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VIA ELECTRONIC FILING

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RE: Notice of Intent to Amend Air Quality Regulations and Revise the State Implementation Plan

Sierra Club respectfully submits the following comments in response to the Department of Energy and Environmental Protection's (DEEP) March 20, 2023 Notice of Intent to Amend Air Quality Regulations and Revise the State Implementation Plan (SIP). As part of DEEP's revisions to Connecticut's SIP, Sierra Club urges the Department to adopt emissions limits on nitrogen oxides (NOx) from new residential and commercial appliances including furnaces, water heaters, and boilers and to ultimately phase out the sale of such appliances by adopting a zero-NOx emissions standard. Emissions from fossil fuel appliances impair air quality, harm public health, and exacerbate climate change in Connecticut. Phasing out these appliances would help Connecticut come into attainment with federal air quality standards for ozone; reduce both indoor and outdoor health harms from NOx and ozone; support Connecticut's transition to clean, efficient, zero-emission electric appliances; and move the state toward its climate goals as zero-emission electric appliances also reduce greenhouse gas emissions.

I. NOx emissions from buildings contribute significantly to nonattainment of National Ambient Air Quality Standards for ozone in Connecticut, making measures to reduce emissions from buildings critical to Connecticut's air quality attainment strategy.

Connecticut has persistently been designated as a nonattainment area for National Ambient Air Quality Standards (NAAQS) for ozone.[1] For the purposes of EPA classification, Connecticut is divided into two non-attainment areas for ozone: the southwest portion of the state (the Connecticut portion of the New York-New Jersey-Connecticut area) and the remainder of the state (Greater Connecticut). Effective November 7, 2022, Fairfield, New Haven and Middlesex Counties were reclassified from serious to severe non-attainment with respect to the 2008 ozone NAAQS,[2] and the remaining counties (Hartford, Litchfield, New London, Tolland, and Windham) were reclassified from marginal to moderate non-attainment with respect to the

[1] https://portal.ct.gov/DEEP/Air/Planning/Ozone/Ozone-Planning-Efforts
[2] https://portal.ct.gov/-/media/DEEP/air/ozone/Maps/SW-CT-2008-Ozone-Severe-Bump-up.pdf

2015 ozone NAAQS[3] due to their failure to meet these standards, highlighting that harmful ozone pollution remains a persistent problem in the state.

NOx emissions from buildings contribute significantly to nonattainment of NAAQS in Connecticut and must be curtailed to help Connecticut reach attainment. Sixty-one percent of homes in Connecticut burn oil or propane for heating and 35 percent of homes burn gas.[4] Residential and commercial buildings are a major source of NOx emissions, as the combustion of gas, fuel oil, and propane emits NOx. NOx emissions from these appliances contribute to Connecticut's ongoing failure to attain NAAQS for ozone, which is formed by chemical reaction of NOx with other pollutants.

Sierra Club retained Sonoma Technology to model the ozone impacts of buildings and boilers on Connecticut's nonattainment areas using the Comprehensive Air Quality Model with Extensions (CAMx) with Ozone Source Apportionment Technology (OSAT) for the 2016 ozone season (April to October). The source apportionment modeling simulations used EPA's 2016v2 (2016fj_6j) modeling platform, which relies on emissions data from the National Emissions Inventory, as well as EPA's 2023 projections platform.

Sonoma found that emissions from buildings and boilers in Connecticut consistently have impacts greater than 1% of the 2015 ozone NAAQS at Air Quality System monitoring locations within ozone nonattainment areas. In 2016, there were 20 days when Connecticut monitors registered exceedances of the ozone standard of 70 ppb. On 12 of those days, the highest modeled ozone impacts from buildings and boilers exceeded 1 percent of the NAAQS--0.70 ppb-- and on every day except one, the impacts exceeded 0.5 percent of the NAAQS--0.35 ppb. The highest modeled impacts on any given day ranged from 0.33 ppb to 2.81 ppb, or 0.5% to 4% of the 2015 NAAQs standard. Results showing that a single source category of ozone precursor emissions in Connecticut alone contributes more than 1% of the ozone NAAQS on high ozone days are extremely significant. For example, EPA has considered contributions from all anthropogenic emissions in an upwind state to be significant if they exceed 1% of the ozone NAAQS averaged over a subset of high ozone days during an ozone season.[5] These thresholds are surpassed by Connecticut's in-state building emissions by themselves.

