City of SACRAMENTO

Existing Building Electrification Strategy

Final Draft

April, 2024

PREPARED FOR

City of Sacramento

Sacramento City Hall
915 I Street
Sacramento, CA 95814

Existing Building Electrification Strategy

In Consultation With:
Rincon Consultants, Inc.
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INTRODUCTION

Sacramento's Building Electrification Opportunity

WHY IS SACRAMENTO ELECTRIFYING EXISTING BUILDINGS?

Most buildings in Sacramento, and California in general, rely on both electricity and natural gas for energy. Energy consumed in buildings represents one of the largest sources of greenhouse gas (GHG) emissions within the state. With the passage of Assembly Bill (AB) 1279, the State of California codified the reduction of GHG emissions to carbon neutrality by 2045 and is developing strategies to achieve this goal. The City of Sacramento adopted an updated Climate Action & Adaptation Plan in February 2024 that details the City's efforts to support the State goal of carbon neutrality by 2045.The Strategy reflects CAAP direction and early implementation of CAAP Action E-3.1, which calls for the development of a comprehensive existing building electrification strategy that identifies associated costs and addresses potential equity impacts. The City's 2016 GHG Inventory identified buildings as contributing 37 percent of total emissions citywide, making it a critical sector for decarbonization. The Sacramento Municipal Utility District (SMUD) developed the 2030 Clean Energy Vision[1] that outlines a pathway to carbon-free electricity by 2030. This commitment to carbon-free electricity is the backbone of the City's CAAP efforts to achieve carbon neutrality. Based on the scenario planning and emissions strategies developed by the CAAP, reflecting SMUD's 2030 Clean Energy Vision, electrification of Sacramento's existing building stock, by means of replacing natural gas appliances with efficient electric alternatives is a key strategy for achieving the City's climate goal of carbon neutrality by 2045.

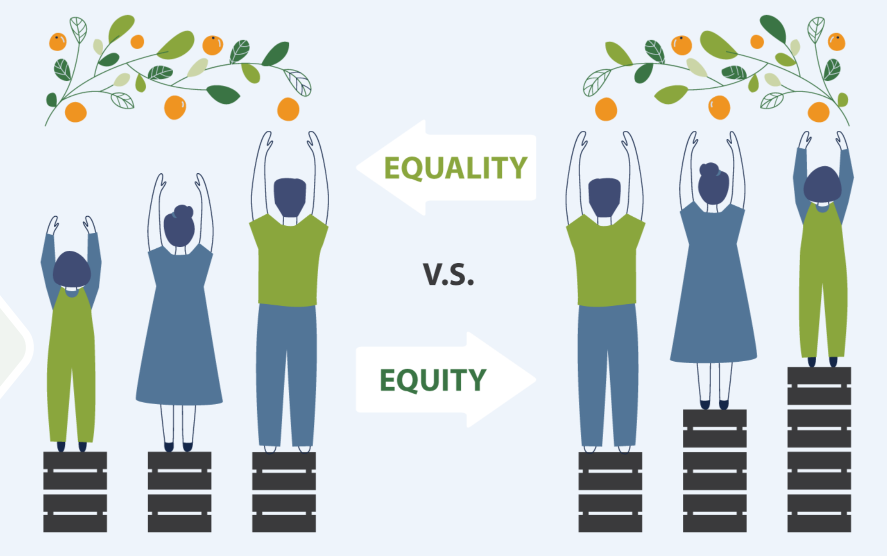
ALIGNMENT WITH THE MAYORS' COMMISSION ON CLIMATE CHANGE: In 2019, the mayors of Sacramento and West Sacramento convened a Commission on Climate Change to chart a path towards carbon neutrality by 2045. The Commission was comprised of 19 representatives from major partners in the region. In addition, dozens of other leaders were engaged in technical working groups on the key topics of equity, mobility, the built environment, community health and resilience, and finance and funding. These technical reports fed into a final Commission report (dated June 2020) that outlines a high-level pathway towards carbon neutrality for Sacramento and West Sacramento. These recommendations include electrification of existing buildings with a goal of transitioning 25 percent of existing residential and small commercial buildings to all-electric by 2030.

1. Accessed at: *https://www.smud.org/en/Corporate/Environmental-Leadership/2030-Clean-Energy-Vision*

Electrification of new construction is becoming common across the state and the City of Sacramento is remarkably well-positioned to be a leader in cost-effectively electrifying existing buildings. In Sacramento, going all-electric is projected to save many residents money through ongoing on-bill utility savings, is critical for achieving climate goals, improves health outcomes for the most vulnerable, helps address the region's long-standing air quality challenges, and establishes the next generation of high-paying jobs. In the Council-adopted Framework for the Electrification of Existing Buildings in the City of Sacramento (Framework),[2] the City emphasized the need for an equitable transition and established the vision of achieving a zero-emission building stock through a collaborative analysis, goal setting, and planning process.

EQUITY DEFINITION: Regardless of one's identity, *equity* is a condition wherein all people have just treatment, access to opportunities necessary to satisfy their essential needs, advance their wellbeing, and achieve their full potential, while identifying and eliminating barriers that have prevented the full participation of some groups (City of Sacramento, adapted from the Government Alliance on Race and Equity definition).[3]

Key equity components of the Framework's goals and objectives focus on minimizing the cost-burden and displacement risk to frontline communities, prioritizing financial assistance and access to health, safety, and cost benefits for those most in need, and engaging with all communities throughout the electrification process. These values formed the foundation for Sacramento's Existing Building Electrification Strategy (Strategy) and were formalized through the development of the equity criteria that guided the strategies and actions included in this report.



2. Accessed at: ***https://www.cityofsacramento.org/-/media/Corporate/Files/CDD/Planning/Major-Projects/Electrification-of-New-Construction/R20210166-Framework-for-Building-Electrification-and-the-Evaluation-of-Water-Conservation--Green-Job.pdf?la=en.***
3. Accessed at: ***https://www.cityofsacramento.org/HR/Divisions/Diversity-Equity#:~:text=The%20City%20of%20Sacramento%20affirms,serve%20all%20our%20diverse%20communities.%20*** (accessed May 2023). The Sacramento Office of Diversity and Equity was created in July 2018. The Race & Gender Equity Action Plan spans 2020-2025.

SACRAMENTO'S UNIQUE ELECTRIFICATION CONTEXT

Electrifying existing buildings in Sacramento offers residents and businesses a critical opportunity to cost-effectively invest in improving the efficiency, sustainability, and resilience of the spaces where Sacramento residents live, work, and play. Sacramento also enjoys some of the lowest electricity rates in California, with SMUD rates averaging approximately 47 percent lower than those of neighboring electricity providers.[4]

According to the California Energy Commission's (CEC) 2019 Residential Appliance Saturation Study[5] (RASS), an estimated 69 percent of Sacramento's 181,000 households use gas for space heating and 67 percent use gas for water heating. These estimates correlate to approximately 125,000 households requiring gas-to-electric retrofits for space heating and approximately 121,000 households requiring gas-to-electric retrofits for water heating. For more information about appliance use in Sacramento, please see the ***Appendix***.

Due to Sacramento's climate that requires large heating and cooling loads, SMUD's competitive electricity rates and rebates, and overall cost-effectiveness of electrification in Sacramento, the City is in a unique position to facilitate building electrification. Electrification not only will cost less than using natural gas for space and water heating but also improve air quality, reduce respiratory health impacts, and improve building comfort.[6] The following considerations demonstrate why electrifying buildings in Sacramento holds significant opportunity for widespread and equitable cost-savings, while delivering a suite of public health and environmental benefits.

- **An unprecedented level of public incentives for electrification** are on the horizon. SMUD, the State of California's TECH program, and federal Inflation Reduction Act rebates currently provide a significant level of incentives for electrification, and additional new federal and State incentives and programs are on the horizon. Sacramento households will have the opportunity to leverage these significant incentives to electrify residential buildings. For low- and moderate-income households, incentives may, in some instances, cover up to 100 percent of up-front costs. For households that fall above moderate income, the combination of up-front incentives and tax credits make the switch cost-comparable to a like-for-like gas replacement in many cases. In addition, due to SMUD's competitive electricity rates, every home in Sacramento is projected to see on-bill savings with full-home electrification. ***Chapter 03*** details information from cost scenarios addressed, as well as a full list of incentives available or planned as of spring 2024.

4. SMUD. March 2023 data. ***https://www.smud.org/en/Rate-Information/Compare-rates*** (accessed May 2023).
5. ***https://www.energy.ca.gov/publications/2021/2019-california-residential-appliance-saturation-study-rass.***
6. Rocky Mountain Institute. March 29, 2021. ***https://rmi.org/eight-benefits-of-building-electrification-for-households-communities-and-climate/*** (accessed May 2023).

- **Sacramento's indoor and outdoor air quality is a long-standing environmental and public health problem.** In 2023, the Sacramento-Roseville Metropolitan Statistical Area ranked seventh in the nation for ozone pollution, and eighth in the nation for short-term particle pollution.[7] Sacramento County also has a higher rate of adult asthma (20.4 percent) than the state (16.1 percent) or United States (14.9 percent).[8] In California, natural gas combustion in buildings releases over seven times as much nitrogen oxide (NO_x) as California's power plants, while also producing carbon monoxide, formaldehyde, and fine particulate matter ($PM_{2.5}$).[9] Building electrification offers a key opportunity to improve health outcomes for all Sacramento residents by removing pollutants produced by natural gas combustion, a key source of both indoor and outdoor air pollution.
- **90 percent of households in Sacramento already have air conditioning.**[10] While many homes have gas-powered heaters, air conditioning units already run on electricity. Sacramento's peak electricity demand occurs in the summer, when residents are running air conditioning units. Building electrification will create a new winter peak, when residents run electric heat-pump heaters, but it is not expected to exceed the existing summer peak. The new winter peak is not expected to be reached until approximately 2040.
- **Sacramento has committed to ambitious climate leadership goals through its CAAP that cannot be achieved without existing building electrification policies.**[11] Existing building electrification is outlined under CAAP Measure E-3: Transition natural gas in existing buildings to ***carbon-free electricity*** by 2045. This measure is one of the most impactful GHG-reduction measures identified to help the City achieve 2030 and 2045 GHG-reduction targets and is forecasted to reduce Sacramento's emissions by 42,451 metric tons of carbon dioxide (MT CO_2e) by 2030.[12]

7. ***https://www.lung.org/research/sota/city-rankings/most-polluted-cities.***
8. Be Healthy Sacramento, Adults, Children and Teens with Asthma data from California Health Interview Survey. ***https://www.behealthysacramento.org/indicators/index/view?indicatorId=2112&localeId=271.***
9. NRDC 2020. ***https://www.nrdc.org/experts/pierre-delforge/gas-appliances-pollute-indoor-and-outdoor-air-study-shows***.
10. ***https://www.energy.ca.gov/data-reports/surveys/2019-residential-appliance-saturation-study.***
11. The full draft CAAP was released in conjunction with the Draft 2040 General Plan in April 2023
12. City of Sacramento Draft CAAP. April 28, 2023. ***http://www.cityofsacramento.org/-/media/Corporate/Files/CDD/Planning/Major-Projects/generalPlan/Climate-Action-and-Adaptation-Plan---April-28--2023.pdf?la=en***.

STATE AND FEDERAL CONTEXT FOR BUILDING ELECTRIFICATION

In addition to unique opportunities supporting equitable electrification in Sacramento, there is tremendous momentum and support for existing building electrification at the State and federal level. The Inflation Reduction Act[13] (IRA) was signed into law in August 2022, initiating substantial federal funding for "Energy Security and Climate Change." The investment includes specific provisions for existing building decarbonization, including:

- $4.5 billion for the High Efficiency Electric Home Rebate Act (HEEHRA), which will provide up-front incentives for low- and moderate-income households to install new efficient electric appliances
- $4.3 billion for Homeowner Managing Energy Savings (HOMES) rebates
- $1 billion for energy efficiency, water efficiency, and climate resilience for Affordable Housing
- Residential Energy Efficiency Tax Credits and Commercial Buildings Energy Efficiency Tax Deductions
- The Infrastructure Investment and Jobs Act (IIJA), also known as the Bipartisan Infrastructure Law, was signed in November 2021, and is among the largest investments in clean-energy infrastructure in American history.[14] It will invest in our power grid, including energy efficiency and clean-energy improvements in homes, schools, businesses, and communities to make them cleaner and more affordable. The IIJA will also fund new programs to accelerate our transition to a zero-emission economy, while also creating high paying jobs and investing in manufacturing in communities across the country. Some IIJA clean energy and power-funding programs that may support Strategy implementation include four major areas:
- ~$21 billion for delivering clean power
- ~$22 billion for clean-energy demonstrations
- $6.5 billion for energy efficiency and weatherization retrofits for homes, buildings, and communities
- $8.6 billion in funding for clean-energy manufacturing and workforce development

13. *https://www.whitehouse.gov/wp-content/uploads/2022/12/Inflation-Reduction-Act-Guidebook.pdf.*
14. *https://gfoaorg.cdn.prismic.io/gfoaorg/0727aa5a-308f-4ef0-addf-140fd43acfb5_BUILDING-A-BETTER-AMERICA-V2.pdf.*

At the state level, the California Energy Commission has allocated significant resources related to building decarbonization including:

- $639 million for the Equitable Building Decarbonization Program,[15] which is a direct installation program that will provide low- or no-cost retrofits for low- and moderate-income households in California, as well as up-front incentives for appliances to reduce GHG emissions in buildings. Guidelines for the Equitable Building Decarbonization Program were adopted in October 2023.
- $68 million for the Industrial Decarbonization and Improvement of Grid Operations Program,[16] which will provide incentives for industrial projects that provide benefits to the electrical grid, and reduce emissions and local air pollution.
- $750 million for California Schools Healthy Air, Plumbing, and Efficiency Program,[17] which includes grant programs to assess, maintain, and repair heating, ventilation, and air conditioning (HVAC) systems in schools.

In September 2022 the California Public Utilities Commission (CPUC) voted unanimously to eliminate subsidies for new gas line extensions, beginning in July 2023. In December 2023, the Commission also voted to eliminate subsidies for electric line extensions for mixed fuel buildings, beginning in July 2024. Meanwhile, electric line extension subsidies will be continued for all-electric buildings. In addition, the CPUC adopted a new framework[18] in December 2022 to plan for the maintenance and retirement of gas distribution infrastructure. However, additional regulatory changes may be needed to enable a managed transition away from the use of natural gas in buildings. Today, Section 451[19] of the Public Utilities Code articulates energy utilities' "obligation to serve", requiring that they "furnish and maintain... adequate, efficient, just, and reasonable service" for customers. This regulation is broadly interpreted as requiring utilities to provide gas service to any customer who requests it, which impedes opportunities for gas infrastructure decommissioning (also known as gas pruning) and subsequent neighborhood scale electrification. Advocacy actions to address this regulatory barrier are included in ***Chapter 04*** and ***Chapter 05***

In September 2022, the California Air Resources Board (CARB) released their 2022 State Implementation Plan Strategy,[20] which includes a zero-emissions standard for space and water heating appliances beginning in 2030 that would prohibit the sale of space and water heating appliances that emit GHGs in the state of California. CARB staff anticipate bringing the proposed regulation to the board for consideration in 2025. Once implemented, this regulation would be extremely supportive of building electrification at the local level.

The state has also adopted two key pieces of legislation to facilitate energy efficiency and decarbonization of large commercial nonresidential and multi-unit residential buildings. The Building Energy Benchmarking program

15. Funding allocation as of March, 2024. ***https://www.energy.ca.gov/programs-and-topics/programs/equitable-building-decarbonization-program.***
16. ***https://www.energy.ca.gov/programs-and-topics/programs/industrial-decarbonization-and-improvement-grid-operations-indigo***
17. ***https://www.energy.ca.gov/programs-and-topics/programs/california-schools-healthy-air-plumbing-and-efficiency-program.***
18. ***https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M499/K396/499396103.PDF.***
19. ***https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?sectionNum=451.&lawCode=PUC.***
20. ***https://ww2.arb.ca.gov/sites/default/files/2022-08/2022_State_SIP_Strategy.pdf.***

was established by the adoption of AB 802 in 2015 and went into effect in 2016.[21] This regulation mandates annual energy benchmarking for commercial non-residential buildings 50,000 square feet and larger and multi-unit residential buildings 50,000 square feet and larger that have 17 or more units. Senate Bill 48,[22] known as the Building Energy Savings Act, mandates utilities to maintain records of energy usage data for all buildings they serve for at least the preceding 12 months and provide this aggregated data to building owners of buildings 50,000 square feet and larger. Additionally, the bill requires the State Energy Resources Conservation and Development Commission (Energy Commission), in collaboration with other state agencies, to develop a strategy by July 1, 2026, to utilize this energy usage data to monitor and manage energy usage and greenhouse gas emissions from covered buildings, aligning with the state's energy and emissions goals. The Energy Commission must submit this strategy and related recommendations for legislative action to the Legislature by August 1, 2026.

While there is substantial momentum and resources behind electrification of new and existing buildings, there have also been some setbacks. On April 17, 2023, the Ninth Circuit Court of Appeals determined that an ordinance enacted by the City of Berkeley that prohibited gas piping in new construction was preempted by the federal Energy Policy and Conservation Act ("EPCA"). Preemption generally means that a law or rule of an inferior government entity is of no effect if it conflicts with a law or rule of a superior government entity. Among other things, the EPCA preempts state and local regulations concerning the energy use of covered appliances. The term 'covered appliances' includes appliances such as water heaters, furnaces, clothes dryers, and kitchen ranges. This ruling has an impact on the legal mechanisms available to the City in its approach to building decarbonization. The policies outlined in ***Chapter 04*** and ***Chapter 05*** reflect this.

21. *https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201520160AB802*
22. *https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=202320240SB48*

BENEFITS OF EXISTING BUILDING ELECTRIFICATION

Electrifying existing buildings offers a host of other well-documented health, safety, and workforce benefits.

Healthy Communities: Electrifying existing buildings can improve both indoor and outdoor air quality, due to elimination of pollutants emitted by natural gas appliances. Ensuring that Sacramento residents and workers breathe clean air is important for public health. The hazardous air pollutants emitted by common natural gas-burning appliances, like nitrogen oxides, sulfur oxides, carbon monoxide, formaldehyde, and particulate matter, are known to increase the risk of respiratory disease. It has been shown that living in a home with a gas stove has the potential to increase children's risk of asthma by 42 percent.[23] These risks primarily occur when homes are improperly vented, or from a gas leak. However, gas stoves also have been shown to leak 12 hazardous air pollutants, including benzene, a chemical known to cause cancer with no safe level of exposure, even when stoves are not in use.[24] Though the process of cooking with heating oils, fats, and other food ingredients in poorly-ventilated buildings can generate indoor air pollution regardless of appliance type; air pollution emitted by gas-burning stoves pose a unique and hazardous additional source of indoor air pollutants.[25] Gas-powered appliances also contribute to poor outdoor air quality, the impacts of which are most pronounced in low-income communities and communities of color.[26] In contrast, all-electric buildings avoid this additional pollution from the combustion of fossil fuels.

Energy Affordability: The cost analysis described in full in ***Chapter 03*** shows that replacing natural gas-powered appliances with electric technology is a cost-effective strategy available to the City to achieve building decarbonization. Electrification can also contribute to long-term energy affordability by protecting ratepayers from future increases in the cost of natural gas. Gas costs are expected to increase over the next several decades as infrastructure maintenance costs will be distributed across fewer natural gas customers as the switch to electric space and water heating accelerates. The CPUC generally allows each gas utility to increase gas rates based on the necessary expenditure to keep gas systems operational. Decreasing natural gas sales combined with sustained infrastructure costs mean that each therm[27] sold must cover more of these costs, leading to escalating consumer costs that have the potential to impact low-income households significantly.[28] According to a 2019 Gridworks study, the cost of natural gas is expected to increase from approximately $1.50 per therm to $19 per therm by 2050 without a managed transition plan.[29] Furthermore, gas rates can be volatile,

23. Weiwei, L., Brunekreef, B., & Gehring, U. (2013). "Meta-analysis of the effects of indoor nitrogen dioxide and gas cooking on asthma and wheeze in children." *International Journal of Epidemiology*, 42(6), 1724–1737. ***https://doi.org/10.1093/ije/dyt150***.
24. Bendix, Aria. (2022). NBC News. ***https://www.nbcnews.com/health/health-news/gas-stoves-leak-benzene-chemicals-linked-cancer-rcna52948.***
25. CARB. Indoor Air Pollution from Cooking. ***https://ww2.arb.ca.gov/resources/documents/indoor-air-pollution-cooking.***
26. ***https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-40.***
27. A unit of heat equivalent to 100,000 British thermal units.
28. Energy and Environmental Economics, Inc. (2020). The Challenge of Retail Gas in California's Low-Carbon Future. California Energy Commission. ***https://www.energy.ca.gov/sites/default/files/2021-06/CEC-500-2019-055-F.pdf.***
29. Gridworks. (2019). California's Gas System in Transition: Equitable, Affordable, Decarbonized and Smaller. ***https://gridworks.org/wp-content/uploads/2019/09/CA_Gas_System_in_Transition.pdf.***

with 2022 winter gas prices spiking to 90 percent higher than 2021.[30] While the cost of electricity may also increase over time, SMUD is a not-for-profit, publicly owned utility with a long history of affordable rates and a commitment to providing safe, reliable, and affordable service to its customers.[31] Upgrading buildings to all-electric is also an opportunity to complete other building upgrades, such as air sealing and insulation, which can reduce energy costs and improve affordability.

Just transition through the creation of high-quality local jobs: New electrification policies and requirements support opportunities for new local jobs and existing local businesses in construction, building trades, and the "clean and green" economy, which are key components of the City's economic development strategy. A recent UCLA study found that electrifying all existing and new buildings in California by 2045 would create over 100,000 full-time equivalent jobs.[32] By being an early leader in existing building electrification, the City of Sacramento can lead the way in this next wave of green job creation.

GHG Reductions: Gas usage in buildings accounted for 14 percent of the City of Sacramento's GHG emissions in 2016.[33] GHG emissions from electricity is projected to decrease to near zero due to SMUD's goal to provide 100 percent GHG-free electricity to the community by 2030.[34] This means that any appliance converted from gas to electric is expected to have GHG-free operation in 2030. SMUD already provides electricity that is more than fifty percent carbon free. Reducing GHG emissions by electrifying space and water heating will contribute to the City's General Plan and CAAP goals to reduce per capita emissions 63 percent by 2030.[35]

30. Morales, Caroline. (2022). Here's why your PG&E gas bill might be high this month. ***https://www.abc10.com/article/news/local/sacramento/heres-why-your-pge-gas-bill-is-high-this-month/103-b1bb2f2e-4a95-4ef1-af92-cbc4bbb65afd.***
31. ***https://www.smud.org/en/Corporate/About-us/Company-Information/Strategic-Direction.***
32. UCLA Luskin Center for Innovation. California Building Decarbonization Workforce Needs and Recommendations. ***https://innovation.luskin.ucla.edu/california-building-decarbonization/***.
33. Quantification of GHG emissions from gas in Sacramento's buildings has been conducted as part of the City's CAAP effort. The plan has not yet been formally adopted by the City, but the City Council is anticipated to adopt the plan in early 2024. The GHG emissions from gas usage in buildings cited here does not include methane leakage.
34. On April 28, 2021, SMUD's Board of Directors adopted the 2030 Zero Carbon Plan, which establishes the commitment to zero carbon for SMUD's energy resources by 2030.
35. A 63 percent reduction below 1990 levels by 2030 is the City's proposed CAAP target as of the time of preparing this document. Final City Council action is anticipated in early 2024.

Strategy Development Framework

The Strategy was developed using a framework that focused the project on the core idea of equity. In addition to being equitable, the Strategy must also be effective and implementable. The Effectiveness Criteria were used in addition to the Equity Criteria to make sure that the benefits of electrification can be fully realized while avoiding negative impacts on other City priorities and projects, as well as on residents and business owners. Criteria were developed with support from community members to define each of these priorities.

Equity Criteria

Affordable and Reliable Energy

Easy and Affordable Installation

Holistic Building Improvements

Culturally Competent Outreach and Education

In addition, the Strategy should support City and regional efforts to:

- Avoid displacement of households and businesses
- Prioritize of low-income and under-resourced communities and small businesses
- Support growth in "green-collar" jobs to create a ladder of opportunity for jobseekers and a just transition for Sacramento's workforce.

Effectiveness Criteria

Cost-Effectiveness

Programmatic Feasibility

Measurable and Sustained Impact

Technological and Regulatory Feasibility

Energy Security

These criteria were used to guide the development of the Strategy. More information on the criteria and their development process can be found in *Chapter 04*.

Prioritizing Vulnerable Communities

In June 2021, City Council adopted Resolution 2021-0166,[36] directing staff to develop a strategy to transition existing buildings to all-electric by 2045. The resolution articulates the vision that "Sacramento's building stock will be zero-emission by first ensuring a collaborative and just decarbonization transition, to bring the benefits of clean, affordable, and resilient energy use to the most pollution- and cost-burdened households." This strategy was also developed as part of the 2021 Climate Implementation Work Plan, which identified a range of priority Climate Action and Implementation Plan actions that should be implemented prior to adoption of the Climate Action & Adaptation Plan (CAAP) and the 2040 General Plan. In addition to the development of this strategy, the City has partnered with SMUD and Habitat For Humanity to implement two (2) full home electrification and energy resiliency projects, which included rooftop solar photovoltaic systems, back-up battery storage, and other critical building repairs. The City has also partnered to install 29 total heat pumps (HVAC and water heaters) in 20 homes, with additional energy efficiency upgrades integrated into these projects. Ongoing work to facilitate electrification of small businesses is taking place in the Northgate Boulevard area. Key partners include Habitat for Humanity of Greater Sacramento, SMUD, and the Sacramento Hispanic Chamber of Commerce Foundation. These pilot projects are grant funded, supporting repairs and retrofits at little to no cost for participants. These City-led pilots in priority neighborhoods complement other residential electrification projects led by SMUD, including a Gardenland neighborhood pilot which was completed in 2023, and a forthcoming electrification pilot for the Meadowview neighborhood that is anticipated to begin in 2024.

The City adopted the 2040 General Plan and the Climate Action & Adaptation Plan in February 2024. The CAAP includes a Climate Change Vulnerability Assessment that identifies key projected climate change impacts in Sacramento and a set of policies and actions to mitigate these impacts, in addition to a dozen Greenhouse Gas reduction measures that will guide Sacramento's path to carbon neutrality in 2045. The General Plan Environmental Justice Element includes commitments to "prioritize investments in infrastructure and interventions that address long-standing inequities, empower disadvantaged residents, and build neighborhood resilience." This Strategy seeks to align with these commitments in its actions to ensure that cost- and pollution-burdened community members realize the economic, environmental, and health benefits available through building decarbonization. In addition, the Strategy will leverage data and analysis compiled in the General Plan and CAAP to help identify communities that may need the most support as we transition to a decarbonized energy future.

36. *http://www.cityofsacramento.org/-/media/Corporate/Files/CDD/Planning/Major-Projects/Electrification-of-New-Construction/Adopted-Resolution-Establishing-Framework-for-Existing-Building-Electrification-6-1-21.pdf?la=en*

Sacramento Building Stock

Sacramento's building stock and energy use sets the stage for building electrification in the city. Understanding the types of buildings, the primary energy source by end-use (e.g., heating, hot water, and process loads like drying and cooking) and building age help the City to understand where to focus electrification efforts to maximize both equity and effectiveness. As part of the Strategy development process, the City completed detailed analysis of Sacramento's building stock. *Chapter 03* and the *Appendix* contain descriptions of the methodology used to analyze Sacramento's building stock and model energy consumption. Although hospitals, schools, and State and federal office buildings are included in the building stock analysis, these building types fall outside the jurisdiction of the City of Sacramento. Decarbonization of buildings outside the purview of the City of Sacramento will require cross-agency communication and collaboration, and policy direction and implementation by these agencies. Several key agencies have set ambitious policy agendas related to building decarbonization, including Sacramento City Unified School District's adoption of carbon neutral goals and guidelines[37] as part of their 2023 Facilities Plan. Actions to support collaboration between agencies in the region are outlined in *Chapter 04* and *Chapter 05*.

XEROHOME

To understand on-bill costs for electrification, the City worked with SMUD and Vistar Energy to develop the XeroHome modeling tool for Sacramento. *XeroHome* creates individual energy models for single-unit homes in Sacramento. Residents can access the model *here* to learn more about their home's specific costs and savings.

37. *https://www.scusd.edu/sites/main/files/file-attachments/10.1_carbon_neutral_goals_and_guidelines_for_scusd_buildings.pdf*

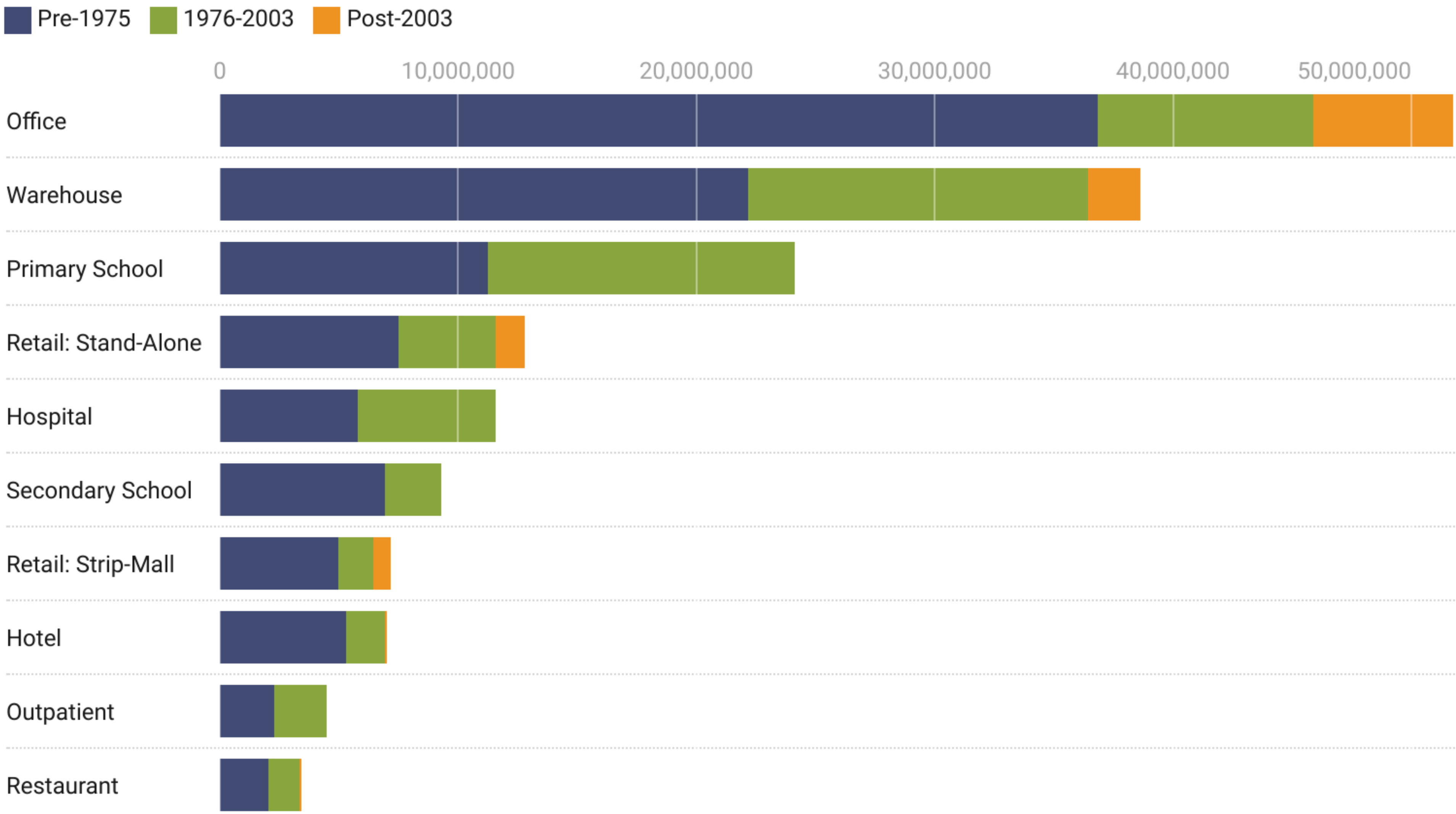
As shown in *Figure 1*, single-unit homes (both attached and detached) comprise 65 percent of Sacramento's modeled building stock by square footage.[38] Multi-unit residential low-rise (three stories and less) comprises the next largest category accounting for 10 percent of total building square footage. High-rise, multi-unit residential over three stories comprise 2 percent of total building square footage, and commercial buildings represent the remaining 23 percent of total building area.

Figure 1. Sacramento's Building Stock Summary (Percent by Square Footage)

Figure 2 shows the distribution of different types of commercial buildings by square footage and year of construction across Sacramento, modeled using ComStock.[39] Offices represent the largest amount of square footage followed by warehouses and then primary schools.[40] In addition to square footage, *Figure 2* also shows the age of these buildings. Age of building (referred to as "building vintage") can help inform logistical considerations for electrification, with older buildings sometimes requiring more electrical work to replace natural-gas appliances with all-electric appliances. These considerations are described further in ,*Chapter 03* and also in the *Appendix*. In Sacramento, most commercial buildings were built prior to 1975 (62 percent), while only 6 percent were built after 2003. This represents a challenge and opportunity for commercial building electrification with buildings in need of new, energy-efficient technologies that might also need supportive infrastructure upgrades.

