Equitable Electrification of Existing Buildings: A Pathway to Decarbonization

ABOUT THE STUDY

This study looks at the progress towards decarbonizing residential and commercial buildings in California, the barriers this process faces, and its impacts on equity. For residential buildings, the study draws on data from statewide electrification programs, building permits, energy use data from utilities, surveys of renters, and interviews with owners of multi-family buildings. For commercial buildings, in addition to an analysis of statewide electrification programs and energy use data, a flexible tool to identify priority commercial building subsectors was developed to aid further study and potential regulatory development. The tool draws on information about emissions, social impacts, and technical feasibility and can be customized by changing the relative importance of these factors.

BACKGROUND

Direct emissions from buildings in California generate about 12% of greenhouse gas (GHG) emissions. The California Energy Commission's 2021 Building Decarbonization Assessment identifies appliance electrification as one of the first strategies in a plan to lower GHG emissions at least 40% below 1990 levels by 2030. Governor Gavin Newsom built on these targets by setting new goals of three million climate-ready homes by 2030 and seven million by 2035, as well as the installation of six million heat pumps by 2030.

Decarbonizing the existing building stock in California is projected to be costly: estimates for the costs of electrifying the state's space heating and cooling and water heating end-uses alone range from $72-150 billion. Although some building owners can afford–and may choose–to retrofit their buildings, state funding is important to achieve wide-spread electrification, especially for lower- and moderate-income businesses. Moving too slowly—or too quickly without sufficient planning—risks reinforcing existing inequitable patterns of technology adoption and leads to negative impacts for California's disadvantaged communities.

SUMMARY OF RESEARCH FINDINGS

Residential Buildings

California's residential building stock shows modest electrification readiness. Slightly more than half of single-family homes have sufficient electrical panel capacity (above 100 amps) to support electrification of space and water heating, while only one-third of multifamily properties meet their respective threshold (above 60 amps). Disadvantaged communities face greater barriers: single-family homes in DACs are four times more likely to have smaller panels compared to non-DAC properties, and multifamily properties are 1.75 times more likely to have undersized panels in DACs.

Despite 231 utility, local, and state residential rebate programs and over $550 million in funding, incentive-driven adoption remains limited. Between 2019 and 2023, roughly 540,000 households adopted zero-emission space heating, but fewer than 8% of those installations can be traced to an incentive program. The gap between incentives and actual project costs is significant. The median cost to install a ducted heat pump in a single-family home without a panel upgrade approaches $20,000, only a small fraction of which would be covered by a typical incentive. Cost sensitivity is a major factor: renters' willingness to electrify drops sharply even at modest monthly cost increases, and multifamily property owners stated near-universally that they would not proceed with projects unless incentives achieved full cost-neutrality–a bar that current programs do not meet. The proportion of households in 2–4 unit residential buildings using zero-emission appliances for heating declined between 2017 and 2022.

Commercial Buildings

The commercial sector shows even lower electrification uptake than the residential sector, despite comparable state funding. Between 2006 and 2022, electricity's share of total commercial energy consumption declined from 37% to 31% as gas use increased—suggesting market decisions are moving away from electrification. Commercial electrification incentive claims fell from 2,428 in 2019 to just 299 in 2023, representing only 2% of residential claim volumes.

The gap between incentives and costs is severe. Restaurants face total electrification costs of $60,000–$124,000 per facility, against a maximum cooking equipment incentive of $17,500. Office buildings require roughly $158,000 in upgrades, which available incentives cannot meaningfully offset.

To better understand where commercial electrification efforts may yield the greatest impact, the project developed a prioritization framework. This framework assesses subsectors based on the impact of pursuing zero-emission appliance adoption across categories of difficulty, social impact, and emissions. This analysis found that offices, restaurants, and healthcare facilities are the top contributors to total CO_2 and NOx emissions. Offices and restaurants also rank the highest in the difficulty category, while

restaurants rank highest for worker vulnerability due to low wages and large workforces. Lodging buildings rely heavily on gas for many uses, have seen sharp declines in zero-emission heating, and face major challenges electrifying due to high costs, limited staff capacity, and low owner response rates.

CONCLUSION AND POLICY IMPLICATIONS

Achieving California's 2045 climate neutrality goals will require a shift away from the current piecemeal approach toward comprehensive and long-term building system strategies. This includes:

- Establishing clear electrification targets to address the lack of coordination in planning efforts across many organizations and levels of government.
- Scaling incentives to actual total project costs. This includes ancillary costs, such as electrical infrastructure upgrades, and not only equipment purchase prices.
- Creating whole-building retrofit programs that address panel upgrades, deferred maintenance, and multiple end-uses at once, particularly for multifamily buildings and customized for different types of commercial buildings.
- Redesigning program delivery mechanisms around trusted intermediaries such as contractors, trade associations, and turnkey service providers, rather than expecting direct engagement from time-constrained property owners.