This significant contribution to Connecticut's nonattainment is modeled to persist. Sonoma also used forward projections of emissions to model 2023 ozone impacts. These projections are consistent with the upward trend documented by EPA in its recently updated National Emissions Inventory, which shows an increase in NOx emissions from both residential

[3] U.S. EPA, Determinations of Attainment by the Attainment Date, Extensions of the Attainment Date, and Reclassification of Areas Classified as Marginal for the 2015 Ozone National Ambient Air Quality Standards; Final Rule, 87 Fed. Reg. 60,897 (Oct. 7, 2022).
[4] Connecticut Greenhouse Gas Emissions Inventory at 14. https://portal.ct.gov/-/media/DEEP/climatechange/1990-2021-GHG-Inventory/DEEP_GHG_Report_90-21_Final.pdf.
[5] See, e.g., EPA, Revised Cross-State Air Pollution Rule Update for the 2008 Ozone NAAQS, 86 Fed. Reg. 23054, 23057 (Apr. 30, 2021); EPA, Federal "Good Neighbor Plan" for the 2015 Ozone National Ambient Air Quality Standards, EPA-HQ-OAR-2021-0668, Mar. 2023).

and commercial gas combustion in Connecticut between 2017 and 2020.[6] The results of Sonoma's projections for 2023 show an even more pronounced impact from buildings on ozone. The impacts often exceed 1% of the NAAQS, with the highest projected impacts on any given day ranging from 0.59 ppb to 5.17 ppb, or 0.8% to 7.4% of the 2015 NAAQs standard. Given the significant impact NOx emissions have on Connecticut's non-attainment of the NAAQs standard, the Department should adopt emissions limits on NOx from new residential and commercial appliances in Connecticut, with an aim to ultimately phase out the sale of such appliances with a zero-NOx emissions standard.

II. NOx emissions impair air quality in Connecticut, especially in communities already overburdened by pollution.

Addressing the impacts of emissions from fossil fuel combustion in buildings is also important because NOx emissions endanger public health and welfare, both directly and as a chemical precursor to other ambient air pollutants—namely, ozone and fine particulate matter. There is broad consensus in the scientific and public health community that direct exposure to NOx itself causes negative impact to human health.[7] After being emitted into the atmosphere, NOx reacts with organic compounds in the presence of sunlight to form ground-level ozone, the primary ingredient of smog.[8] Researchers have long understood the serious detrimental health impacts from exposure to ground-level ozone.[9] It is estimated, for instance, that up to 11% of all asthma emergency room visits in the United States are attributed to ozone.[10]

NOx emissions especially contribute to adverse health outcomes in communities already overburdened by pollution. Ozone and NO_2 pollution does not harm all populations equally, but is most likely to burden specific communities, many of whom already suffer from income and public health disparities. Research from the University of Minnesota has found that communities of color experience levels of NO_2 exposure that are 38% higher than white communities.[11] Negative health outcomes caused by such pollution have been found to disproportionately impact communities of color. A report from the Asthma and Allergy Foundation of America showed that Black, Hispanic, and Indigenous populations have the highest rates of asthma in the United

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[6] EPA, 2020 National Emissions Inventory (NEI) Technical Support Document (TSD), Secs. 25 & 26 (March 2023), https://www.epa.gov/air-emissions-inventories/2020-national-emissions-inventory-nei-technical-support-document-tsd.

[7] In its 2016 ISA, EPA found a causal relationship between short-term exposure to nitrogen dioxide (NO_2) and respiratory effects, as well as evidence suggesting a causal relationship between short-term NO_2 exposure and both cardiovascular effects and total mortality. EPA also found a likely causal effect between long-term NO_2 exposure and respiratory effects, as well as evidence suggesting a causal relationship between NO_2 exposure and cardiovascular effects, diabetes, adverse birth outcomes, cancer, and total mortality. EPA, Integrated Science Assessment (ISA) for Oxides of Nitrogen ("NOx ISA") (Jan. 2016) at lxxxii, Table ES-1, https://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=310879.

