COMMUNITIES LEAP
U.S. DEPARTMENT OF ENERGY

Household Energy Efficiency Analysis in San José, California

Many households in the City of San José, California, could save hundreds of dollars annually on their energy bills and reduce carbon emissions with energy efficiency retrofits and upgrades in their homes and apartments. As part of the U.S. Department of Energy's (DOE) Communities LEAP (Local Energy Action Program) pilot, the National Renewable Energy Laboratory (NREL) analyzed energy efficiency and electrification upgrades for 83,000 housing units in low-to-moderate-income census tracts experiencing disproportionately high energy burden in San José. **The results in this fact sheet only pertain to the housing units included in the analysis.**

For more information about the Communities LEAP effort in San José, visit: https://www.energy.gov/communitiesLEAP/san-jose-california.

Top Residential Energy Uses for Modeled Housing in San José:

Heating is the dominant end use for energy, and natural gas is the dominant fuel type.

Top 4 residential energy uses:

- 25% for space heating using natural gas
- 20% for hot water heating using natural gas
- 17% for plug loads using electricity
- 6% for interior lighting using electricity.

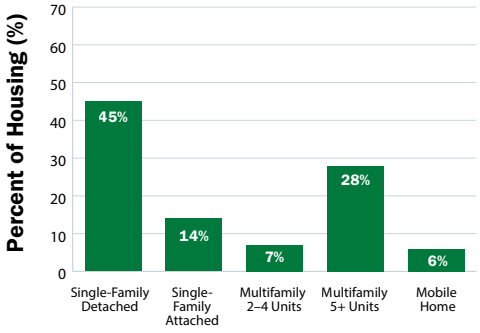
For more information on energy efficiency improvements, including smaller do-it-yourself projects, visit DOE's Office of Energy Efficiency and Renewable Energy's Energy Saver webpage: https://www.energy.gov/energysaver/energy-saver

Energy Challenges of San José's Housing Stock

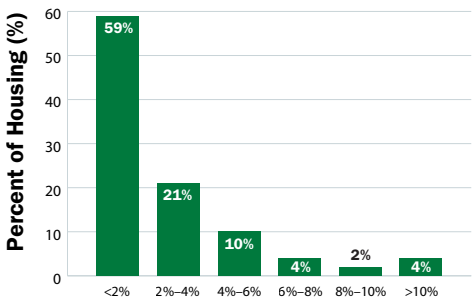
An estimated 70%–94% of the homes and apartments analyzed in San José have below average building envelopes, meaning inadequate insulation and sealing allows air in and out of homes. Inadequate building envelopes increase the cost of heating and cooling homes, which requires residents to spend a higher share of their income on energy. Updating the building envelope could help lower the share of income residents must spend on energy, known as energy burden, and provide a more comfortable and safe indoor environment.

San José, California Residential Housing Stock Summary

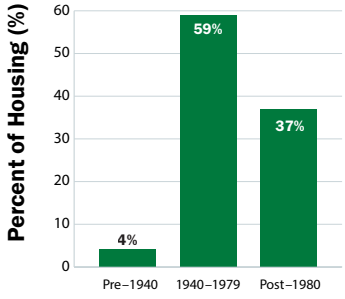
Building Type



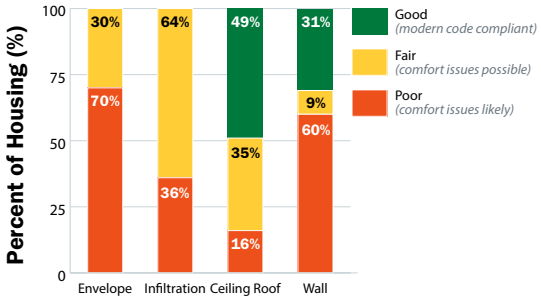
Energy Burden



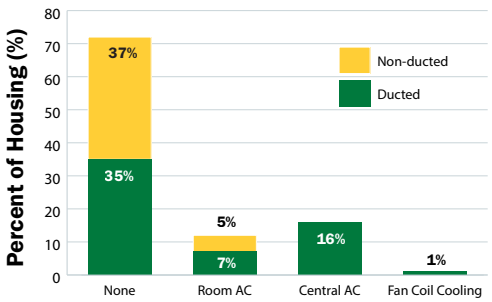
Construction Year



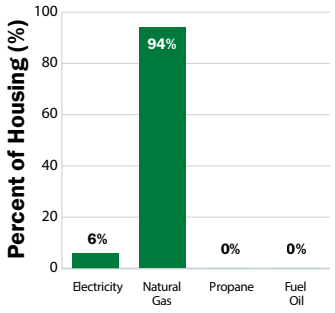
Envelope Status for Buildings with Frame Wall



Cooling Type



Space Heating Fuel Type



Source: ResStock-modeled data and results, https://data.nrel.gov/submissions/224

Annual Community-Wide Savings by Upgrade

The results below are the estimated annual savings for all modeled household types located in San José.

