Post-Fire Energy Futures

Estimating the Energy Impacts of Residential Rebuild Footprint and Building Electrification

Authors: Rachel Sheinberg, Samantha Smithies, Eric Fournier, Stephanie Pincetl

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UCLA California Center for Sustainable Communities

UCLA Institute of the Environment & Sustainability

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Post-Wildfire Energy Futures

Estimating the Energy Impacts of Residential Rebuild Footprint and Building Electrification after the Palisades and Eaton Fires

Authors: Rachel Sheinberg, Samantha Smithies, Stephanie Pincetl, Eric Fournier

Table of Contents

Palisades Fire (photo credit: CAL FIRE on Flickr).

Introduction

The Eaton and Palisades fires left a trail of devastation—destroying homes, displacing communities, and disrupting lives. They also severely damaged local energy infrastructure. As communities look toward rebuilding, the suitability of restoring the legacy energy infrastructure design to its preexisting specifications is called into question by the impetus to reduce wildfire risk and advance building decarbonization, as well as the uncertainty of rebuilding plans. In their Initial Recommendations and Draft Action Plan, LA's Blue Ribbon Commission emphasized the importance of "energy efficient, solar powered, and all-electric homes" for healthy, resilient, and cost-effective rebuilding (Blue Ribbon Commission on Climate Action and Fire-Safe Recovery, 2025). The priority concern is how to support impacted communities: facilitating streamlined construction, ensuring new construction is resilient against future extreme weather events, and minimizing health impacts from emissions produced by indoor natural gas combustion; secondary, is the potential to align recovery with the state's climate and energy goals. There is a lack of information on how rebuilding decisions might affect future energy needs, and a limited window of time to implement additional policy interventions for the recovery effort.

In this report, we aim to inform local and state policymakers by answering the following three questions for the fire-affected areas:

1. How might the reconstruction of residential properties at greater square footages impact electricity and natural gas consumption?

2. How might widespread substitution of gas appliances for electric alternatives impact both electricity and natural gas consumption?

3. How might widespread adoption of rooftop solar photovoltaic (PV) impact electricity and natural gas consumption?[1]

To answer these questions, we have developed a set of hypothetical rebuilding scenarios that are informed by local and state policies, and applied to customer energy usage and building attribute information. In our approach, we utilize the energy use intensity from recently constructed buildings (prior to the fires) using metered consumption data as a basis for estimating building energy performance of future new construction.

The report is organized as follows: first, we present an overview of the data and methods that were used for our analysis, with more detailed information available in the Technical Appendix. Next, we present results from our analysis of recently constructed buildings and estimates for future energy consumption after new construction. Finally, we discuss the implications of the different rebuilding scenarios on the energy system.

1 "Natural gas" and "gas" are used interchangeably throughout this report.

Data and Methods

At a high level, for each future rebuilding scenario (s) under consideration, we project the total Post-Fire energy consumption in the affected regions(En) by multiplying the future total new building square footage (SQFT) in each of the fire zones (n) by a median energy use intensity (EUI). The EUIs were derived from analysis of metered consumption data for recently constructed buildings in each of the two regions. This approach is depicted in Equation 1 below. The details of each step in this process are described in the following subsections.

Equation 1.

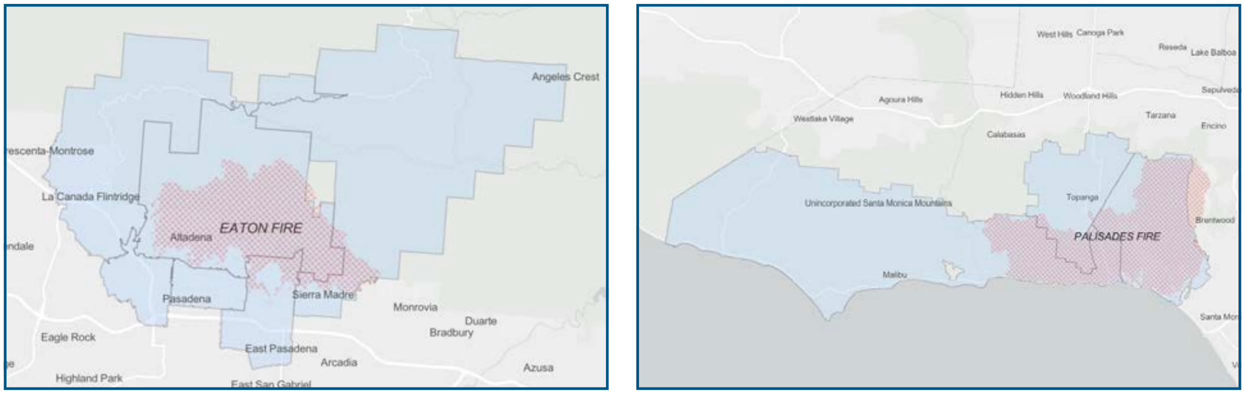
$$En_{n,s} = SQFT_{n,s} * EUI_{n,s}$$

Step 1: Defining Rebuilding Scenarios and Boundaries

The first step in this process involved defining the specific residences of interest and their associated rebuilding scenarios. This analysis focused on homes which are expected to be entirely rebuilt and considered new construction. In this analysis, we assumed this includes homes categorized as *Minor Damage (10-25%)*, *Major Damage (26-50%)*, and *Destroyed (50% or more damaged)* in the CAL FIRE Damage Inspection (DINS) database (CAL FIRE, Office of the State Fire Marshal, 2025). The DINS database provides information on structures impacted by wildland fires that are inside or within 100 meters of the fire perimeter. The square footage and consumption from these homes prior to the fires make up the Pre-Fire Baseline, which is used as a basis of comparison for the future evaluation scenarios. The rebuilding scenarios were not applied to residences categorized as *No Damage* or *Affected (1-9%)*. In this report, reference to a "fire region" includes all residences in zip codes that are within or substantially overlapping with the fire perimeters (Figures 1 and 2).[2] The fire regions include portions of the following cities: Los Angeles (specifically the Pacific Palisades neighborhood), Topanga, Malibu, Altadena, Pasadena, and Sierra Madre.

2 We were given access to premise-level energy consumption data in the following zip codes: 90272, 90290, 90265, 91001, 91104, 91103, 91011, 91107, and 91024. These zip codes capture 98.8% of the fire-affected regions' residences.

Figures 1 and 2. Eaton and Palisades Fire Regions



Sources: Esri, DeLorme, HERE, MapmyIndia, County of Los Angeles Enterprise GIS Group

Future evaluation scenarios were defined to capture potential variance in rebuilding size and electrification levels. We define two rebuilding property size growth scenarios. These include 100% of Pre-Fire floor area and 110% floor area size growth, as incentivized by Governor Newsom's Executive Order N-4-25.[3]

We further evaluate the energy use impacts of four different end-use energy equipment electrification packages for each of the size growth scenarios, resulting in a total of eight different scenarios. Electrification, as the primary mechanism for building decarbonization, is a key policy objective of the Los Angeles region and the state of California. Electrification seeks to address the human and planetary health impacts of gas combustion. Exposure to natural gas and its combustion byproducts contribute to premature mortality, and increased risk of illness in children and adults (American Lung Association, 2023). These four electrification packages, designed to inform regulatory development and policy advocacy, are as follows:

1. Recent build baseline: All homes are rebuilt in a manner that reflects electrification patterns of recent construction in the fire regions;

2. Electric space and water heating: All homes are rebuilt with high-efficiency electric heat pumps and water heaters, with other end uses (e.g. cooking, clothes drying) following fuel use patterns across the US Southwest;[4,5]

3 Under Governor Newsom's Executive Order N-4-25, projects to restore, demolish, or replace property substantially damaged by the fires can receive an exemption from California Environmental Quality Act and California Coastal Act requirements if they rebuild at no more than 110% of original building footprint and height (California Office of the Governor, 2025).

4 This electrification package is reflective of the South Coast Air Quality Management District (SCAQMD) and California Air Resources Board (CARB) proposals to phase out gas-powered space and water heating (South Coast Air Quality Management District, 2025a, 2025b). This would result in remaining residential gas consumption and its associated health impacts.

