducted rigorous analysis to demonstrate how the 10% sequestration level could realistically and cost-effectively be achieved. The Roadmap limited its analysis to enhancing the carbon sequestration potential of Massachusetts' forests and soils and found that their potential for sequestration (~5 $MMTCO_2e$) is well short of the 10% sequestration needed (~9.4 $MMTCO_2e$), never mind the 15% established by state mandate (14.1 $MMTCO_2e$).[37] **E3's modeling makes a simple assumption that 10% sequestration will be needed and the Commonwealth will achieve that level of sequestration, but the analysis does not investigate how or at what cost.** The E3 report makes one reference to this topic in a footnote: *"Consistent with the 2050 Roadmap, remaining emissions in 2050 are assumed to be netted off by carbon sinks to achieve carbon neutrality by 2050."*

Many reputable studies investigating the most cost-effective route to achieving negative emissions at scale point to the critical role of biomass. For example, one of the key conclusions of the Princeton Net Zero-America modeling effort was that, by far, the most valuable and cost-effective use of limited biomass feedstocks was the production of hydrogen via biomass gasification with carbon capture and sequestration.[38] According the Princeton analysis, biomass gasification with carbon capture and sequestration to produce hydrogen has a two-birds-one-stone advantage: It both 1) Results in negative emissions 2) Generates a *net negative-emissions fuel* that can be used to decarbonize hard-to electrify sectors (e.g. high-heat industrial, aviation, maritime, clean firm power generation).

As a result, the Princeton study's "High Electrification" pathway found that by 2050, about 68% of all biomass feedstocks nationally were used to produce net negative-emissions hydrogen. The "Less-high Electrification" pathway reached a similar conclusion with about 61% of all biomass feedstocks allocated to production of net

[36] IPCC Sixth Assessment Report, Summary for Policymakers Headline Statements, page 3
https://www.ipcc.ch/report/ar6/wg3/resources/spm-headline-statements/

[37] Massachusetts 2050 Decarbonization Roadmap, Economic and Health Impacts Report, page 72
https://www.mass.gov/doc/ma-2050-decarbonization-roadmap/download

[38] Princeton University Net-Zero America Potential Pathways, Infrastructure, and Impacts Final Report. Slide 172.
https://netzeroamerica.princeton.edu/the-report

negative-emissions hydrogen.[39] Critically, Princeton found overwhelmingly that the most cost-effective use of the hydrogen generated via biomass gasification was for direct "demand side" uses (e.g. transport, production of chemicals, direct-reduced iron, process heat in various industries) and production of synthetic liquid fuels for use in portions of the transportation sector that are highly challenging to electrify. None of the scenarios investigated in the Princeton study found it cost-effective to use any hydrogen in residential and commercial buildings.[40]

Biomass gasification and pyrolysis plays a lynchpin role in achieving negative emissions in the Princeton study: In the "high electrification scenario" biomass accounts for approximately 70% of captured carbon and in the "less-high electrification" scenario (where higher levels of negative emissions are required) it accounts for approximately 40% of captured carbon.[41] This is a critical point**. Biomass gasification to produce RNG for eventual consumption in commercial and residential buildings will, under *absolutely ideal* circumstances, will at best be a carbon neutral fuel.**[42] Because supplies of truly sustainable biomass are extremely limited, using these limited feedstocks to produce (theoretically) carbon neutral biomethane for consumption in a relatively easy-to-electrify sector (buildings) comes with a huge opportunity cost. **It inhibits the ability of Massachusetts, and the U.S. as a whole, to use biomass produce net-negative that will be needed to achieve the 2050 net zero target and the negative emissions that are needed *beyond* 2050.**

E3's modeling approach completely ignores this tradeoff by making a blanket assumption that the Commonwealth will achieve 10% sequestration in all scenarios without modeling how or at what cost. By ignoring this critical tradeoff, scenarios analyzed by E3 that rely heavily on RNG, if implemented, jeopardize the ability of the Commonwealth to actually achieve the 2050 net zero target and sustain necessary negative emissions beyond 2050.

E3's Analysis Doesn't Evaluate Net System Costs Beyond 2050 and Thus Underestimates the Savings Associated with Gas System Decommissioning

Initial decisions on how a model is set up can significantly impact the policy recommendations and conclusions resulting from that model. One of the modeling decisions that was made in the early phases of the 20-80 analysis was to only investigate decarbonization pathways, and their associated costs and benefits, out to 2050. Figure 2 in the Independent Consultant Report highlights cumulative energy system costs relative to the reference scenario by decade across the eight scenarios analyzed by E3.[43] However, the figure begs the question, "What is happening to cumulative energy system costs after 2050?" Given that largescale energy transitions of the scale currently being undertaken in the Commonwealth take decades, are capital intensive, and often have delayed benefits, this strikes Acadia Center as a critical question.