	Energy Bill Reductions *Million $*	**Emissions Reductions** *Million kilograms of CO_2 equivalent*	**Energy Savings** *Million British Thermal Units (MMBtu), equivalent to 293 kilowatt-hours (kWh)*	**Average upgrade cost per household (in $)*** **
Basic enclosure*	15	33.86	578,900	8,300
Heat pump water heater	14	56.53	766,300	4,000
High-efficiency heat pump with electric heat back up	9	49.04	617,300	27,800
High-efficiency whole home electrification**	40	128.88	1,733,500	36,300
Enhanced enclosure and high efficiency whole home electrification	45	132.04	1,870,000	42,500

** Basic enclosure includes attic floor insulation, general air sealing, duct sealing, duct insulation, and wall insulation.*
*** High-efficiency whole home electrification includes a high-efficiency heat pump, heat pump water heater, ventless heat pump dryer, electric oven, and induction range.*
****Costs do not include rebates, incentives, or any other financing mechanisms. Costs were based on national average information adjusted by a simple proxy to account for cost-of-living differences, and were supplemented with local, regional, or state-wide cost estimates when possible. In reality, local costs will have more variations from national data and the cost differential will be different between technology options and households.*

Average Annual Savings Per Household from Enhanced Enclosure and Whole Home Electrification

Housing Type	Area Median Income	Average Site Energy Use Reduction (%)	Estimated Average Energy Bill Reductions	Impact of Energy Bill Reductions on Energy Burden (pre -> post)
Multifamily building with 5+ units built between 1940 and 1979	All	41%	$308	4.1% → 2.9%
	0%–80%	42%	$300	5.2% → 3.7%
Multifamily building with 5+ units built 1980 or after*	All	38%	$312	9.0% → 6.6%
	0%–80%	36%	$310	12.0% → 8.7%
Single-family detached homes built between 1940 and 1979	All	50%	$832	2.5% → 1.6%
	0%–80%	49%	$827	4.6% → 3.0%
Single-family attached homes built between 1940 and 1979	All	45%	$534	1.7% → 1.2%
	0%–80%	52%	$731	3.5% → 2.2%

Actual site energy reductions, energy bill reductions, and changes to energy burden for any individual household will vary.
** Results are average annual savings per household (per unit for multifamily buildings with 5+ units); actual savings for any individual household can vary. Buildings built after 1980 generally require fewer or smaller upgrades than older buildings.*

The Most Impactful Upgrade

NREL's analysis for San Jose showed that on average, the most impactful upgrade for reducing carbon emissions is the enhanced enclosure and whole home electrification, which includes adding insulation to exterior walls, the attic, and sealing openings around vents, doors, windows, and crawlspaces, and all high-efficiency appliances. Actual costs will vary depending on many factors, including the price of materials, contractor, size of the project, current incentive programs, and more.

Approach Details

Information on Upgrade Packages

NREL analyzed a total of 16 energy efficiency upgrades for San Jose. The most impactful upgrade was defined as the energy efficiency and retrofit package that provides the most site energy reductions per upgrade. All four housing types identified in this fact sheet had the same most impactful package. Modeled energy burden and energy bill reductions vary by ownership (resident-owned or rented), housing type, and other factors. This analysis does not account for federal, state, and local rebates or programs that may further lower energy burden, upgrade costs, and payback periods.

Modeling Assumptions

- Vacant housing was not included as part of this analysis per the community's request.
- Local equipment, labor costs, and utility costs were taken from a mixture of local and national data sources from 2023 or the most recently available data.
- The envelope status figure was based on 2023 International Energy Conservation Code (IECC) requirements for wall insulation, attic insulation, infiltration rates, and wall construction type.
- Upgrades did not consider new electric panel requirements.

To learn more about the modeled packages and upgrades in all building types, please visit https://data.nrel.gov/submissions/224.

This work presents energy efficiency and electrification modeling results for dwelling units using ResStock EUSS 2022.1, which is a statistical representation based on modeling predictions of energy use and savings, and actual results may vary. Scan the QR code to access the methodology document at https://www.nrel.gov/docs/fy24osti/88058.pdf

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For more information about Communities LEAP, visit:
energy.gov/communitiesLEAP

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