



June 26, 2024

California Air Resources Board  
1001 I Street  
Sacramento, CA 95814

**RE: Comments on CARB Zero-Emission Space and Water Heater Standards**

Dear Board Members and Staff,

Thank you for the opportunity to provide these comments on the California Air Resources Board's (CARB) May 29, 2024 Public Workshop (Workshop) for the agency's Zero-Emission Space and Water Heater Standards (Standards), submitted on behalf of the 13 undersigned organizations.

CARB's commitment to develop zero-emission space and water heater standards is a vital part of a broad portfolio of strategies to advance an equitable transition to non-polluting buildings. Fossil fuel combustion in the state's residential and commercial buildings is responsible for more

than 45 million metric tons of greenhouse gas (GHG) emissions annually, nearly 30% more than the entire electric power sector generates each year.<sup>1</sup>

Along with these climate-warming emissions, fossil fuel building equipment releases approximately 34,000 tons of nitrogen oxides (NO<sub>x</sub>) pollution and 3,000 tons of fine particulate matter (PM<sub>2.5</sub>) into California's outdoor environment each year, nearly seven times the NO<sub>x</sub> and three times the PM<sub>2.5</sub> emissions as come from the state's power plants.<sup>2</sup>

CARB requested public feedback on specific topic areas in the Workshop, and responses to those prompts follow. As it proceeds in developing the Standards, CARB should:

- I. Continue to pursue Draft Regulatory Proposal C for statewide consistency;
- II. Include propane-burning equipment in the Standards;
- III. Prioritize disadvantaged communities in planning and implementation;
- IV. Phase out sales and installation of new dual-fuel heating systems;
- V. Consider South Coast AQMD compliance timelines for manufactured housing;
- VI. Further refine technology and cost modeling; and
- VII. Coordinate with the CPUC to address service entrance upgrade costs and other barriers to successful implementation.

### **I. Continue to Pursue Draft Regulatory Proposal C for Statewide Consistency**

At the Workshop, CARB presented Draft Regulatory Proposal C, the updated version of the agency's previous proposal, which expands statewide the existing health-protective compliance timelines from the Bay Area Air Quality Management District's (BAAQMD) adopted zero-NO<sub>x</sub> rules<sup>3</sup> and the South Coast Air Quality Management District's (SCAQMD) adopted and proposed zero-NO<sub>x</sub> rules.<sup>4,5</sup> CARB should continue to pursue this draft proposal while ensuring there will be equity protections in place before the rules take effect. The implementation planning stage of this rulemaking process will be important to inform the target compliance dates and ensure that the Standards will drive an equitable transition.

An approach focused on aligning regulatory timelines across these jurisdictions is the strongest path forward for the state for the following reasons:

- Alignment on effective dates among regulators at different levels of government will provide maximum consistency and predictability to equipment manufacturers, distributors, installers, and purchasers in all areas of the state.

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<sup>1</sup> U.S. Energy Information Administration (EIA), "[Energy-Related CO2 Emission Data Tables – Sectoral specific emission tables by state](#)," July 2023.

<sup>2</sup> U.S. Environmental Protection Agency (EPA), [2020 National Emissions Inventory](#), March 2023. Appliance emission estimates include residential & commercial emissions for the gas, oil, & other fuel categories, with commercial emissions adjusted to exclude certain non-appliance sources like pipeline compressor stations and industrial-size boilers. All commercial nonpoint source emissions are included, and commercial point source emissions are included if they have input heat capacities less than 10 million Btu/hr or if they are classified as space heaters.

<sup>3</sup> Bay Area Air Quality Management District, "[Rules 9-4 and 9-6 Building Appliances](#)," February 2024.

<sup>4</sup> South Coast Air Quality Management District (SCAQMD), "[Proposed Amended Rule 1146.2](#)."

<sup>5</sup> SCAQMD, "[Proposed Amended Rules \(PAR\) 1111 and 1121](#)."

