



ADVANCED WATER HEATING INITIATIVE®

White Paper

Increasing Equitable Access to Heat Pump Water Heaters

Key Strategies and Emerging Practices to Accelerate
Equitable Decarbonization in Water Heating

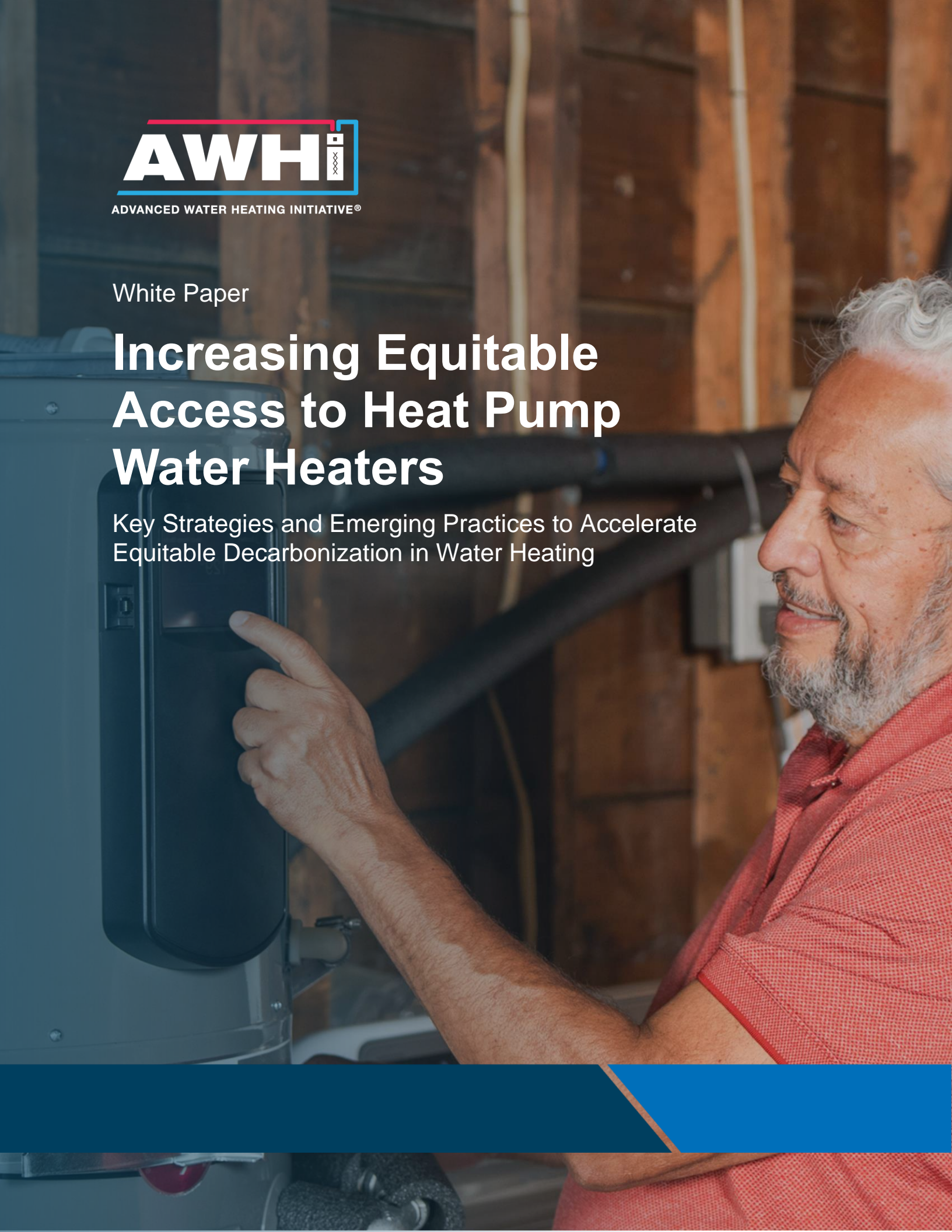


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Executive Summary

This white paper aims to share data about current methods and programs used to overcome barriers to Heat Pump Water Heater (HPWH) adoption in Low-to-Moderate Income (LMI) households and disadvantaged communities.

These barriers include high initial costs, the split incentive between landlords and tenants, technical constraints, workforce challenges, and local policy barriers. This paper outlines opportunities and considerations to help ensure that those who cannot afford HPWHs or have other barriers preventing their installation are not left with the negative impacts of gas-fueled and electric resistance water heaters.

LMI households should not be unfairly saddled with the increasing costs of maintaining gas infrastructure or stuck with inefficient equipment. Because of this, heat pump water heater market transformation programs focused on LMI households and disadvantaged communities are critical to equitable decarbonization. The ultimate goal of these programs is to realize long-term energy savings, emissions reductions, and financial benefits for LMI people and across disadvantaged communities.

This paper has been released in parallel with [“The Why, What, and How of Successful Heat Pump Water Heater Programs” Resource Guide](#). It details the need for and benefits of HPWHs in LMI and disadvantaged communities and compiles successful real-world examples and actionable recommendations for HPWH adoption in LMI communities.

This report is a product of the Advanced Water Heating Initiative[®] (AWHI), a market transformation initiative led by New Buildings Institute (NBI). AWHI is comprised of hundreds of industry, nonprofit, and governmental organizations aiming to transform the water heating market into energy-efficient heat pump water heaters for residential and commercial applications. To this end, AWHI created a dedicated task group of relevant national stakeholders to focus on increasing equitable access to HPWHs. That task group supported NBI in researching and compiling this report.