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[39] Princeton University Net-Zero America Potential Pathways, Infrastructure, and Impacts Final Report. Slide 175. https://netzeroamerica.princeton.edu/the-report

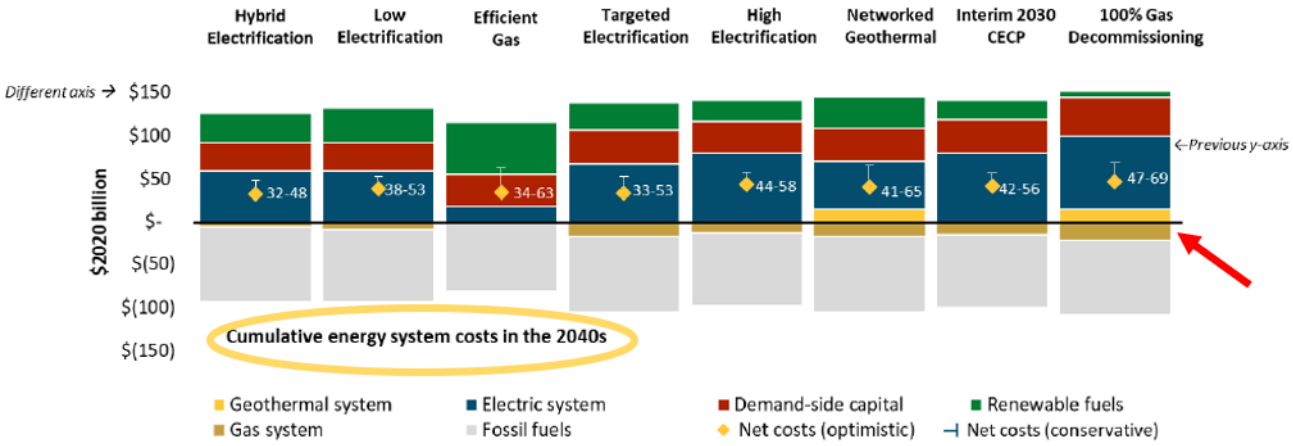
[40] Princeton University Net-Zero America Potential Pathways, Infrastructure, and Impacts Final Report. Slides 30-34. https://netzeroamerica.princeton.edu/the-report

[41] Princeton University Net-Zero America Potential Pathways, Infrastructure, and Impacts Final Report. Slide 206. https://netzeroamerica.princeton.edu/the-report

[42] Assuming sustainable sources of biomass feedstocks and significantly reduced levels of methane leakage across the entire biomethane supply chain which are likely not technically feasible.

[43] Independent Consultant Report, Figure 2, page 13.

Figure 2. Cumulative (simple sum) energy system costs relative to reference by decade ($2020, billion). Demand-side capital costs include all incremental consumer costs, including heating appliances, building shell retrofits and the cost of EVs.



Take, for example, the "100% Decommissioning" scenario that envisions a fully decommissioned gas system by 2050. It intuitively makes sense that a large portion of the avoided costs from this scenario would occur post-2050, when past investments in the gas system have become fully depreciated and Massachusetts ratepayers are no longer responsible for the costs associated with maintaining an extensive gas system (because that gas system has been fully decommissioned). Yet, because the analysis made the arbitrary decision to only consider costs over the next 28 years, it doesn't provide any insight into post-2050 energy system cost comparisons across scenarios.

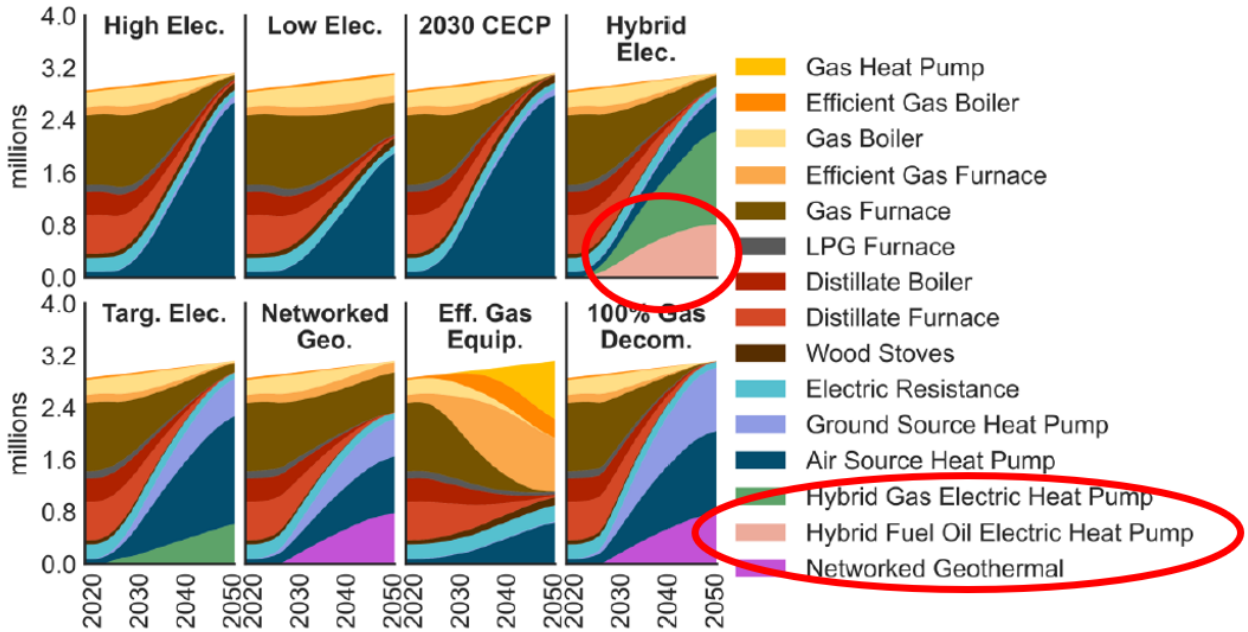
This modeling decision seems particularly disadvantageous to scenarios that partially or fully decommission the gas system and particularly favorable to scenarios (e.g. Efficient Gas, Hybrid Electrification) where a higher share of the total energy system costs in the 2030s and 2040s are the result of procuring "renewable fuels." There was no discussion of this critical topic in the E3 report. Acadia Center thinks it is essential to quantify cost-benefit tradeoffs across scenarios beyond 2050 in order to make an informed decision on the most suitable decarbonization pathway moving forward.

