BAY AREA AIR QUALITY MANAGEMENT DISTRICT

STAFF REPORT

Informational Update Regarding Regulation 9, Rule 6:

Nitrogen Oxides Emissions from Natural Gas-Fired Water Heaters less than 75,000 BTU/hr

December 2024

Prepared By

Air District Staff Leads for the Implementation Working Group

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ACKNOWLEDGEMENTS

Primary Authors:
Amy Dao, Senior Environmental Planner, Planning and Climate Protection Division
Eric Lara, Senior Air Quality Specialist, Rules and Strategic Policy Division
Idania Zamora, Assistant Manager, Planning and Climate Protection Division
Jennifer Lam, Assistant Manager, Rules and Strategic Policy Division
Richard Chien, Advanced Projects Advisor, Planning and Climate Protection Division

Air District Staff members who also greatly contributed to the development of this report:
Abby Young, Manager, Planning and Climate Protection Division
Arsenio Mataka, Deputy Executive Officer, Equity & Community Programs
Brian Butler, Senior Air Quality Engineer, Community Engagement Office
Carrie Schilling, Senior Assistant Counsel, Legal Division
Gregory H. Nudd, Deputy Executive Officer, Science and Policy
Komal Masood, Assistant Staff Specialist II, Planning and Climate Protection Division
Kristina Chu, Manager, Communications
Kristine Roselius, Director, Communications
Mark Tang, Assistant Manager, Planning and Climate Protection Division
Victor Douglas, Director, Rules and Strategic Policy Division
Viet Tran, Deputy Executive Officer, Public Affairs
Wendy Goodfriend, Director, Planning and Climate Protection Division

External partners who also contributed to the development of this report:
Alyssa Cheung, California Public Utilities Commission
Eric Rodriguez, Silicon Valley Clean Energy (SVCE)
Diane Bailey, City of Palo Alto
Irene Farnsworth, Metropolitan Transportation Commission
Jessamyn Allen, SVCE
Nate Dewart, Energy Solutions/TECH Clean California
Rachel Kuykendall, Pacific Gas and Electric
Zoe Elizabeth, SVCE
Members of the 2023-2024 Implementation Working Group

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Informational Update Regarding
REGULATION 9, RULE 6: NITROGEN OXIDES EMISSIONS FROM NATURAL GAS-FIRED WATER HEATERS LESS THAN 75,000 BTU/HR

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ABBREVIATIONS AND ACRONYMS

Acronym	Full Name
Air District	Bay Area Air Quality Management District
BayREN	Bay Area Regional Energy Network
BTU	British Thermal Unit; measures heat and energy
CARB	California Air Resources Board
CAC	BAAQMD's Citizens Advisory Committee
CARE	California Alternate Rates for Energy
CBO	Community Based Organization
CCA	Community Choice Aggregation
CEC	California Energy Commission
CPUC	California Public Utilities Commission
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
EVSE	Electric Vehicle Supply Equipment
FHR	First Hour Rating
HEEHRA	High-Efficiency Electric Home Rebate Act program (Federally funded rebates)
HOMES	Home Owner Managing Energy Savings program (Federally funded rebates)
HP HVAC	Heat Pump Heating, Ventilation and Air Conditioning
HPWH	Heat Pump Water Heater
IRA	Inflation Reduction Act
IUI	Inclusive Utility Investment
IWG	Implementation Working Group
MCE	Marin Community Choice Energy
MF or MF Res	Multifamily Residential
NEIF	National Energy Improvement Fund
NGO	Non-Government Organization
PACE	Property Assessed Clean Energy
PCE	Peninsula Clean Energy
PG&E	Pacific Gas & Electric
PSPS	Public Safety Power Shutoff
ROG	Reactive Organic Gases
SCAQMD	South Coast Air Quality Management District
SF or SF res	Single Family Residential

SIP	State Implementation Plan
SVCE	Silicon Valley Clean Energy
TECH	TECH Clean California
TOBF	Tariffed On-Bill Financing

I. EXECUTIVE SUMMARY

Background and Purpose

In March 2023, the Bay Area Air Quality Management District (Air District) Board of Directors adopted amendments to Regulation 9, Rule 4 and Regulation 9, Rule 6 ("building appliance rules," or "rules") which included zero nitrogen oxides (NOx) emissions standards starting in 2027, 2029, and 2031 depending upon the appliance type and size (BTU/hr). Given that the only zero NOx space and water heating appliances currently available are electric, rule implementation presents specific challenges regarding switching from natural gas to electric appliances. Thus, the Board required that two years prior to each compliance date, Air District Staff (Staff) must provide updates to them regarding implementation challenges, especially focused on those raised by stakeholders during rulemaking—such as costs, workforce, market development, and equity issues.

With this direction, Staff coordinated and led a multi-stakeholder Implementation Working Group (IWG) from May 2023 through August 2024 to provide input on those topics for this informational update report, which is focused on the January 2027 implementation date for small water heaters less than 75,000 BTU/hr. These water heaters are tanked and typically 75 gallons or smaller; approximately 120,000 of these water heaters turn over in the Bay Area annually. Larger water heaters (> 75,000 BTU/hr) including natural gas tankless on-demand water heaters, are not covered by the rules until 2031. Summaries and key takeaways of the primary IWG topic areas are below, as well as broad discussion of next steps for future rule changes.

Market Development

In the two years since the writing of the last Staff Report for the rule amendments, there have been significant developments in the fast-moving space of zero NOx water heaters, specifically heat pump water heaters (HPWH). In the Bay Area, local agencies including local jurisdictions, Bay Area Regional Energy Network (BayREN), and several Community Choice Aggregators (CCAs) began or continued to fund HPWH programs. These agencies also pursued a multitude of pilots and programs spanning whole-home electrification on 100 amps; green workforce development; HPWH permit streamlining; consideration of local ordinances encouraging planning and readiness; emergency replacement; and supporting easier access to electrification and incentives through concierge services and AI-powered mobile apps.

Statewide, programs such as TECH Clean California continued enrolling contractors (more than 1,000 statewide), incentivizing heat pump projects (over 35,000 deployed) and heat pump market development. The California Heat Pump Partnership was announced in 2023, along with commitments from major manufacturers and utilities, to get the State to its 6 million heat pumps by 2030 goal.

Nationally, sales of heat pump water heaters (HPWH) increased 35% in 2023. Though HPWHs are still a small share of new water heaters sold, federal IRA tax credits are just starting to be reflected in sales data and these numbers are expected to grow after Inflation Reduction Act (IRA) rebate program deployment. Some IRA rebate programs have already executed contracts and begun fund disbursement. In 2024, the US Department of Energy (DOE) passed new efficiency standards for electric water heaters with a 2029 compliance date that are expected to push further development of HPWHs nationally and increase HPWH sales from 3% to 50% of electric tanked water heaters.

Grid and Reliability Impacts

Though often voiced by the public as a concern, new electrical loads resulting from the building appliance rules are highly unlikely to cause power outages. The large majority of power outages are not caused by load or bulk capacity issues, but are instead caused by physical impacts (downed trees, storms) or public safety power shutoffs (PSPS), which have been significantly reduced since 2019. There are already current and new (SB 410) requirements for utilities and the California Energy Commission (CEC) regarding grid planning for increasing loads, which will include added load from the building appliance rules. For the rare instances of bulk capacity issues (e.g. statewide Flex Alerts), HPWHs allow users to shift energy usage to off-peak hours, essentially using electricity and "storing" hot water during periods of lower electricity usage and prices. HPWHs are increasingly being used for demand response to help improve grid reliability.

At the appliance level, zero NOX and new NOx emitting gas water heaters have similar reliability in power outages. New gas water heaters will not operate without electricity, which is needed for fans and pilot lights. Tanked water heaters, including HPWHs, can stay hot for several hours during an electrical outage, especially when installed with a cold water mixing valve.

Workforce

Workforce research shows positive signs for contractor availability and readiness. Based on national benchmarking, the Bay Area has equivalent levels of relevant contractors compared to the US average. Based on region-wide surveys, the majority of contractors are available to respond to emergency water heater failures within a couple days. A two-thirds majority of surveyed contractors were already aware of the building appliance rules and at least one category of applicable incentives, though slightly less than half of the surveyed contractors participated in incentive programs. Correspondingly, slightly less than one-third (29%) of surveyed contractors were planning on pursuing heat pump training for their firm or employees. Though overall positive, the workforce research points to some hiring challenges, as well as the need for more outreach, training and incentive program participation, especially for small independent contractors.

Permitting

The Air District pursued research to evaluate how changes in local government building permitting requirements for zero NOx appliances could affect implementation timelines and costs, and to understand the current status of best practices in the Bay Area. Survey and interview results from eleven local governments of various sizes around the region showed that turnaround time for issuance of electric water heating appliance permits takes less than 3 days in most jurisdictions, and that most cities surveyed have a single permit for HPWHs. A growing number of local jurisdictions are pursuing best practices for HPWH permitting, informed by efforts from BayREN and TECH Clean California's Permitting Pilot, San Mateo County, and Silicon Valley Clean Energy (SVCE).

Costs

Operational costs analyses conducted by our consultant E3 found that with the switch to HPWHs, households will either see utility bill savings or a very small monthly increase. Ninety-five percent of high usage customers (5,000 kWh or more annual usage before electrifying) see bill savings or no change in bills after switching to a HPWH. For low-use customers, approximately 35% of single-family (SF) and 60% of multi-family (MF) market-rate customers (those not receiving any low-income program discounts) experience a bill increase of around $2 on average per month.

The average upfront incremental cost to install a zero NOx HPWH compared to a NOx emitting gas water heater is estimated to fall between $1,840, and $3,496, depending upon the baseline appliance (tanked and tankless vs. tanked only), before incentives. After incentives, including state and local rebates and $2,000 federal tax credits, the purchase and installation costs for a HPWH can be less than those for a NOx emitting gas water heater and even zero cost for some low-income households. The current list of available incentives from the federal[1], state and regional/local administrators[2], however, are a snapshot in time; higher incremental costs for HPWHs point to the need for longer-term sources of funding for incentives, financing and other programs especially for low income households.

Challenging Installation Cases

Variations across the building stock (i.e. existing space configurations, existing electric panel condition, amount of deferred maintenance) will result in some challenging installation cases. TECH program data for HPWH installations in the Bay Area from September 2024 shows costs ranging from $2,900 to $38,800, with the high end of costs representing the most challenging installation cases.

Complex electrical work and panel and utility service upsizing can result in additional costs as well as long timelines. 120-volt plug-in HPWHs can help solve the time and cost challenge of complex additional electrical work leading to cost savings for some homes. A “watt diet” or panel optimization strategies (low-voltage appliances; circuit pausing/sharing; smart panels) could be deployed in 32% and 59% of California’s single-family and multi-family homes, respectively, to avoid panel and service upsizing. Developing structured incentive and education programs can help increase implementation of these important strategies. Current and future California Public Utilities Commission (CPUC) proceedings will consider how to reduce service upgrade costs for single-family and multi-family building owners as well as how to improve Pacific Gas & Electric (PG&E) wait times for service upsizing. These proceedings are important as the current wait times will likely lead to service gaps in the rare cases where a service upgrade is required.

Modifications to address space constraint range in costs and can be additional to other installation measures. According to Palo Alto HPWH program data, added ventilation (air openings such as louvred doors) are mostly relatively low cost (average=$208 and max=$1,701), while other space constraint measures, especially relocation, can cost significantly more (average= $1,287 and max= $4,540). Emerging and lesser utilized technologies, such as electric on-demand tankless water heaters and split-system HPWHs (with an unattached, outside condenser/heat pump), are promising solutions to reduce cost for some challenging installation cases.

Potential Housing Impacts

Research was conducted to increase understanding of the potential risks to residential tenants in the Bay Area from rule implementation. Fortunately, the cities with the highest concentration of renters also have the strongest renter protections. The policy analyses, however, confirmed that implementation of the building appliance rules could lead to capital cost pass-throughs and potential rent increases for some tenants. The amended rules could potentially lead to temporary evictions due to construction activities required to install zero NOx appliances (“substantial repair”), though this is a greater risk for furnace replacements compared to small water heaters. Continued stakeholder engagement,

[1] https://www.energy.gov/save/rebates

[2] See Appendix A. *Installation Costs for Zero-NOx Space and Water Heating Appliances*

coordination, and research on the topic will be a key consideration for the next Implementation Working Group discussion cycle.

Conclusion and Next Steps

Recommendations for the Air District to support rule implementation through advocacy for funding, research, engagement and coordination with relevant stakeholders including contractors, local and state agencies, energy service providers, and programs administrators are fully listed in **Section XI. D.** The section also touches broadly on the future process for upcoming rule changes that will consider:

- Alignment with other agencies that are developing similar rules, such as the South Coast Air Quality Management District (SCAQMD) and California Air Resources Board (CARB)
- Facilitating streamlined compliance
- Alignment with the California Department of Housing and Community Development on the definition of manufactured and mobile homes.
- Challenging installation cases, such as those that require modifications to address space constraints or additional electric service.

The Air District will pursue more targeted outreach and communication campaigns to diverse and relevant stakeholders starting in Q3 2025. Compliance and Enforcement Activities will begin in Q4 2025.

II. INTRODUCTION AND BACKGROUND

A. PURPOSE

In March of 2023, the Bay Area Air Quality Management District Board of Directors adopted amendments to Regulation 9, Rule 4 and Rule 6 which include first-of-their-kind zero NOx requirements for furnaces and water heaters installed in buildings. These rules will be referred to as "Rule 9-4", "Rule 9-6", individually, and as the "building appliance rules", collectively, throughout the body of this report. These rules only apply to natural gas-fired water heaters and furnaces. . These rules do not apply to other appliances such as stoves and dryers. . These rules also do not apply to appliances that use a fuel other than natural gas, such as propane.

The building appliance rule amendments include three different dates after which newly manufactured natural gas-fired NOx-emitting appliances may not be sold in the Bay Area. These dates depend on the type and size of appliance. This timeline is as follows:

- January 1, 2027: water heaters less than 75,000 BTU/hr
- January 1, 2029: all applicable furnaces[3]
- January 1, 2031: water heaters between 75,000 BTU/hr and less than 2 million BTU/hr

The amended rules also include a requirement for Staff to report back to the Board of Directors two years prior to each zero NOx compliance date in the rules. Section 9-4-405 and 9-6-404 require the report to include information learned about the compliant technology options available and projected to be sold, installed or offered for sale, the projected costs of purchase and installation of such technologies, including applicable ancillary costs, any incentive programs available to reduce these costs, and infrastructure readiness associated with rule compliance.

The intent of the interim reporting requirement arose from a desire from Staff, the Board of Directors, and members of the Bay Area community to understand developments in technology options, market readiness, costs, equity considerations, and other factors leading up to the zero NOx implementation dates. This interim reporting requirement deadline was set for two years prior to the implementation dates to leave time for a rule amendment process if the Board of Directors determines that it is necessary based the information presented herein by Staff. This report is informational only and meets the requirement of providing an interim report for the January 1, 2027 zero-NOx requirement under 9-6-404.