Introduction

About 20 million American households are behind on their utility bills.¹ Water heating accounts for 16%-30% of all energy use in US households. In larger multifamily buildings, water heating is the largest energy end-use, surpassing space heating and cooling.² The substantial energy consumption of these systems drives people to spend significant sums of money heating water. This especially harms lower-income members of our society.

Fuel-burning water heaters produce local pollution from the on-site combustion of fossil fuels. Such pollutants include particulate matter, nitrous oxide (NO_x), sulfur oxides (SO_x), formaldehyde, and other criteria and unregulated air pollutants. According to the American Lung Association, disadvantaged communities, usually in low socioeconomic conditions, “often face higher exposure to pollutants and...may experience greater responses to such pollution.”³ These pollutants not only affect the people but also impact outdoor air quality and may present indoor hazards when equipment is not properly vented to the outdoors. With that, improper venting is anecdotally reported as a common occurrence by plumbers and contractors, although reliable data indicating how often it occurs are unavailable.³

As of 2023, Heat Pump Water Heaters (HPWHs) comprise less than 1% of all water heaters nationwide. There are more than 123 million existing residential water heaters in the United States, and 54% use methane (natural gas) or other fossil fuels to heat water.⁵ Nearly all the rest of the US water heater stock uses electric resistance technology.⁴ Compared to these legacy technologies (fuel-burning or electric resistance water heaters), HPWHs offer many benefits.

Because HPWHs are 2-4 times more efficient⁵ than on-site combustion or electric resistance products, they cost significantly less to operate in most replacement scenarios, which helps reduce energy burden (percentage of income spent on utility bills). Since HPWHs rely on electricity instead of fossil fuels, they reduce locally produced pollution and global air pollution. They also allow households to save on their utility bills by reducing energy usage during expensive peak hours. Finally, HPWHs futureproof communities from fossil fuel system obsolescence.

¹ CNN. “Nearly 20 million households are behind on their utility bills.” 2023

<https://www.cnn.com/2023/05/23/business/utility-bills-arrears-summer/index.html>

² United States Department of Energy. “New Infographic and Projects to Keep Your Energy Bills Out of Hot Water” 2013. <https://www.energy.gov/energysaver/articles/new-infographic-and-projects-keep-your-energy-bills-out-hot-water>

³ American Lung Association, “Disparities in the Impact of Air Pollution,” 2023. <https://www.lung.org/clean-air/outdoors/who-is-at-risk/disparities>

⁴ US Energy Information Administration, “Table HC8.1 Water heating in US homes, by housing unit type, 2020,” Residential Energy Consumption Survey 2023. <https://www.eia.gov/consumption/residential/data/2020/hc/pdf/HC%208.1.pdf>

⁵ US ENERGY STAR, “ENERGY STAR Certified Heat Pump Water Heaters.” 2023. https://www.energystar.gov/sites/default/files/asset/document/ES_HPWH_Factsheet_July_2023.pdf

Around 60% of households in the United States earned a yearly income of \$68,000 or less. This classifies them as Low- to Moderate-Income (LMI) households.⁶ Even though HPWHs would benefit most households, LMI community members often lack access to equitable HPWH adoption. This is due to various barriers, including upfront costs, ongoing operational costs, split incentive structures, HPWH technical constraints, workforce limitations, and policy barriers. These barriers constrain HPWH purchasing and installation access for low- to moderate-income households and disadvantaged communities. Furthermore, given that the incremental cost of switching from legacy technologies to a HPWH generally exceeds \$1,200, adopting a HPWH can be simply out of reach for these households.⁷

Considering the inequity of these barriers, HPWH market transformation programs focused on LMI communities are needed to extend the benefits of advanced water heating. Since many households in disadvantaged communities face high barriers to accessing heat pump water heaters, these programs must be planned thoughtfully to prevent unintentional systemic barriers to participation.



This white paper discusses barriers to HPWH adoption in low-income to moderate-income households, presents solutions for programs and initiatives aiming to overcome LMI household barriers to HPWH adoption, and introduces a new resource guide showcasing successful, established, and emerging HPWH adoption programs for LMI households and disadvantaged communities.

To learn more about HPWH benefits for LMI and disadvantaged communities, see the accompanying [“The Why, What, and How of Successful Heat Pump Water Heater Programs” Resource Guide](#). This guide also includes an introductory list of successful, established, and emerging state or local HPWH adoption programs.

⁶ “Throughout this document, “low- to moderate-income (LMI)” is used as an inclusive term intended to capture households and customers earning up to 120% of the Area Median Income (AMI), which was approximately \$64,388 nationally in 2014, given a 2014 national median income of \$53,657. According to the US Census Bureau, 60% of American households earned up to \$68,212 in 2014. Thus, although there is some discrepancy in the numbers, approximately 60% of households earned roughly 120% of AMI. Carmen DeNavas-Walt & Bernadette D. Proctor, US Census Bureau, *Income and Poverty in the United States: 2014*, at 6, 31 (Sept. 2015), available at www.census.gov/content/dam/Census/library/publications/2015/demo/p60-252.pdf. From IREC. “Shared Renewable Energy for Low- to Moderate-Income Consumers,” 2023. https://www.energy.gov/sites/default/files/2016/04/f30/IREC-LMI-Guidelines-Model-Provisions_FINAL.pdf

⁷ Rewiring America, “Upfront Cost of Home Electrification,” 2023. <https://www.rewiringamerica.org/electrification-costs-estimates>

