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Energy Equity Indicators

Adding to the Energy Commission's Tracking Progress reports,[1] this report launches a set of energy equity indicators to identify opportunities and track progress for advancing the recommendations in the SB 350 Low-Income Barriers Study. This report includes nine indicators relating to clean energy access, investment, and resilience in California's low-income and disadvantaged communities.

Key themes emerging from these indicators are highlighted below, illustrating how the indicators apply in different areas of the state:

- Census tracts with median household income less than 60 percent of statewide median household income (Figure 2) are likely to be eligible for most low-income clean energy programs. In 2014, the year used for most of the low-income census data in this report, this equated to a maximum of $46,607 in annual income for a four-person household.
- Many counties in the San Joaquin Valley have high levels of asthma-related emergency room visits (Figure 16) and heat-related illness (Figure 17). These areas are expected to see more than 1,000 additional cooling degree days per year on average, a measure used to estimate energy demand needed to cool a building, by midcentury (2035-2064) compared to 1961-1990 due to climate change.[2] For comparison, Fresno had more than 1,800 cooling degree days on average in 1961-1990.[3] Some low-income communities in these areas have low levels of investment from investor-owned electric utilities' energy efficiency programs.
- While many San Joaquin Valley counties report a fair number of clean energy jobs compared to other counties, they tend to score in the bottom 20 percent in terms of clean energy jobs per 1,000 people (Figure 20). Expanded clean energy outreach and investment for energy efficiency, rooftop solar, and access to electric vehicle infrastructure in these counties should be designed to help low-income communities improve health and safety conditions, such as asthma and heat-related illness. For example, the percentage of people owning electric vehicles is lower in the Central Valley than in other parts of the state, suggesting an opportunity for programs to focus on this region to provide greater access to electric vehicles (Figure 14).
- Regarding inland areas of Southern California, opportunities for improved clean energy services for low-income communities vary across indicators. For example, more than 140 low-income census tracts in the Southern California Edison service territory had an average 2014 August electricity bill greater than $300. Many of these inland areas,

[1] The Energy Commission Tracking Progress reports provide sector-specific summaries of California's progress toward a cleaner energy future, with links to additional resources. Information and metrics are updated regularly. The reports are available at: http://www.energy.ca.gov/renewables/tracking_progress/.
[2] For example, if the average temperature is 10 degrees above 65 degrees for one day in a year, there are 10 cooling degree days for that year for that location.
[3] Energy Commission staff analysis using data from the Cal-Adapt Cooling Degree Days tool. Observed data for the city of Fresno (Incorporated and Census Designated Places, 2015). cal-adapt.org.

including Riverside and San Bernardino, expect to see 1,300 or more additional cooling degree days by midcentury (2035-2064) compared to 1961-1990 due to climate change (Figure 4). In San Bernardino, for example, the number and frequency of days hotter than 101.9 degrees Fahrenheit during midcentury (2035-2064) are expected to increase to 30, up from 4.3 during 1961-1990 (Figure 6). Several low-income census tracts in San Bernardino also score low on energy savings (Figure 7).

- In low-income areas of coastal Los Angeles and Orange Counties, 70 percent of the structures in many census tracts were built before 1979, indicating potential opportunities for energy savings from measures such as insulation. Much of this area scores low on energy savings (Figure 8), indicating a high-priority opportunity for further outreach and investment in energy efficiency. In the wake of the June 2013 shutdown of the San Onofre Nuclear Generating Station and the large methane leak in October 2015 at the Aliso Canyon natural gas storage facility, investment to expand energy savings in this area should be designed to help improve local energy reliability and offset the previous reliance on these resources. Also, many high-density low-income areas in Los Angeles County served by SCE score low on the amount of net-energy-metered rooftop solar per 1,000 people (Figure 11).
- San Diego, public charging stations along major transportation corridors present opportunities for expanding electric vehicle ownership and car-sharing options, especially for low-income areas near these corridors (Figure 13).
- In Northern California, some areas of Lassen, Del Norte, Humboldt, Lake, and Colusa Counties with low energy efficiency investments also have 70 percent or more of structures built before 1979. This may indicate opportunities for energy efficiency upgrades, such as insulation and dual- pane windows (Figure 10). Many census tracts in Northern California are included in the California Public Utilities Commission's (CPUC) 2018 map showing high fire threat areas indicating potential opportunities to coordinate fire preparedness and resilient distributed energy resources to provide energy to critical firefighting resources during planned or unplanned grid outages (Figure 19). Humboldt County also ranks high on emergency visits due to asthma per capita (Figure 16).
- California state government has met the 25 percent minimum goal for small business participation for the past three fiscal years (Figure 21). Additional data and effort are needed to accurately track what percentage of this funding has gone to small and microbusinesses in low-income areas and disadvantaged communities and to help these businesses compete successfully for state funding.
- The Energy Commission is working to expand access to funding for energy innovation demonstration projects in disadvantaged communities, including funding for innovative small businesses in these areas. As of December 31, 2017, $194 million was awarded for technology demonstration and deployment agreements. Of this amount, more than $61.7 million was allocated to project sites located in disadvantaged communities.

As next steps, the Energy Commission anticipates continuing to work closely with other public agencies and relevant stakeholder groups to add information on natural gas and fill key data

gaps identified during development of this initial draft energy equity indicators tracking progress report. Moving forward, Energy Commission staff plans to improve and update this report annually, in coordination with other supporting agencies. While this report illustrates the performance of unique energy equity indicators in specific regions of the state, the intent is to eventually develop and make public an interactive mapping tool that stakeholders will be able to use for their own analyses and visualization for each indicator.

Low-Income Clean Energy Access, Investment, and Resilience

In December 2016, the California Energy Commission adopted the *Low-Income Barriers Study, Part A: Overcoming Barriers to Energy Efficiency and Renewables for Low-income Customers and Small Business Contracting Opportunities in Disadvantaged Communities* (Barriers Study). The study, mandated by Senate Bill 350 (De León, Chapter 547, Statutes of 2015), included 12 recommendations (Table 1) to address barriers to clean energy investment in California's low-income and disadvantaged communities.

Table 1: Energy Commission Low-Income Barriers Study Recommendations and Associated Indicators

#	Recommendation	Indicator
1	Organizing a multiagency task force to facilitate coordination across state-administered programs	Health and safety issues abated
2	Enabling community solar offerings for low-income customers	Community energy resilience
3	Formulating a statewide clean energy labor and workforce development strategy.	Clean energy jobs
4	Developing new financing pilot programs to encourage investment for low-income customers.	Energy savings
5	Establishing common metrics and encouraging data sharing across agencies and programs.	All Indicators
6	Expanding funding for photovoltaic and solar thermal offerings for low-income customers.	Rooftop solar
7	Enhancing housing tax credits for projects to include energy upgrades during rehabilitation.	Amount invested
8	Establishing regional outreach and technical assistance one-stop shop pilots.	Number served
9	Investigating consumer protection issues for low-income customers and small businesses in disadvantaged communities.	Number served
10	Encouraging collaboration with community-based organizations in new and existing programs.	August electricity bill
11	Funding research and development to enable targeted benefits for low-income customers and disadvantaged communities.	Amount invested
12	Conducting a follow-up study for increasing contracting opportunities for small businesses located in disadvantaged communities.	Small businesses

Source: California Energy Commission

This Tracking Progress report was developed to advance implementation of Recommendation 5 summarized in the above table, which indicates the need for "collaboration among all program delivery agencies to establish common metrics and collect and use data systematically across programs to increase the performance of these programs in low-income and disadvantaged communities." Specific subrecommendations include directives to:

- Develop standardized energy equity indicators as metrics to ensure low-income customers are being served.
- Use these metrics to set a statewide baseline, advance energy savings, and track performance.
- Establish standardized metrics to track employment and job quality impacts of clean energy programs.

Building on the recommendations from the Barriers Study, Energy Commission staff identified a set of indicators to measure progress toward the following objectives for low-income residents and disadvantaged communities.

- **Access.** Advance access to clean energy, including actions to increase product selection options, access to high-quality jobs, expand small business contracting opportunities, and improve access to nondebt financing offerings.
- **Investment.** Increase clean energy investment in low-income and disadvantaged communities, including technology development and demonstration funding, infrastructure investments, emergency preparedness, technical assistance, and local capacity building. Capacity building includes workforce development, small business development, outreach, and education for clean energy.
- **Resilience.** Improve local energy-related resilience, defined as energy services to support the ability of local communities to recover from grid outages and enjoy affordable energy in a changing climate. Local energy resilience includes energy reliability, energy affordability, health, and safety.

Energy Commission staff has worked with other state agencies, stakeholders, and the U.S. Department of Energy's Clean Energy for Low-Income Communities Accelerator (CELICA) initiative to develop the indicators described in this report. Staff issued a draft framework and indicators report for public comment in May 2017. An update on development of draft indicators was presented at the August 2017 business meeting. Staff plans to publish an update of this Tracking Progress report for energy equity indicators in late 2018 and annually thereafter, improving the report over time as indicators are refined and additional data become available.

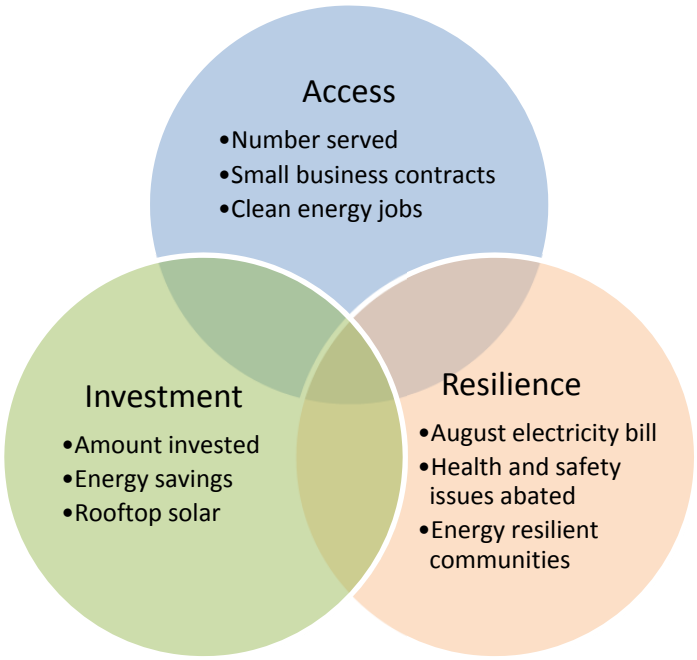
This report is organized around the following questions consumers may ask when considering whether and how to seek greater access, investment, and resilience through clean energy:

- Why is my electricity bill so high in the summer (August bill)?
- How can I lower my bill with the smallest investment (energy efficiency)?

- What else can I do to lower my bill (renewable energy)?
- How can I further reduce emissions (clean transportation)?
- How will climate change affect asthma and heat-related illness in California (health and safety)?
- What other energy-related steps can be taken to improve the resilience of my community and encourage local innovation (energy resilient communities)?

Figure 1 uses a Venn diagram to illustrate how the indicators map to each objective, recognizing some indicators help advance more than one objective. For example, energy savings result from investment and access to energy efficiency. Energy savings can also improve resilience if designed to help match energy demand with supply. This Venn diagram hints that there are likely to be other interactions and multiple benefits flowing from each indicator, with the aim of stimulating innovative program and technology design to support the three objectives described above.

Figure 1: California Energy Equity Objectives and Indicators



Source: Energy Commission staff

Another view of the objectives advanced by each indicator is shown in Table 2, which groups the indicators by energy resource starting with a consumer's bill moving out to public health, jobs, and innovation. Further information on clean energy transportation is under development through the California Air Resources Board's (CARB) SB 350 *Low-Income Barriers Study, Part B: Overcoming Barriers to Clean Transportation Access for Low-Income Residents Final*.[4]

[4] *Low-Income Barriers Study, Part B: Overcoming Barriers to Clean Transportation Access for Low-*

Table 2: Clean Energy Equity Indicators Relationships to Energy Equity Objectives

Indicator	Access	Investment	Resilience
August electricity bill			✓
Energy efficiency: savings, amount invested, number served	✓	✓	
Rooftop solar		✓	
Electric vehicles	✓	✓	✓
Health and safety issues abated	✓	✓	✓
Energy resilient communities	✓	✓	✓
Clean energy jobs	✓	✓	✓
Small business contracts	✓	✓	✓
Amount invested: Innovation	✓	✓	✓

Source: Energy Commission staff

Most indicators include a map to highlight geographic areas that warrant further consideration to improve clean energy access, investment, and/or resilience. Due to availability of data, some indicators are measured by census tract, some are measured by zip code, and others are measured by county. There are two main issues with determining low-income and disadvantaged communities by zip code: 1) there are multiple census tracts within a single zip code, and 2) a zip code boundary may transect a single or multiple census tracts. The census tract data are most appropriate for year-to-year comparison of changes to an indicator for each census tract. The county data may be evaluated this way but also lends itself to county-to-county comparisons to help target areas for focusing attention.