B. SCOPE

This report serves to fulfill the interim reporting requirement of Rule 9-6 (Section 9-6-404) associated with the zero NOx emissions standard for storage tank water heaters with a rated heat input rating of 75,000 BTU/hour or less set forth in Section 9-6-301.5. Therefore, this report focuses on the implementation of the zero NOx standard specifically for small, tanked water heaters that are typically found in residential settings. The body of this report serves to fulfill this requirement by compiling data, research, and other learnings that Air District Staff have gained since the publication of the final rule

[3] Natural Gas-Fired Furnace is defined in Regulation 9, Rule 6 as: A furnace that utilizes single-phase, three-phase or direct current in conjunction with natural gas.

amendment Staff Report in March 2023. This includes the following contracted research conducted between March 2023 and October 2024:

- *Installation Costs for Zero-NOx Space and Water Heating Appliances*, Appendix A
- *Challenging Use Cases and Emerging Solutions for Zero-NOx Appliances*, Appendix B
- *Market and Sales Trends for Zero-NOx Appliances*, Appendix C
- *Permitting Requirements for Zero-NOx Appliances*, Appendix D
- *Grid Related Impacts on the Implementation of Rules 9-4 and 9-6*, Appendix E
- *Workforce Challenges for Zero-NOx Requirements*, Appendix F
- *Renter Protections Policy Landscape Summary and Recommendations*, Appendix G
- *Lived Experience Interviews with Renters Report 2024*, Appendix H

This report was additionally informed by discussions of the Implementation Working Group (IWG) that was convened by the Air District. The IWG members were key stakeholders and partners in this process, informing Staff's knowledge and thinking on the issues presented in this report. That being said, this report represents the Air District's understanding of relevant issues based on the contracted research and discussions with IWG and other stakeholders. The IWG did not co-author or review this report. Further information about the IWG process is contained in the next section.

Following the publishing of this report and its related public presentation and feedback from the community and Board of Directors, Staff will consider next steps. Possible next steps include consideration of further rule amendments which would follow a separate public rule development process. Therefore, this report does not contain explicit recommendations for further rule amendments.

Additional reports are planned to be presented to the Board of Directors in the coming years to comply with the interim reporting requirements associated with the emissions standards set forth in 9-4-301.3 and 9-6-303.5 for furnaces and water heaters greater than 75,000 BTU (including tankless water heaters), respectively.

C. IMPLEMENTATION WORKING GROUP

The IWG began formally meeting in May 2023 to provide the Air District with information, insights, and strategies to support a smooth, accessible, and equitable technology transition and implementation of the building appliances rules. The IWG provided space for discussion of diverse ideas among members in a way that supported understanding, joint fact-finding, and surfacing potential recommendations on implementation.

The IWG was comprised of over 40 invited members representing a variety of stakeholder segments including environmental justice groups, community-based organizations (CBOs), subject matter experts in building energy, affordable housing development, and technology, local and regional government, labor and trade organizations, relevant state agencies, utilities, and CCAs. The full list of IWG members can be found at the Air District IWG website.[4]

To appropriately account for the broad range of topics, questions, and concerns related to the building appliance rules, the IWG included a Technical Subcommittee, an Equity Subcommittee, and a Steering

[4] https://www.baaqmd.gov/community-health/building-appliances-rule-implementation/building-appliances-implementation-working-group

Committee. The subcommittees were organized to focus on technical or equity-related topics, respectively, while the Steering Committee helped prioritize the topics to be discussed at quarterly plenary meetings with the full IWG.

The IWG considered a variety of topics, including:

- market availability of zero NOx compliant appliances
- costs of purchase and installation of zero NOx compliant appliances
- technology, market, affordability, and accessibility barriers to meet the regulatory compliance deadlines adopted by the Air District Board of Directors, especially among lower income households and small businesses
- incentives, funding, and financing programs available to members of the Bay Area community, especially lower income households and small businesses
- potential infrastructure readiness associated with rule compliance
- potential interventions that may be needed for some populations to meet the regulatory deadlines
- equitable access to incentive and funding programs
- disparate impacts to different stakeholder groups (e.g. renters, homeowners, local governments, workforce, etc.)
- potential challenges and opportunities to equitably implement the rule amendments

Although the IWG was an advisory group and not a decision-making body, the Air District is committed to thoroughly consider the group's input and feedback in its implementation process and in its periodic reports to the Board. IWG discussion and recommendations are explicitly cited in this report, and many of the referenced information sources came from IWG discussion and consideration. As outlined in the IWG charter, the Air District retains its independent decision-making role in the rule implementation process.

D. ENGAGEMENT PROCESS

The Air District has conducted a robust engagement process for the Building Appliances Rules implementation, with an initial focus on Rule 9-6. Since its inception, the IWG has held the following meetings:

- 6 IWG Plenary Meetings
- 5 Steering Committee Meetings
- 5 Equity Subcommittee Meetings
- 5 Technical Subcommittee Meetings

Though the IWG included community-based organizations, the Air District engaged with over 12 additional CBOs in individual meetings. In addition, Air District Staff presented on the IWG to the Community Advisory Council (CAC) and invited its members to join the Equity Subcommittee. The CAC advises the Air District on community-related matters to advance an equity-forward policy agenda. Following our invitation, three CAC members joined the Equity Subcommittee and participated in several Plenary and Equity Subcommittee meetings. Staff often invited these CAC members to follow-up discussions after IWG meetings. Based on their guidance, the Air District Staff conducted interviews with nine Bay Area renters to gather their lived experience regarding displacement risks, dealing with repairs and construction, utility costs, and in-unit health and comfort issues, among other related topics. These interviews are summarized in Appendix H. *Lived Experience Interviews Report 2024.*

Throughout this process, Air District Staff have met with State and local agencies as well as utilities, CCAs and non-governmental organizations (NGOs). Staff met monthly with CARB and SCAQMD to discuss their upcoming zero emission and zero NOx building appliance rules and coordinate on a range of technical and policy challenges, and periodically met with PG&E, CPUC, and CEC to discuss energy code, incentives, grid, and other important topics. The Air District team also met regularly with the CCAs to collaborate on implementation challenges such as outreach and emergency appliance replacement.

Lastly, Air District Staff have also participated in, and often presented at, numerous public events relevant to zero NOx appliance rule implementation including county and city electrification fairs, contractor education and workforce events, and forums on zero NOx rules, permitting, building electrification, sustainability, and climate resilience.

III. BENEFITS OF THE RULES

The amended rules are expected to significantly reduce NOx emissions from covered building appliances. The baseline emissions from appliances covered by the rules currently emit more NOx emissions than passenger vehicles in the Bay Area. Nitrogen oxides are considered "criteria air pollutants". They contribute to the formation of other air pollutants such as fine particulate matter ($PM_{2.5}$) and ozone (O_3). Nitrogen oxides are formed during combustion processes. Nitrogen and oxygen present in the ambient air react at the high temperatures of combustion to form nitric oxide (NO) and nitrogen dioxide (NO_2), collectively referred to as NOx. These compounds can further react in the ambient air with other compounds in the presence of sunlight to form other air pollutants. Nitrogen oxides can form fine particulate matter when reacting with either ammonia to form ammonium nitrate (NH_4NO_3) or with sulfur dioxide to form ammonium sulfate ($(NH_4)_2SO_4$), referred to as secondary particulate matter. Nitrogen oxides can also react with reactive organic gases (ROG) in the atmosphere to form ozone, a main component of smog.

Through the NOx reductions expected to be achieved through implementation of the zero-NOx requirements, the Bay Area will also experience ozone and secondary particulate matter formation reductions. These pollution reductions will assist in achieving ambient air quality standards and provide vital health benefits. Assuming electric appliances will be installed, implementation of the zero-NOx requirements will indirectly achieve greenhouse gas and primary particulate matter reduction as well.

A. PUBLIC HEALTH BENEFITS

The zero NOx requirements of the building appliance rules will result in reductions in NOx emissions and reductions in secondary $PM_{2.5}$ across the Bay Area. Reductions in total $PM_{2.5}$ attributable to the zero NOx requirements, including reductions in primary $PM_{2.5}$ from the adoption of electric appliances, will avoid an estimated 37 to 85 premature deaths per year and about 110 new cases of asthma each year. The societal costs of the health impacts from total $PM_{2.5}$ were estimated to be between 400 to 890 million U.S. dollars annually.

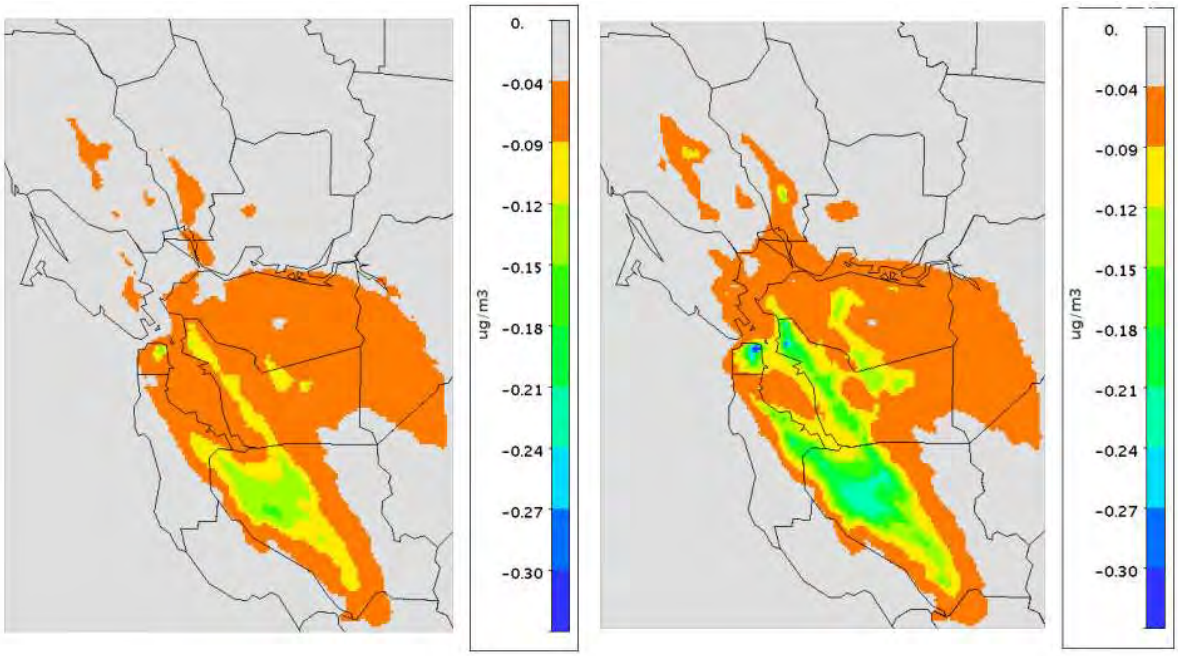
B. EMISSIONS REDUCTIONS

The zero NOx requirements of the building appliance rules are expected to have significant emissions reduction benefits. Resulting net NOx emissions reductions from full implementation are estimated to be 3,236 tons NOx per year. Atmospheric modeling assessments[5] performed by the Air District can be seen in Figure 1 below. The key findings of this analysis showed that NOx emissions from building appliances covered by the zero NOx requirements result in an annual average contribution between about 0.04 microgram per cubic meter ($\mu g/m^3$) to 0.18 $\mu g/m^3$ of secondary $PM_{2.5}$ across most residential areas of the Bay Area. These emissions reductions are the result of decreased NOx emissions and therefore secondary PM formation. Additional emissions benefits may be seen if electric appliances are used to comply with the zero NOx requirements as emissions from natural gas-fired appliances also include primary, or directly emitted, $PM_{2.5}$. The total annual average contribution to $PM_{2.5}$, including both

[5] BAAQMD, 2022. *Assessing Ambient Air Quality and Health Impacts from Natural Gas Building Appliances in the Bay Area: Supplemental Information for Proposed Amendments to Regulation 9, Rule 4 and Rule 6.* https://www.baaqmd.gov/~/media/dotgov/files/rules/reg-9-rule-4-nitrogen-oxides-from-fan-type-residential-central-furnaces/2021-amendments/documents/20221220_sr_appe_rg09040906-pdf.pdf?rev=d4b056153496491fad817c6d4a87df78&sc_lang=en

primary and secondary $PM_{2.5}$, across most residential areas of the Bay Area varied between 0.10 µg/m^3 and 0.42 µg/m^3.

Figure 1: Secondary (left) and Total (right) PM2.5 Contributions from Building Appliances in the Bay Area



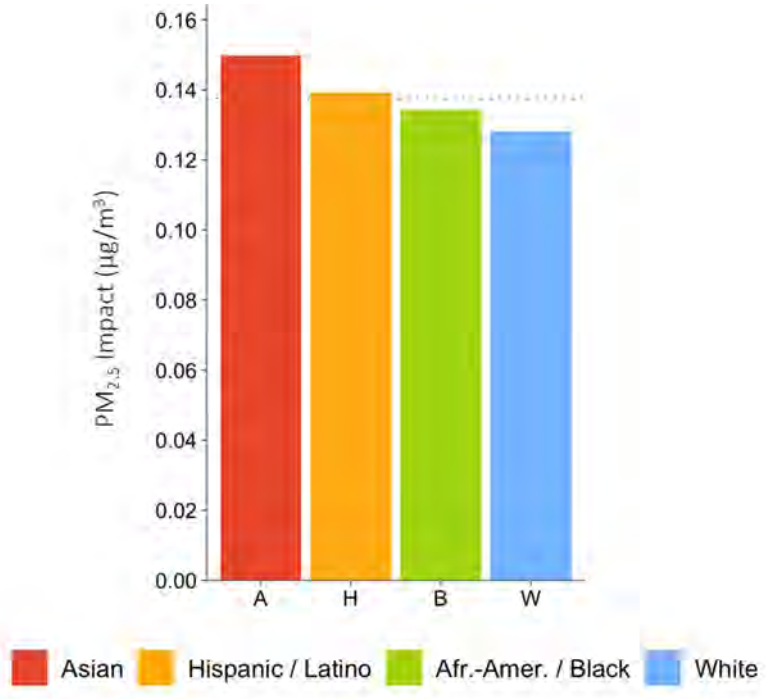
C. HEALTH EQUITY IMPLICATIONS

When applied to the population of the Bay Area, the emissions reductions mapped above and the related health benefits predominantly accrue to communities of color in the Bay Area, particularly the Asian/Pacific Islander population. Within individual counties[6], the greatest modeled reductions in health impacts from $PM_{2.5}$ emissions are projected to benefit Hispanic/Latino, African-American/Black, or Asian/Pacific Islander residents, depending on the county. These communities have historically borne a disproportionate burden of air pollution and associated health impacts, making these reductions crucial for addressing longstanding environmental health disparities.

Figure 2, below, shows this modeled impact for the entire Bay Area. The dotted line on the chart indicates the average exposure level.

[6] BAAQMD, 2022. *Exposure and Equity Assessment of Natural Gas Appliances in the San Francisco Bay Area.* https://www.baaqmd.gov/~/media/dotgov/files/rules/reg-9-rule-4-nitrogen-oxides-from-fan-type-residential-central-furnaces/2021-amendments/documents/20221220_sr_appf_rg09040906-pdf.pdf?rev=a6f1c065273243b99cffcf290a08fe74&sc_lang=en

Figure 2: Modeled Total PM2.5 Impacts Attributed to Targeted Emissions from Space and Water Heating Appliances.



This focus on delivering health benefits to impacted communities ties directly to the Air District's broader commitment to equity, as outlined in its 2024-2029 Strategic Plan.[7] The plan highlights equity as one of the Air District's six core values (see Figure 3 below) and emphasizes the need to prioritize air quality improvements in communities that have been marginalized or overburdened by pollution. These recently adopted rule amendments, which target reductions in $PM_{2.5}$ exposure in areas with higher concentrations of communities of color, serve as an important example of how the Air District is aligning its regulatory efforts with its equity-driven mission.

Figure 3: The Six Core Values Identified in the Air District's 2024-2029 Strategic Plan

[7] BAAQMD, 2024. *Bay Area Air Quality Management District 2024-2029 Strategic Plan.* https://www.baaqmd.gov/~/media/files/strategic-plan/2024_2029-strategic-plan_final_090424-pdf.pdf?rev=4432bd55a4e84f55b8ead3dea4355b2e&sc_lang=en

IV. POTENTIAL HOUSING IMPACTS

A key issue raised by stakeholders during the rulemaking process was the potential impact that implementation of the building appliance rules could have on renters in residential buildings. Depending on the level of work required to comply with the building appliance rules, tenants may be required to vacate units or experience other disruptions during appliance installation, in particular if there are construction activities required. They could also experience rent increases or pass-through costs to cover the expenses. These experiences can have significant negative effects on renter households, including displacement, eviction, stress, and economic hardship, particularly for lower income tenants with fewer housing options, families with children, the elderly, and other vulnerable groups.