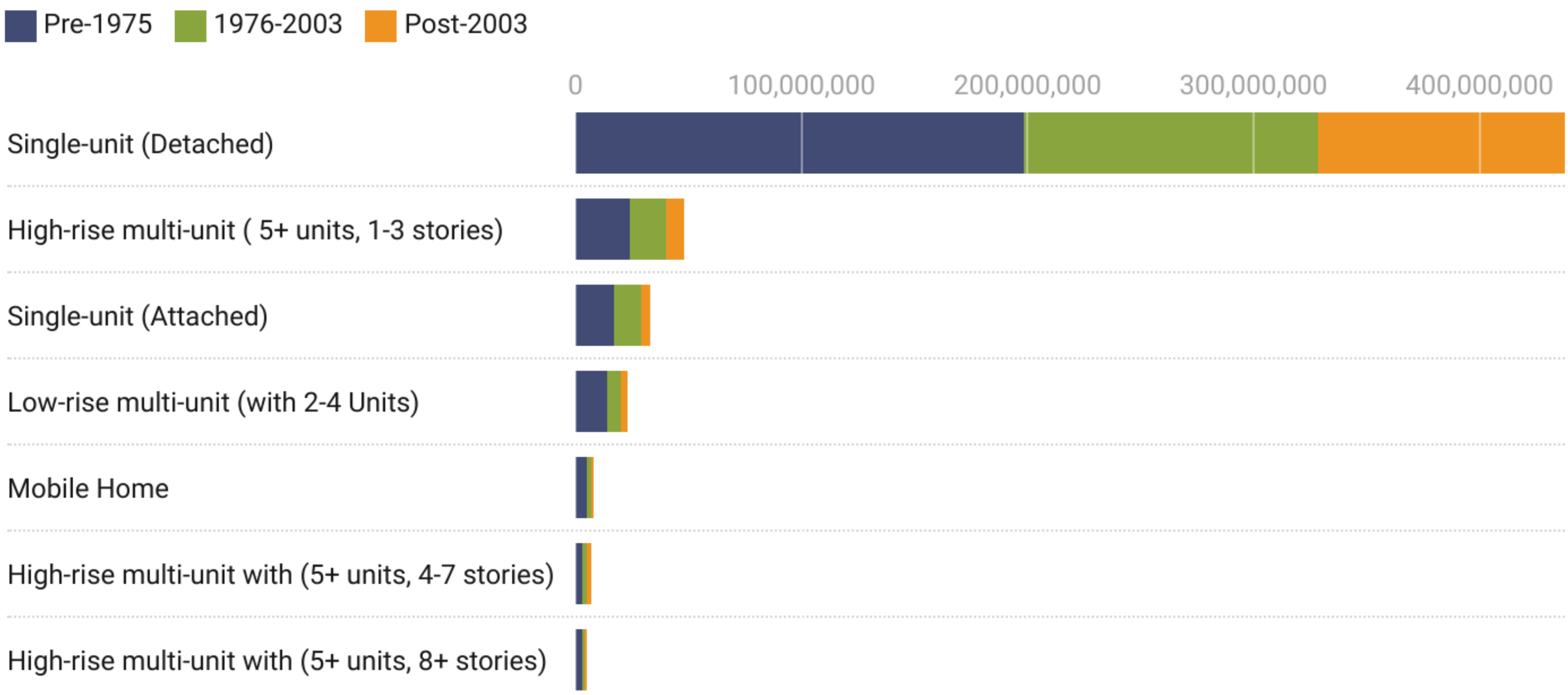
38. National Renewable Energy Laboratory. ***https://resstock.nrel.gov/.***
39. National Renewable Energy Laboratory. ***https://www.nrel.gov/buildings/comstock.html.***
40. Primary schools are not under the City of Sacramento's purview.

Figure 2. Sacramento's Commercial Building Stock by Year of Construction (Square Feet)



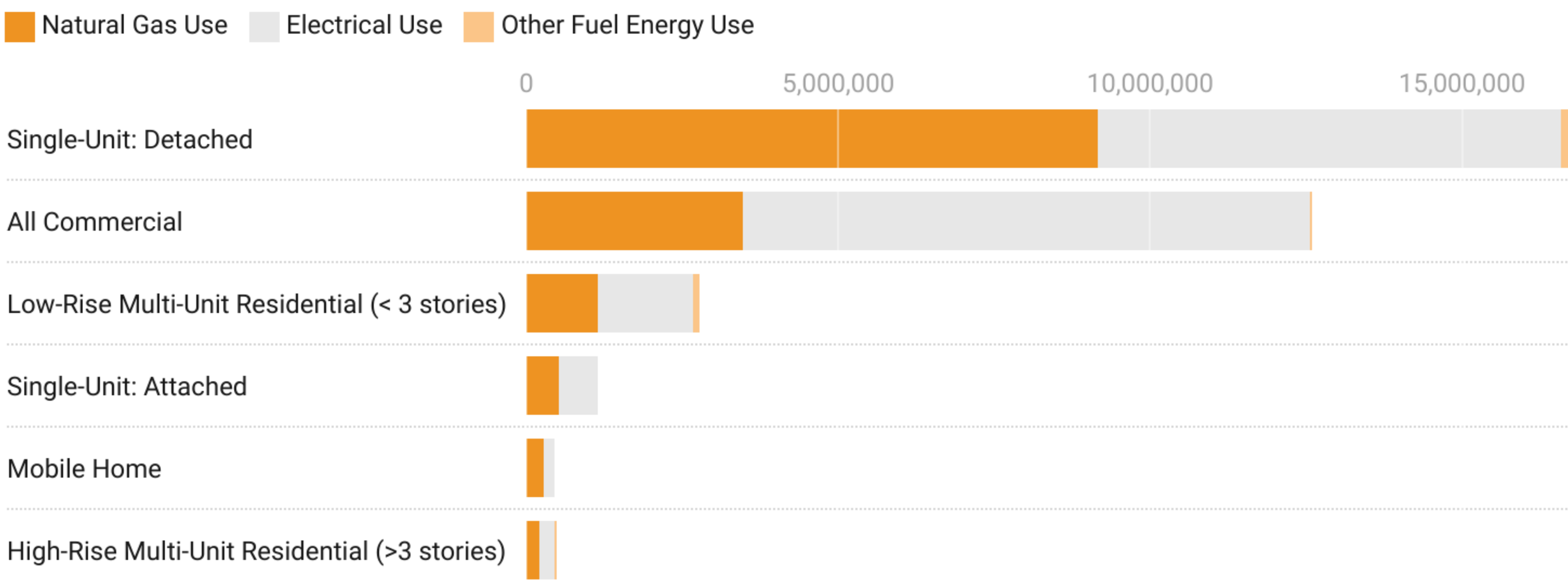
Single-unit detached homes are by far the most common residential building type in Sacramento. Single-unit homes make up 78 percent of residential square footage and 65 percent of total building square footage in the city. ***Figure 3*** shows the building vintages of residential buildings in Sacramento. Residential buildings built in the 1970s or later are more likely to have electrical panels 100 amps or larger, which decreases the likelihood of needing a panel upgrade to enable full building electrification. For more information about panel sizing/upgrades, see the ***Appendix***.

Figure 3. Sacramento's Residential Building Stock by Year of Construction (Square Feet)



While square footage and building vintage provide important context about the building stock, analyzing energy consumption by building type illustrates where the majority of natural gas is being consumed. ***Figure 4*** displays energy consumption data provided by the ComStock[41] model, which shows single-unit detached homes in Sacramento contributed the vast majority (62 percent) of natural gas use in the city. All multi-unit residential combined consumes 9 percent of the total, while all commercial building types combined use 23 percent of the total natural gas use across the city. Additional information about implications of building vintage can be found in the ***Appendix***.

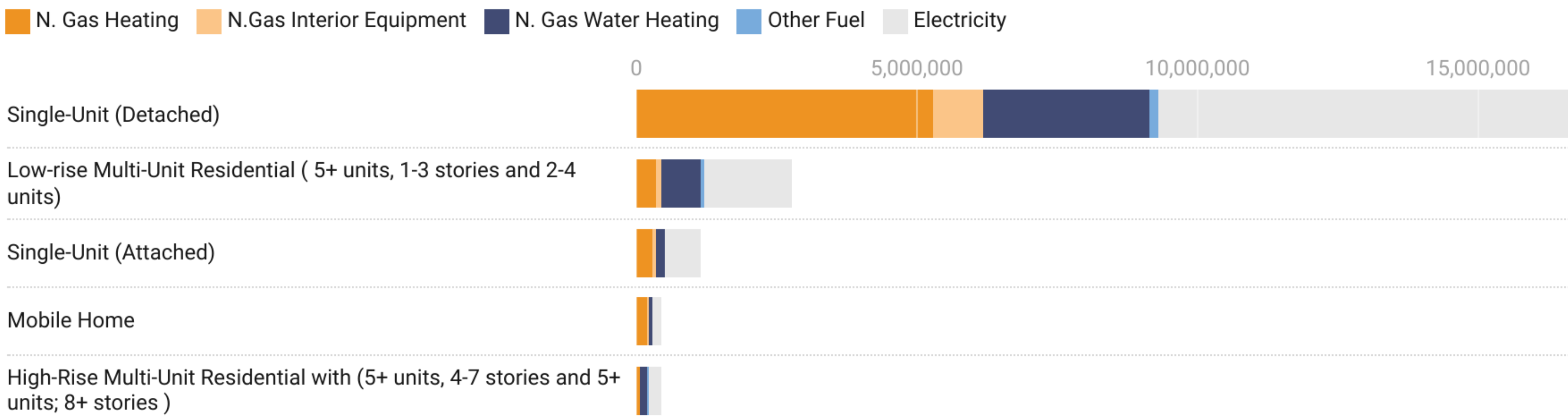
Figure 4. Total Sacramento Energy Use by Building Type (MMBtu/Year)



41. National Renewable Energy Laboratory. ***https://comstock.nrel.gov/***.

Among residential buildings, natural gas consumption is driven by single-unit detached homes. These homes use the most natural gas for space heating, followed by water heating, and then a relatively small amount for cooking, clothes drying, and other uses. For multi-unit homes and condos (attached single-unit), water heating represents the largest natural gas use. This is due to the increased efficiency of heating multi-unit homes, since each unit has less building envelope exposed to the outside air. *Figure 5* displays this breakdown of residential building energy use.[42]

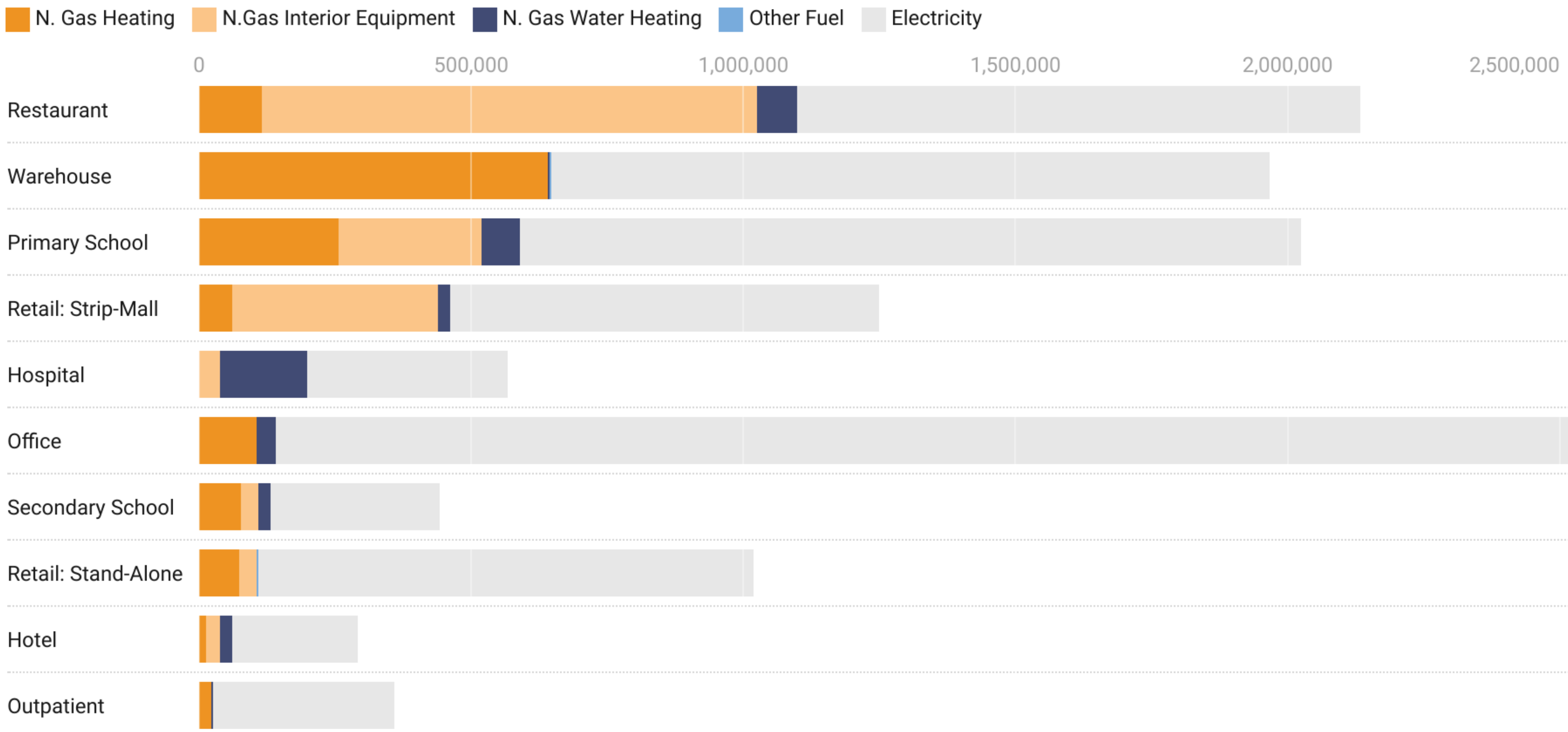
Figure 5. Residential Building Energy Consumption by End Use (MMbtu/Year)



Commercial building natural gas consumption varies by building type. As shown in *Figure 6*, the largest users of commercial natural gas in the city of Sacramento are restaurants (full service, quick service, and retail strip mall) for cooking equipment, warehouses for space heating, and primary schools for space and water heating, as well as cooking.

42. Note that high-rise multi-unit residential with (5_ units, 4-7 stories and 5+ units, 8+ stories is a comparatively small contributor of energy consumption by end use, as represented in *Figure 5*. Values for energy consumption by end-use (MMbtu/Year) are called out here for clarity: N. Gas Heating: 44,741, N.Gas Interior Equipment: 19,283, N. Gas Water Heating: 125,049, Other Fuel: 13,235, Electricity: 244,161

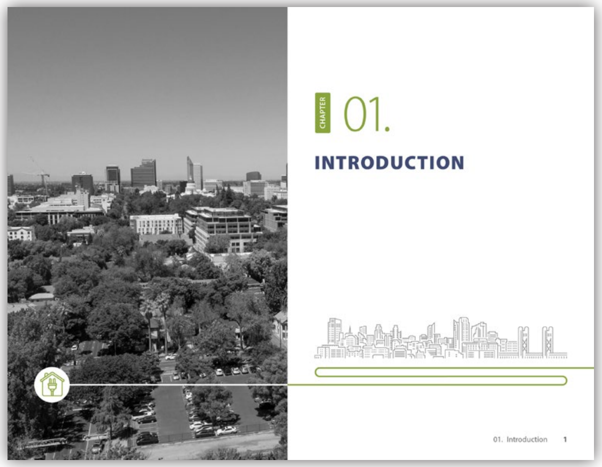
Figure 6. Commercial Building Energy Consumption (MMbtu/Year)

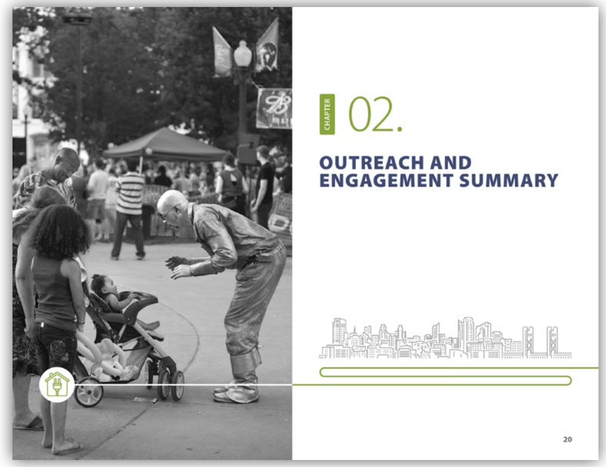


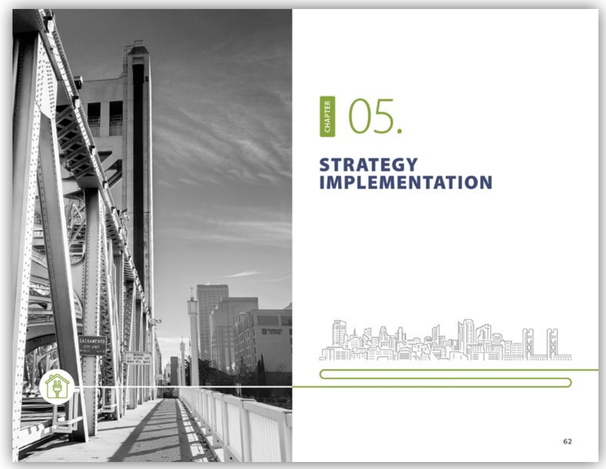
Natural gas consumption by building type provides context on where the most natural gas is consumed in the city and shows key areas where the required GHG reductions could be achieved. ***Chapter 03*** describes the cost and energy modeling analysis that was completed to provide additional information on costs, paybacks, and technological feasibility to further inform the strategies and actions that are presented in ***Chapter 04***.

Reading this Document

The Strategy is divided into five chapters and includes a technical ***Appendix***. ***Chapter 02*** summarizes the outreach efforts that informed the Strategy. ***Chapter 03*** covers cost analysis and energy modeling results. ***Chapter 04*** outlines core policies and supporting actions, and ***Chapter 05*** details the implementation timeline and implementing departments.







CHAPTER 02.

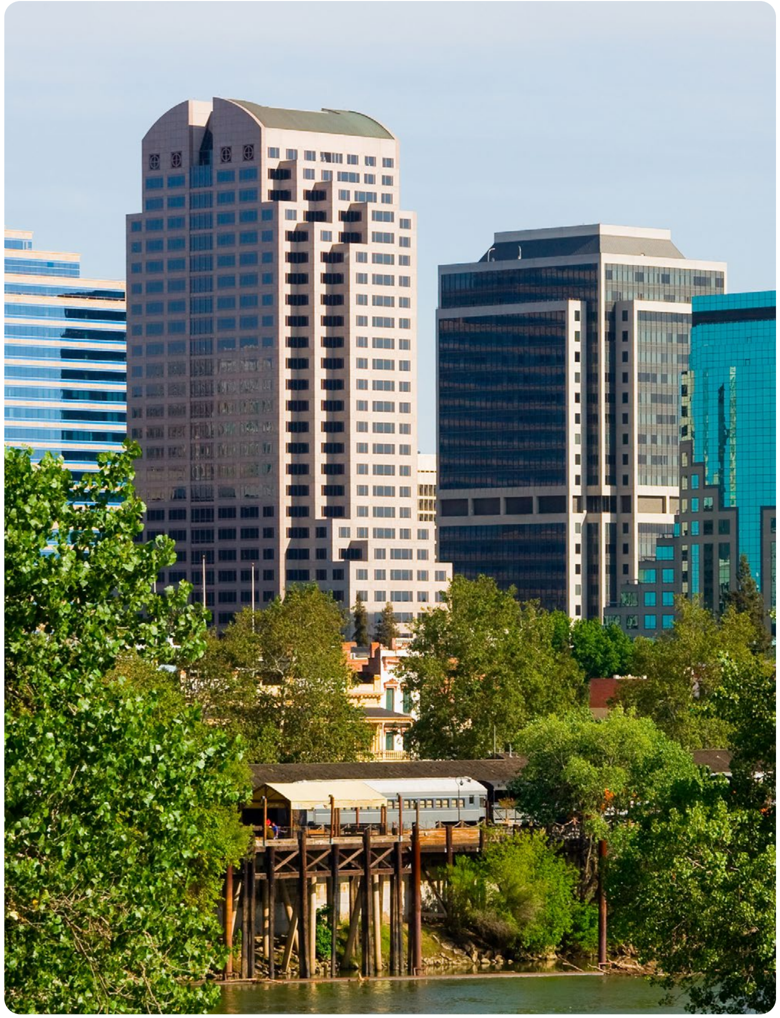
OUTREACH AND ENGAGEMENT SUMMARY

The Strategy was informed by an extensive equity-focused community engagement process that brought community members into the project early and often. The input received played a critical role in informing the equity and effectiveness criteria, as well as the resulting policies. Outreach and engagement achieved key objectives of community education, generating support and buy-in and ensuring that equity is foundational to the Strategy.

Community engagement was informed by these objectives:

- Build a strong understanding at the community level of the electrification process, up-front costs, long-term economics, benefits, and relevance to GHG reduction targets
- Enhance community partnerships to support future policy implementation
- Work with the community to define equity, identify community concerns and risks to the strategy, and develop equity and effectiveness criteria based on the community's input to inform and drive the policy and program development
- Identify community-identified priorities and incorporate those priorities into the developed policies and programs
- Promote community ownership of the Existing Building Electrification Strategy, with community feedback as a critical part of the planning and implementation process
- Develop an equitable electrification strategy governed by the Equity Criteria

At the start of the project, a Community Engagement Plan was developed to direct the overall outreach approach. The Plan was designed to account for public concerns regarding the COVID-19 pandemic, with an abundance of caution for public health and safety, though several in-person events were held later in the outreach process when conditions were determined to be safe.



Outreach Phases and Approach

The Strategy outreach was conducted in two phases. Phase 1 focused on collecting community and stakeholder feedback to shape the equity and effectiveness criteria. These criteria were then used to select strategies for building electrification. Phase 2 focused on community and stakeholder feedback for the primary strategies and supporting actions for building electrification, ensuring that the selected strategies and actions met the needs of the community and were consistent with the community-informed equity and effectiveness criteria from Phase 1. The following section provides an overview of the outreach conducted during each phase.

PHASE 1 OUTREACH: SHAPING EQUITY AND EFFECTIVENESS CRITERIA

Phase 1 outreach focused on introducing the concept of existing building electrification and working with the community to shape the equity criteria that were later used to select and prioritize building electrification policies and supporting actions. This phase of outreach focused on the general public, environmental justice, housing and climate advocates, as well as other contributors from the business community. The following section outlines key actions and feedback themes from Phase 1.

City staff convened a range of workshops, speaking events, and meetings in collaboration with key stakeholders and community partners to introduce electrification and to elicit input on the equity criteria. These events included:

- Citywide Virtual Workshop in June 2022 to introduce the project and elicit feedback on the equity criteria
- Focused meetings with key stakeholders, including restaurant representatives, housing advocates, climate and environmental justice advocates, and representatives from Property and Business Improvement Districts (PBID) and Chambers of Commerce
- Ongoing working group meetings focused on core issues:
  - Sacramento Clean and Green Workforce Working Group
  - CRCRC Building Decarbonization Working Group

Panel discussions:

- Sacramento Association of Realtors Electrification Panel
- Valley Vision's Energy Construction, and Utilities Advisory

The Neighborhood Development Action Team (NDAT) Community Ambassador Program[43]

- An informational flyer and survey was translated into Vietnamese with support from the Community Ambassadors, and a Vietnamese Language Workshop focused on Vietnamese restaurant owners and operators was convened. Surveys were also translated into Spanish and both translations were distributed at City of Sacramento Community Centers, though participation was very limited.

43. The NDAT Community Ambassador program is a language justice program created to facilitate multicultural bridge-building to create and maintain relationships with community partners, businesses, and residents who represent linguistically diverse populations and/or historically underrepresented communities.

Focus group meetings were organized by the City's community-based organization (CBO) partner, Sacramento Area Congregations Together (Sacramento ACT) and convened environmental justice, climate, and affordable housing advocates to provide feedback on the draft equity criteria, as well as to promote awareness of existing building electrification as a whole.[44] These focus groups provided an opportunity for dialogue on equity priorities, key electrification issues, and policy opportunities.

- **Mini-grants:** The City provided $6,000 in mini-grants to facilitate this focus group series in partnership with Sacramento ACT. The focus group series connected City staff with climate, environmental justice, and housing advocates and provided support for participation.

44. Community outreach conducted with Sacramento Act was supported by and funded through the Rocky Mountain Institute Equitable Home Electrification Cohort. As part of the Cohort, the City of Sacramento and Sacramento ACT met monthly with participants from around California. The City and Sacramento ACT then applied for and was awarded more funding to continue collaboration, developing a plan together for two additional listening sessions and workshops with congregations in Sacramento.

KEY COMMUNITY PARTNER: SACRAMENTO ACT

The City of Sacramento participated in the California Equitable Home Electrification Program, a learning cohort convened by RMI and the Emerald Cities Collaborative. Municipalities across California were paired with local community-based organizations and together completed a 6-month program to support the development of an equitable building electrification strategy. Sacramento ACT was the City of Sacramento's community partner for the RMI program. Sacramento ACT has continued to engage with the City's electrification outreach efforts since with support from a mini-grant and additional funding secured through RMI. Sacramento ACT is a multi-racial, multi-faith organization that advocates for community transformation to create justice and equity rooted in shared faith values. Sacramento ACT's members represent 60,000 families in Sacramento County, through the inclusion of 56 member neighborhood groups, schools, and congregations. Sacramento ACT's organizing is focused on communities of color who have experienced historical discrimination and disinvestment.

Sacramento ACT selected Existing Building Electrification as a key issue for 2022 and was instrumental in convening key stakeholders and sharing information about existing building electrification with its members and beyond. For more information visit *sacact.org*.

Feedback received in the Phase 1 outreach was fundamental to the development of the Equity Criteria that were used to inform the policies and actions selected for the strategy. Key feedback themes from the Phase 1 Outreach are summarized below.

- Community members identified the need for a tailored approach for residential and commercial buildings. Small residential buildings are relatively straightforward to electrify, but commercial buildings are more complex, especially when they have difficult-to-electrify end uses, such as commercial cooking equipment. Thus, the strategy should take a different approach for residential and commercial buildings.
- Community members expressed concern about the cost of retrofits. Many low-income households and small business owners cannot afford high up-front costs, and any requirements implemented by the City should not be financially burdensome to individuals, particularly those from vulnerable communities. Individuals may be distrustful of incentive programs and may not know how to navigate complex logistics. Incentive programs were seen as valuable, but only if individuals know how to access them and the requirements are not onerous.
- Community members expressed the idea that older homes pose unique challenges, including the need for panel upgrades and additional repairs in order to maximize benefits of electrification. (Current analysis indicates that panel upgrades are not needed in many cases. Please see the ***Appendix*** for more information about building vintage and panel upgrades.)
- Many community members were interested in electrifying but were overwhelmed by the idea that they would need to upgrade their panels and complete other costly improvements in order to install electric appliances. Outreach events provided opportunities to share information with participants about options for avoiding the need for panel upgrades.
- Community members expressed interest in commercial cooking equipment and other specialized end uses. There are no commercially available induction wok burners, so the impact on Asian restaurants was of particular concern. Community members shared that electrifying commercial cooking equipment may be cost prohibitive, and immediate transition was not feasible for restaurant owners and operators, as they emerge from the difficulties created by the pandemic.
- Community members expressed concern about impacts to renters/incentives for building owners.
  - Building electrification should not be used to raise rent or evict tenants.
  - Building owners do not have an incentive to make these upgrades, because utility bill benefits would go to the tenant.
- Climate, health, and utility bill savings were cited as most important motivators for electrification.
- Up-front cost and preference for gas stoves were cited as the biggest barriers to electrification.

PHASE 2 OUTREACH: COLLECTING FEEDBACK ON PROPOSED POLICIES

Phase 2 outreach built on the community relationships from Phase 1 to raise community awareness on proposed strategies and actions, which at the time of phase 2 outreach included:

- Electrify on replacement for HVAC and water heaters in single-unit residential and small multi-unit residential
- Electrify on replacement for rooftop package units
- A phased building performance standard for commercial buildings and large multi-unit residential buildings.

This package of policies was revised based on community input and legal and regulatory context, and is detailed in ***Chapter 04*** and ***Chapter 05***. In addition to influencing the policy direction for the strategy, feedback received in Phase 1 informed the outreach approach for Phase 2. Based on community feedback, separate online webinar-style workshops were held to present key findings and primary strategy proposals under consideration for both residential and commercial building electrification strategies. The tailored presentations and discussion gave stakeholders the opportunity to engage on the issues that were most relevant to them. This outreach phase brought together the general public, unions, climate advocates, and other key local stakeholders to discuss and receive feedback on proposed policies and supporting actions.

City staff convened a range of workshops, speaking events, and meetings in collaboration with community partners, the public, and key stakeholders including:

- **Two citywide virtual workshops** in March 2023. One focused on residential electrification, on March 1, and the other focused on commercial electrification, on March 8. Recordings of both workshops, with supporting materials, are available on the project website.
- **Focused meetings** were held with key stakeholders, including real estate representatives, climate and environmental justice advocates, union representatives, and representatives from PBIDs and chambers of commerce.
- **Focus groups** were held in October 2022 and February 2023, in partnership with Sacramento ACT, that reconvened environmental justice, climate justice, and housing advocates to share high-level policy ideas and receive feedback on the strategy.

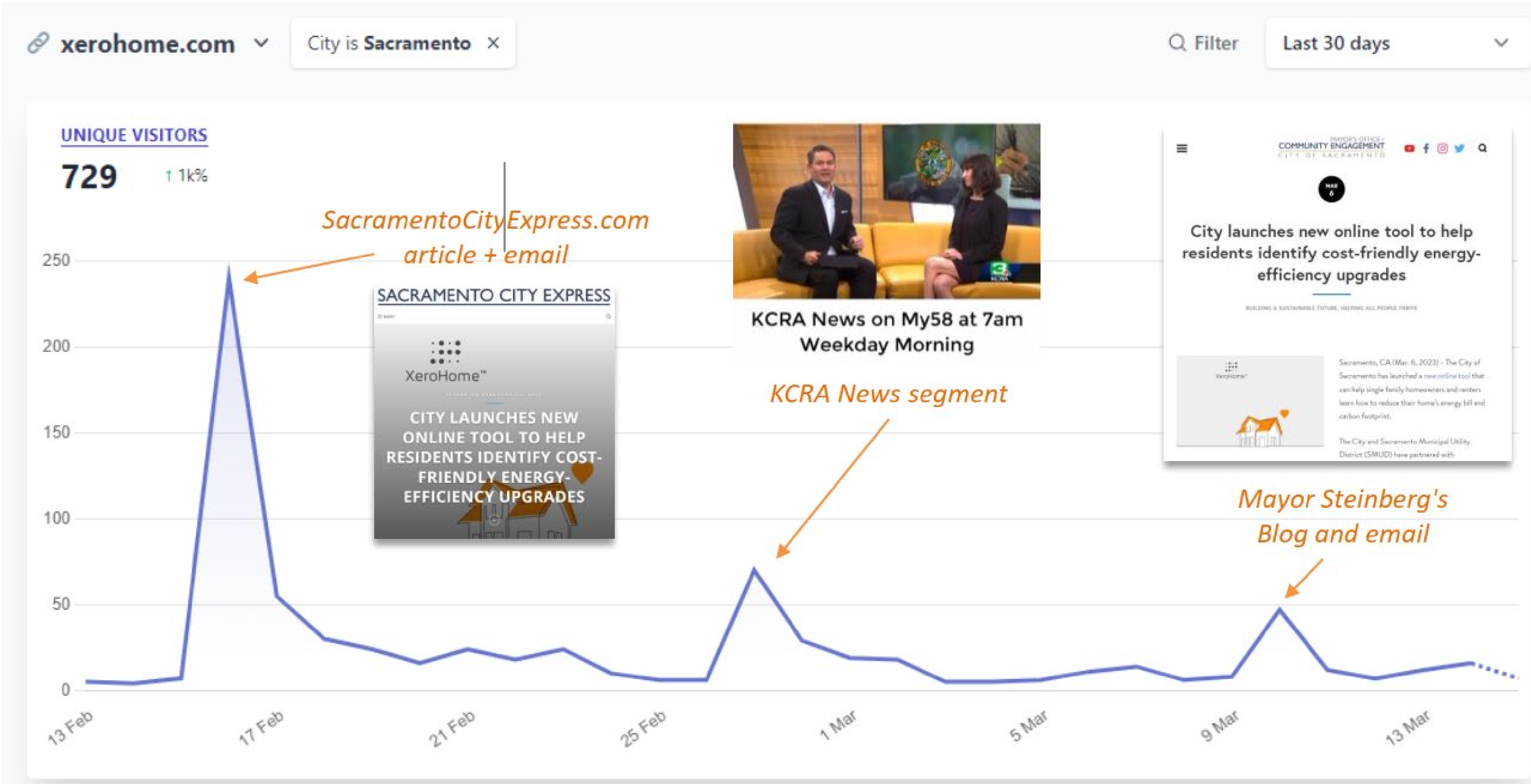
Key feedback themes from Phase 2 outreach:

- **It is critical for the City to connect community members with available incentives.** In-language materials and community partnerships are essential to communicating information about incentives to our diverse community members.
- **Community members raised questions about grid preparedness/resilience.** There is a widespread view that grid infrastructure improvements will be needed in order to support electrification. SMUD participated in many Phase 2 outreach efforts and shared information about grid planning efforts with community members.
- **Phase 2 outreach was completed following a series of winter storms, which left many Sacramentans without power.** Individuals expressed concern about power outages and reliance on a single energy source.