California Low-Income Areas

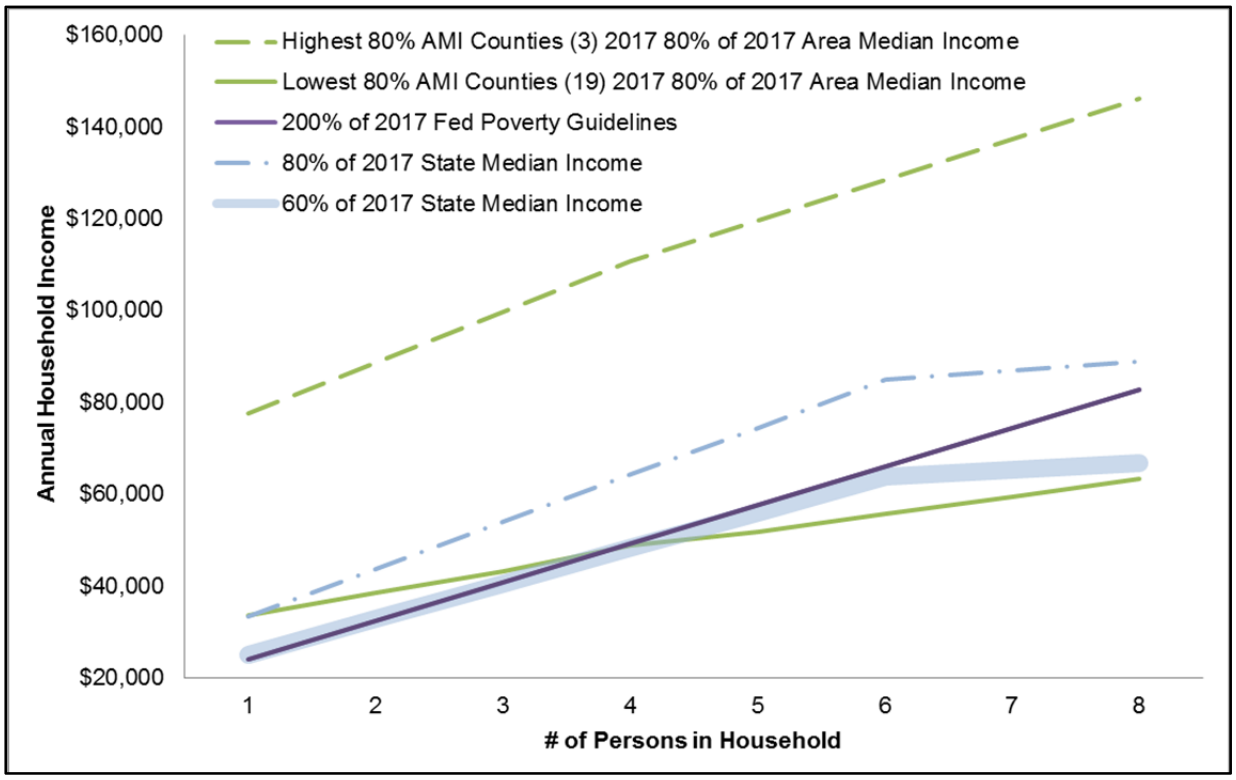
One of the key drivers of recommendations from the Energy Commission's Barriers Study is to align program eligibility requirements. Figure 2 provides examples of eligibility requirements as translated to income per household.[5] This figure shows information for 2017. Three counties reached the highest 80 percent Area Median Income threshold. These counties were in urban and/or suburban areas. Nineteen counties reached the lowest 80 percent Area Median Income threshold. These counties were primarily in rural areas.[6]

Income Residents Final Guidance Document. California Air Resources Board. February 2018. Accessible at: https://www.arb.ca.gov/msprog/transoptions/transoptions.htm.

[5] Additional information on income eligibility requirements for affordable housing is available online at http://www.hcd.ca.gov/grants-funding/income-limits/state-and-federal-income-limits.shtml.

[6] *Area Median Income* is determined by the U.S. Department of Housing and Urban Development (HUD) by county annually.

Figure 2: Comparison of Low-Income Eligibility Requirements for Energy Programs (2017)

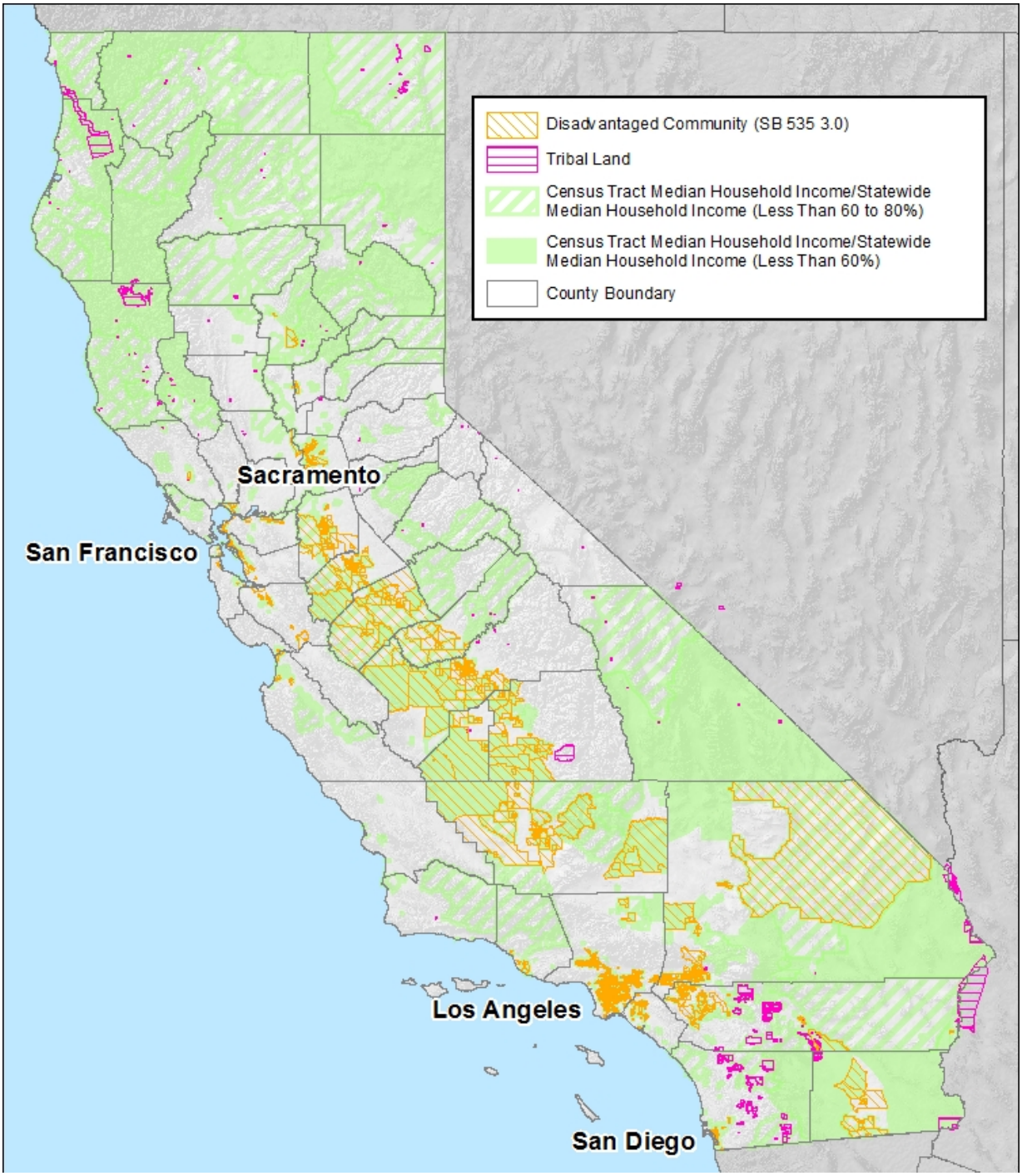


Source: Energy Commission staff.

Census tracts with median income at or below 60 percent of statewide median income are likely to include many households that meet the income eligibility requirements for clean energy programs serving low-income customers (Figure 3). For example, many of the census tracts that are eligible for funding for Senate Bill 535 disadvantaged communities[7] have a median household income that is 60 percent or less of the statewide median income. However, many rural census tracts with a median household income at this level or below do not meet the definition of disadvantaged communities, in many cases because they have good environmental quality. By highlighting opportunities to expand access to clean energy in areas at or below 60 percent of statewide median income, these indicators aim to simplify matchmaking between unmet low-income community needs and available program funding.

[7] *Disadvantaged communities* are defined as California census tracts facing the highest environmental burdens, as determined by economic, environmental, and socioeconomic factors including low income, high unemployment, poor health conditions, air and water pollution, and hazardous wastes. SB 535 (De León, Chapter 830, Statutes of 2012) directs the California Environmental Protection Agency (CalEPA) to identify disadvantaged communities for funding, and as of April 2017, CalEPA uses the top scoring 25 percent of communities using the CalEnviroScreen 3.0 tool to make this determination.

Figure 3: California Tribal Lands, SB 535 Disadvantaged Communities, and Low-Income Communities



Source: U.S. Census Bureau 2010 census tract boundaries; 2011-2015 American Community Survey (ACS) 5-year estimates; Bureau of Indian Affairs Pacific Regional Office 2017; CalEnviroScreen 3.0, 2017.

Table 3 illustrates the percentage of California low-income investor-owned utility customers that are renters and live in multifamily housing, as estimated by participants in the Energy Savings Assistance (ESA) and California Alternative Rate for Energy (CARE) programs for 2015. This table highlights the importance of state agencies designing clean energy programs that target renters, with particular focus on addressing the unique challenges associated with multifamily buildings. Both of these arrangements require careful consideration of benefits for building owners in addition to tenants. The numbers shown in this table may not represent the entire low-income and disadvantaged population of each utility, as Southern California Edison has separately reported that 40 percent of residential households are in disadvantaged communities and/or have subsidized electric rates.[8]

Table 3: California 2015 Investor-Owned Utility Low-Income Customer Statistics

	PG&E	SCE	SCG	SDG&E
Percent of ESA Low-Income Customers That Are Renters[1]	56%	45%	46%	70%
Percent of ESA Low-Income Customers in Multifamily Households[1]	22%	21%	22%	48%
Percent of Total Customers on CARE[2]	26%	30%	29%	20%
Number of Customers on CARE[2]	1.4 M	1.3 M	1.6 M	0.3 M
Total Annual CARE Subsidy Amounts	$558.6 M	$372.6 M	$102.3 M	$76.4 M
Average Annual CARE Subsidy per Customer[2]	$392	$291	$66	$282

[1]Numbers based on ESA Program participants, which may not represent the entire low income population of each IOU territory. The *ESA Program Multifamily Segment Study Report* (The Cadmus Group, Inc., 2013) contains additional information on low-income IOU customers in multifamily housing.
[2]CARE enrollment and total number of active accounts vary slightly from month-to-month. These numbers are based on the month of December.
Source: California Public Utilities Commission ESA/CARE information.

Challenges to increasing energy investment in low-income areas, especially in multifamily housing, include diverse building characteristics and needs, complex ownership and financial arrangements, and limited budgets with restricted opportunities to take on additional debt. As such, the Barriers Study recommended developing a comprehensive multifamily building distributed energy resource action plan to help identify detailed strategies to address these challenges. To inform this action plan and future updates to this Tracking Progress report, benchmarking data for the state's largest multifamily buildings will be considered once they are made publicly available as required by Assembly Bill 802 (Williams, Chapter 590, Statutes of 2015).

[8] Presentation by Adam Smith of Southern California Edison at Integrated Energy Policy Report workshop on August 29, 2017. Slide 10. Available at http://docketpublic.energy.ca.gov/PublicDocuments/17-IEPR-09/TN220908_20170825T132632_SCE_Climate_Resilience_and_Disadvantaged_Communities.pdf.

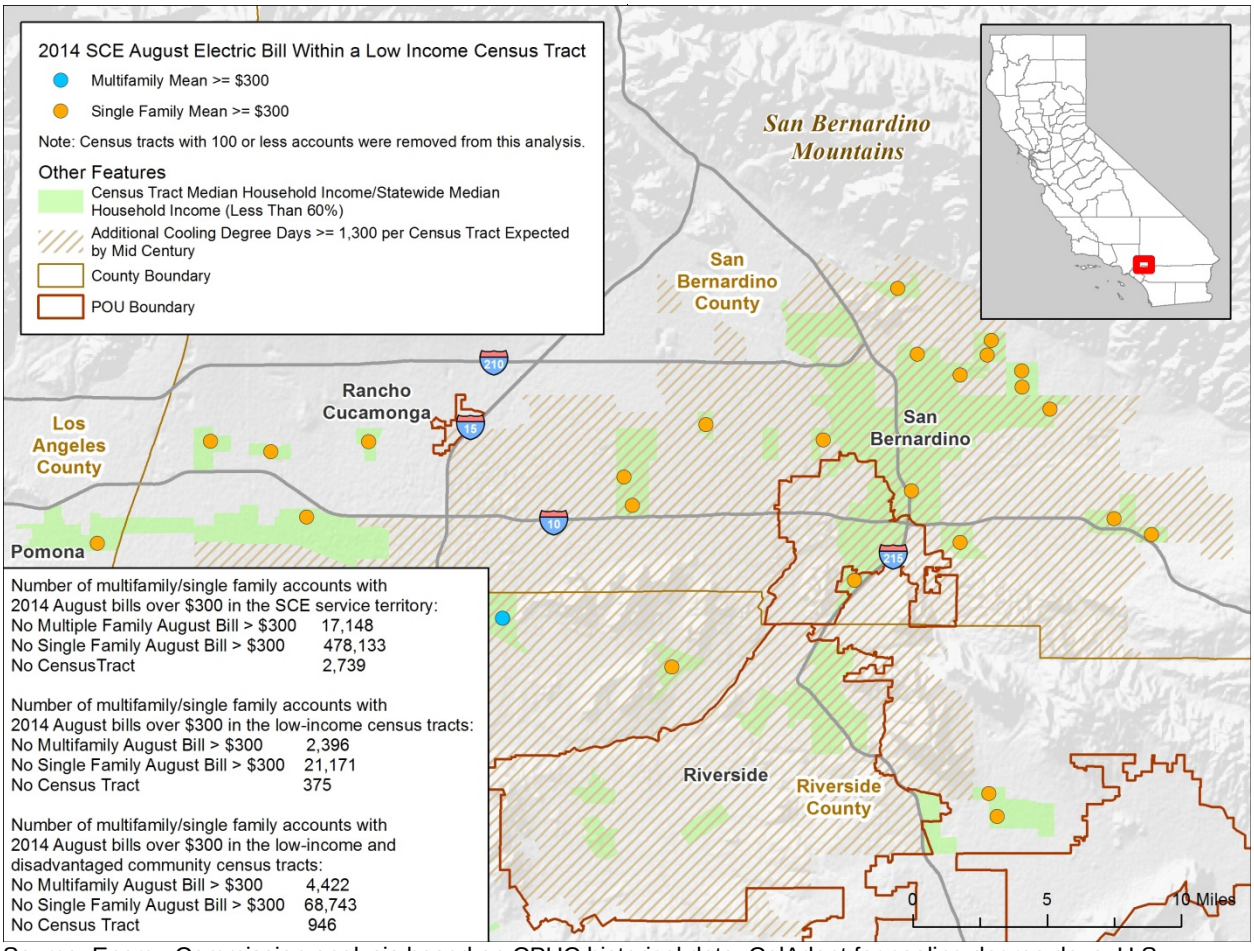
August Electricity Bill

In the Southern California Edison (SCE) service territory, many low-income census tracts with low energy savings from existing energy efficiency programs also have August electricity bills of $300 or more. Greater awareness and access to energy efficiency programs, as well as development of new energy efficiency pilots focusing on these low-income areas, can strengthen energy resilience by improving affordability and relieving energy burden.