5 This analysis uses the NREL modeled building consumption time series (i.e. load shapes) for Climate Zone 3B, Warm Dry Climate, which contains Los Angeles and other parts of the Southwest.

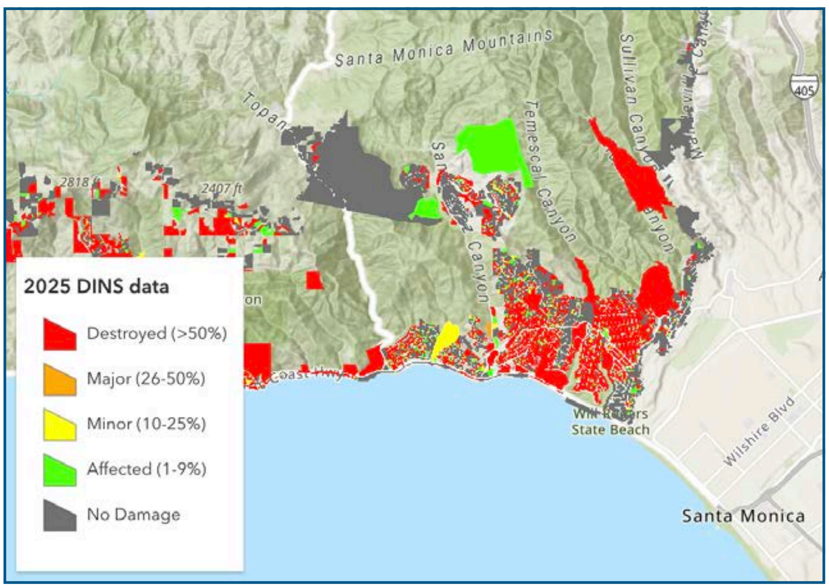
3. All-electric (high efficiency): All homes are rebuilt with high-efficiency electric appliances for all end-uses (no gas);

4. All-electric (min efficiency): All homes have been rebuilt with low-efficiency electric appliances for all end-uses (no gas).[6]

Step 2: Assessing Fire Damage and Parcel Data Collection

The second step in this process involves identification of the total residential square footage that we anticipate will be rebuilt in both the Eaton (also referred to as Altadena) and Palisades Fire regions. By joining the CAL FIRE Damage Inspection (DINS) database with LA County parcel data, we calculated the total square footage of buildings in the burn regions, summed by building type and damage level (Figure 3) (Los Angeles County Office of the Assessor, 2025).

Figure 3. Screenshot of data from the DINS ArcGIS mapping platform for properties in the Eaton Fire burn area. These data are available for download and are used in this report.



Step 3: UCLA Energy Atlas Energy Consumption Data Processing

After damaged and destroyed buildings were identified via the DINS database, we calculated both regions' Pre-Fire baseline, and Post-Fire scenario consumption levels using energy consumption data maintained in the UCLA Energy Atlas (California Center for

6 The all-electric packages were included to provide insight into those advocating for all-electric rebuilding, as well as the implications if the City of Los Angeles' municipal requirement for all-electric new construction had not been waived for fire-affected homes.

Sustainable Communities, 2025). The Energy Atlas, developed by the California Center for Sustainable Communities (CCSC), is a database of historical, premise-level, metered energy consumption records for utilities throughout California. In the database, these usage records have also been linked to a host of other building and property attributes. The Energy Atlas currently includes records for customers in the majority of the utilities of interest for this project: Los Angeles Department of Water and Power (LADWP) (electricity consumption; Los Angeles), Southern California Edison (SCE) (electricity consumption; Altadena, Topanga and Malibu), and SoCalGas (natural gas consumption; both regions). Premise-level data are stored securely and are not publicly accessible, but can be utilized in secure working environments for research projects and presented publicly in an aggregated or otherwise anonymized format (California Public Utilities Commission, 2014).

We use energy consumption data from 2019, as it is the most recent year available in the Energy Atlas where customer behaviors were not impacted by shelter-in-place orders associated with the COVID-19 pandemic.

ENERGY CONSUMPTION BASELINE

We summarized energy consumption levels by building type and rebuilding designation. Our interests in this analysis were to understand opportunities for energy conservation and implications for energy infrastructure. Accounting for solar photovoltaic (PV) adoption prior to the fires was critical to assess Pre-Fire baseline consumption. Net metered consumption data available in the Energy Atlas does not include electricity consumption from local solar. Therefore, we estimated annual solar production using NREL's PVWatts Calculator to capture the electricity produced and consumed directly from distributed generation (National Renewable Energy Laboratory, n.d.).

Lastly, the Energy Atlas database did not include the Pasadena Water and Power. We identified approximately 4,175 fire-impacted customers served by Pasadena Water and Power. Given the lack of access to Pasadena Water and Power customers' data, we developed simple electricity consumption estimates by multiplying the electricity usage intensities (kWh/sqft) of the neighboring SCE customers by the estimated square footage of the Pasadena Water and Power residential customer buildings.

RECENT CONSTRUCTION

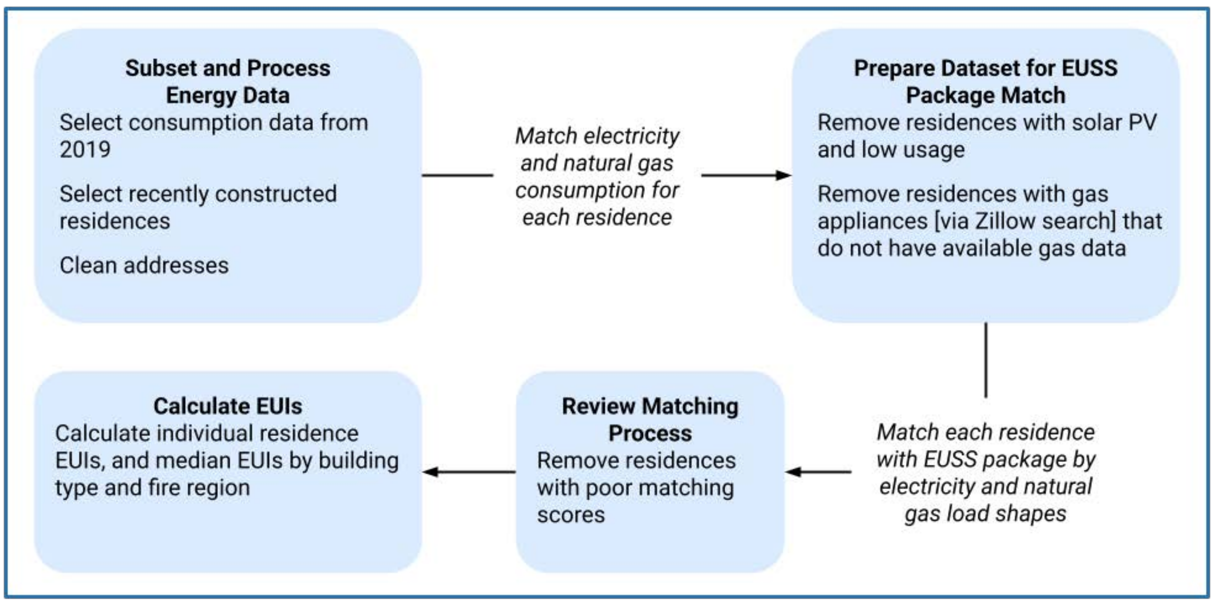
The Energy Atlas data was also used to determine EUIs for electricity and natural gas in buildings that were recently constructed or underwent major renovations prior to the fires in the fire regions.[7]

7 Again, zip codes sampled include: 90272, 90290, 90265, 91001, 91104, 91103, 91011, 91107, and 91024.

We defined recent builds as single family residences with an effective year after 2015; and multi-family residences with an effective year of or after 2000.[8] Because there were no recently built mobile homes in the fire regions, we did not conduct the recent build EUI analysis for mobile homes.[9]

In addition to the recent-build requirements, we only included residences with all 12 months of both electricity and natural gas data available in the Energy Atlas; except in cases where gas consumption was missing and full electrification seemed feasible based on our analysis. We also exclude buildings with a net energy metering (NEM) tariff out of consideration for the consumption that would be masked by distributed energy resources, as previously introduced. The full process of data cleaning, matching, and selection for the recent construction samples is shown in Figure 4.

