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Closing the Electrification Affordability Gap

Planning an equitable transition away from fossil fuel heat in Bay Area buildings

Acknowledgments

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The findings and recommendations of this report are SPUR's and do not necessarily reflect the views of any reviewer or interviewee. Any errors are the author's alone.

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Additional appendices on market-transforming regulations and analysis of net costs and savings are available at spur.org/buildingelectrification.

Executive Summary

The Bay Area is poised to take a big leap forward in cleaning up air pollution. In April 2023, the Bay Area Air Quality Management District passed rules that will require newly installed furnaces and hot water heaters to emit zero nitrogen oxide (NOx), a health-harming pollutant that is released by burning fossil fuels and that contributes to smog and dangerous fine particulate matter.

The only equipment available to heat air and water in buildings without polluting the air with NOx is electric-powered equipment. Fortunately, there's a superior technology waiting in the wings to take the place of gas-fired building equipment: heat pumps. Switching from a gas appliance to an electric appliance is more involved than doing a like-for-like replacement. But when installed properly, a heat pump can heat air and water just as effectively as a gas appliance and do it with far less energy. Moreover, heat pump space heaters can act as air conditioners in the summer. In addition to offering energy efficiency and cooling benefits, electric heat pumps would greatly reduce the region's carbon footprint.

A major challenge in adopting heat pumps is that they cost more to install than their gas counterparts. Even though heat pumps have been around for decades and are very popular in some parts of the world, they're not that well known to contractors and consumers in California. That lack of familiarity contributes to a cycle of low visibility and low sales for the technology, leading to high manufacturing costs, markups, and labor expenditures.

These barriers could be overcome as historic government incentives, combined with codes requiring heat pumps in new construction and retrofits, bolster the market. The Bay Area's zero-pollution equipment rules will be key to growing the market for heat pumps and bringing down installation costs. However, it's likely that, for a few years, upfront costs for heat pumps will remain high relative to costs for baseline equipment. (Baseline equipment refers to gas furnaces, gas water heaters, and air conditioners). Making it affordable for low-income households and rental housing to make the switch to heat pumps is key for an equitable rollout of the rules.

This report urges Bay Area policymakers to cover the incremental cost difference between heat pumps and baseline equipment for low-income homeowners and low-income rental housing, while implementing policies that would bring down the cost to install heat pumps, gradually alleviating the need for large subsidy programs.

SPUR evaluated the extent to which current incentive programs for low-income households and rental housing cover the cost difference between baseline equipment and heat pumps in the Bay Area. We found that the incremental cost between a heat pump HVAC and a gas furnace with a room air conditioner is about $11,000. The incremental cost between a heat pump HVAC and a gas furnace and central air conditioner is about $6,000, and the incremental cost between a heat pump water heater and a gas water heater is about $2,900. **In the current incentive landscape, every low-income Bay Area household can receive a free heat pump water heater. Similarly, landlords with low-income rental buildings and many homeowners can access free heat pump HVACs.**

When single-family households and owners of low-income multifamily buildings choose heat pump water heaters and heat pump HVACs, not only do they get the new equipment for free; they also save thousands of dollars by not buying gas equipment.

The landscape is more complicated when it comes to the net cost of installing a central ducted or unducted mini-split heat pump in place of a new furnace in single-family homes. In that scenario, some single-family households will come out ahead by installing a heat pump; others would have spent less on a furnace. The difference is due to the Community Choice Aggregator (CCA) that serves their home: if they're fortunate enough to live in an area served by a CCA that offers generous heat pump HVAC incentives, a heat pump HVAC system will be less expensive than a furnace would have been.

Currently available incentives are generous and promise to bring the California heat pump market to maturity, but incentives come and go. Funding can run out, and program providers can change eligibility requirements, the amounts awarded, or both. Regardless, the takeaway message is that **the affordability gap between heat pump HVACs and baseline equipment at this time, while meaningful, can be filled by incentive programs.** Right now, those incentive programs are mainly composed of rebates, but new on-bill financing options are expected to come online soon. At the same time, energy market experts predict that higher market demand is likely to reduce costs by 30%–40% for heat pump HVAC systems and 50%–55% for heat pump water heaters by 2050. That means the incremental cost difference between baseline equipment and heat pumps is likely to shrink, and the amount of funding and financing needed to make zero-pollution equipment affordable to low-income households will diminish accordingly. In the short term, rebates and financing, paired with policy decisions that reduce heat pump installation costs, will be necessary to boost the affordability of heat pumps for low-income households.

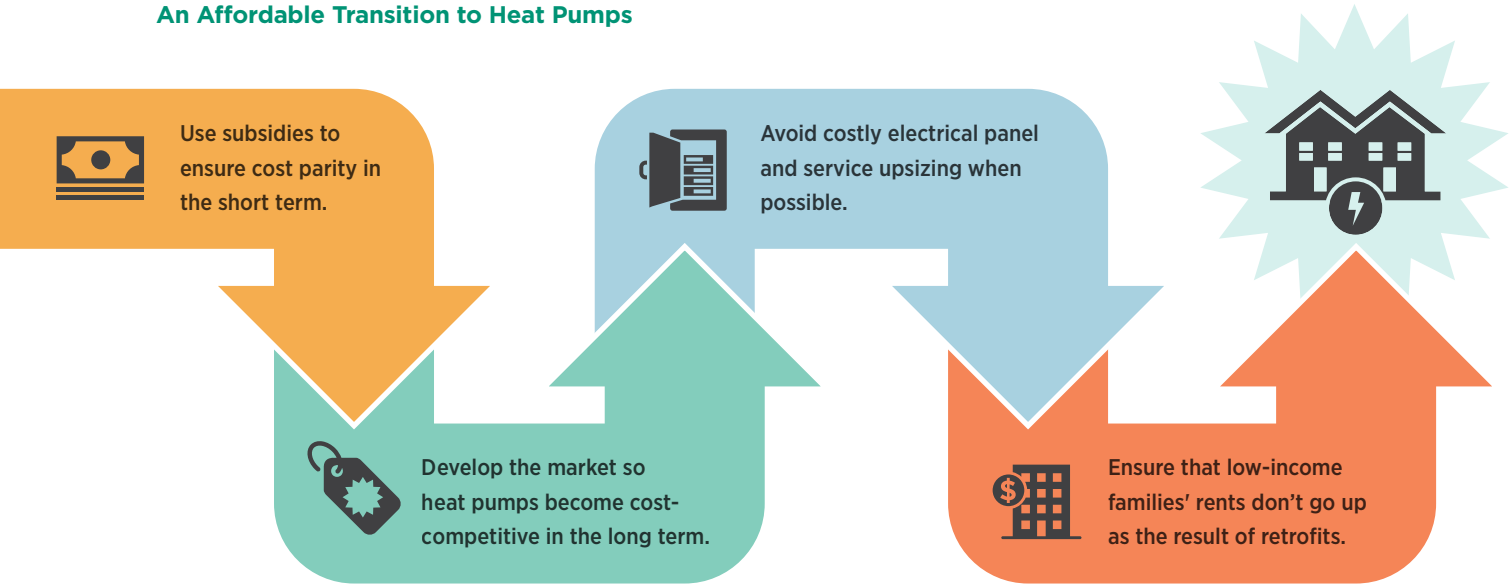
SPUR recommends that policymakers work to achieve the following objectives:

Objective 1

Bring down the cost of zero-emission technologies to make them cost-competitive with gas equipment.

- → Use standards and regulations to guarantee demand for manufacturers, distributors, and contractors.
- → Avoid unnecessary electric panel upsizing, and make increasing the capacity of the electric service less expensive when it's necessary.
- → Offer services that help homeowners and landlords find the best contractors and competitive bids.
- → Ensure customers are aware that they can save money on their electric bills by taking advantage of electrification-friendly rate structures from their energy provider.

An Affordable Transition to Heat Pumps



Objective 2

Mitigate any cost burden of zero-emission appliance rules on low-income homeowners.

- → Ensure that incentives (both rebates and financing) are large enough to cover the cost differential between heat pumps and baseline equipment for low-income households.
- → Increase the availability of financing options, especially options such as Inclusive Utility Investment, which allows customers to repay debt over time from guaranteed bill savings.

Objective 3

Mitigate impacts on low-income renters and low-cost rental housing.

- → Design incentive programs for owners of multifamily buildings housing low-income tenants such that landlords pass on little or no cost for equipment upgrades to their tenants.
- → Target incentive programs to small, hard-to-reach landlords who have historically been poorly served by energy efficiency incentive programs.
- → Serve the tenant by serving the landlord. To deliver equitable outcomes for tenants, electrification incentive programs need to be easy to navigate and financially rewarding for landlords. Otherwise, landlords won't enroll, and most tenants will remain unprotected from rent hikes and displacement.

The California Air Resources Board, the South Coast Air Quality Management District, and states across the United States are watching how the Bay Area steers the implementation of zero-pollution heating equipment standards. If the rules roll out smoothly and equitably, many other

jurisdictions — some much larger than the Bay Area — are likely to adopt similar regulations, further spurring the market for heat pumps.

Taking the leap to all-electric space and water heating seems daunting now, but in a decade or two, gas furnaces and water heaters will seem as outdated as lead gasoline. Homes will no longer rely on fossil fuel combustion, which produces no fewer than six gasses that contribute to respiratory disease and cancer.

This report's detailed action plan shows how the Bay Area can make a transition to energy that is gentler on our health and our climate — and do so without financially penalizing low-income households.

Introduction:
Planning an Affordable Transition to Clean-Energy Buildings

Slowing climate change and reducing air pollution requires that we stop burning fossil fuels and start powering our lives with clean electricity. Renewable energy resources like wind and solar are increasingly abundant and already often cheaper than oil and gas. **California now gets 59% of its electricity from renewables and zero-carbon sources and is on track to reach 100% clean electricity by 2045.**[1]

To maximize the benefit of a cleaner grid, California needs to convert energy end uses from fossil fuel combustion to electricity. The state is at an inflection point in converting to electric transportation. At the end of 2022, more than 1.1 million electric vehicles zipped down California roads, and under state policy, this number is projected to surge to 12.5 million by 2035.[2]

A similar transformation is underway in California homes and buildings — but in this sector, the state is falling behind. Only 28% of California homes use clean electricity for heat, compared with 40% of homes nationwide.[3] The numbers for water heating are even more concerning: just 21% of California homes have an electric water heater, compared with 47% of homes nationwide.[4]

That leaves more than 7 in 10 California homes dependent on fossil fuels for home heating, water heating, or both. Pollution from gas heating equipment in homes and buildings is responsible for roughly 10% of California's total greenhouse gas emissions.[5]

Meanwhile, California's 2045 deadline to stop burning fossil fuels in all but a few end uses is just a little more than two decades away. Transitioning all of the state's homes and buildings away from fossil fuel heat in time will be particularly challenging due to the long life span of heating equipment.

Most gas furnaces and water heaters burn out in 15 to 20 years, but some can last decades longer.[6] Some of the heating equipment we install today could still be polluting well beyond 2045.[7] The time to stop digging the hole is now.

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[1] California Energy Commission, "New Data Indicates California Remains Ahead of Clean Electricity Goals," February 2022, https://www.energy.ca.gov/news/2022-02/new-data-indicates-california-remains-ahead-clean-electricity-goals.

[2] California Energy Commission, "Light-Duty Vehicle Population in California," 2023, https://www.energy.ca.gov/data-reports/energy-almanac/zero-emission-vehicle-and-infrastructure-statistics/light-duty-vehicle.

[3] Lucas Davis, "Three Facts About Electric Heating in California," *Energy Institute Blog,* UC Berkeley, 2023, https://energyathaas.wordpress.com/2023/05/08/three-facts-about-electric-heating-in-california/.

[4] Davis, "Three Facts about Electric Heating in California."

[5] California Air Resources Board, *Zero-emission Appliances—Frequently Asked Questions (FAQs)*, 2023, https://ww2.arb.ca.gov/our-work/programs/building-decarbonization/zero-emission-appliance-standards/faq.

[6] Paloma Sisneros-Lobato, Margaret Parker, and Laura Feinstein, *Setting California's Clean Appliance Timeline*, SPUR, 2022, https://www.spur.org/sites/default/files/2022-05/SPUR_Setting_California%27s_Clean_Appliance_Timeline.pdf.