Figure 4 shows low-income census tracts in the SCE service territory with the top 20 percent of accounts with August 2014 electricity bills averaging $300 or more. This information can be used to identify high-priority areas for energy efficiency upgrades to improve energy affordability for low-income customers. If a census tract has fewer than 100 accounts, it is not included in this analysis. This map also shows census tracts expected to have 1,300 or more additional cooling degree days per year on average during the 2035-2064 period compared to the 1961-1990 period.[9] For comparison, the average number of cooling degree days in San Bernardino from 1961-1990 was 1,360.[10] The number of cooling degree days indicates how often local temperatures reach above 65 degrees and by how many degrees that base temperature is exceeded. Billing data for the area served by the Riverside publicly owned electric utility (POU) are not included in Figure 4.

[9] Energy Commission staff analysis using data from the Cal-Adapt Cooling Degree Days tool. HadGEM2-ES (warm/Dry) climate model. RCP 8.5. cal-adapt.org.
[10] Energy Commission staff analysis using data from the Cal-Adapt Cooling Degree Days tool. Observed Data for the City of San Bernardino (Incorporated and Census Designated Places, 2015). cal-adapt.org.

Figure 4: Low-Income Areas With Highest August Electricity Bill (SCE, 2014)



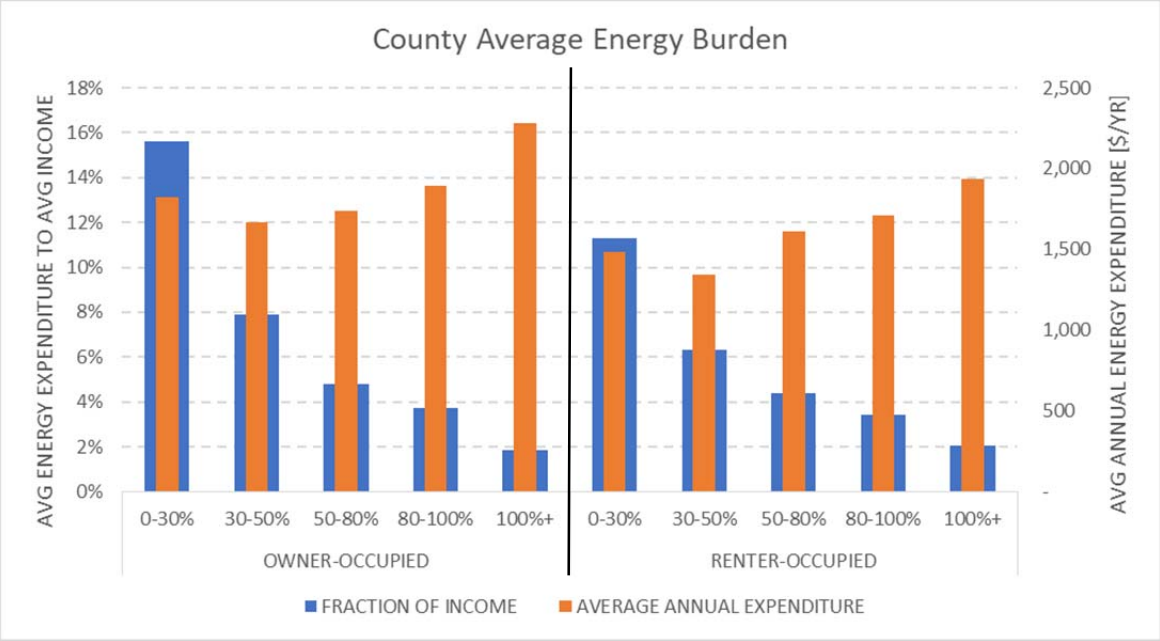
Source: Energy Commission analysis based on CPUC historical data, CalAdapt for cooling degree days; U.S. Census Bureau 2010 census tract boundaries; 2011-2015 ACS.

According to the Low-Income Needs Assessment[11] completed for the CPUC in December 2016, if home energy costs are 6 percent or more of household income, there is an energy burden. For the low-income areas shown in green on Figure 4, this burden would equate to a monthly energy bill higher than $180.[12] A threshold of $300, or a bill equal to almost 10 percent of monthly income for a family of two using the same definition, was selected to highlight those low-income areas in greatest need of energy efficiency to reduce summer electricity use, recognizing that monthly electricity bills vary substantially from month to month in Southern California. More than 23,567 households in low-income census tracts in the SCE service territory received an August electricity bill more than $300 in 2014, and the number of hot days is expected to increase due to climate change.

[11] *Needs Assessment for the Energy Savings Assistance and the California Alternate Rates for Energy Programs*, Final Report, Evergreen Economics, December 15, 2016.
[12] Census tracts with median income 60 percent or lower than the statewide median income, 2014 census estimate

For comparison, Figure 5 shows low-income areas of Riverside County (with 80 percent or less of area median income) pay between 4 percent and 15 percent (or so) of average income for energy (about $1,500-$1,800 per year on average).[13] These data for Riverside County include areas served by SCE and areas served by Riverside POU.

Figure 5: Low-Income Energy Affordability Data: Riverside County (2015)

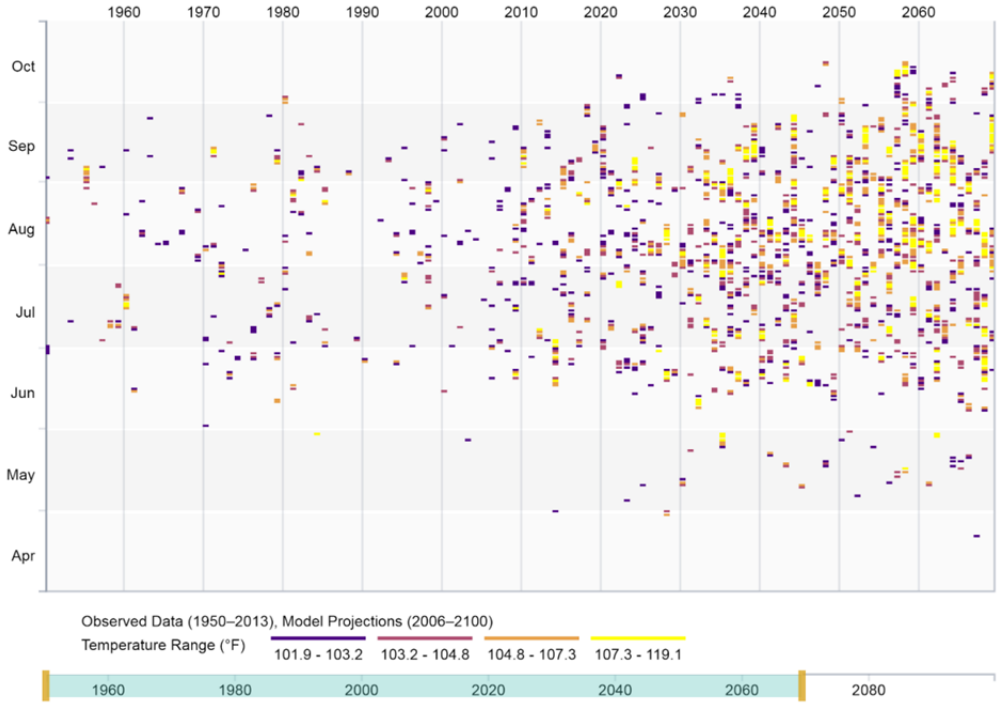


Source: U.S. Department of Energy, Clean Energy for Low Income Communities Accelerator.

As illustrated by Figure 6, the average number of days with a high above 101.9 degrees Fahrenheit in San Bernardino was 4.3 from 1961-1990. From 2035-2064, this number is expected to increase to 30.[14] This scenario suggests that some areas with high August electricity bills are expected have even larger bills as the number of extremely hot days increases over the next several decades and drives additional cooling demand.

[13] The orange bars represent the average energy expenditure in dollars per year by percentage of area median income. The blue bars represent the average percentage of customer income devoted to energy expenses for the same area median income segments.
[14] Cal-Adapt Extreme Heat tool. RCP 8.5. cal-adapt.org.

Figure 6: Trend in Frequency and Temperature of Extreme Heat Days in San Bernardino Through Midcentury From HadGEM2-ES (warm/dry) Climate Model



Source: Cal-Adapt Extreme Heat Tool. www.cal-adapt.org, RCP 8.5 Scenario. HadGEM2-ES (warm/dry) climate model.

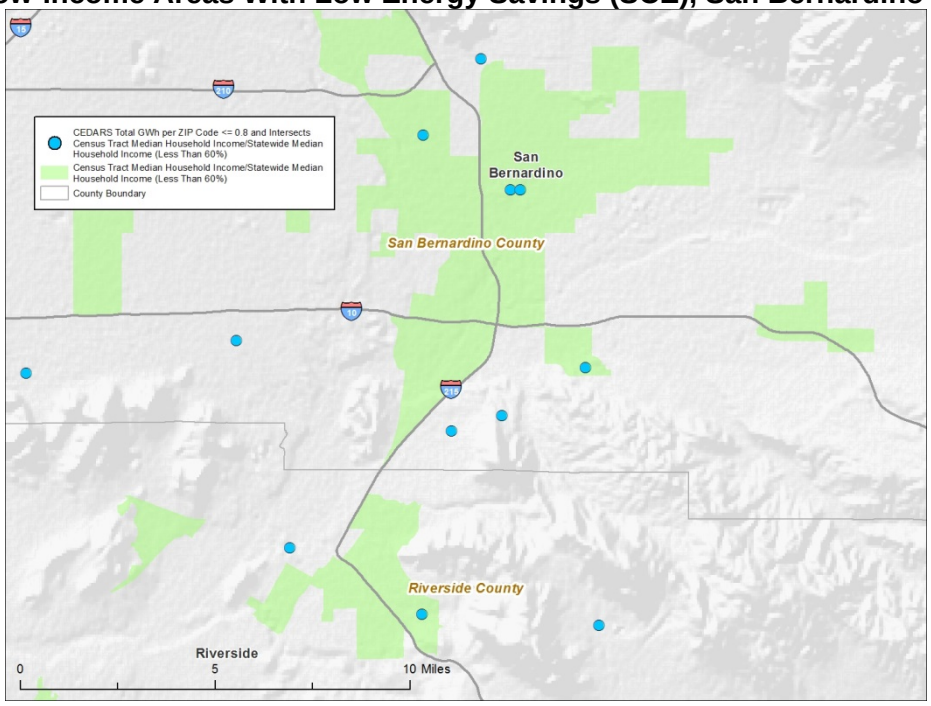
As additional data become available, it will be important to develop a similar indicator that tracks high heating bills for low-income customers in the coldest winter months. This could be an important indicator of energy burden, particularly for rural communities that use propane or other expensive fuels as a primary heating source.

Energy Efficiency: Savings

Improving energy efficiency in the SCE service territory is a high priority to help maintain energy reliability as work to permanently close the Aliso Canyon natural gas storage facility moves forward.[15] Figure 7 and Figure 8 show the low-income communities near San Bernardino and Long Beach with low energy savings in 2016, shown with the blue dots. Long Beach is in a mild costal climate zone, while San Bernardino is inland in a drier climate with higher temperatures, especially in summer. The energy savings achieved are typically higher in warmer climate zones than those achieved in milder climate zones, illustrated by the higher number of blue dots in Long Beach compared to San Bernardino. Identifying areas with low energy savings can indicate which areas may benefit from additional energy efficiency upgrade investments and improved program offerings. However, energy savings potential is higher for areas in warmer climate zones.

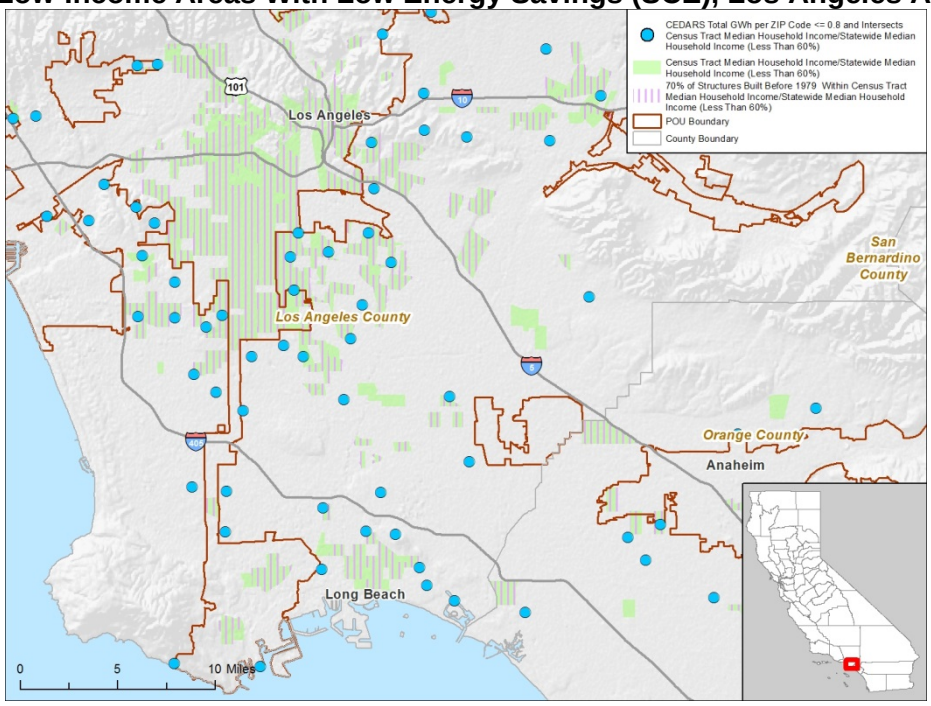
[15] For further information, please see the *2017 Integrated Energy Policy Report*, available online at http://www.energy.ca.gov/2017_energypolicy/.

