Weatherizing Mobile Homes in San Diego

Recommendations and Resources

Prepared for the Climate Equity in San Diego project.

Center for Sustainable Energy®

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I. Background

In December 2015, the City of San Diego (City) adopted one of the most ambitious Climate Action Plans (CAP) in the nation with unanimous bipartisan support from elected leadership. It has been lauded for its goals around mobility and 100% renewable energy. To ensure benefits of the CAP are inclusive of all San Diegans equitably, empowering underserved communities through education and tangible action is key. The Social Equity Chapter of the CAP commits to prioritizing programs and actions to reduce emissions in disadvantaged communities within the top 25 percent of CalEnviroScreen rankings for the San Diego region, as well as other workforce development outcomes for low-income communities.

The Climate Equity in San Diego project was launched to help reach the broad climate and equity goals described above. This project has four main objectives: 1) Coalition Capacity Building, 2) Community Engagement, 3) Weatherization and Resiliency Research and Analysis and 4) Build Relationships to Advance CAP Equity. In support of the third objective, Weatherization and Resiliency Research and Analysis, the Center for Sustainable Energy has conducted a literature review to develop recommendations for weatherizing and improving the energy efficiency of mobile homes and mobile home parks in and around San Diego.

II. Mobile Homes

Overview

Mobile homes are a type of manufactured home that is built off-site and then transported to a property to be used as a residence. Manufactured homes also include other types of structures such as modular homes. For this review, we focused our research on mobile homes, which are differentiated from other manufactured homes by a chassis that is used for their transport. Mobile homes are often located in "mobile home parks" where residents live in a mobile home that they either rent or own while renting the lot from the park owner.[1]

Mobile homes are an affordable housing option for lower income households as they typically cost less than half of what a site-built home costs per square foot.[2] Across the United States, the median income for households in mobile homes is approximately half of that for households in site-built homes and the median net worth of mobile home households is only a quarter of that for households in site-built

[1] Noah J. Durst & Esther Sullivan (2019), The Contribution of Manufactured Housing to Affordable Housing in the United States: Assessing Variation Among Manufactured Housing Tenures and Community Types. *Housing Policy Debate*. DOI: 10.1080/10511482.2019.1605534.
[2] U.S. Census Bureau (2017), Cost and size comparison for manufactured and site built homes. Manufactured Housing Survey Annual Data.

homes.[3] There are about 42,000 mobile homes in San Diego County, accounting for approximately 3% of the housing stock.[4] Historically, many of these mobile homes have been located in San Marcos (20%), Santee (13%) and unincorporated areas (32%) of the county.[5] The mobile home market has been increasing across California in recent years, with nearly 4,000 mobile homes shipped to the state in 2019 compared to 2,600 in 2014.[6]

Brief Regulatory History

Unlike site-built homes with standards established by states, mobile homes are regulated by the federal government since it is often unknown where the home will ultimately be located.[7] Mobile homes were weakly regulated until the establishment of the Housing and Urban Development (HUD) Code in 1976. The HUD Code regulates the design and construction of manufactured homes and sets performance standards for the heating, plumbing, air- conditioning, thermal and electrical systems.[8] The HUD Code has been updated several times since it was established; the most important update with regards to energy efficiency occurred in 1994 when thermal requirements were improved. In 2001, mobile homes were eligible to become ENERGY STAR® certified, which requires a mobile home to be significantly more energy efficient than comparable manufactured homes built to the HUD Code, particularly with respect to heating and cooling.[9] That said, although the energy efficiency of mobile homes has improved significantly in the past decades, they remain relatively energy inefficient as building codes for mobile homes lag behind those for site-built homes. HUD has proposed new standards that will further improve energy efficiency of mobile homes, but these standards are still under review.[10,11]

III. Mobile Home Energy Usage in California

Mobile homes in California use an average of 5,500 kilowatt-hours (kWh) of electricity per year. This is less energy than the average single-family site-built home,[12] but mobile homes are generally smaller and use more energy per square foot.[13] Annual energy expenditures for mobile homes across the U.S. are approximately $1.30 per square foot relative to $0.80 per square foot for single-family detached

[3] Consumer Financial Protection Bureau (2014), Manufactured-housing consumer finance in the United States.
[4] San Diego Association of Governments, Data Surfer, Current Estimates. (visited: 11/2020)
[5] San Diego Association of Governments (2004), Population and Housing Characteristics in the San Diego Region.
[6] U.S. Census Bureau, Manufactured Housing Shipment Tables. (visited: 11/2020)
[7] American Council for an Energy Efficient Economy (2016), Mobile homes move toward efficiency.
[8] CTG Energetics (2012), Sustainability in Manufactured Home Communities: Cost-effective energy, water and community infrastructure strategies to maximize long-term value.
[9] Systems Building Research Alliance (2020), ENERGY STAR Certified Manufactured Homes Program, Version 2, Guide for Home Manufacturers.
[10] As of January 2020, HUD has paused the review in anticipation of new DOE regulations for manufactured housing.
[11] Federal Register (2020), Manufactured Home Construction and Safety Standards, A Proposed Rule by the Housing and Urban Development Department on 1/31/2020.
[12] KEMA, Inc (2010), 2009 California Residential Appliance Saturation Study.

homes.[13] In general, the most consistent and largest source of electricity usage for mobile homes across California are refrigerators and televisions. Table 1 provides the average annual electricity use and saturation percentage by appliance for mobile homes in California.