[7] Sisneros-Lobato, Parker, and Feinstein, *Setting California's Clean Appliance Timeline.*

Fortunately, clean electric alternatives to fossil fuel heating equipment are widely available. The most efficient devices are electric heat pumps for heating and cooling buildings and heating water. Two to four times more efficient than gas furnaces, heat pumps for space heating have quickly become a go-to technology across the country.[8] **In 2022, heat pump sales in the United States surpassed gas furnace sales for the first time, a trend that is likely to accelerate (Exhibit 1).**[9] **In southeastern states, where many homes are already all-electric, as many as 46% of homes use heat pumps (Exhibit 2).**[10]

EXHIBIT 1

U.S. Heat Pump Sales Are Surpassing Gas Furnace Sales

Heat pumps are rapidly gaining in popularity because of cost-savings from purchasing a single unit for heating and cooling, rather than a separate AC unit and furnace.

Source: Air-Conditioning, Heating, and Refrigeration Institute, 2024, "November 2023 U.S. Heating and Cooling Equipment Shipment Data," https://www.ahrinet.org/news-events/news/ahri-releases-november-2023-us-heating-and-cooling-equipment-shipment-data. 2023 numbers include projections for December 2023.

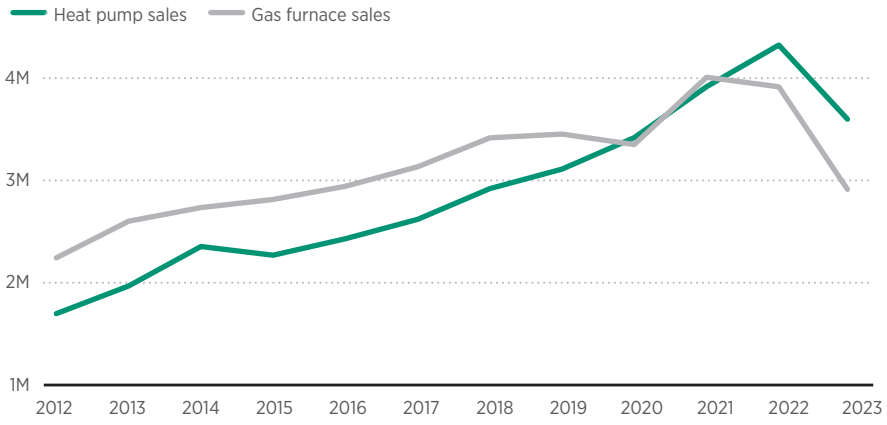
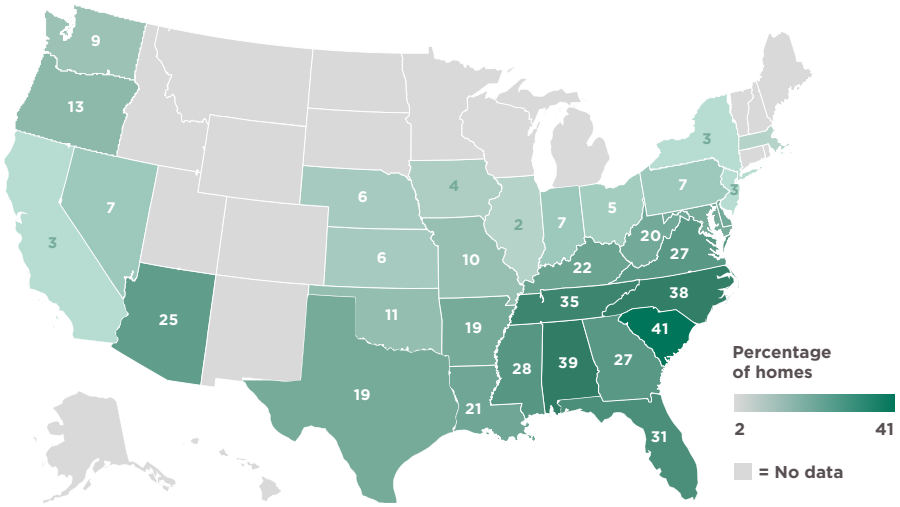


EXHIBIT 2

Percentage of U.S Homes With Heat Pumps

Heat pumps are a proven technology for space heating and cooling. While not many Californians are acquainted with them, they are common in many other states.

Source: U.S. Energy Information Administration, 2023, "Residential Energy Consumption Survey," https://www.eia.gov/consumption/residential/data/2020/index.php?view=state.



[8] John Matson and Chris Potter, "Clean Energy 101: Heat Pumps," RMI, 2022, https://rmi.org/clean-energy-101-heat-pumps/.

[9] International Energy Agency, "Heat Pumps," 2023, https://www.iea.org/energy-system/buildings/heat-pumps.

[10] Maria Virginia Olano, 2022, "Chart: Which States Have the Most Heat Pumps?," *Canary Media*, August 2022, https://www.canarymedia.com/articles/heat-pumps/chart-which-states-have-the-most-heat-pumps.

Although lagging behind much of the country in heat pump adoption, California is in a good position to accelerate progress. In 2023, the Bay Area Air Quality Management District (BAAQMD) adopted nation-leading air quality standards for water heaters and heating equipment (also referred to as heating, ventilation, and air conditioning, or HVAC, equipment), ensuring that only nonpolluting HVAC and water heating equipment can be installed in the Bay Area starting later this decade.

Beginning in 2027, residential fossil fuel water heaters that burn out in the Bay Area must be replaced with a zero-pollution alternative like an electric heat pump. The same is true for furnaces beginning in 2029 and for commercial water heaters and boilers in 2031. The State of California is considering following suit by 2030.[11] Nine other states have pledged to explore adoption of zero-emission standards.[12]

Implementation of the Bay Area's air quality standard for heating equipment will deliver widespread benefits to communities and will serve as a model for state and regional policymakers across the country. Switching to zero-pollution equipment for climate control and hot water in buildings will reduce nitrogen oxide pollution in the Bay Area by 86% by 2045, helping restore the region's compliance with the Clean Air Act.[13] (For a full accounting of how the zero-pollution standards help air quality and public health, see the SPUR, Sierra Club, and RMI report *Gas Appliances and Smog: California's Hidden Air Pollution Problem*.[14])

Upgrading homes to zero-pollution technologies is vital not just for improving air quality and cutting climate emissions, but also for making households more resilient in the face of extreme weather impacts such as heat waves and wildfires. Electric heat pumps don't just heat, they also cool. In the Bay Area, where only 47% of homes have central air conditioning, heat pumps will help keep households safer during the heat waves that have already become more frequent and severe with climate change.[15] At the same time, heat pumps provide air filtration benefits that are more important than ever as wildfires become more frequent with climate change.

This report focuses on the Bay Area's air quality standard and on strategies for closing the electrification affordability gap, defined as the cost difference between installing zero-emission equipment and installing gas equipment for low-income homeowners and landlords of low-income rentals in the nine Bay Area counties. For this report, we use the same definition of low-income as is used in the Federal Inflation Reduction Act incentives for electrification rebates: single-family homes earning less than 80% Area Median Income (AMI), and multifamily buildings where at least half the units are occupied by households earning under 80% AMI.

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[11] Caleigh Wells, "California Plans to Phase Out New Gas Heaters by 2030," National Public Radio, 2023, https://www.npr.org/2022/09/23/1124511549/california-plans-to-phase-out-new-gas-heaters-by-2030#:~:text=The%20Golden%20State%20just%20became,water%20heaters%20beginning%20in%202030.

[12] U.S. Climate Alliance, "United States Climate Alliance Announces New Commitments to Decarbonize Buildings Across America, Quadruple Heat Pump Installations by 2030," press release, September 21, 2023, https://usclimatealliance.org/press-releases/decarbonizing-americas-buildings-sep-2023/.

[13] Jennifer Elwell and Eric Lara, *Final Staff Report: Proposed Amendments to Building Appliance Rules – Regulation 9, Rule 4: Nitrogen Oxides From Fan Type Residential Central Furnaces and Rule 6: Nitrogen Oxides Emissions From Natural Gas-Fired Boilers and Water Heaters*, Bay Area Air Quality Management District, 2023, https://www.baaqmd.gov/rules-and-compliance/rule-development/building-appliances.

[14] Laura Feinstein, Leah Louis-Prescott, and Monica Embray, *Gas Appliances and Smog: California's Hidden Air Pollution Problem*, Sierra Club, SPUR, and RMI, 2022, https://www.spur.org/publications/policy-brief/2022-09-20/gas-appliances-and-smog-californias-hidden-air-pollution.

[15] Yoohyun Jung, "The Bay Area Is Getting Hotter. Is Air Conditioning Becoming Standard for Homes Here?," *San Francisco Chronicle*, June 27, 2021, https://www.sfchronicle.com/local/article/How-many-Bay-Area-homes-have-air-conditioning-16273057.php.

In a region where housing costs are among the highest in the nation, low-income households cannot afford additional costs for upgrading to electric heat pumps when their fossil fuel equipment expires. For now, the upfront cost of heat pumps is higher than the replacement cost of gas heating equipment, although the cost differential is likely to decline as the market matures.

Fortunately, with already-approved subsidies for low-income households, the economics for heat pumps are far more favorable — in fact, low-income households can often save by installing a heat pump rather than replacing their gas furnace with another gas furnace. However, the number of households seeking pollution-free equipment upgrades could soon spend down the funding that California and the federal government currently have in place. Making an equitable transition to heat pumps will require additional infusions of funding and new financing approaches.

As vital as subsidies are for securing an affordable transition, they are just one part of the solution. California's state agencies must work together to tackle key challenges such as lowering equipment costs, ensuring the availability of a trained workforce, avoiding delays, and ensuring an adequate supply of zero-pollution technologies.

This report seeks to inform implementation of the Bay Area's air quality standard by providing realistic estimates of the cost of upgrading to pollution-free heating equipment in the Bay Area and of the savings that low-income households can realize by taking advantage of current and soon-to-be-available incentives from the federal government, state government, and regional agencies. The report then outlines who in the Bay Area will need help affording pollution-free HVAC and water heating equipment.

Lastly, the report outlines strategies for reducing the cost of upgrading homes with pollution-free equipment, such as scaling up the market for heat pumps and avoiding unnecessary electrical panel and service upsizing. The report's recommendation section includes concrete steps that state and local policymakers can take to ensure that pollution-free equipment is cost-competitive with gas heating equipment, along with strategies to mitigate any impacts on low-income renters and low-cost rental housing.

Our key takeaway is that incentive programs can close the affordability gap on zero-emission equipment for low-income households in the immediate future. In the long run, policymakers should focus on strategies to make heat pumps cost-competitive with gas furnaces and water heaters.

As the first region in the nation to adopt a zero-pollution air quality standard for HVAC and water heating equipment, the Bay Area will set a precedent for the rest of the nation in implementation of the rules. Policymakers across the country will be watching closely as the standard goes into effect. If the Bay Area is successful at protecting low-income households and upgrading homes smoothly, cities and states across the nation will follow.

But if the Bay Area fails to lower costs or resolve barriers such as long wait times for electricity upgrades, other regions could be dissuaded from moving forward with strong standards. This outcome would be devastating. We simply cannot meet our climate targets while continuing to install polluting heating equipment in homes.

With the right policies in place, the Bay Area can get the home electrification transition right. Fortunately, BAAQMD adopted its zero-pollution air quality standards for HVAC and water heating equipment several years before their implementation date, allowing policymakers time to prepare.

This report answers several questions that are critical to developing an effective cross-agency approach to safeguarding low-income households.

Will the cost of zero-pollution equipment come down?

Previous experiments with market-transforming regulations have successfully reduced the cost of new technologies. The National Renewable Energy Laboratory projects that HVAC heat pumps and heat pump water heaters will come down in price by 28% and 50%, respectively, by 2050.

What financial incentives are available?

In the Bay Area, financial incentives come from federal and state programs, plus the Bay Area Regional Energy Network (BayREN), which serves the nine counties. Regionwide, single-family homes with low-income occupants can access up to $22,000 in incentives for heat pump HVACs, water heaters, and electric panels. Multifamily buildings in which at least half the occupants are low-income can access up to $26,000 per unit in incentives. On top of that, tax deductions are available for multifamily building owners, and the six clean electricity providers known as Community Choice Aggregators (CCAs) offer additional incentives in their service areas.