Barriers to HPWH Adoption in LMI Households and Disadvantaged Communities

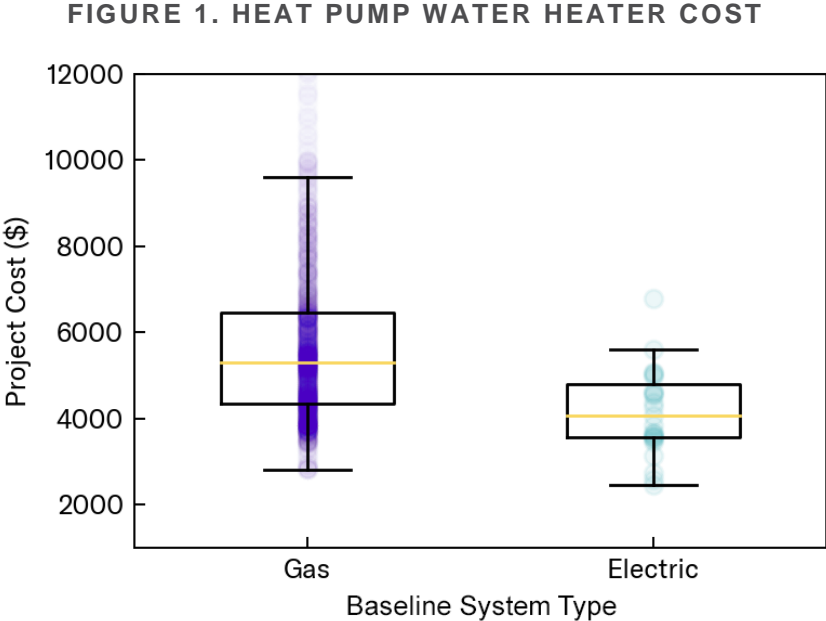
The widespread adoption of HPWHs in LMI households and disadvantaged communities is held back by multiple financial, technical, and other barriers, including:

- 1. Upfront (purchase and installation) costs
- 2. Operating (utility bill) costs, mainly in areas with high electric rates and low gas rates
- 3. Technical constraints
- 4. Workforce limitations
- 5. Policies and programs that systemically exclude and do not prioritize LMI and disadvantaged communities

This section discusses these barriers in detail.

Upfront Costs

Despite the significant potential benefits that HPWHs hold for LMI households and disadvantaged communities, their higher upfront costs have put them out of reach for most low-income people.



This diagram from Rewiring America shows the average cost ranges for HPWH installations when replacing gas and electric water heaters.⁸

⁸ Rewiring America, “Upfront Cost of Home Electrification,” 2023. <https://www.rewiringamerica.org/electrification-costs-estimates>

Purchasing and installing a HPWH can be significantly more expensive than purchasing and installing legacy fuel-burning and electric resistance water heaters. Furthermore, the cost to install a HPWH as a replacement usually varies considerably depending on the prior water heater type.

Based on 2022 data gathered by Rewiring America:

- Replacing a gas water heater with a HPWH generally costs \$4,300 - \$6,500 (25th to 75th percentile; median \$5,300) before rebates and incentives.
- Replacing an electric resistance water heater with a HPWH generally costs \$3,600 - \$4,800 (25th to 75th percentile; median \$4,100) before rebates and incentives.



These costs are generally the most significant barrier to HPWH adoption. The typical cost premium of \$1,500-\$3,000 is an insurmountable barrier for millions of households.⁹ It is also worth noting that, at times, these costs can be unclear and significantly underestimated for natural gas replacement use cases.

Fortunately, these numbers represent costs before substantial government rebates, tax credits, and utility incentives are included. Unfortunately, LMI communities can't always take advantage of these financial assistance mechanisms due to lack of knowledge and the uneven coverage of equity-oriented government and utility-run HPWH incentive programs.

To understand the landscape of existing HPWH utility programs, NBI sourced data from the ENERGY STAR 2023 Water Heater Rebate Survey.¹⁰ This survey captured information about single-family residential utility-run HPWH incentive programs. The overall average incentive for HPWHs was slightly over \$500, with customer incentives as low as \$60 and as high as \$1,100 per water heater. While these rebates help make HPWHs more affordable, many low-income consumers can't afford the high upfront costs of the technology.

⁹ These cost ranges were gathered by Rewiring America. US EPA estimates a \$1,500 incremental cost for HPWHs over a standard electric resistance water heater.
https://www.energystar.gov/products/water_heaters/high_efficiency_electric_storage_water_heaters/benefits_savings

¹⁰ US EPA, "ENERGY STAR Summary of Water Heater Programs," 2023.
<https://www.energystar.gov/productfinder/downloads/2023/2023%20ENERGY%20STAR%20Summary%20Water%20Heaters.pdf>

The 2022 Inflation Reduction Act (IRA) includes billions of dollars in rebates and tax credits for HPWH adoption and other decarbonization upgrades. The IRA provides a HPWH rebate of up to \$1,750, which can cover 100% of project costs for low-income households or 50% of costs for moderate-income households. Additionally, whole-home retrofits, which can include HPWH installations, can receive incentives of up to \$8,000. These rebates are discussed in more detail below.

Operating Costs

ENERGY STAR estimates that replacing a residential electric resistance water heater with a HPWH can save a household of four approximately \$550 per year on its electric bills. This equates to over \$5,600 net savings over a HPWH's 13-year lifetime.¹¹ The Department of Energy (DOE) estimates that switching to more efficient water heaters (e.g., HPWHs) would save American consumers over 11 billion dollars annually.

These savings when replacing electric resistance water heaters are substantial; however, in locations where gas prices are relatively low and electric rates are relatively high, gas-to-HPWH conversions may end up increasing utility bills. That is to say, utility bill reduction is not guaranteed when switching from gas to HPWHs. One example of this dynamic is in Southern California, where, for some residents, gas rates are relatively low, and electricity rates are relatively high.