Inconsistent Oil Sector Modeling Decisions Make Apples-to-Apples Cost Comparisons Across Scenarios More Challenging and Potentially Skew Results in Favor of the Hybrid Electrification Scenario

When reviewing E3's Hybrid Electrification scenario, one thing that jumps out is the heavy reliance on hybrid fuel oil/electric heat pump systems (i.e., buildings that serve a portion of their space heating demand from a heat pump and the remaining portion of from a fuel oil back-up system that uses 100% biodiesel by 2050). Figure 5 from the Independent Consultant Report Appendix 1 below highlights the heavy reliance on hybrid oil systems in the residential sector out to 2050.[44]

[44] Independent Consultant Report, Appendix 1, Figure 5, page 14

Figure 5. Transformation of residential space heating stocks.



The Hybrid Electrification scenario is the only scenario in the E3 report that uses hybrid oil heating systems. As of 2019, 24.4% of households in Massachusetts relied on fuel oil as their primary heating source.[45] E3's reference scenario appears to assume that percentage will decrease by 2050, with fuel oil space heating equipment making up 15% of residential space heating sales share in 2050. The Hybrid Scenario, in contrast, assumes that hybrid oil systems will make up 26% of residential space heating sales by 2050.[46] This is important to note, because the Reference scenario assumes that a significant portion of customers that currently heat with oil will switch to gas heating, a transition that requires a significant capital investment in the gas system, a cost that is avoided in the Hybrid Electrification scenario.

There is significant up-front capital cost associated with either A) Expanding the gas distribution system to reach oil heating customers or B) Transitioning oil heating customers to all-electric heat. **By avoiding both up-front investments, the modeling decision to rely heavily on the hybrid oil approach in the Hybrid Electrification scenario is likely a major driver of the overall system-wide cost savings portrayed in that scenario.** This point is not discussed in the E3 report, but it seems like a critical piece of the overall discussion from Acadia Center's perspective. The modeling decision to use hybrid oil heating in one scenario is peculiar, given that the primary focus of the 20-80 analysis is the future of the gas distribution system. It's difficult to compare the overall costs across the scenarios developed by E3 when the assumptions around the oil sector are not kept consistent across scenarios and it's not made clear what portion of overall scenario savings are the result of oil sector modeling decisions.

It's also important to note that E3 made a modeling decision to use "non-pipe" hybrid approaches (i.e. hybrid heating solutions that don't rely on the gas distribution system) for one subset of customers (oil heating customers) in one specific scenario (Hybrid Electrification). They chose not to use this "non-pipe" hybrid approach for any other scenarios or for any existing gas customers in any scenario. For example, one can imagine

[45] EIA Massachusetts State Energy Profile https://www.eia.gov/state/print.php?sid=MA

[46] Independent Consultant Report, Appendix 4, "Scenario parameters (details)" worksheet.

a version of the Targeted Electrification scenario where non-pipe hybrid heating options (e.g. heat pump paired with propane, heat pump paired with pellet stove) are used to accelerate strategic decommissioning of the gas system, minimize the impacts of winter peak, and minimize overall system-wide costs. Was this option considered by E3? If it was included, would it improve the overall cost-effectiveness of the Targeted Electrification or 100% Gas Decommissioning scenarios? It's impossible to answer these questions as a stakeholder without additional information.

In summary, Acadia Center thinks that modeling decisions related to the oil sector should have been kept more consistent across scenarios to facilitate apples-to-apples costs comparisons across scenarios and maintain the overall focus of the analysis on the future of the gas system. E3 needs to provide additional information on the logic behind this modeling decisions and the ramifications of only considering the "non-pipe" hybrid approach in the Hybrid Electrification scenario.

