Advancing the Clean Energy Future

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Via Email

August 31, 2021

Poppy Milliken
ERM, on behalf of the Future of Gas
1 Beacon Street,
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RE: Considerations for LDC and Consultant Proposed D.P.U. 20-80 Scenario Analysis Modeling

Dear Future of Gas Consultants:

Acadia Center appreciates the opportunity to participate in and comment on the D.P.U. 20-80 process, an investigation into the role of gas local distribution companies (LDCs) as the Commonwealth works to achieve its mandated 2030 and target 2050 climate goals. As a non-profit research and advocacy organization committed to advancing the clean energy future, Acadia Center is at the forefront of efforts to build clean, low-carbon, and consumer-friendly economies throughout the Northeast – and remains very interested in decarbonizing the economy of Massachusetts in compliance with the Global Warming Solutions Act and Next Generation Climate Roadmap targets.

In addition to the concerns raised in the joint stakeholder letter to which Acadia Center was a signatory, Acadia Center has several concerns stemming from the most recent Massachusetts Future of Gas Stakeholder meeting held on August 24, 2021. Given the nature of the scenario analysis being undertaken by the LDCs and their consultants, decisions made early in the process can have a profound effect on the key findings from the study in the coming months. Based on our participation in the stakeholder process to date, Acadia Center is concerned that several of the early decisions by the LDCs and their consultants related to scenario analysis approach could jeopardize the value of the ultimate outputs of the analysis. These concerns include a modeling approach that does not:

1. Explicitly analyze a scenario that considers 100% decommissioning of the existing gas system.
2. Acknowledge the feedback loop associated with customers disconnecting gas service to avoid paying an ever-increasing share of the fixed costs associated with maintaining a gas system that serves an ever-decreasing number of customers.
3. Attempt to quantify the significant health and safety costs associated with being dependent on a system that is reliant on hazardous, highly combustible gases like natural gas and hydrogen.
4. Acknowledge the proven ability of cold climate air source heat pumps to serve as the sole source of space heating in the vast majority of the Commonwealth's buildings, even on the coldest of winter nights.

Acadia Center encourages the LDCs and their consultants to modify their planned scenarios to model these factors that could undercut the validity of the study's results. We would be happy to discuss our concerns further, either directly or in a smaller, technical session regarding scenario planning. We also share, in this comment letter, some of the questions that the August 24th presentation raised, which we look forward to discussing at the upcoming technical session.

Need to Model a Scenario that Explicitly Considers 100% Decommission of the Existing Gas System

Many experts hold the view that 100% decommissioning of the natural gas system will be necessary to achieve net zero emissions by 2050. Critics of this view often argue that full decommissioning of the gas system will be too financially burdensome to enact. For this reason, analyzing a scenario that includes full decommissioning of the natural gas system is necessary to develop a more comprehensive understanding of the benefits and costs associated with this path forward. Analysis of this scenario should be a core priority of the 20-80 process. As it currently stands, of the ten scenarios being put forward for analysis by the consultants, not one proposes to address full decommissioning. Stakeholders have consistently called for full decommissioning to be addressed, but even the most aggressive decommissioning scenario of the four "alternative scenarios" proposed during the August 24th stakeholder meeting falls short. This "Targeted & Optimized Electrification" scenario still assumes many customers will rely on gas furnaces or boilers to compliment electric heat pumps, calls for only "segments" of the gas network to be decommissioned, and assumes an additional six years of gas network build out through 2027. The "Targeted & Optimized Electrification" scenario is a far cry from full decommissioning of the gas network and will simply not address outstanding questions regarding full decommissioning. Acadia Center is aware that the consultants are running an Eversource-specific "100% Electrification" scenario and feel strongly that this scenario should be expanded to cover all the LDCs.

Under a 100% decommissioning scenario, Acadia Center does find it reasonable to conduct a sensitivity analysis that allows for an extremely limited renewable natural gas (RNG) or hydrogen distribution network to serve geographies with concentrations of heavy industry that are extremely challenging to electrify. However, the analysis may also find that it is more cost effective to transport limited quantities of compressed hydrogen, liquid hydrogen, or a "hydrogen carrier" such as ammonia, particularly to dispersed heavy industry end users, using trucks and rail.