NBI's 120-volt field study in California (which has some of the highest retail electric rates in the US) found that 72% of participants saved on utility bills when switching from a gas water heater to a HPWH. The remaining 28% of participants saw their bills rise, with bill increases between \$9 and \$21 per month.¹² These cases are a minority in California and nationwide, but it is important to note that cases do exist where moving from a gas-burning water heater to a HPWH increases utility costs. Ultimately, in all cases, care must be taken to avoid increasing the energy burden on LMI and disadvantaged community members.

The Split Incentive

In general, rental housing suffers from a split incentive, where the landlord pays for the first cost of the equipment while the tenant pays for the ongoing energy bills. In this dynamic, tenants are at the will of a landlord to make the decisions about home investments, including appliances.

When it comes to water heaters, specifically, rental apartments have a disproportionate share of electric resistance water heating. While most water heaters nationwide burn fuels (primarily gas), most water heaters in multifamily dwellings use electric resistance heat.¹³

¹¹ ENERGY STAR, "Save Money and More with ENERGY STAR Certified Heat Pump Water Heaters." https://www.energystar.gov/products/water_heaters/high_efficiency_electric_storage_water_heaters/benefits_savings

¹² NBI, "Plug-In heat Pump Water Heater Field Study Findings & Market Commercialization Recommendations." 2023. <https://www.advancedwaterheatinginitiative.org/120v-field-study>

¹³ EIA, "Residential Energy Consumption Survey (RECS)." 2023. <https://www.eia.gov/consumption/residential/>



Landlords generally make purchase decisions based on how their choice will affect their own costs. This is especially the case regarding upfront purchases and installation costs. In many cases, operating costs are not considered in their choices. This structure makes it hard to justify an upfront (landlord) investment, like the purchase of a HPWH, that will reduce operating (tenant) costs over time.

This split incentive saddles these tenants with a higher energy burden, raising their utility bills. This dynamic can force LMI households and disadvantaged communities to remain in the cycle of debt in their utility bills.

Technical Constraints

HPWHs, regardless of where they are adopted, have some important technical differences from other water heater product types. These differing specifications can result in technical barriers in some installations.

HPWH technical constraints include:

- **Airflow:** Nearly all HPWHs pull heat from the air surrounding the heat pump unit. Given that most HPWHs are packaged (not split) systems, this means the room in which the HPWH is placed must be large enough to serve as a heat source without excessively chilling the air.¹⁴ Alternatively, the air intake and outflow from a HPWH may be ducted to and from the outdoors.
- **Condensate water:** Air source heat pumps produce a small amount of condensate water from the heat exchanger, which must be routed to a drain, sink, or condensate pump.
- **Size:** The size of the HPWH itself can be another physical barrier. The heat pump in most systems is placed above the hot water storage tank, which means the water heater is somewhat taller than its equivalent gas or electric tank water heater.
- **Wiring:** When a HPWH replaces a fuel-burning water heater, existing wiring, panel capacity, or electrical service may be insufficient to install a 240V HPWH, which usually requires a 30A circuit. New wiring, capacity, or service may be needed because plug-in HPWH products that need only 120V power have only recently been on the market and may not be suitable for all applications.

¹⁵ EPA recommends that HPWH have at least 700 cubic feet of air around the unit (e.g., a 10x10-foot utility room with a 7-foot ceiling). ENERGY STAR, "Ask the Experts." 2023. <https://www.energystar.gov/products/ask-the-experts/is-a-heat-pump-water-heater-right-for-your-home>.

Workforce Constraints

The number of plumbers and electricians in the industry today is not nearly enough for all the work needed to address the climate crisis.¹⁵ Today's plumbers and contractors are often inexperienced with HPWH installations and do not know best practices. Because callbacks are expensive and generate little to no profit, they are hesitant to branch out and install new and emerging equipment types, like HPWHs. The workforce's lack of formal training and real-world experience is a significant roadblock for LMI communities.

Policy Barriers

Current energy codes, municipal regulations, and government program limitations can hinder broader HPWH adoption in LMI communities. In many states, utilities may not incentivize fuel switching. That is, utility incentive funds may not be used to defray the costs of converting from gas to electric equipment.

Furthermore, as recent as April 2023, a three-judge panel of the Ninth Circuit of Appeals struck down the all-electric residential new construction ordinance in Berkeley, CA.¹⁶ The city appealed, seeking a rehearing en banc (all judges), but the majority of active judges on the Ninth Circuit refused the request in January 2024. This ruling may also slow the spread of similar mandates and the adoption of HPWHs in new construction in some locations.

While the federal Weatherization Assistance Program (WAP) can provide substantial financial assistance to improve energy efficiency in low-income housing, the program's cost-effectiveness limitations and other structural barriers can limit the use of these funds for heat pump water heaters.



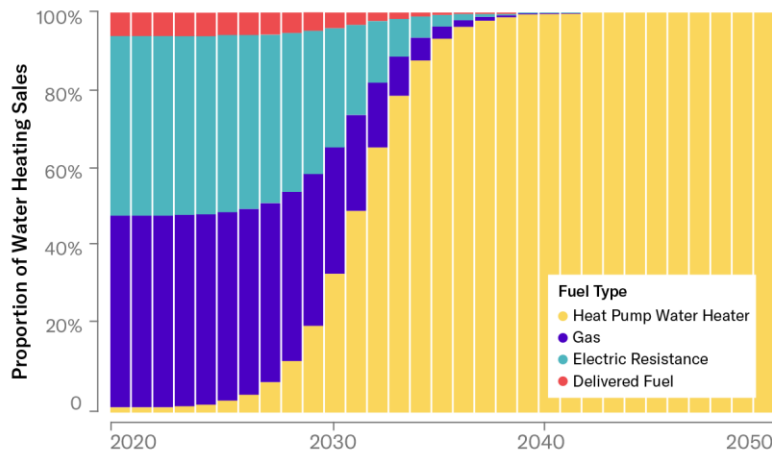
¹⁵ New Yorker, "The Great Electrician Shortage." 2023. <https://www.newyorker.com/news/dept-of-energy/the-great-electrician-shortage>