Appliance	Average Annual Electricity Use	Saturation
Water Heaters (electric)	2,575 kWh	16%
Second Refrigerators	1,123 kWh	18%
Central AC	876 kWh	48%
Freezers	802 kWh	27%
Refrigerators	740 kWh	100%
Televisions	697 kWh	100%
Evaporative Cooler	552 kWh	28%
Clothes Dryer	489 kWh	37%
Personal Computer	437 kWh	72%
Room AC	423 kWh	16%
Outdoor lighting	204 kWh	65%

Table 1. *Average annual electricity use and saturation by appliance for mobile homes in California for 2009. Saturation indicates the percent of mobile homes in 2009 with the corresponding appliance installed. All data in this table are from the U.S. Energy Information Administration.*[12]

Appliances that are less common can also consume a considerable amount of electricity including air conditioning units (AC), second refrigerators or freezers, electric water heaters and electric clothes dryers (Table 1).[12] For instance, air conditioning units can use 400-900 kWh per year but this is highly dependent upon the type of AC (Table 1).[12] Further, it should be noted that these AC consumption estimates represent all of California and may not be representative of San Diego County. For instance, a small subsample of San Diego AC usage indicates that central and room AC may only average 584 kWh and 347 kWh, respectively.[12] Electric water heaters are rare (16% saturation), but they use a significant portion of electricity in mobile homes where they are installed (Table 1). Indoor lighting typically contributes approximately 9% of total electricity usage for mobile homes nationwide,[13] but we could find no information on indoor lighting usage for mobile homes in California.

Gas is a common fuel for several major appliances in mobile homes across California. Mobile homes with gas metering use an average of 352 therms (compared to 425 therms for site-built homes) and approximately 70% of mobile homes use some type of gas (mostly natural gas).[12] Most mobile homes have gas stoves and ovens and about 29% have gas dryers.[12] That said, over 95% of gas usage in mobile homes in California can be attributed to water (41%) and space heating (55%).[12]

[13] U.S. Energy Information Administration, Residential Energy Consumption Survey. (visited: 10/2020)

IV. Weatherization and Energy Efficiency Measures

There are several cost-effective measures that increase the energy efficiency of mobile homes. Basic energy efficiency measures for mobiles homes include cleaning and adjustments to the HVAC systems and upgrading minor appliances. More significant measures include air sealing, improved insulation and major appliance replacement. A list of common measures in Table 2 are grouped into three tiers based on the estimated cost of implementing each measure. The low- and no-cost measures (Tiers I and II) can typically be performed by the resident and are often the most cost-effective options for reducing energy use.[14] That said, Tier III measures typically will generate the greatest energy savings, but these measures are relatively costly and often require professionals to perform the measure.[15]

Common Energy Efficiency and Weatherization Measures		
Tier I ($0-$100)	**Tier II ($100-$500)**	**Tier III ($500-$2,500)**
• Clean or Replace AC Filter* • Insulate Water Heater Tank* • Install LED Bulbs* • Clean/Replace Furnace Filter* • Fully Open all Registers and Vents* • Weather Stripping* • Clean AC Condensing Cooling Coils • Lower Water Heater Temperature • Install Low-Flow Showerhead • Shade AC Unit • Install Energy-Saving Sensors on Exterior Lighting • Patch/Replace Damaged Bottom Board	• AC Tune-Up* • Seal Duct Leaks* • Landscape Shading* • Exterior or Interior Window Shading • Furnace Tune-up • Replace Water Heater	• Air Seal* • Window replacement* • New DWH Heat Pump • Ceiling and Floor Insulation • Refrigerator Replacement • Furnace Replacement • Wall Insulation

Table 2. *This table shows common measures that can result in energy savings in mobile homes. They are grouped into three tiers based on their estimated costs. These measures and associated costs were primarily derived from 8,14. * indicates that the measure can reduce significant amounts of energy relative to the costs of the measure. However, it should be noted that the effectiveness of each measure will vary significantly from house-to-house based on the local climate, the energy efficiency status of the home and its appliances.*

The actual energy savings of these measures will be dependent upon characteristics of the home, resident behavior and local climate. In general, mobile homes with higher energy baselines prior to any energy upgrades will be the best opportunities for energy efficiency improvements. Higher energy use will typically occur in larger and less-efficient homes, especially those built before 1976 when the first HUD Code was established. In San Diego, homes further inland where the local climate is hotter during

[14] U.S. Department of Housing and Urban Development, Office of Policy Development and Research (2005), Manufactured Homes: Saving Money By Saving Energy: Energy-saving tips, techniques and recommendations for owners of manufactured (mobile) homes.