A. WHAT WE LEARNED

The Air District commissioned Arup to conduct research to increase the understanding of how the building appliance rules could impact housing and tenancy-related issues. Specifically, Arup examined whether and where policy mechanisms are in place that could protect renters from either rent increases or evictions as an indirect result of rule implementation. Specifically, they asked the following questions:

Arup first conducted a detailed assessment of existing state and local renter protection policies, and then collected and analyzed other relevant data (e.g. census data by county) to illustrate the geographic relationship between those policies and demographic data from various local governments within the Air District's jurisdiction (e.g. density of renters). They then developed a set of recommendations to address key issues and potential policy gaps identified through the assessment. For brevity, this summary excludes references to deed-restricted affordable housing, which was determined to strictly regulate allowable rent increases and evictions; however, this issue is discussed in Appendix G. *Renter Protections Policy Landscape Summary*.

To augment the desktop policy research described above, the Air District also engaged directly with Bay Area community members to learn about their experiences living in various types of rental housing. The Air District leveraged multiple channels, such as by sending invitations to existing community-based organization partners and grantees, and by sharing the opportunity with other groups working on related issues, to recruit individuals willing to share their stories through structured interviews. Stipends were offered to interviewees, along with in-language interpretation in Spanish as needed. A total of nine 45-minute interviews were conducted with renters from San Francisco, Marin, Alameda, and Santa Clara counties, which covered topics such as their experience with evictions, displacement, disruptions, and harassment; appliances, repairs, and construction; utility costs; health; education and awareness about energy programs. The full report with more detail and key takeaways can be found in Appendix H. *Lived Experience Interviews Report 2024*.

1. RENTER PROTECTION LAWS – LOCAL AND STATE

As part of the policy assessment, Arup identified two main aspects of renter protection laws most relevant to implementation of the zero NOx requirements: rent stabilization (sometimes also referred to as rent control, which limits how much rent can be increased each year) and eviction protections. These types of policies can be found in slightly different forms across various municipalities, creating a complex patchwork of local policies.

All jurisdictions are subject to The California Tenant Protection Act of 2019 (AB 1482) which caps rent increases at 5% plus inflation and applies just cause eviction protections to multi-family properties over 15 years old throughout the state through 2030. Most local rent stabilization policies include stronger rent increase percentage caps and do not have expiration dates; similarly, most local just cause eviction policies do not have expirations. If a unit is covered by a local eviction and/or rent increase regulation, the stronger policy applies. Generally, AB 1482 is less protective than what is typically found in cities with local renter protection ordinances in the Bay Area.

Key Policy Terms

*"**Just cause**" eviction protections limit the reasons for which landlords can evict tenants or refuse to renew their leases. Within just cause policies, allowable reasons fall into two types of categories:*

1. ***At-fault**: Reason for eviction is based on the tenant's actions (like breaking the law or health and safety violations) or non-compliance with lease terms (like not paying rent, causing damage, or refusing to leave when lease expires).*
2. ***No-fault**: Landlords may legally evict tenants (at "no fault" of theirs) for limited and specific reasons (i.e. if the landlord or their dependent plans to move in, if they are doing substantial repairs or renovations, or if they want to remove the property from the rental market).*
   - *In these cases, the tenant may be entitled to certain benefits, such as relocation assistance.*
   - *In the context of rule implementation, only no-fault evictions are relevant as "substantial repairs" needed to install zero NOx appliances could trigger temporary evictions.*

The study also highlighted the issue of pass-through costs and the "substantial repair" clause in local policies as key to understanding how implementation of the building appliance rules could impact renters financially, specifically as noted below:

- Most local policies allow pass-through costs of capital improvements when they are required for compliance reasons, but landlords must petition local agencies to legally pass these costs on to renters. In most cases, these approved pass-through costs exceed existing rent caps, although some cities have established a separate explicit cap for increases related to capital improvements or other maintenance costs.

- Under state and local renter protection policies, the "substantial repair" clause (noted above) can be used to initiate a no fault, just cause eviction. Substantial repair is generally defined as repairs 1) needed to bring the unit into code compliance, 2) that cannot be done with tenants safely living in the unit, and 3) that require a permit from the local permitting agency.

Therefore, based on the current analysis and understanding, implementation of the building appliance rules poses some risks to renters. Specifically, compliance costs can be passed through to renters, and depending on the conditions of a given rental property, implementation could result in landlords using

the substantial repair clause to evict tenants if the project scope is significantly increased by a need to make additional building modifications to install the compliant appliance.

These challenges are complicated by a lack of data and transparency regarding how renter protection laws are enforced as local and state laws are enforced through complaints, for example, if a tenant objects to a rent increase or eviction if they believe a landlord is not following these laws. It is difficult to assess how strongly local and state policies are followed and how frequently tenants' rights are violated. San Francisco is the only jurisdiction in the Bay Area with a housing tenant right to counsel, which makes it more likely that tenants can assert their rights if violated.

2. POTENTIAL SOLUTIONS TO REDUCE RENTER IMPACTS

When considering these issues, it is important to acknowledge that housing security in California is a complex and dynamic topic and cannot be viewed or addressed solely within the context of the building appliance rules. However, in designing and implementing these new policies, stakeholders can work to minimize and mitigate any negative impacts on tenants.

Based on findings from the policy assessment, Arup put forward recommended actions and opportunities to further support renters in the implementation of the building appliance rules:

- Strengthening tenant protections:
  - Add specific language to AB 1482 to limit rent increases and/or pass throughs related to zero NOx appliance replacements.
  - Improve policy enforcement, data collection, and tracking of pass-throughs and evictions due to construction activities at the local and state levels.
  - Increase resources to proactively provide clear and culturally accessible tenant rights education and support services to renter populations.
- Eviction protections:
  - When substantial repair is invoked and tenant relocation is necessary, expand relocation assistance programs for displaced tenants.
  - Increase resources to provide greater local and state oversight to focus on renovictions (i.e. when construction activities are used to harass tenants).
- Pass throughs:
  - Local governments that provide oversight on local renter issues could consider opportunities to limit pass throughs from certain upgrades, including zero NOx appliance replacements.
  - Clarify that end-of-life equipment replacements for services already provided (i.e. heat and hot water) should be treated as regular operations & maintenance costs, not capital improvements.

Sample quotes from Lived Experience Interviews

"I am aware of rebates, for switching from gas to electric appliances. My landlord has not taken the measure yet, but he is interested in changing from gas to electric...My landlord should be the one to take care of figuring out the switch."

"[The water heater] works, but I don't like it because it's gas and very old. I don't feel safe."

"Disposable income needs to be considered with this trend (electrification), and tenants might not be able to afford the transition. It needs to be affordable."

"I didn't have a contract and it was an informal agreement. Many people like to rent without a formal contract, because sometimes the requirements are a lot, especially for Latinos. I have experienced housing discrimination for being Latino."

  - Enhance efforts to engage with residential landlords to increase their knowledge of, and participation in, financial incentive programs to reduce overall implementation costs and related pass through amounts.

Arup also provided recommended next steps and areas for further research, including:

- Interview legal service providers, tenant representation organizations, and others to gain more insight regarding how different local renter protection policies (e.g. 'right to return' ordinances, relocation assistance and eviction protections, pass throughs and rent stabilization) are implemented "on the ground," and how they interact with one another, to identify specific ways to strengthen tenant protections for different types of building upgrades, including zero NOx appliance installations.
- Perform further research regarding if and how zero NOx appliance replacements apply to the "substantial repair" clause, and explore if changes could be made in those laws to minimize tenant displacement.

- Compile and make available local government examples of relevant renter protection policy approaches. Continue multi-agency coordination and information sharing between the Air District, SCAQMD, and CARB regarding the potential impacts of appliance rules on renters and identify implementable next steps, key partners, and timelines.

V. CHALLENGING INSTALLATION CASES AND EMERGING SOLUTIONS

While average costs[8] and timelines for zero NOx heat pump water heaters are understood, some existing conditions and policies can lead to challenging "edge-cases" with significantly greater costs and longer timelines. Challenging cases include installations with space constraints; electric panel upsizing; electric utility service upsizing or energization; and emergency replacements. According to TECH Clean CA September 2024 data, purchase and installation costs for SF HPWH projects in the nine-county Bay Area range from $2,900 to $38,800.

This section summarizes the growing understanding of challenging edge cases in the Bay Area while also acknowledging that the exact extent and parameters for predicting all edge cases and resulting additional costs or timelines are unknown. This section also considers new developments and potential solutions that have progressed since the writing of the Regulation 9, Rule 4 and Rule 6 Staff Report in late 2022. Technology advancements and pilots, as well as new legislation, proceedings, and policies will be discussed and highlighted as they relate to the known challenges.

A. WHAT WE LEARNED

Palo Alto's HPWH program considered a "standard" installation as one that has adequate space to install the HPWH, with 25' or less of electrical conduit run and easy drainage. The program found that only 20% of projects met the standard installation definition; 80% of projects needed additional work and thus additional charges, which the program covered up to $1,000.[9] Of the 80% of projects needing additional

[8] See Table 1: Small Water Heaters Upfront and Incremental Costs Summary of this report

measures, approximately one third of projects had more than $1,500 of additional charges and slightly less than half had less than $800 of additional charges.

Palo Alto's initial program data suggests that overall, approximately 3 out of 20 projects required additional work and charges greater than $1,500, for measures addressing space constraints, conduit/electrical work and/or drainage.[10]

1. SPACE CONSTRAINTS

HPWHs inherently need more space due to ventilation requirements and larger tanks (standard guidelines recommend upsizing 10-15 gallons, compared to a NOx-emitting gas water heater, to offset HPWH slower recharge times). In homes where the existing enclosure is small without adequate ventilation space (e.g. interior closets), installation requires additional measures, including potential relocation to another part of the home and/or other work that can add significant costs. For further discussion on this challenge, please see Appendix B. *Challenging Use Cases and Emerging Solutions for Zero-NOx Appliances.*

Given the diversity of the Bay Area building stock and individual nature of existing water heater locations, estimating the extent of this challenge is difficult. California field studies of 120V HPWH installations found space constraints were the biggest reason for site rejections (sites where program administrators did not install projects), with 35 out of 121 sites (28%) rejected due to space constraints.[11] Given the objective of the study was to avoid upgrades typically associated with fuel switching, the project did not pursue any additional measures, and only added venting to one project site.[12]

Between March 2023 to July 2024, in Palo Alto's comprehensive HPWH replacement program, out of 311 projects the following number of program projects were likely impacted by space constraints:

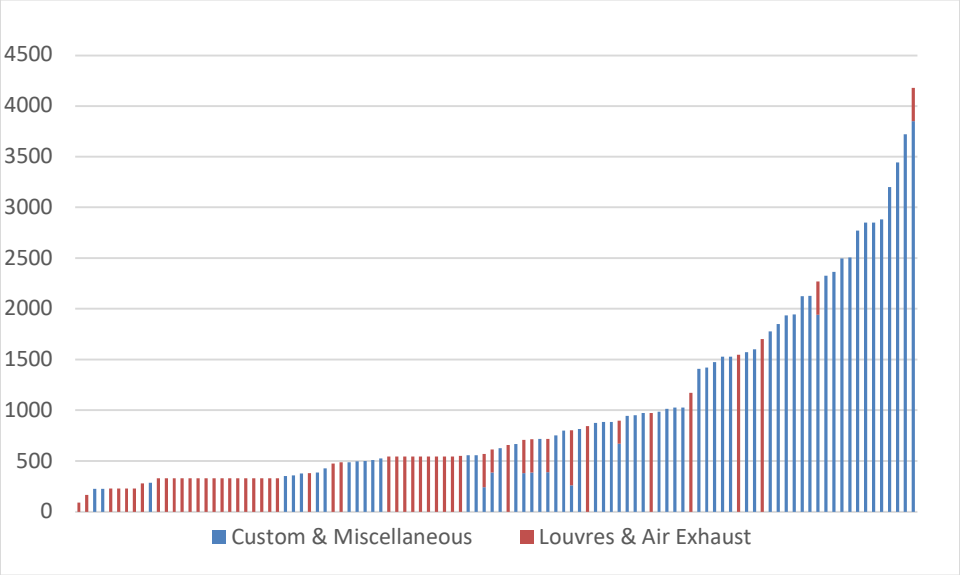
- 36 projects (12%) required some space reconfiguration work
- 14 projects (5%) requiring work by a carpenter (though some measures were minor adjustments, e.g. removal and reinstallation of doors and frames)
- 65 projects (21%) needed ventilation measures

Additional costs from these measures, including carpentry, ranged from $89 to $3,850 per measure; the average additional costs from space constraints per project was $998 with a median of $620. Higher average vs. median costs indicated that a few high-priced outliers are pulling average costs up; to see further data spread, please see Figure 4 below.

[11] https://newbuildings.org/wp-content/uploads/2023/07/PlugInHeatPumpWaterHeaterFieldStudyFindingsAndMarketCommercializationRecommendations_NBI202308.pdf

[12] Based on conversation with study authors, September 2024.

Figure 4: Palo Alto HPWH Program: Additional Space Constraint Costs for Space Reconfiguration, Carpentry, and Ventilation Measures



Source: Data provided by Palo Alto Utilities staff, September 2024.

Note that the above referenced costs are *additional* costs to address space constraints only. As discussed earlier, Palo Alto also included two other categories of additional costs in its program (electrical/conduit and drainage).

Although the Air District currently has limited data on how often building conditions and space constraint caused additional costs for HPWH installations, more comprehensive datasets estimating triggers and likely costs of space constraints throughout the Bay Area are expected soon from separate research coming from CARB, CCAs, as well as from BayREN in 2025.

2. PANEL UPSIZING

In June 2024, UCLA released a multi-year study[13] providing a better understanding of the extent of smaller electrical panels in existing buildings in California, and what percentage can be expected to require upsizing to achieve comprehensive electrification. Statewide, 3% of SF homes had panels smaller than 100 amps and 10% of MF homes had panels smaller than 60 amps (per dwelling unit) which will most likely require upsizing for electrification. In disadvantaged communities (DACs), the number of SF homes with panels smaller than 100 amps is disproportionately higher at 8%. Study results show that 32% of SF and 59% of MF homes in California have panels of intermediate size (100 amps for SF, 60 amps for MF) and will likely require load management and panel optimization (to be discussed in the next subsection B. Ongoing Strategies and Path Forward) to support comprehensive electrification.

In the Bay Area, these numbers correspond with data suggesting that 44% of existing SF homes currently have electrical panels of 200 amps and above, which should support electrification without panel upsizing.

[13] https://www.sciencedirect.com/science/article/pii/S0301421524002581

Note that many of these estimates are looking at *comprehensive* electrification of *all* appliances and end-uses. Given that the 2027 Rule 9-6 compliance date is solely focused on small water heaters, it's important to note that heat pump/resistance water heaters ranked fourth (out of 5) for end-use types that would likely trigger electrical panel upsizing. Table 4 shows the factors that influenced this ranking, such as typical equipment size and required circuit breaker size ranges. Discussion with members of the IWG, including electrification experts, concluded that 80 amp panels would be sufficient for solely the electrification of the water and space heating for most SF houses. One IWG member who is a service provider noted that in their work with thousands of homes across California, no home they had ever worked with needed a panel upgrade solely to install a HWPH.