- **Community members expressed the need for a phased approach for commercial buildings.** Cost-effectiveness of commercial building electrification is unclear, and the approach should be driven by economic benefit to building owners. Commercial buildings are more complex and require site-specific solutions. There is no 'one-size-fits-all' approach for commercial buildings. In addition, individuals expressed that in situations where infrastructure improvements, such as new transformers, are needed, investments could be cost and time prohibitive. XeroHome is a web-based application that gives individual homeowners an address-level cost-analysis tool for single-unit homes to gauge individual home carbon footprints, utility bills, and investment recovery of home electrification. Phase 2 outreach included information about XeroHome, with an aim to encourage as many Sacramento residents as possible to use the tool to run unique cost analyses on electrifying their home. Resident use of XeroHome is critical to raising awareness that the policy options being posed for building electrification are cost-effective and can even lead to cost savings, combatting a potential misperception that building electrification policies will burden Sacramento residents with additional costs.

Outreach conducted specifically on the XeroHome tool, and the project in general, was completed through online channels, including the City's website and email lists, through news outlets and through a blog post and email blast from Mayor Steinberg's office. These outreach touchpoints drove new community members to the site as shown in ***Figure 7***. SMUD has partnered with the City of Sacramento to make XeroHome available for a limited duration. More information about XeroHome can be found in ***Chapter 03***.

Figure 7. XeroHome Outreach through March 16, 2023

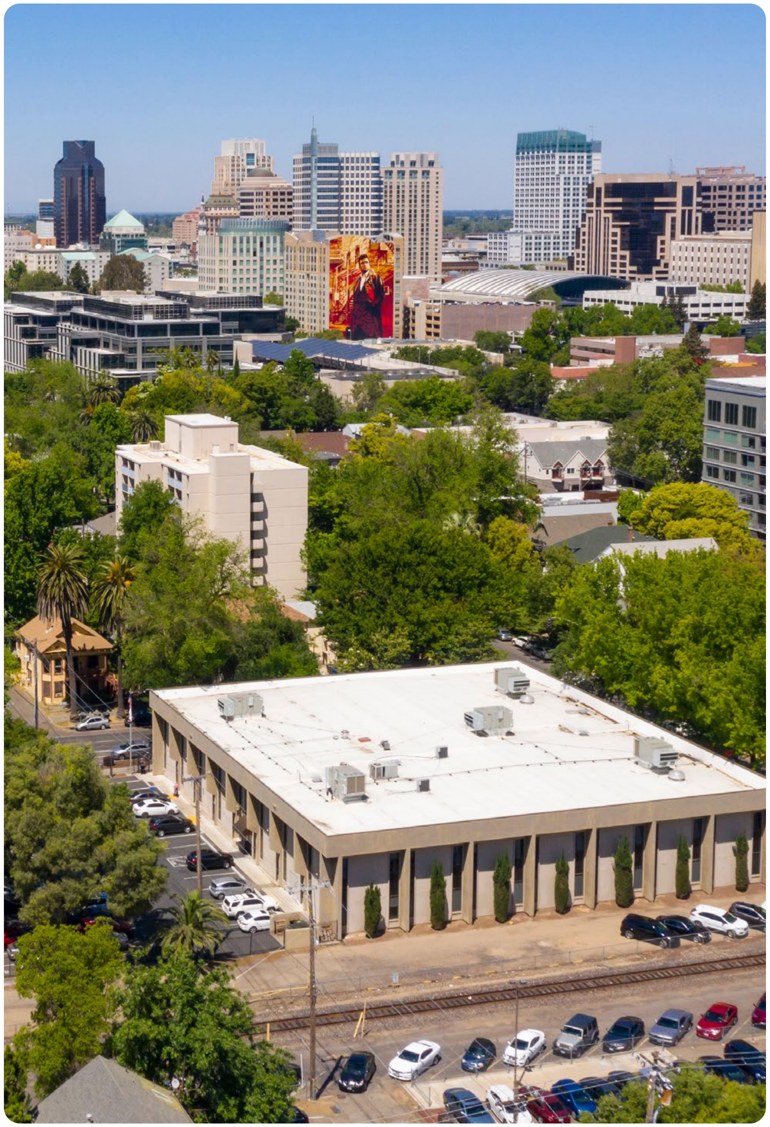


PHASE 3 OUTREACH: PUBLIC REVIEW OF THE DRAFT STRATEGY

In August, 2023, the City published the draft Existing Building Electrification Strategy for extended public review. The comment period was open from August 17th, 2023, to January 15th, 2024. Staff received 123 comments from 13 commenters using the online platform Konveio, as well as 11 comment letters. Staff have revised the document based on public input.

Key Feedback Themes from the phase 3 outreach:

- **Up front cost estimates:**
  - Community members raised questions about the cost estimates in ***Chapter 03*** of the strategy.
  - Several commenters shared information about unique characteristics of their homes, which might make it more costly for them to electrify.
  - Several commenters highlighted questions about how long incentives will be available.
- **Industrial decarbonization:**
  - Several industrial businesses in Sacramento submitted comments, highlighting the challenges of decarbonizing industrial process loads.
- **Impacts to rental property owners:**
  - Several building owners of small-scale rental properties raised concern about burden to 'mom and pop landlords' due to the 'split incentive,' where property owners must pay for the up-front cost of equipment but may not receive the benefit of reduced utility bills.
- **Grid preparedness:**
  - Community members asked questions about whether our electric grid is ready for the transition to all-electric buildings.



HOW COMMUNITY ENGAGEMENT SHAPED THIS STRATEGY

Feedback received during the outreach process was instrumental in shaping the Existing Building Electrification Strategy. *Table 1* documents key feedback themes and how the feedback is reflected in the strategy document.

Table 1. Community Feedback Strategy Incorporation

Key Feedback Theme	How Feedback is Reflected in the Strategy
Up-front Costs	The cost estimates in *Chapter 03* were initially developed through a series of contractor interviews conducted in the early stages of the project. Commenters on the public review draft suggested that the cost estimates were unrealistically low. To improve the cost estimates for the final draft of the strategy, staff incorporated cost data from the state's TECH program, as well as updated desktop research on costs of non-permitted equipment (stoves and clothes dryers). To improve access to cost estimates and information about available incentives, the City has partnered with SMUD to make the XeroHome tool available to all residents in the City for a limited duration.
Commercial vs. Residential Buildings	The strategy takes a two-pronged approach—with different foundational strategies for residential and commercial buildings. The commercial building strategy is largely non-prescriptive and allows building owners flexibility to choose which systems to decarbonize first and reduce pressure on hard-to-electrify equipment. The residential strategy relies on the time of replacement strategy to avoid unnecessary up-front costs that allow households to electrify at the time they would otherwise choose or need to replace existing gas appliances, with encouragement for Sacramento households to replace equipment prior to failure to avoid emergency repairs and to take maximum advantage of currently available incentives and rebates for electric appliances.
Cooking Equipment	The strategy does not include any requirements for stoves. Action R-2 and Action C-14 focuses on collaborating with local chefs to develop an innovation kitchen pilot in order to train local chefs on electric cooking. Building Performance Standards (*Chapter 04* and *Chapter 05*) are a phased approach that would allow commercial buildings containing restaurants to focus on electrifying space and water heating first to meet performance requirements.
Panel Upgrades	There have been great improvements in efficiency of appliances and load-sharing devices, which reduces the likelihood that panel upgrades will be needed. In addition, the strategy prioritizes connecting individuals with available incentives, including incentives for panel upgrades and rewiring through SMUD and the Inflation Reduction Act (Community Engagement Actions F-2-F-5).

Key Feedback Theme	How Feedback is Reflected in the Strategy
Tenant Impacts	Avoiding displacement for households and businesses was identified as a key equity priority. While the Existing Building Electrification Strategy cannot independently generate tenant protections, the strategy identifies supporting actions to coordinate and share informational resources about Sacramento's Tenant Protection Program (actions R-17) and to advocate for the incorporation of tenant protections in direct install pilot programs (R-18). Furthermore, the primary strategies are not anticipated to increase the likelihood of displacement.
Industrial Decarbonization	Decarbonization of industrial and manufacturing facilities was identified as a key challenge in our path to all-electric buildings, due to the lack of feasible electric alternatives for high heat industrial process loads. This highlights the need for specific approaches tailored to meet the needs of industrial businesses in Sacramento. Staff added action C-10 to support decarbonization of industrial processes.
Data Collection and Tracking	The importance of tracking our progress toward decarbonization goals was highlighted by a number of commenters on the draft strategy. In response, staff added an additional section to the foundational actions included in the strategy focused on data collection and tracking (actions F-25, F-26, F-27 and F-28)
Small Rental Property Owners	Owners of small-scale rental properties were identified as an important and potentially challenging group to reach, due to the 'split incentive,' where property owners are faced with the up-front cost of equipment replacement but may not reap the utility bill benefits. Staff revised action R-16 to reflect information sharing with all residents, and revised action R-2 to include information sharing about electrification incentives with property owners through the Rental Housing Inspection Program.

CHAPTER 03.

COST-BENEFIT ANALYSIS AND ENERGY MODELING RESULTS

Introduction and Summary

In order to understand the costs and benefits of existing building electrification in Sacramento, energy modeling and cost analysis were completed through a multifaceted approach based on building type. The results of the modeling provide insight regarding the cost-effectiveness and benefits of electrification in Sacramento. The electrification of single-unit and small multi-unit homes in the city of Sacramento was found to be cost-effective relative to replacement with like-for-like gas appliances. In comparison to baseline utility costs, 100 percent of the homes modeled are expected to see on-bill savings after electrification of their HVAC and water heaters. When incentives from SMUD and the IRA were included, many homeowners are estimated to pay less for an electric upgrade than they would if they replaced with gas HVAC and hot water heaters. In cases where incremental up-front costs were projected to be higher, the average return on investment (ROI) for the electric upgrade was found to be less than 11 years.

Single-unit homes were modeled using the XeroHome energy model developed by Vistar Energy. XeroHome used large datasets of building orientation, square footage, permit data, and other information to generate a complete energy model for single-unit homes in the city of Sacramento, based on an amalgam of approximately 115,000 unique models. While Xerohome has not provided a detailed energy model for small multi-unit residential buildings (like duplexes and triplexes), these buildings largely use similar appliance types and configurations as single-unit buildings, so the results of the Xerohome analysis can reasonably be used as a proxy for these projects. Commercial and large multi-unit residential building energy consumption, as shown in ***Chapter 01***, was modeled using the ComStock model provided by the National Renewable Energy Laboratory (NREL). ComStock is a United States Department of Energy model of the United States commercial building stock, which uses sample building characteristics from commercial building models in combination with public and private-sector datasets to model utility loads based on specific geographies and climate zones, daily peaks in energy use, and sectoral building types. Due to immense variability across commercial buildings, specific cost estimates for commercial buildings were not identified. However, cost considerations shared by local contractors for commercial building electrification are documented in the ***Appendix***.

For commercial and large multi-unit residential buildings, the results of the analysis provide less conclusive evidence regarding the quantitative costs and benefits of electrification. After numerous interviews with building owners and contractors, commercial buildings were found to be highly variable in their equipment and operations, even within a specific class, such as office buildings. Due to this variability, the project team focused on qualitative cost considerations and understanding what information will be needed to more accurately address decarbonization of commercial buildings. This lack of data was a significant driver for the final strategy, discussed in ***Chapter 04***, which applies a phased Benchmarking and Building Performance Standard (BPS) as the primary decarbonization approach for this building type. This will allow building owners and facility managers to understand building energy use and identify cost-effective efficiency and electrification investments on a building-by-building basis, rather than applying a one-size-fits all policy to commercial buildings. The BPS program may be augmented by a time of replacement approach for rooftop package HVAC units within a specified size threshold, pending available legal pathways.

Types of Costs

There are three types of costs that need to be calculated to understand the full economic impact of building electrification. These are up-front costs, incremental costs, and on-bill costs.

Up-Front Costs: *Up-front costs* are the costs incurred when purchasing a new consumer good. When an appliance, such as a water heater, needs to be replaced, costs are incurred from purchasing the new equipment, acquiring a building permit, paying a contractor to install the equipment, as well as the cost of any related hardware needed for the installation.

Incremental Costs: In the context of existing building electrification, *incremental costs* are defined as the difference in cost between replacing a gas-powered appliance with a similar appliance versus upgrading to an electric appliance. When a gas-powered appliance, such as a water heater fails, the home or building owner will need to replace it with a new one. In this case, the incremental cost of installing a new heat pump water heater would be the total heat pump installation cost minus the cost of installing a new gas water heater.

On-Bill Costs: *On-bill costs* are a function of how much it costs to operate an appliance. When replacing a broken water heater with the exact same model, one can expect the on-bill costs would be the same, because the new water heater would be expected to use the same energy as the one it replaced. However, if you purchased a more efficient water heater, the on-bill costs would be expected to decrease. Conversely, a less efficient model could be cheaper up-front but would increase on-bill costs. Balancing long-term savings with up-front costs is the key to affordability.

Simple Payback: This analysis uses *simple payback* to determine the long-term value of electrification. Simple payback is calculated by dividing the incremental cost of electrification by the annual on-bill savings. For example, a $1,000 incremental cost, which sees a $500 per year savings, has a simple payback of 2 years.

The key to quantifying the cost/benefit of electrification is to determine if the on-bill savings are sufficient to offset any increased up-front costs associated with the switch to electric appliances. To do this, the City of Sacramento undertook a comprehensive energy modeling and cost analysis process. The results of this analysis were then used to inform the development of policies that are intended to make electrification affordable, equitable, and cost-effective for the community. The following section details the up-front and on-bill costs associated with electrification and also provides a high-level description of the methodology used to calculate these costs. Please see the ***Appendix*** for an in-depth analysis of the modeling results.

Utility Rate Assumptions

Utility rates are a key determinant of the cost-effectiveness of building electrification. The analysis for single-unit and small multi-unit residential used SMUD's 5-8 time-of-day electric rate and PG&E's G1 residential gas rate, with no forecasted utility rate changes.[45] While both electric and gas rates are expected to continue increasing over time, electricity rates are expected to increase at a lower rate than gas. For example, In January 2024, both SMUD and PG&E adopted rate increases which are not reflected in this analysis. However, PG&E gas rates increased at a greater rate (50%) than SMUD electricity rates (4%) which should increase the cost effectiveness of electrification. In addition, SMUD has committed to maintaining low rates, while providing safe and reliable, energy to its customers. Analysis completed by Gridworks in 2019 projects that natural gas rates could increase from about $1.50 per therm in 2019 to upwards of $19 a therm by 2050 if the transition away from gas is not managed effectively.[46] This increase is directly tied to a decrease in natural gas consumption due to both efficiency increases in buildings (in large part due to Title 24) and appliances, as well as electrification. As gas consumption decreases, the amount of infrastructure carrying that gas remains the same. Since much of the cost of a therm of gas is tied to infrastructure costs, fewer therms sold means each therm that is sold must pay for a greater percentage of upkeep of existing gas infrastructure. Understanding these potential cost increases has significant strategy implications, including potential equity impacts that are being considered in formulating the process by which the City should move away from gas for building energy systems. To decrease the overall cost of the transition, Sacramento will strive to move the community from gas to electric appliances in a coordinated and cost-effective manner, with special attention paid to ensure that the most vulnerable populations are not left behind.

45. The rates used for the complete analysis were current as of August 2023. For more information on the model assumptions see the *Appendix*.
46. *https://gridworks.org/wp-content/uploads/2019/09/CA_Gas_System_in_Transition.pdf*.

Single-Unit and Small Multi-Unit Residential Cost Results

UP-FRONT COSTS

To understand the up-front costs of electrification, the project team gathered data through interviews with contractors, analysis of data from the state's TECH program, and supplemental desktop research to determine and compare the cost to buy and install new gas appliances and new electric appliances. Early in the analysis, a concern emerged that replacing functioning gas appliances with new electric appliances could result in cost impacts that might not be overcome with incentives or offset by on-bill savings. The cost study has shown that the full suite of incentives and rebates make electrification cost effective for most Sacramento households. In order to minimize the potential burden of unnecessary costs, the Strategy recommends electrification at or near the end of the useful life of the equipment. This approach will reduce the waste and expense of replacing functional appliances or equipment by a certain date, instead allowing households to get the full value of existing appliance investments. Many Sacramento households may find it advantageous to plan and implement electrification of their appliances early to avoid emergency replacements and to maximize access to the full array of beneficial incentives currently available. However, the analysis provided in this section assumes that switching any gas appliance to an electric appliance would only occur if the gas appliance was due for replacement. Thus, the difference in cost between gas and electric appliances, or incremental cost, is the most pertinent cost consideration. The natural gas, electric upgrade, and incremental cost results after SMUD and IRA rebates and tax credits are shown below in ***Table 2***. IRA tax credits are capped at $2,000 per year and therefore, the scenario below assumes the water heater and HVAC unit would be replaced in different years. Estimates are rounded for ease of understanding. A more detailed analysis, as well as full costs (used to calculate incremental costs) for both the like-for-like and electrification scenarios, is found in the ***Appendix***.

The cost for any specific home will be driven in large part by the cost variables described below. For any installation, the City recommends following recommendations of the Contractors State License Board (***https://www.cslb.ca.gov/Consumer.aspx***) in hiring a contractor, such as getting at least three bids from experienced contractors. A list of contractors that are eligible to provide SMUD's rebates up-front to customers can be found at SMUD's website.

Assumptions

For the purposes of this cost study, the City assumed that customers would be purchasing new equipment, getting a permit (as applicable), and having the equipment installed by a licensed contractor, regardless of fuel type. For stoves and dryers, which do not require a permit or professional installation, costs were estimated using average equipment costs at local big box retailers. Specific appliance assumptions are listed below.

Gas Water Heater: 40-gallon storage tank

Heat Pump Water Heater: Incentives listed are for a 80-gallon Heat Pump Water Heater. SMUD incentives vary by size of equipment.

Gas Furnace: 80,000 Btu single-stage gas furnace

Heat Pump HVAC : Cost analysis assumes variable stage air source heat pump.

Gas Dryer: 2 cubic foot vented gas dryer

Electric Dryer: 3 cubic foot 120 volt dryer

Gas Stove : 30-inch gas range

Induction Stove: 30-inch induction range

Table 2. Natural Gas to Electric Upgrade Cost Summary before and after Rebates[47]

Cost estimates for both gas and electric appliances are based on data provided by the TECH Clean California rebate program. Estimates are for informational purposes only.

Appliance Replaced	New Electric Appliance	Electric Upgrade Cost (before Incentives)	SMUD Rebate*	IRA Tax Credit**	Total Electric Upgrade Upfront Cost (after Incentives)	Gas Appliance Cost	Incremental Cost/Savings
Gas Water Heater	Heat Pump Water Heater	$4,850–$7,900	$3,000	$1,450–$2,000	$650–$1,840	$2,400–$3,500	$2,000–$600 up-front savings for electric upgrade
Gas Furnace	Heat Pump HVAC System	$13,700–$24,000	$3,500	$2,000	$6,400–$6,900	$6,400–$6,900	$1,800–$11,600 incremental up-front cost for electric upgrade
Gas Furnace + Air Conditioner	Heat Pump HVAC System	$13,700–$24,000	$3,500	$2,000	$6,400–$6,900	$13,300–$14,600	$5,100 up-front savings to $3,900 incremental cost for electric upgrade
Gas Stove	Induction Stove	$1,800–$4,000	$750	N/A	$1,050–$3,250	$900–$3,400	$150 up-front savings to $150 incremental up-front cost for electric upgrade
Gas Dryer	Heat Pump Clothes Dryer	$1,700–$2,000	N/A	N/A	$1,700–$2,000	$950–$1,300	$700–$750 incremental up-front cost for electric upgrade
Electrical Panel* **	Higher Amperage Electrical Panel	$3,500	$2,500	N/A	$1,000	$0	$1,000 incremental up-front cost. Already factored into above costs and included for informational purposes.

**SMUD rebates are subject to change and estimates are based on February 2024 incentives. SMUD incentives vary based on equipment type. Please see SMUD website for current available rebate information and requirements.*[48]

***IRA tax credits are calculated based on 30 percent of the project cost, with a maximum credit amount of $2000 per year. Tax incentives from the IRA are not provided upfront, but rather accounted for as part of an applicant's annual tax preparation process.*

****The cost of electric panel upgrades and wiring has been captured by the TECH dataset for each appliance. Therefore, the electric panel cost should not be added to the overall cost but is included for informational purposes. Most residential buildings with 100amps or more should not require a panel upgrade.*

Replacing a water heater, furnace, and air conditioning unit are some of the most significant system costs in a home. However, based on cost estimates and available rebates (as of February 2024), households will have up-front cost savings when making the switch from gas to electric for many appliances. In addition, on-bill costs for efficient electric appliances are lower than for gas appliances, as detailed later in this chapter and in the ***Appendix****. Additional cost variables are detailed on* ***page 39*** *below.*

47. Additional Incentives such as those offered by the TECH program may also be available to further reduce costs. Visit ***switchison.org*** for up to date incentive information for Sacramento.
48. ***https://www.smud.org/en/Rebates-and-Savings-Tips/Rebates-for-My-Home***.

Additional Incentives and Rebates

The analysis presented in *Table 2* includes the currently available SMUD rebates and tax incentives provided by the IRA as of February 2024. Up-front incentives through the IRA are expected to become available starting in 2024. Low-income households earning up to 80 percent of Area Median Income (AMI) will be able to access up-front incentives covering up to 100 percent of eligible project costs, while moderate-income households from 80-150 percent AMI will be able to access discounts covering up to 50 percent of eligible project costs. Total IRA up-front incentives are capped at $14,000 across all electrification projects. These additional incentives and tax credits are listed in *Table 3*. Additional incentives for heat pump HVAC units and heat pump water heaters are also available from the State through the TECH program. These incentives were not included in the analysis above, but they can be stacked with SMUD rebates if customers complete their projects with a contractor enrolled in both programs. For customized information about costs and available incentives, visit *xerohome.com*.

Table 3. High-Efficiency Electric Home Rebate Act Up-Front Incentives for Low- and Moderate-Income Households and Inflation Reduction Act Tax Credits

Appliance	End-Use	Up-Front Incentive	Tax Credit
Electric Heat Pump Water Heater	Water Heating	$1,750	$2,000*
Electric Heat Pump HVAC System (heating and cooling)	Space Heating/ Cooling	$8,000	$2,000*
Electric Dryer	Clothes Drying	$840	-
Electric/Induction Stove	Cooking	$840	-
Panel Upgrade		$4,000	$600 max/year + 30% of equipment and installation cost**
Electrical Wiring		$2,500	-
TOTAL DISCOUNTS AVAILABLE (CAPPED)		**$14,000**	

**Depending on income; ** 25C & 25D Tax Credit*

These incentives were not included in *Table 2*, because they are not yet available and are only available to certain income brackets. However, for low- and moderate-income households earning up to 150 percent of AMI, IRA incentives are projected to significantly increase the cost-effectiveness of electrification.

2023 AMI for a household of four in Sacramento is $113,900. This means that a household of four that earns up to $170,850 per year (150 percent AMI) would qualify for up-front incentives through the IRA. For a full table of anticipated income thresholds for IRA incentives based on 2023 AMI for Sacramento County, see *Table 8* in the *Appendix*.

PRIMARY COST VARIABLES

While the equipment and systems in single-unit and small multi-unit residential buildings are relatively similar across buildings, several key cost variables were identified through the cost analysis to capture some variability in costs that a building owner might see, the cost analysis provides both a low and high estimate. These estimates are for illustrative purposes only. The primary variables that can impact the cost of electrification retrofits are described below.

Panel Upgrades

Every home has an electrical panel rated in amperes (amps). Adding more electrical load to a building could require a larger panel (panel upgrade). Recent studies have found that complete electrification of a single-unit home can be done with a 100 amp panel by choosing power-efficient appliances and utilizing load-sharing technology.[49] The cost analysis estimated that, if a panel upgrade is needed, it could add approximately $3,500 to the up-front cost of electrification. However, as of February 2024 SMUD provides a $2,500 rebate for panel upgrades that are completed in conjunction with an electric appliance retrofit, provided the panel demonstrate adequate capacity and circuit space for future full-home electrification. In addition, IRA includes up-front incentives for panel upgrades for households earning up to 150 percent AMI.[50] The estimated cost of a panel upgrade is shown in *Table 2*.

RIGHT SIZING OUR INFRASTRUCTURE: Electrical panels are sized to meet household "peak demand," or the times that electricity consumption is at its highest. While the transition to all-electric appliances will increase annual electricity consumption, peak demand is not expected to increase. For homes with existing AC, a new heat pump will mean new, more efficient AC and thus lower the summer peak demand of the home. Adding additional electric equipment is not expected to raise peak usage more than the amount of energy that was saved by the improved AC efficiency. Heat pumps will add a winter peak that is not expected to surpass the existing summer peak demand. In cases where overall electricity demand is increased (e.g., when adding an electric vehicle charger), households can manage electric loads to avoid the need to upsize electrical panels. "Right-sizing" individual electrical equipment and using "smart" circuit sharing (e.g. powering both a clothes dryer and a Level 2 electric vehicle charger from the same 240V outlet) and panel technology can often avoid a panel upgrade. "Smart" devices are designed to manage peak electric consumption, lowering household energy costs while minimizing disruption to the household. These are also important for managing peak demand on the electrical grid as a whole. This technology will allow more electricity to be delivered using our existing infrastructure, mitigating the need for some electrical grid upgrades that might otherwise be required, and paving the way for a smoother, faster, and more cost-effective transition to all-electric buildings.

49. *https://www.redwoodenergy.net/watt-diet-calculator*
50. *https://www.rewiringamerica.org/app/ira-calculator*

Space Constraints

Heat pumps tend to be larger than gas alternatives. This can complicate installation if equipment needs to be relocated or framing changes need to be made. The cost estimates assume adequate space for new equipment.

Air Conditioners

Since installing an HVAC heat pump unit provides both heating and cooling, two appliances can be replaced with one heat pump. Since new AC units cost an average of $7,000, replacing a gas-powered furnace with a heat pump HVAC that also replaces an existing AC unit could result in a incremental cost savings of nearly $5,000. Since this savings can have such a large impact on overall cost, this savings has been broken-out as a separate line item in *Table 2*.

Appliance Choice

Appliances are available in a wide range of efficiency, quality, and size, all of which will impact cost. Depending on the desired features and finishes of the existing and future appliances, the cost impacts could vary widely. SMUD rebates also vary based on appliance type and size. In addition, certain home types and situations may make it more costly to electrify. See the *Appendix* for more information.

ON-BILL RESIDENTIAL COSTS

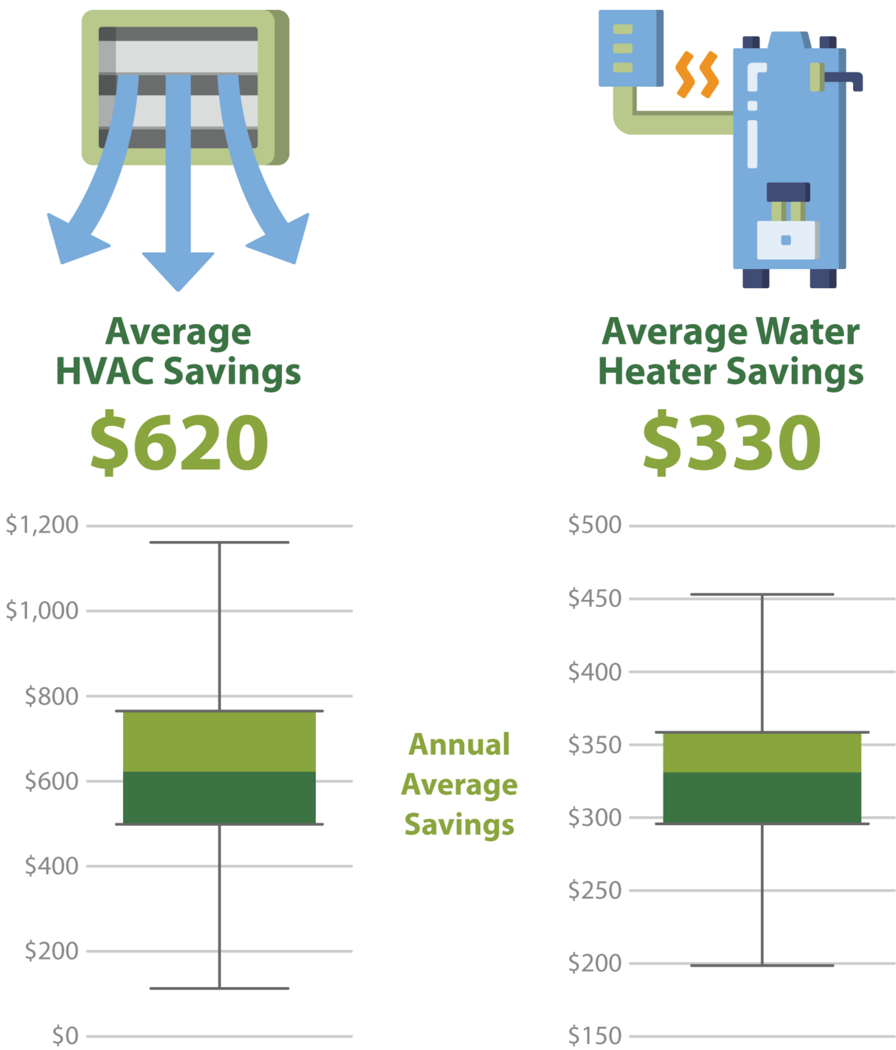
To understand projected on-bill costs, development of the strategy included development of the XeroHome modeling tool customization for the Sacramento region. XeroHome created individual energy models for single-unit homes in Sacramento. Homeowners can access the model listed in the footnote to learn more about their home's specific costs and projected savings.[51] It should be noted that the XeroHome tool does not include incremental costs. Rather, the costs shown in XeroHome are the total cost to install each piece of equipment, without consideration for the comparative cost of a like-for-like replacement of existing gas equipment.

Based on the XeroHome model inputs, every home in Sacramento is projected to save money on their utility bills by going all-electric. This is due to SMUD's relatively low rates and the high efficiency of heat pump water heaters and HVAC units. ***Figure 8*** shows the savings for every one of the approximately 115,000 single-unit homes in Sacramento. The box plot provides a summary of the statistical results provided by XeroHome. Fifty percent of all buildings fall within the shaded area, and 75 percent fall within the "whiskers" on either side. Any outliers outside this area were removed. However, it is worth noting that no homes, including outliers, were projected to have additional on-bill costs as a result of electrification.

Modeled on-bill cost savings ranged from $113 to $1,159 per year for heat pump HVAC units and from $200 to $425 per year for heat pump water heaters, after replacing existing gas appliances. In general, larger buildings saw the highest savings due to larger heating and hot water loads. The median annual cost savings after replacing the gas-powered furnace and water heater with heat pump electric alternatives was $950.

51. Access the XeroHome model: ***https://xerohome.com/app/#/***

Figure 8. Annual On-Bill Cost Savings for Single-Unit Residential Homes after Switching to a Heat Pump



RESIDENTIAL SIMPLE PAYBACK

Based on the up-front incremental costs after rebates and the on-bill costs modeled by XeroHome, every single-unit home in Sacramento that electrifies their gas appliances with furnace and AC unit replaced at the same time is projected to see up-front and on-bill savings (compared with like-for-like gas replacement). In cases where no air conditioning is present (or the current air conditioner is brand new) and the home is very large or requires additional work the incremental cost of electrification could be as high as $10,250. Based on the median savings, the simple payback for single-unit homes in Sacramento was estimated to be between 0 years (net savings from day one) and 11 years under a difficult scenario and median on-bill savings (e.g., difficult install, no AC unit, panel upgrade, higher-end appliances, etc.). However, under the new 2024 utility rates, the cost of natural gas has far outpaced the cost of electricity, increasing the cost effectiveness of electrification.

Actual paybacks will be based on the individual phasing of each home's electrification projects. Based on this analysis, electrification of Sacramento's single-unit and small multi-unit residential building stock is considered cost-effective under utility rates and rebate structures in place as of February 2024.

Commercial and Large, Multi-Unit Cost Results

To better understand costs and other constraints related to large, multi-unit residential and commercial building electrification, Rincon conducted interviews with five energy engineers and facility managers working on large building decarbonization in Sacramento. All interviewees communicated that larger multi-unit residential and nonresidential buildings are more complicated to electrify than single-unit homes and that accurately estimating costs is typically only possible on a project-by-project basis. Because most larger buildings gas systems are oversized and inefficient, replacing a gas system with a similarly sized electric system is cost prohibitive. Therefore, efficient and cost-effective electrification often requires a deeper understanding of a buildings' heating and cooling needs to determine the right size for an electric alternative. For this reason, a detailed cost analysis for large multi-unit residential and commercial buildings was not developed. However, several important findings were identified through interviews with engineers and building managers.

Commercial Building Infrastructure is Generally Oversized. Several interviewees noted that most commercial and large, multi-unit residential buildings utilized oversized equipment to provide heat and hot water. Historically, it was easier to oversize the systems than to fine tune the performance of a smaller system. While this guaranteed heat and hot water performance, it did so at a cost of reduced efficiency. To effectively electrify a commercial building, it is important to engineer holistic solutions based on an understanding of the building's real heating, cooling, and hot water needs.