How much does it cost to install heating equipment in the Bay Area?

Based on actual installations of heat pumps in the Bay Area, the average installation cost of a central ducted heat pump HVAC is $19,600; a ductless mini split HVAC, $15,400; and a heat pump water heater, $6,300. New electric breaker panels cost between $3,000 and $4,000. By comparison, the average installation cost for a gas central ducted furnace is $7,700; a wall furnace is $4,500; a combined central ducted gas furnace and air conditioner, $13,600; and a gas water heater is $2,900. (All installation costs are in 2022 dollars.)

After incentives, how do the installation costs of zero-pollution equipment compare with those of gas equipment in low-income single-family homes?

After incentives, low-income single-family homes spend $2,900 *less* installing a heat pump water heater than a gas water heater. The same is true if they're replacing central air conditioning and a gas furnace with a heat pump HVAC. In parts of the Bay Area where CCA incentives for heat pump HVACs are more generous, low-income households can save money installing a heat pump HVAC in place of a room air conditioner and a central furnace or wall furnace. The affordability gap for heat pump HVACs in single-family homes without air conditioning could largely be closed by redirecting some funds from heat pump water heater subsidies to heat pump HVACs.

After incentives, how do the costs of zero-pollution equipment compare to those of gas equipment in low-income multifamily homes?

Multifamily buildings with in-unit furnaces and water heaters can realize net savings by replacing that equipment with heat pump HVACs and water heaters. For units that have central ducted air conditioning, the net savings are more than $6,000; without central air conditioning, the net savings are in the range of $350 to $1,350. Net savings for switching to a heat pump water heater are approximately $2,900. More research is needed to understand the costs of upgrading shared systems in multifamily buildings.

Who needs help to afford zero-pollution HVAC and water heating equipment?

The Bay Area's 231,000 low-income homeowner households need subsidies and inclusive financing programs to cover at least the incremental cost difference between heat pumps and baseline gas and air conditioning equipment. For low-income households, the incremental cost is likely larger than it appears in this report because when they install a gas furnace or water heater, they don't need rebates and may make use of used equipment, hire unlicensed contractors, and skip the expense of permitting.

Landlords are expected to pay for the cost of new equipment for the 353,000 low-income households who rent in the Bay Area. But that cost can be passed on in the form of rent increases in housing that's neither formally subsidized affordable housing nor subject to a local rent control ordinance. In housing without strict rent controls, it's important for incentive programs to target buildings with a high share of low-income tenants, to cover much or all of the upfront costs, and to ask for an agreement that the landlord raise rents no more than the average increases in their area for a few years following installation of zero-pollution equipment.

In rent-controlled housing, landlords are already tightly limited on how much of a capital investment they can pass on to their existing tenants, but rents can be increased when a new tenant moves in. For rent-controlled housing, incentive programs should encourage projects that allow tenants to stay in the building or return after the retrofits, and these programs should cover enough of the upfront costs that the landlord isn't pushed to sell the building, thereby triggering the Ellis Act and allowing evictions.

In subsidized affordable housing, there are legal limits on how much can be charged in rent, and that amount doesn't change when new tenants move in. For this type of housing, incentive programs should focus on covering enough of the upfront costs that landlords don't eat into their operations and maintenance budget or take on excessive debt.

What about the cost of electrical service upsizing?

Adding new electric equipment can trigger the need for a higher-capacity electrical panel, which can trigger service upsizing from the utility. The electrical service is the wire that runs from the utility's infrastructure to the customer. Upsizing the electrical service can be the most time-consuming and expensive step in home electrification. In many cases, the customer doesn't pay anything for upsizing the electrical service, but when the service line needs to be undergrounded

or the project requires the utility to upgrade its transformer, customer costs can reach as much as $46,000 and timelines can extend to several months.

Bringing down the cost of service upsizing requires two strategies: *avoid* unnecessary panel and service upgrades and *reduce the costs* of unavoidable upgrades. Avoiding unnecessary panel and service upgrades requires three key moves: shifting incentive programs to encourage panel optimization, revising and clarifying the National Electrical Code, and making sure contractors and building owners have access to tools and training to optimize the electrical panel. Reducing costs for necessary service upgrades will entail shifting responsibility for some costs from the individual customer to the utility, as has already been done for customers seeking electrical service upgrades for new electric vehicle chargers.

Chapter 1:
The Projected Cost of Zero-Pollution Heating Equipment

Market transformation is not a new undertaking; in fact, it's how the United States cleaned up the rampant air pollution that clouded skies and shortened lifespans in the 1970s. The U.S. government has dramatically reduced pollution by setting standards that required industry to develop and scale up new technologies such as catalytic converters, more fuel-efficient vehicles, and low-nitrogen-oxide equipment (Exhibit 3). These regulations save more than 5,000 lives a year in the Bay Area alone while reducing energy and fuel costs for people and businesses and decreasing U.S. reliance on foreign oil.[16]

EXHIBIT 3

From Haze to Clear Skies: Evolution of the Market for Clean Air Technology Through Regulations

In the 1970s and 1980s, air pollution killed more than 8,000 people a year in the Bay Area; by 2015, that figure had declined to fewer than 3,000. These achievements were spurred by forward-looking regulations that guided technologies from the early stages of development to market dominance.

FIRST YEAR	COVERED GEOGRAPHY	IMPACT
1973	United States	Required catalytic convertors for new vehicles
1975	United States	Set fuel-efficiency standards for new vehicles
1975	United States	Set regularly updated appliance energy-efficiency standards
1983	Bay Area*	Capped NOx emissions from furnaces
1990	California	Set a decreasing cap on emissions from new vehicles
1992	Bay Area*	Capped NOx emissions from water heaters
1993	Southern California	Set a decreasing cap on NOx and SOx emissions from industry
2009	United States	Capped greenhouse gas emissions for new light-duty vehicles

Sources: Sources for laws and regulations are given in Appendix B at spur.org/buildingelectrification.

* Many other local Air Districts have since followed suit.

NOx = nitrogen oxides; SOx = sulfur dioxides

[16] Bay Area Air Quality Management District (BAAQMD), *Spare the Air, Cool the Climate: A Blueprint for Clean Air and Climate Protection in the Bay Area*, 2017, https://www.baaqmd.gov/-/media/files/planning-and-research/plans/2017-clean-air-plan/attachment-a_-proposed-final-cap-vol-1-pdf.pdf?la=en.

The retail and installation costs of green technology tend to drop rapidly after the technology is first introduced to the market. The prices for furnaces and air conditioners declined rapidly between 1980 and 2010, even as minimum standards for efficiency became more rigorous.[17] As a result, early projections of the additional cost for a more efficient appliance tend to be far too high.[18] Similarly, the price of lithium-ion batteries has declined by 97% in the 30-plus years since they were first sold in 1991.[19] Costs for rooftop solar systems have dropped more than 50% since 2012.[20] These price declines arise across a diverse range of products as a result of technological innovation and economies of scale in production.

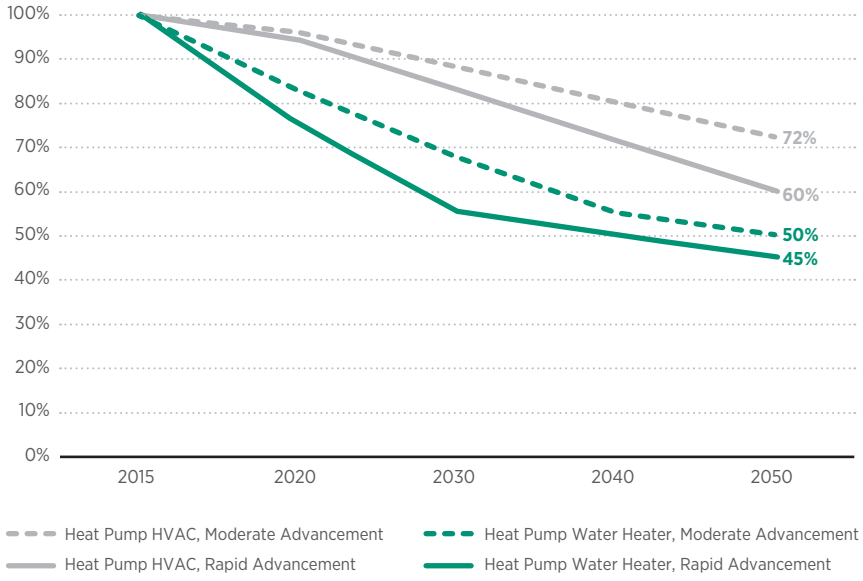
Will heat pump technology follow the same downward trend in costs? A National Renewable Energy Laboratory study projects that — with moderate research and development funding to spur innovation, shifts in policy and consumer choice that increase demand, and a corresponding increase in heat pump production — costs for HVAC heat pumps and heat pump water heaters will decrease by 30%–40% and 50%–55%, respectively, by 2050 (Exhibit 4).

EXHIBIT 4

Cost Projections for HVAC Heat Pumps and Heat Pump Water Heaters

Energy market experts predict that higher market demand is likely to reduce costs by 30%–40% for heat pump HVAC systems and 50%–55% for heat pump water heaters by 2050.

Source: Paige Jadun et al., *Electrification Futures Study: End-Use Electric Technology Cost and Performance Projections Through 2050*, National Renewable Energy Laboratory, 2017, https://www.nrel.gov/docs/fy18osti/70485.pdf.



The recent surge in funding for building electrification programs, coupled with regulations promoting building electrification, promises to shift the market toward zero-pollution technologies. Exhibit 5 shows many of the programs that fund building electrification and research and development in California. Many regional programs and programs in the energy efficiency space also put part of their funds toward building electrification. With a total budget of $1.9 billion over the next few years in California, these programs will encourage research and development and drive

[17] Louis-Benoit Desroches et al., "Trends in the Cost of Efficiency for Appliances and Consumer Electronics," ECEEE Summer Studies Proceedings, 2013.

[18] Larry Dale et al., "Retrospective Evaluation of Appliance Price Trends," *Energy Policy* 37, no. 2 (2009): 597–605, https://doi.org/10.1016/j.enpol.2008.09.087.

[19] David L. Chandler, "Study Reveals Plunge in Lithium-Ion Battery Costs," *MIT News*, March 23, 2021, https://news.mit.edu/2021/lithium-ion-battery-costs-0323.

[20] Mike De Socio, "Why the Cost of Solar Panels Will Likely Keep Getting Cheaper," *CNET*, September 25, 2023, https://www.cnet.com/home/energy-and-utilities/why-the-cost-of-solar-panels-will-likely-keep-falling/.

uptake of clean technologies that will enable economies of scale. The majority of programs are available regardless of income. For some programs, a base amount is available to households of any income and an extra amount is added for low-income households.

EXHIBIT 5

Building Electrification Programs in California

With a total budget of $1.9 billion, these programs will encourage research and development and drive uptake of clean technologies that will enable economies of scale. The majority of programs are available regardless of income. Some programs make a base amount available to households of any income and add an extra amount for low-income households

AUTHORITY	PROGRAM	BUDGET	INCOME-QUALIFIED SINGLE-FAMILY HOME	INCOME-QUALIFIED MULTIFAMILY UNIT	FOR
Federal	Homeowner Managing Energy Savings	$282 million	Y	Adder*	Retrofits
	High-Efficiency Electric Homes Rebate	$280 million	Y	Y	Retrofits
	25C Tax Credit	NA	N	N	Retrofits + new construction
	179D Tax Deduction	NA	N	N	Retrofits + new construction
State	Equitable Building Decarbonization	$922 million	Y	Y	Retrofits
	TECH Clean California	$50 million	N	N	Retrofits
	Self-Generation Incentive Program – Heat Pump Water Heaters	$85 million	Adder*	Adder*	Retrofits
	Building Initiative for Low-Emissions Development	$60 million	NA	Y	New construction
	California Electric Home Program	$58 million	N	N	New construction
	Electric Program Investment Charge	$75 million	N	N	Research
	Gas Research and Development	$80 million	N	N	Research
BayREN	Home+	$ 11 million	N	NA	Retrofits
	Bay Area Multifamily Building Electrification	$ 5 million	NA	Adder*	Retrofits
Total		**$1.908 billion**			

Sources: Jennifer Nelson, "Equitable Building Decarbonization Program," presented at the EBD 1A Workshop, December 13, 2022, https://efiling.energy.ca.gov/Lists/DocketLog.aspx?docketnumber=22-DECARB-03; TECH Clean California, "About," https://techcleanca.com/about/; California Public Utilities Commission, "CPUC Provides Additional Incentives and Framework for Electric Heat Pump Water Heater Program," April 7, 2022, https://www.cpuc.ca.gov/news-and-updates/all-news/cpuc-provides-additional-incentives-and-framework-for-electric-heat-pump-water-heater-program; and Bay Area Regional Energy Network, *Bay Area Regional Energy Network (BayREN) 2022 Annual Report*, 2022, https://www.bayren.org/sites/default/files/2023-05/BayREN%20AR%2011x17.pdf.