Figure 7: Low-Income Areas With Low Energy Savings (SCE), San Bernardino (2014)



Sources: CPUC – California Energy Data and Reporting System (CEDARS), U.S. Census Bureau 2010 census tract boundaries; 2011-2015 ACS.

Figure 8: Low-Income Areas With Low Energy Savings (SCE), Los Angeles Area (2014)



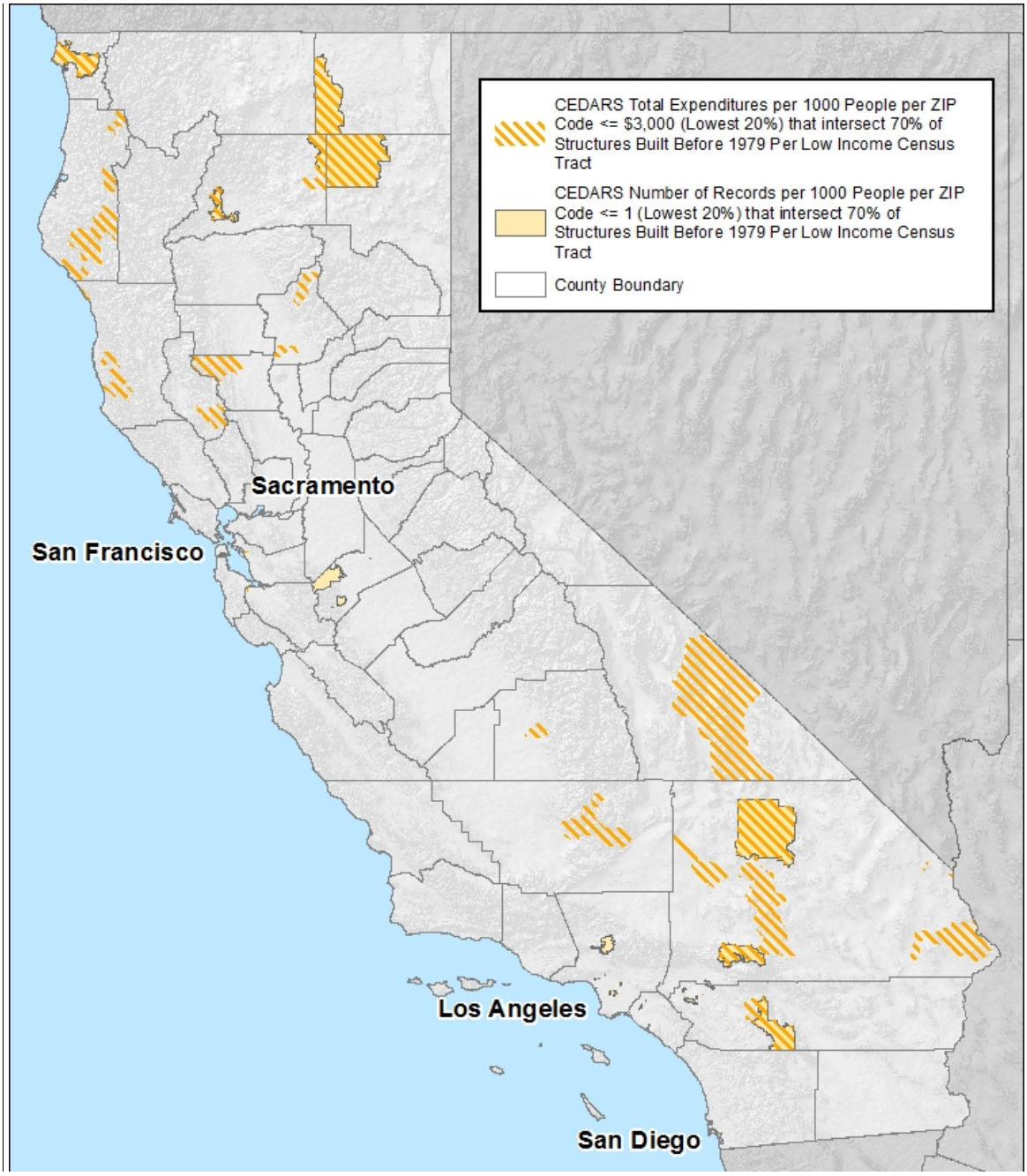
Sources: CPUC – CEDARS, U.S. Census Bureau, 2010; 2011-2015 ACS.

The Barriers Study included recommendations for a series of new energy upgrade financing pilots. The pilot programs would include the cost of health and safety measures required to accomplish energy efficiency upgrades. The energy savings indicator can be used to help track the effect of these programs to increase energy savings in low-income communities. Staff plans to add data for other areas of the state in future updates of this indicator. Moreover, staff plans to track trends in energy savings across low-income and disadvantaged communities annually.

Energy Efficiency: Amount Invested and Number Served

Figure 9 shows areas with low levels of investor-owned electric utility energy efficiency investments corresponding with low participation in the same programs. It also shows areas with more than 70 percent of structures built before 1979. As such, the locations noted on this map may be good candidates for energy efficiency upgrades. These locations may also highlight opportunities for launching additional regional service centers or one-stop shop pilots to improve market delivery and streamline services, potentially driving increased participation in energy efficiency programs and resultant efficiency savings. Note that publicly owned utility (POU) territories have been excluded from this analysis.

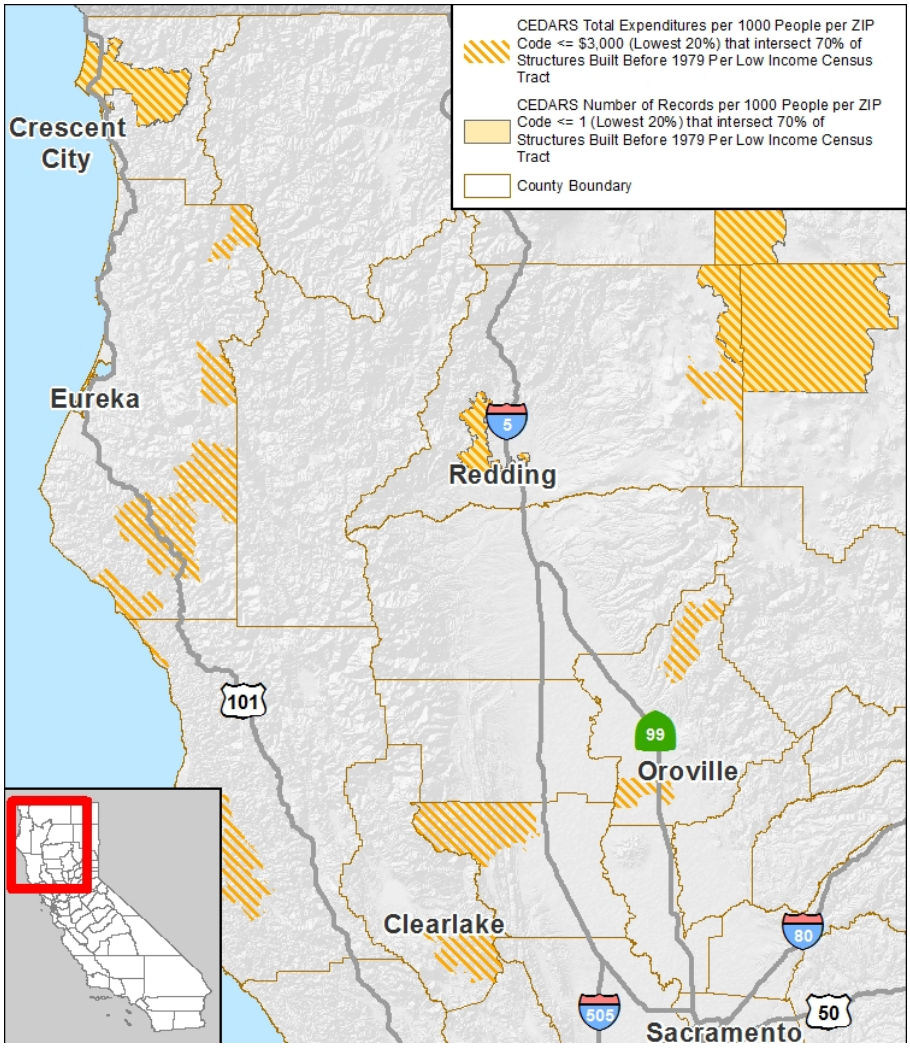
Figure 9: Areas With Lowest IOU Energy Efficiency Investments



Source: CPUC – California Energy Data and Reporting System (CEDARS), U.S. Census Bureau, 2010; ESRI zip codes – 2015 population estimate.

Figure 10 shows this same information as it looks in low-income census areas of Northern California. Particular emphasis for additional energy efficiency investment should be prioritized for the areas showing low investment overlapping with low participation and a high percentage of old structures.

Figure 10: Areas With Lowest IOU Energy Efficiency Investments in Northern California

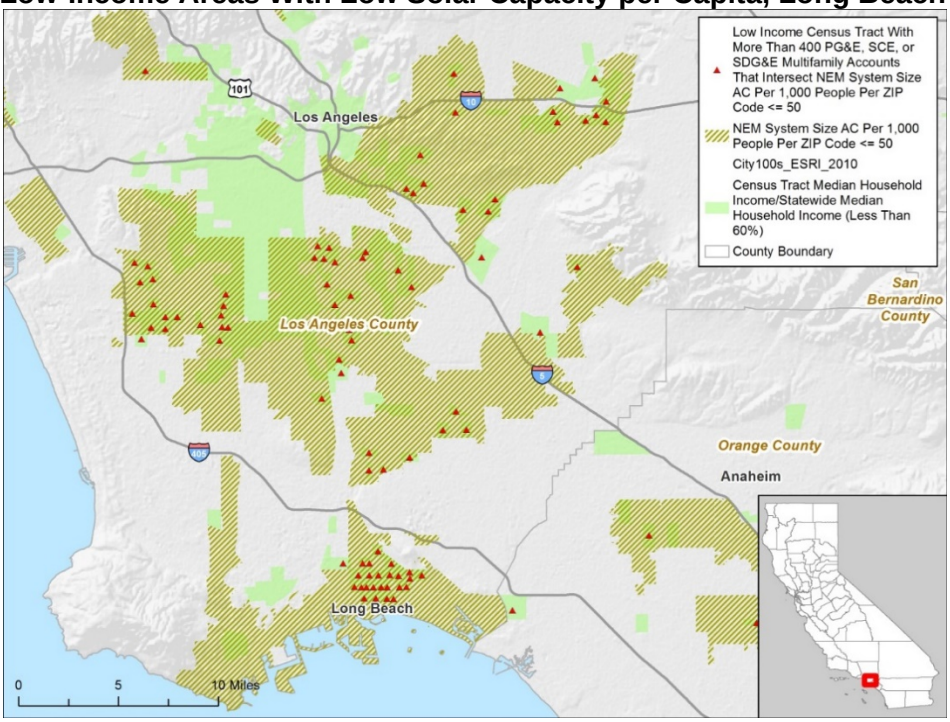


Source: CPUC – California Energy Data and Reporting System (CEDARS); U.S. Census Bureau, 2010; 2011-2015 ACS; ESRI zip codes.

Rooftop Solar

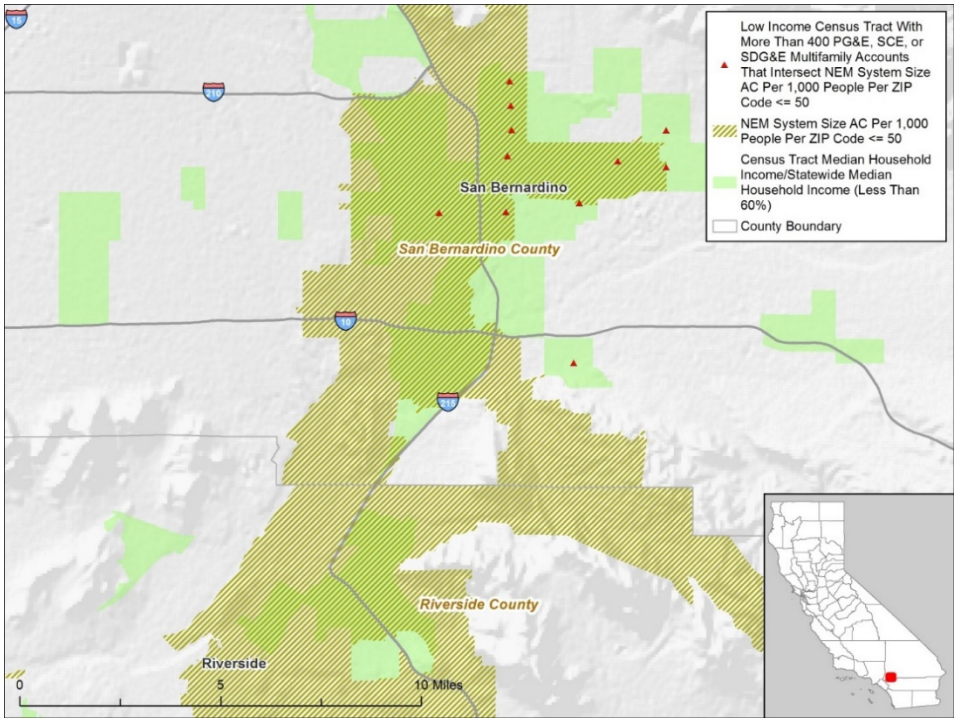
Figure 11 and Figure 12 show low-income census tracts with the lowest number of installed kilowatts of rooftop photovoltaic system capacity per thousand people in investor-owned utility territories. Publicly owned utility data are not displayed. These maps include net-energy-metering (NEM) rooftop solar capacity installed in the SCE service territory. This information can be used to identify high-priority areas for expansion of rooftop solar access and tracking of low-income customer adoption of rooftop solar. Increasing access to rooftop solar for low-income customers can reduce energy burden, especially in summer months, if energy use coincides with periods of sunshine or rooftop solar is combined with energy storage that can be discharged after the sun sets.