Data Collection Is Key. Every interviewee stressed the need to understand a buildings' current equipment, costs, and operations from an engineering standpoint before making significant investments in electrification. This can be done through benchmarking current energy use and retro-commissioning, which is the process of investigating, analyzing, and optimizing an existing building system. This process allows the building manager to understand what the true energy needs of the building are. It also provides the data needed for building engineers to avoid increasing peak electricity demand, and thereby avoid triggering a need for costly electrical service upgrades.

Buildings with Current Performance Issues are Opportunities. Buildings that are currently struggling with poor heating, cooling, or hot water performance are major opportunities for electrification. These issues usually point to failing systems in need of replacement that are usually inefficient and costly to operate. Finding electrification alternatives can help bring costs down, reduce maintenance costs, and make buildings more comfortable.

Rooftop Package Units can be Interchangeable. Gas-fired rooftop package units are extremely common on small- to medium-sized commercial buildings (<50,000 square feet).[52] These units can cost-effectively be electrified with a heat pump package unit in most commercial building types and represent a major opportunity area for natural gas reduction in commercial buildings.

52. *https://localenergycodes.com/download/1263/file_path/fieldList/Pocket%20Guide%20to%20All-Electric%20Commercial%20Retrofits.pdf.*

COMMERCIAL AND LARGE, MULTI-UNIT RESIDENTIAL CASE STUDIES

Due to the variability of commercial and large, multi-unit residential buildings, specific costs were not identified. However, electrification of commercial buildings across the state and beyond have been completed successfully. Below are several case studies that illustrate the feasibility of electrification of commercial and large multi-unit residential buildings today.

Office

Immix Law Office, Portland, Oregon (11,615 square feet; all-electric retrofit) – The building utilizes a highly efficient dedicated outside air system with heat recovery ventilation (HRV) for their HVAC system that separates heating and cooling from the ventilation system to allow for optimal control of each of these critical building functions. The new HVAC system is comprised of a 16-ton Mitsubishi variable refrigerant flow and four Ventacity VS1000RT HRVs. The HVAC system heats and cools 30 office spaces, five conference rooms, a lunchroom, exercise room, two restrooms, and open common spaces. The project resulted in increased occupant comfort, improved indoor air quality, lower energy bills (between $300 to $700 per month to heat, cool, and ventilate the building), saved roof space, and precise temperature and humidity control. The building has seen a 63 percent reduction in energy usage.[53]

Restaurant

Benihana, Sushi & Japanese Steakhouse, various locations, United States – The first Benihana restaurant was started in New York City in 1964 and has since grown to 116 locations. Benihana performs teppanyaki cooking on steel grills. Recently the restaurant chain converted its gas teppan grills to electric resistance and induction grills, which can cook meats faster, hotter, and more efficiently than gas, while reducing the risk of uncontrolled fires.[54]

Large Multi-Unit Residential

Sacramento Manor, Sacramento, California – The 260-unit, garden-style apartment complex is grouped into 21 building clusters. Although low-rise, this facility has large central equipment and square footage and is considered a large multi-unit property. Two-thirds of the apartments are maintained as affordable units through a 10-year contractual agreement with the Sacramento Housing and Redevelopment Agency. The central gas boiler, central chiller, and cooling tower were replaced by heat pump water heaters and mini-split heat pumps for each apartment. Single-pane windows were replaced with dual pane windows, and a gas storage tank water heater for the swimming pool was replaced with a variable stage heat pump water heater.

53. Redwood Energy. June 2022. A Pocket Guide to All-Electric Retrofits of Commercial Buildings.
54. Redwood Energy. June 2022. A Pocket Guide to All-Electric Retrofits of Commercial Buildings.

Bayview Tower, Seattle, Washington – The 100-unit, large multi-unit residential building was retrofitted to be all-electric, using the Origin heat pump water heater system that provides all needed water heating components (heat pump, storage tank, valves, controls, etc.) on one skid to maximize ease of installation. The system is expected to reduce energy use by 59 percent.[55]

For additional case studies please see the ***Appendix***.

55. ***https://www.redwoodenergy.net/publications/redwood-energys-pocket-guide-to-all-electric-commercial-retrofits***.

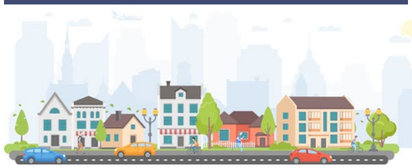
CHAPTER 04.

POLICY OVERVIEW AND SELECTION CRITERIA

Policy Overview

The strategies and actions included in the Strategy were developed based on the findings of the energy and cost-effectiveness analysis presented in ***Chapter 03***, feedback from industry professionals, and case studies. The initial list of strategies and actions were then refined utilizing the equity and effectiveness criteria and community feedback received through the various outreach efforts, detailed in ***Chapter 02***. The Strategy presents a holistic roadmap for the equitable electrification of existing buildings, a significant step towards decarbonizing the city of Sacramento, while being mindful of feasibility constraints and leveraging potential positive economic benefits. The strategies, like the analysis presented in the previous chapters, are broken into two primary categories of buildings:

Single-Unit Residential/ Small Multi-Unit Residential



Commercial/ Large Multi-Unit Residential

These building types are grouped based on the types and sizes of natural gas equipment that they primarily use. Primary strategies were developed to act as the main driver of decarbonization for both building types. For each primary strategy, a series of specific supporting actions were also developed utilizing the equity and effectiveness criteria, which are described in detail below. Together, the strategies and actions provide an implementable blueprint for the City of Sacramento to meet its existing building decarbonization goals, while providing the flexibility and support the community needs to maximize economic and public health benefits and avoid negative impacts. A summary of the primary strategies is illustrated in ***Figure 9***. In addition to the strategies and actions focused on the two primary building types, a suite of foundational actions was also developed. These actions are necessary to ensure equitable and effective implementation and cover topics, including ongoing community outreach and engagement, workforce development, gas-infrastructure pruning, data collection, and tracking. The strategies named in this section are the most cost-effective and efficient solutions identified during the analysis. However, given the dynamic legal, regulatory, and technological contexts surrounding building electrification efforts, the City will need to adaptively manage its approach to building decarbonization. Options include a regional approach to regulating air pollution, statewide amendments to the California Building Standards Code, and/or implementation of the California Air Resources Board's proposed zero emissions standards for space and water heating appliances.

Figure 9. Strategy Summary

Single-Unit Residential/Small Multi-Unit Residential

Feasibility Findings

- 100% of homes projected to see on-bill savings
- Low upfront marginal cost, with many households saving money due to rebates and incentives
- Similar equipment types across building stock
- Indoor air quality and long-term cost effectiveness benefits
- Electrifying space and water heaters yield greatest economic and GHG reduction benefit

Strategy

Electrify on Replacement

- Reduce GHG emissions from existing buildings through support and requirements, in accordance with applicable law
- Focus on HVAC and water heaters
- Financial support available from SMUD, state and federal incentive programs
- Enhanced financial and technical support for under-resourced/disadvantaged communities, with direct installation support possible under some programs

Commercial/Large Multi-Unit Residential

Feasibility Findings

- High degree of variability in equipment types
- Need for building data and engineering
- Cost effectiveness is less certain
- Clear opportunity for rooftop package units

Strategy

Benchmarking and Building Performance Standard

- Recommended minimum size threshold of 50,000 square feet*
- Phased implementation
- GHG emissions per square foot targets set following benchmarking
- Performance based, allowing building owners to customize solutions*
- Financial support available for electrification projects from SMUD, state and federal programs

Electrify on Replacement

- Reduce GHG emissions from existing buildings through support and requirements, in accordance with applicable law
- Focused on rooftop package unit HVAC
- Financial support available for some projects

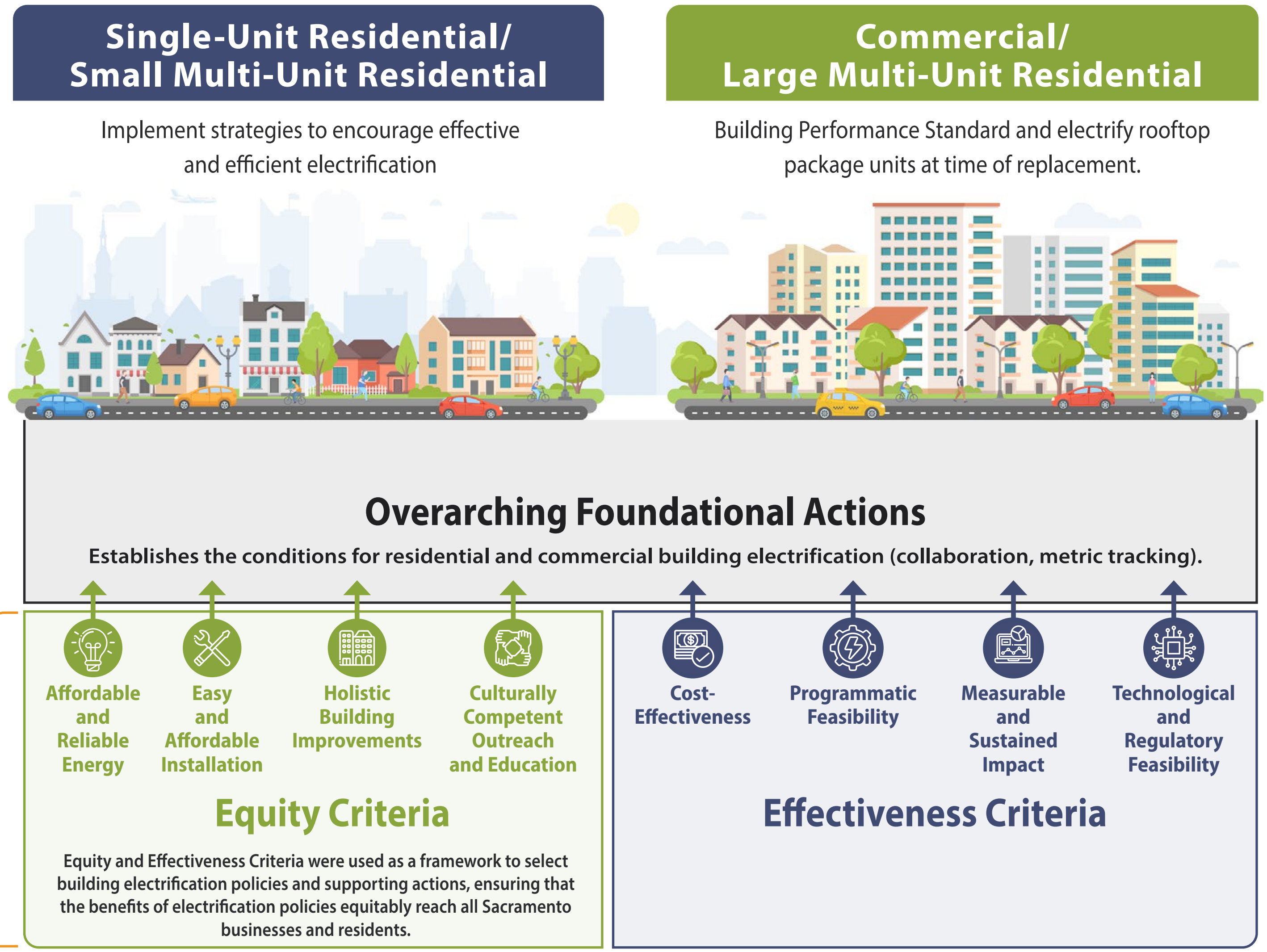
**AB 802 requires energy benchmarking for buildings 50,000 square feet and larger.*

Analysis Framework

Prior to developing strategies and actions, the City facilitated a community outreach process to establish a set of equity and effectiveness criteria. Together, these criteria formed a decision-making framework that guided the development of the Strategy. *Figure 10* summarizes the framework and resulting primary strategies.

Equity and Effectiveness Criteria were used as a framework to select building electrification policies and supporting actions, ensuring that the benefits of electrification policies equitably reach all Sacramento businesses and residents.

Figure 10. Analysis Framework Summary



EQUITY CRITERIA

Equity is a core consideration of the policy direction to electrify buildings in Sacramento. In adopting the Electrification of Existing Buildings in the City of Sacramento,[56] the City Council established a vision to achieve a zero-emission building stock, just decarbonization, and a collaborative transition. This vision includes the following equity goals and objectives:

1. Minimize the cost-burden and displacement risk to frontline communities.
2. Prioritize financial assistance and access to health, safety, and cost benefits for those most in need.
3. Engage and listen to all communities throughout the electrification process.

Conducting community outreach to develop the equity criteria was the first action the City took to develop the Strategy. The feedback, which is summarized in *Chapter 02*, helped the project team understand the concerns and goals of the community. Once finalized, the equity criteria were used to select and prioritize strategies and supporting actions. This meant that some strategies with meaningful decarbonization potential were not included at this time because of associated inequitable impacts. Instead, the Strategy prioritizes cost-effective and equitable approaches that will yield ongoing benefits and avoid the imposition of new cost burdens on Sacramento households.

The equity criteria include:

Affordable and Reliable Energy

Building electrification should support access to affordable and reliable energy for all community members, especially disadvantaged communities, renters, and small businesses. This includes affordable utility bills and electric service that meets the needs of households in Sacramento.

Easy and Affordable Installation

Community members, including renters and disadvantaged communities, should be connected with incentives and programs that provide meaningful support for electrification. The City should continue to ensure a process that minimizes burdens and facilitates the positive impacts associated with code-compliant installation of electric equipment.

Holistic Building Improvements

Electrification of a building provides opportunities for other whole-building improvements that may come with additional up-front costs, but which would otherwise be more expensive to implement separately. These opportunities should be financially accessible for low-income populations and may be implemented in part through State and federal funding programs that support equitable building electrification.

56. *https://www.cityofsacramento.org/-/media/Corporate/Files/CDD/Planning/Major-Projects/Electrification-of-New-Construction/R20210166-Framework-for-Building-Electrification-and-the-Evaluation-of-Water-Conservation--Green-Job.pdf?la=en*.

Culturally Competent Outreach and Education

Provide access to information in multiple languages, particularly for disadvantaged communities, using culturally competent and relevant approaches and channels of communication. Language should be clear and easy to understand to enable residents to shape, engage with, and understand the information about electrification, regardless of the language spoken or cultural background.

In addition, the Strategy should support City and regional efforts to:

Avoid displacement of households and businesses

- Electrification upgrades should not displace renters (households and businesses), result in increased rents, or overburden homeowners. Programs should support or avoid impacts to housing preservation and tenant protections. Programs should also avoid leading to the displacement of small local businesses and organizations.

Prioritize low-income and under-resourced communities and small businesses

- Prioritize aligning resources and investment in low-income and under-resourced communities and small businesses to ensure community benefit from the clean energy and decarbonization transition. This prioritization capitalizes on a very unique opportunity to leverage State and federal investments in electrification to deliver equity investments and ongoing utility bill savings, particularly for fixed-income and low-income households.

Support the growth in "green collar jobs" to create a ladder of opportunity for jobseekers and a just transition for Sacramento's workforce

- Maximize the local impact of forthcoming federal and state incentives[57] for electrification, weatherization, and energy efficiency, which have the potential to provide local, low-, medium-, and high-skill job opportunities.[58] Seek opportunities to leverage Sacramento's strong market position to foster growth for Sacramento electrical and HVAC contractors, and associated workforce opportunities for Sacramentans, with a focus on employment to historically under-employed and disadvantaged neighborhoods.
- Support the just transition of workers impacted by the transition to the low-carbon economy, such as plumbers and gas pipefitters, through complementary City[59] and regional efforts.

57. *https://www.rewiringamerica.org/policy/inflation-reduction-act*.
58. In 2008, Van Jones wrote a book called "The Green Collar Economy", which outlined his plan for "the green new deal" that could simultaneously solve socio-economic inequality and environmental problems. Fifteen years later, the green new deal is finally poised to take place with federal and State incentives that are on the horizon: IRA incentives (HEERA and HOMES) and the CEC's Equitable Building Decarbonization Program.
59. *https://www.cityofsacramento.gov/community-development/planning/long-range/climate-and-sustainability-planning/onsite-water-reuse-study*.

EFFECTIVENESS CRITERIA

In addition to being equitable, the Strategy must be effective, implementable, and prioritize positive economic benefits. Broad effectiveness criteria have been developed to evaluate strategies and actions to ensure that benefits of electrification are fully realized by as many residents and businesses as practical and are aligned with other City priorities and projects and avoid negative impacts on residents and business owners.

Similar to the application of the equity criteria, policy pathways and their associated actions were evaluated against the effectiveness criteria to identify and prevent gaps in the electrification approach. Each policy pathway selected below includes at least one action that addresses the effectiveness criteria, as well as the equity criteria. The effectiveness criteria developed for the Strategy are:

Cost-effectiveness

Prioritize sectors that can electrify cost-effectively, and which are projected to see ongoing utility bill savings following electrification.

Minimize or offset costs associated with electrification through funding and financing strategies for residents and business owners and efficiently use limited resources. Prioritize sectoral approaches that draw on SMUD, State, and federal support for electrification in order to maximize positive economic impacts.

Programmatic Feasibility

Electrification policies should align with available City, SMUD, State, and federal resources and programmatic structures.

Measurable and Sustained Impact

Electrification policies must be impactful and provide evidence-based results over the long-term.

Technological and Regulatory Feasibility

New technologies or upgrades considered for electrification retrofits must be technologically feasible and reflect the most up-to-date electrification practices and regulatory requirements.

Energy Security

Energy security must be preserved or improved in the long-term through access to reliable, affordable, and sustainable energy throughout the community.

HOW TO READ THIS SECTION

Strategies and actions are organized by building type (single-unit/small, multi-unit residential; and commercial/large, multi-unit residential), with a third foundational actions section that contains actions that benefit electrification in general. Each building type includes at least one primary strategy that will drive electrification in the city. Below these strategies are multiple actions that are specifically designed to help achieve the equity and effectiveness goals of the primary strategy. The actions are organized by equity criteria below each primary strategy.

Strategy: Overarching strategy/ policy approach for existing building electrification, which is supported by numbered actions.

Action Description: Describes actions that support the overarching strategy for building electrification, categorized by equity criteria group.

Table 5. Single-Unit Residential and Low-Rise Multi-Unit Residential

Action #	Action Description
SUPPORTING ACTIONS	
R-1	Provide education to the community on the benefits of upgrading air conditioning unit to a heat pump that provides both heating and cooling at time of air conditioner or furnace replacement.
R-2	Connect individuals to City, SMUD, State, and federal resources on the electrification process, including likely cost and incentives during project planning and at time of permit request.
EQUITY CRITERIA 1: Affordable and Reliable Energy	
R-3	Collaborate with SMUD and other partners to publicize current programs and develop additional accessible and affordable financing options for renters and homeowners.
R-4	Integrate available grant and incentive funding for electrification into existing low-income housing rehabilitation programs and ensure the use of coordinated direct-referral processes to leverage incentives and other resources across partners.
R-5	Monitor grant opportunities to assist in direct electrification investments in environmental justice communities.
R-6	Provide information and coordinate with community partners to support disadvantaged communities in obtaining funding and financing for electrification and energy efficiency retrofit projects.
EQUITY CRITERIA 2: Easy and Affordable Installation	
R-7	Conduct a review of permitting procedures to identify and remove hurdles to electrification.
R-8	Continue to work with SMUD to review and simplify incentive programs.
R-9	Continue to support SMUD in their direct install program for residents under the Energy Assistance Program Rate (EAPR) and leverage complementary City investments.

Equity Criteria: Each the actions within each strategy are organized by the equity criteria which they were developed to support.

Foundational Actions

In addition to the strategies presented by building type, the Strategy identifies a suite of foundational actions that will support building electrification of all kinds. Foundational actions create the conditions needed for citywide electrification, with the goals of increasing cost-effectiveness, feasibility, equity, and implementation of electrification in general. Foundational actions are those that support or enhance electrification strategies across multiple building types. Many of the foundational actions guide the City to create partnerships, streamline processes, or implement education and outreach. Others, such as natural gas-infrastructure pruning, are potentially significant drivers of electrification and cost-effectiveness but cannot be currently fully implemented due to regulatory constraints or other barriers. The full list of foundational actions can be found below and in Table 4.

1. **Community Engagement Actions**
2. **Advocacy and Regulatory Changes**
3. **Workforce Education Actions**
4. **Gas Pruning & Infrastructure Planning**
5. **Grid Capacity and Reliability**
6. **Data Collection and Tracking**

The foundational actions also include actions specific to advocacy and policy facilitation. While the Strategy focuses primarily on actions which the City has operational control over (such as permitting and performance standards) several opportunities for larger collaboration and advocacy were also identified. These actions to be pursued by the City will help support electrification not just in Sacramento, but will also promote forward thinking state and federal legislation and potentially unlock new electrification strategies for the future. Through these actions the City will advocate for changes that facilitate equitable electrification at the state, regional, and federal level in alignment with the City's State and Federal Legislative Platform. One example is advocating for modernization of the California Public Utilities Commission's policy of "obligation to serve,"[60] the interpretation of which requires utilities to provide fuel gas to any customer who requests it, even if it means installing or maintaining increasingly expensive infrastructure. While this regulation stands, it will limit the ability of any jurisdiction to strategically reduce the amount of gas infrastructure within its boundaries.

60. *https://leginfo.legislature.ca.gov/faces/codes_displayText.xhtml?lawCode=PUC&division=1.&title=&part=1.&chapter=3.&article=1*.

Table 4. Foundational Actions

Action #	Action Description
COMMUNITY ENGAGEMENT ACTIONS	
F-1	Build a coalition of community partners that includes representatives from local communities to implement ongoing community education efforts around existing building electrification.
F-2	Continue outreach and engagement with the community through multiple approaches (workshops, working groups, surveys, pop-ups) to communicate potential policies and ordinances and gain feedback on implementation challenges and successes.
F-3	Conduct outreach and build partnerships with the Sacramento Metropolitan Air Quality Management District, Sacramento County Public Health, and other partners to communicate the health benefits associated with indoor air quality improvements created through building electrification. Outreach could include a pilot program, or promotion of existing programs that provide indoor air quality monitoring devices to households to better understand the impact of gas appliances in the home and raise awareness around poor indoor air quality associated with gas appliances, particularly stoves.
F-4	Collaborate with SMUD and other partners to facilitate access to comprehensive online electrification resources, made available on multiple websites including the City's Existing Building Electrification website, that provide information on current rebates and incentives, expected costs, contractors and frequently asked questions.
F-5	Work with SMUD and/or other partners to answer building owner questions on the electrification process, including available incentives and best practices for electric retrofits.
F-6	Connect individuals with guidance documents and technical support in multiple languages.
ADVOCACY AND REGULATORY CHANGES	
F-8	Advocate for the California Public Utilities Commission to modernize its obligation to serve requirement by emphasizing the need to provide affordable and reliable energy, without regard to the energy source.
F-9	Advocate for enhanced regional, state, and federal appliance emissions standards through earlier implementation dates and an expansion of appliances covered, through the California Air Resources Board (CARB) and Sacramento Metropolitan Air Quality Management District. Advocacy through CARB should seek to expand existing emissions standards beyond water and space heaters.
F-10	Advocate at the state level for utilities such as PG&E that have funds earmarked for natural gas line retrofits to instead use those funds for electric end uses or gas line decommissioning to facilitate neighborhood electrification.

Action #	Action Description
F-11	Advocate for rate structure changes at the CPUC that fairly reflect the current and future costs of gas and electricity.
WORKFORCE EDUCATION ACTIONS	
F-12	Support existing efforts for workforce training in the building retrofit market being brought forward by SMUD .
F-13	Support design/engineering professionals in all-electric design through information sharing, troubleshooting, and promotion of SMUD electrification training efforts.
F-14	Provide support through information sharing and targeted opportunities for contractors in low-income communities to gain electrification work and register as SMUD-approved contractors.
F-15	Support efforts led by community partners to advance a range of high-road job opportunities with skill requirements, healthcare and wage standards, quality assurance processes, targeted hire requirements, and community workforce agreements.
F-16	Support efforts led by organizations including local contractors; unions; California State University, Sacramento; Sacramento City College; University of California, Davis; and CBOs to build inclusive training opportunities and a long-term pipeline of work in the building-retrofit market that carries high-road labor standards and target these opportunities to contractors in environmental justice communities.
GAS PRUNING & INFRASTRUCTURE PLANNING	
F-17	Work directly with PG&E and SMUD to identify natural gas-infrastructure pruning and subsequent neighborhood electrification opportunities, especially when gas-line maintenance or replacement is required or expected to occur.
F-18	Develop a pilot project implementation plan that allows PG&E to demonstrate potential solutions to current regulatory and financial barriers to natural gas-line pruning (e.g., gas versus electrical assets, capital versus expense accounting).
F-19	Identify parameters to prioritize one or more neighborhoods for a beneficial neighborhood electrification pilot project with SMUD and PG&E, securing resources and partnerships.
F-20	Support SMUD's electrical load projection efforts through data sharing and collaboration.

Action #	Action Description
GRID CAPACITY AND RELIABILITY	
F-21	Collaborate with SMUD in identifying City permit coordination improvements to ensure that SMUD receives sufficient and timely development project information, so that it can adequately plan for and accommodate future increases in electricity demand.
F-22	Explore the development of a cost-sharing program to allow for grid upgrades to be paid by multiple stakeholders through in-lieu fees or other mechanisms.
F-23	Increase the amount of electricity produced from local resources and work with SMUD to install additional local storage by 2030 (CAAP Measure E-4).
F-24	Support SMUD's development of Virtual Power Plant programs to stabilize the electrical grid during peak demand by accessing Distributed Energy Resources from Sacramento homes and businesses.
DATA COLLECTION AND TRACKING	
F-25	Develop procedures to track gas to electric retrofits using the City's building permit database, to inform grid preparedness, targeted outreach, and the identification of cost-effective gas-pruning opportunities. Utilize data to support monitoring of implementation of CAAP Measures E-3.
F-26	Collaborate with SMUD to share permit data as needed to support electrification goals
F-27	Collaborate with community partners to develop an inventory of existing affordable housing to facilitate targeted resource delivery that supports electrification of affordable housing throughout Sacramento.
F-28	Evaluate opportunities to collect information on HVAC, water heaters, stoves, and clothes dryers through the Rental Housing Inspection program.

Single-Unit Residential and Small Multi-Unit Residential

PRIMARY STRATEGY:

Reduce GHG emissions from existing buildings through a multi-faceted approach, consistent with applicable laws and regulations including:

1. Implement strategies to encourage effective and efficient electrification of space and water heating, stoves and clothes dryers through outreach, education, and leveraging available incentives; advocate for early retirement of gas appliances to maximize access to federal, state, and local incentives and to avoid the need for electrification retrofits in the context of an emergency replacement;
2. Adopt an EPCA compliant reach code, requiring certain additions/significant remodels to exceed the State Building Energy Efficiency Standards;
3. Adopt an ordinance requiring that main service panel replacements demonstrate capacity for and reservation of breaker space to accommodate future full-home electrification.
4. Support inclusion of a requirement in the 2025 California Building Standards Code that central air conditioners be replaced with heat pumps with some exceptions; if that requirement is not included in the 2025 California Building Standards Code, adopt this requirement as a local ordinance.
5. Coordinate with Sacramento Municipal Air Quality Management District to develop a Zero NO_x standard for space and water heating appliances.

Strategy Background

Single-unit residential and small, multi-unit residential buildings account for 77 percent of natural gas use in the city of Sacramento. Based on the information provided by local installers, TECH program cost summary data, the existing literature, and the XeroHome energy efficiency and cost-effectiveness modeling results of 115,000 single-unit homes in the city of Sacramento, it was determined that electrification at time of replacement is cost-effective in Sacramento. Modeling results project immediate on-bill savings after replacing HVAC and water heaters with high-efficiency electric models for every building in this category. In addition, as shown in ***Chapter 03***, the application of incentives can shorten the payback period for retrofits, which signals the potential benefits for early retirement of gas appliances as they reach the end of their useful life to maximize the opportunities for residents to take advantage of incentives while they are available through local, state, and federal programs, and minimize instances where individuals are faced with a situation requiring emergency replacement. Furthermore, forthcoming incentives from the Inflation Reduction Act are expected to further reduce costs, particularly for households with incomes below 150 percent area median income. The City's approach to ordinance development will vary depending on the approach adopted by the State as it formulates the 2025 Building and CalGreen Code updates.

Strategy Benefits

Based on the cost-effectiveness findings, the co-benefits, and the City's CAAP goals, the primary strategies were selected to provide the greatest balance between cost-effectiveness, equity, and GHG-emissions reductions. Electrifying equipment near the end of its useful life allows households to receive the majority of the lifecycle benefit of the existing appliances in their homes before electrifying, while avoiding emergency replacements. For many households, the incremental costs of buying electric appliances can be covered by existing and upcoming rebates and incentives, with some households expected to save substantially by electrifying appliances. Preparing for full-home electrification in advance makes the process of adding future appliances and appropriately scaled EV charging easier and less costly.

Equity Impacts

Neighborhood-scale electrification is believed to be the most efficient and effective long-term approach to achieve comprehensive decarbonization of Sacramento's economy. However, an appliance-based strategy was found to be the most feasible, cost-effective near-term approach to achieve GHG-emissions reductions and economic benefits for single-unit and small multi-unit residential buildings. Replacing gas appliances with highly efficient electric alternatives and using electric appliances in additions and significant remodels, in the context of SMUD's competitive electric rates and the robust incentives and rebates available from multiple agencies, can deliver positive outcomes for many Sacramento households. However, to be equitable in its implementation, a range of supporting actions are required to connect individuals with relevant programs and incentives, and to address the potential for increased up-front costs, increased complexity, and added time associated with the retrofit process. Therefore, the following actions will be implemented by the City and its partners to support the transition of residential buildings away from fossil fuels.

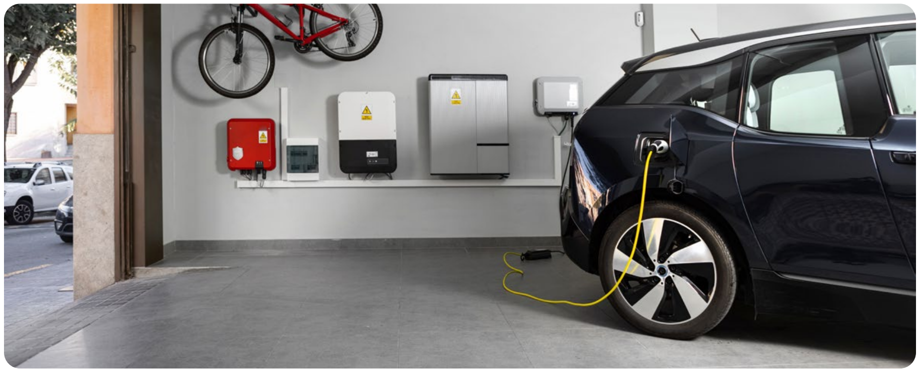


Table 5. Single-Unit Residential and Small Multi-Unit Residential

Action #	Action Description
SUPPORTING ACTIONS	
R-1	Provide education to the community on the long-term cost savings and health benefits of upgrading air conditioning unit to a heat pump that provides both heating and cooling at time of air conditioner or furnace replacement.
R-2	Provide education to the community on the indoor air quality, safety, and health benefits of switching from gas to electric or induction stoves. Collaborate with community partners to disseminate information to groups most vulnerable to the impacts of poor indoor air quality.
R-3	Connect individuals to City, SMUD, State, and federal resources on the electrification process, including likely cost and incentives, during project planning and at time of permit request and through the Rental Housing Inspection Program.
EQUITY CRITERIA 1: Affordable and Reliable Energy	
R-4	Collaborate with SMUD and other partners to publicize current programs and develop additional accessible and affordable financing options for renters and homeowners.
R-5	Integrate available grant and incentive funding for electrification into existing low-income housing rehabilitation programs and ensure the use of coordinated direct-referral processes to leverage incentives and other resources across partners.
R-6	Monitor grant opportunities to assist in direct electrification investments in environmental justice communities, including innovative approaches such as portable and low-voltage heat pumps.
R-7	Provide information and coordinate with community partners to support disadvantaged communities in obtaining funding and financing for electrification and energy efficiency retrofit projects.
EQUITY CRITERIA 2: Easy and Affordable Installation	
R-8	Conduct a review of permitting procedures to identify and remove hurdles to electrification.
R-9	Continue to work with SMUD to review and simplify incentive programs.
R-10	Continue to support SMUD in their direct install investments for residents under the Energy Assistance Program Rate (EAPR) and leverage complementary City investments.

Action #	Action Description
R-11	Continue to work with SMUD to make information available to help Sacramento households avoid unnecessary panel upgrades and associated time and cost at the time of electrification improvements.
EQUITY CRITERIA 3: Holistic Building Improvements	
R-12	Work with program administrators to investigate the feasibility of integrating electrification education efforts with existing weatherization education programs.
R-13	Support low-income weatherization programs and tie in electrification when feasible to maximize health benefits and cost savings.
R-14	Continue to support building electrification through collaboration with the City's low-income home rehabilitation and repair pilot programs.
EQUITY CRITERIA 4: Culturally Competent Outreach and Education	
R-15	Promote and support local electric cooking pilot collaborations and identify external funding opportunities for implementation.
R-16	Assess opportunities to acquire funding and otherwise collaborate with community organizations and the City's Community Ambassadors regarding best practices for providing culturally sensitive education to the community on electrification opportunities and benefits, links to incentives, financing options, and technical assistance, including education targeted to disadvantaged communities.
EQUITY CRITERIA 5: Support City and Regional Efforts to Avoid Displacement for Households and Business, Prioritize Low-Income and Under-Resourced Communities and Small Businesses	
R-17	Evaluate opportunities to share information about Tenant Protection Program substantial repairs provisions when sharing information about electrification.
R-18	Work with community partners to identify best practices for tenant protections in concert with electrification incentives, so that electrification supports housing stabilization for tenants and low-income homeowners.
R-19	Collaborate with community partners to create, expand, and maintain low-income home repair, weatherization, home efficiency, and electrification programs that address needs holistically by leveraging and bringing together partner organizations to close gaps in funding and resources.
R-20	Develop and share resource materials on costs and logistics of electric retrofits so all residents are knowledgeable about the process of electrification. Develop a collaborative outreach approach with CBOs and neighborhood groups to share information with historically underrepresented communities and communities most vulnerable to the impacts of climate change.