LDC/Consultant Proposed Regulatory Changes

Based on the work of E3 (which we have critiqued above), Scott Madden produced Considerations and Alternatives for Regulatory Design to Support Transition Plans (Regulatory Designs Report). This report included a set of six objectives and corresponding recommended regulatory changes for the LDCs to pursue to "implement strategies relating to the transition of the gas system to net-zero emissions as well as to mitigate cost and rate impacts on customers, especially low-income customers and those in environmental justice (EJ) communities."[47] In general, Acadia Center strongly supports four of these objectives and the recommendations that enable them: namely, 1) support customer adoption and conversion to electrified heating technologies; 4) manage gas infrastructure investments and cost recovery; 5) evaluate and enable customer affordability; and 6) develop LDC transition plans and chart future progress. However, for health, safety, economic, and GHG accounting issues detailed above, we believe that it is premature and ill advised to begin to introduce gas alternatives into the pipeline, tariff, or design standards that would enable customer-funded R&D or pilots related to fuel production or type (recommendations 2 and 3).

From the Regulatory Designs Report, the LDCs then developed a Common Regulatory Framework and Overview of Net Zero Enablement Plans (Common Framework). The LDCs used the recommendations of the Consultants to develop their own suite of regulatory initiatives. The following subsections cover Acadia Center's thoughts on both the objectives and recommendations from the Consultants and the LDCs proposed regulatory initiatives in greater detail.

LDC/Consultant Proposed Regulatory Changes that Acadia Center Supports

The LDCs make a number of recommendations that are in line with Acadia Center policies and should be adopted. In particular, the expansion and enhancement of the energy efficiency programs as recommended by the Consultants should embraced. Energy efficiency has historically been and remains one of the best options for the Commonwealth to reduce greenhouse gas emissions. Included with that recommendation must be an investigation into alternative funding mechanisms for the deep decarbonization, including weatherization, pre-weatherization barriers, and electrification. Beyond energy efficiency, the Consultants recommend investigations into electric and gas rate policies and potential cost recovery options and the development of frameworks for Net

[47] Independent Consultant Report-Considerations and Alternatives for Regulatory Designs to Support Transition Plans https://thefutureofgas.com/content/downloads/2022-03-21/3.18.22%20-%20Independent%20Consultant%20Report%20-%20Regulatory%20Designs.pdf, at 8

Zero Enablement Plans, minimizing or avoiding gas infrastructure projects, and improved coordination between gas and electric system planning and investments. Acadia Center believes each of these recommendations represent interested possibilities that should be explored.

Increase Funding of Energy Efficiency Programs

As the Consultants highlighted, "in order for net zero climate goals to be met, nearly every LDC customer will need to take action to retrofit their homes and business[es]".[48] Such an undertaking will require massive increases in funding, workforce development, and programs designed to drive the large-scale retrofit efforts. As the LDCs stated in the Common Framework, "each pathway will require a focused and tailored communication outreach and program development for environmental justice communities, low-income consumers, and landlords/tenants to address challenges and hurdles unique to these customer groups."[49] Acadia Center agrees – and recommends a regulatory change that directs the efficiency programs to begin the large-scale intervention to electrify and weatherize such populations first, rather than letting market forces leave them until the end. By funding substantial expansions to the energy efficiency and electrification programs that focus on underserved communities, the Commonwealth can drive broad market transformation while also addressing longstanding inequities in access to efficiency services. Serving these populations is even more crucial given the consultants' finding that customers who are unable to fund upfront costs for electrification are, absent supportive regulatory changes that Acadia Center recommends, more likely to remain as LDC customers and bear a disproportionate responsibility for LDC distribution costs, and that low-income ratepayers, unable to participate in decarbonization are likely to spend increasingly high shares of their income on energy.[50]

Enhance Energy Efficiency Measures

The energy efficiency programs should be both better funded and expanded to include new measures. A push for new strategies and technologies, such as electrification and geomicrogrids, will require novel ideas and updates. Therefore, Acadia Center agrees with the consultants that these programs should be enhanced. Such enhancements would include higher targeted incentives, modifications to the cost-effectiveness criteria to account for the full range of benefits of electrification, and other strategies to raise customer education, awareness, and adoption of decarbonization strategies and technologies. Acadia Center would also go further than the Consultants, calling for a ban on new fossil fuel equipment supported through the programs. This concept, also proposed in the Interim 2030 CECP, is also contained in the recent Massachusetts Senate climate bill, S.2819, *An Act Driving Climate Policy Forward*.

Evaluate Alternative Funding Mechanisms

In tandem with the increased funding necessary for an enhanced energy efficiency program, there must also be an evaluation of the funding mechanisms currently associated with the energy efficiency programs. As stated earlier, the rapid expansion of these programs will require massive increases in funding. The current system

[48] Ibid, at 97

[49] LDC Common Regulatory Framework And Overview of Net Zero Enablement Plans https://thefutureofgas.com/content/downloads/2022-03-21/Common%20Regulatory%20Framework%20(3-18-22)%20FINAL.pdf, at 12

[50] Ibid, at 12-13, citing Independent Consultant Report-Considerations and Alternatives for Regulatory Designs to Support Transition Plans, at 102-103, 106.

funds most of the program through ratepayers' bills, which is not sufficient to deliver the widespread deep decarbonization necessary without significant bill hikes. Additionally, raising electric rates through increasing efficiency charges, is incompatible with encouraging more electrification. There must be ongoing funding. For example, the creation of a building decarbonization fund, supported by funds from the American Rescue Plan Act of 2021, bond authorizations, or other options, could serve as a model for sustainable funding. Acadia Center agrees with the Consultants that an investigation of alternative funding mechanisms for deep decarbonization efforts such as weatherization and electrification is necessary, but we disagree with their assertion that such funds should go to support the ongoing utilization of an aging natural gas system as it declines in usefulness. Funding at this point must be primarily focused on true deep decarbonization efforts.