[8] EPA, *Integrated Science Assessment (ISA) for Ozone and Related Photochemical Oxidants ("Ozone ISA")* (Apr. 2020), at lxiv, https://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=348522.

[9] *Id.* at ES-16.

[10] Susan C. Anenberg et al., *Estimates of the Global Burden of Ambient $PM_{2.5}$, Ozone, and NO_2 on Asthma Incidence and Emergency Room Visits*, 126(10) Env't Health Persp. 107004 (Oct. 2018).

[11] L.P. Clark et al., *National Patterns in Env't Injustice and Inequality: Outdoor NO_2 Air Pollution in the United States*, 9(4) PLOS ONE (2014), https://doi.org/10.1371/journal.pone.0094431.

States, and that Black Americans are three times more likely than the general population to die from asthma.[12] The unequal burden of ozone-caused public health impacts in Connecticut is borne out by asthma data. Asthma is one of the primary public health impacts of ozone exposure and affects Black communities at disproportionate rates in the State, as shown by emergency department visits, hospitalizations, and death rates. The data illustrate that emergency department visits for asthma are much more frequent—over five times higher—among Black children aged 2-17 years than white children.[13] In addition, Black Connecticut residents are nearly three times as likely, and Hispanic residents twice as likely, to die from asthma as white residents.[14]

EPA's EJScreen tool shows that communities in the NY-NJ-CT nonattainment area, which includes the City of New Haven, have high environmental justice index values for ozone, considering both exposure to pollution and socioeconomic indicators. These impacts are reflected in disproportionately poor health outcomes for people of color and those living in poverty. The environmental justice index for ozone is calculated by combining the environmental factor of ozone concentration with demographic factors, including populations of low-income individuals and people of color residing in a geographic area.[15] In New Haven, the EJ index for ozone is in the 91st percentile compared to the state of Connecticut and the 87th percentile compared to the U.S. This means that only 9% of the state and 13% of the country's population have worse EJ index values for ozone.[16] In Hartford, the EJ index for ozone is in the 70th percentile in the state and 79th percentile in the U.S.[17] Connecticut must use this SIP revision to mitigate the negative impacts of NOx pollution from buildings on already overburdened communities and to create a more equitable and just state for its residents.

III. Connecticut should follow the lead of other states that have proposed low and zero-NOx appliance standards.

Several states, including Texas, Utah, and many air districts in California have had low-NOx gas appliance standards for years,[18] and two California air districts are now taking the next step by developing zero-NOx appliance standards.[19] In March, the Bay Area Air Quality

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[12] Melanie Carver et al., *Asthma Disparities in America: A Roadmap to Reducing Burden on Racial and Ethnic Minorities*, Asthma and Allergy Foundation of America, (2020), https://www.aafa.org/asthmadisparities.
[13] Connecticut Health Foundation, *Health Disparities in Connecticut: Asthma Fact Sheet*, (updated 2020), https://www.cthealth.org/wp-content/uploads/2020/08/Health-disparities-fact-sheet-asthma.pdf.
[14] *Id.*
[15] For EPA's explanation of this indicator, *see* EPA, *EJ and Supplemental Indexes in EJScreen* (last accessed Feb. 13, 2023), https://www.epa.gov/ejscreen/ej-and-supplemental-indexes-ejscreen.
[16] *See* EPA, *EJScreen* (last accessed May 4, 2023), https://ejscreen.epa.gov/mapper/. Numbers for New Haven were generated by selecting the city and generating the "Printable Standard Report."
[17] *Id.*
[18] *See, e.g.*, 30 Tex. Admin. Code § 117.3205(a)(2)(A), https://texreg.sos.state.tx.us/public/readtac$ext.TacPage?sl=R&app=9&p_dir=&p_rloc=&p_tloc=&p_ploc=&pg=1&p_tac=&ti=30&pt=1&ch=117&rl=3205; Utah State Construction and Fire Codes Act § 15A-6-102(2)(a)(i), https://le.utah.gov/xcode/Title15a/C15A_1800010118000101.pdf; Cal. Air Res. Bd., *2022 State Strategy for the State Implementation Plan: Draft Measures* 54 (Oct. 6, 2021) (summarizing California air districts' low-NOx standards), https://ww2.arb.ca.gov/sites/default/files/2021-10/2022_SSS_Draft_Measures.pdf.
[19] Bay Area Air Quality Management District, *Final Staff Report: Proposed Amendments to Building Appliance Rules* (Mar. 2023), https://www.baaqmd.gov/~/media/dotgov/files/rules/reg-9-rule-4-nitrogen-oxides-from-fan-type-residential-central-furnaces/2021-amendments/documents/20230307_fsr_rules0904and0906-pdf.pdf?la=en; South Coast Air Quality Management District, *2022 AQMP Proposed Draft NOx Stationary Source Measures* (Nov. 10,