Figure 11: Low-Income Areas With Low Solar Capacity per Capita, Long Beach (2017)



Source: California Distributed Generation Statistics; U.S. Census Bureau, Esri zip codes.

Figure 12: Low-Income Areas With Low Solar Capacity per Capita, San Bernardino (2017)

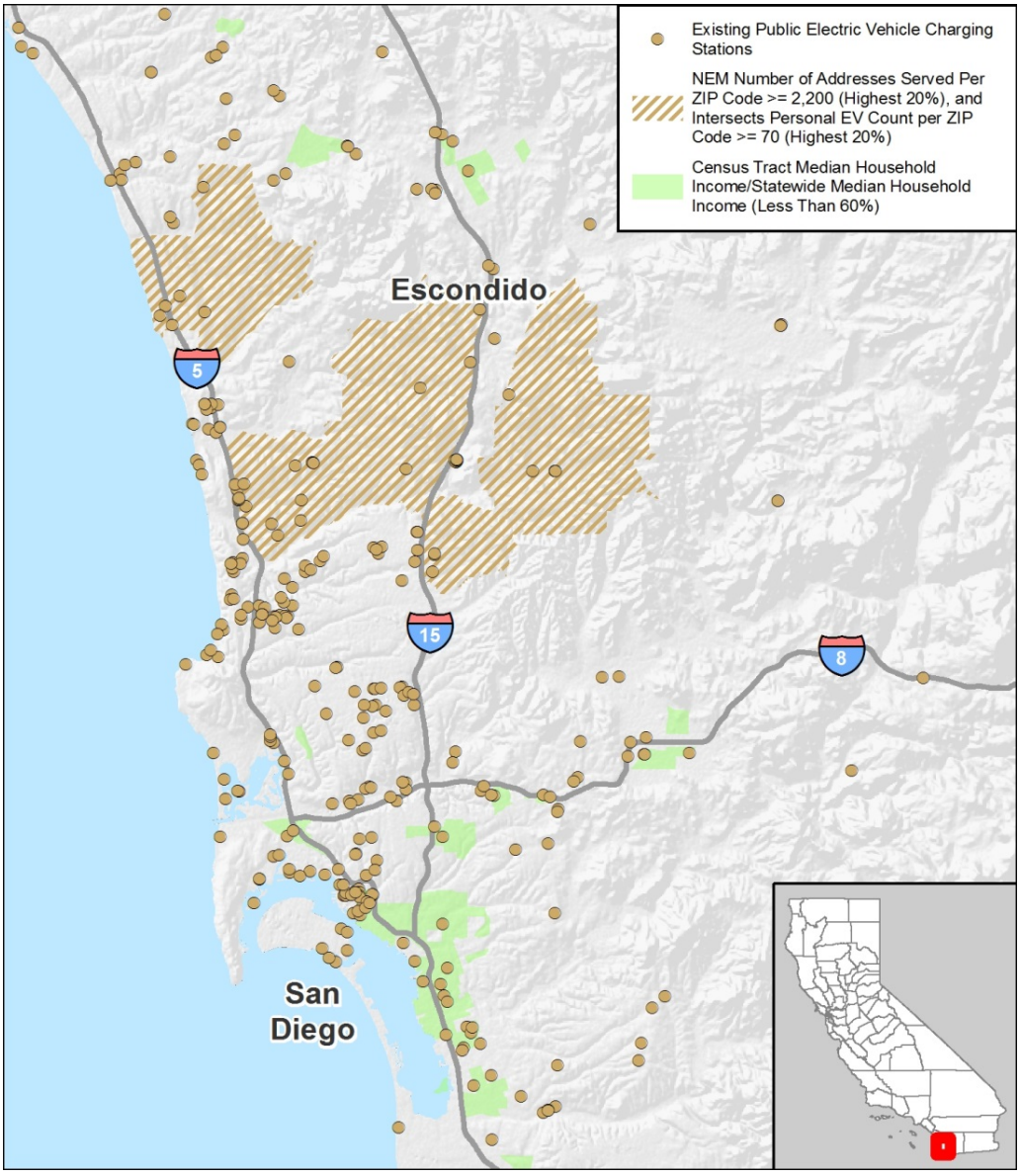


Source: California Distributed Generation Statistics; U.S. Census Bureau; Esri zip codes.

Electric Vehicles

Public charging stations in San Diego are available along major transportation corridors, providing important infrastructure to encourage growth of electric vehicle (EV) transportation ownership and car-sharing options across highly populated areas of the region, including low-income areas along these corridors (Figure 13). Expansion of transportation electrification may provide significant non-energy benefits for disadvantaged communities located near these corridors due to a reduction in associated localized air pollutants.

Figure 13: Opportunities Related to Electric Vehicles in San Diego



Sources: Energy Commission Staff Analysis; Department of Motor Vehicles; California Distributed Generation Statistics; U.S. Census Bureau; Esri zip codes.

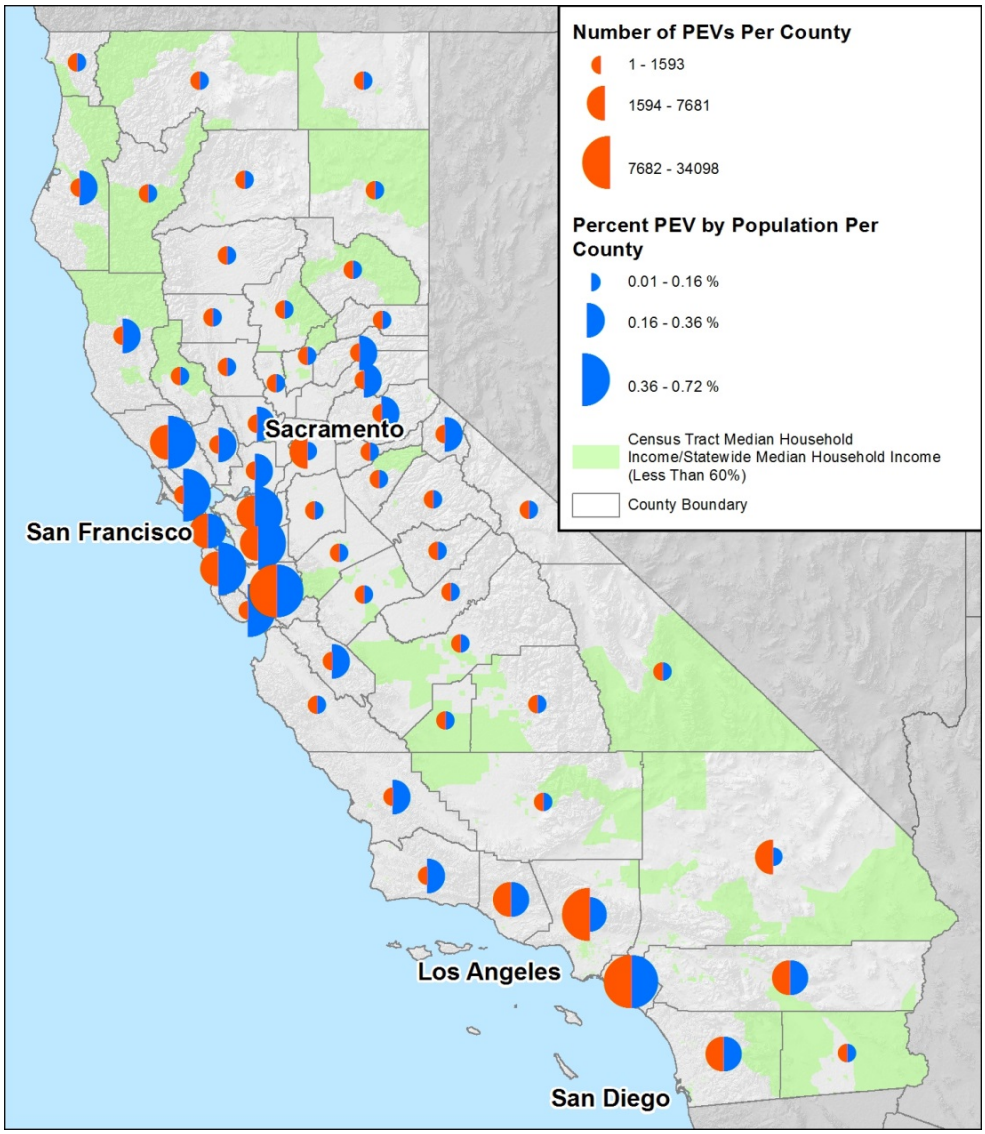
One example of a program that could be ripe for potential additional investment is the Center for Sustainable Energy's Public Fleet Pilot Project. This program offers electric vehicle rebates to public entities in disadvantaged communities. The maximum rebate amount is $15,000 for fuel-cell EVs, $10,000 for battery or range-extended EVs, and $5,250 for plug-in hybrid EVs. Since the program began, $4,387,279 in rebates has been issued.[16]

Areas of high EV counts per zip code coincide with areas of high NEM participation in San Diego, indicating rooftop generation during the day may be pulled from the grid at night to charge EVs. This suggests a potential opportunity for investment in distributed energy storage as rate structures move to reward midday energy use when rooftop solar generation is plentiful. For further discussion of the benefits of energy storage, refer to the Energy-Resilient Communities section.

Figure 14 shows the number of plug-in EV sales in 2016 aggregated at the county level, including both total number of sales with the orange-shaded semicircles and levelized by population with the blue semicircles. The semicircles are placed in the center of each county but represent data for the whole county. The number and percentage of EV ownership are lower in the Central Valley than in other parts of the state, suggesting an opportunity for programs to focus on this region to provide greater access to EVs, and supporting charging infrastructure, through ownership or car-sharing incentives.

[16] For additional information, visit https://cleanvehiclerebate.org/eng/pfp.

Figure 14: Number of Cumulative Plug-In Electric Vehicle Sales as of 2016 by County



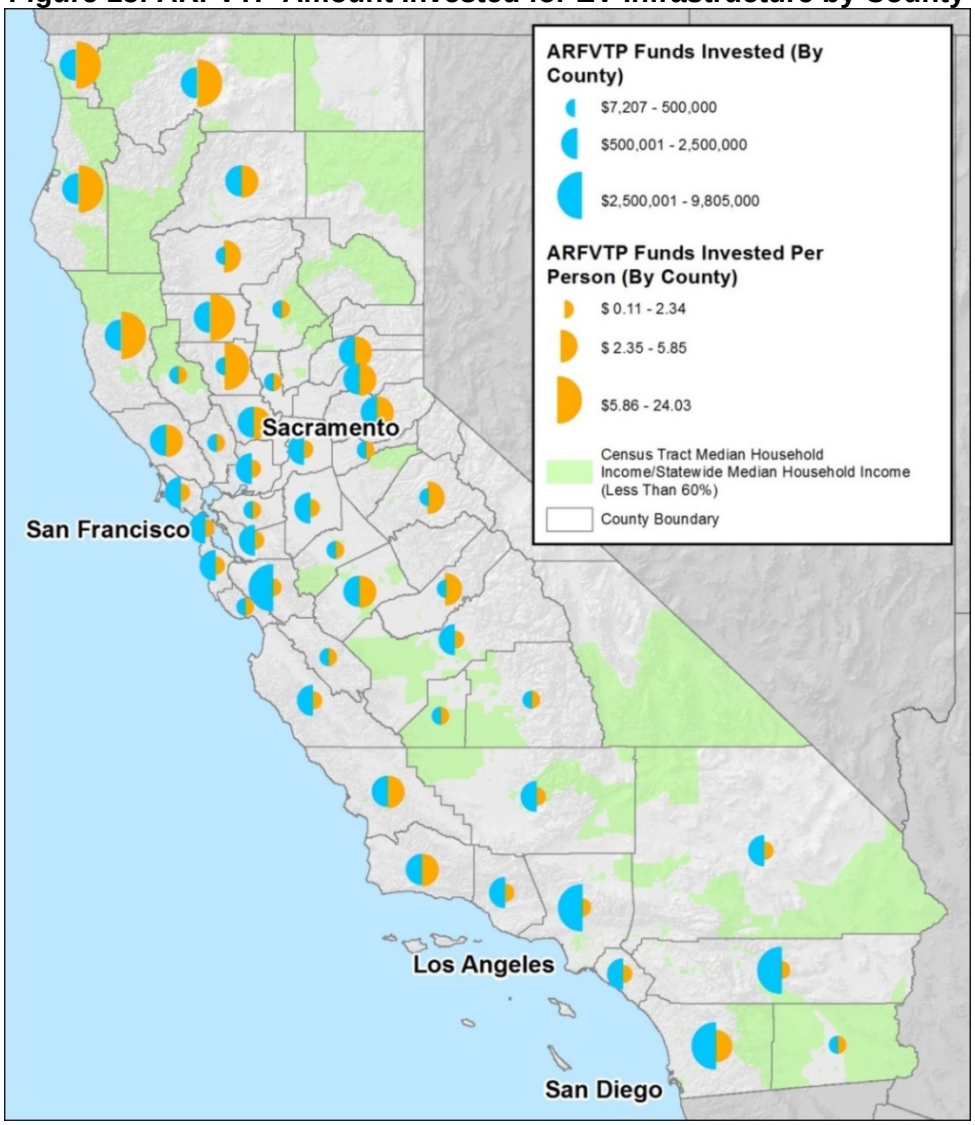
Source: Department of Motor Vehicles; U.S. Census Bureau. Semicircles are placed in the center of each county but represent data for the whole county.

Figure 15 shows the amount invested through the Alternative and Renewable Fuel and Vehicle Technology Program (ARFVTP). This competitive grant program provides as much as $100 million each year for clean transportation projects. Through 2017, the program has invested more than $600 million for more than 540 clean transportation projects. In January 2018, Governor Edmund G. Brown Jr. announced a new target of 5 million zero-emission vehicles (ZEVs) in California by 2030 and proposed a new ZEV initiative to provide a total of $2.5 billion over eight years.[17]

[17] See http://www.ebudget.ca.gov/2018-19/pdf/BudgetSummary/ClimateChange.pdf and

California seeks to expand access to clean transportation. For example, the Energy Commission has established the California Electric Vehicle Infrastructure Project (CALeVIP) to help target specific gaps in the availability of electric vehicle charging infrastructure. The first round of available funding is anticipated to provide $4 million to support the installation of Level 2 charging stations at businesses and multiunit dwellings throughout Fresno County. The first CALeVIP project in Fresno was launched in December 2017.