Figure 4. Data cleaning pipeline for recent-build samples.



After the recent construction samples were selected, we calculated the median electricity and natural gas EUIs for multi and single family buildings. The results of this process, including the sample sizes and median EUIs, are depicted in Table 1.

8 The “Effective Year” in the UCLA Energy Atlas and LA County Parcel data refers to the most recent date of either the building vintage or last major construction.

9 Thus, when evaluating totals in comparison to the Pre-Fire baseline for electricity and gas, we include the Pre-Fire mobile home consumption.

Table 1. Recently Constructed Building Characteristics

	Eaton Fire		Palisades Fire	
	Multi Family	Single Family	Multi Family	Single Family
Sample Size (# of residences)	109	73	149	129
Median Electricity EUI (kWh/sqft)	3.8	2.91	2.99	3.9
Median Natural Gas EUI (Therms/sqft)	0.17	0.17	0.14	0.22
Median Total EUI (kbtu/sqft)	29.67	26.49	23.38	34.91

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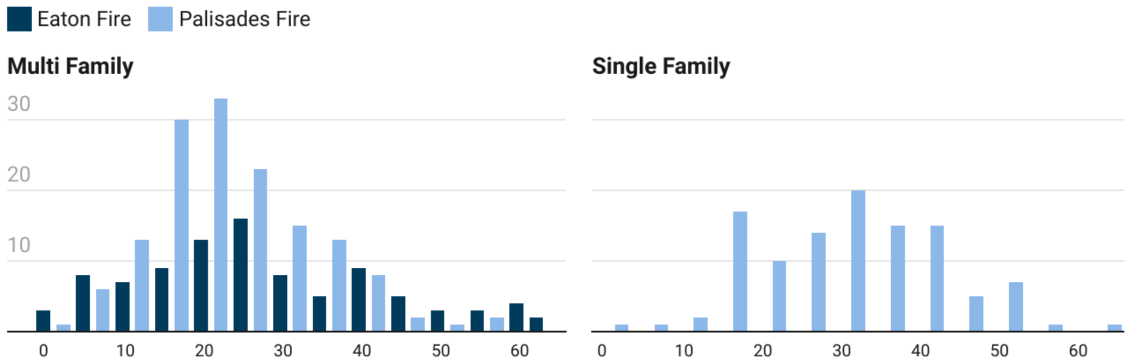
We used these median EUIs as a proxy for the EUIs of future construction(the "Recent build baseline" scenarios). The intention behind this approach is to capture the variations in physical building preferences (insulation, number of stories, appliances, EV adoption, etc.) and occupant behavior and preferences that are characteristic of each fire region. This approach assumes that the energy usage behavior of households in the recent-construction buildings is representative of the region's Pre- and Post-Fire energy usage behavior, such that the Pre-Fire baseline energy consumption calculations serve as a like-for-like comparison with Post-Fire consumption estimates.[10]

Each recent construction sample set's distribution of EUIs for electricity, natural gas, and total combined energy use are presented in Figures 5 through 7.

10 The exception to this is solar adoption. We explicitly remove homes with solar from the recent construction dataset (see Fig 2), so that EUIs represent only non-solar households. Local solar is then accounted for in Step 6 of our methodology.

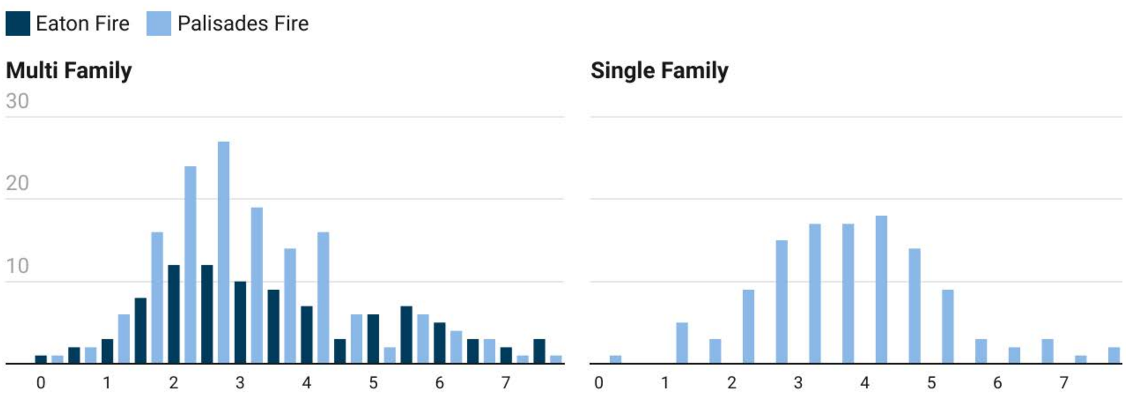
Figure 5. Recently Constructed Residence Annual Electric EUI (kWh/sqft).



** EUIs for the Eaton Fire single family homes are masked due to data privacy rules for groups of under 100 residences.*

Created with Datawrapper

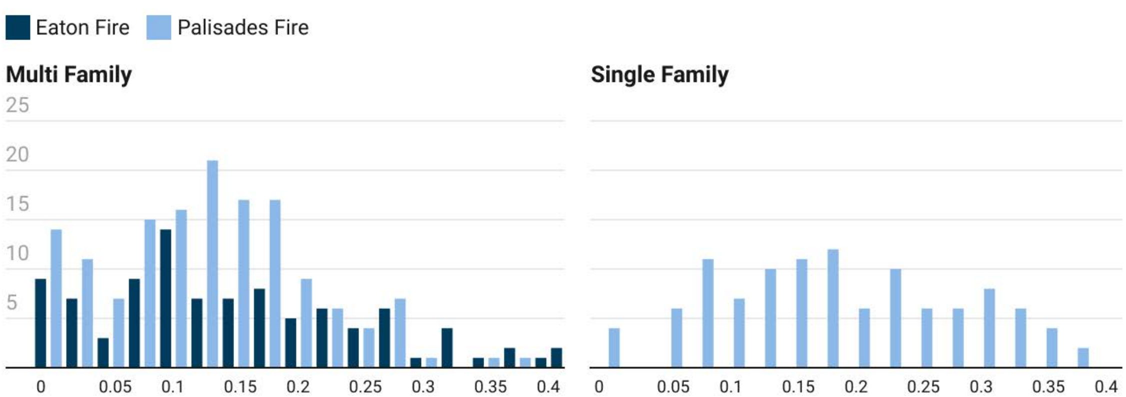
Figure 6. Recently Constructed Residence Annual Natural Gas EUI (Therms/sqft).



** EUIs for the Eaton Fire single family homes are masked due to data privacy rules for groups of under 100 residences.*

Created with Datawrapper

Figure 7. Recently Constructed Residence Annual Total EUI (kbtu/sqft).



** EUIs for the Eaton Fire single family homes are masked due to data privacy rules for groups of under 100 residences.*

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For the scenarios that involved electrification measures, we transformed the recent-construction building EUIs using multipliers from the National Renewable Energy Laboratory's (NREL's) ResStock End Use Load Savings Shape dataset (National Renewable Energy Laboratory, 2022). The dataset and transformation process are described more in the following section, Step 4.

Step 4: Applying NREL ResStock Analysis

INTRODUCING RESSTOCK

NREL developed the ResStock End-Use Savings Shapes (EUSS) dataset to evaluate the impact of different electrification measures on household energy usage (National Renewable Energy Laboratory, 2022). ResStock models energy consumption profiles for different electrification scenarios across the U.S. (lower 48 and D.C.) housing stock, split up by climate region using parametric, physics-based building energy simulation techniques.