Note: Federal program budgets reflect allocations to California.
* An additional incentive amount is available for low-income participants.

Chapter 2
Installation Cost of Zero-Pollution Equipment in the Bay Area

For this report, we looked at single-family homes and at multifamily buildings with in-unit HVAC and hot water systems. Most low-rise buildings — those with no more than three stories — have individual water heating and HVAC systems for each unit.[21] We did not look at the cost of retrofitting multifamily buildings that have hot water and HVAC systems serving multiple units — more common in high-rise multifamily buildings — because high-rise residential units are less common for the region and especially in low-income housing. In the Bay Area, 75% of multifamily units are in low-rise buildings, and 90% of households earning less than 200% of the Federal Poverty Line live in low-rise buildings.[22] The 2027 deadline for compliance with the new air quality rules affects only water heaters with the capacity to serve a single unit. Collecting and analyzing cost data for whole-building systems will become pressing as the compliance deadlines for HVAC systems (2029) and commercial-type water heaters and boilers (2031) approach.

To understand installation costs, we used data from three programs that offer incentives for electric appliances in the Bay Area: BayREN, TECH Clean California, and Silicon Valley Clean Energy.[23] These programs had information for thousands of projects in the Bay Area in recent years (Exhibit 6).

We used the definition of "low-income" that is used in the Federal Inflation Reduction Act incentives for electrification rebates: single-family homes earning less than 80% of area median income (AMI) and multifamily buildings where at least half the units are occupied by households earning under 80% of AMI.

[21] City of Berkeley, "Berkeley Existing Buildings Electrification Strategy," 2021, p. 56, https://berkeleyca.gov/your-government/our-work/adopted-plans/berkeley-existing-buildings-electrification-strategy, and Frontier Energy, Inc. and Misti Bruceri & Associates, LLC, *2019 Cost-Effectiveness Study: Existing Multifamily Residential Building Upgrades*, p. 3, and *2022 Reach Code Cost-Effectiveness Studies*, https://localenergycodes.com/download/986/file_path/fieldList/Low-rise%20Multifamily%20Retrofits-Cost-eff%20Report.pdf.

[22] SPUR analysis of U.S. Census Bureau, "2021 American Housing Survey for San Francisco and San José Metropolitan Areas," 2021, https://www.census.gov/programs-surveys/ahs/data/interactive/ahstablecreator.html?s_areas=00000&s_year=2021&s_tablename=TABLE1&s_bygroup1=1&s_bygroup2=1&s_filtergroup1=1&s_filtergroup2=1.

[23] BayREN, "Home+ Incentive Projects," 2023, shared via email, and Silicon Valley Clean Energy, "FutureFit Heat Pump Water Heater Program Reservation Tracker," 2022, https://www.svcleanenergy.org/wp-content/uploads/Reservation-Tracker-Public-Update-2022.04.19.pdf; and TECH Clean California, "Public Data," 2023, https://techcleanca.com/public-data/.

EXHIBIT 6

Sample Size for Estimating Installation Costs

SPUR's analysis relied on actual installation costs from thousands of projects in the Bay Area in recent years. All costs were corrected for inflation to 2022 real dollars. The full installation costs for heat pumps generally roll in electric wiring costs.

Sources: BayREN data on heat pumps from 2020–2023; TECH Clean California data on heat pumps from 2021–2023; BayREN data on gas appliances from 2018–2023 and SVCE data collected in 2021.

EQUIPMENT	PROJECT SAMPLE SIZE	DATA SOURCE
Central ducted heat pump	1,494	BayREN + TECH
Ductless mini split	323	BayREN + TECH
Packaged terminal heat pump	22	TECH
Heat pump water heater (65 gal.)	281	BayREN + TECH
Gas water heater	516	BayREN
Gas furnace	5,539	BayREN
Panel replacement	82	Silicon Valley Clean Energy
No panel replacement	195	Silicon Valley Clean Energy

Financial Incentives Available in the Bay Area

A host of incentive programs for building electrification retrofits are already available or are approved and coming soon. For this report, SPUR looked at rebates (as opposed to tax credits or financing) available for retrofits of low-income households (see Exhibit 7).

EXHIBIT 7

Electrification Rebate Programs Included in the Analysis

The following rebate programs for electrification retrofits of low-income households were included in the analysis.

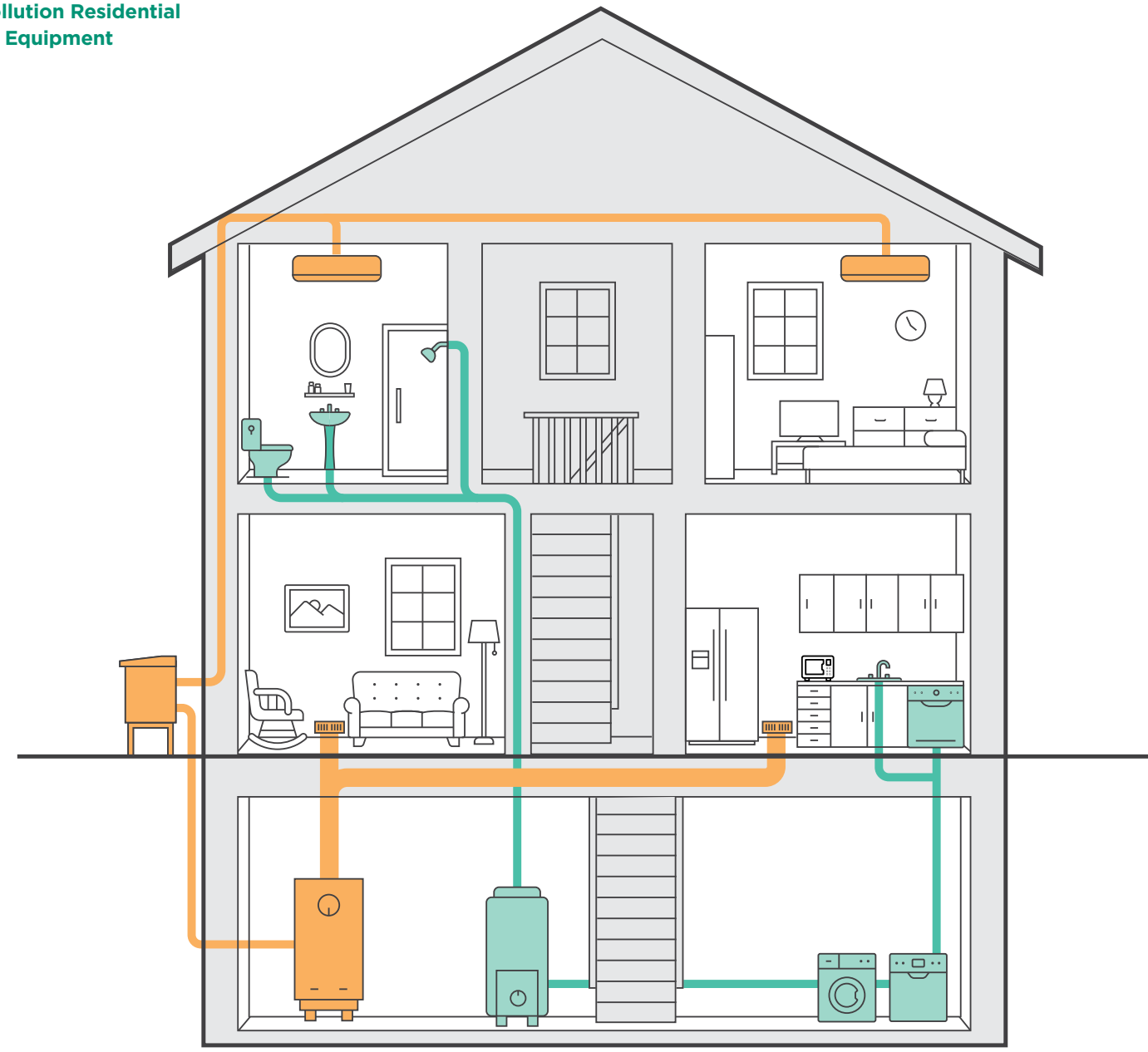
PROGRAM	AREA COVERED
High-Efficiency Electric Home Rebate	United States
TECH Clean California	California IOU customers
Self-Generation Incentive Program (SGIP)	California IOU customers
BayREN Single-Family Home+ and Bay Area Multifamily Enhancements Program	Bay Area
Silicon Valley Clean Energy	Santa Clara County except City of San José
Peninsula Clean Energy	San Mateo County
Ava Energy	County of Alameda except City of Alameda
San Francisco Clean Energy	City and County of San Francisco
Marin Clean Energy	Counties of Marin, Napa, Contra Costa, and Solano except cities of Vacaville and Dixon
Sonoma Clean Power	Sonoma County except City of Healdsburg

Source: Rebate program websites

IOU = investor-owned utility

Identifying all these rebates, much less applying for all of them, is a daunting experience. Different programs have different eligibility requirements for equipment and may have a requirement that only contractors on their certified list be used. SwitchIsOn.org identifies the rebates currently available by zip code, and some local providers are starting to provide one-stop shops to walk property owners through getting their rebates. Examples are the City of San Francisco's Climate Equity Hub and Peninsula Clean Energy's direct install program. More of these types of offerings will enable customers to access the full stack of incentives for which they qualify.

Zero-Pollution Residential Heating Equipment



Net Cost for Zero-Pollution Equipment

We used the cost of installing the zero-pollution equipment, minus incentives, and the avoided cost of replacing baseline equipment, to calculate a net cost for each of four scenarios:

- → Home with a central ducted gas furnace and room air conditioner switching to a central ducted heat pump HVAC
- → Home with a wall furnace and room air conditioner switching to a ductless mini split heat pump HVAC
- → Home with a central ducted gas furnace and central ducted air conditioning switching to a central ducted heat pump HVAC
- → Home with a gas tank water heater switching to a tank heat pump water heater

We also looked at the net cost of electric panel replacements, which are needed in some percentage of homes when electrifying HVAC and water heating equipment.

We looked at installation costs in each of the four scenarios in single-family and multifamily housing. We evaluated net cost by estimating the incremental cost between a heat pump and baseline equipment after taking into account all incentives available to low-income homeowners and landlords of low-income rentals. The income terms were taken from the Inflation Reduction Act definitions, according to which low-income households earn less than 80% of Area Median Income (AMI) and low-income rental housing is buildings with at least half the units occupied by households earning less than 80% of AMI.

At present, about 40% of homes (single and multifamily) in the Bay Area have central air conditioning, and another 12% have room air conditioning.[24] A portable room air conditioner costs about $500. SPUR included either room air conditioning or central air conditioning in the baselines because Bay Area residents increasingly

Key Terms in Cost Analysis

Baseline cost: The cost to install appliances that would be needed if rules requiring zero-pollution appliances weren't in effect. The types of baseline equipment considered are gas wall furnaces, gas central ducted furnaces, central air conditioners, room air conditioners, and gas water heaters.

Zero-pollution installation costs: The costs, including wiring costs, for equipment, labor, and permits to install a zero-pollution HVAC or hot water system.

Incremental cost: The cost difference between a heat pump and the baseline gas appliance. For a heat pump water heater, the baseline gas appliance is a gas tank water heater. For a heat pump HVAC system, the baseline appliance may be a gas furnace alone or a gas furnace plus an electric air conditioning unit.

Net cost: The incremental cost after subsidies.

[24] SPUR analysis of U.S. Census Bureau, "2021 American Housing Survey for San Francisco and San Jose Metropolitan Areas," https://www.census.gov/programs-surveys/ahs.html.

need access to at least one room with cooling as wildfire and extreme heat events become more common.