- Alignment on dates will enable more concerted state and regional action on complementary measures necessary for the successful and equitable implementation of zero-NO<sub>x</sub> standards, such as coordinated tenant, labor, and bill protections.
- Statewide application of BAAQMD and SCAQMD measures will achieve pollution reductions as soon as possible for the equipment categories where zero-emission products are available soonest, rather than waiting until 2030 to begin transitioning those end uses and leaving feasible emissions reductions on the table. Meanwhile, those product categories that may need a longer time to reach market maturation are granted additional product development runway through this proposal.
- These proposed effective dates come out of lengthy public processes at BAAQMD and SCAQMD that have already taken in a large amount of stakeholder feedback, and these compliance timelines have been thoughtfully selected to reflect the current and anticipated state of the market.
- A stepwise compliance approach may be more manageable for CARB from a resource allocation perspective, mitigating the need to address all administration, compliance, and enforcement activities for all space and water heating sources in all residential and commercial buildings across the state on the same day.

Draft Regulatory Proposal C clarifies that wall and floor furnaces will be covered by the Standards, aligns the compliance date for commercial furnaces with SCAQMD rulemaking, and notably reduces an additional 5% of GHG emissions with the inclusion of large pool heaters into the Standards. CARB ably meets the moment by seeking additional feasible emission reductions to include in this rulemaking following the previous Public Workshop. As the agency engages in implementation planning for these Standards, it should focus on engineering complementary statewide policy changes to ensure equitable outcomes before the rules take effect.

## **II. Include Propane-Burning Equipment in the Standards**

More than 450,000 households in California use propane as their primary heating fuel, largely in more rural areas of the state,<sup>6</sup> and CARB should be sure to include these residents in the clean heating transition. Propane fuel costs are far higher than natural gas, nearly double per Btu in California at this time,<sup>7,8</sup> and the energy bill savings from decarbonization through electrification will be most significant for residents currently using propane.

An RMI analysis of single-family homes across California climate zones found that households that utilize propane for all end uses would reduce energy bills between \$140 and \$487 per year through whole-home electrification.<sup>9</sup> Reducing the energy burden of these residents will be an important benefit of these Standards.

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<sup>6</sup> United States Census Bureau, "[2018 - 2022 American Community Survey 5-Year Data Profile: Selected Housing Characteristics](#)."

<sup>7</sup> EIA, "[Weekly Heating Oil and Propane Prices](#)," June 20, 2024.

<sup>8</sup> EIA, "[Natural Gas Prices](#)," May 31, 2024.

<sup>9</sup> RMI analysis using [Green Upgrade Calculator](#) v1.3, including single-family homes of pre-1980 and 1980-2000 vintage in California [climate zones](#).

Propane-burning building equipment also emits disproportionately more air pollution into the local environment than units that burn methane, contributing 55% more NO<sub>x</sub> emissions per household.<sup>10,11</sup> Mobile fuels like propane are also likely delivered to neighborhoods in diesel-burning trucks, which bring additional PM<sub>2.5</sub>, NO<sub>x</sub>, and toxic air contaminant emissions into communities being served.

Rather than limiting inclusion of propane-burning equipment in the Standards, CARB should focus on assisting these households to make the clean appliance transition, including through targeted incentives and financing mechanisms to eliminate the higher upfront cost of non-polluting alternatives. Shifting Californians directly from propane heating and water heating to zero-emission units when their equipment is replaced will benefit their health, their air quality, and their energy bills alike. Working with counties that have the highest proportion of propane use – like El Dorado and Nevada – and representatives of impacted communities, CARB should collaborate to develop scalable and accessible outreach strategies and customer journey maps that can maximize benefits to residents.

### **III. Prioritize Disadvantaged Communities in Planning and Implementation**

When planning for successful implementation of this transition in under-resourced areas of the state, CARB should be mindful of the lessons from previous efforts to electrify communities that have deep, systemic challenges to overcome. The community-led evaluation of the San Joaquin Valley Affordable Energy Pilot Program is one critical source of community-led, on-the-ground data that should be integrated into future planning and program design,<sup>12</sup> and the agency should seek out other such reports from the user perspective, including through the community case studies planned as part of CARB's cost analysis.