MATCHING RECENT CONSTRUCTION WITH RESSTOCK PACKAGES

Because existing installed appliance fuel types are not available in any comprehensive or publicly-available dataset, we estimated each residence's combination of appliance fuel types by matching its monthly electricity and gas load profiles to the most similar EUSS package, on the basis of load shape similarity.[11] The assigned EUSS packages for each of the Single Family and Multi Familyresidences from the recent construction samples are presented in Figures 8 and 9.[12]

11 All utility customer data was calendarized as part of the UCLA Energy Atlas data cleaning process.

12 Here we match each building to a package using its specific building type label (Mobile Home, Multi-Family 2-4 Units, Multi-Family 5+ Units, Single Family Attached, and Single Family Detached), and then, to simplify analysis, combine Multi-Family 2-4 Units and Multi-Family 5+ Units into Multi Family, and Single Family Attached and Single Family Detached into Single Family.

Figure 8. Assigned ResStock Electrification Packages for Single Family recent construction in the Palisades and Eaton regions, by number of residences.

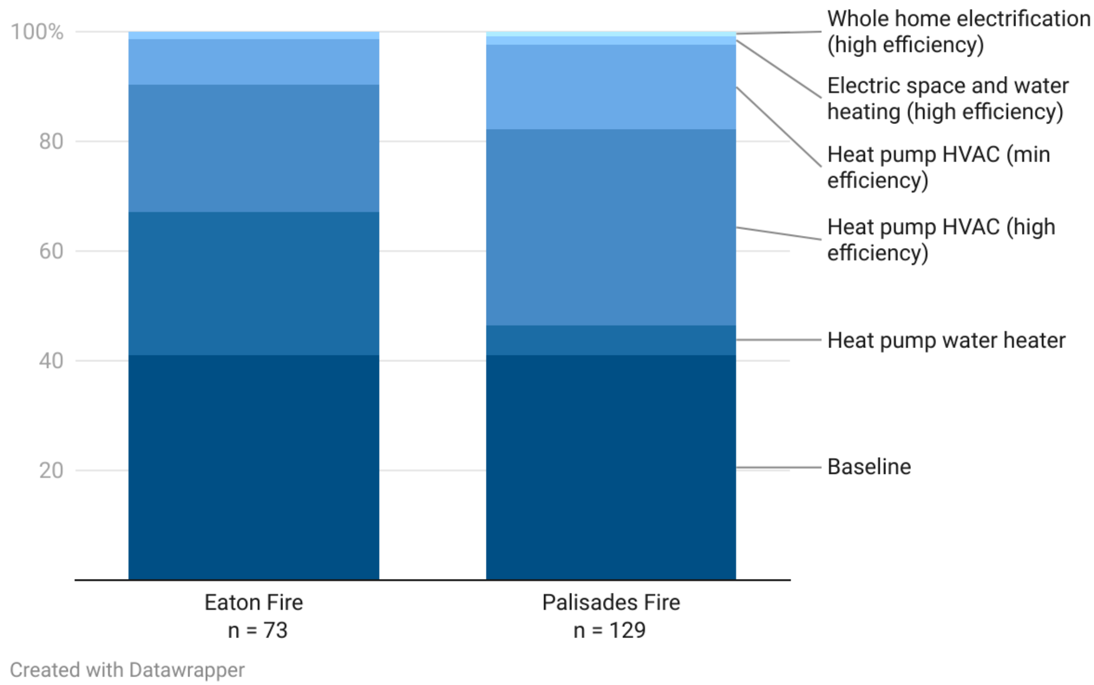
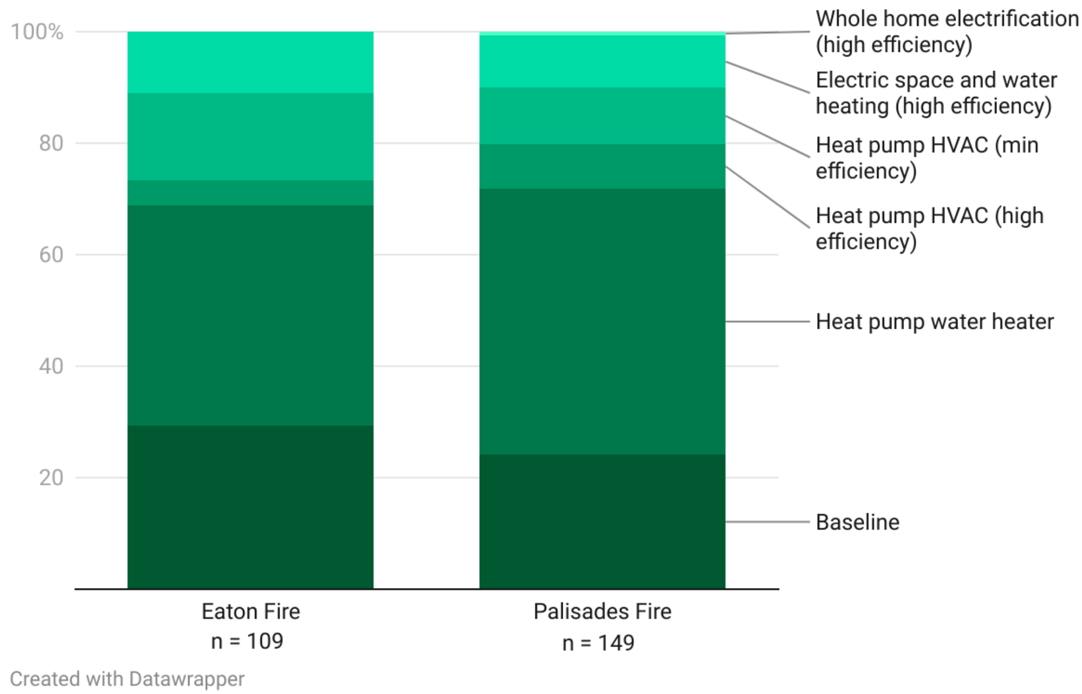


Figure 9. Assigned ResStock Electrification Packages for Multi Family recent construction in the Palisades and Eaton regions, by number of housing units.



TRANSFORMING EUIS TO REFLECT REBUILDING SCENARIOS

After each residence was assigned an EUSS package, its metered consumption was transformed to estimate consumption under the partially and fully electrified scenarios. To simulate the effect of a building upgrade, we multiplied the monthly consumption for each of the sample residences by package-specific adjustment factors derived from the EUSS profiles. Next, for each building size scenario, we calculated EUIs for each residence by dividing the residence's total electricity and gas consumption by building square footage. Finally, we aggregated the sample residences' EUIs by building type and fire region, computing the median electricity and gas EUIs. We repeated this process for each of the electrification upgrade packages.

Step 5: Estimating Post Fire Loads

The next step in the process was to combine the transformed median EUIs from the previous step with estimated new construction square footage to project electricity and natural gas usage across all eight future scenarios for each of the fire regions.