Figure 15: ARFVTP Amount Invested for EV Infrastructure by County



Source: California Energy Commission; U.S. Census Bureau. Semicircles are placed in the center of each county but represent data for the whole county.

https://www.gov.ca.gov/2018/01/26/governor-brown-takes-action-to-increase-zero-emission-vehicles-fund-new-climate-investments/.

Health and Safety Issues Abated

The Barriers Study recommended steps to heighten coordination among energy, housing, and other programs to address health and safety issues facing California's low-income and disadvantaged communities. Two initial health and safety indicators were selected for this initial Tracking Progress report to help identify high-priority locations for energy-related actions to improve local resilience: asthma and heat-related illness.

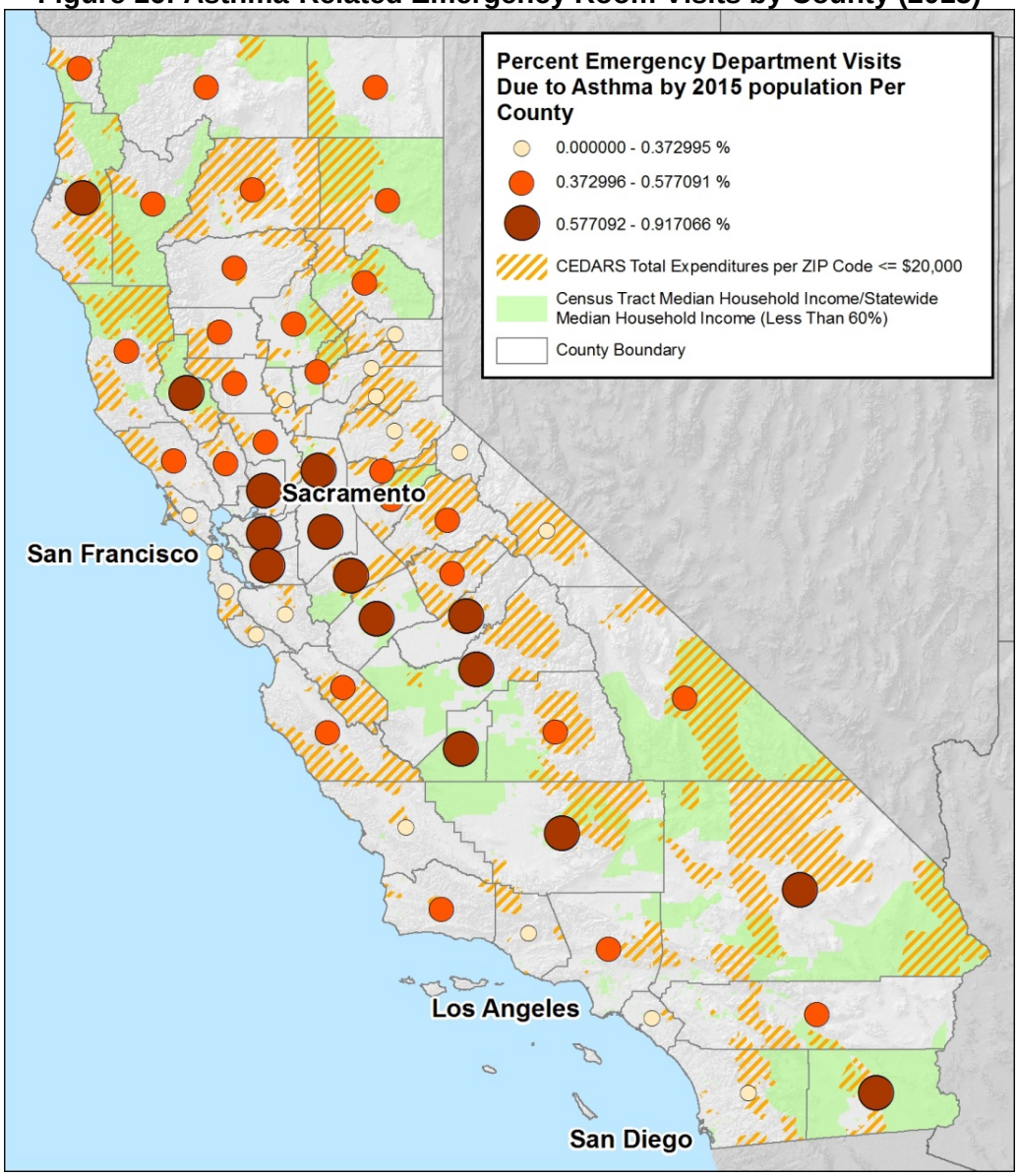
Based on a 2016 study by Drehobl and Ross, the Barriers Study reported that high energy bills relative to income may drive low-income households to make do with insufficient heating or cooling, which can increase the incidence of asthma, especially in children.[18] Figure 16 shows counties in California with a high number of emergency room visits for asthma in 2015, shown as large red circles. This map also shows the counties with the lowest investment from investor-owned electric utility energy efficiency programs, as represented by the orange dashed areas.

Areas with poor air quality, such as the San Joaquin Air Basin in Central California, experience high incidents of asthma-related emergency room visits. Many of these areas also serve as major traffic corridors for passenger vehicles and freight and face geographic conditions that aggravate poor air quality. A 2015 study supported by CARB reports asthma-related hospital visits are elevated in populations living near areas with high traffic-related air pollution.[19] This information is useful for targeting areas to implement clean vehicle and sustainable freight programs, as well as energy efficiency upgrades.

[18] Scavo, Jordan, Suzanne Korosec, Esteban Guerrero, Bill Pennington, and Pamela Doughman. 2016. *Low-Income Barriers Study, Part A: Overcoming Barriers to Energy Efficiency and Renewables for Low-Income Customers and Small Business Contracting Opportunities in Disadvantaged Communities.* California Energy Commission. Publication Number: CEC-300-2016-009-CMF, page 13. This statement is based on information provided in Drehobl, Ariel and Lauren Ross. 2016. *Lifting the High Energy Burden in America's Largest Cities: How Energy Efficiency Can Improve Low Income and Underserved Communities.*

[19] Delfino, Ralph J., M.D., Ph.D., and Michael J. Kleeman, Ph.D., University of California, Irvine, University of California, Davis. April 7, 2015. *Risk of Pediatric Asthma Morbidity From Multipollutant Exposures*. Contract No. 10-319. California Air Resources Board. Final Report. https://www.arb.ca.gov/research/apr/past/10-319.pdf.

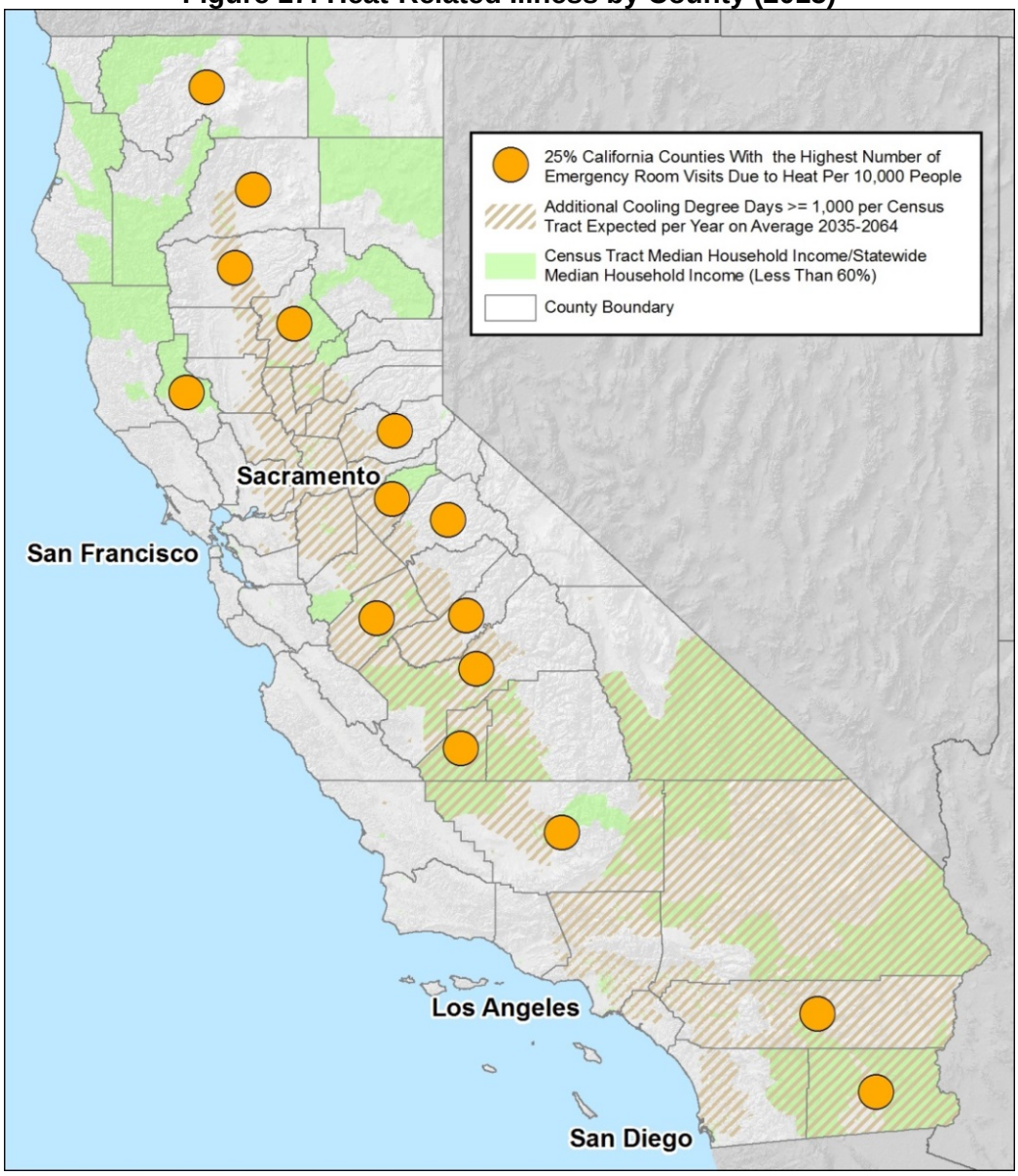
Figure 16: Asthma-Related Emergency Room Visits by County (2015)



Source: California Environmental Health Tracking Program; CPUC – California Energy Data and Reporting System (CEDARS), U.S. Census Bureau; Esri zip codes. Circles are placed in the center of each county but represent data for the whole county.

Figure 17 shows potential opportunities in the Central Valley and Southern California deserts for energy efficiency investments to help alleviate heat-related illness and improve the efficiency of space cooling. It also shows areas expected to see more than 1,000 additional cooling degree days (average daily temperature minus 65 degrees) per year on average by midcentury (2035-2064) compared to 1961-1990 due to climate change.

Figure 17: Heat-Related Illness by County (2015)



Sources: California Environmental Health Tracking Program; CalAdapt; U.S. Census Bureau; Circles are placed in the center of each county but represent data for the whole county.

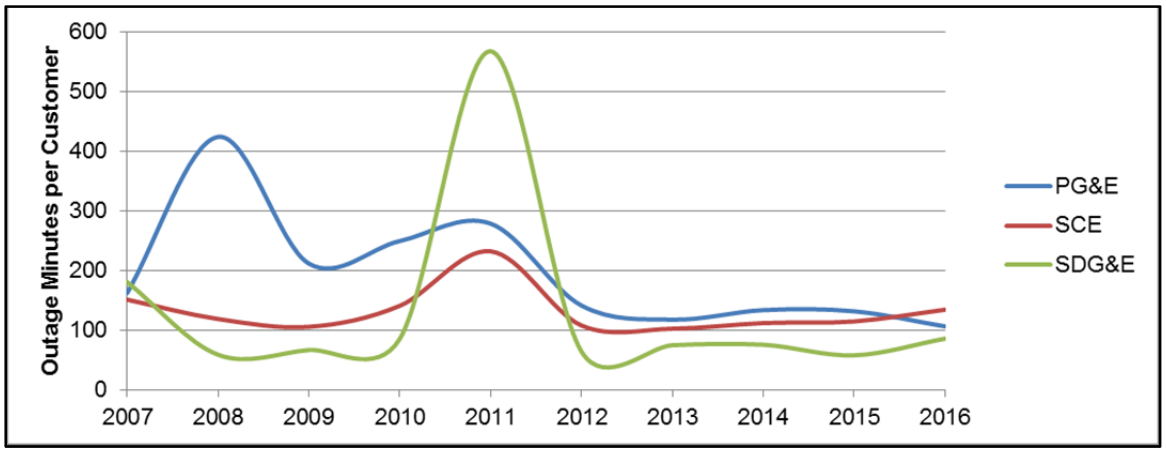
In addition to energy savings, energy efficiency can provide improved indoor comfort, increased property value, and reduced illness. The Barriers Study recommended greater coordination among state agencies to incorporate non-energy benefits into energy efficiency program offerings. For example, a 2017 CPUC study on utility disconnections included maps showing non-CARE disconnections in 2016 by zip code for SCE, Pacific Gas and Electric Company (PG&E), San Diego Gas & Electric Company (SDG&E) and Southern California Gas Company

(SoCalGas).[20] Many of the zip codes with the highest number of disconnections are in counties with high levels of heat-related illness in 2015, indicating an opportunity for targeted efforts to ensure disconnections are minimized during periods of extreme heat.

Energy-Resilient Communities

In 2008, PG&E service was affected by strong storms. In 2011, SCE and PG&E system outages were affected by storms and SDG&E service was affected by the Pacific Southwest Electrical Outage (Figure 18). Electrical grid reliability and outages can have a significant impact on the health and safety of customers, especially in regions affected by extreme heat and in need of cooling. More granular information is needed in updates to this report on the local reliability as it relates to low-income and disadvantaged communities specifically.