Examine Electric and Gas Rate Policies to Reflect Changing Demand Requirements and Cost Implications

Our current rate structure was designed for our current energy system, with two major energy transmission and distribution systems running in parallel. As the Consultants point out, electrification and decarbonization technologies provide an opportunity to evaluate and examine our current rate policies, specifically those for low-income customers. The shift in peak demand as more customers electrify combined with the Commonwealth achieving close to full adoption of advanced metering infrastructure underscores the need for an investigation into electric rates. The Department may also investigate an update of revenue decoupling, as outlined later in this document. Gas rates should similarly be evaluated for fair and reasonable sharing of accelerated depreciation costs.

Approval of Framework for Net Zero Enablement Plans

A key component of the proposals from the LDCs is the development of initial transition plans, also called Net Zero Enablement Plans. These plans would be specific to each LDC and designed to pursue a portfolio of the various decarbonization strategies analyzed by the Consultants, in order to meet the Commonwealth's 2050 net zero GHG emissions target, while maintaining the safety and reliability of the gas distribution system. While Acadia Center strongly opposes approval of the currently proposed Net Zero Enablement Plans, which will be discussed in greater detail below, we are more supportive of the proposed framework for developing future iterations of LDC-specific Net Zero Enablement Plans. The LDCs propose that the timing on these plans aligns with the state's 3-year energy efficiency plan, using a 5 and 10-year planning horizon, and require:

- A Demonstration of non-pipeline alternatives
- Data to inform decision making
- Periodic updates regarding progress toward specific issues, specifically environmental justice issues
- Other enabling proposals under consideration by LDCs

As explained further below in the section on our proposed procedural reforms, Acadia Center agrees that to meet our Commonwealth's ambitious climate targets, well-reasoned long-term planning is essential. We disagree that the initial planning should be performed by the LDCs, but otherwise support the timeline, development of non-pipeline alternatives, data sharing, and updates towards progress on specific issues like environmental justice. We hope for the LDCs to be full partners in the transition to a decarbonized future and are open to the process

including "[o]ther enabling proposals under consideration by LDCs," within certain parameters.[51] For example, a framework centered around a proposal for comprehensive environmental justice protections would be appreciated. However, a proposal focused on an expansion of the natural gas system would be opposed.

Investigation of Potential Cost Recovery Options

The Common Framework makes a crucial point about customer costs and burdens. It accurately points out that our rapidly shifting energy infrastructure will cause major changes to how energy costs are recovered by utilities (though they limit their analysis to the natural gas distribution system). Currently, utilities recover costs from customers served by the gas system through supplier charges, distribution charges, and revenue decoupling. As electrification efforts progress in the Commonwealth, the customer base for natural gas will decline. Therefore, it is imperative that the Department investigate various cost recovery options, as recommended by the LDCs. The LDCs identify three specific ideas for study, each of which has some merit:

- **Customer Affordability Issues:** As more and more customers in the Commonwealth electrify their homes, the LDCs will see a declining customer rate base. Therefore, there is the possibility that, without appropriate regulatory changes, those remaining on the system (those in the most difficult to electrify homes), will disproportionately suffer the costs of the transition. Acadia Center agrees with the LDCs that further investigation into solutions to address customer affordability issues is necessary. However, we disagree that exit fees from customers leaving the gas system or subsidies from electric customers will emerge from that investigation as appropriate methods.
- **Role of Accelerated Depreciation:** The LDCs offer accelerated depreciation as an opportunity to align cost recovery of gas distribution costs with the utilization of the distribution system. Acadia Center believes this concept is worthy of investigation.
- **Revenue Decoupling:** As part of the order in the 2022-2024 Statewide Three -Year Energy Efficiency Plan, the Department announced its intent to discontinue revenue decoupling for electric distribution companies (EDC) and directed each EDC to include a rate proposal that included full recoupling in each company's next base rate proceeding.[52] The Department raises the idea that revenue decoupling for EDCs may conflict with the Commonwealth's push for electrification. Acadia Center agrees that evaluation of alternatives to decoupling is worth additional study, but disagrees that full recoupling is the best solution.[53] Acadia Center prefers a full generic investigation in its own docket, as opposed to a piecemeal approach in each EDC's rate base proposal. In addition, as the forthcoming wave of building electrification will affect not only the electric companies' business models, but also the LDCs, Acadia Center believes that a reevaluation of decoupling for gas rates is also an appropriate topic for the generic docket.