Table 1: Ranked List of Electric Appliances That Will Likely Drive Service Panel Upsizing

Rank	End-Use Energy Service Category	Electric Appliance Technology Category	Typical Equipment Size Range	Required Circuit Breaker Size Range *
1	Electric Vehicle Charging	Level-2 Electric Vehicle Fast Chargers	3.3–20 kW Peak Power Rating	15–100 Amps at 240-V
2	Cooking	Induction Cooktops and Ranges	7.2–12 kW Peak Power Rating	30–50 Amps at 240-V
3	Heating, Ventilation, and Air Conditioning	Centrally Ducted/Mini-Split Heat Pump HVAC Systems	1–7 Tons (12,000–84,000 BTU)	15–125 Amps at 120/240-V
4	Water Heating	Heat-Pump/Resistance Based Water Heaters	10–100 Gallon Tank Capacity	10–30 Amps at 120/240-V
5	Clothes Drying	Heat-Pump/Resistance Based Clothes Dryers	1.5–9.0 ft^3 Drum Capacity	15–30 Amps at 120/240-V

* Quoted amperage ratings include NEC required margins of safety which must be applied to the sizing of breakers used for continuous loads with backup equipment.

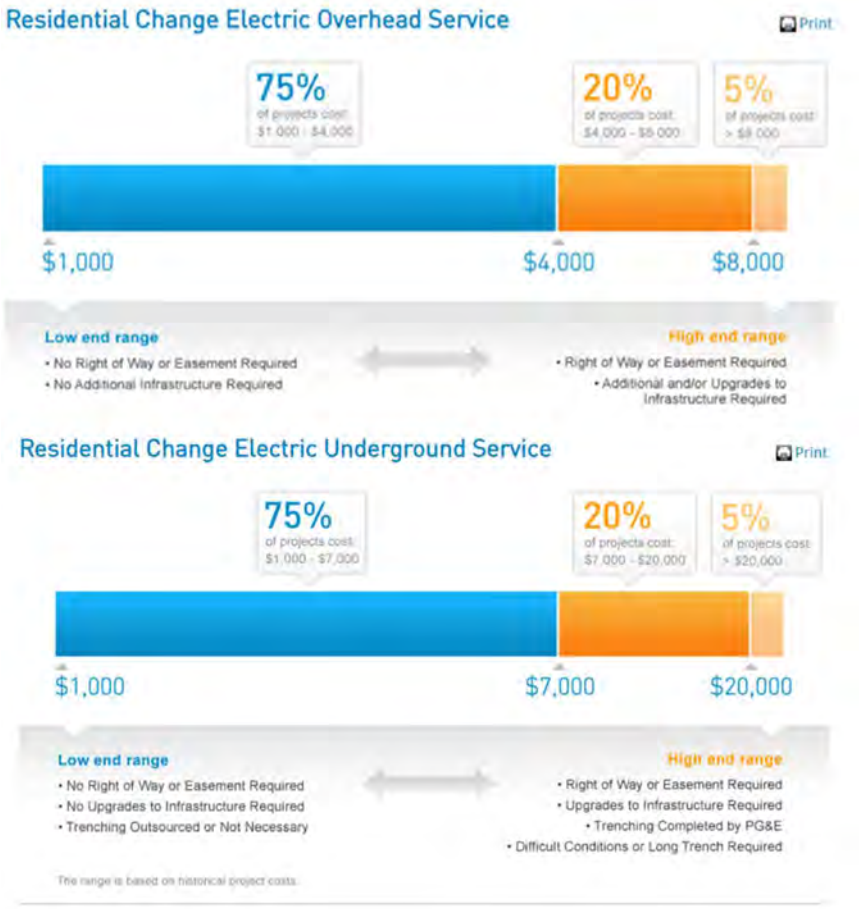
Source: *Quantifying the electric service panel capacities of California's residential buildings*[14]

3. ELECTRIC UTILITY SERVICE UPSIZING: COSTS AND TIMELINE

For the small number of homes that may need to upsize their electrical panels, some may also require utility service upsizing (also referred to as energization) from PG&E. For costs, the current PG&E Rules 15 and 16 allow PG&E customers $3,255 in customer credits for each project; thus, for less costly projects the full customer cost may be covered by the allowance. However, historically 25% of overhead service upgrade projects have cost greater than $4,000, with costs for underground service upgrades even higher, as illustrated in Figure 5.

[14] https://www.sciencedirect.com/science/article/pii/S0301421524002581

Figure 5: Typical Costs for PG&E Overhead and Underground Service Upsizing



Source: pge.com. Accessed January 2024.

The Powering Up Californians Act (SB 410), passed in October 2023, requires the CPUC to establish reasonable average and maximum target energization time periods, as well as reporting requirements so that investor-owned utility energization can be tracked and improved. SB 410 also required detailed analysis of the utility's current and future qualified staffing levels for each job classification and a subsequent adequate pipeline of apprentices where applicable. These actions aim to improve some of the root causes of slow PG&E service upgrade work.

In September 2024, the CPUC concluded Phase I of the Energization proceeding (R.24-01-018) and approved a decision setting energization targets and timelines, including interim steps in the energization process. The target average vs. maximum timelines approved are 10 and 45 days for application decision; 30 and 45 days for panel upsizing; and 182 days on average and a maximum target

of 306-357 days for standard energization depending on whether the line upgrade/extension goes from the secondary transformer to the meter (Rule 16) or to the substation (Rule 15).[15]

Capacity upsizing requiring new or upgraded circuits and/or substations will range from 684 to 3,242 days. Capacity planning is discussed further in **Section IX. Grid and Reliability Impacts**.

Though the CPUC targets and timelines for energization represent an improvement from the status quo, the resulting timeframes may still cause delays in projects and gaps in service for households that need panel upsizing and PG&E service upsizing.

Overall, the approved CPUC decision for Phase I of the Energization proceeding represents a first step. With required bi-annual reporting that must detail reasons and analyses for any energization projects that exceed the prescribed targets (e.g. staffing, equipment availability, funding), as well as required Customer Engagement Plans, the CPUC proceedings and processes aim to track and improve utility energization services over the long run. Phase II of the Energization proceeding is expected to kick off sometime early 2025.

4. EMERGENCY REPLACEMENT AND GAPS IN SERVICE

Anywhere from seventy-five to ninety percent of water heater replacements in California only happen upon failure of the existing appliance.[16] Unlike a like-for-like replacement, upgrading to a zero NOx water heater may necessitate additional work as discussed—such as a higher voltage socket for standard 240-volt HPWHs; ventilation; drainage; and/or appliance relocation—and thus different contractors and different permitting requirements as detailed in **Section VII. Permitting**. Given that many building owners do not pre-plan for water heater replacement, this work could take weeks. This lag time can result in a gap in hot water service. For further detailed discussion, please see Appendix B.

B. ONGOING STRATEGIES AND PATH FORWARD

1. TECHNOLOGIES AND MEASURES FOR SPACE CONSTRAINTS

Technologies to address space constraints are now available on the market and increasingly utilized.

Split-system HPWHs are HPWHs where the compressor and tank storage unit are unattached, which allows the tank to fit in smaller spaces; they do, however, require outside access for the outdoor compressor. As of the writing of this report, Energy Star lists 16 records for split-system HPWHs from three different manufacturers.[17] The EmberH20 is an additional split-system HPWH model, manufactured by Embertec, which has recently passed certifications. The EmberH20 was specifically designed to fit in manufactured/mobile home utility closets and be a “plug-and-play” option at 120 volts.[18] Based on conversation with this manufacturer, they expect to begin US distribution and sales early 2025 with suggested retail prices ranging from$2,250-2,600. For further discussion on split-system HPWHs, including contractor interview discussion regarding successful installation of SANCO2 brand mini-split HPWHs in multifamily buildings, see Appendix B.

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[15] https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/transportation-electrification/energization/fact-sheet-energization-091224.pdf

[16] Emergency Replacement Heat Pump Water Heater Market Study | ETCC (etcc-ca.com)

[17] https://www.energystar.gov/productfinder/product/certified-heat-pump-water-heaters/

[18] https://embertec.com/heat-pump-water-heater/

Though the majority of zero NOx water heating projects will likely be HPWHs due to better energy efficiency and resulting bill savings, electric on-demand tankless water heaters also offer zero NOx water heating. Bill increases from using electric on-demand tankless water heaters will be less significant for smaller households with low hot water demand, and upfront costs may also be lower compared to HPWHs given the lack of condensate/drainage needs and ventilation requirements. With no storage tank, on-demand electric resistance water heaters are much smaller than tanked water heaters, with multiple manufacturers offering models at US major retailers.[19] For further discussion on upfront retail costs, please see the section *On-Demand (Tankless) Electric Hot Water Heater Upfront Costs* in Appendix A. *Installation Costs for Zero-NOx Space and Water Heating Appliances*.

For ventilation requirements, if a location in the manufacturer-recommended sized room is not possible due to existing building conditions, then the installer can increase the supply of air through strategies such as air return grilles, louvered doors, exhaust ducts, wall grilles, and structures to create forced convection without a duct.

2. MINIMIZING ELECTRICAL WORK NEEDED AND PANEL UPSIZING

120V Plug-in HPWHs

Energy Star lists 68 records[20] of 120-volt integrated HPWHs in the US market, and there are now two major manufacturers (A.O. Smith and Rheem) who provide their offerings directly at US major retailers. These models are designed to be "plug and play" to reduce cost and complexity of installation in comparison with a standard 240-volt HPWH.

In July 2023, the Advanced Water Heating Initiative released a study of 120-volt integrated HPWH installations in California.[21] Study results showed cost savings between $800 and $15,000 per household compared to installations of 240-volt HPWH, mostly due to simplified or avoided electrical upgrades. The study also highlighted that the contractors found the 120-volt HPWHs faster to install. These water heaters also draw very low amperage: while rated at 15 amps, monitoring showed they only drew 4-6 amps of current. The study concluded that though the standard 240V HPWH has small performance advantages, the 120V plug-in models can meet the needs of the majority of homes that are less than 2,000 square feet with households of four or less people.

It is important to note there were IWG discussions and anecdotes about 120V HPWH installed by Bay Area contractors only to be rejected by local permitting due to California Plumbing Code [501.1 (2)]. This points to the need for careful installer attention to first hour rating (FHR) requirements and manufacturer specifications, but also points to improvements that could be made through code amendments and manufacturer efforts. According to IWG discussion and members:

- 501.1 (2) needs updating to reflect new technologies such as 120V HPWHs and California's predominance of water-saving fixtures/appliances that would likely lower household FHR needs;

[19] https://www.homedepot.com/b/Plumbing-Water-Heaters-Tankless-Water-Heaters-Tankless-Electric-Water-Heaters/N-5yc1vZc1ty
https://wholesalewaterheater.com/collections/tankless-instant-electric-water-heaters

[20] https://www.energystar.gov/productfinder/product/certified-heat-pump-water-heaters/. Accessed September 2024

[21] https://newbuildings.org/wp-content/uploads/2023/07/PlugInHeatPumpWaterHeaterFieldStudyFindingsAndMarketCommercializationRecommendations_NBI202308.pdf

- Many of the manufacturer guidelines assume a storage temperature of 120 degrees and does not include resulting FHR for high temperatures (e.g. 140 degrees). However, 120V HPWHs can store water at a higher temperature due to an integrated mixing valve, which would increase the FHR of these appliances.
- The amount of hot water use is dependent on the number of occupants rather than the number of bedrooms and bathrooms as currently written in 501.1 (2).

Panel Optimization Strategies (or "Watt Diet")

Overall, low-amperage appliances such as 120V HPWHs are just one of the three main categories of "watt diet" or panel optimization strategies that allows for households to electrify on less than the modern "standard" of 200-amp panels. Other strategies include circuit sharing or circuit splitting/pausing (e.g. sharing a single circuit between a HPWH and EV charger), as well as smart panels.[22] Multiple local case studies of SF homes fully electrifying on 100-amp panels have been published, demonstrating the strategies in practice and individual cost-savings realized.[23] Multiple guidelines exist to support homeowners in utilizing these strategies.[24] There are also forthcoming projects funded by CalNEXT[25] and the CEC[26] to provide tools to homeowners and contractors to help them plan electric equipment installations without a panel upgrade.

Panel optimization strategies would benefit from further socialization and support to facilitate wide-spread adoption. Many homeowners and contractors are unfamiliar with these strategies, pointing to the need for consumer and contractor education. The Air District will highlight educational resources encouraging panel optimization where applicable in its outreach and education. Panel optimization strategies save homeowners, utilities, and ratepayers money by decreasing panel and grid upsizing costs. However, there are currently few incentive programs actively funding these technologies. Incentive programs should offer subsidies for load management before offering subsidies for panel upsizing, and ratepayer funds should incentivize power efficiency, similarly to how California has long provided energy efficiency funding. For further recommendations on accelerating the progress and normalization of watt diet/panel optimization strategies, see SPUR's report *Solving the Panel Puzzle.* [27]

3. ASSIST HOUSEHOLDS WITH UTILITY SERVICE UPSIZING COSTS

Rate-basing or spreading the costs between all PG&E customers for service upsizing for electrification will decrease the upfront cost burden for individual homeowners. In July 2024, the CPUC opened Phase 4 of the Building Decarbonization proceeding (R.19-01-011). Among other questions, the proceeding requested consideration for assistance to under-resourced customers for electric line extension or upsizing, and ways to prevent unnecessary service line upsizing. PG&E's comment letters, dated August

[22] Market Study of Household Electric Infrastructure Upgrade Alternatives for Electrification. https://calnext.com/wp-content/uploads/2023/12/ET22SWE0057_Market-Study-of-Electric-Infrastructure-Upgrade-Alternatives-for-Electrification_Final-Report.pdf. December 2023

[23] https://www.smcsustainability.org/energy-water/decarbonizing-homes/cost-plans/. See examples from East Palo Alto; Half Moon Bay; Pescadero; Redwood City Town Home; Redwood City Ranch; San Bruno; and San Mateo.

[24] https://www.peninsulacleanenergy.com/wp-content/uploads/2024/07/Design-guidelines-for-home-electrification-v051724.pdf

https://homes.rewiringamerica.org/articles/electrical-panel/how-to-electrify-home-100-amp

[25] https://calnext.com/wp-content/uploads/2024/09/ET23SWE0021_Residential-Electrical-Service-Upgrade-Decision-Tool_Final-Report.pdf

[26] https://www.energy.ca.gov/solicitations/2023-12/gfo-23-303-decision-tool-electrify-homes-limited-electrical-panel-capacity

[27] https://www.spur.org/sites/default/files/2024-05/SPUR_Solving_the_Panel_Puzzle.pdf

7th[28] and August 19th[29], affirm its support for assisting PG&E customers with the upfront costs associated with building electrification-related service upsizing. These letters suggest that CPUC should consider limiting this support to service upsizing projects of 200 amps or lower, rather than limiting it solely to under-resourced or low-income households. If CPUC accepts and approves this recommendation, it would open up support for market-rate SF and MF building owners.

Though the proceeding will take months to reach a final decision, it lays out a first step in potentially reducing utility service upsizing costs for individual homeowners. Socializing or rate-basing the costs of electric utility service upsizing would also need to include panel optimization to minimize the number of service upgrade or energization projects and the resulting costs to rate payers statewide. A CPUC decision is expected by early 2025 with any major rule changes likely coming into effect by the summer.

4. EMERGENCY REPLACEMENT LOANERS AND OPPORTUNITIES FOR FASTER INSTALLATION

Statewide pilots have shown the success of programs providing a temporary loaner water heater until the work required for a full HPWH installation is completed.[30] In the Bay Area, there are currently two emergency replacement programs in effect through the City of Palo Alto[31] and MCE[32], and upcoming pilots from Peninsula Clean Energy (PCE) and SVCE. Though these programs are not available region-wide, PCE has mentioned that the structure of the current pilot allows "adders"—thus, expansion of the current contract and programmatic terms for other entities and their service areas (e.g. other CCAs, municipal utilities, etc.) which would speed up procurement and simplify administrative effort.