Management District (BAAQMD) adopted amendments to rules governing emissions from furnaces, boilers, and water heaters that set zero-NO_x standards for new gas-fired furnaces starting in 2029[20] and for new gas-fired water heaters starting in 2027 or 2031 (depending on the unit type, use, and size).[21] BAAQMD's amended rules also establish an "ultra low-NO_x" standard (i.e., a limit of 14 ng/J of NO_x compared to the current standard of 40 ng/J for furnaces) between 2023 and 2029.[22] These requirements apply to "manufacturers, retailers/wholesalers, and installers and would affect Bay Area consumers when they replace their existing furnaces."[23] As BAAQMD noted, "[s]pace and water heaters are the greatest source of NO_x emissions in the building sector" and "vent directly outdoors into the ambient air, affecting the local and regional air quality of the Bay Area."[24]

The South Coast Air Quality Management District (SCAQMD) is taking similar steps to require a phase-out of NOx-emitting appliances. In order to address the requirements for meeting the 2015 ozone NAAQS, SCAQMD developed an Air Quality Management Plan in 2022.[25] The Plan includes stationary source measures aiming to reduce NOx emissions from residential and commercial combustion equipment—specifically, requiring zero emission or low NOx appliances for space and water heating and for cooking. Additionally, the EPA recently proposed to disapprove California's SIP for the San Joaquin Valley nonattainment area, which was reclassified from moderate to serious for the 2012 annual PM2.5 NAAQS, for failure to consider zero-emissions appliance technology as Best Available Control Measures. The EPA reasoned that several jurisdictions in California have already adopted policies that require all-electric buildings or appliance standards for building heating and that zero-emission appliance technologies are readily available.[26] Connecticut should follow the lead of these states by implementing low- and zero-NOx appliance standards as part of the SIP.

2021), http://www.aqmd.gov/docs/default-source/clean-air-plans/air-quality-management-plans/2022-air-quality-management-plan/am-pres-agenda-item-3-zero-emission-technology-110621.pdf?sfvrsn=6.

[20] BAAQMD, Rule 9-4-301.3 (March 15, 2023), https://www.baaqmd.gov/~/media/dotgov/files/rules/reg-9-rule-4-nitrogen-oxides-from-fan-type-residential-central-furnaces/2021-amendments/documents/20230315_rg0904-pdf.pdf?la=en.

[21] BAAQMD, Rules 9-6-301.5 and 9-6-303.5 (March 15, 2023), https://www.baaqmd.gov/~/media/dotgov/files/rules/reg-9-rule-4-nitrogen-oxides-from-fan-type-residential-central-furnaces/2021-amendments/documents/20230315_rg0906-pdf.pdf?la=en.

[22] BAAQMD, Rule 9-4-301.2.

[23] BAAQMD, *Notice of Preparation of an Env't Impact Report and Notice of Public Scoping Meeting for the Proposed Amend.*, at 4-5 (May 19, 2022), https://www.baaqmd.gov/~/media/dotgov/files/rules/reg-9-rule-4-nitrogen-oxides-from-fan-type-residential-central-furnaces/2021-amendments/documents/20220519_02_nop_rules09040906-pdf.pdf?la=en.

[24] *Id.* at 4.

[25] SCAQMD, 2022 Air Quality Management Plan (December 2, 2022), http://www.aqmd.gov/docs/default-source/clean-air-plans/air-quality-management-plans/2022-air-quality-management-plan/final-2022-aqmp/final-2022-aqmp.pdf?sfvrsn=16.