Exhibit 8 shows how the calculations would work for a low-income single-family home in Silicon Valley Clean Energy (SVCE) territory switching from a central ducted gas furnace to a central ducted heat pump HVAC.

EXHIBIT 8

Net Conversion Costs for a Low-Income Single-Family Home That Is a Silicon Valley Clean Energy (SVCE) Customer

With currently available incentives, the home in this example would save $1,000 by converting to a heat pump HVAC rather than installing a gas furnace and room air conditioner. Additional incentives might be available from Community Choice Aggregators (see Exhibit 9, page 21).

Source: See exhibits 6 and 7.

HVAC and Plumbing Co.

ESTIMATE FOR SERVICES

Description of Work: Replace a central ducted furnace with a central ducted heat pump HVAC

Rebate eligibility: Customer is eligible for low-income incentives

ITEM	
Central ducted heat pump HVAC	($19,600)
Panel replacement, if necessary	($4,100)
INCENTIVES	
Stacked federal, state, and regional incentives for heat pump	$9,400
Stacked federal, state, and regional incentives for panel	$4,100
Cost after federal, state and regional incentives	**($10,200)**

Money *not* spent on a gas furnace: $7,700

ADDITIONAL LOCAL INCENTIVES

	Community Choice Aggregator	Additional Rebate	Net Cost/ Savings Compared to Gas Furnace and Room AC	Final cost of Heat Pump HVAC
1	Peninsula Clean Energy	$3,500	$1,000	($6,700)
2	Silicon Valley Clean Energy	$3,500	$1,000	($6,700)
3	Sonoma Clean Power	$10,200	$7,700	FREE
4	Marin Clean Energy	$2,000	($500)	(8,200)
5	Ava Energy	$0	($2,500)	($10,200)
6	San José Clean Energy	$0	($2,500)	($10,200)
7	Clean Power San Francisco	$0	($2,500)	($10,200)

We found encouraging results: installing heat pumps instead of gas equipment provides net savings in all scenarios for multifamily units and in most scenarios for single-family homes. A high-level summary of findings is provided in Exhibit 10; for a more complete tabulation, please refer to Appendix C at spur.org/buildingelectrification.

For heat pump water heaters, there are net savings across the board in the Bay Area because federal, state, and regional incentives are quite generous. Average-cost panel replacements could be fully covered in all nine counties with incentives from the federal High-Efficiency Electric Homes Rebate (HEEHR) program and the state Self-Generation Incentive Program for Heat Pump Water Heaters (SGIP-HPWH). Moreover, property owners can tap CCA incentives in some places.

The only group without net savings in SPUR's analysis is single-family homes that have no central air conditioning and that are installing a heat pump HVAC system in locations that don't

have relatively generous CCA incentives — namely, the City of San José and the counties of Alameda, Contra Costa, Marin, Napa, San Francisco, and Solano (Exhibit 9). Net costs are higher for households that don't already have central air conditioning because their baseline equipment is much less expensive. While these homes do incur a net cost, they are also gaining air conditioning, which will become increasingly important with climate change. By contrast, installing heat pump HVAC systems in multifamily homes, regardless of whether they already have air conditioning, offers net savings because incentives for these homes are larger than those for single-family homes.

EXHIBIT 9

Incentives From Clean Energy Providers Vary

Low-Income households can save money on heat pump HVACs if their local clean energy provider offers a generous incentive. In some areas, low-income residents can stack regional, state, and federal incentives with funds from their local clean energy provider to fully cover the cost difference between a heat pump and a traditional gas furnace with a room AC. But where the local Community Choice Aggregator offers smaller incentives, that isn't the case. In the case of heat pump water heaters, there's a net cost savings of $2,900 for all nine Bay Area counties.

Source: SPUR analysis.

Notably, actual incremental costs, compared with costs in our analysis, could be skewed higher for low-income households. These households are more likely to rely on unlicensed contractors, so their actual cost to install baseline equipment could be lower than that reflected in available datasets. Moreover, low-income households may have older, poorly insulated homes that require more expensive, higher-capacity HVAC units or extensive improvements to ductwork or electric wiring.

Exhibit 10 shows the cost savings that many households can realize by switching to zero-pollution equipment.

EXHIBIT 10

Cost Savings of Switching to Zero-Pollution Equipment

Net costs or savings are calculated as the mean upfront costs of installing zero-emission equipment in the Bay Area, minus regional and state incentives, compared with the costs of installing baseline equipment. Column 6 takes federal, state, and regional incentives into consideration; column 7 indicates net costs or savings with the addition of any locally available incentives from a Community Choice Aggregator (CCA). Net costs (negative numbers, marked in red) indicate that the customer would spend more on zero-pollution equipment; net savings (marked in green) indicate that the customer would save money by switching to zero-emission equipment.

In most cases, low-income single-family homes save money by switching to zero-emission equipment instead of sticking with gas.

ZERO-POLLUTION EQUIPMENT	BASELINE EQUIPMENT	ZERO-POLLUTION COST (2022 DOLLARS)	ZERO-POLLUTION COST AFTER REGIONAL INCENTIVES	BASELINE COST (2022 DOLLARS)	NET (COST) OR SAVINGS AFTER FEDERAL, STATE AND REGIONAL INCENTIVES	NET (COST) OR SAVINGS AFTER CCA PLUS FEDERAL, STATE, AND REGIONAL INCENTIVES
Central Ducted Heat Pump HVAC	Central Ducted Gas Furnace and Room AC	19,600	10,200	7,700	(2,500)	Peninsula Clean Energy 1,000 Silicon Valley Clean Energy 1,000 Sonoma Clean Power 7,700 Marin Clean Energy (500) Ava Energy (2,500) San José Clean Energy (2,500) Clean Power SF (2,500) Areas with no local rebate (2,500)
Ductless Mini Split Heat Pump HVAC	Wall Furnace and Room AC	15,400	6,000	4,500	(1,500)	Peninsula Clean Energy 2,000 Silicon Valley Clean Energy 2,000 Sonoma Clean Power 4,500 Marin Clean Energy 100 Ava Energy (1,500) San José Clean Energy (1,500) Clean Power SF (1,500) Areas with no local rebate (1,500)
Central Ducted Heat Pump HVAC	Central Ducted Gas Furnace and Central AC	19,600	10,200	13,600	3,400	Peninsula Clean Energy 6,900 Silicon Valley Clean Energy 6,900 Sonoma Clean Power 13,600 Marin Clean Energy 5,400 Ava Energy 3,400 San José Clean Energy 3,400 Clean Power SF 3,400 Areas with no local rebate 3,400
Heat Pump Water Heater (60 Gal)	Gas Tank Water Heater	6,300	0	2,900	2,900	All Bay Area 2,900
Panel Upsize	Existing Panel	4,100	0	0	0	All Bay Area 0

Continued →

All multifamily units save on the per-unit costs of switching to zero-pollution equipment.

ZERO-POLLUTION EQUIPMENT	BASELINE EQUIPMENT	ZERO-POLLUTION COST (2022 DOLLARS)	ZERO-POLLUTION COST AFTER INCENTIVES	BASELINE COST (2022 DOLLARS)	NET (COST) OR SAVINGS, AFTER FEDERAL, STATE AND REGIONAL INCENTIVES	NET (COST) OR SAVINGS AFTER CCA PLUS FEDERAL, STATE, AND REGIONAL INCENTIVES
Central Ducted Heat Pump HVAC	Central Ducted Gas Furnace and Room AC	19,600	7,350	7,700	350	Sonoma Clean Power 725 Marin Clean Energy 3,950 Remaining 5 CCAs: no additional incentives
Ductless Mini Split Heat Pump HVAC	Wall Furnace and Room AC	15,400	3,150	4,500	1,350	Sonoma Clean Power 1,725 Marin Clean Energy 4,500 Remaining 5 CCAs: no additional incentives
Central Ducted Heat Pump HVAC	Central Ducted Gas Furnace + Central AC	19,600	7,350	13,600	6,250	Sonoma Clean Power 6,625 Marin Clean Energy 9,850 Remaining 5 CCAs: no additional incentives
Heat Pump Water Heater (60 Gal)	Gas Tank Water Heater	6,300	0	2,850	2,850	Sonoma Clean Power 2,850 Marin Clean Energy 2,850 Remaining 5 CCAs: no additional incentives
Panel Upsize	Existing Panel	4,100	0	0	0	All Bay Area 0

Households That Need Assistance

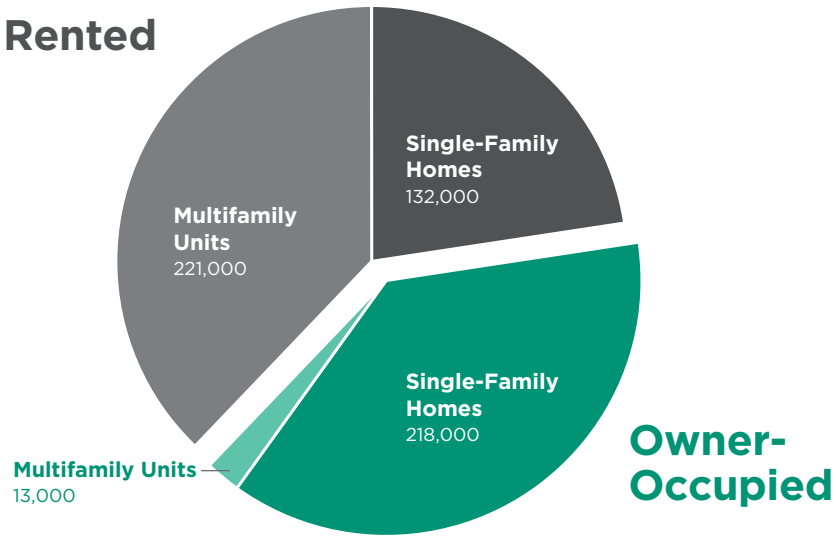
The Bay Area is home to approximately 585,000 low-income households (Exhibit 11). About 40% are homeowners, and making zero-pollution appliances affordable for them requires funding and financing to cover at least the incremental costs. The majority of low-income households — about 60% — are renters. For renters, ensuring that the cost of installing zero-pollution equipment is affordable means ensuring that those costs aren't passed on in rents and that the region's already-scarce supply of affordable housing isn't further depleted.

EXHIBIT 11

Low-Income Households in the Bay Area by Housing Type

Making zero-pollution appliances affordable for the Bay Area's approximately 231,000 owner-occupied low-income households requires funding and financing to cover incremental costs. For the 353,000 renter-occupied households, there's a need to provide financial support for landlords paired with guarantees to ensure that the savings from incentive programs are passed along to tenants.

Source: Based on data from Reem Rayef, *Housing Equity & Building Decarbonization in California*, 2020, https://www.veloz.org/wp-content/uploads/2021/09/Housing-Equity-and-Building-Decarbonization_FINAL_Sept-2020-1.pdf.



To understand how to safeguard low-income tenants and the affordable housing stock during retrofits, it's helpful to consider housing segments by affordability and rent regulation.

HOUSING SEGMENTS BY AFFORDABILITY

Regulated affordable housing: In deed-restricted and Section 8 affordable housing, where rents are below median rents by design, tenants are protected from rent increases. The goal of electrification incentive programs should be to ensure that owners can cover the costs of electrification without eating into their budget for operating and maintaining the property. Most deed-restricted and Section 8 buildings are likely candidates for income-qualified incentives that require at least 50% of a building to be occupied by low-income tenants.

Unregulated affordable buildings: In Naturally Occurring Affordable Housing (NOAH) properties, rents are lower than the area median because the properties are relatively less desirable. Compared with other residential properties, these properties tend to be older, smaller (20 or fewer units), located in marginalized communities, and owned by individual landlords or family trusts rather than large real estate companies.[25] They could be subject to local rent controls, state rent caps, or no rent controls.

NOAH properties house many low-income tenants — however, NOAH properties are often hard to engage in energy efficiency programs, and tenants may not be willing to disclose their incomes for the landlord to demonstrate eligibility for income-qualified subsidies. The goal for incentive

[25] StopWaste and Association for Energy Affordability, *Accelerating Electrification of California's Multifamily Buildings: Policy Considerations and Technical Guidelines*, 2021, https://www.stopwaste.org/accelerating-electrification-of-california%E2%80%99s-multifamily-buildings.

programs would be to cover landlord costs and (in the case of buildings that aren't subject to local rent control) ensure those savings are passed on to the tenants by preventing or limiting landlords from raising rents because of retrofits. Incentive programs need to be very easy for NOAH properties to use. One way to encourage more participation by these properties would be to ask landlords to demonstrate that the majority of their units rent for below-median rents, rather than verifying the income of tenants.