Develop Standards for Review and Approval of Pilot and Research and Development Programs & Design Cost Recovery Mechanisms

The Consultants propose the development of a process for the Department to review and approve pilot opportunities for decarbonized technologies. They state that the current process includes project-by-project

[51] LDC Common Regulatory Framework and Overview of Net Zero Enablement Plans, at 18

[52] https://fileservice.eea.comacloud.net/FileService.Api/file/FileRoom/14509636, at 234

[53] See https://www.nrdc.org/experts/max-baumhefner/are-efficiency-and-electrification-policies-conflict

evaluation and should be streamlined with guidance toward qualified projects, including filing requirements, qualification criteria, and pricing and rate design modifications. Acadia Center agrees that these standards should be developed, though with some qualifications. Research, development and piloting programs designed to enable deep weatherization, electrification, and geomicrogrids, address pre-weatherization and pre-electrification barriers, and permit other ways of utilizing LDCs' expertise to enable decarbonization in ways that do not involve expanded use of alternative fuels like hydrogen and RNG, should be approved. These types of programs are the true path toward a decarbonized economy and should be supported, with closely tracked performance mechanisms. The Department should also work toward the Consultants' recommendation to design cost recovery mechanisms for these approved programs.

Acadia Center believes that, pursuant to the precautionary principle, there should be a ban on piloting new fuel mixtures for use within consumers' homes and businesses until they are established to be safe to occupants, along pipelines, and truly carbon-neutral. Research and development related to fuel mix should remain as they are now, paid at shareholder expense (like fossil fuel extraction through fracking). Use of these fuels in the gas distribution system is highly problematic for the multitude of reasons discussed in detail above.

Develop Framework to Examine and Implement Opportunities to Minimize or Avoid Gas Infrastructure Projects Through Utilization of Decarbonized Technologies and Strategies, While Maintaining Safety and Reliability

The Consultants provide four recommendations to support recovery of embedded infrastructure costs. The first of these, centered around minimizing or avoiding gas infrastructure projects through utilization of decarbonized technologies and strategies, is wholeheartedly supported by Acadia Center, though for slightly different reasons. Avoiding or minimizing unnecessary infrastructure, combined with coordinated system planning, provides major ratepayer benefits and keeps costs low. It also protects against poor investments that lock-in ratepayers into financing long-term investments that make little economic, climate, or health and safety sense.

Include in the Framework a Standard to Improve Coordination Between Gas and Electric System Planning and Investments

Acadia Center essentially agrees with the Consultant's recommendation requiring the Department to consider how to improve coordination between gas and electric utilities regarding planning and investments. The transition will require careful thought and coordinated planning, as articulated in more detail in Acadia Center's regulatory proposal, below

LDC/Consultant Proposed Regulatory Changes that Acadia Center Opposes

Unfortunately, the LDCs and Consultants also include a number of regulatory recommendations that Acadia Center cannot support. These recommendations rely upon assumptions from the Consultants' model. As outlined above, Acadia Center believes much of the model, particularly assumptions relative to RNG, SNG, and hydrogen, is critically flawed. It follows that the regulatory recommendations that focus on maintaining LDC pipelines for use with RNG, SNG, and hydrogen are critically flawed as well and should be rejected.

Approval of Net Zero Enablement Plans/ Net Zero Enablement Plan Factor Model Tariff

When developing their Net Zero Enablement Plans, the LDCs relied upon deeply flawed models from the Consultants. The accuracy of the Net Zero Enablement Plans cannot be relied upon and should not be approved by the Department. Additionally, Acadia Center urges the Department to compel the Consultants to revise its

models and the LDCs to update their Net Zero Enablement Plans accordingly. At worst, Acadia Center urges the Department to open an adjudicatory proceeding on the Plans. Similarly, the Net Zero Enablement Plan Factor Model Tariff is a product of each LDC's Net Zero Enablement Plans. As those Plans are critically flawed, the Department should reject this request for a tariff.

Authorization of Decarbonized Gas Cost Recovery Through CGA Clause

The LDCs request to recover for the cost of so-called decarbonized gas through the Cost of Gas Adjustment Clause. However, by the LDCs' own admission, presently renewable gas does not meet the Department's "least cost" supply standard.[54] Further, as outlined above, the Consultants have massively underestimated the costs associated with RNG, pushing it even further away from the "least cost" supply standard. Additionally, the justification for pursuing this kind of cost recovery would be for the proposed climate benefits. However, as outlined above, the Consultants' model likely grossly underestimates the carbon content of the RNG available to Massachusetts. Acadia Center urges the Department to not approve RNG cost recovery.