[26] 40 CFR Part 52 [EPA–R09–OAR–2021–0884; FRL–9292–03–R9] Clean Air Plans; 2012 Fine Particulate Matter Serious Nonattainment Area Requirements; San Joaquin Valley, California, Federal Register, Vol. 87, No. 192, October 5, 2022, Proposed Rules at 60510-12.

IV. Electric appliances are widely available as an alternative to NOx-emitting appliances.

Electric-powered heating and cooking appliances are a widely available, cost-effective way to eliminate direct building emissions and provide real public health and climate benefits. Building electrification has the potential to reduce NOx emissions by hundreds of thousands of tons. RMI analysis indicates that ramping up to all-electric new appliance sales nationwide by 2030 could avoid over 500,000 tons of NOx, 14,400 tons of $PM_{2.5}$ emissions, and 3,750 premature deaths per year by 2045.[27] Likewise, the National Renewable Energy Lab's Electrification Futures Study finds that electrification significantly reduces net emissions of NOx and other criteria pollutants.[28] Under NREL's high electrification scenario, nationwide NOx emissions from buildings decrease by nearly 275,000 tons per year.[29] This is several times more than the incremental increase in electric sector NOx emissions under that scenario, resulting in a significant net decrease in NOx emissions. Other studies have similarly found significant NOx reduction potential from building electrification.[30] Building electrification can also achieve significant GHG emission reductions and help Connecticut achieve its emissions reduction mandates under the Global Warming Solutions Act, as building appliances are responsible for ~30 percent of annual GHG emissions in Connecticut.[31]

Modern electric appliances are highly efficient, widely available, effective in cold climates,[32] and increasingly cost-competitive in a growing range of applications.[33] Research by Efficiency Maine on heat pump deployment has shown that heat pumps can be cost-effective to

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[27] RMI & Sierra Club, *Factsheet: Why EPA Must Address Appliance Pollution* 3 (June 4, 2021), https://rmi.org/wp-content/uploads/2021/04/rmi_factsheet_appliance_pollution.pdf.

[28] Caitlin Murphy et al., *Electrification Futures Study: Scenarios of Power System Evolution and Infrastructure Development for the United States* at xii, 31-36, 70, NREL (Jan. 2021), https://www.nrel.gov/docs/fy21osti/72330.pdf.

[29] *Id.* at 35 (275,000 US tons per year is equivalent to 250,000 metric tons per year).

[30] *See, e.g.*, Alexandra Karambelas and Coralie Cooper, *Estimating the Emissions Benefits of Switching to Heat Pumps for Residential Heating*, NESCAUM (June 2021), https://www.nescaum.org/documents/nescaum-otc-emission-reduction-analysis-for-residential-heating-202106.pdf/; Yifang Zhu et al., *Effects of Residential Gas Appliances on Indoor and Outdoor Air Quality and Public Health in California* 39, UCLA Fielding School of Public Health (Apr. 2020) (finding that if all residential gas appliances in California were replaced with clean electric alternatives, the reduction in outdoor air pollution would avoid about 350 deaths, 600 cases of acute bronchitis, and 300 cases of chronic bronchitis each year, translating to about $3.5 billion in annual monetized health benefits), https://ucla.app.box.com/s/xyzt8jc1ixnetiv0269qe704wu0ihif7; E3, *Quantifying the Air Quality Impacts of Decarbonization and Distributed Energy Programs in California* (2021), https://www.ethree.com/wp-content/uploads/2022/01/CPUC-Air-Quality-Report-FINAL.pdf.

[31] Connecticut Greenhouse Gas Emissions Inventory, https://portal.ct.gov/-/media/DEEP/climatechange/1990-2021-GHG-Inventory/DEEP_GHG_Report_90-21_Final.pdf.

[32] *See, e.g.*, Michael Gartman and Amar Shah, *Heat Pumps: A Practical Solution for Cold Climates*, RMI (Dec. 10, 2020), https://rmi.org/heat-pumps-a-practical-solution-for-cold-climates/.