A history of redlining based on race has resulted in some Californians residing in communities that have more homes with substandard electrical infrastructure and more households that require other significant building improvements besides electrification. In addition, communities with more non-English-speaking residents require additional investment from state agencies in order to achieve the accessibility and inclusion necessary for a successful energy transition. CARB should use intentional program design to engage robustly with these disadvantaged communities, so they too can receive the health and air quality benefits of the Standards.

Recent comments to CARB by the Building Energy, Equity & Power (BEEP) Coalition lay out a number of specific recommendations the agency should take to:

- Better identify which homes will need the most support to meet the Standards in a smooth and timely manner, and
- Coordinate with state agency partners to ensure that residents with the greatest need are prioritized for additional policy and financial support.<sup>13</sup>

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<sup>10</sup> EPA, [2020 National Emissions Inventory](#), March 2023. See note 2.

<sup>11</sup> United States Census Bureau, "[2018 - 2022 American Community Survey 5-Year Data Profile: Selected Housing Characteristics.](#)"

<sup>12</sup> Common Spark Consulting (The Center on Race, Poverty & the Environment), "[San Joaquin Valley Affordable Energy Pilots - Community Findings Memo](#)," April 2024.

<sup>13</sup> Building Energy, Equity & Power (BEEP) Coalition, "[Re: Equity Analysis for Zero-Emission Space and Water Appliance Standards Workshop](#)," May 8, 2024.

CARB should follow BEEP’s recommendations and continue to break down silos between agency partners in order to implement a “whole-state” approach to these Standards that is equitable, affordable, smooth, and timely. Equitable implementation will require dedicated policy changes to the statewide status quo of tenant protections, incentive accessibility, building readiness, and other important areas, and state agencies must work in concert to ensure greater equity protections are in place before the Standards take effect.

When pursuing decarbonization of residential buildings in overburdened and other marginalized communities, state agencies should also consider buildings like public schools and neighborhood centers that provide vital social infrastructure to these households.

#### **IV. Phase Out Sales and Installation of New Dual-Fuel Heating Systems**

CARB’s 2022 State Strategy for the State Implementation Plan (SIP) and 2022 Scoping Plan for Achieving Carbon Neutrality (Scoping Plan) both dedicated sections to acknowledging the central role that building emissions reductions will play in achieving our critical climate and clean air targets, and both documents laid out zero-emission standards on space and water heating as a key emissions reduction solution.<sup>14,15</sup> In the case of the State SIP Strategy, this included a commitment by the state to pursue these Standards in order to attain binding federal air quality standards enforced by the U.S. Environmental Protection Agency (EPA).

Continued combustion of fossil fuels for heating and hot water in California’s homes and businesses is incompatible with a healthy and sustainable future for the state. Given the climate zones present in the state, sales and installation of new dual-fuel heating systems that include fossil fuel combustion should not be allowed under these Standards. A dual-fuel exemption would worsen the state’s ability to meet emissions standards and is unreasonable given the availability and cost-effectiveness of existing zero-emission technology.

Recent SCAQMD rulemaking presentations have highlighted the array of zero-emission HVAC and water heating alternatives – like highly efficient electric heat pumps – that are available and can provide heating reliably across California, even in sub-zero temperatures.<sup>16</sup> Heat pump technology has advanced markedly in recent years, and there are now more than 100 heat pump manufacturers offering thousands of cold climate heat pump models that can serve a wide range of building types efficiently at California’s temperature extremes.<sup>17</sup>

Heat pumps perform two to four times more efficiently than gas, oil, or propane systems in California’s climate thanks to improved performance in both mild temperatures and extreme

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<sup>14</sup> California Air Resources Board (CARB), [2022 State Strategy for the State Implementation Plan](#), September 2022, pp.101-103..