[15] Oak Ridge National Laboratory (2014), National Weatherization Assistance Program Impact Evaluation – Energy Impacts for Mobile Homes.

the summer and cooler during the winter will also use more energy for heating and cooling and, thereby, will likely benefit greater from measures that reduce heating- and cooling-related energy use. Weatherization measures alone could save mobile homes between 1-14% in annual gas and electricity savings in hot climates[16] based on impact assessment for homes weatherized by the Weatherization Assistance Program (WAP).[15] Typical weatherization measures include installing insulation, air sealing, sealing and repairing ducts, and tuning and repairing heating and cooling units.

V. Recommendations and Resources

Recommended Strategies

Based on the literature reviewed in this report, the following recommendations should be considered when conducting outreach and education to mobile home residents and mobile home park owners.

- Target older (particularly pre-1976) and larger mobile homes since these are the homes that will tend to use the most energy. In addition, homes located in inland areas should be prioritized given the larger temperature ranges.
- Weatherization upgrades should prioritize replacing windows, adding insulation, sealing duct leaks, increasing shading and installing or replacing weather stripping.
- Weatherization activities across an entire mobile home park could increase cost-effectiveness since service providers may be able to reduce per-household costs.
- Other energy efficiency measures should include tuning and conducting maintenance on heaters and air conditioners, replacing incandescent lightbulbs with LEDs and adding shade to the landscape.
- Engage with San Diego Gas & Electric® (SDG&E) to determine if there are opportunities to coordinate efforts. Participants in the Mobilehome Meter Conversion Program may be especially interested in energy efficiency programs given the residents will begin receiving energy usage metrics for their home and their behaviors will directly impact their bills.

Resources for Mobile Home Residents

Numerous programs and resources are available to low-income residents living in manufactured housing administered by state, federal and local governments and SDG&E. Some of the programs listed below are aimed only at mobile home residents and others are specifically for lower-income residents. Further, there is assistance available for mobile home parks that also could be beneficial to mobile home residents.

[16] Defined as Nevada, California and Arizona.

Mobile Home Energy Programs

SDG&E offers the Mobilehome Park Utility Conversion Program. This program replaces aging park-owned energy distribution systems with new utility-owned systems. The infrastructure upgrade provides mobile home residents with individual utility service thereby allowing residents to monitor their electricity use and enabling them to save money by being more efficient.

Another SDG&E program called the Energy Assistance Program provides low- and no-cost energy-saving products and installation, including insulation, lighting and appliance replacement. Eligibility is based on income and household size. Participants may be eligible to receive these home improvements at no cost:*

- Attic insulation
- Energy-efficient lighting
- Door weather stripping
- Replacement of qualified appliances**
- Caulking
- Minor home repairs
- Low-flow showerheads
- Water heater blankets

** Homes previously participating in the program may be excluded from additional program participation*

*** Existing appliances must meet age requirements to qualify for replacement. Co-pay may be required for landlords who own appliances and pay tenant utility bill.*

General Energy Efficiency and Resiliency Programs

The California Weatherization Assistance Program is a Department of Energy program that is implemented by California to improve energy efficiency in low-income households. The assistance is generally used to install insulation, seal ducts and implement other energy-saving measures. Specific measures have included: bypass air sealing; insulation for attics, walls or other areas; replacement of furnaces, windows, water heaters and/or refrigerators; and duct sealing. Individuals that already receive Supplemental Security Income or Temporary Assistance for Needy Families are automatically eligible.

The Self-Generation Incentive Program offers rebates for installing energy storage technology that can provide power for several hours or longer during power outages. This program is particularly aimed at those living in High Fire-Threat Districts or in areas that have experienced multiple Public Safety Power Shutoffs.

California's Low-Income Weatherization Program (LIWP) provides low-income households the opportunity to get energy efficiency upgrades and the installation of solar photovoltaic systems at no cost.

Low-Income Energy Programs

The Medical Baseline Allowance Program is a program for households with an individual that has a qualifying medical condition or requires medical equipment in the home. The program allows residents to receive electricity and gas at a lower cost.

The California Alternate Rates for Energy (CARE) and Family Electric Rate Assistance (FERA) programs offer discounts of 30% and more for eligible households that are having difficulties paying their energy bills.

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