Need to Account for the Dynamic of Customers Electrifying and Disconnecting Gas Service at an Accelerated Rate to Reduce Their Total Utility Bill Costs

As conversion to all-electric homes and businesses becomes more prevalent over the coming decades, many customers will fully disconnect from natural gas service. As customers defect from the gas system, fixed costs associated with maintaining the gas network will need to be covered by a continuously decreasing number of ratepayers. It is likely that many of the remaining gas customers, motivated by avoiding increasing per-customer fixed costs associated with maintaining the gas service, will respond to this phenomenon by opting for full electrification. The gas system will also likely incur additional costs associated with decarbonization that could further exacerbate the issue. For example, an increasing reliance on decarbonized fuels, that will likely to be more expensive to produce than natural gas, and the need for infrastructure upgrades to safely accommodate these decarbonized fuels could push additional costs onto a dwindling customer base. The positive feedback loop of

customers disconnecting gas service as the pace of electrification accelerates could be further magnified by decreasing electricity rates as more renewables with zero fuel costs come online and as the installed costs of heat pumps decrease as the technology matures and contractors become more familiar with the technology.

The proposed supply-side modeling by the LDCs and their consultants does not account for this dynamic. This will skew the results of the analysis, particularly for the scenarios including "Targeted & Optimized Electrification" that consider significant, but not complete, decommissioning of the gas network. Not accounting for this dynamic also has environmental justice ramifications. Without significant policy intervention, it is likely the middle- and high-income gas customers with sufficient access to capital will opt to invest in electrification upgrades, enabling them to disconnect gas service and avoid high energy costs. Customers in disadvantaged communities without the same access to capital to install efficient heat pumps systems will thus be forced to bear the costs of maintaining the gas network in the form of increased rates across an ever-decreasing gas customer base.

Additionally, without a careful accounting of the impact that customer defections from the natural gas distribution system due to rising costs will have on the energy bills of the remaining customers, the consultants' scenario analysis will be incomplete. If the consultants' supply-side model cannot directly incorporate this dynamic, Acadia Center asks that the consultants consider conducting a separate analysis focused on this phenomenon. For example, an analysis could be conducted to estimate the number of households disconnecting from the gas network needed to trigger a certain threshold percent increase in future gas utility bills compared to current gas utility bills. The remaining number of households on the gas network could then be compared to the total number of low- to moderate-income (LMI) households currently connected to the gas system in the state.

Need to Quantify Health and Safety Costs and Benefits

Part of the driving impetuous behind the 20-80 process is that, because the product that the LDCs are selling is causing societal harm, the future role of gas requires detailed examination. This societal harm associated with natural gas is not just limited to accelerating climate change through the release of greenhouse gas (GHG) emissions – it also extends to the adverse health and safety impacts of relying on natural gas. Because all ten potential scenarios outlined by the consultants comply with the GHG targets established in Massachusetts climate legislation, the GHG emissions component of societal harm is adequately addressed by the scenarios. However, Acadia Center is concerned with the decision made by the consultants to not quantify health and safety damages associated with a continued reliance on natural gas or a transition to other combustible fuels including hydrogen and renewable natural gas (RNG). Considering the negative health and safety impacts of these fuels only from a qualitative perspective diminishes the influence these impacts should have in the selection of the most cost-effective path towards decarbonization.

In the U.S., an estimated average of 4,200 home structure fires per year started with the ignition of natural gas. These fires caused an average of 40 civilian deaths, 140 civilian injuries, and $54 million in direct property damage per year.[1]

[1] National Fire Protection Associated, "Natural Gas and Propane Fires, Explosions and Leaks Estimates and Incident Descriptions," 2018. https://www.nfpa.org/-/media/Files/News-and-Research/Fire-statistics-and-reports/Hazardous-materials/osNaturalGasPropaneFires.ashx

In addition to an immediate threat to life and property, there are well documented risks to respiratory health from gas stove pollution, especially among children. Homes with gas stoves have approximately 50 percent to 400 percent higher average nitrous oxide (NO_2) concentrations than homes with electric stoves[2] and strong evidence exists for a relationship between long-term exposure to NO_2 and the development of asthma in children, in addition to symptoms related to the respiratory track like wheeze, cough, and chest tightness.[3]

While transitioning to electrification eliminates these health and safety hazards associated with the transmission, distribution, and combustion of natural gas, a transition to decarbonized fuels does not. RNG poses identical risks to natural gas and hydrogen is both more combustible and more prone to leaks than natural gas. Hydrogen can ignite more easily than natural gas and its flame is nearly invisible. Blending hydrogen with natural gas, even at volumes of 20% or less, increases the risk of ignition and the severity of explosions.[4] Because hydrogen is a very small molecule with low viscosity and the propensity to degrade metal pipes over time, it is prone to leakage. Measurements from steel and ductile iron gas distribution systems suggest that the leakage rate for hydrogen is about three times higher than that for natural gas. Similarly, in polyethylene pipes, transitioning from 100% natural gas to a 20% hydrogen blend is estimated to nearly double the total amount of gas leakage.[5] It is critical that the health and safety damages associated with natural gas and decarbonized fuels, and conversely the health and safety benefits associated with full electrification, be factored into the consultants' scenario analysis in a quantitative manner that puts health and safety on a level playing field with other variables being considered in the analysis.