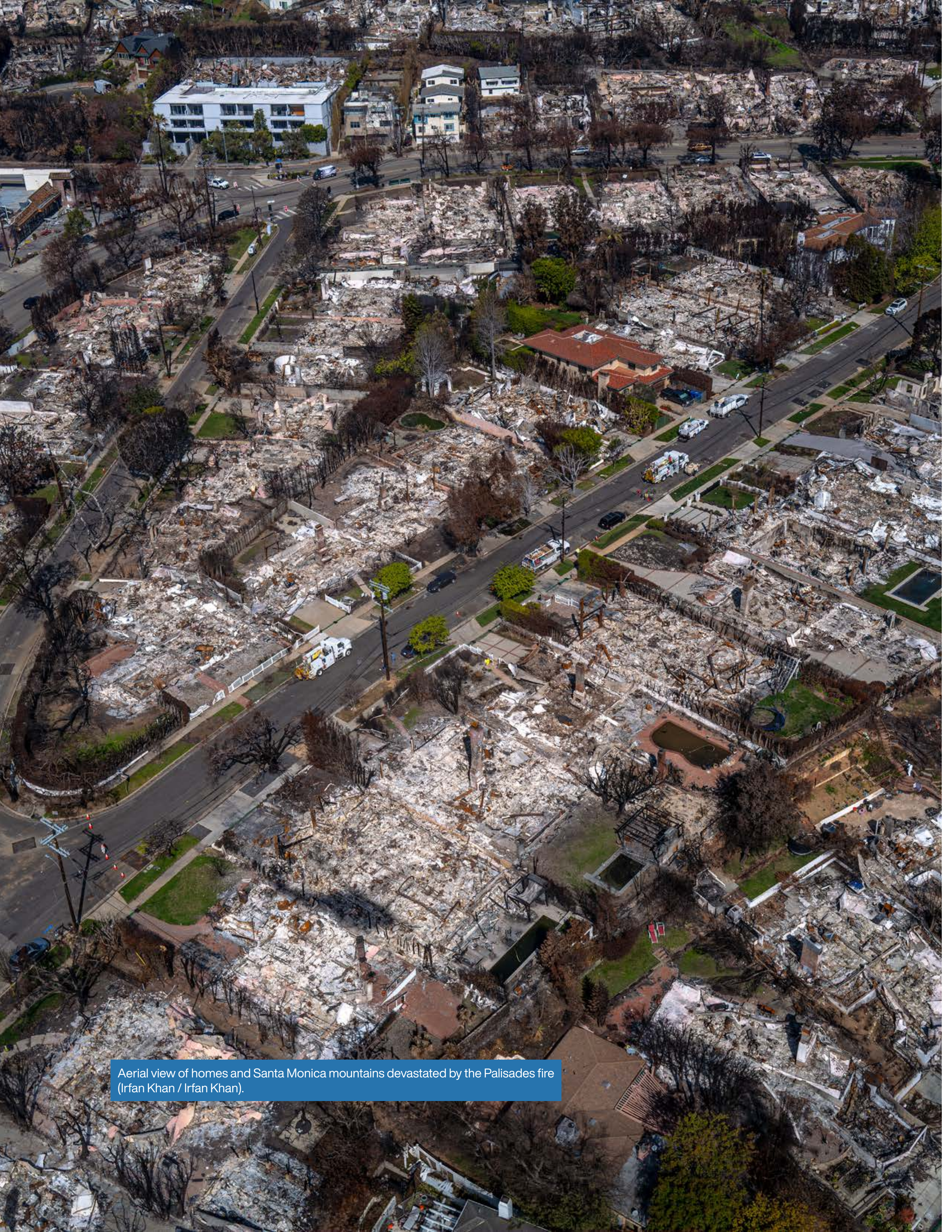
Each square footage value was multiplied by the four sets of computed median electricity and gas EUIs: recent build baseline (matching recent-construction preferences), electric space and water heating, all-electric (min efficiency), and all-electric (high efficiency).

Step 6: Solar PV Sensitivity

Finally, we estimated net metered single family residential electricity consumption with projected 100% solar adoption, in line with California Building Energy Efficiency Standards (Energy Code). The 2019 Energy Code introduced solar PVsystem requirements for all newly constructed low-rise residential buildings (California Energy Commission, 2020). Eaton and Palisades residential property rebuilds will need to comply with these current code requirements, including installing solar panels (LA County Recovers, 2025). While we recognize the potential complexity in PV system sizing, we assumed a 4 kW size default for each residence.[13] For each fire region, we used NREL's PVWatts model to estimate annual solar system output.[14]

13 4 kW is the default system size for NREL's PVWatts Calculator.

14 Solar system outputs of 1,657 kWh and 1,732 kWh per kW were used for Eaton and Palisades regions respectively. The estimated solar performance in the Palisades was based on an average of the values used for SCE and LADWP customers in Step 3.



Aerial view of homes and Santa Monica mountains devastated by the Palisades fire (Irfan Khan / Irfan Khan).

Results

Building Size

The scale of the new construction in these regions will be dramatic relative to the surviving buildings. The residences expected to be rebuilt represent 7.8% and 22.7% of the total fire-impacted region's square footage in Eaton and Palisades respectively, with 110% building size growth increasing the proportion to 8.6% and 25% (Table 2). The number of properties that were designated as recent construction prior to the fire, as defined for this analysis, made up just 0.5% and 2.3% of the building stock in the Eaton and Palisades Fire regions, respectively.

Table 2. Estimated New Construction Total Floor Area Relative to Pre-Fire Building Stock

	Eaton Fire				Palisades Fire			
	Multi Family	Single Family	Total	% of Fire Region Building Stock*	Multi Family	Single Family	Total	% of Fire Region Building Stock*
100%	201,841	9,682,746	9,889,777	7.8%	439,162	11,547,498	12,286,660	22.7%
110%	222,025	10,651,021	10,878,755	8.6%	483,078	12,702,248	13,515,326	25%

**Percent is defined on the basis of square footage. Fire region building stock includes residences in zip codes that are within or substantially overlapping with the fire perimeters.*

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Median EUI by Rebuild Electrification Scenario

The median energy use intensity of recently constructed buildings varies substantially by building type and region. In the Eaton Fire region, recently constructed buildings are significantly better performing than the average Pre-Fire building: newer single family homes used 38% less electricity and 50% less natural gas per square foot. In the Palisades region, recent construction electricity EUI changed minimally, while gas EUI declined more substantially. Compared with the complete residential building stock in the Palisades, the median new single family home uses 20% less gas per square foot, while the median multi family residence uses 60% less gas per square foot. A slight increase in recent-construction multi-family electricity usage intensity in this region, along with a decrease in gas use intensity, may be attributed to greater electric appliance adoption, as identified by the EUSS matching process (Figures 6 and 7).

In contrast, there are fewer homes that have electrified their cooking and clothes drying. Comprehensive, or whole home, electrification will more frequently involve appliance fuel substitution (i.e. switching away from gas). In other words, there are fewer existing inefficient electric appliances throughout the building stock that will be replaced with higher efficiency upgrades. Further, the potential efficiency gains associated with these end uses are significantly less than those that are associated with space and water heating and the use of heat pump technologies. Pursuing all-electric construction with high-efficiency appliances only entails a marginal difference in electricity and natural gas consumption compared with electric space and water heating–increasing median electricity EUI by between 0 and 0.29 kWh/sqft/year, and decreasing median gas EUI by between 0.037 and 0.054 Therms/sqft/year.

Perhaps counterintuitively, adopting high-efficiency electric space and water heating is associated with a lower median electricity usage intensity than both the Pre-Fire residential building stock and recently constructed stock for both building types and fire regions. For the Pre-Fire and recent build baselines, there was likely a higher preponderance of electric appliances in the building stock for space and water heating end uses (e..g, electric resistance heating, air conditioning, or electric resistance water heating) than other end uses (e.g., cooking, clothes drying). In cases with existing electric appliances, there is potential for electricity savings when switching to high efficiency alternatives.

In contrast, there are fewer homes that have electrified their cooking and clothes drying. Comprehensive, or whole home, electrification will more frequently involve appliance fuel substitution (i.e. switching away from gas). In other words, there are fewer existing inefficient electric appliances throughout the building stock that will be replaced with higher efficiency upgrades. Further, the potential efficiency gains associated with these end uses are significantly less than those that are associated with space and water heating and the use of heat pump technologies. Pursuing all-electric construction with high-efficiency appliances only entails a marginal difference in electricity and natural gas consumption compared with electric space and water heating–increasing median electricity EUI by between 0 and 0.29 kWh/sqft/year, and decreasing median gas EUI by between 0.037 and 0.054 Therms/sqft/year. All scenarios involving electric appliance adoption significantly decrease median combined EUI—as electricity is a much more efficient fuel than natural gas (Table 3C). When compared to recent build baseline, all-electric scenarios lead to 47-60% decreases in overall energy use intensity, depending on region and building type.