IWG discussion also brought up new experimental ideas for loaner programs using heat pumps on a temporary basis until electrical upgrades and permanent installation (for example, a 240V HPWH in 400 Watt heat pump mode on a temporary 500-1500W step-up transformer plugged into a 120V outlet). This would also be a "loaner" program, but potentially less work-intensive than installing and un-installing a temporary gas or 120V electric water heater.

IWG discussion also pointed to potential opportunities to speed up installations. The California State Licensing Board (CLSB) allows for contractors with C20-HVAC and C36-Plumbing licenses to self-perform any incidental electrical work required to accommodate the installation of a HPWH, although this does not include an electrical service panel upgrade or replacement. Thus, expanding contractor education and clarifying local permitting requirements could reduce the total number of contractors needed for a project resulting in faster installation times, especially for 120V HPWHs. Further clarification would be needed on definitions of "incidental electrical work," specific training needs for C20 and C36 contractors, and city permitting requirements.

For further discussion on streamlining permitting, see **Section VII. Permitting**.

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[28] Microsoft Word - R.19-01-011_PGE Opening Comments on Phase 4 Scoping Memo_8-7-24.docx (ca.gov)

[29] Microsoft Word - R.19-01-011_PGE Reply Comments on Phase 4 Scoping Memo & Staff Proposal_8-19-24.docx (ca.gov)

[30] https://www.etcc-ca.com/reports/emergency-replacement-heat-pump-water-heater-market-study
https://techcleanca.com/quick-start-grants/2021-quick-start-grant-recipients/barnett-plumbing/

[31] New! One Call Does It All During a Water Heater Emergency – City of Palo Alto, CA

[32] https://mcecleanenergy.org/mce-launches-emergency-water-heater-loaner-program/

5. ENCOURAGE PRE-PLANNING AND READINESS

Most water heaters last between 8-12 years.[33] Though many building owners do not typically pre-plan for water heater replacement, the rules present opportunities to encourage pre-planning and readiness—especially for homes that currently do not have sufficient electrical home infrastructure, such as an electrical outlet near the water heater.

Local governments can consider adopting reach codes that can encourage planning and readiness, such as Piedmont's menu-style of options including panel readiness.[34] A similar, more targeted proposed ordinance from Mountain View was released October 2024.[35] The basic structure for such codes could include requiring that any applications for an electrical panel upgrade must include capacity in the panel to accommodate future zero NOx appliances or electrification of all appliances. More targeted policies could focus on pre-wiring for both space and water heating when reaching a remodeling threshold, such as 50% of total home square footage.

Pre-wiring often makes sense when there is already an electrician onsite for other work, and/or at time of home sale. Becker's SB 382 *Notice to Homebuyers* (sponsored by the Air District and passed in 2024) requires real estate agents to provide disclosure to homebuyers, advising them to inspect the home's electrical system and informing them of any applicable regional laws that would impact appliance replacements.

The Air District will provide education and outreach on the upcoming rules to residents and building owners, and work with partners on education regarding preplanning and electrification readiness. The IWG discussed preplanning resources for individual homeowners[36], as well as broader possible strategies and partners to encourage readiness and preplanning. This discussion covered:

Partnering with:

- Contractors including solar and electric vehicle charging infrastructure (EVSE)
- Retailers
- CBOs
- CCAs
- Cities and Counties
- Developers and Realtors

Prioritizing:

- Areas with underground lines
- Homes with water heater closets and no garages
- Water heaters older than 10 years

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[33] https://svcleanenergy.org/wp-content/uploads/2020/02/HPWH_Basics_edit.pdf

[34] Reach Code Information - City of Piedmont (ca.gov)

[35] Mountain View proposed ordinance language https://mountainview.legistar.com/gateway.aspx?M=F&ID=db7e3554-95e1-44f3-8652-1fec21c5cfa5.pdf

City Council report: https://mountainview.legistr.com/gateway.aspx?M=F&ID=0c9df77c-62cf-4ba7-b466-d49e2855fc05.pdf

[36] https://homes.rewiringamerica.org/personal-electrification-planner

https://www.quitcarbon.com/

https://electrifymyhome.com/no-visit-energy-assessment/

More specific IWG discussion on encouraging readiness and preplanning for multi-family buildings focused additionally on partnering with technical assistance providers; local governments (Housing Authority, Planning, Permitting, Rent Boards); and tenant organizations. IWG members agreed that the priority should be the largest MF buildings; MF buildings that are sole service for a transformer; and affordable housing. MF strategies should not only encompass education but also technical assistance and planning, as well as financial support.

VI. COST UPDATES

The only compliant technologies with zero NOx emissions for water heaters less than 75,000 BTU/hour that are currently available in the market are electric. Given the price of electricity, as well as installation complexities and resulting costs, many members of the public and other stakeholders have expressed concern regarding the upfront costs as well as ongoing operational costs and utility bill impacts of complying with the rules. The following section, compared to the previous Staff Report, will provide an updated and more detailed understanding of the average and median costs as well as options to support residents with upfront costs, such as incentives and financing; and expected utility bills and key factors. For further details, please see Appendix A. *Installation Costs for zero NOx Space and Water Heating Appliances*.

For a discussion on project types and factors that would likely push projects beyond average costs, please see Appendix B. *Challenging Use Cases and Emerging Solutions for Zero-NOx Appliances*.

C. WHAT WE LEARNED

1. OPERATIONAL COSTS

Modeled Bill Impacts

As part of the January 2024 costs summary study for Appendix A, the energy and economics consulting firm E3 ran an analysis of the billing impacts from switching to a HPWH. This analysis was based on 1,500 East Bay customers and used monthly customer data provided by Ava Community Energy and models from CEC-funded research.[37] Given that by 2027, PG&E will have implemented the Income Graduated Fixed Charge (IGFC) approved by the CPUC in mid-2024[38], the analysis was updated to include the IGFC in September 2024.

The E3 analyses found that 95% of high-usage customers have either bill savings or no change to their bills after switching to a HPWH. As Table 3 shows, approximately 35% of (single family residential (SF Res) and 60% of multi-family residential (MF Res) non-CARE, low electricity use customers see a bill increase of around $2 on average per month. The CARE and E-ELECT programs are described in the next section.

[37] https://www.ethree.com/wp-content/uploads/2023/12/E3_Benefit-Cost-Analysis-of-Targeted-Electrification-and-Gas-Decommissioning-in-California.pdf

[38] https://www.utilitydive.com/news/california-puc-approves-income-based-fixed-charge/715748/

https://www.publicadvocates.cpuc.ca.gov/-/media/cal-advocates-website/files/press-room/press-releases-and-statements/240509-public-advocates-office-press-release-cpuc-flat-rate-decision.pdf

Table 2: Zero NOx Water Heating Bill Impacts with Income Graduated Fixed Charge

Usage	Sector	Customer	% Customers who Switch to E-ELEC	Bill Impact	% Customers	Avg $/Month
Low	SF Res	CARE	8%	Increase	12%	$1.33
				Decrease	88%	-$8.28
		Non-CARE	10%	Increase	34%	$1.73
				Decrease	66%	-$7.51
	MF Res	CARE	13%	Increase	10%	$1.33
				Decrease	90%	-$7.89
		Non-CARE	18%	Increase	59%	$2.09
				Decrease	41%	-$7.65
High	SF Res	CARE	62%	Increase	4%	$1.50
				Decrease	96%	-$15.38
		Non-CARE	64%	Increase	5%	$1.71
				Decrease	95%	-$32.97
	MF Res	CARE	48%	Increase	7%	$1.42
				Decrease	93%	-$16.58
		Non-CARE	76%	Increase	3%	$1.24
				Decrease	97%	-$27.59

Source: Appendix A

Factors Impacting Bill Savings

Some key factors can impact bill savings for individual customers. As shown in Table 3 the CARE bill discount program provides a larger discount on electric bills than on gas bills, which supports greater bill savings for CARE customers who switch to electric appliances.[39] PG&E's E-ELEC rate, a newly designed tariff to support electrification, will structurally benefit larger electricity users but also supports some low electricity users. Approximately 48 to 76 percent of high electricity users and 8 to 18 percent of low electricity users would save more from switching to E-ELEC with their switch to HPWHs. If these customers remained on their existing tariffs post-electrification, they would experience either bill increases or less bill savings. Thus, for maximized bill benefits, it is key that households switch to the appropriate rate and discount program if eligible. For further discussion, please see Appendix A.

Future Rates

Relative savings from switching from a NOx-emitting natural gas appliance to a HPWH are dependent on two factors: electricity and natural gas prices. Forecasting conducted by the CEC shows that future gas rates will increase significantly, with recent models capped at 8% annual growth in future gas rates,[40] and

[39] CARE is a monthly discount of 20% or more on gas and electricity, which participants can qualify for by meeting income guidelines or enrolling in public assistance programs (e.g. SNAP, CalFresh). https://www.pge.com/en/account/rate-plans/find-your-best-rate-plan/electric-home.html

[40] https://www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/2025-building-energy-efficiency see 2025 Energy Code Accounting Report

with some households having monthly bills as high as $600 by 2050.[41] However, given large increases in PG&E electricity rates in 2024[42] due to undergrounding lines, wildfire safety and resiliency, future electricity price increases may pose a risk to the operational cost savings of electric appliances.

2. UPFRONT COSTS

Average Incremental Costs

The Air District commissioned a study through Rincon to analyze upfront purchase and installation costs for Bay Area HPWHs using incentive data from multiple programs and administrators across the region that was unavailable prior to 2023. Data points for HPWH projects were over four thousand. However, data to calculate upfront costs for new, NOx-emitting natural gas water heating projects were far fewer. Given that some of the data for NOx-emitting natural gas water heaters lacked detail, with one dataset including tanked as well as tankless, and a smaller dataset involving only tanked storage, the study assumed two average upfront costs ($5,231 and $3,575). Thus, the incremental cost to install a zero NOx HPWH instead of a NOx-emitting gas water heater is estimated to fall between $1,840 and $3,496, on average, as shown further in Table 1 below.

Table 3: Small Water Heaters Upfront and Incremental Costs Summary

NOx-emitting Type	End User	NOx-emitting Average Upfront Cost	Zero NOx Average Upfront Cost	Incremental Cost
Tanked + Tankless (N=450)	Single-family	$5,231	$7,071	$1,840
Tanked (N=37)	Single-family	$3,575	$7,071	$3,496
N/A	Multi-family	N/A	$8,939	N/A

Source: Appendix A

For MF projects, data for new HPWH retrofit projects were limited (n=54) with upfront costs averaging $8,939 per project; however, it is likely that SF program data includes in-unit MF projects. For "business as usual" comparisons for costs of NOx-emitting water heaters, datasets were unavailable for MF thus incremental cost for MF is not calculated.

The project costs in Table 1 are from incentive programs, and reflect high quality and permitted installations. Given the datasets were collected in late 2023 and are from past program installations, they are likely skewed to historically available 240-volt HPWHs; however, 120-volt HPWHs are a newer technology which are simpler to install and discussed in further detail later in this report. It was difficult to parse out additional project costs such as insulation or panel upgrades as those costs are not reported separately in each program's datasets.

Given that HPWHs are much more efficient than other Zero NOx water heating technologies, the working assumption is that HPWHs will make up the dominant compliant technology for most cases. However,

[41] https://www.energy.ca.gov/sites/default/files/2021-06/CEC-500-2019-055-F.pdf

[42] https://www.pge.com/assets/pge/docs/account/rate-plans/electric-rate-advisory-2024.01.pdf

the study does also discuss retail costs for electric resistance tankless on-demand models. For further details see Appendix B.

D. ONGOING STRATEGIES AND PATH FORWARD

3. OPTIONS TO SUPPORT UPFRONT COSTS: INCENTIVES AND FINANCING

Incentives

Current and upcoming HPWH and panel upgrade incentives are offered from multiple sources, including federal (Home Efficiency Rebates (HOMES), Home Electrification and Appliance Rebates (HEEHRA)), state (TECH Clean CA and the CEC's Equitable Building Decarbonization program), regional (BayREN), PG&E, as well as local (municipal and CCA) sources. Note that federal incentives may be at risk with a new administration in 2025. For HPWHs at the time of writing this report, these incentives range from $500 up to $2,000 each and may be combined. Incentive levels for some programs will vary depending upon income level with low- and moderate-income (LMI) households eligible for increased funds compared to market-rate households. Overall, existing incentives can close the incremental cost gap, and for some LMI households, provide cost savings in comparison with the purchase and installation of a NOx-emitting water heating appliance.

For further detail, please see Table 27 of Appendix B. Note that this is a snapshot in time, and that some program budgets can become fully allocated quickly.

IWG members discussed not only incentive programs, but also the relative accessibility of those programs, especially for lower income households. Given that many incentives are "braidable" or "stackable" (i.e. are eligible to be utilized with other incentives), IWG members expressed concerns regarding the capacity of residents to efficiently navigate the complex incentive landscape. Currently, residents can find information about applicable incentives for their zip code and income level at The Switch Is On.[43] Additional ways to provide incentive application support or technical assistance are also currently being tested. For example, SVCE is currently implementing two pilot programs, one for "concierge services" that offer telephone support technical assistance for building owners,[44] and one through 'Rock Rabbit,' an AI-powered mobile app that aims to simplify access to incentives and rebates.[45] Additionally, many incentive programs geared towards equity customers are "direct install" programs where the contractor handles the incentive application for the customer.

The Air District expects an annual turnover of water heaters of around 7 to 8 percent of the installed base of equipment at the time implementation of Rule 9-6 starts in 2027. This timeline suggests that financial incentives to offset the incremental costs of HPWHs will be needed for many years, especially for low-income households. Given the uncertainty of predicting future program budgets and incentive levels, including programs funded by the IRA with the new administration, there is a need for innovative, long-term sources of funding.

Though not a funding source or program like incentives and rebates, one example of new alternative ways to pay for heat pumps could result from SB 1221 Gas Planning Bill[46], which passed in September

[43] https://incentives.switchison.org/

[44] https://goelectric.svcleanenergy.org/

[45] https://svcleanenergy.org/wp-content/uploads/2024-0508-SVCE-May-BOD-Agenda-Packet-scrubbed.pdf

[46] https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=202320240SB1221

2024. The bill will establish a public process for review of planned gas infrastructure investments and allow utilities to divert those investments to pursue cost-effective pilots of zero emission alternatives or neighborhood-scale electrification. Project participants would receive zero cost full electrification in exchange for decommissioning natural gas service in their neighborhood. PG&E would begin with 30 pilot projects across its service territory and would need to sunset pilots by the end of 2029. Given that aging gas infrastructure across the state could cost ratepayers up to $20 billion over the next decade[47], long-term wider adoption of SB 1221 strategies could prove significant in helping some homeowners reduce the cost of zero NOx appliances.

Green Financing

Many households could also defray upfront costs and lack of upfront cash available for zero NOx water heaters through financing. Current program financing, beyond conventional loan options such as equity line of credit, are now available and tailored to green building upgrades including HPWHs [48]; see Table 2. New green financing programs will also be forthcoming, as discussed below.

Table 4: Residential Financing Programs for Energy Efficiency, Electrification, and Rooftop Solar

Program Name	Geographic Availability	Source	Notes
GoGreen	IOU (PG&E) service territory	CA State Treasurers Office, Investor Owned Utilities, Credit unions	Must use a GoGreen or TECH Clean CA participating contractor
Property Assessed Clean Energy (PACE)	Participating communities	Renew Financial; PACE Funding Group; FortiFi Financial; and Ygrene Energy Fund California.[49]	For homeowners only. Qualification is primarily based on the home's equity, not borrower credit score; loan is attached to the lien of the house.
Energy Smart Homes	Nationwide	National Energy Improvement Fund	Must use a NEIF-approved contractor and apply via their application link for an instant credit decision
GreenChoice	Nationwide	Freddie Mac	Can fund emergency replacements. Ask your local lender.