Update Forecast and Supply Plan Standards to Add Renewable Gas

It is incredibly important for the LDCs to have a good understanding of what is happening in the alternative fuels market - whether, for example, RNG will track SNG prices as expected by most experts (but not modeled by the Consultants). But it is ill-advised to add alternative fuels to the supply plan standards as these fuels have not yet been determined to be either safe for use in homes and businesses, climate-compliant (life cycle GHG neutral), affordable to ratepayers, or in great enough supply to build an entire long-term decarbonization strategy around. As explained above, the Department should question the conclusions of the Consultants on all of these parameters. Acadia Center urges the Department to reject this recommendation

Provide Customers with an Option to Purchase Renewable Gas from the LDC/Third Parties

As outlined in the modeling sections above, using biomass resources to produce RNG for eventual use in residential and commercial buildings is one of the absolute lowest-value end uses of an extremely supply-constrained resource. As relatively low-cost supplies of biogas are exhausted, future competition for limited biomass resources will cause the price of RNG to increase dramatically over the coming decades at a much faster rate than modeled by E3. Additionally, methane leaks along the entire RNG supply chain significantly undermine the actual GHG emissions mitigation value of RNG. Blending RNG into the gas distribution system is a short-term Band-Aid with extremely limited GHG emission reduction potential that perpetuates continued investment in a gas system that has no viable long-term path to full decarbonization. The clearest, most cost-effective path to true decarbonization of the buildings sector relies on electrification and deep weatherization, coupled with a rapid expansion of renewable electricity generation and the electric grid. Establishing a mechanism by which ratepayers can voluntarily pay a premium for RNG does nothing to advance the long-term emissions reduction goals of the Commonwealth and should not be supported.

[54] LDC Common Regulatory Framework and Overview of Net Zero Enablement Plans, at 20

Acadia Center's Proposed Regulatory Changes

Utility Planning Reform Background

Acadia Center has identified three key problems with utility distribution planning and regulatory oversight: (1) utility planning is siloed between electric and gas utilities, which causes overspending, reduced reliability and resilience, and increased climate pollution; (2) current planning processes ignore equity and environmental justice; and (3) distribution utilities have a financial interest in the outcomes of their planning decisions, creating significant conflict of interest. Acadia Center's Reforming Energy System Planning for Equity and Climate Transformation (RESPECT) report proposes two reforms to address these challenges:[55]

1) **Massachusetts should conduct independent and comprehensive distribution system planning that incorporates meaningful stakeholder input, including voices that have been ignored to date**. Comprehensive planning should consider supply- and demand-side resources, as well as climate requirements, environmental justice impacts, and the need to transition off natural gas and electrify across the state.

2) **Massachusetts should separate "planners" and "owners" by creating a separate, neutral planning entity that is designed to look for solutions beyond utility boundaries and across fuels.** A separate, independent planning entity could help to reduce financial conflicts of interest, better align system planning with climate and clean energy goals, and maximize consumer benefits through planning that prioritizes environmental justice.

The reforms in Acadia Center's RESPECT proposal will help to ensure the alignment of system planning with state and regional climate, equity, and clean energy goals and requirements and will clarify the role of incumbent utilities and reduce risk for energy system investments. Towards these ends, Acadia Center urges the Department to consider how best to incorporate stakeholder input and perspectives into utility planning efforts. Massachusetts ratepayers and communities must have more opportunities to engage directly with the state's utilities as the Commonwealth considers critical long-term planning needs.

While Acadia Center believes that an entirely independent planning entity would be the preferred approach to help enable key planning reforms, there are actions that the Department can take that would make a meaningful difference today. For example, the Department should 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 cause overspending and a delayed transition away from gas towards electrification. This recommendation echoes those provided by the Consultants.

Independent Planning Authority

Acadia Center recommends the creation of a planning authority, either an entirely new agency, or a division within the Department, to oversee long-term distribution planning. The planning authority could be tasked with conducting a fair evaluation of which regulatory options and solutions are best for the Commonwealth and consumers (rather than those which are most preferred by utilities). This regulatory reform likely requires

[55] For more information, see https://acadiacenter.org/resource/respect-reforming-energy-system-planning-for-equity-and-climate-transformation/

legislation, but such a bill could clarify goals and objectives and provide sustainable funding for staffing. Support from the Department for such a division could help pass such legislation

An independent distribution system planning authority could work across utility jurisdictions to identify electric grid and gas system needs and investments necessary to achieve certain policy goals, including meeting the state's greenhouse gas emissions reduction requirements; advancing equity and environmental justice; reducing energy burdens; ensuring safety, resiliency, reliability, and affordability; and maximizing customer benefits. The planning authority must also work to maintain the natural gas infrastructure only for what is absolutely necessary and develop a plan to decommission the rest.

By taking the planning beyond fuel-driven silos, the planning entity could contemplate the use of all supply- and demand-side resources, including load flexibility, non-wires alternatives, and behind-the-meter distributed energy resources, to meet consumers' energy, capacity, and thermal needs. Coordinated planning by a neutral planning entity could prioritize electrification in a way that existing siloed planning processes do not, accelerating progress towards meeting the state's regulatory goals and developing a planned, rapid transition away from fossil fuels.

Coordinated Planning to Electrify and Decarbonize

Coordinated planning could help to avoid investments made by individual utilities that may be duplicative, or worse, involve spending billions of ratepayer dollars on gas system upgrades that lock-in gas dependence for decades, making it impossible to achieve state climate targets and wasting consumer dollars.