Table 3A. Median Annual Electricity Use Intensity (kWh/sqft)

2.56 – 5.37

	Eaton Fire		Palisades Fire	
	Multi Family	Single Family	Multi Family	Single Family
Pre-fire	4.5	Masked*	3.0	4.0
Recent build baseline	3.8	Masked*	3.0	3.9
Electric space and water heating (high efficiency)	3.5	2.6	2.9	3.8
All-electric (high efficiency)	3.5	2.8	2.9	4.1
All-electric (min efficiency)	4.4	3.6	3.6	5.4

** Values are masked due to data privacy rules for residential consumption in groups of fewer than 100 residences. Because comparisons are made, pre-fire is also masked.*

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Table 3B. Median Annual Gas Use Intensity (Therms/sqft)

0 – 0.39

	Eaton Fire		Palisades Fire	
	Multi Family	Single Family	Multi Family	Single Family
Pre-fire	0.4	Masked*	0.3	0.3
Recent build baseline	0.2	Masked*	0.1	0.2
Electric space and water heating (high efficiency)	0.1	0.0	0.0	0.1
All-electric (high efficiency)	0.0	0.0	0.0	0.0
All-electric (min efficiency)	0.0	0.0	0.0	0.0

** Values are masked due to data privacy rules for residential consumption in groups of fewer than 100 residences. Because comparisons are made, pre-fire is also masked.*

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Table 3C. Median Annual Combined Energy Use Intensity (kbtu/sqft)

9.41 – 53.88

	Eaton Fire		Palisades Fire	
	Multi Family	Single Family	Multi Family	Single Family
Pre-fire	53.9	Masked*	45.0	41.0
Recent build baseline	29.7	Masked*	23.4	34.9
Electric space and water heating (high efficiency)	19.0	12.4	15.3	18.5
All-electric (high efficiency)	12.0	9.4	10.0	13.9
All-electric (min efficiency)	14.9	12.4	12.4	18.3

** Values are masked due to data privacy rules for residential consumption in groups of fewer than 100 residences. Because comparisons are made, pre-fire is also masked.*

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Scenario Results

Estimated Electricity Consumption

Estimated Post-Fire electricity consumption varies greatly across fire regions and electrification scenarios. For rebuilding in the Eaton Fire region, pursuing high-efficiency all-electric new construction with the same square footage as the damaged property is estimated to decrease electricity consumption by 40% relative to Pre-Fire consumption. Minimum-efficiency all-electric appliances in new construction offer a lower level of benefit, but are still estimated to reduce total energy consumption by over 15%. In contrast, in the Palisades Fire region, where Pre-Fire residences had lower energy use intensities, increasing the share of electric appliances is estimated to result in between a marginal change and 35% higher total electricity consumption (depending on appliance efficiency), because there are fewer opportunities for efficiency gains.

Understanding the effects of different electrification scenarios on peak electricity demand growth, and thus, potential needs for electrical infrastructure capacity expansion, require a more granular (hourly time interval) analysis that, while consistent with the approach taken here, was beyond the project scope.

In all cases, building back larger sized homes is expected to negate some efficiency gains, particularly in terms of the energy requirements for HVAC heat pumps. For the Palisades region, for example, rebuilding with minimum efficiency all-electric appliances with a 10% increase in total new construction floor area leads to a 41% increase in total annual energy usage. And while rebuilding with high efficiency electric space and water heating at 100% of the original square footage leads to an approximately 5% decrease in electricity consumption, rebuilding under this scenario at 110% floor area leads to an estimated 5% increase. Further, while almost all projected scenarios in the Eaton Fire region lead to decreases in energy consumption from the Pre-Fire baseline, rebuilding with minimum efficiency all-electric appliances at 110% square footage is estimated to increase consumption by approximately 10%.

Table 4. Estimated Percentage Change in Electricity Consumption from Pre-Fire Baseline by Rebuild Scenario.

−100 0 100

Scenario	Eaton Fire			Palisades Fire		
	Multi Family	Single Family	Total*	Multi Family	Single Family	Total*
100% Pre-Fire Floor Area						
Recent build baseline	−15%	−40%	−40%	0%	0%	0%
Electric space and water heating (high efficiency)	−20%	−45%	−45%	0%	−5%	−5%
All-electric (high efficiency)	−20%	−40%	−40%	0%	0%	0%
All-electric (min efficiency)	0%	−25%	−25%	20%	30%	30%
110% Pre-Fire Floor Area						
Recent build baseline	−5%	−30%	−30%	10%	10%	10%
Electric space and water heating (high efficiency)	−10%	−40%	−40%	10%	5%	5%
All-electric (high efficiency)	−15%	−35%	−35%	10%	15%	15%
All-electric (min efficiency)	10%	−20%	−15%	25%	50%	50%

Note: All values rounded to the nearest 5%. Exact values have been made available to the Blue Ribbon Commission.
** Totals for first four rebuild scenarios include pre-fire baseline consumption from Mobile Homes, adjusted for square footage.*

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While high-efficiency building electrification can vastly decrease overall building EUI, efficiency gains cannot always - and have not historically - fully offset the effects of building size growth. Despite stricter building codes and improvements in building materials and appliances, building energy consumption in California has increased over the past decades as buildings have trended larger – especially in high income neighborhoods (Fournier et al., 2019). And while building back at up to 110% square footage represents a relatively modest increase, there is an additional possibility of much larger new construction.

Estimated Natural Gas Consumption

New homes, regardless of electrification measures, are likely to consume far less gas than the building stock prior to the fire. Even with like-for-like new construction, gas consumption across single and multi-family buildings is expected to be decrease by 50% and 20% for the Eaton and Palisades regions, respectively (Table 5). Electrification measures, of course, amplify this decline. All-electric space and water heating alone would result in a 90% (Eaton) and 75% (Palisades) decrease in natural gas consumption relative to the Pre-Fire baselines.

Table 5. Estimated Percentage Change in Natural Gas Consumption from Pre-Fire Baseline by Rebuild Scenario.

−100 0 100

Scenario	Eaton Fire			Palisades Fire		
	Multi Family	Single Family	Total*	Multi Family	Single Family	Total*
100% Pre-Fire Floor Area						
Recent build baseline	−60%	−60%	−50%	−60%	−20%	−20%
Electric space and water heating (high efficiency)	−90%	−90%	−90%	−90%	−80%	−80%
All-electric (high efficiency)	−100%	−100%	−100%	−100%	−100%	−100%
All-electric (min efficiency)	−100%	−100%	−100%	−100%	−100%	−100%
110% Pre-Fire Floor Area						
Recent build baseline	−55%	−45%	−45%	−60%	−15%	−15%
Electric space and water heating (high efficiency)	−85%	−90%	−90%	−85%	−80%	−75%
All-electric (high efficiency)	−100%	−100%	−100%	−100%	−100%	−100%
All-electric (min efficiency)	−100%	−100%	−100%	−100%	−100%	−100%

Note: All values rounded to the nearest 5%. Exact values have been made available to the Blue Ribbon Commision.
** Totals for first four rebuild scenarios include pre-fire baseline consumption from Mobile Homes, adjusted for square footage.*

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Mixed-fuel development would require investing in the maintenance of gas distribution infrastructure. However, as these results indicate, this infrastructure is likely to recoup significantly less revenue due to anticipated usage decreases. There is justifiable concern that this trend will result in rising gas rates in the future, in order to spread a fixed infrastructure revenue requirement across a declining volume of gas sales. The pattern seen here is not exclusive to the fire regions, but reflects a broader trend that has become an issue of emerging concern as gas fuel-substitution efforts ramp up across the state. Targeted "pruning" of the gas system, by decommissioning underperforming gas distribution infrastructure assets, is one strategy to reduce the risk and consequences associated with these types of gas usage declines (California Public Utilities Commission, 2024). Pursuing all-electric new construction, in concert with supporting surviving buildings in transitioning away from gas, might be a natural opportunity to further pilot this strategic decommissioning approach.

Table 6. Impact of Rebuilding on Natural Gas Consumption in Both Fire Regions, by Scenario.