¹⁶ Courthouse News Service, "Divided Ninth Circuit panel refuses rehearing on blocked Berkeley gas ban." 2024. <https://www.courthousenews.com/divided-ninth-circuit-panel-refuses-rehearing-on-blocked-berkeley-gas-ban/>

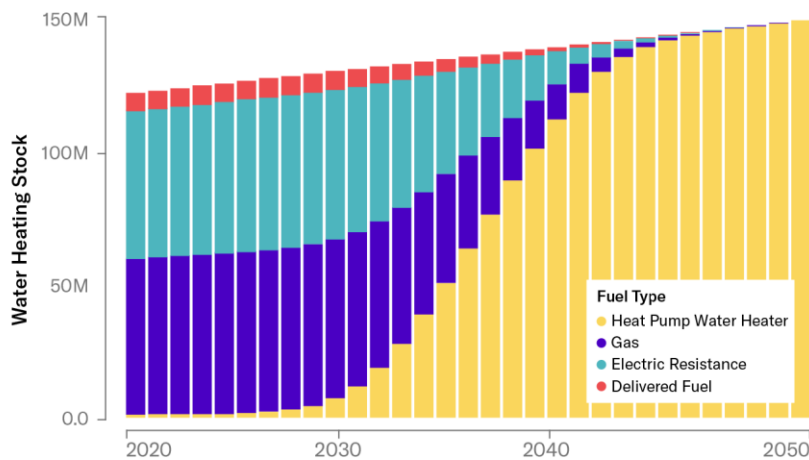
Forces Advancing Electrification and HPWH Adoption Nationally

The United States is rapidly shifting from fossil fuel to clean energy sources to reduce carbon emissions within the timeline established by the Intergovernmental Panel on Climate Change.

FIGURE 2. REQUIRED GROWTH OF HEAT PUMP WATER HEATERS TO MEET 2050 CLIMATE GOALS



Water heaters have a lifetime around 10 years, so we set a target of electric heat pump water heaters comprising 100 percent of sales by 2040. This yields the sales curve above.



100 percent heat pump water heater sales by 2040 would therefore result in 100 percent turnover of the stock of homes using fossil fuels for water heating by 2050. This is demonstrated in the stock curve above.

Source: Rewiring America¹⁷

¹⁷ Rewiring America, "Pace of Progress Report" 2023. <https://www.rewiringamerica.org/pace>

With the goal of “100% of homes having heat pump water heaters by 2050,” the US aims to avoid the worst effects of global warming. Appliances and equipment that produce or efficiently use renewable electricity, such as electric vehicles, solar panels, induction stoves, and heat pumps, are experiencing exponential growth patterns, also known as S-curves.

What is causing this dramatic change? In large part, the key drivers are falling costs for items like these and governmental mandates and incentives. Now more than ever, HPWH policies, programs, and initiatives that reduce the prices of HPWH adoption are vital.

To that end, equitable partnerships with low- to moderate-income households and disadvantaged communities are essential for successful HPWH programs. Program models already exist to facilitate these partnerships, but more work is needed to implement them effectively. In particular, priority should be given to multifamily and rental buildings where landlords control equipment purchasing decisions, and tenants pay energy bills. These split incentive cases can be challenging to overcome without targeted support and incentives.

Futureproofing LMI Communities from Fossil Fuel Appliance Obsolescence: HPWH Transition Policy, Programs and Initiatives

Across markets, regions, and industries, current and anticipated future equipment is moving away from burning fossil fuels and toward clean energy, primarily electricity. Low-income communities face an elevated risk of being the last ones to make the transition and being left to carry the infrastructure costs since they have less capacity to pay to upgrade equipment. For the water heating sector in particular, standards, policies, and tax credits are pushing the market towards rapid decarbonization and adoption of heat pump water heaters.

Federal Water Heating Standards

The Department of Energy (DOE), under the National Appliance Energy Conservation Act (NAECA), has the authority to set minimum appliance standards and does so for 60 categories of residential appliances. The DOE last set standards for residential water heaters in 2010. On July 21, 2023, DOE released a Notice of Proposed Rulemaking with a draft of updated water heater efficiency standards.¹⁸

For electric water heaters, the draft rule proposes to phase out electric resistance water heaters over 35 gallons by 2029. For gas water heaters, the draft rule slightly increases efficiency standards. If adopted, these rules are expected to dramatically increase heat pump water heater annual sales from one hundred and fifty thousand to several million.

¹⁸ US Department of Energy (DOE), “DOE Proposes New Energy Efficiency Standards for Water Heaters to Save Americans More Than \$11 Billion Annually on Utility Bills,” 2023. <https://www.energy.gov/articles/doe-proposes-new-energy-efficiency-standards-water-heaters-save-americans-more-11-billion>



State, Regional, and Local Electrification Incentivization and Mandates

Various other levels of government are also moving to phase out all types of fossil fuel combustion. This trend is also expected to accelerate the adoption of heat pump water heating. Recent state and local policies include:

- **New York:** New York became the first state to mandate all-electric new construction in 2023.¹⁹
- **Washington:** The Washington State energy code strongly encourages all-electric construction.²⁰
- **California:** In California:
 - » The Bay Area Air Quality Management District passed a rule in March 2023 prohibiting the sale of combustion appliances, with water heaters starting in 2027.²¹
 - » The South Coast Air Quality District is currently considering a similar rulemaking.²²

¹⁹ New York Assembly, “The ALL-ELECTRIC BUILDINGS LAW: What it means for you.” 2023. <https://www.assembly.ny.gov/all-electric-buildings/>