Commercial and Large, Multi-Unit Residential

PRIMARY STRATEGIES:

1. Consistent with applicable laws and regulations, develop a program to implement a phased energy benchmarking and building performance standard for properties with buildings totaling 50,000 square feet and larger.
2. Support inclusion of a requirement in the 2025 California Building Standards Code that rooftop package HVAC units be replaced with heat pumps; If that requirement is not included in the 2025 California Building Standards Code, consistent with applicable laws and regulations, adopt an ordinance requiring that rooftop package HVAC units be replaced with heat pumps at time of air conditioner replacement.
3. Develop an Industrial Decarbonization Strategy to support the cost-effective decarbonization of process loads in Sacramento's industrial sector.

Strategy Background

Commercial and large, multi-unit residential buildings under City jurisdiction account for 23 percent of natural gas use in Sacramento. Early in the Strategy development process, the project team conducted interviews with engineers, facility managers, and other stakeholders to gain an understanding of the costs and benefits of commercial building electrification. Through these interviews and reviews of case studies and other literature, it was determined that while commercial and large, multi-unit residential building electrification can typically be done cost-effectively, the high degree of variability in each building's systems and operations requires a tailored approach specific to each building. These buildings tend to have boilers and other systems that are oversized; replacing them with similarly sized heat pumps or other electric technologies may not be cost-effective or efficient. The Strategy identifies a phased energy benchmarking and Building Performance Standard (BPS) Program as the most cost-effective and equitable approach to commercial and large, multi-unit residential electrification. The City of Sacramento is a part of the National Building Performance Standards Coalition, which is a group of State and local governments that have committed to "inclusively design and implement building performance policies and programs in their jurisdictions.[61]

61. *https://nationalbpscoalition.org/#:~:text=About%20the%20National%20BPS%20Coalition,and%20programs%20in%20their%20jurisdictions*.

While large commercial and large, multi-unit residential buildings can have a wide range of natural gas equipment, including furnaces and boilers, commercial buildings of all sizes often use rooftop package units for heating and cooling. These units combine both heating and cooling equipment in one structural unit. Replacing these units with an electric heat pump is straightforward and cost-competitive at the time of replacement. Thus, the Strategy recommends supporting State Building Code updates and/or developing local requirements that would require that rooftop package units be replaced with heat pumps at time of air conditioner replacement.

Decarbonization in the industrial and manufacturing sector is challenging due to the reliance on gas for high-temperature processes, and the current lack of feasible electric alternatives for some operations. Significant technological innovation will be required to decarbonize some industrial sectors, while other industrial sectors are actively scaling up new low-carbon technologies. In addition to electrification, there are a range of considerations for industrial decarbonization including energy efficiency, use of low or no carbon fuels such as hydrogen and biofuels, and carbon capture, utilization, and storage.[62] Thus, the overarching Existing Building Electrification Strategy proposes that the City develop a strategy focused on industrial decarbonization that is tailored to the opportunities and needs of Sacramento's industrial sector, leveraging federal and state assistance to drive cost-effective decarbonization of industrial processes in Sacramento.

62. *https://www.energy.gov/industrial-technologies/doe-industrial-decarbonization-roadmap#:~:text=to%20decarbonization%20efforts.-,Decarbonization%20efforts%20include%3A,driven%20processes%20with%20electrochemical%20ones.*

Strategy Details

A BPS Program is implemented in phases. Energy benchmarking must be completed prior to setting BPS thresholds. Best practices for implementing a BPS Program are detailed below:

Energy Benchmarking: Covered Buildings (buildings and properties with buildings totaling the specified size threshold or larger) report their annual energy usage in Energy Star Portfolio Manager. This process is already mandated by AB 802, which requires energy usage reporting to the CEC for buildings over 50,000 square feet. The data collected in the benchmarking phase improves building manager and City understanding of building energy usage and will inform GHG-emissions performance standards.

Retro-commissioning: Retro-commissioning is a process through which a building's energy consuming systems are analyzed for efficiency and proper operation. The retro-commissioning process serves two primary purposes. The first is to uncover inefficient operations, increase energy efficiency, and save building owners money. The second is to identify cost-effective opportunities to reduce building GHG emissions through electrification and energy efficiency. Building owners of covered buildings may complete retro-commissioning as a means of improving building performance and prioritizing retrofits prior to BPS implementation. Retro-commissioning would be a voluntary approach that building managers could pursue to identify the most cost-effective and efficient investments available for their building.

Building Performance Standards: Require building owners of covered buildings to meet GHG emissions per square footage thresholds set by the City. The City will develop differentiated thresholds for each building type (i.e. restaurants, offices, warehouses, etc.) based on energy benchmarking data, CAAP GHG-reduction targets for 2030 and 2045, cost-effectiveness data, and opportunities and constraints related to building end-uses. Building owners can meet BPS requirements through actions identified in the retro-commissioning phase, including electrification of building equipment. Over time, GHG-emissions thresholds for each building type would decrease, with the end goal of reaching zero GHG-emissions buildings.

Strategy Benefits

The commercial and large, multi-unit residential strategy addresses the high degree of variability in these building types by focusing primarily on performance-based requirements. BPSs provide a phased approach that will guide building owners and facility managers through the process of better understanding their building's energy systems and operations. This process will uncover energy and cost saving opportunities and provide the data necessary for cost-effective building decarbonization over time. The BPS approach allows building owners and operators flexibility in which systems they replace and decarbonize. The timeline and gradual reduction in GHG per square footage thresholds will allow for a focus on electrification at time of replacement to minimize costs. This approach also reduces pressure on harder to electrify equipment types, such as commercial cooking equipment, to allow for technological advancements and increased cost-effectiveness over time.

Equity Impacts

Building Performance Standards (BPS) were found to be the most effective approach to electrification of commercial buildings. However, it is important to consider possible equity impacts from the potential for increased costs, increased complexity, and added time required to complete retrofits and participate in incentive programs. Therefore, the following supporting actions will be implemented by the City and its partners to support the transition of commercial and large, multi-unit residential buildings away from fossil fuels. The size threshold for Building Performance Standards was selected to initiate a BPS approach with the large buildings that utilize the majority of gas used by this sector, while delaying requirements for the City's small businesses.

Table 6. Commercial and Large, Multi-Unit Residential

Action #	Action Description
SUPPORTING ACTIONS	
C-1	Provide education and technical support to the business community and multi-unit residential property managers to help identify opportunities and plan for cost-effective energy efficiency and building decarbonization investments.
C-2	Conduct outreach to inform and educate stakeholders about BPS requirements, including responsibilities of building owners of covered properties.
C-3	Assess the feasibility of development of a building performance improvement committee, technical committee, and community advisory committee to support development and implementation of a BPS Program.
C-4	Develop BPS program framework including a staffing and funding strategy.
C-5	Develop monitoring and assessment protocols to track costs and benefits associated with the program and adjust building size and GHG thresholds as needed.
C-6	Explore the possibility of expanding the BPS Program to include buildings less than 50,000 square feet.
EQUITY CRITERIA 1: Affordable and Reliable Energy	
C-7	Work with SMUD and other partners to develop and/or disseminate information regarding tools, funding, and financing to assist buildings with meeting building performance standards requirements. Examples could include funding support through SMUD, State and federal rebate and incentive funding, or the State's GoGreen Energy Financing program.

Action #	Action Description
C-8	Dedicate City staff time to assisting building owners to access rebates and other incentives for electrification through SMUD, State, and federal programs, with particular focus on historically underrepresented communities and small businesses.
C-9	Work with leaders in the local business community with the aim of identifying, piloting, and scaling large energy efficiency and electrification projects.
C-10	Initiate an industrial and manufacturing decarbonization strategy that identifies a pathway for the City and partner agencies to support Sacramento's industrial districts in decarbonizing process loads, emphasizing cost-effectiveness, reflecting adequate technological feasibility, and leveraging state and federal funding to drive innovation and business expansion.
EQUITY CRITERIA 2: Easy and Affordable Installation	
C-11	Connect building owners covered by the BPS program with SMUD for incentives, financing, education, and information to support buildings undergoing electrification retrofits.
EQUITY CRITERIA 3: Holistic Building Improvements	
C-12	Promote the inclusion of energy efficiency and optimization upgrades to commercial buildings to avoid upsizing of electrical infrastructure and appliances.
EQUITY CRITERIA 4: Culturally Competent Outreach and Education	
C-13	Collaborate with local ethnic businesses, restaurants, and associations to advance education and partnership for innovative electric and zero-carbon cooking technologies.
C-14	Explore opportunities to support and collaborate with local CBOs for culturally appropriate, multilingual outreach campaigns about building electrification in environmental justice communities and Black, Indigenous, and People of Color-run businesses, with a focus on hard-to-electrify building types, including commercial kitchens.
C-15	Identify chefs and restaurateurs to collaborate with to promote all-electric commercial kitchen training through local business-led collaboration and partnerships.
EQUITY CRITERIA 5: Support City and Regional Efforts to Avoid Displacement for Households and Business, Prioritize Low-Income and Under-Resourced Communities and Small Businesses	
C-16	Develop and expand pilot programs to support building repair and electrification of small businesses to reduce monthly costs and support anti-displacement.

CHAPTER 05.

STRATEGY IMPLEMENTATION

Introduction

Meeting Sacramento's goal of carbon neutrality by 2045 requires significant building energy efficiency improvements and changes to the energy that powers buildings. These changes will also require the adoption of new technologies, behaviors, and policies to limit negative consequences and promote the equitable distribution of the long-term benefits of building decarbonization policies and incentives. The City of Sacramento has committed to make these changes, developing the Climate Action & Adaptation Plan (CAAP) as a roadmap to navigate the transition to a carbon neutral Sacramento by 2045. The Strategy builds on the CAAP foundation through robust data analysis that was leveraged to identify specific strategies and actions that are feasible, cost-effective, and equitable. Through this Strategy, the City's has identified and made a commitment to implement key policies to decarbonize the buildings under its jurisdiction. However, leadership and support from stakeholders, partner agencies, and the entire Sacramento community will be critical to the successful implementation of this plan.

This chapter outlines the implementation program for the Strategy, including timelines, roles and responsibilities, and the key partners who will be critical to successful Strategy implementation. ***Figure 11*** shows the high-level implementation timeline for the Strategy. The implementation timeline for each action is included in the implementation summary tables that begin on ***page 77***.

Figure 11. Near Term Implementation for Key Strategies

2024: Partnerships and Establish Ordinance Pathways

- Monitor State and federal funding and program development, State legislation, and available legal pathways for ordinance development.
- Monitor 2025 Building Code and CalGreen Code development, to identify policy direction that will be set by the State.
- Develop partnership framework and consider additional City staffing to connect low-income Sacramento residents and small businesses with available rebates, incentives, and direct install programs available to support electrification.

2025–2026: Develop and Pass Ordinances[63]

- Pending State action in the 2025 Building Code and Cal-Green Code, develop and pass single unit residential, low rise multi-unit residential, and small commercial building ordinances to reduce GHG emissions from existing buildings.
- Evaluate the State's Building Performance Standards Strategy, which is required to be developed by July 1, 2026. Determine whether to develop a municipal programmatic framework to support Benchmarking and Building Performance Standard Programs.
- If the City develops a municipal BPS, evaluate the adequacy of AB 802 data Benchmarking requirements for buildings 50,000 square feet and larger. If a local benchmarking program is determined to be preferential, initiate a municipal benchmarking program.
- Continue programmatic support to assist Sacramento residents and small businesses to access available rebates, incentives, and direct install programs available to support electrification.
- Develop an Industrial Decarbonization Strategy to support the decarbonization of industrial processes outside the scope of the BPS program.

2027–2030: Implement and Adapt[64]

- Implement ordinances, as applicable, and continue programmatic support to assist Sacramento residents and businesses to access available rebates, incentives, and direct install programs available to support electrification.
- Update Strategy to reflect changes in State law, technology, and cost effectiveness. This update will be integrated with the next CAAP update, tentatively scheduled to begin in 2027 and to be completed in 2030.
- Building Performance Standard requirements to take effect, pending City Council approval of BPS Ordinance and program, or development of a state level BPS program.

63. Consistent with applicable laws and regulations.
64. Consistent with applicable laws and regulations.

GHG-Emissions Reductions

The CAAP includes Measure E-3, which calls for the City to transition natural gas in existing buildings to carbon-free electricity by 2045. Measure E-3.1 of the CAAP articulates the development of a comprehensive existing building electrification strategy for existing buildings, and measure E-3.2 calls for the development of one or more ordinances to reduce GHG emissions in existing buildings. The CAAP calls for natural gas usage rates of 156 therms per person or less by 2030, resulting in GHG emissions reductions of 42,451 MT CO_2e and natural gas usage rates of 47 therms per person or less by 2045, resulting in GHG emissions reductions of 402,468 CO_2e.

Implementation Roles

The following partners will be critical in the successful implementation of the Strategy. This list identifies the core responsibilities of each organization.

City of Sacramento – The role of the City of Sacramento will identify and implement the policies and planning initiatives identified in the Strategy. This includes passing ordinances, addressing zoning and permitting hurdles, and promoting housing and anti-displacement policies. The City will continue to identify and work with partners to disseminate information on incentives, grants, and rebates available to support Sacramento households and businesses as they complete electrification retrofits.

SMUD – SMUD's core function is to provide safe, reliable, affordable, and increasingly carbon free electricity to its service area. SMUD plans to provide 100 percent carbon free electricity by 2030, a key policy commitment around which the City is structuring the Strategy and a range of related measures and actions identified in the CAAP. SMUD has developed rebates and other financial incentives to support the transition to all electric buildings. In addition, SMUD has led equity-focused programs, such as direct install programs for low-income communities in the city. SMUD is responsible for maintaining the electric grid and completing upgrades as needed to enable electrification projects throughout the City. SMUD's rates are some of the lowest in the State and has achieved a "diamond" score for reliability from the American Public Power Association for their low rate of outages.[65] SMUD's commitment to this role is a major contributor to cost-effective and reliable building electrification in Sacramento.

California Energy Commission (CEC) – The CEC implements AB 802, which requires buildings 50,000 square feet or larger to report energy use annually. In addition, the CEC is developing a State Equitable Building Decarbonization Program, which will include low- or no-cost electrification retrofits for low- and moderate-income households, as well as incentives to promote low-carbon technologies in homes that will reduce GHG emissions throughout the state.

California Public Utilities Commission (CPUC) – The CPUC regulates privately owned utilities, including PG&E, the natural gas utility within the city of Sacramento. The CPUC's core function is to "protect consumers, safeguard the environment, and assure Californians' access to safe and reliable utility infrastructure and services."[66] The CPUC has adopted a framework to facilitate an orderly transition away from natural gas use in California.[67]

65. *https://electricenergyonline.com/article/energy/category/t-d/56/889072/smud-recognized-as-a-reliable-public-power-provider.html*.
66. *https://www.cpuc.ca.gov/-/media/cpuc-website/files/legacyfiles/c/11310-cpuc-basics.pdf*.
67. *https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M500/K158/500158371.PDF*.

United States Department of Energy (DOE) and Environmental Protection Agency (EPA) – The DOE and EPA play a key role in delivering funding through the Inflation Reduction Act, which is providing a variety of incentives and rebates to support households making the switch to electric appliances. In addition, the National Building Performance Standards Coalition, of which Sacramento is a member, builds on DOE's commitment to retrofit buildings in an effort to reduce utility bills, minimize exposure to pollution and emissions, and support high-quality employment.

Sacramento Metropolitan Air Quality Management District (SMAQMD) – The Sacramento Metropolitan Air Quality Management District is responsible for monitoring air pollution and for developing an administering programs to reduce air pollution levels below the health-based standards established by the state and federal governments.

California Air Resources Board (CARB) – CARB is charged with protecting the public from the harmful effects of air pollution and developing programs and actions to fight climate change. CARB oversees all air pollution control efforts in California to attain and maintain health-based air quality standards.

Contractors and Installers – Local contractors and installers will need to continue to learn new technologies, as manufacturers continue to innovate heat pump HVAC and heat pump water heater technology. They also play a critical role in spreading information regarding the City's electrification ordinances and requirements and driving code-compliance through participation in incentive programs, such as those administered by SMUD and TECH Clean California. Contractors also play an important role in helping Sacramento households to understand correctly whether and which supportive investments may be needed to enable household electrification. Concepts such as panel sizing, load management, and other new ideas will need to become more commonplace among the contractor community in order to facilitate a smooth transition to all-electric technology. Trainings and incentives provided by other partners will be critical in filling this need and ensuring that local contractors can benefit from the clean energy transition.

Community Groups/Community Leaders – Community partners who supported the development of the Strategy through ongoing partnership with the City, will continue to be important partners during implementation. Community groups and community leaders can act as conduits for information on electrification incentives and other programs for hard-to-reach communities throughout the city. In addition, these groups can also provide information to the City about successes and hurdles of the implementation programs, so the City can adaptively manage each program over time to reduce negative impacts and promote the desired equitable distribution of benefits.

State of California – While the City can make policy changes and requirements for buildings under its own jurisdiction, buildings, such as schools and State government buildings, are not required to follow City building requirements. However, to meet the CAAP and California GHG-reduction goals, nearly all buildings in the city will need to decarbonize through electrification. Working collaboratively with these agencies to share information, strategies, and funding information will be important for achieving overall success.

The Community – Each community member will be responsible for following the policies adopted by the City and for planning ahead to comply with current and future electrification requirements. When current appliances begin to reach the end of their life, it will be important for building owners (both residents and businesses) to reach out to the available planning support programs offered by SMUD, the IRA, and others to understand the basics of electrification. Putting a plan in place to electrify equipment over time and looking into the benefits of electric cooking and clothes drying are all key roles the community will need to play to meet the City's GHG-emissions reduction goals.

Implementation Timelines and Responsibilities

PHASING

Each action identified in the Strategy has been given a phasing priority and an implementation lead, including support, who will be responsible for each action's implementation progress. The timeline for implementation has been divided into three phases, defined as follows:

Near-Term – Actions identified as near-term will occur between 2024 and 2025. These actions will allow the City to begin making progress toward the electrification of existing buildings and the 2030 GHG-emissions reduction goals and will help form the foundation of the overall strategy. These actions also support education, outreach, and information sharing.

Mid-Term – Mid-term actions will allow the City to continue making meaningful advancements in building electrification, expanding programs, and pursuing new and innovative strategies. These actions will be completed between 2026 and 2030.

Long-Term – Long-term actions include a managed transition from the use of gas infrastructure that will require regulatory changes and direction from the State in order to be feasible. Advocacy and policy actions that are necessary to enable long-term actions are defined at the end of this chapter. Additional long-term actions will be formulated with the Strategy update, reflecting additional State policy direction that is anticipated to be completed prior to the Strategy update. The Strategy update will be prepared in conjunction with the next update of the City's General Plan and CAAP, tentatively scheduled to begin in 2027.

RESPONSIBLE ENTITIES

The leading and supporting entities for implementation are made up of City departments, offices, and other partners such as SMUD. While additional community and non-profit partners will be critical to successful decarbonization of Sacramento's existing buildings, key entities with known roles are identified below:

Community Development Department (CDD) – The CDD helps plan, build, and maintain a thriving city by regulating building and planning permits, as well as developing long-range policies and plans with input from the community. The goal is to partner with the community and customers to ensure a safe, growing, and lively Sacramento. The CDD will support the Strategy through development of new ordinances. The CDD will also continue to engage the community on the Strategy and will lead the update of the Strategy in conjunction with the CAAP update, tentatively scheduled to begin in 2027. The Building Division within the CDD will comply with State building code and implement any ordinances adopted by City Council. The CDD will play a role in enforcing any subsequent electrification requirements, most notably through the permit process. The permit application process will also provide the CDD an important opportunity to share information regarding electrification incentives and rebates.

Department of Public Works – The Department of Public Works provides innovative and sustainable public infrastructure and services. Public Works maintains all City facilities and will support the Strategy through implementation of all municipal retrofit projects.

Office of Climate Action & Sustainability (OCAS) – The OCAS leads the City's overall climate policies and works to accelerate the City's progress to carbon neutrality. OCAS works directly with other departments to ensure progress relating to the City's climate action and sustainability and institutional capacity for implementation. The OCAS will support interdepartmental teams and partnerships with other entities to implement the Strategy.

Office of Innovation & Economic Development (OIED) – The OIED works to encourage job growth and investment in the city of Sacramento by retaining, attracting, growing, and scaling new and innovative businesses. The OIED will play a role in connecting businesses to available incentives and support for green workforce opportunities. In addition, the OIED is a key partner in pilot electrification efforts.

SMUD – SMUD will be a key partner throughout the implementation of the Strategy, taking a role in a majority of the actions. Notably, current SMUD rebates and incentives are expected to support cost-effective electrification for many Sacramento households. Furthermore, SMUD is expected to be a key partner in larger-scale neighborhood electrification efforts, an important step that is expected to become feasible in the coming years as State regulations are modified.

Each action identified in ***Chapter 04*** is outlined below with lead and supporting entities, as well as the phase. ***Table 7*** lists the foundational actions; ***Table 8*** lists the residential and small multi-unit actions; and ***Table 9*** lists the commercial and large multi-unit actions. Additionally, several actions are included in ***Table 4*** that direct the City to advocate for larger statewide policy changes that are anticipated to increase the cost-effectiveness, feasibility, and pace of building electrification.

STAFFING NEEDS

The Existing Building Electrification strategies and actions call for a significant increase in City responsibilities and programs to drive building decarbonization. Some programs will be managed by existing staff. However, partnership development and additional outreach and support for Sacramento households and businesses to equitably access electrification incentives for all building types would be significantly enhanced through the provision of additional staff. Implementation of the proposed BPS program would require significant additional staffing. If a 50,000 square foot threshold is enacted, the BPS program would be projected to cover as many as 1,200 buildings, pending further data collection and analysis. Should the program be expanded to include smaller buildings, additional staff would be required for implementation. Based on information from the Institute for Market Transformation, other cities of equivalent size typically have between three to seven full-time staff implementing BPS programs. The City would need to augment staffing of the program over time as the phases (benchmarking, BPS) are implemented. A funding strategy will need to be developed to support additional staffing.

Table 7. Foundational Actions Implementation Summary

Action #	Action Description	Phase	Lead	Support
F-1	Build a coalition of community partners that includes representatives from local communities to implement ongoing community education efforts around existing building electrification.	Near	CDD	SMUD, OCAS
F-2	Continue outreach and engagement with the community through multiple approaches (workshops, working groups, surveys, pop-ups) to communicate potential policies and ordinances and gain feedback on implementation challenges and successes.	Near	CDD	OCAS
F-3	Conduct outreach and build partnerships with the Sacramento Metropolitan Air Quality Management District, Sacramento County Public Health, and other partners to communicate the health benefits associated with indoor air quality improvements created through building electrification. Outreach could include a pilot program, or promotion of existing programs that provide indoor air quality monitoring devices to households to better understand the impact of gas appliances in the home and raise awareness around poor indoor air quality associated with gas appliances, particularly stoves.	Near	CDD	SMUD, OCAS
F-4	Collaborate with SMUD and other partners to facilitate access to comprehensive online electrification resources, made available on multiple websites including the City's Existing Building Electrification website, that provide information on current rebates and incentives, expected costs, contractors, and frequently asked questions.	Near	CDD	OCAS, SMUD, OIED
F-5	Work with SMUD and/or other partners to answer building owner questions on the electrification process, including available incentives and best practices for electric retrofits.	Near	CDD	
F-6	Connect individuals with guidance documents and technical support in multiple languages.	Near	CDD, OIED	SMUD
F-7	Advocate for the California Public Utilities Commission to modernize its obligation to serve requirements by emphasizing the need to provide affordable and reliable energy without regard to the energy source.	Near	CDD, OCAS	
F-8	Advocate for enhanced regional, state, and federal appliance emissions standards through earlier implementation dates and an expansion of appliances covered through the California Air Resources Board (CARB) and the Sacramento Metropolitan Air Quality Management District. Advocacy through CARB should seek to expand existing emissions standards beyond water and space heaters.	Near	CDD	OCAS

Action #	Action Description	Phase	Lead	Support
F-9	Advocate at the state level for utilities such as PG&E that have funds earmarked for natural gas line retrofits to instead use those funds for gas line decommissioning or electric end uses, to facilitate neighborhood electrification.	Near	CDD, OCAS	
F-10	Advocate for rate structure changes at the CPUC that fairly reflect the current and future costs of gas and electricity.	Mid	CDD, OCAS	
F-11	Support existing efforts for workforce training in the building retrofit market initiated by SMUD and PG&E.	Near	OIED	OCAS
F-12	Support design/engineering professionals in all-electric design through information sharing, troubleshooting, and promotion of SMUD electrification training efforts.	Near	CDD	SMUD
F-13	Provide support through information sharing and targeted opportunities for contractors in low-income communities to gain electrification work and register as SMUD approved contractors.	Near	CDD	SMUD, OIED
F-14	Support efforts led by community partners to advance a range of high-road job opportunities with skill requirements, healthcare and wage standards, quality assurance processes, targeted hire requirements, and community workforce agreements.	Near	OIED	CDD, OCAS, SMUD
F-15	Support efforts led by organizations including local contractors, unions, California State University, Sacramento, Sacramento City College, University of California, Davis, and CBOs to build inclusive training opportunities and a long-term pipeline of work in the building retrofit market that carries high-road labor standards and target these opportunities to contractors in environmental justice communities.	Near	OIED	CDD, OCAS, SMUD
F-16	Work directly with PG&E and SMUD to identify natural gas infrastructure pruning and subsequent neighborhood electrification opportunities, especially when gas line maintenance or replacement is required or expected to occur.	Near	CDD	OCAS, OIED, SMUD
F-17	Develop a pilot project implementation plan that allows PG&E to demonstrate potential solutions to current regulatory financial barriers to natural gas-line pruning (e.g., gas versus electrical assets, capital versus expense accounting).	Near	OCAS, OIED	PG&E, SMUD, CDD
F-18	Identify parameters to prioritize one or more neighborhoods for a beneficial neighborhood electrification pilot project with SMUD and PG&E, securing resources and partnerships.	Mid	CDD, OCAS	OIED

Action #	Action Description	Phase	Lead	Support
F-19	Support SMUD's electrical load projection efforts through data sharing and collaboration.	Near	CDD	
F-20	Collaborate with SMUD in identifying City permit coordination improvements to ensure that SMUD receives sufficient and timely development project information, so that it can adequately plan for and accommodate future increases in electricity demand.	Mid	CDD	OCAS
F-21	Explore the development of a cost-sharing program to allow for grid upgrades to be paid by multiple stakeholders through in-lieu fees or other mechanisms.	Mid	SMUD	CDD
F-22	Increase the amount of electricity produced from local resources and work with SMUD to install additional local storage by 2030 (CAAP Measure E-4).	Near	CDD, OCAS, DPW, DOU	OIED
F-23	Support SMUD's development of Virtual Power Plant programs to stabilize the electrical grid during peak demand by accessing Distributed Energy Resources from Sacramento homes and businesses.	Near	CDD, DPW	OCAS, OIED, DOU
F-24	Develop procedures to track gas to electric retrofits using the City's building permit database, to inform grid preparedness, targeted outreach, the identification of cost-effective gas-pruning opportunities. Utilize data to support monitoring of CAAP Measures E-3.	Near	CDD	
F-25	Collaborate with SMUD to share permit data as needed to support electrification goals	Near	CDD, SMUD	
F-26	Collaborate with community partners to develop an inventory of existing affordable housing to facilitate targeted resource delivery that supports electrification of affordable housing throughout Sacramento. in the City of Sacramento	Near	CDD, OIED	OCAS, SHRA, CADA
F-27	Evaluate opportunities to collect information on HVAC, water heaters, stoves, and clothes dryers through the Rental Housing and Inspection program.	Near	CDD	

Table 8. Residential and Small Multi-Unit Actions Implementation Summary

Action #	Action Description	Phase	Lead	Support
R-1	Provide education to the community on the long-term cost savings and health benefits of upgrading an AC unit to a heat pump, which provides both heating and cooling at time of AC or furnace replacement.	Near	CDD	SMUD, OCAS
R-2	Provide education to the community on the indoor air quality, safety, and health benefits of switching from gas to electric or induction stoves. Collaborate with community partners to disseminate information to groups most vulnerable to the impacts of poor indoor air quality.	Near	CDD	SMUD, OCAS
R-3	Connect individuals to City, SMUD, State, and federal resources on the electrification process, including likely costs and incentives, during project planning and at time of permit request and through the Rental Housing and Inspection Program.	Near	CDD	SMUD
R-4	Collaborate with SMUD and other partners to publicize current programs and develop additional accessible and affordable financing options for renters and homeowners.	Near	CDD	OIED, OCAS
R-5	Integrate available grant and incentive funding for electrification into existing low-income housing loan and rehabilitation programs and ensure the use of coordinated direct-referral processes to leverage incentives and other resources across partners.	Mid	OIED	SMUD, OCAS, CDD, SHRA
R-6	Monitor grant opportunities to assist in direct electrification investments in environmental justice communities, including innovative approaches such as portable and low voltage heat pumps.	Mid	OCAS	SMUD, CDD, OIED
R-7	Provide information and coordinate with community partners to support disadvantaged communities in obtaining funding and financing for electrification and energy-efficiency retrofit projects.	Near	OCAS, OIED\	CDD, SMUD
R-8	Conduct a review of permitting procedures to identify and remove hurdles to electrification.	Near	CDD	SMUD
R-9	Continue to work with SMUD to review and simplify incentive programs.	Mid	CDD	OCAS
R-10	Continue to support SMUD in their direct install investments for residents under EAPR and leverage complementary City investments.	Near	OCAS, OIED	CDD
R-11	Continue to work with SMUD to make information available to help Sacramento households avoid unnecessary panel upgrades and associated time and cost at the time of electrification improvements.		CDD	SMUD, OCAS

Action #	Action Description	Phase	Lead	Support
R-12	Work with program administrators to investigate the feasibility of integrating electrification education efforts with existing weatherization education programs.	Near	CDD	SMUD, OIED, Community Partners
R-13	Support low-income weatherization programs and tie-in electrification, when feasible, to maximize health benefits and cost savings.	Mid	OIED	SMUD, OCAS
R-14	Continue to support building electrification through continued collaboration with the City's low-income home repair pilot programs.	Near	OIED	SMUD
R-15	Promote and support local electric cooking pilot collaborations and identify external funding opportunities for implementation.	Near	OCAS, OIED	CDD, SMUD
R-16	Assess opportunities to acquire funding and otherwise collaborate with community organizations and the City's Community Ambassadors regarding best practices for providing culturally sensitive education to the community on electrification opportunities and benefits, links to incentives, financing options, and technical assistance, including education targeted to disadvantaged communities.	Near	CDD, OCAS	SMUD
R-17	Evaluate opportunities to share information about Tenant Protection Program substantial repairs provisions when sharing information about electrification.	Near	CDD	OCAS
R-18	Work with community partners to identify best practices for tenant protections in concert with electrification incentives, so that electrification supports housing stabilization for tenants and low-income homeowners.	Mid	OIED	CDD
R-19	Collaborate with community partners to create, expand, and maintain low-income home repair, weatherization, home efficiency, and electrification programs that address needs holistically by leveraging and bringing together partner organizations to close gaps in funding and resources.	Near	OIED	CDD, OCAS, SMUD
R-20	Develop and share resource materials on costs and logistics of electric retrofits so all residents are knowledgeable about the process of electrification. Develop a collaborative outreach approach with CBOs and neighborhood groups to share information with historically underrepresented communities and communities most vulnerable to the impacts of climate change.	Near	OIED, CDD	SMUD

Table 9. Commercial and Large Multi-Unit Residential Action Implementation Summary

Action #	Action Description	Phase	Lead	Support
C-1	Provide education and technical support to the business community and multi-unit residential property managers to help identify opportunities and plan for cost-effective energy efficiency and building decarbonization investments.	Near	CDD	SMUD, OIED
C-2	Conduct outreach to inform and educate stakeholders about BPS requirements, including responsibilities of building owners of covered properties.	Near	CDD	OIED
C-3	Assess the feasibility of development of a building performance improvement committee, technical committee, and community advisory committee to support development and implementation of a BPS program.	Near	CDD	OIED, SMUD
C-4	Develop BPS program framework, including a staffing and funding strategy.	Mid	CDD	SMUD
C-5	Develop monitoring and assessment protocols to track costs and benefits associated with the program and adjust building size and GHG thresholds as needed.	Near	CDD	SMUD
C-6	Explore the possibility of expanding the BPS program to include buildings less than 50,000 square feet.	Mid	CDD	OIED
C-7	Work with SMUD and other partners to develop and/or disseminate information regarding tools, funding, and financing to assist buildings with meeting building performance standards requirements. Examples could include funding support through SMUD, State and federal rebate and incentive funding, or financing through SMUD or the State's GoGreen Energy Financing program.	Mid	CDD	OIED, SMUD
C-8	Dedicate City staff time to assisting building owners access rebates and other incentives for electrification through SMUD, State, and federal programs, with particular focus on historically underrepresented communities and small businesses.	Mid	CDD	OIED, SMUD, Community Partners
C-9	Work with leaders in the local business community with the aim of identifying, piloting, and scaling large energy efficiency and electrification projects.	Near	CDD, OIED	OCAS, SMUD

Action #	Action Description	Phase	Lead	Support
C-10	Initiate an industrial and manufacturing decarbonization strategy that identifies a pathway for the City and partner agencies to support Sacramento's industrial districts in decarbonizing process loads, emphasizing cost-effectiveness, reflecting adequate technological feasibility, and leveraging state and federal funding to drive innovation and business expansion.	Mid	CDD, OIED	SMUD
C-11	Connect building owners covered by the BPS with SMUD for incentives, financing, education, and information for buildings undergoing electrification retrofits.	Near	OIED, CDD	SMUD
C-12	Promote the inclusion of energy efficiency and optimization upgrades to commercial buildings to avoid upsizing electrical infrastructure and appliances.	Near	CDD	SMUD
C-13	Collaborate with local ethnic businesses, restaurants, and associations to advance education and partnership for innovative electric and zero-carbon cooking technologies.	Near	OIED	SMUD, OCAS
C-14	Explore opportunities to support and collaborate with local CBOs for culturally appropriate, multilingual outreach campaigns about building electrification in environmental justice communities and Black, Indigenous and People of Color-run businesses, with a focus on hard-to-electrify building types, including commercial kitchens.	Mid	CDD, OCAS, OIED	SMUD
C-15	Identify chefs and restaurateurs to collaborate with and promote all-electric commercial kitchens, including training through local business-led collaboration and partnerships.	Mid	OCAS, OIED	SMUD
C-16	Develop and expand pilot programs to support building repair and electrification of small businesses to reduce monthly costs and support anti-displacement.	Near	OCAS, OIED	SMUD, Community Partners

Implementation and Adaptive Management

When fully implemented, this Strategy is anticipated to meet the 2030 GHG-emissions reductions requirements for existing buildings established by the Sacramento CAAP. However, additional actions may be needed to fully decarbonize buildings in Sacramento and meet the CAAP goal of carbon neutrality by 2045.