Need to Acknowledge the Proven Track Record of Cold Climate Heat Pumps as a Buildings Only Source of Space Heating

Massachusetts' 2050 Roadmap found that electrification is the most cost-effective[6] way to eliminate emissions from buildings. Several of the scenario analyses proposed by the 20-80 consultants, by contrast, suggest that there are technical limitations to heat pump functionality in cold weather which will require the retention of gas-fired heating equipment as a backup. In reality, hundreds of cold-climate air-source heat pump (ccASHP) models that are available

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[2] Integrated Science Assessment For Oxides Of Nitrogen – Health Criteria (Final Report, July 2008), US Environmental Protection Agency, Washington, DC, EPA/600/R-08/071, 2008, p. 2–38, https://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=194645

[3] Integrated Science Assessment (ISA) For Oxides of Nitrogen – Health Criteria (Final Report, 2016). US Environmental Protection Agency, Washington, DC, EPA/600/R-15/068, 2016, Table ES-1, p. lxxxii, https://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=310879

[4] NREL, "Blending Hydrogen into Natural Gas Pipeline Networks: A Review of Key Issues." 2013. https://www.nrel.gov/docs/fy13osti/51995.pdf

[5] Ibid.

[6] Massachusetts 2050 Decarbonization Roadmap. Page 45. "Across a wide range of potential futures, electrification of end uses, particularly space heating through the use of electric heat pumps, was found to be the most economically advantageous and cost-effective decarbonization strategy for widespread deployment across the Commonwealth's building sector." (https://www.mass.gov/doc/ma-2050-decarbonization-roadmap/download)

for purchase in Massachusetts today can fulfill the entirety of a home's space heating requirement without fuel-fired backup heating equipment of any kind.

E3's presentation at the stakeholder meeting on August 24th described a "Hybrid Electrification" scenario wherein "buildings are expected to adopt electric heat pumps with gas furnaces for heating on cold days." Acadia Center would like for the consultants to clarify how they define "cold days" in their modeling: does this definition account for the demonstrated sub-zero performance characteristics of ccASHP equipment? According to the ASHRAE handbook,[7] winter temperatures at the coldest weather station in the state—Worcester Regional Airport—are higher than 1.6°F for 99.6% of the year. By comparison, ccASHP models by Mitsubishi, Daikin, and other major brands can provide for a home's full heating load in temperatures well below zero.[8]

State policies and programs may adopt performance standards to ensure that the heat pump models they support can provide heat throughout the winter, as the Mass Save programs have done.[9] Acadia Center recommends that the consultants consult the Mass Save product list and Northeast Energy Efficiency Partnerships' (NEEP) ccASHP Specification and Product List[10] for information about ccASHP efficiency and capacity maintenance at cold temperatures. One may safely assume that models with a ratio of maximum capacity at 5°F to rated capacity at 47°F equal or close to 1.0 can provide for a home's heating need throughout the year.

In addition, Acadia Center would like to direct the consultants to recent testimony[11] pertaining to Efficiency Maine's draft fifth Triennial Plan which provides several clear data points about ccASHP performance. Alone among New England states, Maine has a heat pump installation target in statute; that, combined with a high incidence of heating oil use, has made Maine the most aggressive promotor of ccASHP technology in the region. This testimony of Efficiency Maine staff on heat pump performance provides several valuable explanations and data points which E3 could use in its analysis.

Acadia Center recommends that the performance characteristics explained in the product lists and Efficiency Maine testimony be integrated into E3's analysis.

Additional Questions to Discuss at a Future Technical Stakeholder Meeting

In addition to the four issues that could undercut the validity of the LDCs' consultants' study outlined above, Acadia Center has the following questions related to technical approach and assumptions as they relate to scenario analysis. Responses should be provided in writing in advance of the September stakeholder meeting. In addition, Acadia

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[7] 2009 ASHRAE Handbook. Chapter 14: Climatic Design Information. http://arco-hvac.ir/wp-content/uploads/2015/05/2009-ASHRAE-HANDBOOK-FUNDAMENTALS-CHP14_Climates.pdf

[8] For example, Mitsubishi Hyper-Heat (H2i) models maintain 80% of their rated heating capacity at -13°F.