Market-rate buildings: In these buildings, rents are at or above area median rents. In the Bay Area, these buildings are more likely to have landlords who have access to capital and credit and who set rents according to perceived value of units rather than to cover expenses. These buildings also are more likely to be occupied by middle- and high-income tenants and should be a lower priority for incentive programs.

When designing incentive programs for rental housing, much of the conversation has revolved around whether and how the programs should set guardrails on rent increases. In regulated affordable housing, rent increases are already strictly limited. In unregulated affordable and market-rate housing, rent restrictions depend on whether a unit is subject to local rent control. Incentive programs generally don't need to layer on additional rent increase restrictions in deed-restricted and Section 8 housing or in locally rent-controlled housing. Incentive programs should consider setting additional conditions on rent increases in housing that is subject to the state rent cap or no rent restrictions.

HOUSING SEGMENTS BY RENT REGULATION

Deed-restricted and Section 8 affordable housing: Regulated affordable housing is already subject to strict controls on rent increases and utility bill increases. Capital costs are not passed through to tenants. Incentive programs do not need to apply additional restrictions on rent increases.

Locally rent-controlled housing: Housing subject to local rent control typically has safeguards in place to keep rent increases modest for tenants once they occupy a unit, but rents can be increased to market rate when a unit turns over. In most cases, cities with rent control ordinances allow a percentage of capital investments to be "passed through" to tenants to allow landlords to recover a portion of their investment. There is usually a low maximum on the dollar amount and percent increase in rent that is allowed; in San Francisco, the maximum pass-through allowed is 5% of rent or $30 a year, whichever is greater. Incentive programs generally do not need to apply additional restrictions on rent increases.

Rent-capped housing and housing with no rent increase restrictions: The California Tenant Protection Act of 2019 protects against extreme rent gouging, requiring rent increases to stay within an annual cap of 5% plus the cost of living or 10%, whichever is lower. The act gives exemptions for properties built within the last 15 years, duplexes in which one unit is occupied by

the owner, dormitories, deed-restricted and subsidized housing, and certain single-family homes and condos not owned by corporations or real estate trusts. Regardless of whether the building is subject to the state rent cap, landlords can increase rents quite substantially to cover the cost of a retrofit. If an incentive program is covering all or nearly all of the cost of a retrofit, it makes sense to set limits on a landlord raising rents more than they would have had they not retrofitted their building.

Cost of Electrical Service Upsizing

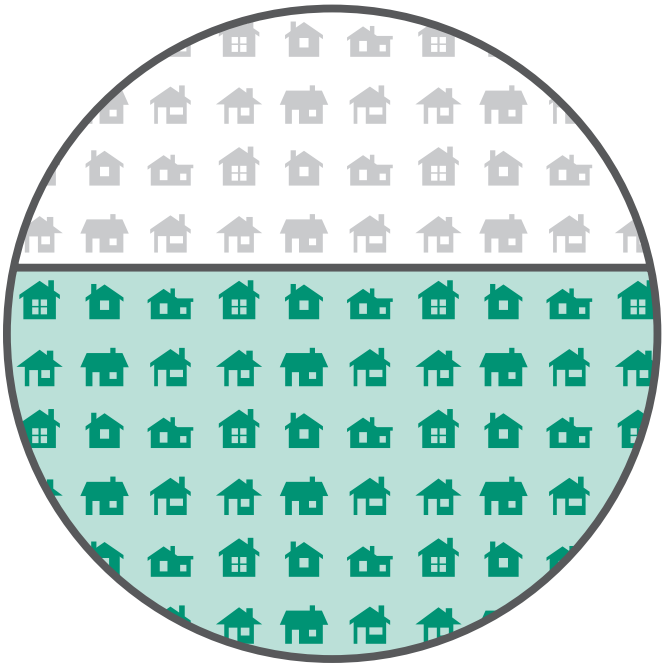
One of the most time-consuming and expensive steps in electrification is upsizing the circuit breaker panel and the electrical service. Electrical service is the wire that connects the utility infrastructure to the circuit breaker panel owned by the customer. The service wire and the panel each are rated for a maximum capacity in amps. Converting equipment from gas to electricity increases the home's potential peak load — the maximum amount of electricity it demands at a given time. When a building increases its peak load, it can require a higher-capacity panel, service wire, or both. Replacing the panel, the service, or both with equipment rated for a higher amperage is a process known as upgrading or upsizing.

Upsizing the electric panel costs between $2,000 and $4,500 and requires going through a complex approval process with PG&E. On top of that, panel upsizing often triggers electrical service upsizing from the energy utility. For many customers, the cost of service upsizing is covered by a utility allowance — about $3,500 for PG&E. But for projects that cost more than the allowance because they require expensive items such as trenching or undergrounding service wires, the customer pays the additional costs. When two or fewer customers are served by a transformer, those customers are required to cover the costs of a new transformer and potential pole replacement. This circumstance is most common for multifamily buildings that are the only customer for a transformer and for residences in remote rural areas where few customers are served by a single transformer. Service upsizing, including not only changing the service wires but also potentially changing the pole-top transformer and digging trenches, can cost the consumer between $300 and $46,000 and can take from a few weeks to eight months to complete.[26] These numbers are concerning — they can easily represent the most expensive and time-consuming step in home electrification for a property owner.

It's been common practice for electricians to advise homeowners seeking to electrify a major end use such as home heating and water heating to install at least a 200-amp panel. Data collected from homes through electrification and energy efficiency programs indicate that half of the homes in California have panels under 200 amps; the percentage is 60% in the Bay Area, where the building stock is older on average. High-income, easy-to-reach customers may be overrepresented in these programs, so the results may be biased toward homes with larger panels. More accurate estimates of panel size are expected to come out soon from studies that use representative samples of California homes.

[26] NV5 Inc. and Redwood Energy, *Service Upgrades for Electrification Retrofits Study Final Report*, PG&E and SDG&E, 2022, https://pda.energydataweb.com.

Careful design choices can help millions of building owners avoid the cost and delay associated with electrical panel and service upsizing.



With thoughtful policy and design decisions,

MOST HOMES

could electrify without complicated and expensive panel upgrades.

Sources: SPUR analysis of Home Energy Analytics' 2022 "Dataset on Residential Panel Capacity and Utilization"; TECH Clean California's "Public Data," https://techcleanca.com/public-data/; and Bay Area Regional Energy Network's 2022 *Home Energy Score Data*.

Housing stock data are from the U.S. Census Bureau's 2021 "American Community Survey," https://data.census.gov/advanced.

We estimate that most homes have 100 or 200 amp panels. With thougtful policy and design decisions, most homes could electrify without potentially expensive panel and service upsizing.

Fortunately, panel and service upsizing aren't always necessary. Homes with panels in the range of 100 to 199 amps have many options to electrify on their existing panel.[27] (For homes with panels under 100 amps, it's possible, but harder). If the Bay Area can reduce the percentage of homes that upsize their panels from 60% to 30% by using these strategies, customers (and incentive programs) would save $3.4 billion in panel upsizing costs — not to mention avoiding hard-to-predict service upsizing costs.

Fortunately, there are strategies to avoid or streamline panel and service upsizing and to fill in knowledge gaps to enable better decision making. By taking advantage of these strategies and implementing policies to bring them into widespread use, it should be possible to reduce the number of truly necessary panel and service upsizings to single-digit percentages. Key strategies to achieve these percentages are making sure contractors and building owners have access to tools and training to optimize the panel, shifting incentive programs to encourage them to do so, and revising and clarifying the National Electrical Code.

[27] Redwood Energy, "Watt Diet Calculator," 2022, https://www.redwoodenergy.net/watt-diet-calculator.

Takeaways

Addressing climate change and air pollution in California requires transitioning from fossil fuels to clean electricity. To accelerate the electrification of housing, the Bay Area has adopted air quality standards for heating equipment, ensuring that only nonpolluting alternatives like electric heat pumps will be installed in the region starting in 2027 for residential-type water heaters, 2029 for HVAC systems, and 2031 for commercial-type water heaters and boilers. These standards serve as a model for other regions and will improve air quality and climate resilience.

Low-income households need help covering the upfront cost of installing heat pumps, which still cost more than gas furnaces and water heaters. Landlords who serve low-income households also need help covering upfront costs, paired with guardrails to ensure that subsidies help insulate their tenants from rent increases.

Given the remarkable subsidies that are available or are due to roll out in the next year, many households can realize net *savings* from installing heat pumps in place of gas furnaces and water heaters. There's one exception: In places where CCA incentives are less generous, low-income households that are replacing a gas furnace and a room air conditioner (rather than central air conditioning) face net costs by switching to a heat pump HVAC system. This affordability gap could potentially be filled by adding incentives or by redirecting some incentive program funds from water heaters to HVAC systems.

Although subsidies are essential to make the transition from fossil fuels to electricity affordable for low-income households, they are just one part of the solution. The Bay Area and California also need to work to bring down installation costs in their own right by increasing demand for heat pumps through codes and standards and by avoiding or reducing costly electrical panel and service upsizing whenever possible. Other strategies, discussed in SPUR's recommendations, include offering risk-free financing options and restructuring electrical rates so households more consistently see savings when they switch to electricity for home heating.

If California's 35 local Air Districts implement the home electrification rules smoothly, equitably, affordably, and on time, California state agencies and other U.S. Air Districts will follow suit. If the rules unfairly burden low-income households with a new expense they can't afford, the state's climate and air quality goals will slip further out of reach. With the right policies and preparations, the Bay Area can lead the way in achieving climate and air quality targets and protecting low-income households.

Chapter 3
Recommendations to Make Zero-Pollution Equipment Affordable

To close the home electrification affordability gap, SPUR recommends pursuing three objectives: making zero-pollution technologies cost-competitive with gas equipment, reducing costs for low-income homeowners through incentive programs, and protecting low-cost rental housing and low-income renters through incentive programs paired with tenant protections.

Objective 1
Ensure that zero-emission technologies are cost-competitive with gas equipment.

At present, it's cheaper install new gas equipment than a new heat pump. And in some cases, customers may experience energy bill increases when converting from gas to electric equipment. Incentives are a powerful tool to bring down upfront costs, but their funding levels aren't predictable, and they don't reach everyone. To become affordable even without incentives, heat pumps must reach cost parity with gas equipment, and energy rates need to be designed so customers don't pay more in energy bills when switching to heat pumps. This goal is challenging because there will always be additional costs that come with switching fuel sources. Achieving these goals requires scaling up the market for heat pumps — not just in the Bay Area but in wider markets — helping people find the most competitive bids, reining in the add-on costs of panel and service upsizing, avoiding missed opportunities to install heat pumps, and restructuring energy rates to encourage electrification.

RECOMMENDATION 1

Roll out policies, such as zero-emission equipment standards, zero-emission building codes, and California's 2030 heat pump installation targets, at the state level to guarantee demand.

Who's responsible: *California Air Resources Board for its zero-emission equipment standards; California Energy Commission for the Energy Code*

The Bay Area is a fairly large market, but California, with five times the population and 14% of the U.S. gross domestic product, can drive a much faster market transformation. Scaling up demand

can bring down manufacturing costs and costs for contractors to do installations as they grow familiar with the technology. More demand also encourages more manufacturers to enter the market and to offer a greater diversity of products, including more heat pumps aimed at the price-sensitive consumer and heat pumps that work in space-constrained locations.

The California Air Resources Board committed to ensuring that only nonpolluting HVAC and water heaters are installed in homes starting in 2030 in its 2022 climate scoping plan and its 2022 Clean Air Act implementation plan. In May 2023, the agency kicked off rulemaking for the environmental standard, with a vote planned for early 2026. Keeping this process on track for adoption and implementation would send a strong market signal to manufacturers, in turn supporting implementation of the Bay Area's air quality standards for heating equipment.[28]

Efforts by Governor Newsom and the California Energy Commission could increase demand for heat pumps during the critical period before the Air District mandates go into effect. In a letter to the California Air Resources Board, Governor Newsom set an ambitious goal of 3 million climate-ready and climate-friendly homes by 2030 and 7 million such homes by 2035, as well as the deployment of 6 million heat pumps statewide by 2030.[29]

Meanwhile, the California Energy Commission is working on its 2025 Building Code update. The draft proposal would drive further uptake of heat pumps in new construction and would encourage consumers to install heat pumps in place of one-way air conditioners starting in January 2026.[30] Air conditioners and heat pumps are essentially identical, except that a heat pump has a reversing valve that allows it to heat as well as cool. The draft code would require that new air conditioning units be two-way heat pumps or one-way air conditioners with additional efficiency improvements.

