



Cost of Conversion

Case Study of Electric Home Energy Retrofits in Sacramento

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Key Findings:

- ICS studied 14 different home energy retrofits in the City of Sacramento completed by a home performance contractor with nearly four decades of market experience in Northern California. This included 10 actual all-electricity retrofits completed in 2020 and four prototype homes in Sacramento as case-study examples.
- This study verified that Sacramento homeowners can expect to pay \$23,000 to \$24,000 on average for an all-electric retrofit to their property, not including electric appliance upgrades. With appliance upgrades (electric stove, dryer) the total is \$26,000 to \$27,000 on average.
- Sacramento homeowners can expect to receive financial rebates that range from several hundred dollars to more than \$10,000, with the average homeowner receiving \$8,000 in this study, equal to a third of the upgrade cost.
- Under normal conditions (work scheduling, equipment availability, permissible weather conditions), an energy upgrade will take approximately four weeks to complete from contract signing to project completion, with the average equipment installation taking 2-4 days. The bulk of the four-week period is accounted for by the availability of SMUD personnel for scheduling home inspections and sign-off, contractor work lead times, and the lead time to secure necessary permits.
- If the retrofit is financed, the average pay-off period is 15-20 years, depending on the financial vehicle and terms. This study found that SMUD was the most popular financier, offering a market-leading 6.99 APR and 20-year payoff, with no pre-payment penalties.
- There are presently 17-20 home performance firms listed on SMUD's

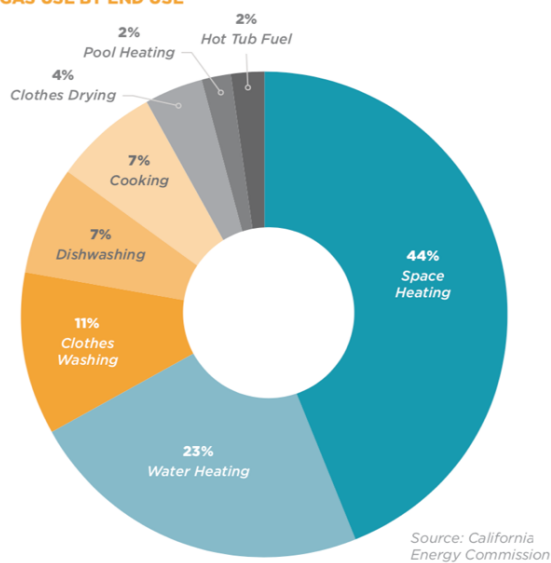
website that are "SMUD-qualified," which do home performance upgrades in the City of Sacramento, and virtually all are local businesses.

Overview:

Buildings became electrified 150 years ago. So why is "building electrification" the hot new trend being promoted by California utilities, public policy makers, and various interest groups? Most buildings run on electricity to power lights, refrigerators and appliances, but rely on natural gas or propane to power water heaters, stoves, furnaces and boilers. This reliance on fossil fuels for heating and cooling makes buildings a significant source of greenhouse gas (GHG) emissions. According to the University of California, energy use in commercial and residential buildings contributes 6.4% of global GHG emissions, equal to the total GHG emissions of the country of India. There is also a growing body of peer-

Building sector to be decarbonized no later than 2045

SHARES OF RESIDENTIAL GAS USE BY END USE



reviewed research¹ highlighting the danger posed to public health by gas stoves and heaters and their contribution to poor indoor air quality, an area of increasing policy activism. In California, the campaign for building

“ICS Sought to understand the real-world costs associated with retrofitting a typical Sacramento residential property to 100% electric heating, cooling, and appliance systems.”

electrification has major adherents among major utilities (e.g., PG&E with 5.5 million customers; Southern California Edison with 5.1 million customers; and SMUD with 1.5 million customers), state agencies, including those that set building standards, and academicians, as well as global and local environmental and social justice organizations.