Figure 18: System Average Interruption Duration Index for California Investor-Owned Electric Utilities Including Major Event Days (2007-2016)



Source: California Public Utilities Commission, *Annual Electric Reliability Report*, cpuc.ca.gov/2016_aers.

One impact of climate change is increased frequency and intensity of wildfires and severe weather. Steps to strengthen the energy resilience of communities and supporting energy infrastructure, especially in low-income areas, are highlighted in the *Safeguarding California Plan* report,[21] as well as the *2017 Integrated Energy Policy Report (IEPR)*[22] and other California climate adaptation reports.[23] In addition, the CPUC has set new fire-safety standards, including

[20] White, Richard. December 28, 2017. *A Review of Residential Customer Disconnection Influences and Trends.* California Public Utilities Commission, Policy and Planning Division. See http://www.cpuc.ca.gov.
[21] http://resources.ca.gov/wp-content/uploads/2018/01/CNRA-releases-2018-upate-to-Safeguarding-Report.pdf.
[22] http://www.energy.ca.gov/2017_energypolicy/.
[23] http://opr.ca.gov/clearinghouse/adaptation/. See also, http://www.opc.ca.gov/webmaster/ftp/pdf/docs/rising-seas-in-california-an-update-on-sea-level-rise-science.pdf.

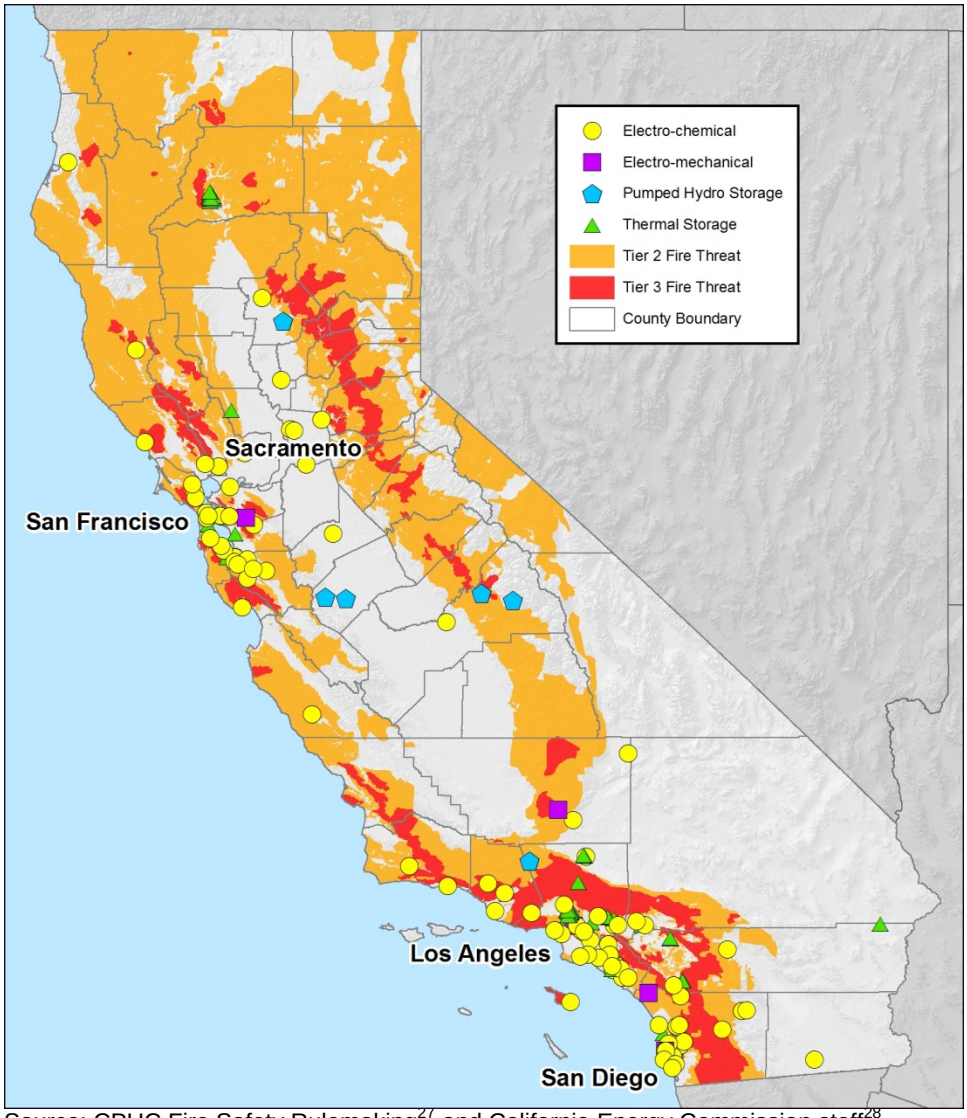
de-energizing of transmission and distribution lines under specified conditions to reduce the risk of fire. The CPUC anticipates holding discussions of preferred options, potentially including energy storage, to balance access to energy for water pumping, telecommunications, and other critical infrastructure with the need to reduce the risk of fire.

Figure 19 illustrates current high-fire-risk areas and deployed energy storage installations across the state. More than 25 percent of SCE's service territory is within CPUC Tier 2 and 3 boundaries, including mountainous areas in and around the Los Angeles metropolitan area. As noted at the CPUC Wildfire en banc panel on January 31, 2018,[24] strategic deployment of energy storage may provide critical services such as water pumping and telecommunications to firefighters and other emergency responders in the event of planned or unplanned grid outages because of extreme events. Beyond forest fires, this approach may be relevant for other disasters such as extreme weather events, flooding, or earthquakes.

The California Infrastructure and Economic Development Bank (IBank) offers low-cost financing to state and local governments for projects that reduce greenhouse gas emissions (including energy efficiency, demand response, renewable energy, and electric vehicle investments) through the California Lending for Energy and Environmental Needs Center.[25] IBank also has the potential to improve climate resilience by helping mobilize private sector investment for innovative clean energy infrastructure development, including energy storage and electric vehicle charging to support grid reliability and resiliency needs.[26]

[24] For more information, see http://www.cpuc.ca.gov/2018FireEnBanc/.
[25] http://www.ibank.ca.gov/ibank/Programs/California-Lending-for-Energy-and-Environmental-Needs-CLEEN-Center.
[26] See http://www.ebudget.ca.gov/2018-19/pdf/BudgetSummary/ClimateChange.pdf.

Figure 19: Opportunities to Improve Community Resilience: Designing Energy Storage to Maintain Critical Services and Reduce Fire Risk



Source: CPUC Fire Safety Rulemaking[27] and California Energy Commission staff[28]

Clean Energy Jobs

Figure 20 shows statewide clean energy jobs in California by county for 2015. The data in this figure are from the Advanced Energy Employment survey, which defines clean energy jobs by North American Industry Classification System (NAICS) codes, consistent with the U.S.

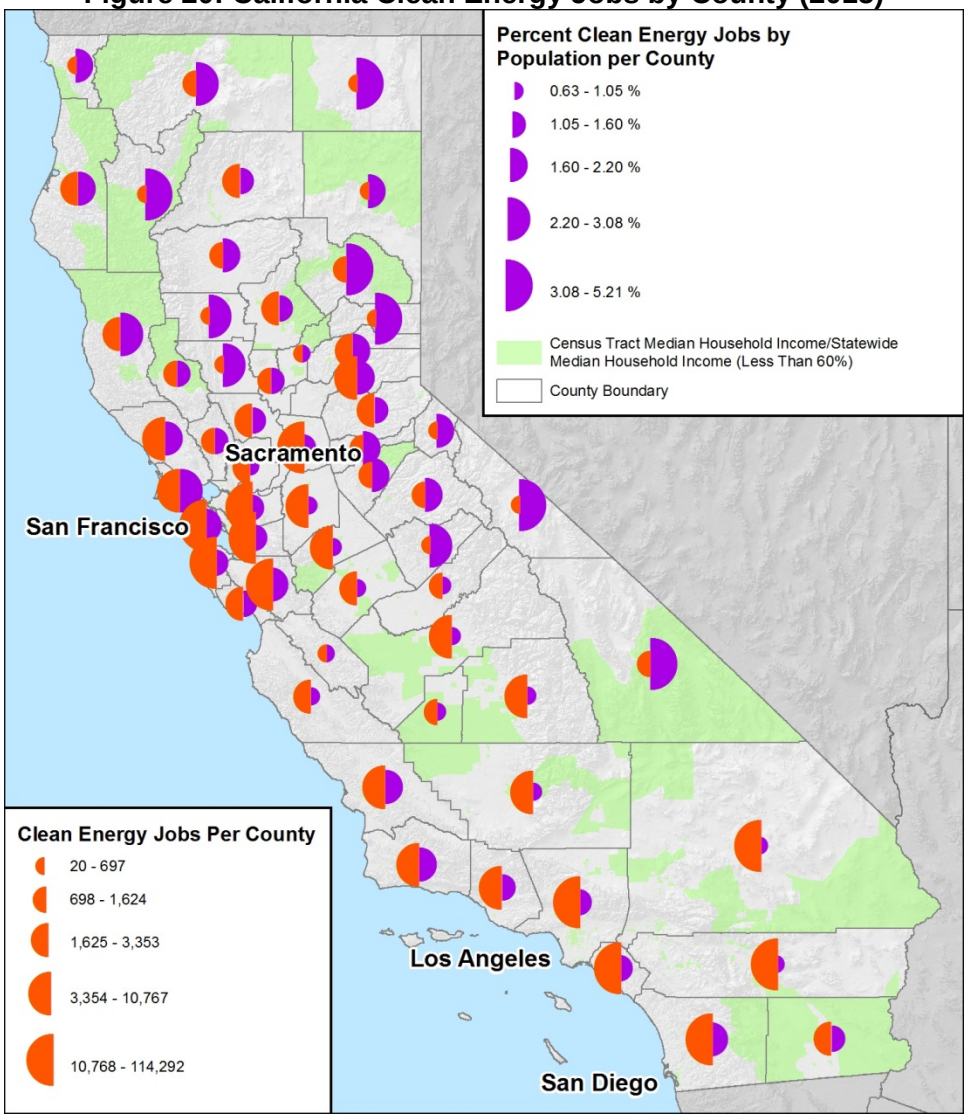
[27] http://cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/Safety/IRT-Approved%20Shape%20B%20Map%2011-17-2017.pdf.
[28] http://energy.ca.gov/renewables/tracking_progress/documents/energy_storage.pdf.

Department of Energy's U.S. Energy and Employment Reports.[29] Counties with a large number of clean energy jobs include Fresno and Tulare Counties. These two areas show that although there are many clean energy jobs available compared to surrounding counties, they have a low number of jobs when comparing it to its respective population. This finding suggests a need for local hiring, job creating, clean energy investment, and workforce development efforts consistent with local priorities.

San Bernardino, Riverside, Sacramento, the San Francisco Bay Area, the Greater Los Angeles Area, and the San Joaquin Valley also have a large number of clean energy jobs. However, while the San Joaquin Valley scores well in terms of clean energy jobs, in 2015 it did not keep pace with other areas. As this is an area with many low-income and disadvantaged communities, this conclusion indicates an opportunity to invest in the local workforce through educational institutions and additional clean energy job opportunities.

[29] The U.S. Department of Energy *2017 U.S. Energy and Employment Report* is available online at https://energy.gov/downloads/2017-us-energy-and-employment-report.

Figure 20: California Clean Energy Jobs by County (2015)



Sources: Advanced Energy Economy Institute; U.S. Census Bureau. Semicircles are placed in the center of each county but represent data for the whole county.

Missing from this workforce indicator is information on job quality (wages and working conditions), workforce development, and whether people living in low-income and disadvantaged communities are getting jobs in clean energy. Also, this indicator does not include information on apprenticeship and preapprenticeship opportunities, as well as the number, trend, and location of community workforce agreements. If this information becomes available, it may help identify adjustments needed to job training services and energy-related investment to match workforce and small business development with anticipated job availability.

California's largest investor-owned utilities administer extensive workforce, education, and training programs. Information from these and similar programs will be useful in identifying

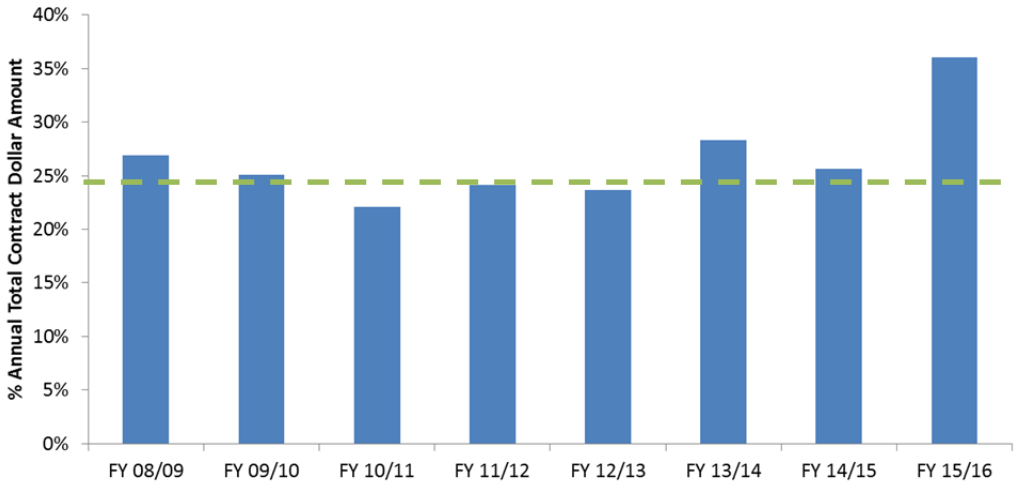
potential improvements to strengthen workforce development opportunities for small businesses and employees in low-income and disadvantaged communities.

The Barriers Study recommended that state agencies collaboratively develop a comprehensive clean energy workforce development strategy. As this recommendation is implemented, tracking metrics will be refined, and additional data will likely become available to monitor more fully the status of clean energy jobs in California.