RECOMMENDATION 2

Offer contractor and homeowner education, including home electrification plans, to avert unnecessary electrical panel and service upsizing.

Who's responsible: *PG&E's Energy Centers and Home Performance Academy, BayREN, and local union chapters for contractor training; PG&E for the Home Energy Checkup program; BayREN and StopWaste for the Home Energy Score audit program; program administrators for high-touch electrification programs*

Many homes in the Bay Area can avoid the costly and time-consuming step of electrical panel and service upsizing by using panel optimization strategies, also known as the Watt Diet. Expanding awareness of these strategies among contractors and property owners can make electrification easier and less expensive.

[28] California Air Resources Board, "Zero-Emission Appliance Standards," October 2023, https://ww2.arb.ca.gov/our-work/programs/zero-emission-appliance-standards.

[29] Governor Gavin Newsom, Letter to California Air Resources Board, July 22, 2022, https://www.gov.ca.gov/2022/07/22/governor-newsom-calls-for-bold-actions-to-move-faster-toward-climate-goals/.

[30] Merrian Borgeson and Meg Waltner, "NRDC Comments on Draft Express Terms," November 20, 2023, https://efiling.energy.ca.gov/Lists/DocketLog.aspx?docketnumber=22-BSTD-01.

Energy contractor training is offered through PG&E's Energy Centers and Home Performance Academy, BayREN, and local union chapters. These are excellent venues to train contractors on how to make use of panel optimization strategies.

The right time to advise building owners on how to adopt zero-pollution equipment without panel and service upsizing is early on, before they put in a major new piece of electric equipment. The appropriate touchpoints for offering information would be when a customer first indicates interest in an incentive program and when they complete an online Home Energy Checkup through PG&E. Custom plans could be provided through programs that involve in-person visits, such as the Home Energy Score audit program operated by BayREN and StopWaste, or as part of high-touch one-stop or concierge services offered by some Bay Area CCAs.

RECOMMENDATION 3

Design incentive programs to include subsidies for technologies that mitigate the need to upsize a panel.

Who's responsible: *California Energy Commission, CPUC, CCAs, Regional Energy Networks such as BayREN, and other entities*

Some incentive programs, including the SGIP-HPWH program from the California Public Utilities Commission (CPUC) and the HEEHR program from the federal government, offer subsidies to upsize electrical panels. Circuit controllers are technologies that control electrical demand from one or two pieces of electrical equipment connected to one circuit. Some models supply power only to one piece of equipment at a time. One such model is the Dryer Buddy, which supplies power to an electric vehicle charger only when the clothes dryer isn't running. Circuit pausers are a bit more sophisticated. They monitor whole-home electrical demand and can throttle or pause supply for a piece of equipment when demand nears the capacity of the electrical panel. Some circuit pausers, such as SimpleSwitch 240, pause power supply to a piece of equipment when a certain threshold is reached; others, such as EVduty, throttle the electric vehicle charger to supply the power available at any time. Most homes can install a circuit pauser and rarely, if ever, have power interrupted to a piece of equipment, given that on average, homes in PG&E territory use just 34% of their panel's capacity.[31]

[31] Home Energy Analytics, "Electric Panel Size and Utilized Capacity," 2023, https://onedrive.live.com/view.aspx?resid=428E7D625E39DE0E!1229&ithint=file%2cxlsx&wdo=2&authkey=!ANWX4i0Lyhf8Fj4.

RECOMMENDATION 4

Issue guidance on how the Electrical Code can be interpreted in ways that promote the installation of zero-pollution technologies without upsizing the electrical panel and service.

Who's responsible: *Building Standards Commission, Office of the State Fire Marshal, and Department of Housing and Community Development for California Electrical Code for residences; AHJs for interpretations of the code in their jurisdictions*

There are two pathways in the Electrical Code for determining the necessary panel and service capacity of homes. The bottom-up pathway, which estimates peak electrical demand for a home on the basis of characteristics including square footage and the rated amperage of the equipment, is found in Section 220.83 for single-family homes and Section 220.84 for multifamily homes. The measured consumption pathway, found in Section 220.87, estimates peak demand on the basis of actual measurements of energy consumption by a home. Using these actual measurements typically produces a lower estimate of peak demand than using bottom-up calculations. But electricians are often prevented from using Section 220.87 because it's interpreted differently in different jurisdictions. Some authorities having jurisdiction (AHJs) will accept easily available smart meter data for Section 220.87 calculations; others require much harder-to-collect types of data. Yet other jurisdictions don't accept Section 220.87 calculations at all. Some AHJs are willing to consider reduced total peak demand through the use of circuit controllers; other AHJs will not. These problems should be resolved with full amendments to the national and California electrical codes, but an expedited way to make progress would be for the California Building Standards Commission, in collaboration with other state agencies, to issue guidance on how to interpret the code. In the meantime, AHJs could act on their own to adopt more electrification-friendly interpretations — namely, they could accept 15-minute smart meter data for Section 220.87 calculations and allow electricians to factor in only the larger of two loads connected to a circuit controller.

RECOMMENDATION 5

Revise the National Electrical Code and California Electrical Code to allow homes to add electrical equipment more easily without triggering panel or service upsizing while maintaining safety standards.

Who's responsible: *National Fire Protection Association for the National Electrical Code; Building Standards Commission, Office of the State Fire Marshal, and Department of Housing and Community Development for the California Electrical Code for residences*

The National Electrical Code and the nearly identical California Electrical Code would benefit from the amendments that Lawrence Berkeley National Laboratory (LBNL) has developed in a set of recommendations for the National Fire Protection Association to consider as it works on the 2026

National Electrical Code. LBNL based the recommendations on studies of energy use in homes and identified changes to the Electrical Code that would allow homes to add electrical equipment more easily without upsizing their electrical panel or service and without compromising safety.

California adopts the model National Electrical Code two years after it's published, and the code goes into effect the following year. That timing means that changes to the 2026 National Electrical Code won't be implemented in California until January 2029. California could fast-track important changes by incorporating them into state code during the intervening cycle update in 2025. California has infrequently deviated from model codes when necessary to deliver on an important policy objective, such as when Governor Brown directed state agencies to change the California Building Code to expedite adoption of sustainable building materials.[32]

RECOMMENDATION 6

Evaluate the feasibility of making electrical service upsizing a cost shared by all ratepayers.

Who's responsible: *CPUC*

When the cost for electrical service upsizing is higher than the utility allowance — usually around $4,000 — the customer must pay the amount over that allowance. It's not known how often customers are paying for service upsizing or how much. Therefore, the total costs for and barriers to building electrification are somewhat unclear. The California Public Utilities Commission (CPUC) should conduct a study to document the frequency and distribution of utility- and customer-borne costs for service upsizing and should forecast how it would impact customer rates to socialize the costs — that is, to shift payment to the utility, which would recover costs through electricity rates paid by customers. At the very least, the CPUC should consider socializing the costs of service upsizing for low-income homes.

RECOMMENDATION 7

Grow the scope and reach of the Switch Is On website as a tool to help building owners find incentives and contractors for installation of zero-pollution equipment.

Who's responsible: *Building Decarbonization Coalition for the Switch Is On, with funding from PG&E, CCAs, cities, local Air Districts, and BayREN*

The Switch Is On helps building owners find installation incentives and request bids from multiple local contractors. Getting multiple bids is one of the easiest ways to control the cost of installing zero-pollution equipment because bids often vary widely.[33] The website SwithIsOn.org is an excellent

[32] Governor Jerry Brown, *Executive Order B-52-18*, https://www.ca.gov/archive/gov39/wp-content/uploads/2018/05/5.10.18-Forest-EO.pdf.

[33] Josie Gaillard and Tom Kabat, "Decarbonizing Single-Family Homes," presented at the County of San Mateo Office of Sustainability Webinar, January 6, 2023, https://www.smcsustainability.org/energy/decarbonizing-homes/.

resource for property owners needing a little help to navigate the home electrification process. Ideally, the Switch Is On would direct people who need more assistance to high-touch offerings such as concierge services and local one-stop shops.

RECOMMENDATION 8

Offer high-touch support such as concierge services or one-stop shops that help building owners navigate available incentives, identify interested contractors and obtain competitive bids, and develop electrification plans.

Who's responsible: *CCAs, cities, and counties*

The process of navigating incentives, finding contractors, selecting the best bid, and installing zero-pollution appliances is perplexing, and some building owners need more high-touch support than they can get from an informational website. Some CCAs are launching programs, including Silicon Valley Clean Energy's concierge service and Peninsula Clean Energy's Home Upgrade program. SF Environment is starting a Climate Equity Hub to provide resources and advice on home electrification. Ideally, these offerings would be available in all nine Bay Area counties, with priority placed on reaching households that are low income, speak English as a second language, or live in disadvantaged communities.

RECOMMENDATION 9

Structure energy rates so that customers don't experience bill increases when electrifying.

Who's responsible: *CPUC and electric utilities*

Electrification's impact on household utility bills depends on many factors, including local rates, time of use, and equipment efficiency. New findings indicate that customers can realize savings on their combined energy bills (electricity plus gas) if they take advantage of the most favorable rate plan offered by PG&E. PG&E recently introduced the Electric Home Rate Plan (E-ELEC) with better rates for electric vehicle, battery storage, and heat pump users.[34] According to an analysis by Silicon Valley Clean Energy and Peninsula Clean Energy, customers consistently saved money on their combined gas and electric energy bills when electrifying if they switched to the E-ELEC rate plan.[35] (Customers on PG&E's Electric Vehicle 2A Rate Plan also saw bill reductions, though not as big as those for E-ELEC customers.) This finding is quite different from findings in the electrification cost-effectiveness studies sponsored by energy utilities. Those studies often found that electrifying home

[34] Pacific Gas and Electric, "Electric Home Rate Plan (E-ELEC)," October 10, 2023, https://www.pge.com/en_US/residential/rate-plans/rate-plan-options/electric-home-rate-plan.page.

[35] Peter Mustacich and Blake Herrschaft, "Bill Impacts of Decarbonizing Existing Single-Family Homes," Silicon Valley Clean Energy and Peninsula Clean Energy, September 2023, https://svcleanenergy.org/wp-content/uploads/SVCE-PCE-Single-Family-On-Bill-Impacts-Results-2023.pdf.

space and water heating would result in bill increases. A key difference is that those studies assumed all customers used the most common rate structure.[36]

Objective 2
Mitigate any cost burden of zero-emission appliance rules on low-income homeowners.

The Bay Area faces an affordability crisis driven by decreasing incomes among the lowest 20% of households on the income scale and by a severe housing shortage.[37] The household income for Black and Latinx households is just 73% to 74% of the overall median, pointing to a racial wealth gap.[38] While about 60% of low-income households in the Bay Area rent, the remainder own their homes and pay directly for new electric equipment.[39] Given the Bay Area's substantial income inequality, low-income households must receive the funding and financing they need to cover at least the incremental cost of installing zero-pollution equipment.

RECOMMENDATION 10

Use incentives to achieve at least cost parity between heat pumps and baseline equipment for low-income households.

Who's responsible: *State legislature and governor, CPUC, and CCAs for electrification funding in California; Air District and Santa Clara County for scoping the Bay Area's proposals for climate pollution reduction grants*

Low-income households need upfront costs for heat pumps to be no higher than replacement costs for their baseline equipment. With the available or forthcoming incentives evaluated in this report, most low-income households should save money by purchasing a heat pump water heater instead of a gas water heater. Low-income households should also experience net savings if they're replacing a central air conditioner and furnace. The story is more complicated for households replacing just a furnace or a furnace plus a room air conditioner with a heat pump HVAC. Some CCAs provide sufficient funding to cover the cost difference; others don't. Options to expand funding include using on-bill financing or inclusive utility investment (described below) and seeking climate pollution reduction grants from the federal Environmental Protection Agency. In addition, CCAs not currently offering incentives for heat pump HVACs could increase their funding.