In California’s Capital Region, the mayor of the City of Sacramento and the mayor of the City of West Sacramento joined forces to convene a Mayors’ Commission on Climate Change with the mandate of achieving carbon zero by 2045. The report, unanimously approved on June 29, 2020, states that *“Electrification of existing buildings is a challenging but necessary strategy to reach carbon zero. Existing buildings will need to be retrofitted with new electric equipment and appliances, and older buildings will need upgraded electrical panels to support*

*the increased load. To ensure grid stability, this strategy must also be pursued in tandem with deep energy-efficiency retrofits through partnerships with utilities, nonprofits and the private sector.”*²

As part of this effort, city staff identified eight cities that have adopted ordinances or permit compliance and energy efficiency audits on existing residential properties at point of sale (POS). For the purposes of our case study, we assume the City of Sacramento will adopt an ordinance between 2025 and 2030 to require the following actions at POS: (1) An inspector will conduct an audit to ensure homes comply with all codes and standards for heating, ventilation, and air conditioning systems (HVACs), water heaters and other appliances; (2) the inspector will assess the degree to which the home meets the 100% home electrification requirement set by this ordinance; and (3) as a condition of sale, the buyer or seller will be required to replace all non-compliant HVAC units, stoves and other gas appliances, and upgrade electric panels, circuits and wiring appropriate for the higher electricity load.

Case Study Objective:

ICS sought to understand the real-world costs associated with retrofitting a typical Sacramento residential property to 100% electric heating, cooling, and appliance systems.

Methodology:

“Typical” Sacramento residential properties were defined in this case study by taking the

¹“Effects of Residential Gas Appliances on Indoor and Outdoor Air Quality and Public Health in California.” UCLA Fielding School of Public Health Department of Environmental Health Sciences. April 2020.

² Achieving Carbon Zero in Sacramento and West Sacramento by 2045.” Mayor’s Commission on Climate Change Report, June 2020.

medium value of a home with a mortgage within the City of Sacramento (\$370,271 for November 2020) based upon publicly available information and comparing it to construction age data for the City of Sacramento's 195,749 housing units (2020 figures). By cross referencing home value to the age periods when most of the homes in Sacramento were built, the four case-study homes profiled in this study represent 67.8% of all typical single-family homes in the City of Sacramento.

In order to independently verify the cost of all-electric home conversion, ICS engaged a home performance contractor with an extensive history of completing home energy audits and retrofits to provide a work order and cost estimate for four prototypical properties. After a market examination of leading energy efficiency improvement firms in Northern California who also qualify as a SMUD participating contractor (a key factor given's SMUD's major role in financing and rebates in the Sacramento marketplace), California Energy Consultant Service (CECS), based in Rancho Cordova, California, was selected (see side bar for firm profile) for this study. To provide additional context and depth for the study, CECS provided researchers with ten (10) actual all-electric conversion jobs completed on a range of home types, ages, and valuations within the City of Sacramento. Sample homes ranged in current resale value from \$248,000 to \$953,000 with the bulk centered around the median home price; in size from 770 square feet to 2,133 square feet in two-, three- and four-bedroom layouts; and in one-story and two-story configurations across various age types.



California Energy Consultant Service (CECS) is a Sacramento-based company established in 1981 to provide its clients with high quality, energy efficient windows, doors and siding at a competitive price. Over time the company grew to also provide clients with heating and cooling solutions and other services driven by customer demand. Today, CECS is a diversified home energy solutions company that provides a wide range of energy conservation services to homeowners throughout Northern California. CECS guarantees all its installations and relies upon repeat business and referrals. Click www.calenergyexteriors.com to learn more, or call (916) 852-8132. Lic #627677

COVID-19 Disclaimer:

Due to the public health orders in place when this study was conducted, ICS decided to opt-out of actual on-site property inspections for the four prototype homes. Instead, the estimators at CECS relied upon detailed MLS descriptions of the property configuration and appliance make-up, publicly available property photos, maps, and other data. These observable conditions, combined with the practical experience of estimators at CECS who complete 75 to 150 home retrofits per year, gave ICS confidence in the CECS cost estimates.

Key Findings Based On Ten All-Electric Retrofits To Homes In The City of Sacramento:

Using actual home conversion estimates completed this calendar year, the average conversion cost in this 10-home sample came out to be roughly \$24,000, of which SMUD home owner rebates averaged \$8,000, or a

third of the installed price. SMUD rebate packages ranged from a low of \$2,500 to a high of \$12,500 per home, determined by type of expenditure (see Exhibit 1 below and related rebate scheduled listed in the appendix).