<sup>15</sup> CARB, [2022 Scoping Plan for Achieving Carbon Neutrality](#), December 2022, p.215 & Appendix F pp.38-40.

<sup>16</sup> SCAQMD, “[Proposed Amended Rule 1111– Reduction Of NOx Emissions From Natural Gas-Fired, Fan-Type Central Furnaces & Proposed Amended Rule 1121– Control of Nitrogen Oxides From Residential Type, Natural Gas-Fired Water Heaters – Working Group Meeting #1](#),” October 5, 2023, pp. 30-41.

<sup>17</sup> Northeast Energy Efficiency Partnerships (NEEP), “[Cold Climate Air Source Heat Pump Specification & Product List](#),” January 1, 2023.

cold. New research shows cold climate heat pumps can remain 50% more efficient than fossil fuel systems even at -22 degrees Fahrenheit.<sup>18</sup>

Over 1.5 million American homes already use heat pumps to stay warm in sub-freezing conditions.<sup>19</sup> The Electric Power Research Institute found that cold climate heat pumps were able to meet 100% of home heating needs in 0 degree Fahrenheit conditions, and Efficiency Maine highlights a heat pump performing well without backup during a -49 degree Fahrenheit wind chill.<sup>20,21</sup> Indeed, the world's highest concentration of heat pumps per capita is in frosty Sweden, Finland, and Norway.<sup>22</sup>

Few homes in California are located in cold climates – RMI analysis suggests that 10.7% of California residents live in climate zones with significant heating needs compared to the rest of the state. In the worst-case scenario, compiled by RMI using the 2021 actual meteorological year (AMY) weather data, temperatures in those climate zones drop below 30 degrees Fahrenheit only around 6.6% of the time. Of these customers, only about 4% are already connected to the natural gas distribution system.<sup>23</sup>

Zero-emission technology should suffice to support much of California's building stock. For the narrow suite of Californians operating building heating equipment in extremely cold climate zones, the state should prioritize zero-emission solutions such as cold climate heat pumps, paired with additional incentives to ensure accessibility and affordability to these communities.

For those larger end uses that need more time for the zero-emission market to mature, the later compliance dates should give market actors ample time to prepare. CARB could consider committing to a future market assessment closer to the implementation dates to ensure those end uses are readily available. If CARB considers alternative compliance pathways for any end uses, those instances should be defined by a limited scope, time frame, building type, and climate zone until technical feasibility gaps are closed, as noted in previous comments. Given the imperative to reduce climate pollution and improve air quality and public health, CARB should minimize the allowance of fossil fuel equipment for these Standards, including dual-fuel systems.

Given the availability of zero-emission alternatives and the climatic analysis above, neither BAAQMD's nor SCAQMD's zero-emission regulations covering space and water heaters have supported dual-fuel systems.

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<sup>18</sup> Duncan Gibb et al., "[Coming in from the cold: Heat pump efficiency at low temperatures](#)," *Joule* 7:1939-1942, September 2023

<sup>19</sup> EIA, [2020 Residential Energy Consumption Survey](#), 2023. Breakdown of NO<sub>x</sub> emissions by end use assumes each end use's emissions are proportional to its fuel consumption. The NO<sub>x</sub> emissions for each combination of building type & fuel type are divided between end uses by the percentage of fuel used in each end use within that building/fuel type. This division is made at the smallest census region for which complete and accurate data is available.

<sup>20</sup> Electric Power Research Institute (EPRI), "[Why Improving The Cold Weather Performance of Heat Pumps Can Help Achieve Decarbonization Goals](#)," February 9, 2022.

<sup>21</sup> Efficiency Maine, "[Heat Pump Systems for Maine Homes - High Efficiency Heating in Cold Climates](#),"

<sup>22</sup> International Energy Agency Technology Collaboration Programme on Heat Pumping Technologies, "[The Heat Pump Market, Research and Policy in Norway](#)," 2022.