For example, this Strategy does not include recommended requirements for water heaters, clothes dryers, or stoves in residential settings, nor water heaters, stoves or clothes dryers in small commercial buildings. These areas were excluded at this stage due to the lack of available legal mechanisms,, cost-effectiveness concerns, and/or lack of data. The Strategy will be updated in conjunction with the next CAAP update, to capture new legislation, regulations, and technology advances in order to chart the balance of transition actions needed to significantly reduce building energy usage in Sacramento by 2045.

City staff will monitor the status of Strategy actions and provide annual reporting on progress to City Council as part of planned CAAP reporting. In addition, Strategy actions may be updated as needed. As part of the CAAP implementation, the City will monitor progress on GHG-emissions reductions from existing buildings and adaptively manage Strategy actions. In the period before the 2030 update of the CAAP, the City will inventory the implementation status of each Strategy action and consider whether changes are needed. City staff will consider community feedback, technological and legislative changes, and changes in cost-effectiveness in recommending revisions to the Strategy. For example, Strategy actions may need to be revised to adapt to changes in utility rates (especially gas, which is predicted to increase significantly compared to electricity), or new technologies which are expected to drive down electrification costs.[68] Utility rate changes or new technologies could significantly increase the cost-effectiveness of building electrification strategies, allowing for faster building decarbonization. Likewise, the sunset of incentives and rebates could reduce the cost-effectiveness of electrification retrofits and increase equity impacts. By utilizing adaptive management, the City will work to build on the equity and effectiveness criteria established for the original Strategy.

68. *https://gridworks.org/initiatives/cagas-system-transition/*

CHAPTER

APP.

APPENDIX

Existing Building Electrification Strategy

Appendix – Building and Cost Modeling Results

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1 Single Family and Small Multi-Unit Residential Building Cost Modeling Results

To develop an equitable, implementable, and effective Existing Building Electrification Strategy (Strategy), the City of Sacramento (City) first needed to understand the costs associated with building electrification in Sacramento. This analysis included investigating the upfront costs for electrification, the cost of other upgrades that may be required to convert energy usage in buildings from gas to electricity, the landscape of financial incentives currently available for this work, and the implications of existing conditions of the building stock within Sacramento and other practical opportunities and barriers to electrification of existing buildings.

To answer questions about upfront costs, available incentives, existing conditions, and other opportunities and barriers, Rincon Consultants, Inc. conducted interviews with local contractors and energy engineering consultants between April 19, 2022 and July 7, 2022 and reviewed several electrification project case studies. This Cost Analysis summarizes the information gathered from these interviews and case studies. This Analysis was used in developing educational materials for the community and improving results from the building inventory and market segmentation study that Vistar Energy conducted for the project, which is included in section one of this technical appendix. The cost analysis includes:

- Overview of interviews conducted
- Description of existing conditions of single-family homes in Sacramento
- Summary of the upfront gross and incremental costs of single-family home electrification
- Qualitative understanding of the upfront costs and other considerations of multi-unit residential and nonresidential building electrification
- Summary of multi-unit residential and nonresidential electrification project case studies
- Recommendations from Interviewees
- Summary of current incentives
- Additional information and observations gathered from interviews
- Building Segmentation Analysis Results
- Xerohome Methodology

1.1 Single-Family Home Electrification: Incremental Cost of Appliance Replacement & Contractor Interview Findings (Rincon)

To better understand upfront costs of single-family home electrification, existing conditions of single-family homes in Sacramento, and potential opportunities and barriers, Rincon conducted interviews with two contractors local to Sacramento. Contractors were identified by querying Sacramento Municipal Utility District's (SMUD) Contractor Network database for contractors that install panel upgrades in Sacramento. Interviewees included:

- Lance Newey, General Contractor, Star Energy Inc. – interviewed April 19, 2022
  - BPI Certified Building Analyst
  - 30 years of experience installing windows, siding, heating ventilation and air conditioning (HVAC), roofing, and building homes
- Chris Todd, Contractor and Owner, TRC Heating and Air – interviewed April 29, 2022
  - 37 years of experience installing and repairing HVAC

Interviewees were asked to describe the type of electrification work they do, provide average cost estimates for various appliance and equipment installations/upgrades associated with electrification, typical considerations associated with electrifying different appliance types, hurdles associated with electrification work, and recommendations for the City and SMUD in developing the EBES. A full list of questions used for the contractor interviews are provided in Attachment 1.

Existing Conditions – Single Family Homes in Sacramento

The primary appliances that require gas hookups in single-family homes in Sacramento are:

- Gas-fired water heaters for in-home water heating (showers, sinks, clothes washing)
- Gas-fired space heaters or furnaces (such as HVAC systems) for space heating
- Gas-fired dryers for clothes drying
- Gas-fired stoves for cooking

Additional appliances that require gas hookups include gas-fired fire pits, gas-fired refrigerators, gas-fired pool heaters. These appliances are less prevelant, and therefore were not priortized in the cost analysis.

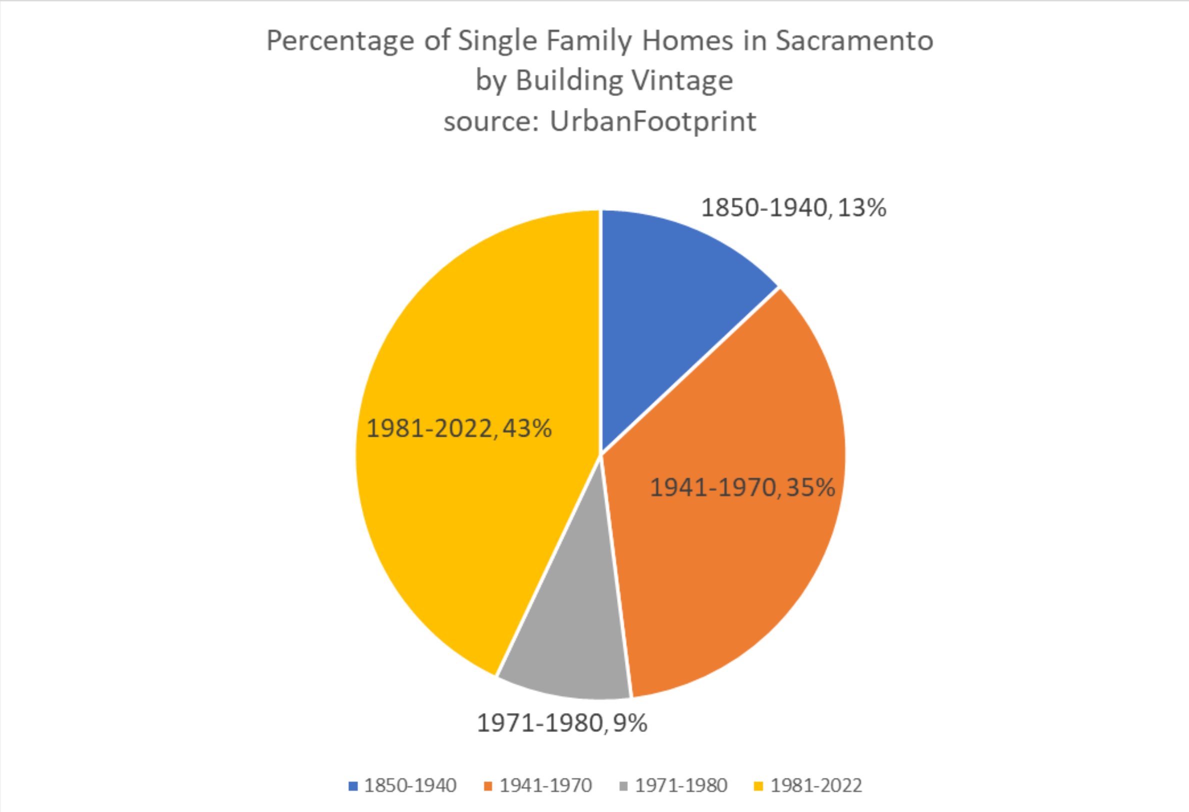
The Residential Appliance Saturation Study (Figure 2 and Figure 3) estimate the prevalence of electric space and water heating appliances in Sacramento. This study shows that 75% of buildings in Sacramento use gas for space and water heating, signaling the need for a retrofit process in order to reach the City's goal of all electric buildings by 2045.

Building vintage can be used as a reasonable proxy for understanding the types of infrastructure homes have or need to support electric retrofits, including the size of a home's electric panel[1] and whether the home has overhead or underground wiring.[2] Older homes may need additional supportive retrofits in order to accommodate all-electric appliances and/or maximize efficiency benefits of electrification. Figure 1 shows the breakdown of single unit building vintages in Sacramento.

[1] A building's existing electric panel can sometimes prohibit replacement of gas appliances with electric appliances if the addition of the electric appliances would result in an maximum electrical load from the house that exceeds the panel's capacity. In these cases, a panel upgrade may be needed to enable building electrification.

[2] Homes are generally connected to the electrical grid (i.e., the local utility's power lines and infrastructure) via either overhead or underground wiring. Overhead wiring connects to overhead power lines via droplines while underground wiring connects to the grid under the home's foundation. Underground wiring is significantly harder to upgrade because trenching is required – therefore, homes with underground wiring that need a panel upgrade for full-home electrification may be prohibitively expensive to electrify.

Figure 1 Single Family Homes by Vintage



Electrification Upfront Costs

To understand the upfront costs of electrification, Rincon gathered data through the interviews and supplemental desktop research to determine the cost to buy and install new gas appliances as well as new electric appliances. Rincon assumed that in an electrification scenario for a home, switching any gas appliance to an electric appliance would only occur if the gas appliance no longer functioned and was due for replacement. Because of this “replace-on-burnout” assumption, Rincon further determined the “incremental” cost of the electrification scenario by comparing it to a “like-for-like” scenario in which non-functioning gas appliances are replaced with similar, new gas appliances. The incremental cost is the difference between the electrification scenario and the like-for-like scenario. The incremental cost is the most relevant cost to understand because most appliances will be replaced “on-burnout”. When an appliance must be replaced anyway the building owner will incur some amount of cost up-front, whether the building owner chooses to electrify or replace like-for-like. While the electrification scenario is typically more expensive for all appliance types, the replace-on-burnout approach means the only relevant cost is the difference between the cost of the electrification scenario relative to the like-for-like scenario.

While some building owners may opt to replace their appliances before burnout in order to gain the benefits of electrification (improved air quality, lower greenhouse gas [GHG] emissions, bill savings, incentives and rebates) most people are expected to wait until burnout to replace their appliances. Therefore, while both gross and incremental costs are included in this memo, the incremental cost should be the focus for determining cost effectiveness.

Gas installation costs for the "like for like" baseline were identified through interviews with Sacramento contractors in 2022. However, these costs are likely low compared to todays rates due to recent inflationary pressures in the region. For example, more recent data provided by BAAQMD for water heater installations in the Bay Area are upwards of $5,000 on average. Therefore, these costs should be considered to be a conservative estimate when comparing the incremental cost of electrification.

For electrification costs, Rincon leveraged data provided by the TECH Clean California Rebate Program which includes installation costs for thousands of pieces of equipment in Sacramento County. This data is current as of January 2024. All costs are before rebates and incentives. Values in the cost columns include both product and installation costs, including additional work like wiring and panel upgrades. Because TECH data includes a panel upgrade if necessary, these costs were not added separately. An average panel upgrade is expected to cost between $3,000 and $5,000 if necessary, based on our conversations with contractors. However, homes which already have air conditioning are not expected to need panel upgrades in most cases, and the prevalence of new 120v water heating solutions also decreases the need to upgrade panels which are at least 100 amps for most single-family residential buildings.

The following tables summarize the cost data from the TECH Clean California (Single-family) for heat pump water heater (HPWH) and heat pump heating, ventilation, and air conditioning (HP HVAC) installation projects in Sacramento County.[3] The table series summarizes the number of projects for which data was collected and the average and median upfront costs for the installation projects. HP HVAC projects are further disaggregated by system duct type because this was identified as a key factor that affects cost. The "Notes" row of each table details how the data was filtered for each installation type. For each appliance install the first and third quartile installation costs are also provided, which were used to establish the "low" and "high" cost range for the analysis as shown below in Table 1, Table 2, and Table 3.

Table 1 Upfront Costs for HPWHs in Single-family Homes

Data Source	Number of Projects	Median Upfront Cost	First Quartile	Third Quartile
TECH Clean California (Single-family)	370	$4,997	$4,850	$7,859
Notes: TECH Clean California (Single-family) cost data was filtered to only include projects in Sacramento County, projects that involved a fuel switch (i.e., excluded projects that replaced an electric resistance water heater), and projects in single-family homes. Projects that included costs for more than one appliance type, thereby inflating costs, were also excluded.				

Table 2 Upfront Costs for HP HVACs in Single-family Homes

Data Source	Number of Projects	Median Upfront Cost	First Quartile	Third Quartile
TECH Clean California (Single-family)[2]	1,386	$19,795	$13,675	$23,940
Notes: TECH Clean California (Single-family) cost data was filtered to only include projects in Sacramento County, projects that involved a fuel switch (i.e., excluded projects that replaced an electric resistance water heater), and projects in single-family homes. Projects that included costs for more than one appliance type, thereby inflating costs, were also excluded.				

[3] TECH Clean California. "TECH Working Data Set_Single-family". Accessed at https://techcleanca.com/public-data/download-data/. Includes installations in single-family homes and small multifamily homes.

Table 3 Upfront Costs for HP HVACs in Single-family Homes by System Duct Type

Duct System	Number of Projects	Weighted Average Upfront Cost	Weighted Median Upfront Cost
HP HVAC - Ductless	55	$17,876.50	$17,071.67
HP HVAC - Ducted	1,331	$21,080.79	$19,947.73

Notes: TECH Clean California (Single-family) cost data was filtered to only include projects in Sacramento County, projects that involved a fuel switch (i.e., excluded projects that replaced an electric resistance water heater), and projects in single-family homes. Projects that included costs for more than one appliance type, thereby inflating costs, were also excluded.

A summary of the gross or total costs associated with the like-for-like scenario and the electrification scenario, as well as the incremental cost of the electrification scenario is provided in Table 4. The results of the cost analysis indicate that the incremental cost of full-home electrification, before incentives, can range between $4,482 and $22,697 depending on multiple factors such as whether economy or premium products are chosen, complexity of the installation, and whether an air conditioner is also being replaced. While these results indicate that the electrification scenario is more expensive than the like-for-like scenario, the incremental cost can, in many cases, be offset through incentives, as detailed below. Furthermore, additional modeling through the XeroHome Energy tool will provide projections regarding the annual on-bill savings associated with electrification and the return on investment (ROI) of an electrification project.

Table 4 Electrification Up-Front Costs As of 2022

Appliance	End Use	Low Estimate[1]	High Estimate[2]
Like-for-Like Scenario **Cost to replace gas appliances with similar, new gas appliances**			
Gas-fired water heater	Water Heating	$2,400	$3,400
Gas-fired HVAC system	Space Heating	$6,400	$6,900
Air conditioner	Space Cooling	$6,900	$7,700
Gas-fired dryer	Clothes Drying	$900	$1,300
Gas-fired stove	Cooking	$900	$3,400
Electrification Scenario **Cost to replace gas appliances with electric appliances**			
Electric heat pump water heater[3]	Water Heating	$4,900	$7,900
Electric heat pump HVAC system (heating and cooling)[4]	Space Heating/Cooling	$13,700	$23,900
Electric dryer	Clothes Drying	$1,700	$1,900
Induction stove	Cooking	$1,700	$4,000
Panel upgrade[5]	Electrical (included in average install, not summed)	$0	$3,500
Dropline upgrade[6]		$0	$0
Electrification Scenario Incremental Cost **Difference between electrification scenario and like-for-like scenario**			
Electric heat pump water heater	Water Heating	$2,500	$4,400
Without AC: Electric heat pump HVAC system (heating and cooling)	Space Heating/Cooling	$7,300	$17,065
With AC: Electric heat pump HVAC system	Space Heating/Cooling	$390	$9,400
Electric dryer	Clothes Drying	$700	$600
Electric stove	Cooking	$900	$600
Additional One-Time Costs[5]		$0	$3,500
Full-Home Electrification Incremental Cost (Without AC)*		**$11,357**	**$22,697**
Full-Home Electrification Incremental Cost (With AC)*		**$4,482**	**$15,017**

[1] Low estimate includes economy product costs and low-end installation costs from a simple install including new 220v wiring to the appliance and a 15% markup (e.g., where minimal configuration of the new system is required).

[2] High estimate includes premium product costs and high-end installation costs for a difficult installation.

[3] Contractors indicated that the worst-case scenario for installation costs of heat pump water heaters are when the heater is inside an interior closet that is too small for a heat pump water heater, or having to run electrical circuits in a 2-story house with slab.

[4] Electrification will sometimes require enlarging the return air, which can make the installation more expensive

[5] Not always required for electrification, and can potentially be avoided with a "watt diet" approach. Install costs for adding a new panel can be up to $10,000 if trenching is needed for a new service to reach underground wiring. The average install cost for each appliance included the cost of any panel or electrical work and is therefore, not added to the total below.

[6] SMUD covers dropline upgrade costs for residential customers.

* Totals may not sum due to rounding

Current SMUD Incentives

Current appliance electrification incentives available through SMUD are summarized in Table 5.

Table 5 Current SMUD Incentives (as of August 2022)

Description	Amount	Details
Induction cooktop rebate	$100-$750	Both standalone cooktops and ranges with built-in induction cooktops are eligible. Must install an induction cooktop/range measuring 30" or larger. Electric-to-electric replacements qualify for a $100 rebate; gas-to-electric replacements qualify for a $750 rebate. Before and after photos are required.
Heat pump water heater rebate	$500-$3000	Electric-to-electric replacements qualify for a $500 rebate; gas-to-electric replacements qualify for a $2,500 rebate. Rebates must be submitted by a qualified participating contractor through SMUD's contractor network.
Heating and cooling rebates	$750-$3,500	Electric-to-electric replacements qualify for a $750 rebate; gas to electric replacements with a two-stage heat pump qualify for a $2000 rebate; gas-to-electric replacements with a variable stage heat pump qualify for a $3,500 rebate. HVAC system must be installed by a participating contractor in the SMUD contractor network.
Panel upgrade rebate	$2,500	A gas-to-electric conversion is required for a project to qualify for this rebate. 220V wiring to appliance locations is required at time of panel upgrade.
Sealing and insulation rebate	Up to $3,000	Rebate available for air-sealing a home to SMUD program standards, installing and sealing new ductwork, and insulating an attic. Rebates must be submitted by a qualified participating contractor through SMUD's contractor network.
Sustainable Home Improvement Loans	APR 4.99%-7.99%	Projects including an energy efficiency upgrade (including gas-to-electric conversions) are eligible to apply for this financing. Can be combined with other SMUD rebates. Projects must use a qualified participating contractor through SMUD's contractor network. No application or origination fees.

Source: https://www.smud.org/en/Rebates-and-Savings-Tips

Inflation Reduction Act Incentives

In addition to the SMUD incentives, Inflation Reduction Act (IRA) tax credits available beginning in 2023 were also included. These include:

- Inflation Reduction Act of 2022 Federal Tax Credit of 30% (up to $2,000) for Air Source Heat Pumps (Reference: https://www.energystar.gov/about/federal_tax_credits/air_source_heat_pumps)
- Inflation Reduction Act of 2022 Federal Tax Credit of 30% (up to $2,000) for heat pump water heaters (Reference: https://www.energystar.gov/about/federal_tax_credits/water_heaters_non_solar)

The IRA tax credits can only be claimed for a total of $2,000 per year per household. Therefore, it was assumed that the heat pump water heater and HVAC credits would be claimed in different years. This was considered reasonable due to the focus on electrify on replacement.

An updated analysis of the incremental cost of full-home electrification with incentives from SMUD and the IRA included is shown in Table 6. The results of this table show that the incremental cost of electrification in Sacramento after rebates are applied can range between -$7,430 to $10,250 meaning that electrification could cost as much as $10,250 more than replacing appliances like-for-like or as much as $7,430 less than replacing gas appliances like-for-like.

Note that these incremental costs do not include TECH Clean California heat pump incentives, due to uncertainties about replenishment of TECH funding during the drafting of this report. These additional incentives are listed in Table 9. Check for the most up to date incentives at https://switchison.org/.

Table 6 Electrification Incremental Upfront Costs Including IRA Tax Credits and SMUD Rebates

Appliance	End Use	Low Estimate	High Estimate
Electrification Scenario Incremental Cost with SMUD rebates			
Electric heat pump water heater	Water Heating	$2,500	$4,440
Without AC: Electric heat pump HVAC system (heating and cooling)[1]	Space Heating/Cooling	$7,260	$17,070
With AC: Electric heat pump HVAC system (heating and cooling)[2]	Space Heating/Cooling	$390	$9,390
Electric dryer	Clothes Drying	$750	$630
Electric stove	Cooking	$860	$570
Additional One-Time Costs		$0	$3,500
SMUD Heat pump water heater rebate		$(3,000)	$(3,000)
SMUD Heating and cooling rebate		$(3,500)	$(3,500)
SMUD Induction cooktop rebate		$(750)	$(750)
SMUD Panel upgrade rebate		$–	$(2,500)
IRA 30% Ductwork incentive ($1,200 max)		$(1,200)	$(1,200)
IRA 30% HVAC tax incentive ($2,000 max)		$(1,460)	$(2,000)
IRA 30% Heat pump water heater tax incentive ($2,000 max)		$(2,000)	$(2,000)
Total Incremental Cost with Rebates (No AC)		**$(550)**	**$10,250**
Total Incremental Cost with Rebates (With AC)		**$(7,430)**	**$2,570**

[1] This is the estimated cost for an average HVAC system. System size varies depending on home size. The Xerohome model (described in more detail below) refines the cost for each individual home based on the size of HVAC needed.

[2] Cost savings are generated from electric heat pump HVAC system displacing cost of replacing AC as well as gas-powered HVAC system separately.

Federal Electrification Incentives under the Inflation Reduction Act & the High Efficiency Electric Home Rebate Act[4]

The Inflation Reduction Act (IRA) was signed into law on August 2022, ushering in significant federal policy support and funding for building decarbonization. The High Efficiency Electric Home Rebate Act (HEEHRA) is the official name of the IRA's rebate program for electric home technology including heat pumps, electrical wiring, and induction stoves, which will be available starting in 2023. The HEEHRA reductions are in addition to the tax credits included in the analysis above. Low-income households up to 80% of Area Median Income (AMI) can access 100% of upfront discount incentives, while moderate-income households from 80-150% AMI can access up to 50% of the

[4] Cost savings are generated from electric heat pump HVAC system displacing cost of replacing AC as well as gas-powered HVAC system separately.

upfront discount, in addition to tax credits that vary based on household income. Total HEEHRA discounts are capped at $14,000 across all electrification projects. HEEHRA discounts and tax credits are listed in Table 7. Only the tax credit reductions available under HEEHRA in late 2022 were included in this analysis. The upfront rebates were not included as they are broken out by income band, and our analysis is broken out by appliance type. However, for low and moderate-income households up to 150% of AMI in Sacramento, IRA incentives are expected to further increase the effectiveness of SMUD electrification incentives, and help to close the gap for appliances like dryers that are not currently covered by SMUD incentives.

Table 7 High Efficiency Electric Home Rebate Act Upfront Discounts and Tax Credits[1]

Appliance	End Use	Upfront Discount	Tax Credit
Electric heat pump water heater	Water Heating	$1,750	$2,000*
Electric heat pump HVAC system (heating and cooling)	Space Heating/ Cooling	$8,000	$2,000*
Electric dryer	Clothes Drying	$840	–
Electric/ Induction stove	Cooking	$840	–
Panel upgrade rebate		$4,000	$600 max/ yr + 30% of equipment and installation cost**
Electrical wiring rebate		$2,500	–
Total Discounts Available (Capped)		**$14,000**	

[1] https://www.rewiringamerica.org/app/ira-calculator

*Depending on income

** 25C & 25D Tax Credit

Area Median Income (AMI) is the household income for the median household in a given region. The Department of Housing and Community Development (HCD) publishes annual tables of the AMI based on household size for each county in California[5]. Anticipated income thresholds for the upfront IRA incentives are documented in Table 8 below. The Inflation Reduction Act defines low income as up to 80% of AMI, and moderate income as up to 150% of AMI. This is a notable difference from HCD's published tables, which define moderate income as up to 120% of AMI. This means that a household of four earning up to $170,850 would qualify for up front incentives for electrification through the IRA. Anticipated income thresholds for upfront IRA incentives are summarized by household size in Table 8.

[5] https://www.hcd.ca.gov/docs/grants-and-funding/inc2k22.pdf

Table 8 Anticipated Income Thresholds for Upfront IRA Incentives for Sacramento by Household Size (Based on 2023 AMI for Sacramento County)

# of Persons in Household	80% AMI	100% AMI	150% AMI
1	$63,800	$79,750	$119,625
2	$72,880	$91,100	$136,650
3	$82,000	$102,500	$153,750
4	$91,120	$113,900	$170,850
5	$98,400	$123,000	$184,500

TECH Clean California Incentives

TECH Clean California is a statewide initiative of $50 million funded by the California 2022-2023 fiscal year budget. Initially when drafting this report, the future availability of TECH funding was in question, but was refreshed through a California Public Utilities Commission Decision (23-02-005) in April of 2023. TECH funding availability should continue to be monitored, as it is subject to change.

TECH funding can be combined with heat pump water heating and HVAC systems from the SMUD Rebate program. Total TECH incentives this funding cycle are described in Table 9 for both single unit-residential buildings, as well as multi-unit residential buildings.

Table 9 TECH Upfront Incentives by Appliance Type & Housing Type (August 2023)

Appliance	End Use	Upfront Discount	Incentive Conditions
Single-Unit Residential*			
Electric heat pump water heater (HPWH)	Water Heating	$3,100	–
Electric heat pump HVAC system (heating and cooling)	Space Heating/Cooling	$1,000	Per HVAC outdoor condensing unit
Multi-Unit Residential*			
Split or packaged rooftop/multi/position heat pump (ducted or ductless)	Space Heating/Cooling	$2,000	Serving individual apartments. Replacing non-heat pump systems for previous space heating sources. Must pass AHRI test standards
PTHP, SPVHP, or unitary through the wall/ ceiling heat pump	Space Heating/Cooling	$500-1,000	Serving individual apartments. Replacing all space heating sources except for PTHPs. Must pass AHRI test standards
HP HVAC	Space Heating/ Cooling	$1,000	Serving multiple apartments. Incentive is per apartment served
Split or packaged rooftop/ multi-position heat pump (ducted or ductless)	Space Heating/ Cooling	$1,800	Serving common areas. Replacing non-heat pump systems
PTHP, SPVHP, or unitary through the wall/ ceiling heat pump	Space Heating/ Cooling	$3000-$800	Serving common areas, replacing non-heat pump systems. $300 incentive is for a single or two-stage compressor, while $800 is for a variable capacity/inverter-driven
< 55 gallon HPWH	Water Heating	$1,400	Replacing gas or propane previous water heating sources
≥ 55 gallon HPWH	Water Heating	$2,100	Replacing gas or propane previous water heating sources
All HPWH	Water Heating	$700	Replacing electric resistance water heating
<17 gal per bedroom served central HPWH	Water Heating	$1,200	Replacing non-heat pump systems for two or more apartments
≥17 gal per bedroom served central HPWH	Water Heating	$1,800	Replacing non-heat pump systems for two or more apartments
Heat pump pool heating	Heat Pump Pool Heating	$2,500	Multifamily heat pump pool or spa heating, incentives are per/system
Apartment panel or subpanel upgrades	Electrical panel upgrades	$1,400	Total incentive per apartment, apartment unit must have received a TECH-funded HVAC system or HPWH. Incentive is designed to replace undersized apartment electrical infrastructure that is upgraded as part of a HPWH or HP HVAC installation.

* Source: https://switchison.org/contractors/incentive-resources/; https://switchison.org/wp-content/uploads/2023/05/MF-Flyer.pdf

1.2 On-Bill Single Family and Low-Rise Multi-unit Costs

Residential Analysis with XeroHome™

In addition to ResStock, the project team also used an innovative building energy modeling (BEM)-based application developed by Vistar Energy called XeroHome™. [6] Unlike ResStock, which is a representative modeling of the building stock in a region, XeroHome takes publicly available data on homes and data from residents about their own homes and develops building energy models of individual homes at scale. Its large-scale building energy modeling platform can conduct customized home energy analysis for individual homes, which can be expanded to a portfolio-scale analysis for an entire city or a utility territory. While XeroHome models single family homes, the on-bill costs are likely to be similar to low-rise multi-unit residential. While savings are likely to be at the lower end due to higher overall efficiency, if single family homes see cost savings, low rise multi-unit residential using the same equipment likely will as well.

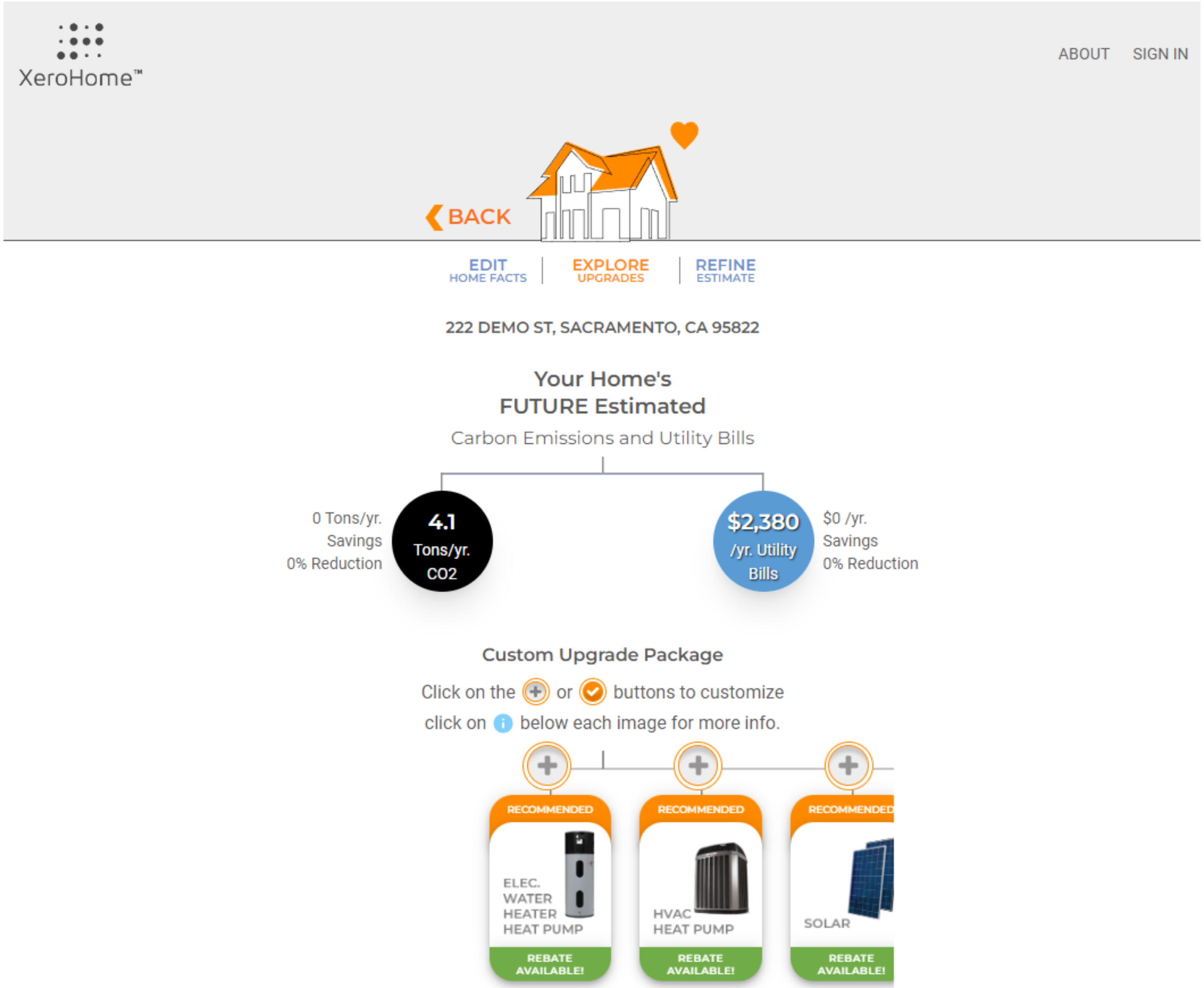
XeroHome generates recommendations for energy efficiency and electrification packages without the need for on-site energy audits. This makes it possible to scale the development of quality estimates of energy savings and upgrade recommendations for all homes in a region. EnergyPlus™, the building energy simulation tool developed by the US Department of Energy (DOE), powers the building energy models for individual homes in XeroHome. These are first developed using publicly available information, such as property tax assessment data, building permit data and GIS-based 3D geometry. These models can then be accessed on a web platform and improved with a virtual home energy audit performed by the home's residents. Residents access their home's energy model over XeroHome's web-based user interface, while cities access the same data aggregated for all homes in the region through a dashboard, shown in Figure 2.