Scenario	Total Therms	Percent Change from Pre-Fire
Pre-fire baseline	7.5M	-
100% of Pre-Fire Floor Area		
Recent build baseline	4.9M	−35%
Electric space and water heating (high efficiency)	1.3M	−85%
All-electric (high efficiency)	-	−100%
All-electric (min efficiency)	-	−100%
110% of Pre-Fire Floor Area		
Recent build baseline	2.9M	−30%
Electric space and water heating (high efficiency)	1.4M	−80%
All-electric (high efficiency)	-	−100%
All-electric (min efficiency)	-	−100%

Note: All values rounded to the nearest 5%. Exact values have been made available to the Blue Ribbon Commission.

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Solar

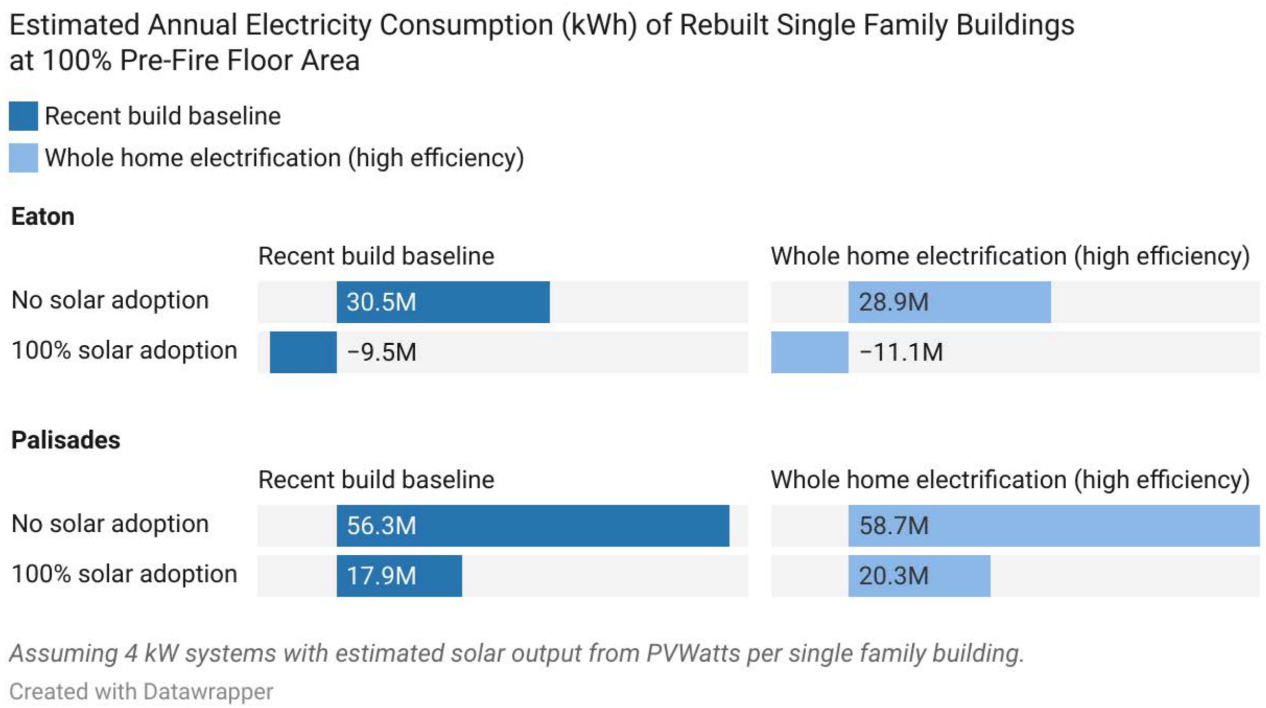
The rate of local solar adoption would dramatically increase if 100% of newly constructed residential buildings install rooftop solar PV, as is required by the California Energy Code. The suitability of the 4 kW system size, which we assume as the default in this analysis, is highly dependent on household-level consumption and solar system performance. In the Eaton Fire region, where the average building square footage is smaller than in the Palisades, 4 kW systems per single family residence would readily offset the average property's estimated total annual consumption (Figure 10). Appliance decisions aligned with the recent build baseline plus 100% solar adoption would result in approximately 9,500 MWh in excess generation that would be sold back to the grid. With all-electric high-efficiency construction and the associated potential for electric efficiency gains, 100% solar adoption would produce even greater excess generation, approximately 11,000 MWh. The 4 kW system default may not be suitable for households that use less electricity. Further, SoCal Edison customers are incentivized to install battery energy storage systems with net billing tariffs (Energy Information Administration, 2024). This would reduce the amount of electricity exported to the grid, as well as households' reliance on purchased electricity.

In the Palisades, there are fewer single family residences which must be rebuilt, but with energy use intensities similar to Altadena yet having greater square footage. As a result, 4 kW systems per residence would be insufficient to offset the total annual electricity consumption of the average home. However, the electricity expected to be drawn from the grid is still drastically reduced with 100% solar adoption in new construction. All-electric new construction would increase overall electricity consumption, and thus with an equivalently sized solar system there would need to be an increase in the amount of purchased grid electricity. Adoption of slightly larger systems for these properties (approximately 6 kW per home), however, would readily make up this difference.

The Energy Code assumes that residences will be grid-connected, meaning there is an obligation for the electric utilities to provide service and supply any demands for electricity that exceed the capabilities of installed rooftop solar (and potentially, battery storage systems). This is true even if the majority of consumption throughout the course of the year is being produced by the distributed generation system. With state mandated universal solar PV adoption in new construction, the revenue base for socializing the cost of restoring electricity infrastructure and implementing grid hardening strategies diminishes – and in the case of Eaton, the local revenue base of the nearly 6,000 affected homes practically disappears. This means that households outside of the fire zones may take on a greater share of the infrastructure costs associated with providing grid electricity to those who choose to return to the burned regions.

However, this perspective focuses on internalized costs and benefits; it does not take into account other benefits of distributed generation and strategies in place to align local solar with energy system needs. Distributed generation in these areas can enable utilities to experiment with alternative grid infrastructure design. Further, distributed energy resources can boost community resilience in the face of future extreme weather events (Leffer, 2024).

Figure 10. Estimated Annual Consumption (kWh) Relative to Pre-Fire Baseline of Rebuilt Single Family Residences at 100% of Pre-Fire Floor Area, Considering Solar PV.



Altadena Residents welcome the Army Corps of Engineers to begin removing the debris of their fire damaged homes (Mayra Beltran / Los Angeles County).

Discussion

This analysis takes a high-level approach to constructing energy demand projections for residential reconstruction in Los Angeles' fire impacted communities, setting aside much of the complexity that comes with greater geographic and temporal resolution. These results get to the general relationships between rebuilding scenarios – highlighting the opportunities for better performing buildings, energy conservation, and the cascading nature of building-level decisions on the energy infrastructure. There are opportunities to leverage this work in a manner that is more deeply engaged with local context. We briefly introduce some of these additional considerations.

Sociodemographic Characteristics

There are notable differences between the sociodemographic characteristics of each fire region (Tables 7 and 8). Neighborhoods affected by the Eaton Fire are markedly more racially and ethnically diverse than the neighborhoods in the Palisades Fire region. Meanwhile, the Eaton Fire region is both more populous and more densely populated. Of particular concern for future rebuilding, both the Eaton and Palisades neighborhoods have significantly greater homeownership rates and median home values than LA County as a whole.

Table 7. Demographics of Neighborhoods Affected by the Eaton and Palisades Fires.

	Eaton Fire	Palisades Fire	LA County
Non-Hispanic white	37%	80%	25%
Black or African American	20%	0.8%	7.5%
Asian, Native Hawaiian, Pacific Islander	5.4%	6.2%	15%
Hispanic or Latino	30%	4.4%	48%

Source: Phillips, 2025 • Created with Datawrapper

Table 8. Characteristics of Neighborhoods Affected by the Palisades and Eaton Fires.