An independent planning authority would be well-positioned to facilitate stakeholder engagement throughout the planning process to guide and inform planning assumptions. Its first task would be an overhaul of the Gas System Enhancement Plan (GSEP) that instead prioritizes electrification at every critical decision point, using a presumption toward electrification to accelerate the regulatory process. Fossil fuels could be allowed only where that presumption is overcome, and only in combination with a planned transition away from fossil fuel and gas alternative dependence.

The planning authority would work with stakeholders and utilities to develop a coordinated approach for comprehensive maps of how the gas distribution system should be repaired (or, for leaks that pose an imminent safety risk, replaced), expanded (to provide fossil gas alternative fuels to difficult-to-electrify sectors), converted to electric appliances, fully decommissioned, or repurposed to meet consumer needs, such as through networked geothermal—essentially utilizing the coordinated framework and geographically targeted electrification concepts recommended by the Consultants in their regulatory proposals. This mapping of the distribution system would proceed according to two primary principles: 1) to help meet the Commonwealth's climate goals, and 2) to decommission all pipelines except those that are needed to service hard-to-electrify sectors. The mapping would also support the regulatory change to the energy efficiency program recommended above, that the large-scale intervention to electrify and weatherize begin with underserved populations of low- and- moderate income consumers, renters, microbusinesses, and language isolated populations, rather than allowing market forces to leave them until the end.

Such a planning process would involve 5- or 10-year planning horizons with 3-year plans integrated with the energy efficiency planning process. A coordinated approach could also allow phased buildouts, simultaneous achievement of climate, economic, energy, environmental, and equity objectives, and integrating load flexibility from the start. Consumers could know 3-5 years in advance that their street is going electric, and prepare accordingly, with assistance from state and federal programs. Statewide, coordinated planning will help to ensure

that all relevant players are informed and can row in the same direction. Energy efficiency program administrators, DER, ESCOs, electric and gas utilities, and others should all have a shared vision for how the Commonwealth should decarbonize.

Recommendations for Future Process

Transparent processes and stakeholder engagement are essential for ensuring that stakeholders can test the assumptions that inform utility planning efforts, and that the utilities are responsive to such concerns. So far, this approach has been mostly absent from the 20-80 docket. In the first part of this process, the Department seemed to relinquish control of the procedure to the LDCs.[56] The LDCs hired the Consultants, who solicited feedback from stakeholders on their planned scenarios, but were not substantively response to most stakeholder concerns about process, issues with modeling, or regulatory recommendations (as described above).

Many questions raised by stakeholders remain unanswered to this day. After the LDCs issued their joint and individual reports, the Department has taken a more active role, opening a period of discovery. However, the Department has not allowed intervenors (which prevents stakeholders from issuing discovery requests), held only two technical sessions and two public hearings, and the overall aim of the docket remains vague. Creation of a stakeholder council or working group(s) with defined objectives and roles could help the Department and stakeholders. The Energy Efficiency Advisory Council ("EEAC") model could provide helpful lessons for how to create a venue dedicated for reviewing assumptions and proposals.

The process that has been undertaken thus far in DPU 20-80 sets a baseline from which the DPU (or a separate planning entity) could begin a transparent and long-term state-wide planning process with stakeholders, perhaps similar to that contemplated by the Attorney General's Office in her letter to the DPU on February 14, 2022. This state-wide entity could be charged with equitable planning for the future of energy across utilities, fuels, and geography.

To help achieve the goals of this section, some critical questions still require answers. Therefore, both in this docket and future proceedings, Acadia Center believes the following questions merit strenuous investigation (some of which have been recommended by the Consultants and LDCs):

- How do we pay for electrification?
- How do we pay for weatherization and pre-electrification barriers?
- How do we ensure that low- and moderate-income customers get transitioned off the gas distribution system first with electric rates that are stable for them?
- What becomes of the gas companies? In addition to geomicrodistricts, should they own and ratebase infrastructure behind the meter, including individual air-source heat pumps?
- How do we ensure that consumers who remain on the gas system do not face energy insecurity from unduly large bills?
- How do we make this a just transition, focusing on jobs, retraining, and regional fairness?

[56] See, e.g., Order DPU 20-A, on the Office of Attorney General's Motion for Clarification, February 10, 2021, at 14, declining to create a process for identifying interested stakeholders and stating "ultimately, the LDCs are responsible for accomplishing the tasks specifically described in the Order, and thus the Department intentionally made the LDCs the final decision-makers with respect to the scope of work to be included in the RFP."

Conclusion

Thank you for the opportunity to submit written comments. If you have any questions or concerns, please do not hesitate to reach out.

Sincerely,

Amy Boyd
Director of Policy
aboyd@acadiacenter.org
617-742-0054 ext. 102

Ben Butterworth
Senior Manager, Climate and Energy Analysis
bbutterworth@acadiacenter.org
617-742-0054 ext. 111

Kyle Murray
Senior Policy Advocate – Massachusetts
kmurray@acadiacenter.org
617-742-0054 ext. 106

Oliver Tully
Director, Utility Innovation and Reform
otully@acadiacenter.org
860-246-7121 ext. 202