[36] Frontier Energy, Inc. and Misti Bruceri & Associates, LLC, *2022 Cost-Effectiveness Study: Single-Family New Construction*.

[37] Sarah Karlinsky, *Losing Ground: What the Bay Area's Housing Crisis Means for Middle-Income Households and Racial Inequality*, SPUR, 2023, https://www.spur.org/publications/research/2023-03-07/losing-ground.

[38] Ibid.

[39] SPUR analysis using Total Low-Income Households (under 400% Federal Poverty Line), ACS 2021, Table S1702 and proportions by housing type and tenure from Reem Rayef, *Housing Equity & Building Decarbonization in California*, 2020, https://www.veloz.org/wp-content/uploads/2021/09/Housing-Equity-and-Building-Decarbonization_FINAL_Sept-2020-1.pdf.

RECOMMENDATION 11

Increase the availability of financing options, especially those that serve the needs of households with poor credit that cannot afford the risk of taking on debt.

Who's responsible: *CPUC, electric utilities, CCAs, and local governments*

A variety of financing options for zero-pollution equipment are available. Loans from a bank and the Property Assessed Clean Energy (PACE) program are options for middle- and higher-income households that have strong credit and stable incomes and that can pay back loans with interest over time. Middle-income households can benefit from low-interest loans, such as the zero-interest loans offered by Peninsula Clean Energy.

On-bill financing allows households to pay back the cost of a heat pump on their monthly energy bill. Low-income households benefit most from financing options that they can repay from bill savings so that they aren't taking on an additional expense they can't afford.

Inclusive utility investment (IUI) is a type of on-bill financing in which the monthly repayment amount is capped as a percentage (such as 80%) of expected energy bill savings. A limitation of IUI is that it can be applied only to projects that demonstrate life-cycle cost savings — that is, the customer must save more in utility bills than the additional expense of installing zero-pollution equipment. It hasn't always been possible to show life-cycle cost savings for heat pumps, but that is changing with the rollout of major incentives that reduce their upfront costs and with more electrification-friendly rate structures.[40]

The CPUC is developing a framework for on-bill financing in its Clean Energy Financing Proceeding (Proceeding 20-08-022). It has directed the four largest investor-owned California utilities to work with Silicon Valley Clean Energy to submit an on-bill financing proposal by May 2024.[41] This effort represents a critical opportunity to offer inclusive utility financing to customers of investor-owned utilities. Ideally, publicly owned energy utilities would adopt a similar financing program.

Objective 3
Mitigate impacts on low-income renters and low-cost rental housing.

Approximately 45% of Bay Area residents are renters, and many of these renters are at risk of displacement due to a shortage of affordable housing. If home electrification policies are not designed and implemented equitably and holistically, renters — in particular, low- and moderate-income renters — could face rent increases or evictions, and the Bay Area could lose affordable

[40] Peter Mustacich and Blake Herrschaft, "Bill Impacts of Decarbonizing Existing Single-Family Homes," Silicon Valley Clean Energy and Peninsula Clean Energy, 2023, https://svcleanenergy.org/wp-content/uploads/SVCE-PCE-Single-Family-On-Bill-Impacts-Results-2023.pdf.

[41] California Public Utilities Commission, Rulemaking 20-08-022, *Decision on Clean Energy Financing Proposals*, 2023, https://docs.cpuc.ca.gov/SearchRes.aspx?DocFormat=ALL&DocID=517717993.

rental units if landlords are unable to cover the costs of electrification. On the other hand, leaving rental housing out of the clean equipment transition excludes renters from the air quality and cooling benefits of heat pumps and exposes them to spiraling gas costs as the gas system reaches its end of life. Ideally, the problem of unaffordable rental housing and potential displacement during retrofits would be addressed systemically rather than through narrow approaches tied to electrification programs. Electrification subsidy programs should focus on offsetting any negative impacts on rent, landlords' costs, and utility bills that are specifically caused by electrification.

RECOMMENDATION 12

Improve information on how multifamily landlords can participate in incentive programs.

Who's responsible: *California Energy Commission, CPUC, CCAs, Regional Energy Networks, and other entities that offer electrification incentives*

As challenging as it is for single-family homeowners to navigate the incentive programs for zero-pollution equipment, it can be even harder for the landlords of multifamily properties. Incentive programs often make vague statements that they are for "single-family" or "multifamily" properties without clearly defining those terms. The biggest inconsistency is regarding buildings that are two to four units. Sometimes buildings in this category are eligible for single-family incentives, sometimes they're eligible for multifamily incentives, and sometimes they're left in a no-man's land with no incentive coverage. Moreover, it's not always easy to tell from public materials whether landlords, renters, or people who live in and own their home can apply. Incentive programs should explicitly state whether landlords, renters, or people who own their own homes can apply; whether multifamily or single-family properties are eligible; and how they define multifamily and single family.

RECOMMENDATION 13

In housing that serves a large share of low-income tenants, aim for incentive programs (including IUI programs) to cover most or all electrification costs.

Who's responsible: *Incentive programs*

For deed-restricted and Section 8 housing, along with rent-controlled housing, there are limits on how much rents can be increased to cover capital investments. Landlords would need to cover electrification costs through incentive programs to avoid slashing their operating budgets or needing to sell their property. For housing that has no rent controls or that is subject only to the statewide rent cap under the Tenants Protection Act of 2019, incentive programs should aim to cover most or all of the cost of installing zero-pollution equipment. If subsidies are paired with IUI programs, little or no capital costs should need to be recovered in rent.

RECOMMENDATION 14

For housing where rents aren't controlled or where rents are subject only to the statewide rent cap, design incentive programs that minimize capital costs passed on to tenants in the form of rent increases.

Who's responsible: *California Energy Commission, CPUC, CCAs, Regional Energy Networks, and other entities that offer electrification incentives*

Low-income renters need to be insulated from rent increases that aim to cover the cost of installing zero-pollution equipment. To accomplish this goal, incentive programs targeted at low-income rental housing not already subject to rent control should limit rent increases for tenants, while offering value to the landlord greater than losses in foregone rent. For the 10 years following installation of zero-pollution equipment, incentive programs should set a cap on rent increases that reflects average rent increases for the county plus the portion of capital costs that can't be covered by an incentive program — which ideally would be very little or nothing.

RECOMMENDATION 15

Target funding and financing programs to landlords who have little access to capital, who serve low-income tenants, or both.

Who's responsible: *California Energy Commission, CPUC, CCAs, Regional Energy Networks, and other entities that offer electrification incentives*

So-called mom-and-pop landlords may face resource challenges in making the transition to zero-pollution equipment. Funding and financing programs should prioritize assistance to landlords who have any or all of the following situations: (1) limited access to capital and credit; (2) a high share of rent-stabilized, subsidized, covenant-restricted, or otherwise rent-restricted or publicly incentivized affordable housing; (3) many units at lower-than-average rents for their market; and (4) a high proportion of low-income tenants.

RECOMMENDATION 16

Ensure that electrification incentive programs include outreach and education to tenants to make them aware of their rights.

Who's responsible: *Cities and counties, incentive programs*

Zero-emission equipment incentive programs should provide accurate and easy-to-understand information about tenant and landlord rules and rights in the context of retrofits. Information should be distributed directly to tenants in multiple languages to ensure that it reaches them. Tenant education services should include counseling services, education and outreach, and media campaigns to spread the word.

RECOMMENDATION 17

Protect tenants from "no-fault" just cause evictions for electrification retrofits in subsidy programs.

Who's responsible: *Incentive programs*

"No fault" just cause evictions are evictions that result from causes other than a tenant action. They can include the removal of the unit from the rental market. Subsidy programs should guard against using electrification retrofits as a way of either creating the conditions for constructive eviction (making retrofits take longer than necessary to push tenants out) or removing units from the rental market. Ideally, programs would ensure that retrofits are minimally disruptive and do not result in a no-fault eviction or an Ellis Act conversion of rental units. Landlords should be required to submit plans for any equipment upgrade retrofits, and these plans should cover tenant habitability, including plans to ensure tenant safety or temporary relocation while retrofits are being carried out to prevent constructive eviction.

Appendix A
Plan of Action

Objective 1
Ensure that zero-emission technologies are cost-competitive with gas equipment.

1	Roll out strong standards, such as zero-emission equipment standards, zero-emission building codes, and California's 2030 heat pump installation targets, at the state level to guarantee demand.	**Who's responsible:** California Air Resources Board for its zero-emission equipment standards; California Energy Commission for the Energy Code
2	Offer contractor and homeowner education, including home electrification plans, to avert unnecessary electrical panel and service upsizing.	**Who's responsible:** PG&E's Energy Centers and Home Performance Academy, BayREN, and local union chapters for contractor training; PG&E for the Home Energy Checkup program; BayREN and StopWaste for the Home Energy Score audit program; program administrators for high-touch electrification programs
3	Design incentive programs to include subsidies for technologies that mitigate the need to upsize a panel.	**Who's responsible:** California Energy Commission (CEC), California Public Utility Commission (CPUC), community choice aggregators (CCAs), Regional Energy Networks such as BayREN, and other entities
4	Issue guidance on how the Electrical Code can be interpreted in ways that promote the installation of zero-pollution technologies without upgrading the electrical panel and service.	**Who's responsible:** Building Standards Commission, Office of the State Fire Marshal, and Department of Housing and Community Development for California Electrical Code for residences; AHJs for interpretations of the code in their jurisdictions
5	Revise the National Electrical Code and California Electrical Code to allow homes to add electrical equipment more easily without triggering panel or service upsizing while maintaining safety standards.	**Who's responsible:** National Fire Protection Association for the National Electrical Code; Building Standards Commission, Office of the State Fire Marshal, and Department of Housing and Community Development for the California Electrical Code for residences

Continued →

6	Evaluate the feasibility of making electrical service upsizing a cost shared by all ratepayers.	**Who's responsible:** California Public Utilities Commission
7	Grow the scope and reach of the Switch Is On website as a tool to help building owners find incentives and contractors for installation of zero-pollution equipment.	**Who's responsible:** Building Decarbonization Coalition for the Switch Is On, with funding from PG&E, CCAs, cities, local Air Districts, and BayREN
8	Offer high-touch support such as concierge services or one-stop shops that help building owners navigate available incentives, identify interested contractors and obtain competitive bids, and develop electrification plans.	**Who's responsible:** CCAs, cities, and counties
9	Structure energy rates so that customers don't experience bill increases when electrifying.	**Who's responsible:** CPUC and electric utilities

Objective 2

Mitigate any cost burden of zero-emission appliance rules on low-income homeowners.

10	Use incentives to achieve at least cost parity between heat pumps and baseline equipment for low-income households.	**Who's responsible:** State legislature and governor, CPUC, and CCAs for electrification funding in California; Air District and Santa Clara County for scoping the Bay Area's proposals for climate pollution reduction grants
11	Increase the availability of financing options, especially those that serve the needs of households with poor credit that cannot afford the risk of taking on debt.	**Who's responsible:** CPUC, electric utilities, CCAs, and local governments

Objective 3

Mitigate impacts on low-income renters and low-cost rental housing.

12	Improve information on how multifamily landlords can participate in incentive programs.	**Who's responsible:** CEC, CPUC, CCAs, Regional Energy Networks, and other entities that offer electrification incentives

Continued →

13	In housing that serves a large share of low-income tenants, aim for incentive programs (including IUI programs) to cover most or all electrification costs.	**Who's responsible:** Incentive programs
14	For housing where rents aren't controlled or where rents are subject only to the statewide rent cap, design incentive programs that minimize capital costs passed on to tenants in the form of rent increases.	**Who's responsible:** CEC, CPUC, CCAs, Regional Energy Networks, and other entities that offer electrification incentives
15	Target funding and financing programs to landlords who have little access to capital, who serve low-income tenants, or both.	**Who's responsible:** CEC, CPUC, CCAs, Regional Energy Networks, and other entities that offer electrification incentives
16	Ensure that electrification incentive programs include outreach and education to tenants to make them aware of their rights.	**Who's responsible:** Cities and counties, incentive programs
17	Protect tenants from "no-fault" just cause evictions for electrification retrofits in subsidy programs.	**Who's responsible:** Incentive programs

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