▼	Eaton Fire	Palisades Fire	LA County
Population per sq. mi.	4,341	3,415	2,426
Population	35,365	23,049	9,848,406
Median home value*	$1,091,976	$2,000,001	$783,300
Median age	47	48	38
Homeownership rate	81%	77%	46%

**Multiple tracts affected by the Palisades Fire had top-coded values for median home value (the maximum value for this variable is $2,000,001).*

Source: Phillips, 2025 • Created with Datawrapper

While the Palisades and the Eaton regions are generally more affluent relative to Los Angeles County, the scale of the losses cannot be understated. Further, not every household within each fire zone is equally well positioned to recover from this catastrophe. Rebuilding in Altadena is not only about reclaiming the homes themselves, but also the legacy of Black homeownership and generational wealth-building seen in few other places as a result of racially restrictive housing covenants commonplace in the mid-20th century (Fatheree, 2025; Mejia, 2025). UCLA colleagues at the Ralph J. Bunche Center for African American Studies, Center for Neighborhood Knowledge, Latino Policy and Politics Institute, and Lewis Institute provide more thorough analysis of anticipated effects on local and regional housing markets, and the Eaton Fire's impact in Altadena's Black community (Ong et al., 2025; Phillips, 2025).

Building Stock Characteristics

Beyond these sociodemographic characteristics, there are also distinct differences in the building stocks of each region. Although the fires affected relatively similar aggregate square footages of residential buildings, this square footage represented a much greater number of residences in the Eaton Fire region. Looking at the single family homes within the two fire perimeters, it is clear that those affected by the Eaton Fire were on average smaller and older than those affected by the Palisades Fire (Figures 11 and 12).[15]

15 This includes all homes in the DINS datasets. Results previously presented are focused on the following damage categories: Minor Damage, Major Damage, and Destroyed.

Figure 11. Square Footage of Residences Within the Fire Perimeters.

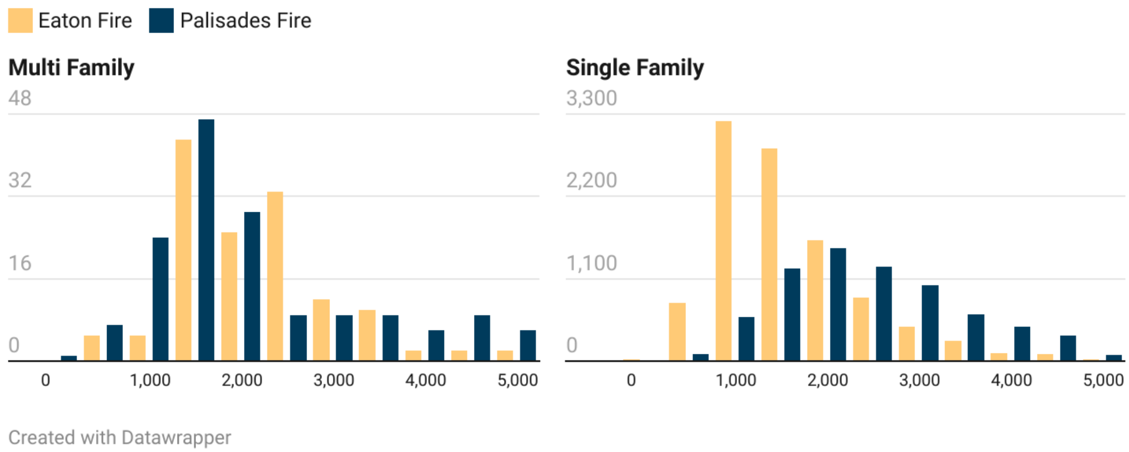
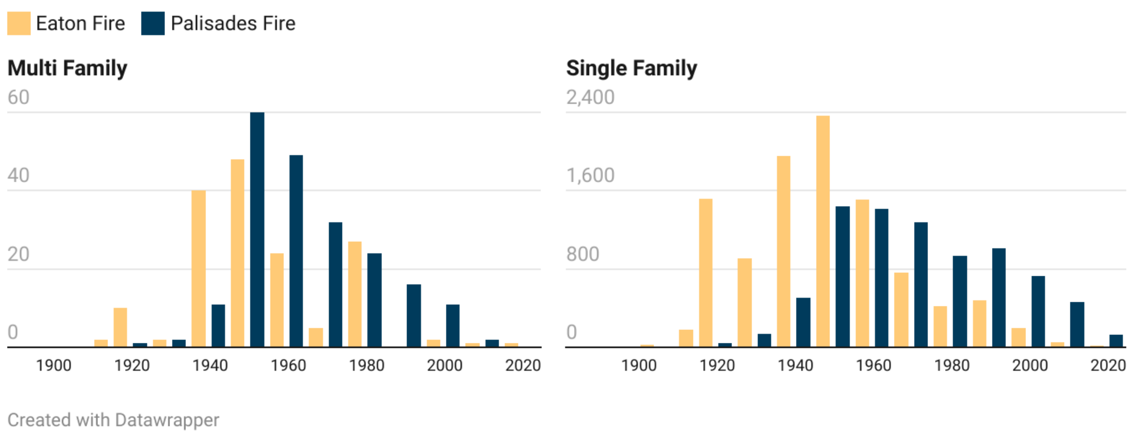


Figure 12. Vintage of Residences Within the Fire Perimeters.



Building codes improve building envelope performance and increase energy efficiency. Although this work is focused on new construction associated with the rebuilding effort, the lessons learned from our findings can be applied to both surviving buildings in Altadena and the Palisades, and the historic housing stock across Los Angeles. High performing buildings not only contribute to energy efficiency and building decarbonization, but also improve quality-of-life, health, and resiliency during extreme heat and air quality events (Gillingham et al., 2021; U.S. General Services Administration, 2025).

Utility Structure and Planning

It is important to reiterate that the burned areas are served by three different electric utilities: the the Los Angeles Department of Water and Power, a municipal utility; Southern California Edison, an investor owned utility; and Pasadena Water and Power, a municipal utility–each of which has its own infrastructure as well as governance complexities. As introduced previously, our analysis does not focus on the temporal component of electricity use. More detailed analysis and collaboration with regional electrical utilities is needed to understand the relationship between consumption change, peak demand, and infrastructure needs.

Manuel Alvarado and Emma Alvarado return to see their property after debris has been cleared (Mayra Beltran / Los Angeles County).

Conclusion

There are competing visions for the future of each fire-impacted region: for some, there is a longing to return to life before the fires as quickly as possible; for others, the current moment is seen as an opportunity for investment and redevelopment. The historic residential building stock of the fire-impacted regions underlie each region's neighborhood character – and there is no telling whether this can or will be restored.

As policymakers work together with the fire-affected communities to rebuild, energy-related considerations,whether they be in homes or at a system level, will have broad-ranging impacts beyond just the communities themselves. Our key findings can support rebuilding in a way that not only better serves the impacted communities, but also advances the state's climate and energy goals:

- **Building Stock Performance Matters**: Overall energy use intensity of Post-Fire construction is expected to be less than the Pre-Fire baseline as recent construction homes are more efficient – both due to improved performance of buildings' thermal shells but also more efficient modern end-use appliances. From a combined fuel standpoint, any electrification measure will offer additional energy efficiency benefits.

- **High Electrification Potential**: All-electric construction would benefit the health of recovering households by improving indoor and ambient air quality. Further, electrification can be pursued without significant expected impact to energy infrastructure buildout. In comparison to Pre-Fire baseline, high-efficiency residential electrification would decrease the Eaton Fire region's electricity use and only marginally increase that of the Palisades Fire region's. The relatively poor building performance of the older Eaton Pre-Fire building stock relative to the Palisades means there is greater opportunity for efficiency benefits with new construction.

- **Rebuilding Must Consider Long-Term Gas Planning**: Appliance electrification and efficiency will drastically decrease the amount of gas that will be consumed, calling into question the economics of maintaining the gas distribution system, and the cost of gas for those who cannot or do not electrify. There is also a need to plan for transitioning surviving homes away from gas.

- **Electric Infrastructure Planning Should Account for Solar Adoption**: If homes are rebuilt with solar according to state requirements, net consumption in the Eaton Fire region can be entirely offset. Solar at a comparable per-building system size in the Palisades will substantially, but not entirely, offset consumption due to larger energy consumption per building. New construction as part of the recovery will likely represent a significant growth in Los Angeles' distributed generation.

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