Generalized activities for these pre-1995 properties included the removal of existing gas or old electric heating and cooling units from walls or attics, together with old ducting, wiring, and circuits. In their place, an all-electric HVAC / modern heat-pump unit or mini-split system was installed with new wiring, circuits, and ducting, together with electronic displays and hand-held controls. Wall, attic, and ceiling repairs and painting, and the disposal of old equipment and materials are included in the pricing. In some instances, old ceiling insulation was removed and replaced with high efficiency insulation, whole house fans were installed, and/or upgraded water heaters. In all cases the main electric panel was upgraded to 200 amps and new electrification circuits run to the water heater, range, dryer and electric vehicle (EV) outlets, whether the homeowner elected to use them immediately or not (a condition SMUD sets for receiving their rebates).

According to HomeAdvisor.com, freestanding electric ranges typically cost from \$360 to \$1,800 and most homeowners spend about \$2,000 on average for the unit and installation. Homeowners can expect to pay anywhere from \$350 to \$1,000 for a new dryer, with installation costs ranging from \$50 to \$175. Both of these costs (+/- \$3K on average, plus installation) would be in addition to the quoted fee for the home electric retrofit under the future ordinance scenario envisioned in this study.

CECS guarantees that all products are installed to manufacturers' specifications, local codes, City permit, and State Title 24 standards, and that meet HERS testing.³

Exhibit 1: SMUD Rebate Mix for Home Electrification

Component	SMUD Rebate
HVAC & heat pump conversion	\$3,000
R49 Attic insulation upgrade	\$3,000
50-80-gallon water heater	\$2,500 – \$3,000
Panel upgrade and electrification circuits	\$2,500
Whole house fan	\$100

According to Jamie Miller, CECS Home Performance and HVAC Division Manager, under normal conditions (work scheduling, equipment availability, permissible weather conditions), an energy upgrade will take approximately four weeks to complete from contract signing to project completion, with the average equipment installation taking just 2-4 days. The bulk of the four-week period is accounted for by the availability of SMUD personnel for scheduling home inspections and

³ Home Energy Rating System (HERS) testing examines a home's energy and notes where energy efficiency can be improved.

sign-off, contractor work lead times, and the lead time to secure necessary permits.

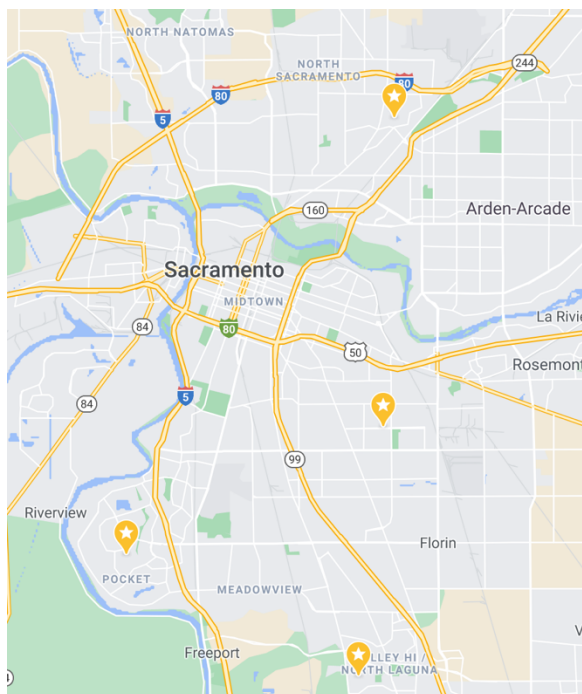
Homeowners are advised that they will need to prepare for a brief power shut-off averaging 4-6 hours during the equipment installation period, but need not leave the property.

All-Electric Upgrades On Four Prototypical Homes:

CECS provided cost estimates for all-electric upgrades for four properties selected by ICS based on their home age and valuation typical of two-thirds of the housing stock in the City of Sacramento. The average upgrade cost for the

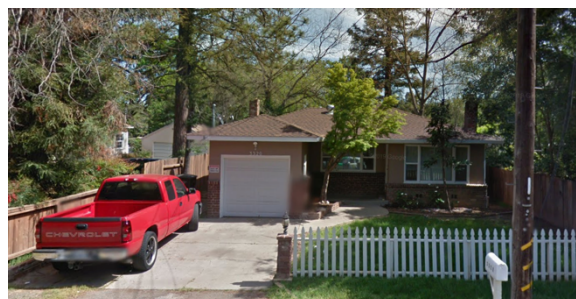
upgrade cost, or \$8,000, comparing favorably to figures derived from the 10 actual home upgrades in Sacramento completed in 2020 by CECS. Appliance upgrades and installation would add approximately \$3,000 to the total. The major expense is the HVAC unit and installation, representing 54% of the total cost. Outlier costs to the homeowner include, but are not limited to, the complications arising from how the property accesses the power grid (overhead vs. underground), attic insulation upgrades, old equipment disposal and wall / ceiling repairs, and the variable expense associated with new electric appliances (e.g., stove, dryer, hot water heater).