As a whole-building energy modeling-based application, XeroHome can identify specific combinations of upgrades that are cost-effective. Using this, the city or utility can see if strategically combining electrification upgrades with energy efficiency or solar options can increase the overall package cost-effectiveness. This packaging of energy upgrade measures can be used to overcome the barrier of promoting electrification where the economics are currently challenging.

This analysis was the basis for the XeroHome web-based tool that was deployed for Sacramento residents, as part of this project. XeroHome's web interface allowed Sacramento residents to review the output of an energy model of any single home within the boundaries of the study. They receive customized home energy analysis, and an interface to review cost-effectiveness of energy upgrades for their home. They also receive information about relevant rebates and programs available to them. The models can be verified and improved with a virtual home energy audit performed by the residents. To encourage electrification, the resident receives information on upgrade packages where electrification upgrades are strategically combined with other efficiency and rooftop solar measures to give a positive return on investment.

[6] (Saxena, et al., 2018) (Saxena, May-Ostendorp, Coulter, & Kuch, 2020) (Saxena, Dhir, Fergadiotti, & Ahmed, 2022) (Saxena, Dhir, Cunningham, Read, & Bruceri, 2022).

Figure 2 XeroHome's Web Interface for Residents



At scale, XeroHome was also used to determine the costs, savings and payback periods for electrification upgrades, which provided a finer-resolution analysis than was possible with ResStock.

Utility Rates

For the XeroHome analysis, the project team used SMUD's 5-8 Time-of-day (TOD) electric rate and PG&E's G1 Residential gas rate. (Reference: https://www.smud.org/en/Rate-Information/Residential-rates and https://www.pge.com/tariffs/rateinfo.shtml). The rates use for this analysis are included in Figure 3 and Figure 4.

Figure 3 SMUD TOD 5-8 Rate Used in XeroHome Analysis

				$/kWh
SMUD	*TOD 5-8*	Winter (Oct-May)	On-Peak	0.1547
			Off-Peak	0.112
		Summer (Jun-Sep)	On-Peak	0.3279
			Mid-Peak	0.1864
			Off-Peak	0.135

Figure 4 PG&E Residential Gas Rate (G1-R in 2020)

		$/therm	$/therm
		Baseline	Excess
PG&E	G1	1.55017	2.06752

Utility Rate Updates (Not Modeled)

In 2024, both PG&E and SMUD adopted rate increases that would cause changes to the cost effectiveness calculations. Due to project constraints, a complete analysis of these impacts was not feasible. However, based on the rate changes by both utilities, the cost effectiveness of electrification is expected to improve as expected. This analysis used the PG&E gas rates under the G-1 residential tariff which was 1.55 $/therm for baseline and 2.067 $/therm for excess usage. Gas rates under G-1 for the first three months of 2024 was an average of 2.33 $/therm for baseline and 2.75 $/therm for excess. This is an increase of baseline per therm usage of 51% for baseline therms and 34% for excess therms as shown in Table 10.

Table 10 Comparison of Modeled and Updated PG&E Natural Gas Rates (dollar/therm)

			Modeled	2024 Rates	Difference
PG&E	G-1	Baseline	$1.55	$2.33	51%
		Excess	$2.07	$2.77	34%

At the same time SMUD also increased the cost of a kWh of electricity, but by a much smaller percentage. SMUD electricity under their 5-8 TOD rate increased between 4% and 6% depending on the time of day with on-peak hours increasing more as shown in Table 11.

Table 11 Comparison of Modeled and Updated SMUD Electricity Rates (cents per kWh)

			Modeled	2024 Rates	Difference
TOD 5-8	Winter	on peak	$0.155	$0.159	3%
		off peak	$0.112	$0.115	3%
	Summer	on peak	$0.328	$0.346	6%
		mid peak	$0.186	$0.197	6%
		off peak	$0.135	$0.143	6%
Average					**4%**

The proportionally greater increase in gas rates would further increase the benefit of electrification in SMUD territory and aligns with the rate projections established in this report. Natural gas rates are expected to continue to outpace electricity rates over time, especially in SMUD territory.

Costs (Vistar Analysis)

The cost of energy efficiency and electrification upgrades were calculated for each home based on specifics of the home. The project team referenced Rincon Consultant's research and utilized the costs referenced in Table 4. It should be noted that the XeroHome tool does not use incremental costs, but rather total costs after rebates.

Rebates for Electrification Upgrades

Rebates included in the analysis were as follows.

- SMUD Rebate: $2,500 for a heat pump water heater upgrade (gas-to-electric) 65 gallon+ (Reference: https://www.smud.org/hpwh)
- SMUD Rebate: $3,500 for a variable-stage heat pump system gas to electric heat pump HVAC (Reference: https://www.smud.org/hvac)
- Inflation Reduction Act of 2022 Federal Tax Credit of 30% (up to $2,000) for Air Source Heat Pumps (Reference: https://www.energystar.gov/about/federal_tax_credits/air_source_heat_pumps)
- Inflation Reduction Act of 2022 Federal Tax Credit of 30% (up to $2,000) for heat pump water heaters (Reference: https://www.energystar.gov/about/federal_tax_credits/water_heaters_non_solar)

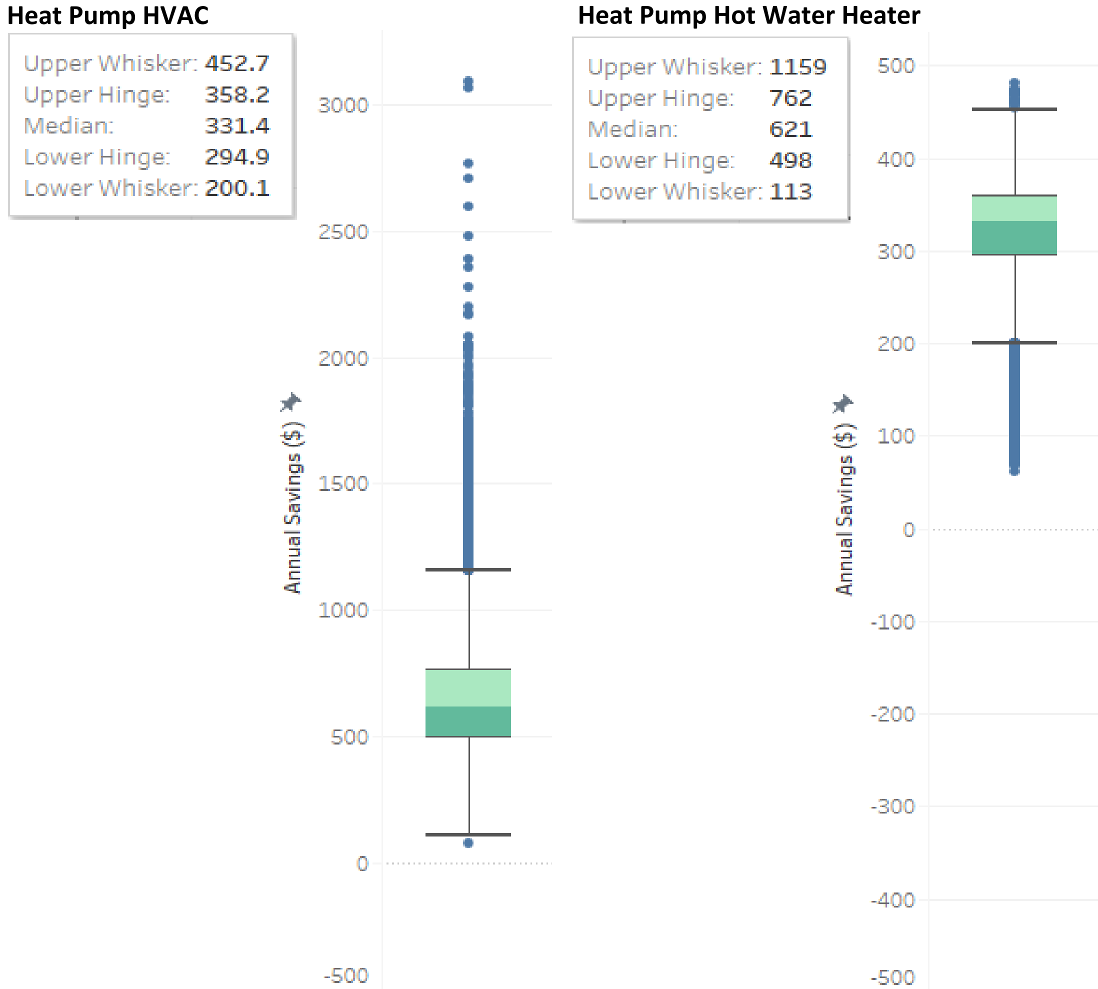
Electrification Upgrade Analysis Methodology

To determine the on-bill cost effectiveness of electrifying single family and low-rise multi-unit residential buildings in Sacramento the XeroHome model was used to replace the furnace and natural gas water heater assumed in the model with heat pumps. The model only looked at these two appliances for two reasons:

1. Furnaces and water heaters account for the majority of overall natural gas consumption as shown in Figure 5. The remaining natural gas use from dryers and stoves was not expected to change on-bill costs in a substantial manner.
2. The proposed ordinance will only cover furnaces and water heaters as they require permits for replacement.

Xerohome was able to model the change in natural gas and electricity consumption resulting from the switch to heat pumps for each of the 115k individual homes modeled. Using this energy demand on an hourly basis along with the rates listed above, the total on-bill costs were calculated for each building. As shown in Figure 5 every home in Sacramento is projected to see on-bill savings from swapping to a heat pump water heater and HVAC unit. The graphs below show box and whisker plots of each of the 115k homes being represented by a dot. 50% of all homes fall within the shaded area and 75% of all homes fall within the whiskers. The upper end of the shaded area is called the upper hinge and the lower end is the lower hinge. Blue dots outside of this area are considered outliers. However, no homes saw increases in their bill.

Figure 5 On-bill Cost Impacts from Switching to Heat Pump Water and Space Heaters



Based on the upfront incremental costs after rebates and the modeled on-bill costs identified by Xerohome, every single-family home that electrifies their gas water heaters and their furnace and AC unit at the same time will see upfront and on-bill savings. In cases where the replacement of the furnace and AC are staggered some homes may see an upfront cost of approximately $2,000 or less. These homes are expected to see a return on investment of less than two years based on the average annual savings of $950 after electrification of these two appliances. Actual paybacks will be based on the individual phasing of each home's electrification projects. Based on this analysis, electrification of Sacramento's residential building stock is considered cost effective under today's utility rates and rebate structures.

2 Large Multi-Unit Residential & Commercial Building and Cost Analysis

To better understand costs and other constraints related to multi-unit residential and nonresidential building electrification, Rincon conducted interviews with three energy engineering consultants working on large building decarbonization in Sacramento. Interviewees were identified through the City's contact network. Interviewees included:

- Dan Mendonsa, Energy Manager, UC Davis Health[7] – interviewed November 7, 2022
  - Mr. Mendonsa manages the UC Davis Health building decarbonization strategy and implementation
- Kelvin Marshall, Account Supervisor, SMUD[8]—interviewed November 8, 2022
  - Mr. Marshall manages school accounts for SMUD, assisting with building efficiency and decarbonization updates
- Jeff Krisa, Managing Director, Brighton Energy9 – interviewed June 8, 2022
  - Brighton Energy administers SMUD's commercial and multi-unit residential building decarbonization program
- Sebastian Cohn, Project Manager, Association for Energy Affordability (AEA)[10] – interviewed July 1, 2022
  - AEA manages and implements SMUD's multi-unit residential rebate program and supports BayREN decarbonization programs
- Nic Dunfee, Building Decarbonization Director, TRC Companies[11] – interviewed July 7, 2022
  - TRC supports utilities in transitioning energy efficiency programs to decarbonization programs

Interviewees were asked to describe the type of electrification work they do, provide an overview of the best opportunities and biggest barriers for multi-unit residential and nonresidential building electrification, and recommendations for the City and SMUD in developing the EBES.

Electrification Up-Front Costs and Other Considerations

All interviewees communicated that larger multi-unit residential and nonresidential buildings are more complicated to electrify than single-family homes and estimating costs is typically only possible on a project-by-project basis. This is because for most larger buildings, replacing a gas system with a similarly sized electric system is cost-prohibitive and therefore, often requires building re-engineering to determine appliance replacement and sizing options. For this reason, a detailed cost analysis for larger multi-unit residential and commercial buildings was not developed

[7] https://energy.ucdavis.edu/
[8] https://www.smud.org/
[9] https://www.brightonenergy.net/
[10] https://aea.us.org/
[11] https://www.trccompanies.com/

and included here. All-electric technologies for process-load specific commercial applications are also less market-tested in comparison to residential technologies, though they are still available on market. Smaller buildings with domestic-sized space and water heating end uses, such as small to medium-sized retail or service buildings, have similar electrification costs as seen for single-family homes.

Electrification Opportunities

Interviewees identified more interest from customers in electrification projects over the past year, mostly driven by rising gas prices. The best opportunities available now are with domestic-sized water and space heating end-uses. These projects often allow for swapping gas systems with similarly sized electrical systems using technologies available for single-family homes. One example identified was switching gas powered package units with similar heat pump package units, which can be done for relatively low incremental cost.

Other scenarios where electrification costs can be favorable include:

- Buildings with systems that are due for upgrades and have had costly performance issues in the past (e.g., heat loss, pipe leaks, system failures).
- Buildings with ongoing maintenance, health, or safety issues where electrification can present a solution to these issues.
- Businesses with morning-heavy hours that may want to take advantage of the lower time-of-use rates that SMUD offers in the morning.
- Buildings that are due for a simple-system water heater upgrade; installing a heat pump almost always results in lower utility bills because of the energy efficiency increase and rising gas costs.

In situations where building re-engineering can't be avoided and whole-system upgrades may be needed for successful electrification, interviewees also noted the benefits of conducting energy modeling on the building's operations and running custom calculations, which can demonstrate a reduced peak electrical load and avoid the need for costly panel upgrades. One interviewee additionally noted that correctly installed equipment is very important, as incorrectly installed equipment can significantly increase the peak electrical load.

Electrification Hurdles

Interviewees generally agreed that in many situations, utility bills will not decrease with electrification. Serious financial analysis is usually needed to make a financial case for electrification, and this does not always show long-term savings. This is especially true for projects involving centralized systems, complex controls, and building management systems. Electrifying larger buildings also takes more time because larger commercial equipment typically lasts longer; one interviewee suggested anticipating that 100% building electrification in Sacramento would likely take two equipment lifecycles. Assuming commercial equipment lasts around 20 years, 100% building electrification may take 40 years without substantial planning and incentives or requirements.

Additional existing hurdles identified included:

- Existing contractor capabilities are limited and not many contractors can do commercial-scale building electrification.

- Last-mile infrastructure (transformers, conductors) must often be upgraded for electrification work and fixing it can be cost prohibitive. This is especially true in downtown Sacramento where electric wiring is typically vaulted underground and difficult to access.
- Retrofits depend strongly on space constraints; electrification can mean rededicating space on a property to system build-out and this is often not favorable to building owners (and may not be feasible based on available space, or roof capacity, for example).

Case Studies

Rincon identified all-electric retrofit case study projects for offices, schools, and restaurants. Schools (primary and secondary), hospitals, and restaurants (full-service and quick-service), represent some of the largest gas users among commercial buildings in Sacramento. However, the City of Sacramento does not have jurisdiction over schools or hospitals. Offices represent a smaller portion of gas usage in Sacramento but are the primary building type owned by the City of Sacramento, and therefore, represent a good opportunity for leadership. Case studies were pulled from The Redwood Energy Pocket Guide to All-Electric Retrofits,[12] the William J Worthen (WJW) Foundation Building Decarbonization Practice Guide Volume 5,[13] and the California State University (CalState) Decarbonization Framework,[14] and summarized here. Hospitals and warehouses are also large gas users in Sacramento, however, at the time of this document no case studies for these building types were identified.

Office

100 AVENUE OF THE AMERICAS, MANHATTAN, NY (>20,000 SQUARE FEET; ALL-ELECTRIC RETROFIT)

This building was retrofitted to meet all winter space heating needed for exterior offices with waste heat from the air conditioning in the interior core of the building during the winter through an all-electric multizone heat pump HVAC system. Multizone systems are best for larger (20,000 square feet or more), more diverse buildings. While only 6% of HVAC systems in California are multizone systems that could be replaced with multizone heat pump technology, these buildings represent 37% to 75% of the GHG emissions from all buildings. They are technically complex to design and require highly skilled installers but also represent the largest GHG reduction opportunities[15]

SONOMA CLEAN POWER HEADQUARTERS, SANTA ROSA, CA (15,000 SQUARE FEET; ALL-ELECTRIC RETROFIT)

The building was originally built in 1979 in Downtown Santa Rosa and retrofitted with all new insulation, all-new windows, all-new siding, and all-new mechanical systems. As part of the retrofit, the building installed Daikin rooftop units with variable air volume delivery and thermofusers at the zone level. The project also included its own microgrid and electric vehicle charging, which required an electrical service upgrade[16].

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[12] Redwood Energy. June 2022. A Pocket Guide to All-Electric Retrofits of Commercial Buildings.

[13] William J Worthen Foundation. March 2022. The Building Decarbonization Practice Guide Volume 5: All-Electric Residential + Commercial Kitchens.

[14] CalState Office of the Chancellor. 2022. CSU Decarbonization Framework.

[15] Redwood Energy. June 2022. A Pocket Guide to All-Electric Retrofits of Commercial Buildings.

[16] Redwood Energy. June 2022. A Pocket Guide to All-Electric Retrofits of Commercial Buildings.

School

CALIFORNIA STATE UNIVERSITY, CALIFORNIA

The CSU Chancellor's Office released a building decarbonization framework for the CSU system, which includes tools to evaluate central plan equipment, thermal overlap calculations for each campus, and a life cycle cost calculation tool for different decarbonization strategies. The framework provides all 23 campuses with a technical roadmap for replacing fossil fuel infrastructure with clean, electrified alternatives. The associated heat recovery potential and natural gas reduction at each campus was analyzed. The Sacramento CSU campus currently uses 78,164 million British Thermal Units per hour (MBTU) for cooling and 52,739 MBTU for heating. The heat recovery potential estimated for the building after adding thermal energy storage on site is 64% and the estimated natural gas reduction potential is 422,000 therms.[17]

CHATHAM UNIVERSITY EDEN HALL CAMPUS, PITTSBURGH, PA (ALL-ELECTRIC NEW CONSTRUCTION)

The campus is the world's first fully self-sustained and zero net energy (ZNE) university campus. The campus includes 46 geothermal wells, an on-campus water treatment site, and a 40-acre farm. The campus kitchen was designed based on extensive energy analysis focusing on commercial kitchen equipment and HVAC systems. The analysis showed that induction equipment would reduce total kitchen energy consumption by over 50% compared to a traditional gas kitchen. The campus also installed demand-based exhaust hoods with integrated heat recovery, a geo-exchange heat pump, and radiant heating and cooling systems for a low-energy HVAC system. The facility operates with an energy usage of approximately 60% below the typical full-service restaurant.[18]

Restaurant

OYSTERMAN SEAFOOD BAR & KITCHEN, LONDON, ENGLAND; RETROFIT (INDUCTION UNITS)

The restaurant switched from gas to induction units, which allowed the restaurant to serve guests at a significantly faster rate. Gas ranges and fryers are half as efficient at transferring heat as electric ranges and fryers (35% vs. 75%), and electric ranges boil water twice as fast as gas ranges. Electric kitchens, therefore, use half or less as much heat to cook food and require half as much air conditioning. Electric equipment also takes less space to do the same amount of cooking, making it easier for a kitchen to expand its cooking capacity. In addition to these benefits, Oysterman also experienced fewer chef burns with their induction burners and found cleaning to be much easier, ultimately reducing staff turnover[19].

HOTEL MARCEL, NEW HAVEN, CT; NEW ALL-ELECTRIC CONSTRUCTION

The hotel has an all-electric commercial kitchen, which uses induction, including an induction wok setup.[20] Induction woks are not common in American commercial kitchens, however, they are becoming increasingly popular in Mainland China, Taiwan, Hong Kong, and Macau. Many commercial options exist on the market for induction cookers that can accommodate concave pans

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[17] CalState Office of the Chancellor. 2022. CSU Decarbonization Framework.

[18] William J Worthen Foundation. March 2022. The Building Decarbonization Practice Guide Volume 5: All-Electric Residential + Commercial Kitchens.

[19] Redwood Energy. June 2022. A Pocket Guide to All-Electric Retrofits of Commercial Buildings.

[20] Business Wire article, accessed at: https://www.businesswire.com/news/home/20220420005918/en/The-First-Anticipated-Net-Zero-Hotel-and-First-Passive-House-Certified-Hotel-in-the-US-Slated-to-Open-This-Spring

(such as woks). 15 million induction cookstoves were sold in Mainland China in 2020, with a growth of nearly 4% from the previous year.[21]

MICROSOFT REDMOND CAMPUS CAFETERIA, REDMOND, WA; NEW ALL-ELECTRIC CONSTRUCTION

The Microsoft Redmond Campus serves over 12,000 meals a day in 77,000 square feet of all-electric kitchens. The project had to overcome barriers such as equipment availability, throughput considerations, and station design. Microsoft has noted a positive response from the industry in the past few years enabling the transition for them.[22]

Recommendations from Interviewees

As part of the interview process, Rincon asked contractors what recommendations they have for the City or SMUD for reducing barriers to electrification in the City. These recommendations included:

- Alleviate the burden on the customer for upgrading older, last-mile equipment such as transformers and services. Having to upgrade this equipment can kill a project. SMUD could identify transformers that are already at peak capacity and deal with them pro-actively, or identify grant funds to help cover these costs.
- More workforce training and work with the unions is needed to prepare the workforce for electrification work.
- Remove cap on incentives to encourage larger buildings to get the full incentive benefit.
- Encourage projects to build in more hot water storage to help avoid an increased peak electrical load.
- Develop policy to avoid over-estimation of panel needs, which can trigger larger-scale electrical upgrades that are prohibitively expensive. Default calculations on equipment tend to overestimate peak load and using real data from a building instead can help avoid ballooning expenses.
- Adjusted rate structures could be an incentive for early electrification adopters, since this would help guarantee on-bill savings in many cases. Peak demand for commercial customers currently sets their billing rate. Many customers are on the edge of hitting their peak demand charge and electrification would bump them into a higher tier, creating a disincentive to electrify. A specific commercial electrification rate with a discount would help remove this barrier.
- Expedited permits could create an incentive for commercial customers to electrify, especially on smaller jobs. Ideally, the permit could be filled out online over-the-counter with a simple set of questions with a permit turn-around rate of 24 hours.
- A building performance standards approach could work well for commercial buildings. San Francisco’s program is recommended as a model. San Francisco’s program is self-reporting but is validated. Buildings over 10,000 square feet are required to complete a level 1 audit; buildings over 50,000 square feet are required to complete a level 2 audit, and reporting requirement is every five years. Setting up the reporting system online with simple report requirements and very low rigor at the start would help get the most buildings into the system.

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[21] HKTDC Market Research, accessed at: https://research.hktdc.com/en/article/MzA3OTE4MTUw

[22] William J Worthen Foundation. March 2022. The Building Decarbonization Practice Guide Volume 5: All-Electric Residential + Commercial Kitchens.

- Releasing a building performance standards program under something other than an electrification strategy may be the best tactic. This approach could appear more feasible, and avoid misunderstandings on potential for mandatory upgrades.

Current SMUD Incentives

Current electrification incentives available through SMUD for commercial and multi-unit residential buildings are summarized in Table 12.

Table 12 Current SMUD Incentives (as of April 2024)

Description	Amount	Details
Commercial Building Incentives		
Residential-style heat pump water heater rebate	$1,500/unit	Equipment must be listed on SMUD's qualified product list. To qualify, submit an application online including photos of the new and old equipment.
Commercial-style heat pump water heater rebate	$4,000/unit	Equipment must be listed on SMUD's qualified product list. To qualify, submit an application online including photos of the new and old equipment.
Inverter driven variable capacity mini-split heat pump rebate	$500/ton of cooling	Equipment must meet minimum Title 24 efficiencies. To qualify, submit an application online including photos of the new and old equipment.
Packaged and split system heat pump (3-20 tons)	$550/ton of cooling	Equipment must meet minimum Title 24 efficiencies. To qualify, submit an application online including photos of the new and old equipment.
Variable refrigerant flow (VRF) heat pump	$1,000/ton of cooling	Equipment must meet minimum Title 24 efficiencies. To qualify, submit an application online including photos of the new and old equipment.
Heat recovery chiller or custom-engineered heat pump for hydronic service rebate	$3,000.ton or $0.30/kWh-e (whichever is higher)	To qualify, submit an application online including photos of the new and old equipment.
Customized engineered air to air heat pump HVAC system, hybrid gas electric systems rebate	Contact SMUD for custom calculations	To qualify, submit an application online including photos of the new and old equipment.
Induction cooktop (hob or wok) rebate	$450/hob	Only available for equipment that replaces/displaces gas usage. Minimum of 2 hobs per unit. 280V/2.5kW per hob minimum. Only available for foodservice customers. Documentation of new and old equipment required for rebate
Electric infrastructure improvement incentive	$1,000-$2,000/unit	$1,000/unit for a split-system heat pump water heater, inverter-driven variable capacity mini-split heat pump (1-5 tons), VRF heat pump, or induction cooktop installation. $2,000/unit for a residential or commercial-style heat pump water heater or packaged and split system heat pump (3-20 tons) installation. To qualify, submit an application online including photos of the new and old equipment.
Permitting and engineering support incentive	$750/project	To qualify, submit an application online including photos of the new and old equipment.
Multi-unit Residential Building Incentives		
Apartment HPWH rebate	$1,800/unit	NEEA Tier 3 or better.
Common area HPWH rebate	$1,800/unit	Serves communal spaces.
100% electric Central HWPW <15-gal HP rebate	$1,500/unit served	

Description	Amount	Details
100% electric Central HWPW ≥ 15-gal HP	$2,000/unit served	
Unitary (residential size) heat pump HVAC rebate	$600-$2,700/unit	$2,700/inverter-driven split system compressor (>17 SEER, single head unit or ducted); $600/head/additional mini-split head unit; $1,400/inverter-driven compressor (through the wall); $1,950/DW heat pump system (split or rooftop, >15 SEER + smart thermostat)
Common space (commercial size) heat pump HVAC rebate	$1.50-$2.50/square foot	$1.50/square foot served for a heat pump system (package & split, single or two stage compressor); $2.50/square foot served for inverter-driven/variable capacity central HVAC system
Multi-apartment (commercial size) heat pump HVAC rebate	$1,500-$2,500/unit	$1,500/unit for commercial heat pump system (package & split, single or two stage compressor); $2,500/unit for inverter-driven/variable capacity central HVAC system service multiple apartments
Residential heat pump dryer rebate	$400/unit	
Induction cooktop rebate	$100-$750/unit	$100 for electric-to-electric conversion; $750 for gas-to-electric conversion
Electrical panel, circuit, or transformer upgrades rebate	Up to $650/unit or $50,000	Only available for gas-to-electric projects.
Permitting and engineering support incentive	$750/project	Only available for gas-to-electric projects.
Low GHG refrigerant rebate	20% additional per applicable heat pump measure	For heat pumps using natural refrigerant with GWP <750

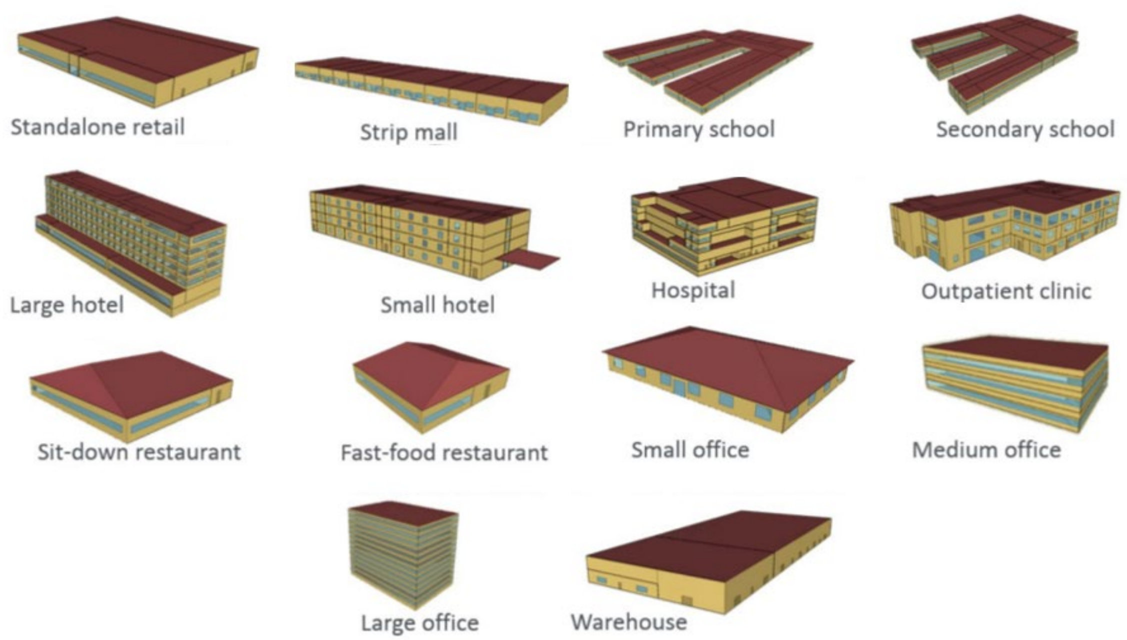
Source: https://www.smud.org/en/Rebates-and-Savings-Tips/Go-Electric/Business-Go-Electric

3 Sacramento Building Energy Use Analysis

3.1 Commercial Buildings Analysis with ComStock™

For commercial buildings, the project team used ComStock, a U.S. Department of Energy (DOE) model of the U.S. commercial building stock, developed and maintained by the National Renewable Energy Laboratory (NREL.) The model uses a sample of building characteristics from DOE's Commercial Prototype Building Models and Commercial Reference Building and combines these with a variety of additional public- and private-sector datasets. Collectively, this information provides high-fidelity building stock representation with a realistic diversity of building characteristics. ComStock provides prototypes for 14 commercial building types as shown in Figure 6 below.

Figure 6 ComStock 14 Building Types



ComStock has a total of 1,052 commercial building prototypes that represent buildings in the Sacramento region. This region is shown in map below Figure 7 that shows Public Use Microdata Areas (PUMAs) that cover the region of the City of Sacramento. PUMAs do not map directly onto the City of Sacramento boundary, which is a limitation of the ComStock Data, as seen below.