In August 2024, SVCE's Board of Directors approved a 200-household pilot for equitable electrification financing. The program will remove the upfront cost barrier of appliances including HPWHs by providing 0% interest loans that are repaid over about a decade on the utility bill, through gas and electric

[47] https://www.ethree.com/wp-content/uploads/2024/06/Gas-Decommissioning-Fact-Sheet-2024-06-18.pdf

[48] https://switchison.org/financing-options/

https://guide.freddiemac.com/app/guide/content/a_id/1003471

[49] Only the four organizations listed are licensed as program administrators under the California Financing Law: https://dfpi.ca.gov/pace-program-administrators/

savings.[50] Similar to Tariffed On-Bill Financing (TOBF) or utility inclusive investment (IUI), the pilot will require that savings must exceed cost recovery charges (thus is not a blanket solution for all HPWH installations in the Bay Area) and will not be means-tested (will not require minimum credit scores or income levels), among other stipulations. Unlike TOBF and IUI, the pilot program loans will *not* be tied to the utility account, disallowing customers if they relocate to automatically pass along the financing to the next occupant of the home. In this scenario, the original property owner would be required to pay off the loan.

The CPUC is also working through proceeding R2008022 [51] to consider TOBF/IUI for all investor-owned utilities in the state including PG&E. At this time, it is unclear whether a PG&E program would be available by the January 2027 implementation of Rule 9-6.

In April 2024, the US EPA announced Greenhouse Gas Reduction Fund winners for the development of new financing programs. The National Clean Investment fund awarded $14 billion to three awardees, with a minimum 40% commitment towards low-income disadvantaged communities (LIDAC).[52] The Clean Communities Investment Accelerator has also awarded $6 billion to five awardees, with 100% of the funds to be LIDAC focused.[53] Financing programs resulting from these IRA/EPA funds are expected to become available for borrowers and end-users within the next year. Contracts have already been executed and funds have begun disbursement, thus there is relatively low likelihood of funding claw-back, given other priorities under the new Administration which would be easier to implement.

[50] https://svcleanenergy.org/news/groundbreaking-clean-energy-financing-program-will-help-californians-electrify/

[51] ttps://apps.cpuc.ca.gov/apex/f?p=401:56:0::NO:RP,57,RIR:P5_PROCEEDING_SELECT:R2008022

[52] https://www.epa.gov/greenhouse-gas-reduction-fund/national-clean-investment-fund

[53] https://www.epa.gov/greenhouse-gas-reduction-fund/clean-communities-investment-accelerator

VII. PERMITTING

As with general water heater and furnace replacement projects, installation of zero NOx appliances require permits to ensure equipment is installed to meet basic health and safety standards. Additionally, permits are typically required to receive financial rebates and other incentives.

Implementation of the building appliance rules introduces new technical considerations for both the permit applicant and the permitting agency. First and foremost, installers will need to understand the key differences between NOx-emitting and zero NOx technologies, which generally involves switching from natural gas appliances to those that run on electricity. This shift impacts what types of permits are typically required, contractor licensing requirements, and local building departments' responsibilities regarding reviewing permit applications and performing inspections.

E. WHAT WE LEARNED

To gain a better understanding of these issues, the Air District commissioned Rincon to evaluate how changes in permitting requirements for zero NOx appliances could affect installation timelines and costs in the Bay Area. As previously noted, the only zero NOx appliance water heating options currently available on the market are electric (e.g. heat pumps, electric resistance storage, and electric on-demand tankless). For this research, Rincon focused on HPWHs as they are the most cost-effective and energy efficient option. Rincon began by conducting a comprehensive review of current permitting processes in the Bay Area, then interviewed building department staff from a range of local jurisdictions, distributed an online survey to relevant stakeholders, and finally hosted virtual interviews with staff from four other Bay Area cities. Table 5 below summarizes the key challenges, potential solutions, related findings and information collected from the surveys and interviews[54].

Table 5: Summary of Consultant Findings Regarding Permitting Issues

Challenge	Survey Results	Solutions
1. Lengthy permit application and approval processes: long lead times result in increased costs and inconvenience for homeowners.	• Turnaround time for issuance of electric water and space heating appliance permits takes less than 3 days in most jurisdictions.	• Offer online and/or same day permit issuance to reduce costs for applicants, create efficiencies for building departments, and increase code compliance. • Provide information sheets that spell out code requirements which can increase the quality of installations and building department efficiency.

[54] Four interviews were conducted with staff from the City of San José, City of Santa Rosa, City of Livermore, and City and County of San Francisco. Staff from nine cities and two counties responded to the survey.

2. Number and type of permits: zero NOx water heaters involve both electrical and plumbing work to install.	• Most cities surveyed have a single permit for heat pump water heaters.	• Allow for a single “multi-trade permit” (electrical, plumbing, mechanical and/or building) to reduce the permit issuance timeline. • Develop a reduced flat rate fee for the ‘multi-trade permit.’ • Allow trades to do "ancillary" work outside their designation, e.g. plumbers can do small electrical work when related to their project (or subcontract out).
3. Plan submittals: requiring overly complex and extraneous information adds time to the process, even more when the installation does not match plan submittals.	• Five cities require plans for space conditioning equipment, while six cities do not.	• Consider waiving plan submittal requirements for simple zero NOx water heater replacements and rely on field inspections to verify code compliance. • If requiring plan submittals, create and provide guidance for applicants to develop and submit simplified plans or drawings.
4. Inspections: requiring multiple inspections is inefficient and results in increased time and costs for the city, contractor, and homeowner.	• Two jurisdictions currently allow virtual inspections while nine do not, indicating there is opportunity to scale this practice up in more communities.	• Allow for virtual inspections. • Allow for one multi-trade inspection to reduce costs and decrease timeline.
5. Potential noise impacts from certain zero NOx installations.	• Survey for water heater permitting – seven districts with no issues. For space heating, nine responses of it being not an issue.	• Develop sound-level thresholds and guidelines and checklists (e.g. preferred locations for outdoor equipment) that address and mitigate potential sound issues.

Interviews generated several additional recommendations for permit process streamlining, such as:

- Conduct outreach and education for the public to increase public awareness and understanding.
- Create and distribute guides on the differences between NOx-emitting and zero NOx appliances, and their respective impacts on the permit submittal and approval process.
- Waive or reduce permit fees for applicants switching from NOx-emitting to zero NOx appliances.
- Institute automatic (online, same day) permitting systems.

F. PILOTS AND FINDINGS FROM OTHER RESEARCH

As part of their research on permitting challenges and opportunities, Rincon also identified several independent efforts related to increasing engagement with, and understanding among, building and permitting departments regarding the rules.

- BayREN and TECH Clean California Permitting Pilot
    - The TECH Clean California program is working with BayREN to support building departments by creating awareness and providing resources to overcome hurdles in creating one-day permit approvals for HPWHs. Goals of the pilot program include the following:
        - Identifying ways to simplify the permitting process for heat pump projects.
        - Developing a model single-day permit for HPWH conversions that can be adopted by jurisdictions statewide.
        - Training building departments on heat pump best practices to improve their familiarity and comfort with this technology.
- San Mateo County – Heat Pump Water Heater Permit Requirements and Costs
    - County staff surveyed building department staff from 18 jurisdictions about permit and document requirements, fees, insurance and inspection timelines, online permit processing, and electrical panel upsizing related to installing zero NOx appliances. Findings indicate significant variations in local documentation requirements, timing, permit sign-off, and fees, and that more harmonization among the approaches could bring significant efficiencies to the process.
- SVCE – Permit Modernization Phase 2: Baseline Assessment and Recommendations
    - The SVCE study focuses on identifying opportunities and barriers in the permitting processes related to electrification technology and is intended to inform efforts to streamline permit processes for SVCE member jurisdictions, with the overall goal of providing agency-specific recommendations to make permit processes easier and more cost-effective for member agencies. Key findings generally point to situations that increase permit staff time, such as when a specific permit type fails initial inspection due to discrepancies between the submitted plans and the installed conditions, or when multiple permits are required. Staff resource constraints are the main barrier to instituting improvements that could simplify the process. Offering multi-trade permits and simplifying or waiving plan submittal requirements would reduce these challenges.

VIII. WORKFORCE AVAILABILITY AND READINESS

Given the relatively low sales and saturation levels of HPWHs and other Zero NOx water heating in California compared to NOx emitting water heaters, there has been public concern on the numbers of contractors who are familiar with these technologies. The Air District received past comment and anecdotes on difficulty of finding available contractors who could install zero NOx water heaters within a timely manner, and heard concern about potential difficulty for future broad-scale installer availability and readiness in time for Rule 9-6 compliance.

G. WHAT WE LEARNED

IWG discussion amongst participating contractors largely concluded that there are Bay Area contractors able to perform the installations as well as local training resources, and that contractors currently unfamiliar with zero NOx water heating technologies would be motivated to pursue training and hiring based on market demand.

To gain a detailed understanding of workforce availability and readiness issues across the Bay Area, the Air District commissioned BW Research to analyze relevant workforce numbers and conduct surveys and interviews with contractors and other workforce stakeholders during the first quarter of 2024. The research developed a snapshot of contractor availability and thoughts on hiring; local training resources; contractor familiarity with heat pump technologies, incentives and the upcoming rules; and recommendations. For further information, the full memo is available in Appendix F. *Workforce Challenges for Zero-NOx Requirements.*

1. WORKFORCE NUMBERS IN THE BAY AREA

Based on Bureau of Labor Statistics numbers, employment of Electricians and Plumbers, Pipefitters, and Steamfitters totals over 30,500 in the Bay Area with further detail shown in Table 6 below. [55]

Table 6: Key Occupations and Employment Numbers in the Bay Area

Occupation	Total Employment	Location Quotient	Number of Establishments
Electricians	19,632	0.98	2,090
Plumbers, Pipefitters, and Steamfitters	10,887	0.86	2,180
Heating, Air Conditioning, and Refrigeration Mechanics and Installers	9,339	0.87	

Source: Appendix F

To put these numbers into context, the Location Quotient is the concentration of employment in the Bay Area relative to national averages. The closer the Location Quotient is to 1, the closer the workforce is to

[55] Note that California licensed HVAC/R contractors are included because they are allowed to install HPWHs. See: https://www.cslb.ca.gov/Resources/GuidesAndPublications/2023/Fast_Facts_for_Heat_Pump_Water_Heaters_and_HVAC_Heat_Pumps.pdf. Though some HVAC/R contractors surveyed mentioned lack of comfort with the technology, pointing to opportunities for training as discussed further in the BW Research memo.

national averages. The Location Quotient range of 0.86-0.98 demonstrates that the relevant workforce in the Bay Area is comparative to national levels.

To further understand contractor availability, the survey asked contractors about customer wait times when there is an emergency failure. Responses showed the majority of contractors are available to service emergency failures within a couple days; 51% cited typical response times of two days or less, and 33% cited three days to 1 week.

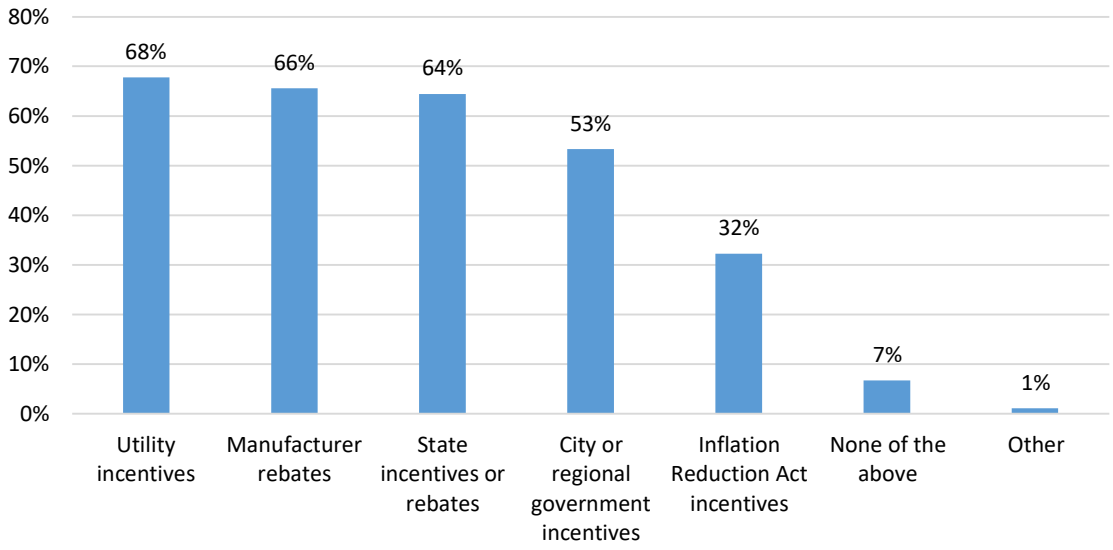
Furthermore, the survey showed that many contractors (between 44% and 61%) plan to hire more employees by 2027, the first compliance date for Rule 9-6. From the contractor firms planning to grow, the average growth rate was 23% for plumbers, 15% for electricians and 14% for HVAC/R[56] technicians.

More questions and discussion of contractor firm thoughts on hiring, including hiring challenges, is in the full research in Appendix F.

2. CONTRACTOR AWARENESS OF BUILDING APPLIANCE RULES, INCENTIVES AND TECHNOLOGIES

Two-thirds (68%) of contractors surveyed were already aware of upcoming Air District requirements under Rule 9-6 for natural gas-fired water heaters to emit zero NOx after the rule compliance dates based on manufacturing date. Two-thirds of contractors were also familiar with at least one incentive category as shown in Figure 6 below.

Figure 4: Familiarity of Incentives Among Surveyed Firms



Source: Appendix F

However, only approximately half (46%) of surveyed contractors participate in incentive programs due to lack of time (40%), financial viability (13%), or eligibility and qualifications (7%). This largely echoes many of the contractor challenges highlighted during IWG discussion, and in particular that many residential

[56] HVAC/R stands for heating, ventilation, air conditioning and refrigeration and generally refers to the mechanical systems used in the heating, cooling and ventilation of indoor environments. The people who service them are called HVAC/R technicians; the trade involves installing, maintaining and repairing climate-control devices such as air conditioners, furnaces, refrigerators and freezer units.

contractors are small businesses and thus face constraints, such as administrative resources, cash flow financing for rebate programs, and the cost of lost wages when attending training. Survey responses do point to potential for further outreach and increased participation from contractors; 24% of surveyed firms not already participating in incentive programs responded that they are just not familiar with these programs and 9% felt unclear about the program application requirements.

While approximately half (46%) of surveyed contractors did not feel additional heat pump training was necessary, 29% said they planned to provide staff additional heat pump training. The remainder responded that they did not work with heat pump technologies (11%) or did not know/did not answer (14%).

H. ONGOING STRATEGIES AND PATH FORWARD

Further analyses on training including a Bay Area inventory of training resources, a discussion on supply of workers including key skills and certifications, as well as forecasted hiring is included in Appendix F.

Appendix F also includes recommendations to increase support of relevant training for new hires and experienced contractors; improve instructor pay and access to training and apprenticeships; improve connections between training providers and employers; and more. IWG discussion of and feedback on those recommendations included the following themes:

Outreach to contractors:

- Engage through current training and other events provided by labor unions and distribution centers
- Focus on small, independent contractors; utilize trade associations for this purpose
- Recommend and uplift several existing HPWH training programs
- Use multi-media approaches

Discussion and caveats on workforce recommendations:

- Education and training – residential sector does not reward training
- Need for compensation for instructors and participants/contractors
- Small business constraints
- Gaps between workforce and employers

Though many of the recommendations fall outside of the Air District's purview, the Air District plans to provide increased outreach and engagement with contractors through partnerships with stakeholders such as CCAs, incentive program providers, and local government permitting offices. The goal will be to achieve 100 percent awareness of the rules by implementation dates, and uplift accessible training[57], incentive programs and subsidies that cover training time[58].