[33] *See* Jim Dennison, Leah Louis-Prescott & Talor Gruenwald, *How Air Agencies Can Help End Fossil Fuel Pollution from Buildings*, RMI (2021) at 12, (citing Gartman & Shah; Lacey Tan & Mohammad Fathollahzadeh, *Why Heat Pumps Are the Answer to Heat Waves*, RMI (Aug. 12, 2021), https://rmi.org/why-heat-pumps-are-the-answer-to-heat-waves/; Alexi Miller & Cathy Higgins, *The Building Electrification Technology Roadmap (BETR)*, New Buildings Institute (Jan. 2021), https://newbuildings.org/wp-content/uploads/2021/01/BuildingElectrificationTechnologyRoadmap.pdf; Livchak et al., *Residential Cooktop Performance and Energy Comparison Study*, Frontier Energy (July 2019), https://cao-94612.s3.amazonaws.com/documents/Induction-Range-Final-Report-July-2019.pdf).

heat whole homes even in Maine's cold climate.[34] Heat pumps and heat pump water heaters can be two to four times as efficient as their fossil fuel-fired counterparts.[35] And new air-source heat pump sales have now matched those of fossil fuel furnaces.[36] Electric appliances already have lower overall net present costs than fossil fuel alternatives in many situations, such as in new construction, when replacing propane or heating oil appliances, and when simultaneously replacing furnaces and air conditioners.[37] Low and zero-NOx emissions standards should also be paired with incentives to help customer adoption for low-income households. Electrification will continue to become cheaper as device and installation costs decrease, equipment becomes even more efficient, and solutions are developed for related issues like utility rate structures and electrical system upgrade requirements.

V. The Department should ensure the SIP includes strong controls on NOx emissions from compressor stations in the state.

The undersigned urge DEEP to explicitly include gas pipeline compressor stations in the list of NOx emitting facilities that are targeted for greater emission controls and regulations as part of the agency's ozone attainment program. Specifically, we urge compressor stations to be included in Sec. 22a-174-22f, and Sec. 22a-174-22e.

There is one gas compressor station in Fairfield County—the Brookfield compressor station that is part of the Iroquois pipeline system—and two compressor stations in neighboring New Haven County, in Milford and Oxford. The Oxford facility is already a major source of NOx, while the owners of the Brookfield compressor station have proposed a controversial expansion to the facility that would bring the NOx emissions into the range of a major source designation. The strongest NOx controls, limits, and regulations are needed for these facilities in order to protect Connecticut communities from the harms of NOx pollution.

VI. Conclusion

Sierra Club urges the Department to adopt emissions limits on NOx from appliances through the SIP, ultimately phasing out the sale of such appliances by adopting a zero-NOx emissions standard, in order to help Connecticut come into attainment with federal air quality standards for ozone; reduce both indoor and outdoor health harms from NOx and ozone; support

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[34] Sarah Shemkus, In Maine, heat pumps are proving themselves even against extreme cold, Energy News Network, https://energynews.us/2022/07/27/in-maine-heat-pumps-are-proving-themselves-even-against-extreme-cold/

[35] *Id.* (citing Miller & Higgins, at 18).

[36] Air-Conditioning, Heating, and Refrigeration Institute, *Historical Data*, www.ahrinet.org/resources/statistics/historical-data.

[37] *See* Jim Dennison, Leah Louis-Prescott & Talor Gruenwald, *How Air Agencies Can Help End Fossil Fuel Pollution from Buildings*, RMI (2021), at 12 (citing Claire McKenna et al., *All-Electric New Homes: A Win for the Climate and the Economy*, RMI (Oct. 15, 2022), https://rmi.org/all-electric-new-homes-a-win-for-the-climate-and-the-economy/; Steven Nadel, *Energy Savings, Consumer Economics, and Greenhouse Gas Emissions Reductions from Replacing Oil and Propane Furnaces, Boilers, and Water Heaters with Air-Source Heat Pumps* 40, ACEEE (July 2018), https://www.aceee.org/sites/default/files/publications/researchreports/a1803.pdf; Rewiring America, *Bringing Infrastructure Home: A 50-State Report on U.S. Home Electrification*, https://content.rewiringamerica.org/fact-sheets/bringing-infrastructure-home/bringing-infrastructure-home-50-state-report-on-us-home-electrification.pdf; Sherri Billimoria et al., *The Economics of Electrifying Buildings*, RMI (2018), https://rmi.org/insight/the-economics-of-electrifying-buildings/).

Connecticut's transition to clean, efficient, zero-emission electric appliances; and move the state toward its climate goals.

Respectfully submitted,

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