²⁰ Crosscut Cascade PBS, “Washington is the first state to require all-electric heating in new buildings.” 2022. <https://crosscut.com/environment/2022/05/washington-first-state-require-all-electric-heating-new-buildings>

²¹ Bay Area Air Quality Management District, “Rules 9-4 and 9-6 Building Appliances.” 2024. <https://www.baaqmd.gov/rules-and-compliance/rule-development/building-appliances>

²² South Coast Air Quality District, “Proposed Amended Rule 1146.2.” 2024. <https://www.aqmd.gov/home/rules-compliance/rules/scaqmd-rule-book/proposed-rules/rule-1146-2>

- » The California Air Resources Board has voted to draft rules prohibiting the sale of gas appliances by 2030.²³
- **Other cities and counties:** Over 140 cities and counties have passed legislation prohibiting fossil-fueled appliances in new construction. This includes the United States' two largest cities, New York and Los Angeles. The 9th Circuit Court has invalidated the legal approach used by Berkeley, CA, but most similar policies remain in effect as of early 2024.²⁴

The need for HPWH adoption has never been higher. As of 2024, there is a significant risk that fossil-fuel-dependent households will be paying increasing maintenance costs as that system's throughput declines and high fixed costs are spread across fewer users. For example, a June 2023 report from The American Council for an Energy-Efficient Economy (ACEEE)²⁵ modeled natural gas prices rising between 172%-544% due to electrification, pipe replacement, and switching to lower carbon biofuels. The study states that "across these different scenarios, it is clear that residential and commercial gas service will become significantly more expensive as states, cities, and utilities move to decarbonize their systems." Transitioning low-income communities to heat pump water heaters in the near term will protect them from these increasing costs, as fossil fuels become more expensive on the road to obsolescence.

Federal incentives: Inflation Reduction Act (IRA)

The 2022 IRA provided heat pump water heater funding through rebate programs and tax credits. In particular, the IRA established \$4.5 billion in point-of-sale Electrification Rebates²⁶ for low- and moderate-income households²⁷ to install electric appliances, including HPWHs. The upfront discount for heat pump water heaters is capped at \$1,750 and can cover up to 100% of costs for low-income households and 50% for moderate-income households.²⁸ State energy offices will implement the Electrification Rebates,²⁹ which are expected to have programs beginning in 2024.

²³ California Air Resources Board, "Zero-Emission Space and Water Heater Standards." 2022. <https://ww2.arb.ca.gov/our-work/programs/zero-emission-space-and-water-heater-standards>

²⁴ Smart Cities Dive, "Legal threats to city, state natural gas bans: A timeline." 2024. <https://www.smartcitiesdive.com/news/biggest-gas-ban-new-building-electrification-news-2023-timeline/702944/>

²⁵ The American Council for an Energy-Efficient Economy (ACEEE), "Impact of Electrification and Decarbonization on Gas Distribution Costs," 2023. <https://www.aceee.org/research-report/u2302>;

²⁶ US Department of Energy (DOE), Office of State Community Energy Programs, "Home Electrification and Appliance Rebates," 2022/2023. <https://www.energy.gov/scep/home-electrification-and-appliance-rebates>;

²⁷ "Low-income" households have a total income less than 80% of their Area Median Income (AMI). "Moderate-income" households have a total income between 80% and 150% of AMI.

²⁸ \$1,750 is unlikely to cover the full cost of a HPWH and braiding additional incentives will most likely be required for low income installations. See upfront costs section below.

²⁹ The funding is allocated by formula; allocations can be viewed at US Department of Energy (DOE), "Biden-Harris Administration Announces State and Tribe Allocations for Home Energy Rebate Program," 2022. <https://www.energy.gov/articles/biden-harris-administration-announces-state-and-tribe-allocations-home-energy-rebate>;

The IRA also includes other incentives that will help with the adoption of heat pump water heaters in low- and moderate-income households. The Efficiency Rebates,³⁰ with \$4.3 billion in funding, incentivizes whole-home energy-saving retrofits, which can include heat pump water heaters. The Efficiency Rebates can deliver \$8,000 or more for whole-home retrofits for low-income households.³¹ Households with federal income tax liability are also eligible for a 30% tax credit³² off the cost of a heat pump water heater.³³ Although the Electrification and Efficiency Rebates cannot be combined for the same single measure (like a heat pump water heater), both rebates *can* be stacked with tax credits. Beyond direct funding for heat pump water heaters, the IRA also established the \$27 billion Greenhouse Gas Reduction Fund,³⁴ which will lower financing costs for clean energy technologies, especially in low-income and disadvantaged communities.

Workforce Development

Future policy must encourage training programs for contractors and installers. Water heaters generally last for about 13 years.³⁵ This means that by 2035, nearly all currently-used water heaters will have been or will soon need to be replaced.³⁶ The National Kitchen and Bath Association highlights an existing shortage of plumbers, estimating that 60,000 plumbers retire yearly while only 30,000 apprentices enter the field.³⁷ On top of this existing shortage of plumbers, there is expected to be a significantly increased need for specialists in decarbonization technologies across all trades. Rewiring America estimates that a rapid electrification of the United States would create as many as 25 million jobs.³⁸ Ensuring that low-income communities have access to well-paying jobs installing efficient technologies like heat pump water heaters can further improve the financial outlook for LMI communities. Currently, several programs are exploring strategies for providing training and related services.³⁹

³⁰ US Department of Energy (DOE), Office of State Community Energy Programs, “Home Efficiency Rebates,” 2022/2023. <https://www.energy.gov/scep/home-efficiency-rebates;>”

³¹ Depending on the amount of energy saved and whether the energy reductions are modeled or measured.