[57] https://www.switchison.org/techcleanca/training
https://pge.docebosaas.com/learn
https://aea.us.org/electrification-knowledge-hub/

[58] https://mcecleanenergy.org/grow-your-business-expertise/
https://svcleanenergy.org/futurefit-fundamentals/

IX. GRID AND RELIABILITY IMPACTS

As buildings across the Bay Area switch from gas to electric appliances for space and water heating, the demand for electricity is expected to increase. This section summarizes research conducted into how the zero-NOx requirements are expected to impacts reliability of the electric grid as it manages higher demands. This includes information related to the operational reliability of gas versus electric appliances during power outages. Detailed findings related to these topics can be found in Appendix E. *Grid Related Impacts on the Implementation of Rules 9-4 and 9-6.*

I. WHAT WE LEARNED

1. New Electric Loads from Zero NOx Appliances and Grid Reliability

A key issue raised by stakeholder during the rulemaking process for the zero NOx requirements was the potential for additional power outages due to building electrification. There is little evidence that increased levels of building electrification would lead to additional outages. It is very rare for power outages to be caused by a shortfall of electricity generation due to high loads, and utilities and system operators are planning for increased electricity demand that will result from state legislation and policies regarding building and vehicle electrification.

More common types of power outages, like those caused by equipment damage or when there are public safety power shutoffs (PSPS) to reduce wildfire risks, have little correlation to electricity demands on the system at the time of the outage. Increased levels of electrification would not impact the frequency of these types of outages and reporting from the CPUC indicates the number of PG&E customers impacted by PSPS events peaked in 2019 and has significantly decreased in the following years.[59]

Although PG&E has moved away from issuing PSPS events, the frequency of overall outages has increased in recent years in PG&E's service territory as they issue more frequent, shorter outages that are targeted at as few customers as possible. PG&E plans to continue to make significant investments in hardening its system to improve reliability and reduce outages. In addition, PG&E has been exploring new approaches to reduce the impact of outages during times of high wildfire risk, which may significantly reduce the duration of outages. Further information on outages and the expectation that outages should decrease in length in the coming years can be found in Appendix E.

Additional information related to grid impacts and the evaluation of the additional load added to the grid by the zero NOx requirements can be found in Appendix D to the Staff Report associated with the rule amendments, *Electric Infrastructure Impacts from Proposed Zero NOx Standards*.[60]

2. Zero NOx Appliances and Resilience

While some older models of NOx-emitting tanked gas water heaters that have a continuously burning pilot light will continue to operate during an electrical power outage, most modern gas water heaters will not function without electric power. Most new gas furnaces and heating and cooling systems require electricity for the fan and air circulation, while most new natural gas-fired tanked water heaters require electricity for the pilot light. Accordingly, most natural gas-consuming devices will also have reliability

[59] CPUC Public PSPS Dashboard (arcgis.com). Accessed October 2024.

[60] Electric Infrastructure Impacts from Proposed Zero NOx Standards (baaqmd.gov). November 2022

challenges in electrical power outages. Tanked water heaters, including HPWHs, can stay hot for several hours during an electrical outage, especially when installed with a cold water mixing valve. Since HPWHs can provide thermal storage, the technology is increasingly being used for demand response, helping to improve grid reliability. Battery storage and bidirectional electric vehicle charging can be solutions to appliance resiliency challenges.

X. MARKET READINESS AND SALES TRENDS

In California, most homes currently rely on gas appliances that emit NOx for heating and cooling. Although the upcoming zero NOx requirements are technology neutral, the most cost-effective compliant technology currently available for most consumers will likely be electric heat pump water heaters (HPWHs) and heat pump space heaters (HP HVAC). For the purposes of this report, the focus will be on HPWHs, which are subject to a January 1st, 2027 compliance date.

According to the latest Census data (2022), the nine counties in the Bay Area contain 2.96 million housing units. The Air District estimates a 13-year lifespan for small water heating appliances regulated under Rule 9-6. As the millions of NOx-emitting gas water heaters in Bay Area homes reach the end of their lifespan, regulatory changes under Rule 9-6 will drive their replacement with zero NOx-emitting water heaters. Current estimates from a 2022 study[61] by the CPUC project the annual demand for HPWHs to be approximately 202,000 units per year in the Bay Area, with a total of 141,000 units installed nationally.[62]

In this section, we will discuss current and projected market trends for zero NOx appliances that meet Rule 9-6 requirements and how these trends may impact rule compliance. A key issue raised by stakeholders during the rulemaking and IWG process was whether the market, including manufacturers, distributors, and contractors, could meet the rising sales trends and increased demand for HPWHs. Additionally, these manufacturers, distributors, and contractors emphasized the importance of streamlining the new requirements across the state to ensure consistency and facilitate a smoother transition to this evolving market.

J. WHAT WE LEARNED

In order to evaluate the current state of the HPWH market the Air District commissioned a study by Rincon Consultants, Inc. (Rincon) to assess current and projected market trends and sales data and to conduct contractor and distributor interviews.

3. ZERO NOX WATER HEATERS IN THE U.S.: A FOCUS ON HEAT PUMPS

Sales of HPWHs in the U.S. grew by 35% in 2023, the largest increase in units (50,000) based on historical data. Although HPWHs have a market share of less than 3%, Energy Star data shows consistent growth in HPWH shipments over the past 12 years, with figures that may now represent “hockey stick” growth (see Figure 7).[63]

The federal Inflation Reduction Act (IRA), passed in 2022, aims to promote clean energy nationwide by investing in clean energy on a national scale, and includes tax incentives for renewable energy, energy-efficient appliances, and electric vehicles as well as funding for new manufacturing facilities for green technologies including heat pumps[64]. While the IRA began offering tax credits in 2023, its impact is only

[61] CPUC and Opinion Dynamics, 2022. *Califnoria Heat Pump Residential Market Characterization and Baseline Study.* https://www.calmac.org/publications/OD-CPUC-Heat-Pump-Market-Study-Report-5-17-2022.pdf

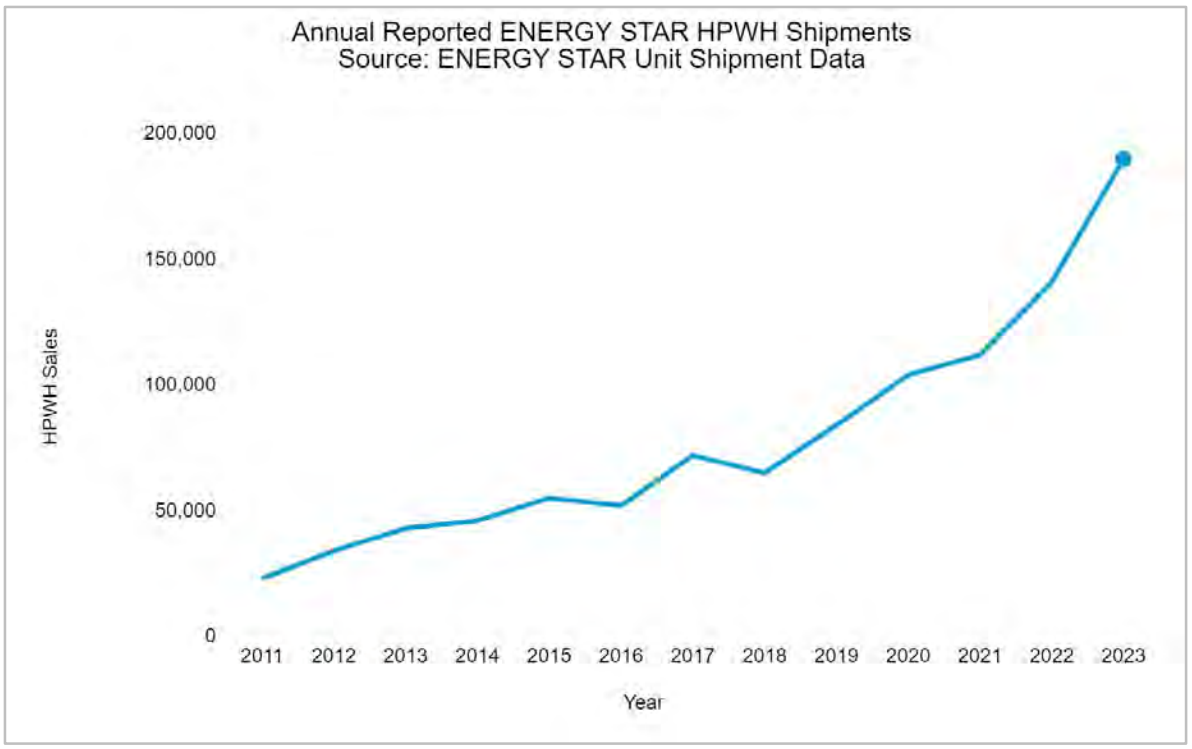
[62] Note that for multi-family housing in California, half of units utilize in-unit water heaters and the remaining half centralized systems.

[63] https://www.energystar.gov/partner_resources/products_partner_resources/brand-owner/unit-shipment-data

[64] https://www.energy.gov/mesc/enhanced-use-defense-production-act-1950

starting to be reflected in the 2023 data, and is expected to further drive national HPWH adoption. Given the November 2024 election results and a new administration, future scaling back of the IRA is a risk.

Figure 7: HPWH US Shipments from Energy Star Manufacturer from 2011-2023

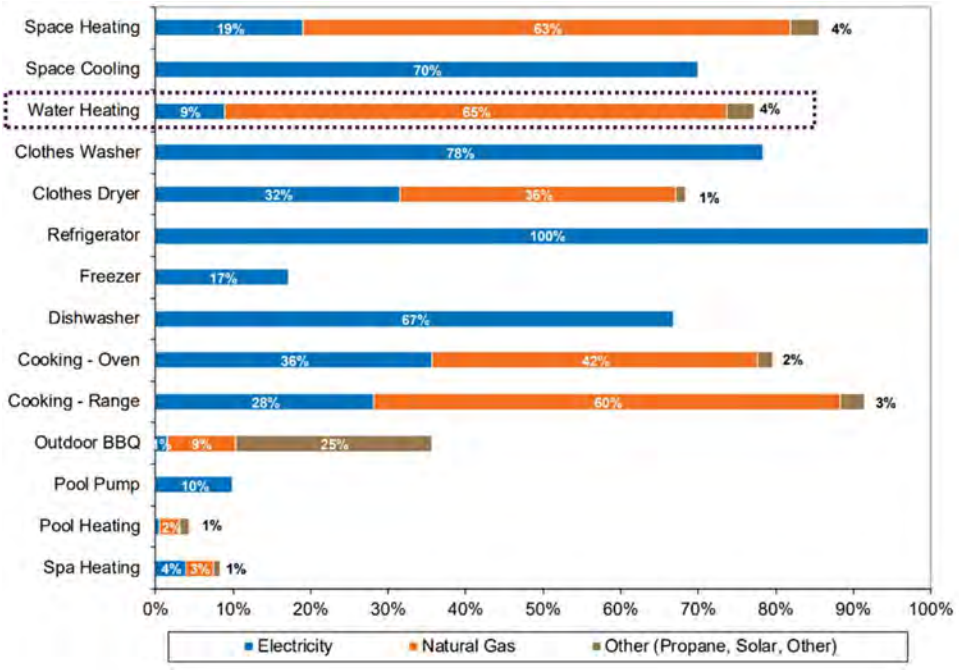


Source: Advanced Water Heating Initiative

4. ZERO NOX SALES TRENDS IN CALIFORNIA

The research conducted by Rincon found that from 2019 onwards, HPWH technologies have seen rapid growth in California with approximately 121,000 units installed. As illustrated in Figure 8 below, a 2019 survey by the California Energy Commission (CEC) indicated that 9% of all water heating in the state was provided by high-efficiency electric appliances. This figure includes both HPWHs and electric resistance units, as the report did not distinguish between the two. Despite this growth, desktop research by Rincon suggests that only 1% of all water heaters in use are HPWH.

Figure 8: CEC Survey Results of Statewide Energy Use for Each Appliance, Based on 2019 Data



Source: CEC. 2019 California Residential Appliance Saturation Survey (RASS)[65].

In recent years these numbers have increased, with the 2022 Census data reporting 146,000 electric water heating appliances (also including electric resistance units) and 2023 research and data by the CEC showing that HPWHs are present in 16% of newly constructed single-family homes.

The Rincon report indicates that California incentives and policies have contributed to the current rise in sales and will continue to contribute to the projected rapid policy-driven future sales growth.

5. AVAILABILITY OF ZERO NOX APPLIANCES IN THE BAY AREA

Rincon conducted outreach to appliance distributors and local contractors to gain additional insights into the current HPWH market. A total of 3 distributors and 11 contractors responded to survey questions. While the sample size is relatively small, it likely reflects broader trends across the Bay Area.

Overall, the distributors surveyed indicated that the timelines for acquiring HPWHs are comparable to those for gas appliances, and that they expect wait times to decrease further with rising HPWH demand. They also noted that wait times have remained stable despite changes in the market landscape and new policies and programs that support heat pump adoption. Additionally, the distributors emphasized that subsidies and incentives have been crucial in making HPWHs more cost competitive.

About 54% of the contractors that responded to the survey reported that they can obtain HPWH equipment in less than two days, as shown in Figure 9. Roughly 18% of contractors surveyed indicated they could source the equipment the same day if needed. Lastly, 55% of contractors surveyed indicated they have not experienced longer timelines than those for NOx emitting water heaters.

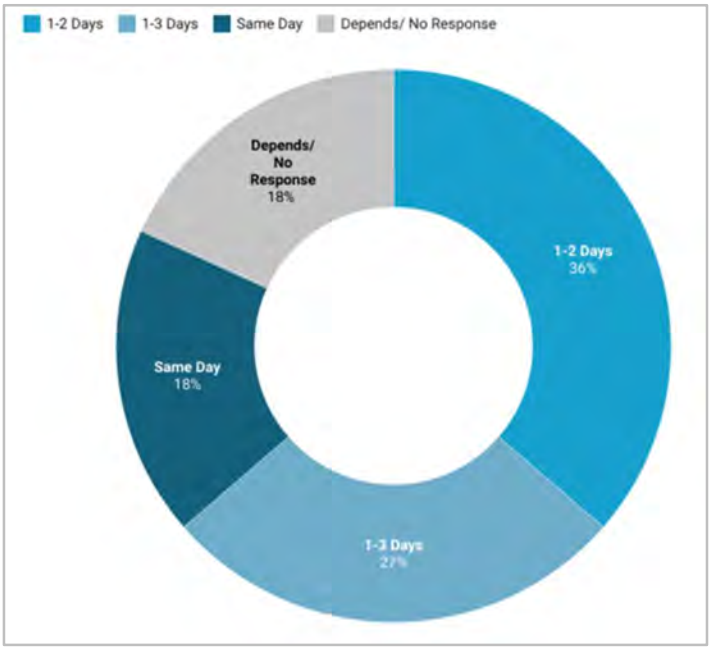
[65] https://www.energy.ca.gov/data-reports/surveys/2019-residential-appliance-saturation-study

Contractors also highlighted the following potential challenges related to this market shift to HPWHs:

- Addressing hurdles for smooth installation of equipment
- Ensuring consistency between manufacturer equipment rating and real-world use
- Ensuring workforce is properly trained and compensated
- Performing additional outreach to homeowners explaining HPWH technologies

A deeper discussion and review of workforce availability and readiness was covered at greater length in **Section VIII. Workforce Availability and Readiness** of this report.