[9] Mass Save Heat Pump Qualified Product List (HPQPL). https://www.masssave.com/saving/residential-rebates/electric-heating-and-cooling/heat-pump-qualified-list

[10] Available at https://ashp.neep.org

[11] Efficiency Maine Draft Triennial Plan V (FY 2023-2025). Appendix I: Heat Pump Analysis and Considerations. August 18, 2021. See especially questions 17-20 on pages 8-10. https://www.efficiencymaine.com/docs/I-Heat-Pump-Analysis-and-Considerations_draft_8.18.2021-1.pdf

Center is concerned with the lack of time in the 20-80 stakeholder process dedicated to answering technical questions in a live discussion format. We were pleased to hear that there will be an additional hour reserved for technical discussion at the end of the upcoming September 28th stakeholder meeting and request that additional technical sessions be held to address concerns with modeling approach and assumptions held by stakeholders.

- **Scenarios should not be mutually exclusive.** Acadia Center is concerned that the scenarios being analyzed by the consultants are being treated as mutually exclusive, when the most cost-effective option may be a combination of multiple scenarios. For example, the "Targeted & Optimized Electrification" scenario does not include an expansion of networked geothermal and the "Networked Geothermal" scenario includes only a fraction of the full electrification and hybrid electrification conversion of the "Targeted & Optimized Electrification" scenario. Deploying networked geothermal and full electrification at scale in parallel to decarbonize the heating sector should be an option that is on the table. Related to this point, Acadia Center has the following questions:
    - Does sensitivity analysis in the modeling effort have the flexibility to account for a scenario with significant deployment of networked geothermal and full electrification?
    - If not, will the consultants consider adding a scenario that relies more heavily on a combination of networked geothermal and full electrification?

- **More information is needed on assumptions related to the use of "decarbonized gas."** Given significant uncertainty around several variables related to the use of decarbonized gas and the heavy reliance on decarbonized gas across multiple scenarios, there is need for clarification on key questions, including:
    - What are the decarbonized gas cost inputs in the model? Given that the use of decarbonized gas as a pipeline fuel has not been proven at scale, understanding the cost assumptions surrounding producing, transmitting, and distributing decarbonized gas at scale are critical.
    - What are the leak rate assumptions for hydrogen using current gas pipelines? As discussed above, hydrogen blended into existing pipelines results in higher leak rates than natural gas alone, triggering concerns about safety and direct emissions from methane leaks.

- **More information is needed on the financial implications of a contracting gas network.** Significant decommissioning of the natural gas system, as highlighted in the Targeted & Optimized Electrification scenario, is uncharted territory for the LDCs and brings with it significant uncertainty on cost ramifications for customers left on the legacy systems. Questions related to financial implications of contracting the gas network include:
    - In both the "Hybrid Electrification" scenario and the "Targeted & Optimized Electrification" scenario, what are the associated cost ramifications for customers remaining on the gas distribution network? This relates directly to the discussion above on the positive feedback loop of gas customers disconnecting from gas service in favor of electrification.
    - In the "Targeted & Optimized Electrification" scenario, how would the strategic decommissioning costs be recovered, given the contraction of the rate base?

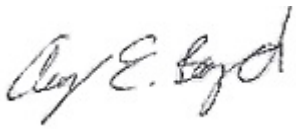
- In the "Hybrid Electrification" scenario, the August 24th presentation states that the gas network will "remain intact" despite "volumes of decarbonized gas required are relatively low." What is the logic behind this assumption, given the likely impacts on consumer costs?

- **More information is needed on technical assumptions related to networked geothermal.** The description of the "Networked Geothermal" scenario as presented during the August 24th lacks enough detail on technical specifics related to the presumed feasibility of converting the gas system to networked geothermal. Acadia Center's questions related to networked geothermal include:
  - In the "Networked Geothermal" scenario, the August 24th presentation describes the scenario as "Conversion of gas system to networked geothermal (where feasible)." How will it be determined where it is feasible to convert the gas system to networked geothermal?
  - In the "Networked Geothermal" scenario, the August 24th presentation states that "Other end-uses that are not suitable for networked geothermal systems remain connected to the gas system." What specific end uses is this statement referring to and what criteria was used to develop this list? Space heating alone can represent 60% or more of a building's total energy use[12]—preserving and maintaining the gas distribution system for the sole use of cooking appliances would be uneconomical on its face.

Conclusion

Acadia Center urges the consultants to adjust their modeling approach to accommodate the four key concerns identified in this letter, allocate more time in the 20-80 stakeholder process for answering technical questions in a live discussion format, and address the specific technical questions identified in this letter. Acadia Center looks forward to continuing to work with the LDCs and their consultants as an interested stakeholder to reach a safe, sustainable, and economic clean energy transition.

Sincerely,



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[12] U.S. Energy Information Administration. Residential Energy Consumption Survey (RECS) 2015. Table CE3.2. https://www.eia.gov/consumption/residential/data/2015/c&e/pdf/ce3.2.pdf