³² Internal Revenue Service (IRA), “Home Energy Tax Credits,” 2024. <https://www.irs.gov/credits-deductions/home-energy-tax-credits;>”

³³ Up to \$2,000 annually through the Energy Efficient Home Improvement Credit program (25C). Energy Star, “Federal Tax Credits for Energy Efficiency,” 2022. https://www.energystar.gov/about/federal_tax_credits;”

³⁴ United States Environmental Protection Agency (EPA), “Greenhouse Gas Fund,” 2023. <https://www.epa.gov/greenhouse-gas-reduction-fund;>”

³⁵ ENERGYSTAR “Save More with ENERGY STAR Certified Heat Pump Water Heaters,” 2024 https://www.energystar.gov/products/water_heaters/high_efficiency_electric_storage_water_heaters/benefits_savings

³⁶ NBI, “2021 AWHI Progress Report.” 2021. https://www.advancedwaterheatinginitiative.org/s/AWHI_ProgressReport2021_20220531.pdf

³⁷ Evans Plumbing, Inc., “Shortages of Plumbers in the US,” 2024. <https://www.evansplumbinginc.com/blog/uncategorized/shortages-of-plumbers-in-the-us/;>”

³⁸ Saul Griffith, Sam Calisch, and Alex Laskey/Rewiring America, “Jobs Report Mobilizing for a Zero Carbon Emissions America: Jobs, Jobs, Jobs, and More Jobs,” 2020. <https://www.rewiringamerica.org/policy/jobs-report>”

³⁹ See “NAACP Guidelines for Equitable Community Involvement in Building & Development Projects and Policies,” <https://naacp.org/resources/guidelines-equitable-community-involvement-building-development-projects-and-policies>

Successful, Established, and Emerging HPWH Adoption Program Approaches

Because HPWHs hold significant potential benefits for low-income households and disadvantaged communities, interested stakeholders nationwide are pioneering programs designed to increase access to this technology.

The following table summarizes various programs to increase HPWH access in LMI and disadvantaged communities.

TABLE 1

Program Types	Description
1. No-cost installations	HPWHs can be installed at no cost to residents in qualifying households.
2. Fixed price and bulk purchasing	Lower upfront HPWH costs are attainable by offering water heaters purchased in bulk and a fixed price for installations.
3. Upfront and zero/low-interest financing	Eliminate the upfront cost barrier by financing the initial cost and installation of HPWHs, charging zero or low interest, and/or offering deferred loan repayment.
4. HPWH leasing programs	Eliminate the upfront cost barrier by installing HPWHs at no cost and charging low monthly lease fees for the water heater.
5. Emergency replacement programs	Offer same-day replacement of burned-out gas or electric resistance water heaters with HPWH installations and/or temporary equipment.
6. HPWH programs for renters	Offer HPWHs to rental properties, provided the renter will benefit from lower utility bills.
7. Demand response programs to lower operational costs	Lower operational costs by setting HPWHs to run during off-peak times when electricity rates are lower.
8. Outreach to targeted communities	Conduct targeted outreach about HPWHs to disadvantaged communities by partnering with trusted local organizations.
9. HPWHs in weatherization programs	Braided weatherization funding is needed to achieve cost-effective HPWH replacements, especially for electric resistance and propane water heaters.

Program Types	Description
10. Workforce development programs	<p>By recruiting both licensed contractors and those interested in the workforce from disadvantaged communities, this program trains individuals on HPWH installation. The goal is to expand access to HPWH installation jobs.</p> <p>This program type also helps minority-owned businesses capitalize on the HPWH market transformation.</p>
11. HPWH programs for manufactured housing	<p>Install HPWHs in manufactured housing, which often serves low-income communities and is all electric. Overcome space constraints through special installation techniques (including ducting) and specification of particular HPWH products that fit into smaller spaces.</p>
12. HPWH programs for multifamily buildings	<p>Install central or large unitary (distributed-central) HPWHs in multifamily buildings using central boilers with hot water circulation loops and overcome the split incentive problem.</p>

To review an introductory list with details about real-world successful, established, and emerging state or local HPWH Adoption programs, see the accompanying [“The Why, What, and How of Successful Heat Pump Water Heater Programs” Resource Guide](#).

The Future of HPWHs in LMI Households and Disadvantaged Communities

Heat pump water heaters are critical for meeting hot water needs while decarbonizing the built environment. Even though they can offer substantial benefits to low-income and disadvantaged communities, these groups are all too often overlooked when it comes to HPWH adoption.

In most cases, HPWHs will reduce utility bill costs, environmental impact, and energy burden. The potential for long-term utility bill savings in households that use HPWHs is invaluable to LMI communities, especially those with inefficient electric resistance or propane water heaters. There are significant barriers to HPWH adoption in LMI communities. These include but are not limited to upfront costs, ongoing operational costs, split incentive structures, HPWH technical constraints, workforce limitations, and policy barriers.

On the road to equity, LMI households and disadvantaged community members must be active participants in efforts to accelerate HPWH adoption. Care must be taken to design programs that prioritize equity, provide access to HPWH benefits for all, and reduce the energy burden of disadvantaged community members as decarbonization efforts proceed.

Policymakers, program planners and implementers, advocates, manufacturers, community leaders, and others must address the high initial cost-to-entry and other barriers to participation. Market transformation programs must be planned thoughtfully to prevent unintentional systemic barriers to participation.