Figure 9: Contractors Wait Times for HPWH Equipment in the Bay Area



Source: Appendix C

K. ONGOING STRATEGIES AND PATH FORWARD

California and the Bay Area have been at the forefront of paving the way for zero NOx building appliances, including HPWHs, through building appliance requirements, policy, and funding programs. National efforts have also accelerated this progress through various programs and subsidies to incentivize the shift. The advancements in policies and funding programs are highlighted below and explored in more detail in Appendix C. *Market and Sales Trends for Zero-NOx Appliances*.

- *TECH Clean California* – In 2018, SB 1477 established the Technology and Equipment for Clean Housing Program (TECH) Clean California program. This multi-year initiative helps drive down costs, incentivize adoption, and expand access to heat pumps. In 2023, in addition to ongoing project incentives and growing the trained contractor pool, TECH also focused on pilots for making installations faster and simpler; layering compatible programs for wrap-around services; solutions for renters; addressing key challenges in multifamily properties; and models for reaching underserved communities. Lastly, TECH shares its program and pilots insights via its website - TECHCleanCA.com - to further inform market development and policymaking.

- *CA's 6 Million by 2030 Heat Pump Goal and CA Heat Pump Partnership* – The California Heat Pump Partnership[66] launched in May of this year[67] to align state and industry leaders to meet California's 6 million heat pump goal. The State's energy agencies and Governor's Office are working with manufacturers, retailers, distributors, utilities, and other market stakeholders to address key barriers and rapidly scale the heat pump market. The group plans to release a Blueprint with near-term priority strategies and launch a marketing campaign in 2025.
- *CARB Zero-Emissions Space and Water Heaters by 2030* – CARB is working on a proposal to require zero-emissions space and water heating appliances in all new construction and existing building replacements by 2030. This proposal is still under consideration and is anticipated to go to the CARB Board of Directors for adoption in 2025.
- *SCAQMD Zero-NOx Rulemaking Efforts* – SCAQMD is undergoing a rule amendment effort to adopt zero-NOx standards for residential and commercial building appliances. SCAQMD's Governing Board has recently approved the funding of a pilot incentive program called "Go Zero" with 21 million dollars to provide rebates, provide installer training, and perform outreach.[68] The program was funded from an existing SCAQMD fund intended to address excess emissions from gas-fired furnaces. The Air District does not have a similar source of funding.
- *Federal Department of Energy (DOE) Appliance Efficiency Standards* – This standard passed in 2024 aimed at electric resistance water heaters over 35 gallons, will lead to over 50% of new electric tanked water heaters nationally using heat pump technology starting in 2029, pushing manufacturers to focus further on HPWHs.[69]
- *Inflation Reduction Act of 2022* – Provides tax credits and rebates for heat pump retrofits, with $528 million allocated to California for a 10-year rebate program, covering a limited number of installations, while additional uncapped tax credits are also available.
- *Defense Production Act of 2023* – $169 million allocated to boost heat pump manufacturing at 15 sites, leveraging the Defense Production Act to enhance domestic energy technology production.

Prior to the adoption of recent policy drivers, HPWH technologies were already experiencing considerable growth as natural gas usage began to decline. This trend has been accelerated by a combination of incentives, workforce development, and forthcoming regulations at the regional and state levels.

As shown in Figure 10 below, without policy interventions, the projected growth of HPWH market share would have remained modest, with only single-digit annual increases (based on country-wide 2021 consumer patterns). However, the introduction of building electrification for new construction and efficiency and performance standards starting around 2023 initiates a shift in the market dynamics. These policies are expected to steadily increase HPWH adoption, primarily by replacing existing natural gas and electric resistance water heaters.

By 2027, the graph shows a significant upward shift, corresponding to the implementation of more stringent building performance standards and appliance emissions standards. These standards drive a

[66] 6M Heat Pumps by 2030 (heatpumppartnership.org)

[67] California Heat Pump Partnership Aims to Scale Up Electrification of HVAC | ACHR News

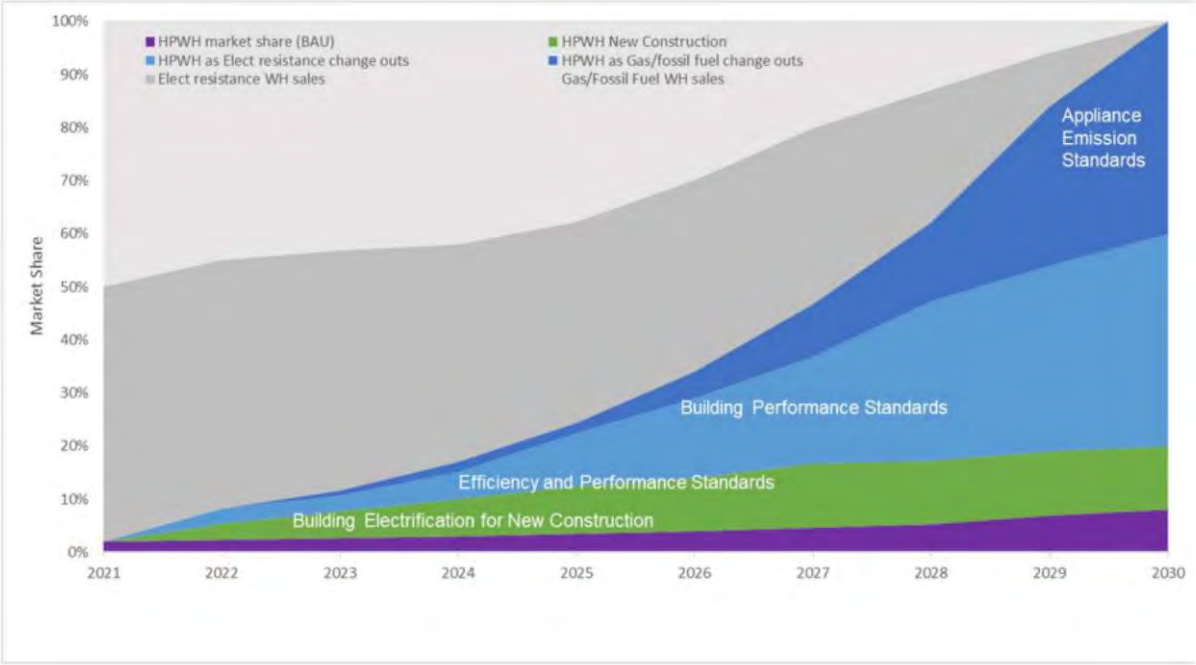
[68] https://www.aqmd.gov/home/rules-compliance/residential-and-commercial-building-appliances; funding for "Go Zero" is from SCAQMD Rule 1111 Air Quality Investment Fund.

[69] https://www.energy.gov/articles/doe-finalizes-efficiency-standards-water-heaters-save-americans-over-7-billion-household

marked increase in HPWH adoption, particularly in new construction and as replacements for fossil fuel-based water heating systems. By 2030, HPWH market share is expected to rise sharply, occupying a substantial portion of the water heater market as the transition towards zero NOx technologies accelerates in response to regulatory changes.

The clear delineation of market growth between policy-driven scenarios (indicated in blue and green) versus business- as-usual (shown in gray) demonstrates the profound impact that regulatory interventions will have on shifting the market towards cleaner, zero-emission technologies. This graph highlights the critical role of policy in achieving large-scale reductions in NOx emissions by promoting widespread adoption of HPWHs in both residential and commercial sectors.

Figure 10: Projected HPWH Sales in Relation to Policy Interventions (New Buildings Institute)



Source: Appendix C

XI. CONCLUSION AND NEXT STEPS 2025-2026

A. AIR DISTRICT OUTREACH AND COMMUNICATIONS

The Air District will be implementing an advertising, communications and outreach campaign to inform residents, contractors and installers, local governments and building departments, as well as other relevant stakeholders about the January 2027 Rule 9-6 implementation. The Air District expects to kick off the campaign by Q3 2025 and fully roll out advertising by Q1 2026. The Air District will also be partnering with key organizations such as community-based organizations in DACs, incentive administrators, CCAs, and the Switch Is On to ensure that information on upcoming compliance is widely disseminated and shared.

Staff anticipate that the communication effort and related resources required to effectively implement the zero NOx requirements of the building appliance rules will be significant. The Air District will be seeking to hire a third-party contractor to assist in delivering the communication campaign as well as dedicating significant staff time to this effort, with the possibility of seeking approval for additional staff to be hired. At this time, Staff estimates that the communication effort will require at least $500,000 on an annual basis from 2026 to 2033 for contracting and advertising as well as two additional full-time employees.

B. COMPLIANCE AND ENFORCEMENT

The Air District will develop a compliance assistance plan to promote awareness and understanding of the requirements of this rule. We will develop compliance and education materials, an outreach plan, and we will start working with manufacturers to process submittals and develop lists of compliant water heater models meeting the zero NOx standards in Q4 2025. The Air District will work with distributors and retailers starting in Q2 2026 to ensure that only eligible zero NOx water heating appliances manufactured after January 1, 2027 are sold within the Bay Area. Air District staff will develop an enforcement program focused on distribution centers and retailers, which needs to be efficient and aligned with the Air District's 2024-2029 Strategic Plan.

The Air District has received questions regarding whether local governments can permit appliances that do not comply with the rules. While local governments are not legally required nor obligated to enforce the Air District building appliance rules, they may *choose* to withhold permits until installations comply with all applicable regulations, including appliance emissions standards. Starting in 2027, if local governments come across permit applications or installations that are non-compliant with the rules, their staff can e-mail the Air District <compliance@baaqmd.gov> and include the following information:

- Installer name
- Contractor license number
- Contact information
- City of installation
- Either
    - Information on non-compliant appliance —Make, Model, Serial #, Build Date, gallon capacity OR
    - Photos of equipment nameplate and location

C. UPCOMING RULE CHANGES

Staff plans to make administrative changes to the building appliance rules in 2025.

In December of 2023, CARB submitted the building appliance rules (Rules 9-4 and 9-6) to the EPA for inclusion in the State Implementation Plan (SIP). This action was approved by the Air District Board of Directors in June of 2023 as Staff saw a need for emission reductions expected from the building appliance rules to be included in the Bay Area's plan for reducing particulate matter concentrations below the revised EPA standard. EPA has reviewed the submitted rules and identified areas that need to be updated to align with existing rules in the SIP and their requirements for enforcement. Staff believe these changes are administrative and do not materially impact the implementation of or compliance with the building appliance rules. While these changes are only administrative, they will require Staff to undertake a full rulemaking process including public noticing and public comment. Staff anticipate that this process will begin by mid-2025.

Throughout the IWG process, other potential changes to the building appliance rules have been identified. Any additional changes would be reviewed and analyzed through a formal rulemaking process. Staff intend for this process to be separate from the administrative rule change described above but started on a parallel time frame. Any non-administrative changes may require re-calculation of emissions estimates and revised analyses including socio-economic impacts and impacts under the California Environmental Quality Act. Staff plan to communicate any intended changes as soon as possible and provide information to stakeholders so they have time to plan accordingly. Potential changes that could be evaluated in this process include:

- Alignment with the California Department of Housing and Community Development on the definition of manufactured and mobile homes.
- Alignment with other jurisdictions that are developing similar rules such as the SCAQMD and CARB to facilitate streamlined compliance
- Considerations for challenging installation cases such as modifications that require construction or additional electric service.

Staff will discuss the process for potential modifications to the building appliance rules at the Air District Board of Directors meeting on December 4, 2024 following the presentation of the findings presented in this report as well at subsequent public meetings in 2025 as necessary.

D. SUMMARY OF RECOMMENDATIONS FOR THE AIR DISTRICT

As mentioned throughout this report, there are opportunities to support more equitable and smoother implementation of Rule 9-6 for water heaters less than 75,000 BTU/hr. The summarized list of those recommendations are:

- **Challenging Installations and Emerging Solutions**
  Minimize electric work needed and panel upsizing:
    - Air District Staff should continue to monitor the development of new HPWH and other zero NOx water heating technologies.
    - Air District will highlight educational resources encouraging panel optimization (where applicable) in its outreach and education.

  Assist households with utility service upsizing:

  - Air District Staff will continue to monitor future phases of the Energization proceeding (R.24-01-018) to understand service upsizing timelines, and Phase 4 of the Building Decarbonization proceeding (R.19-01-011) regarding assisting single- and multi-family building owners with costs to electric service line upsizing.

Emergency replacement loaners and opportunities for faster installation:

  - Air District should consider supporting research or pilots to reduce the number of contractors needed and facilitate plumbers performing "incidental electrical work," and to support local government permitting offices in clarifying definitions and local permitting requirements.

Encourage pre-planning and readiness:

  - Air District should provide informational support for local governments considering reach codes that can encourage planning and readiness.
  - Air District should provide education and outreach on the upcoming rules to residents and building owners, and work with partners on education regarding preplanning and electrification readiness.

- **Potential Housing Impacts**
  - Air District should engage with local governments, legal service providers, tenant representation organizations, and others to gain more insight regarding how different local renter protection policies (e.g. 'right to return' ordinances, relocation assistance and eviction protections, pass throughs and rent stabilization) are implemented "on the ground," and how they interact with one another, to identify specific ways to minimize impacts on renters that could result from zero NOx appliance installations.
  - Air District should continue multi-agency coordination and information sharing with SCAQMD, CARB and other agencies regarding the potential impacts of appliance rules on renters and identify implementable next steps, key partners, and timelines.
- **Costs**
  - Air District should monitor pilots that offer phone and mobile app technical assistance and incentives application support an consider opportunities for expansion.
  - Air District Staff should continue to monitor green financing program development.
- **Permitting**
  - Air District should continue working with key stakeholders such as BayREN, local governments, and other organizations that work on building codes to support best practices that reduce timelines and streamline processes for zero NOx appliance installations.
- **Market Development**

  Support the Expansion of Incentives, Funding, and Workforce Development

  - Air District should find ways to support the continuation and expansion of programs like TECH Clean California that reduce costs for HPWH installations, particularly in underserved communities.
  - Air District should explore investing in contractor training programs, similar to SCAQMD's "Go Zero" and TECH Clean California's growing contractor pool, that prepare the workforce to install HPWHs at scale, particularly for zero NOx technologies.

  Prioritize Policy Development and Adoption

  - Air District should continue to coordinate on and support the adoption of policies like CARB's Zero-Emissions Space and Water Heaters by 2030 and SCAQMD's zero-NOx standards for building appliances.

  Monitor Federal Regulations and Leverage National Support

  - Air District should continue to monitor the Department of Energy's 2024 Appliance Efficiency Standards and explore strategies to maximize potential federal funding, such as the Inflation Reduction Act tax credits and Defense Production Act allocations.

  <u>Educate Consumers and Contractors on Building Appliance Rules</u>

  - Air District should launch outreach and education campaigns to raise awareness of zero NOx technologies among consumers and contractors.
  - Air District should partner with others to emphasize the benefits of HPWHs, available incentives, and policy requirements to accelerate market adoption.
- **Workforce Availability and Readiness**
  - Air District should support and uplift accessible, existing training programs for heat pump water heaters, and partner with incentive programs to incorporate incentive program education in outreach and engagement to contractors.
- **Grid and Reliability Impacts**
  - Air District should continue to coordinate with the CEC to ensure integration of appliance rules into capacity planning, and with PG&E to understand reliability trends and grid work.
- **Rule Development**
  - Evaluate potential for and impact of additional rule amendments to Regulation 9, Rule 6 to address remaining challenges.

APPENDICES

A. Installation Costs for Zero-NOx Space and Water Heating Appliances
B. Challenging Use Cases and Emerging Solutions for Zero-NOx Appliances
C. Market and Sales Trends for Zero-NOx Appliances
D. Permitting Requirements for Zero-NOx Appliances
E. Grid Related Impacts on the Implementation of Rules 9-4 and 9-6
F. Workforce Challenges for Zero-NOx Requirements
G. Renter Protections Policy Landscape Summary and Recommendations
H. Lived Experience Interviews with Renters Report 2024