<sup>23</sup> RMI analysis using 2021 weather data from [White Box Technologies](#), 2020 population data from the [United States Census Bureau](#), and 2019 appliance saturation data from the [California Energy Commission](#).

With the state's fast-approaching target for achieving carbon neutrality, the state must minimize ongoing fossil fuel use, including the sales and installation of new dual-fuel heating systems, which require maintaining costly infrastructure that the state is planning to wind down. If further CARB analysis determines that some households in the state do need backup heat, then a source that doesn't require distribution system infrastructure would likely be more cost-effective for the state than maintaining the entire methane gas system for a tiny number of users. In these cases, there should be temporary supplemental heating available to households in cold climates during extreme weather events, rather than permanent ongoing operation of polluting systems.

As CARB works with the CPUC and the CEC to "align the gas system with State priorities and support a smooth transition to a decarbonized energy system," these Standards should seek to retire gas equipment in buildings as the equipment reaches the end of its life.<sup>24</sup>

## **V. Consider SCAQMD Compliance Timelines for Manufactured Housing**

It is important to include manufactured housing in the transition from fossil fuel building appliances to ensure an equitable transition and secure healthy homes for vulnerable populations. Manufactured homes house a disproportionately large low-income population.<sup>25</sup> Exempting mobile homes from zero-emission technology benefits would further disadvantage vulnerable households in low-income and environmental justice communities.

The state should include this sector in all technology assessments and incentive programs and provide regulatory certainty to the manufactured home heating equipment space through rule requirements. Coupled with targeted support to low-income households, a clear regulatory mandate sends an animating market signal and creates the momentum to ensure these households have equal ownership opportunities for clean energy technologies.

As CARB has done with respect to other equipment categories, the agency should consider statewide application of SCAQMD's proposed zero-emission compliance dates for mobile home furnaces and water heaters where technologically feasible – 2026 for new buildings and 2030 for existing buildings.<sup>26</sup>

Challenges have been noted with panel size and community load in mobile and manufactured housing. CARB should consider incentivizing the deployment of zero-emission technologies that support manufactured housing communities at scale, and the agency should robustly apply the BEEP Coalition's guidance about learning from and prioritizing disadvantaged communities (referenced in Section III) to residents in this sector.<sup>27</sup>

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<sup>24</sup> CARB, California Energy Commission (CEC), and California Public Utilities Commission (CPUC), [2024 Joint Agency Staff Paper: Progress Towards a Gas Transition. A White Paper Supporting the CPUC's Long-Term Gas Planning Rulemaking R.20-01-007](#), February 22, 2024, p.6.

<sup>25</sup> Fannie Mae, "[Manufactured Housing Landscape 2020](#)," May 15, 2020.

<sup>26</sup> SCAQMD, "[Proposed Amended Rule 1111– Reduction Of NOx Emissions From Natural Gas-Fired, Fan-Type Central Furnaces & Proposed Amended Rule 1121– Control of Nitrogen Oxides From Residential Type, Natural Gas-Fired Water Heaters – Working Group Meeting #5](#)," June 20, 2024.

<sup>27</sup> BEEP Coalition, "[Re: Equity Analysis for Zero-Emission Space and Water Appliance Standards Workshop](#)," May 8, 2024.

## **VI. Further Refine Technology and Cost Modeling**

When considering cost estimates for space heating (as on [slide 18](#) of the Workshop materials), CARB should avoid utilizing dollars per kBtu (thousand Btu per hour) as a unit of measurement, as costs do not scale linearly from zero with HVAC system size. Since material costs are only a small fraction of total upfront costs for HVAC installation (usually less than 50%), using the size of the system as the denominator is not recommended.