Leaders can initiate or join this change by:

- Leveraging funding from the Inflation Reduction Act and other sources and providing targeted funds to LMI communities to assist with HPWH installation costs
- Creating or replicating successful program models that help overcome systemic barriers to equitable HPWH adoption
- Fostering genuine, equitable partnerships with low-income households and disadvantaged communities



- Investing in workforce development to support the transition to HPWHs
- Creating low-entry-barrier programs that ensure households can access the benefits of these appliances easily

Successful HPWH program models for low- to moderate-income households have been pioneered nationwide to overcome the upfront cost, split incentive, and technical and workforce barriers to adoption. Utilities, governments, and other stakeholders across the country can and should follow the examples of the pioneering programs and best practices showcased in this paper to transform the water heating market equitably toward the adoption of heat pump water heaters.

Where are We Going?

Equitable partnerships with low-income households and disadvantaged communities are essential for successful HPWH programs. Program models exist to facilitate these partnerships, but more work is needed to implement them effectively.

Furthermore, federal, state, and utility weatherization programs present a significant opportunity for HPWH installation. These programs can provide funding and support to help households access energy-efficient appliances, including HPWHs. However, structural changes to federal program cost-effectiveness rules will be needed on top of the substantial workforce development needed to support market transformation to HPWHs.

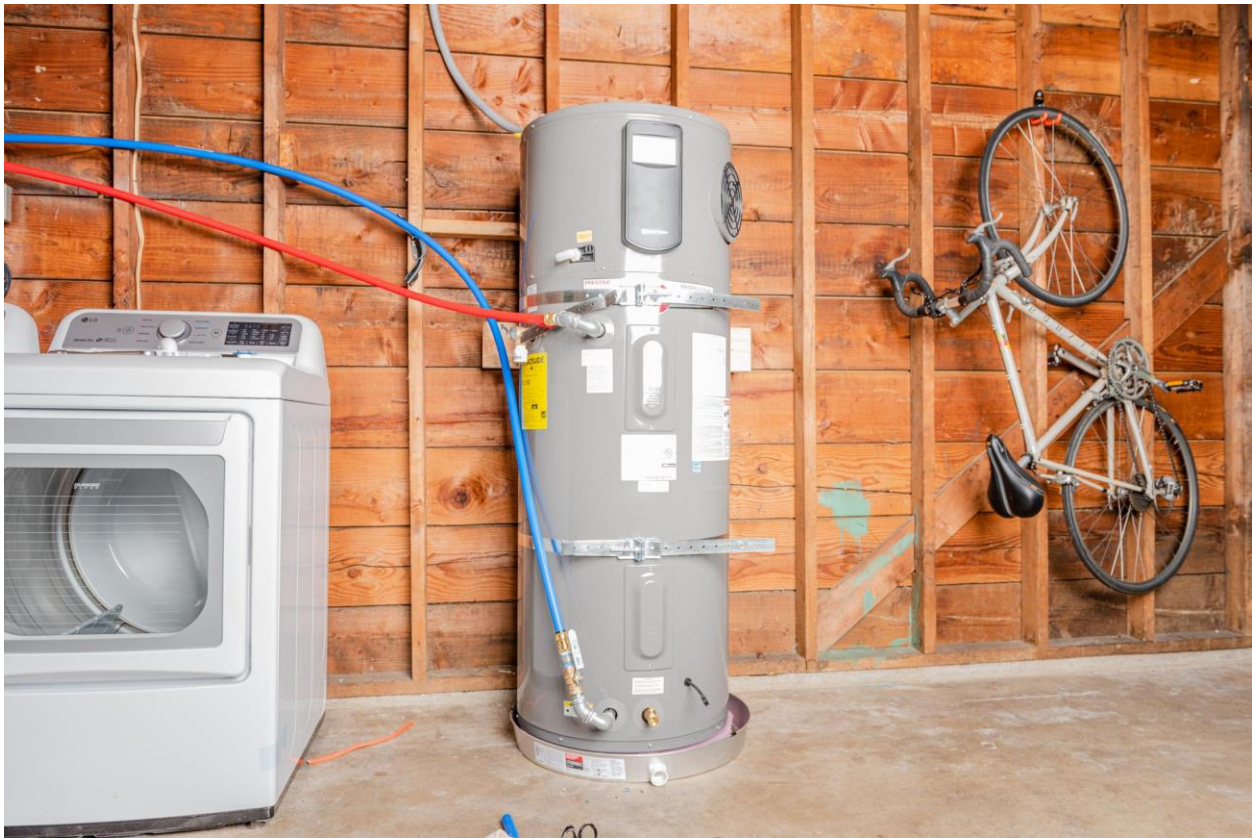
Many “low hanging fruit” opportunities still exist for expanding access to heat pump water heaters, including more broadly incorporating the technology into weatherization programs and focusing market transformation efforts on multifamily buildings. Additionally, workforce development programs should prioritize contractors and installers from disadvantaged communities to extend the business benefits of this future-looking technology to traditionally left-behind communities.

HPWHs have had a 15% annual growth rate since their certification as an ENERGY STAR product in 2009, but they still make up just 1.6% of new water heater sales annually. Centering equity in HPWH programming will help accelerate market transformation and ensure that those who need the benefits of clean, efficient water heating most are the first to receive them.

Much more work is needed, but innovative leaders are showing a clear path to equity-focused HPWH market transformation.

Additional information is available in the following appendices.

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New Buildings Institute (NBI) is a nonprofit organization driving better energy performance in buildings. We work collaboratively with industry market players—governments, utilities, energy efficiency advocates and building professionals—to promote advanced design practices, innovative technologies, public policies and programs that improve energy efficiency and reduce carbon emissions. We also develop and offer guidance and tools to support the design and construction of energy efficient buildings.

The Advanced Water Heating Initiative (AWHI)[®] is a member-funded collaborative of building owners, utilities, federal agencies, state and local governments, manufacturers, engineers, installers, advocates, researchers, and building industry professionals from across the U.S.

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