Figure 7 Sacramento Region Represented by PUMAS in ComStock and ResStock

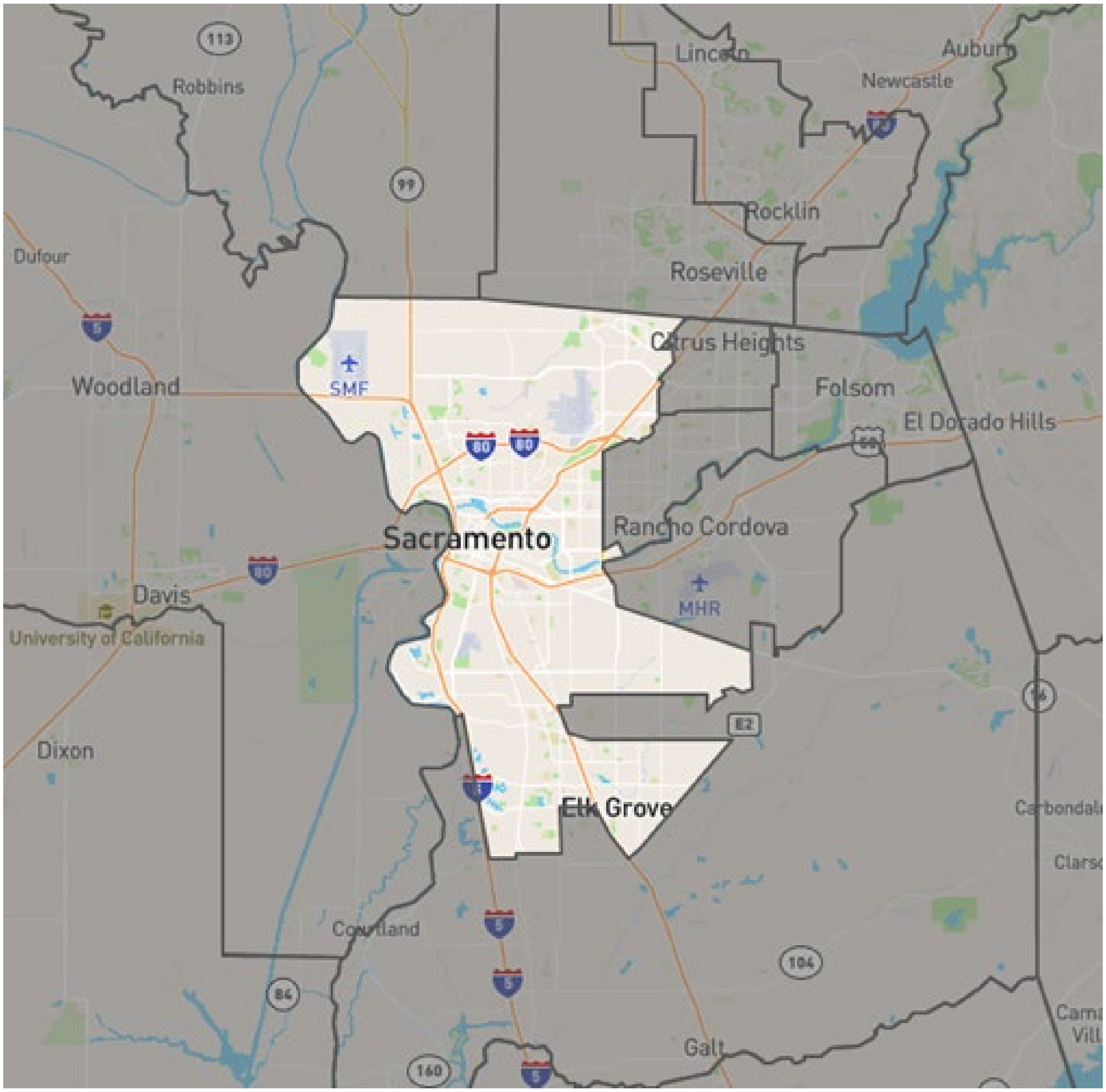


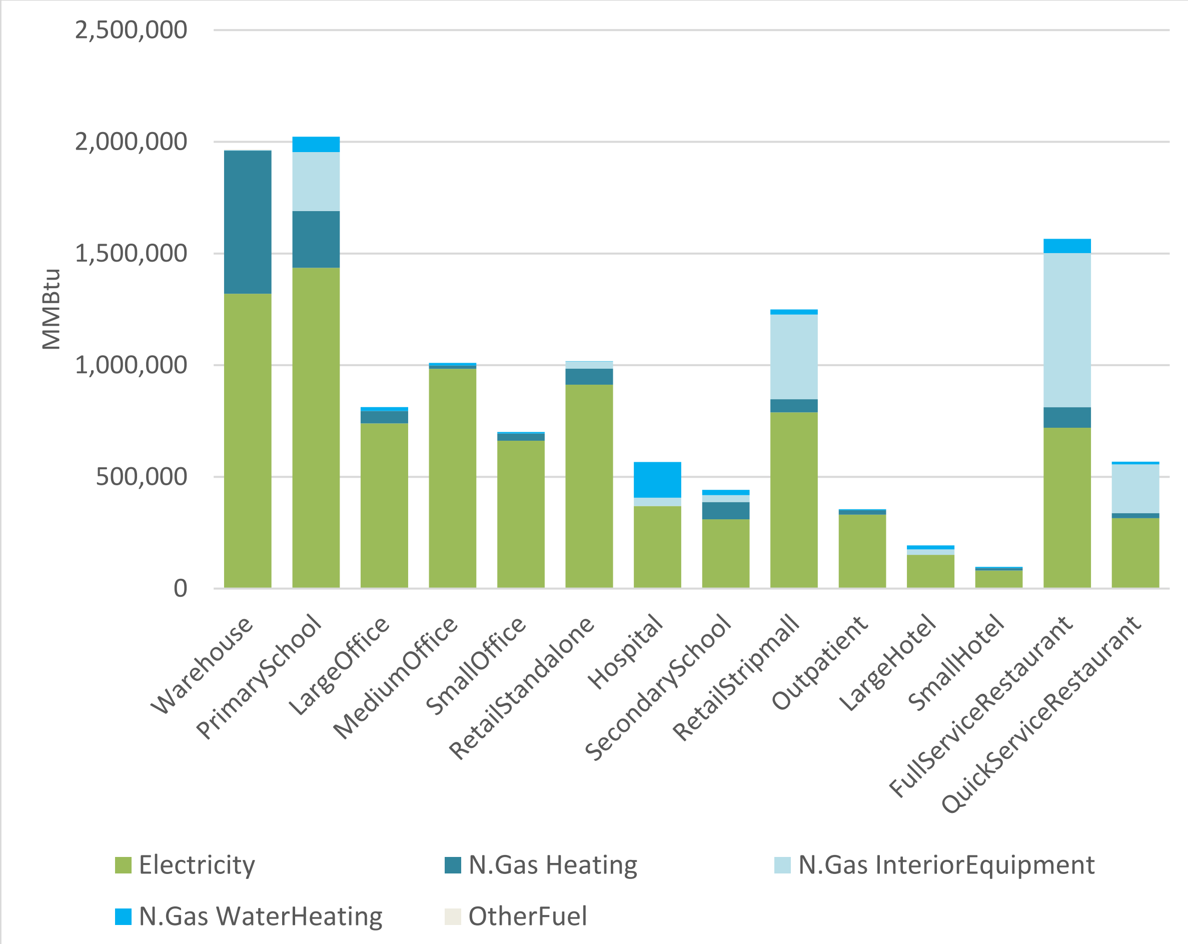
Figure 8 provides the total building area (sq. ft.) of commercial buildings in Sacramento represented by prototypes in ComStock and its breakdown by building type and vintages.

Figure 8 Total Area (sq. ft.) of Commercial Buildings in Sacramento Represented by Prototypes in ComStock

Sacramento Commercial Buildings Total Area (SF) Represented in ComStock	Pre-1975	1976-2003	Post 2003	Total
Full-Service Restaurant	1,746,735	940,983	56,346	2,744,064
Hospital	5,788,549	5,788,549	0	11,577,099
Large Hotel	2,639,157	1,131,067	0	3,770,225
Large Office	16,135,261	0	2,689,210	18,824,471
Medium Office	10,353,905	4,918,105	2,070,781	17,342,791
Outpatient	2,217,390	2,217,390	0	4,434,779
Primary School	11,180,598	12,900,690	0	24,081,287
Quick Service Restaurant	216,244	405,457	27,030	648,732
Retail Standalone	7,446,243	4,061,036	1,288,015	12,795,294
Retail Strip mall	4,922,524	1,504,808	745,099	7,172,431
Secondary School	6,928,977	2,313,132	0	9,242,110
Small Hotel	2,667,486	435,626	21,781	3,124,894
Small Office	10,344,317	4,115,897	1,105,553	15,565,768
Warehouse	22,186,745	14,213,734	2,183,368	38,583,847
Total	**104,774,132**	**54,946,476**	**10,187,184**	**169,907,792**

Using the ComStock model, the total energy consumption for all commercial buildings in Sacramento by building prototype was also estimated. Energy consumption in Metric Million British Thermal Units (MMBtus) was estimated for electricity, natural gas (used for space heating, water heating, and other equipment such as dryers and stoves), and other fuel, which could include propane. The results of this analysis are shown in Figure 9.

Figure 9 Commercial Building Energy Consumption by Building Prototype (MMBtu)



Once the total energy usage in MMBtu was quantified, ComStock was also used to estimate the MMBtu reduction associated with moving from natural gas fired furnaces and water heaters to heat pumps. The results of this analysis are shown below in Figure 10. Most buildings see a significant reduction in natural gas consumption as only stoves and dryers remain. Restaurants continue to have significant natural gas use due to the high natural gas demand related to cooking. Some building types see overall reductions in MMBtu consumption including the warehouse, primary school, and full-service restaurant building prototypes. Other building types see reductions in natural gas usage, but similar overall energy consumption including the medium office and quick service restaurant prototypes. Figure 11 converts MMBtu's to GHG emissions in MT CO_2e for two scenarios. The first scenario (baseline) looks at current emissions based on ComStock results and current electricity and natural gas emission factors. The second scenario (renewables + electrification) shows what emissions would be after all commercial buildings switch to heat pump HVAC and hot water heaters and use SMUD carbon free electricity.

Figure 10 Commercial Building Energy Consumption After Heat Pump Retrofits for HVAC and Water Heating (MMBtu)

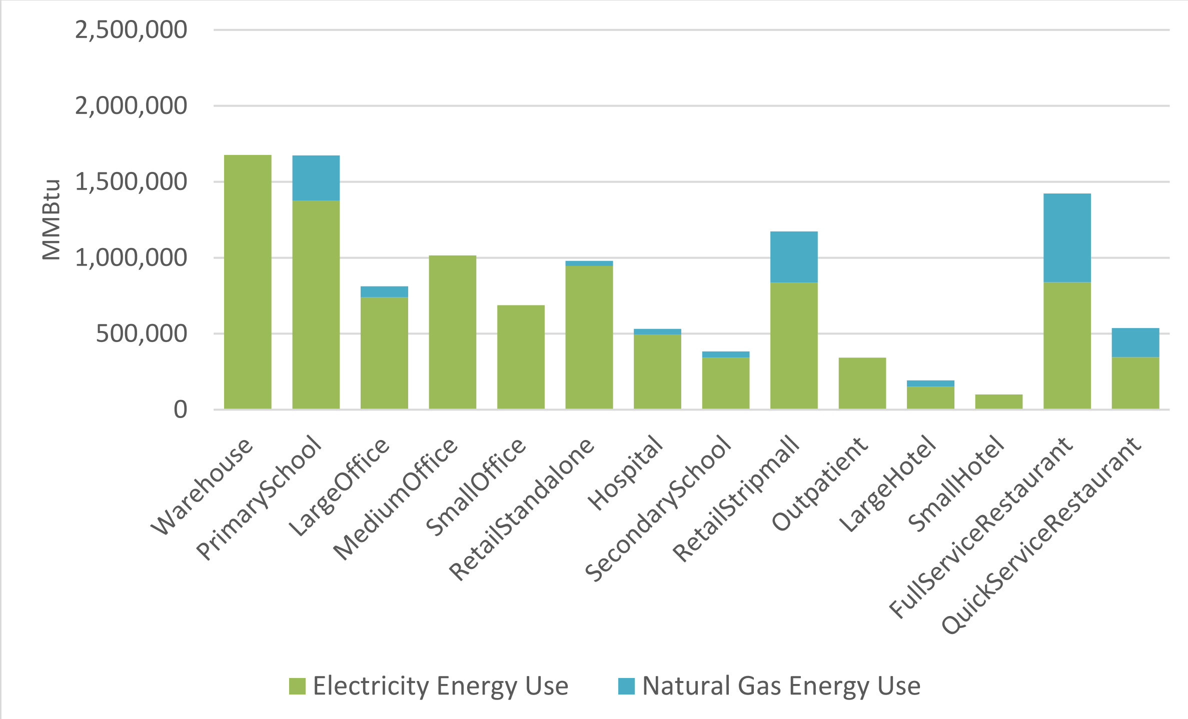
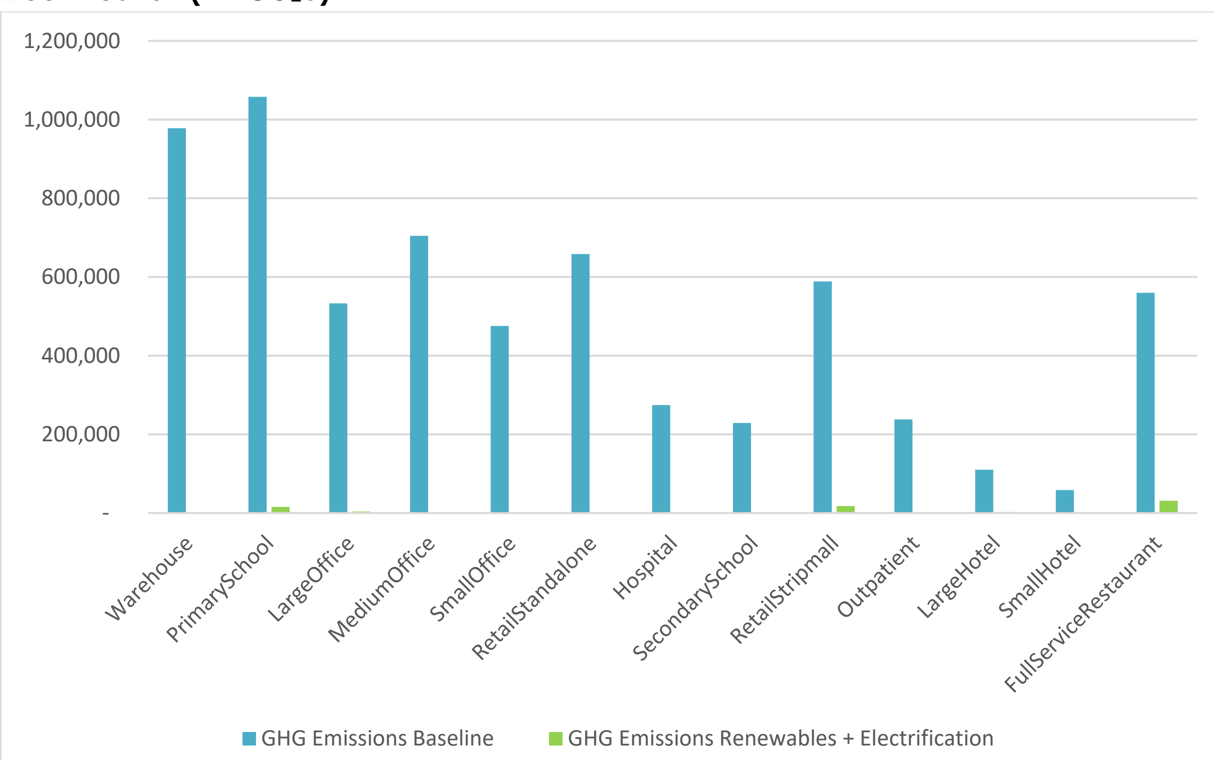


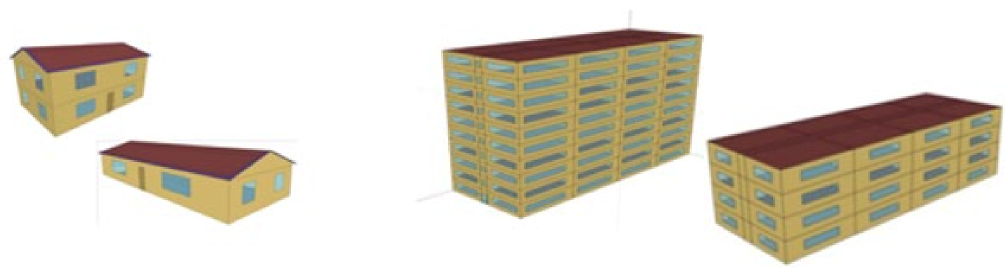
Figure 11 GHG Emissions Estimates By Commercial Building Type Before and After Electrification (MT CO_2e)



3.2 Residential Buildings Analysis with ResStock™

For residential buildings, the project team referenced ResStock – the residential equivalent of ComStock described above for commercial buildings. ResStock represented 7 residential building types as shown in Figure 12. The ResStock program included over 1400 building prototypes for the City of Sacramento. The total square footage of residential buildings in Sacramento is included in Figure 13.

Figure 12 ResStock 7 Building Types



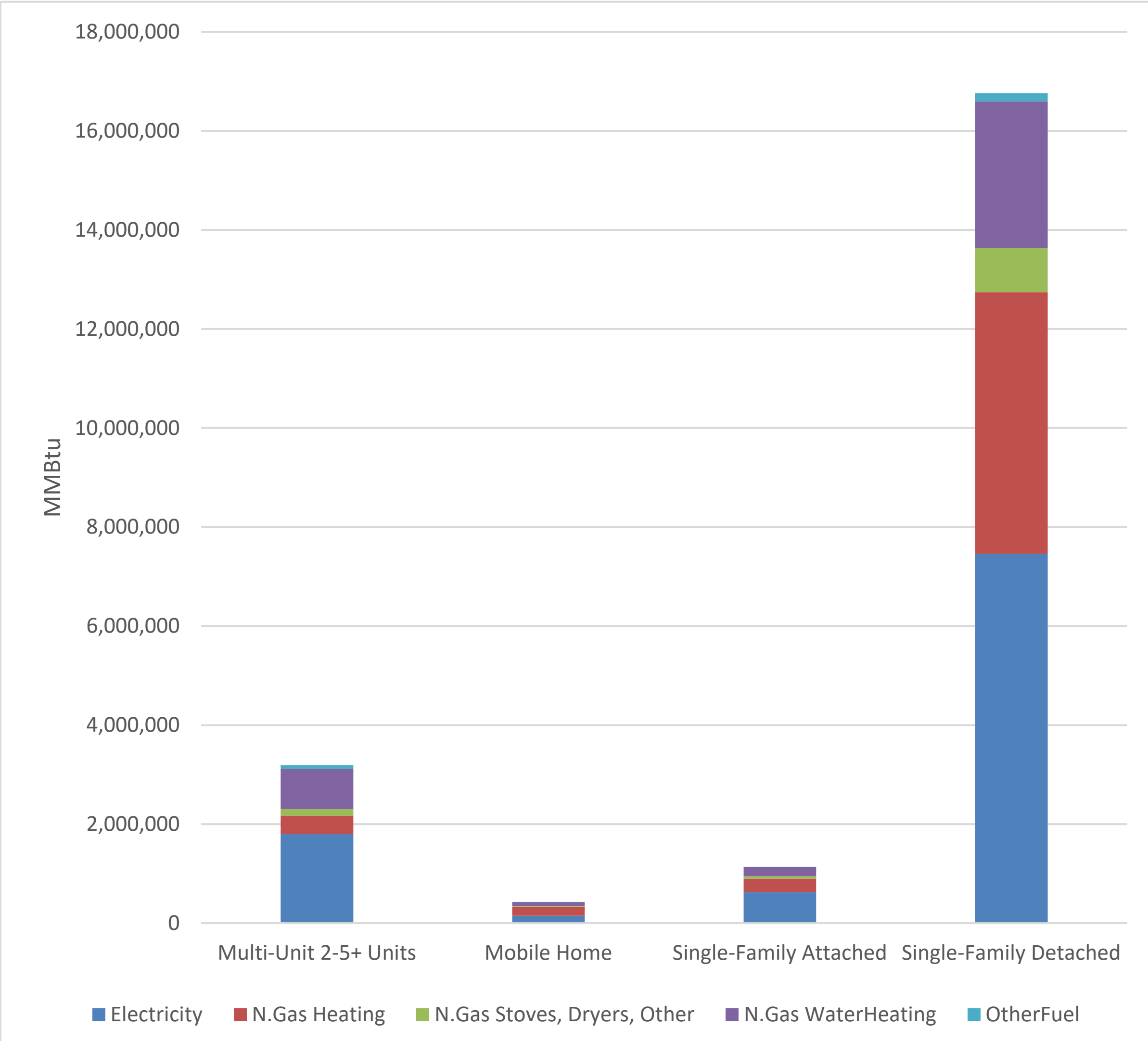
Single-family homes (Types)	Multi-Unit Residential (Types)
▪ Attached single-unit ▪ Detached single-unit ▪ Mobile homes	▪ 2-4 story multi-unit residental ▪ 5+ story multi-unit residential (1-3 stories) ▪ 5+ story multi-unit residential (4-8 stories) ▪ 5+ story multi-unit residential (8+ stories)

Figure 13 Total Area (sq. ft.) of Residential Buildings in Sacramento Represented by Prototypes in ResStock

Sacramento Residential Buildings Total Area (SF) Represented in ResStock	Pre-1975	1976-2003	Post 2003	Total
Mobile Home	4,583,056	1,938,501	1,051,091	7,572,647
Multi-unit residential with 2-4 Units	14,147,231	6,337,053	2,341,891	22,826,175
Multi-unit residential with 5+ units, 1-3 stories	23,979,929	15,753,286	8,715,264	48,448,479
Multi-unit residential with 5+ units, 4-7 stories	2,883,538	1,951,576	2,354,482	7,189,596
Multi-unit residential with 5+ units, 8+ stories	2,997,340	631,478	769,250	4,398,068
Single-Family Attached	17,383,312	12,090,570	3,893,467	33,367,348
Single-Family Detached	198,655,179	130,046,146	109,059,440	437,760,764
Total	**264,630,457**	**168,749,013**	**128,185,024**	**561,564,494**

Using the ResStock model, the total energy consumption for residential buildings by building prototype was also estimated. Total energy consumption in MMBtu's for all Sacramento residential buildings was estimated for electricity consumption, natural gas used for heating, natural gas used for hot water, natural gas used for interior equipment like dryers and stoves, and finally other fuel which could include propane. The results of this analysis are shown in Figure 14.

Figure 14 Residential Building Energy Consumption by Building Prototype (MMBtu)



Once the total energy usage in MMBtu was quantified, ResStock was also used to estimate the MMBtu reduction associated with moving from natural gas heat and hot water to heat pumps. The results of this analysis are shown below in Figure 15. All buildings see a significant reduction in natural gas consumption as only stoves and dryers remain. In addition, all buildings see an overall reduction in MMBtu consumption resulting in more energy efficient buildings regardless of energy type (electricity or natural gas).

Figure 15 Residential Building Energy Consumption After Heat Pump Retrofits for HVAC and Water Heating (MMBtu)

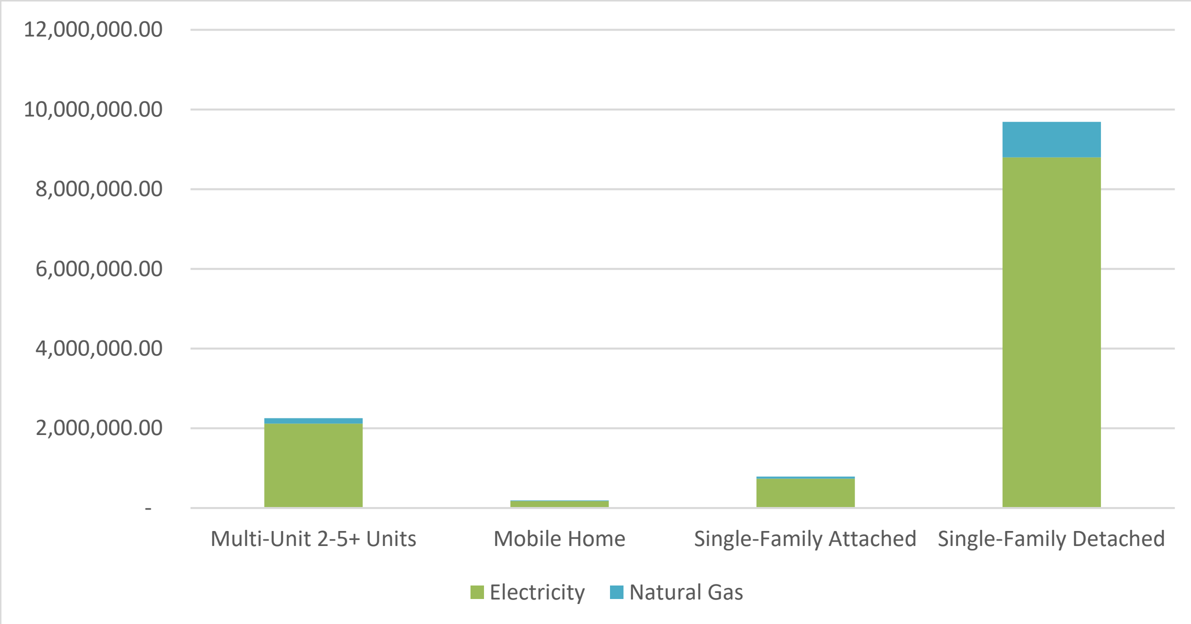
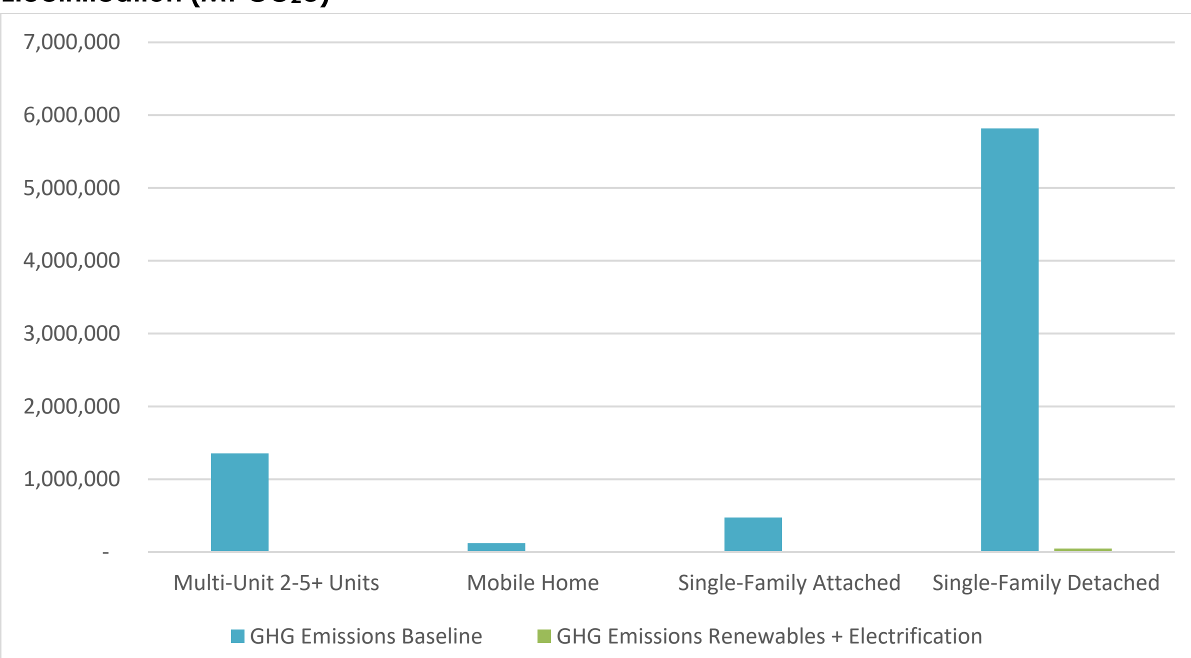


Figure 16 converts MMBtu's to GHG emissions in MT CO_2e for two scenarios. The first scenario (baseline) looks at current emissions based on ResStock results and current electricity and natural gas emission factors. The second scenario (renewables + electrification) shows what emissions would be after all commercial buildings switch to heat pump HVAC and hot water heaters and use SMUD carbon free electricity.

Figure 16 GHG Emissions Estimates by Residential Building Type Before and After Electrification (MT CO_2e)



3.3 California Residential Appliance Saturation Study

In addition to building level energy consumption, the City also investigated appliance level energy consumption by fuel type. In 2019, the California Energy Commission administered the California Residential Appliance Saturation Study (RASS)[23], which yielded energy consumption estimates for electric and natural gas residential end uses and appliance saturations for households. Appliance fuel type breakdown for Sacramento is summarized in Table 13, below.

Table 13 Residential Building Appliance Fuel Type Usage

End Use	Gas System	Electric (Non-heat Pump)	Electric Heat Pump	No System/Other Fuel
Space heating	69%	14%	8%	9%
Water heating	67%	12%	1%	21%
Cooking	48%	47%	N/A	4%
Clothes drying	21%	64%	N/A	15%

Source: 2019 California Residential Saturation Survey; Climate Zone of city is used as a representative sample, with further analysis of the city's building stock characteristics (Typology / Age) to refine estimates at city level

3.4 Sacramento Household Energy Burden

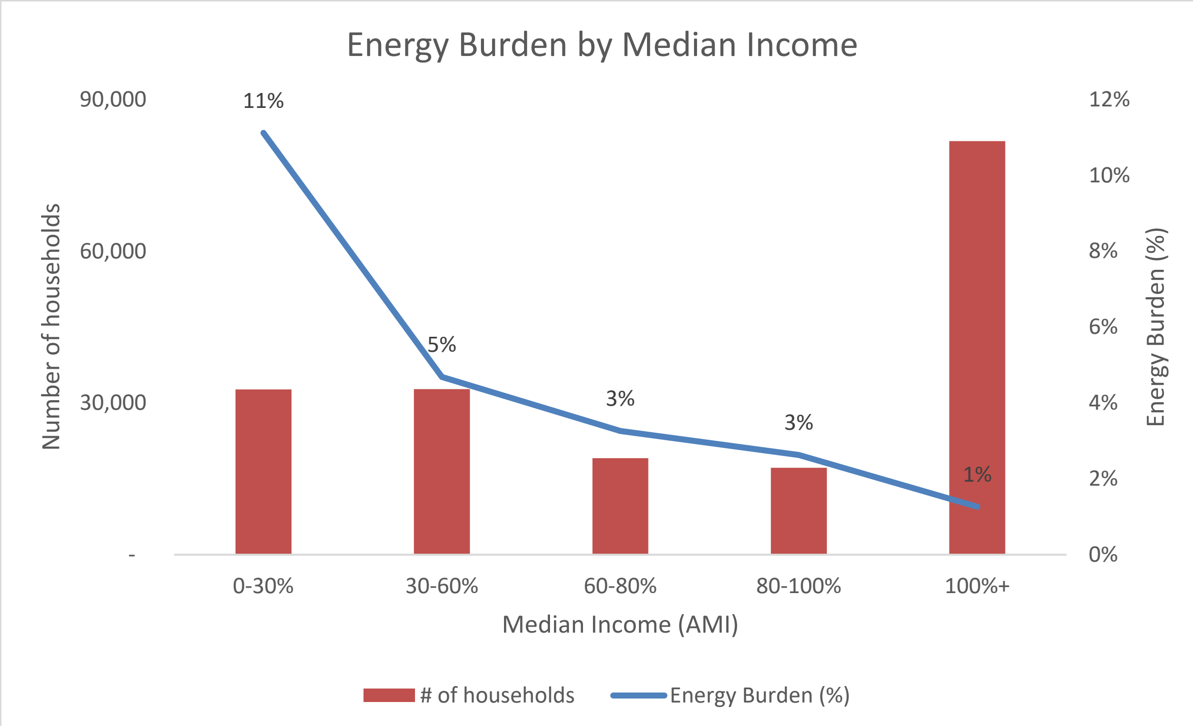
The National Renewable Energy Laboratory developed the Low-Income Energy Affordability Data (LEAD) Tool to help stakeholders understand housing and energy characteristics for low- and moderate-income households. Energy burden is defined as the percentage of household income that is spent on utility bills. Average energy burden in Sacramento by Area Median Income (AMI) Percentile is shown in Table 14 and Figure 17 below. Up front incentives for electrification through the Inflation Reduction Act will be available to low- and moderate-income households below 150% AMI.

Table 14 Percentage of Household Income Spent on Energy Costs (Energy Burden) by Income Range

Median Income (AMI)	Energy Burden (%)	Number of Households
0-30%	11%	32,651
30-60%	5%	32,712
60-80%	3%	19,079
80-100%	3%	17,192
100%+	1%	81,733

[23] https://www.energy.ca.gov/publications/2021/2019-california-residential-appliance-saturation-study-rass

Figure 17 Percentage of Household Income Spent on Energy Costs (Energy Burden) by Income Range



4 Attachment 1: Contractor Interview Questions

For the questions below, please assume that the work would be a simple scenario without panel/equipment access issues in a single story house with a drop line. However, any additional detail or insights about what makes the work more or less expensive/feasible is appreciated.

- Can you give a brief overview of the type of electric retrofit work you do?
- What is the labor (cost and hours) of installing a new 220V line?
- What is the labor (cost and hours) of installing a new panel?
    - What panel capacity is typically required to electrify an average single-family home in Sacramento? Can you ever electrify on a 100- or 150-amp panel?
    - Are there any options to avoid a panel upgrade through “watt diet” approaches or newer technologies?
    - What typically determines if a panel upgrade is needed? Age of the house?
- What is the typical labor (cost and hours) for upgrading a gas water heater to an electric water heater (not including the cost of the appliance itself)?
    - What is the labor (cost and hours) just to replace a gas water heater with another gas water heater (not including the cost of the appliance itself)?
    - What main factors are going to make this work more or less expensive?
    - Are there particular models that you’re typically installing?
- What is the typical install labor (cost and hours) for upgrading a ducted gas-powered HVAC system to a heat pump system?
    - What about just to replace gas with gas?
    - What main factors are going to make this work more or less expensive?
    - Are there particular models that you are typically installing?
- What is the typical install labor (cost and hours) for replacing an air conditioning system but not doing electrification work?
- What scenario would you upgrade a gas heating system to a ductless system mini split? What is the labor (cost and hours) for this work typically?
- What types of weatherization upgrades are you doing on houses that you are electrifying? What is typical labor required (cost and hours)?
- Do you have a sense of how common home electrification upgrades are today?
- What kind of resources or training are needed in the contractor community in Sacramento to get more contractors on board with this work?
- What are your top recommendations for promoting and/or enabling Sacramento to fully electrify existing residential/multi-unit residential buildings?
- What hurdles do you run into when doing electrification work?
- Is there anything the City should be doing to make this work easier?

City of
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