For example, the difference in installation cost between a 60 kBtu furnace and a 90 kBtu furnace is probably only a few hundred dollars, since the material cost is slightly higher but labor to install should be about the same – however, the calculation that CARB is using in this analysis would estimate that the 90 kBtu unit would be 50% more expensive. A more nuanced equation for both traditional HVAC equipment and zero-emission technology alternatives should factor in labor and the efficiency of the unit and should convey costs in dollars per unit.

In estimating costs, CARB pulled heavily from the California electronic Technical Reference Manual (eTRM). eTRM is a very useful data source for deemed measure costs and superior to RSMeans, however these databases do not include “soft” costs that can vary widely and drive real-world project outcomes. While CARB has implemented a series of price markup multipliers as a response (as shown on [slide 21](#) of the Workshop materials), an alternate suggestion would be to benchmark the costs against the TECH Clean California incentive program data for the specific measures CARB is investigating, as the costs reported by the TECH program include all upfront costs.

Lastly, CARB should certainly include 120-volt plug-in heat pump water heaters and cold climate air source heat pumps in the next iteration of its cost analysis, given the importance of the former for avoiding electrical infrastructure upgrades and the centrality of the latter to supporting a full zero-emission transition in California’s coldest climate zones.

## **VII. Coordinate With the California Public Utilities Commission (CPUC) to Address Service Entrance Upgrade Costs and Other Barriers to Successful Implementation**

As CARB, the California Energy Commission (CEC), and the CPUC recognized in the 2024 Joint Agency Staff Paper, *Progress Toward a Gas Transition*, “[t]he complexity of the policy and technical considerations for transitioning away from fossil gas will require close coordination among agencies over a long-term planning horizon.”<sup>28</sup> The need for close coordination among agencies extends to addressing barriers to successful implementation of the Standards. One barrier CARB should work with the CPUC to address is costs allocated to individual homeowners for Service Entrance Upgrades needed to accommodate increased load from electric HVAC and water heating.

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<sup>28</sup> CARB, CEC, and CPUC, [2024 Joint Agency Staff Paper: Progress Towards a Gas Transition. A White Paper Supporting the CPUC’s Long-Term Gas Planning Rulemaking R.20-01-007](#), February 22, 2024, p.42..



Service Entrance Upgrades refer to upgrades in amperage capacity from the pole to the residential meter. In [slide 20](#) of the Workshop materials, CARB identified these costs as ranging from \$4,000 to \$55,000. These potentially exorbitant costs can put adoption of zero-emission building equipment out of reach for many residents and undermine successful implementation of CARB's Standards unless appropriately addressed by the state before the Standards take effect. While the vast majority of homes will be able to add zero-emission HVAC and water heating to their existing electrical panel or upgrade their panel without triggering the need for a Service Entrance Upgrade, some will require grid improvements if a service upgrade is needed.

Placing the burden of paying for needed utility-owned grid infrastructure on individual customers that are complying with regulations is unfair and inappropriate. Indeed, Service Entrance Upgrade costs to accommodate electric vehicle (EV) charging are already socialized. The same treatment should be afforded to accommodate building electrification. Building electrification is similarly critical for California to meet its climate objectives, and Service Entrance Upgrades are triggered less frequently by building electrification than by EV charging.

Accordingly, CARB should work with the CPUC to ensure that Service Entrance Upgrades triggered by panel upgrades that are necessary to accommodate zero-emission space and water heating are treated as common costs, just as they are when triggered by home EV charging.<sup>29</sup> The CPUC can take action on costs of Service Entrance Upgrades from building electrification by including it in the scope of its Building Decarbonization proceeding, where it has already made progress in encouraging all-electric construction by eliminating subsidies for gas lines to new buildings and electric lines to mixed-fuel buildings.

Thank you for considering these comments. We look forward to engaging with CARB as it continues to pursue equitable building decarbonization in California.

Sincerely,

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<sup>29</sup> CPUC, [D.21-12-033: Decision Extending Interim Policy on Common Treatment for Excess Plug-In Electric Vehicle Charging Costs Consistent with Assembly Bill 841](#), December 16, 2021.

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