Exhibit 2: The four case study homes were selected to be representative of the diverse neighborhoods of the City of Sacramento. Their locations are noted by the stars below.



case study homes was approximately \$23,000, with SMUD rebates covering one-third of the

Exhibit 3: One of the four homes typical of residential properties in Sacramento.



3320 Montrose Street
Located in Hagginwood east of Del Paso Heights
 Built: 1952
 Size: 1,447 square feet / one-story
 Rooms: 3 bedrooms and 1 bath
 Est. value: \$251,400

	Total Cost	SMUD Rebate	Net Cost
3-Ton split HP Conversion	\$12,500	\$3,000	\$9,500
50-gallon water heater	\$4,800	\$2,500	\$2,300
Panel upgrade from 100-220 amp plus circuits	\$4,800	\$2,500	\$2,300
TOTAL:	\$22,100	\$8,000	\$14,100



5341 Shortway Drive
Located in Valley-Hi / North Laguna
 Built: 1982
 Size: 1,590 square feet / one-story
 Rooms: 4 bedrooms and 2 baths
 Est. value: \$323,100

	<u>Total Cost</u>	<u>SMUD Rebate</u>	<u>Net</u>
3-Ton split HP Conversion	\$12,500	\$3,000	\$9,500
50-gallon water heater	\$4,800	\$2,500	\$2,300
Panel upgrade from 100-220 amp plus circuits	\$4,800	\$2,500	\$2,300
Underground electrical	\$2,500		\$2,500
TOTAL:	\$24,600	\$8,000	\$16,600

Exhibit 4: One of the four homes typical of residential properties in Sacramento.



1 Meadowview Court
Located south of Florin Road
 Built: 1983
 Size: 1,550 square feet / two-story
 Rooms: 3 bedrooms and 2 baths
 Est. value: \$442,600

	<u>Total Cost</u>	<u>SMUD Rebate</u>	<u>Net Cost</u>
3.5-Ton split HP Conversion	\$13,500	\$3,000	\$10,500
66-gallon water heater	\$5,200	\$2,500	\$2,700
Panel upgrade from 100-220 amp plus circuits	\$4,800	\$2,500	\$2,300
TOTAL:	\$23,500	\$8,000	\$15,500



4771 63rd Street
Located in Tahoe Park South
 Built: 1955
 Size: 1,175 square feet / one-story
 Rooms: 2 bedrooms and 1 bath
 Est. value: \$349,000

	<u>Total Cost:</u>	<u>SMUD Rebate</u>	<u>Net Cost</u>
2.5-Ton split HP Conversion	\$11,500	\$3,000	\$8,500
50-gallon water heater	\$4,800	\$2,500	\$2,300
Panel upgrade from 100-220 amp plus circuits	\$4,800	\$2,500	\$2,300
TOTAL:	\$21,100	\$8,000	\$13,100

Financing Electric Retrofits In Sacramento:

CECS staff confirmed that roughly half of their clients opt to finance the retrofit expense and pay for the remaining balance out-of-pocket. If the retrofit is financed, the average pay-off period is 15 to 20 years, depending on the financial vehicle and terms. CECS staff report that SMUD was the most popular financier for their clients in Sacramento, offering a market-leading 6.99 APR and 20-year payoff, with no pre-payment penalties. For homeowners that are credit-challenged, CECS also connects clients to firms such as GreenSky and Benji that help customers with fixed rate and adjustable payment programs that match their financial needs.

Rebate Outlook:

SMUD is reported to have allocated \$6 million toward homeowner rebates in 2020, then reduced the program to \$5 million following the severe economic contraction brought on by the global pandemic. Jamie Miller, CECS Home Performance and HVAC Division Manager, reported that, in the 10-years she has worked for CECS, she has seen the SMUD rebate program “change quite often,” which has caused CECS and other home improvement contractors in Sacramento to limit promotion of the programs for lack of reliability.

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