Small Business Contracts

Small businesses in California can receive a certification through the Department of General Services (DGS) to qualify for California's Small Business Participation Program. This program has a goal that at least 25 percent of California state government contract dollars go to small businesses annually. As part of this program, small businesses are eligible for a 5 percent bid preference on applicable California state government solicitations. California state government has met the 25 percent minimum goal for small business participation for the past three fiscal years (Figure 21).

Figure 21: Percentage of California State Government Contract Dollars Awarded to Small Businesses and Microbusinesses: Annual Results (Fiscal Year 2009-2015)



Source: Department of General Services[30]

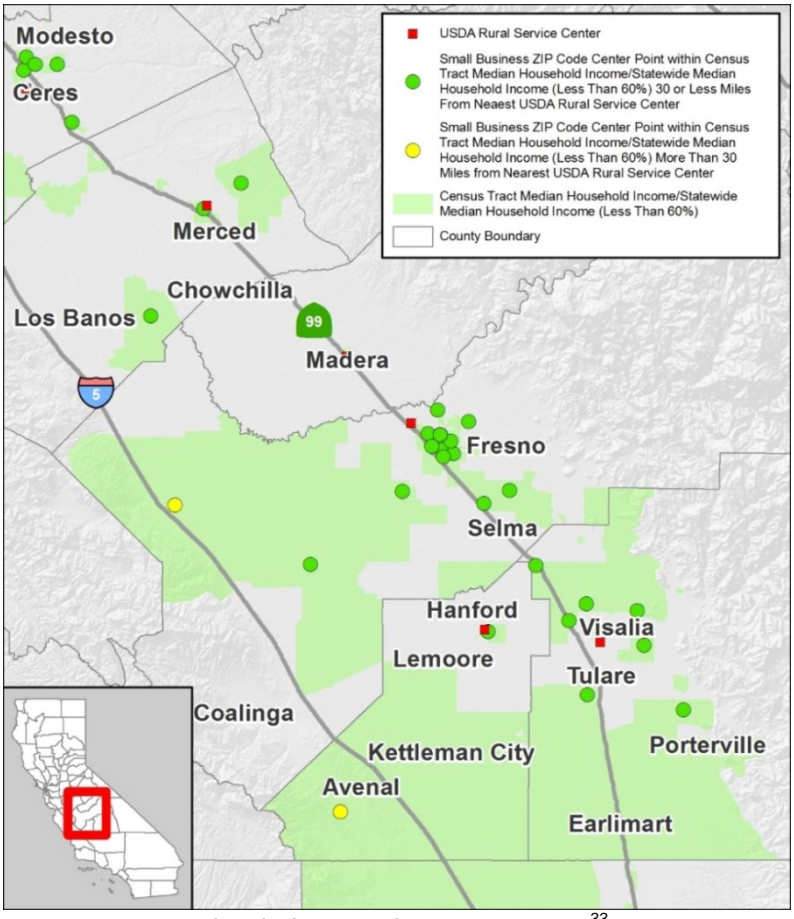
To help increase participation of small businesses in state government contracts, the CaleProcure[31] website offers information and technical assistance with certification, registration, and navigation of the online marketplace. In addition, DGS conducts numerous workshops each year to raise awareness and improve understanding of how to participate in state government

[30] http://www.dgs.ca.gov/pd/Programs/OSDS/ContractReporting.aspx
[31] https://caleprocure.ca.gov/pages/index.aspx

contracting procedures. As part of its supplier diversity program, the CPUC hosts two small business expos each year. In 2016, the expos were held in Pasadena and Fresno. Hundreds of diverse/small business owners took advantage of the opportunity at each expo to meet with buyers from the utilities.[32]

Figure 22 shows low-income zip codes containing clean energy small and microbusinesses in Fresno and surrounding areas. This map indicates locations that may benefit from additional assistance through existing service centers and locations where new pathways for assistance may be needed. One of the recommendations of the Barriers Study called for further study to determine actions for increasing contracting opportunities for small businesses in low-income and disadvantaged communities. Results of that study will inform development of small business energy equity indicators.

Figure 22: California Small and Microbusinesses in Low-Income Areas



Source: U.S Department of Agriculture Service Center Locator[33]; U.S. Census Bureau.

[32] http://www.cpuc.ca.gov/supplierdiversity/
[33] https://offices.sc.egov.usda.gov/locator/app?state=us&agency=rd.

For clean energy small businesses engaged in creating or developing innovative technologies, the Energy Commission's Electric Program Investment Charge (EPIC) program offers competitive funding opportunities to help connect entrepreneurs with the resources needed to bring innovations to market.[34]

Amount Invested: Innovation

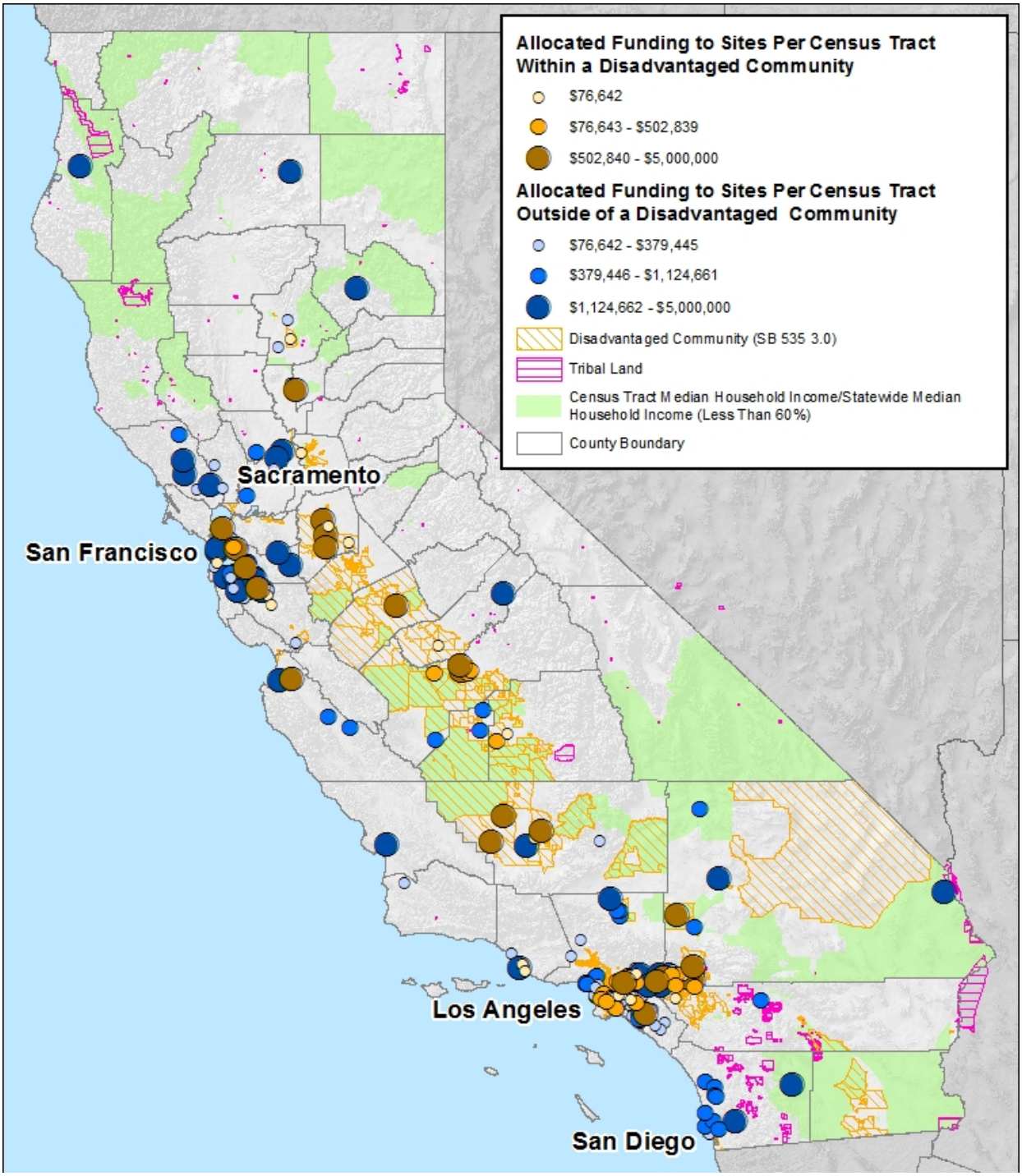
In October 2017, Assembly Bill 523 (Reyes, Chapter 551, Statutes of 2017) was signed into law. This law requires 25 percent of Energy Commission Electric Program Investment Charge (EPIC) technology demonstration and deployment money to fund projects with sites located in, and benefiting, disadvantaged communities. In addition, 10 percent of these funds must be spent at sites located in, and benefiting, low-income communities, defined as census tracts with median household incomes at or below 80 percent of the statewide median income or the applicable low-income threshold identified by the Department of Housing and Community Development.

As of December 31, 2017, $194 million was awarded for technology demonstration and deployment agreements. Of this amount, more than $61.7 million was allocated to project sites located in disadvantaged communities. In 2018, the Energy Commission plans to continue expanding access to demonstration projects to meet the requirements of AB 523.

Figures 23 and 24 show the amount of Energy Commission EPIC technology demonstration and deployment funding invested by census tract, statewide and for Los Angeles County, respectively. The maps also show the location of disadvantaged communities, as well as low-income areas and tribal lands, to give an idea on the geographic and socioeconomic diversity of EPIC project awards and the progress toward maintaining the 25 percent goal and beyond.

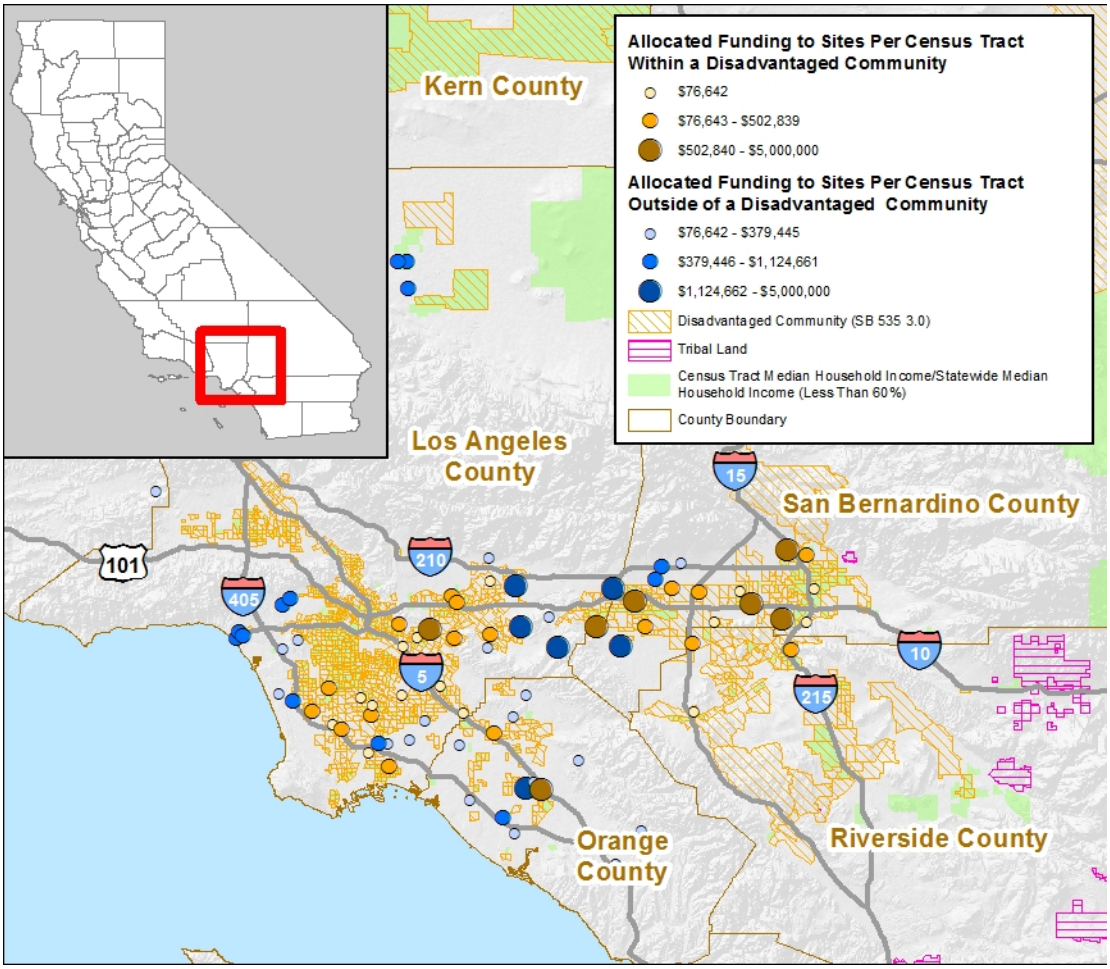
[34] More information about EPIC funding opportunities available at http://www.energy.ca.gov/contracts/epic.html.

Figure 23: Energy Commission EPIC Technology Demonstration and Deployment Funding Through December 2017



Source: California Energy Commission; U.S. Census Bureau; Bureau of Indian Affairs Pacific Regional Office 2017; CalEnviroScreen 3.0, 2017.

Figure 24: Energy Commission EPIC Technology Demonstration and Deployment Funding Through December 2017, Los Angeles County



Source: California Energy Commission; U.S. Census Bureau; Bureau of Indian Affairs Pacific Regional Office 2017; CalEnviroScreen 3.0, 2017.

Next Steps

Work is underway to implement the recommendations described in the Barriers Study, facilitated by the Governor's Office and representatives of key impacted agencies. As the recommendations are implemented, there will be further achievements to report, and additional data may become available to support improvement of energy equity performance indicators and methods. Those improvements will be incorporated into future updates of this report.

In some cases, indicators will be refined to better reflect low-income clean energy program objectives or align with related statewide mandates, such as the SB 350 energy efficiency savings doubling requirement or consideration of disadvantaged community impacts under utilities' integrated resource planning. In other cases, new data sources will need to be identified

to ensure future energy equity Tracking Progress reports display meaningful information on the performance of clean energy programs in low-income and disadvantaged communities.

To help inform further development of energy equity indicators for California, staff has prepared a list of data gaps identified in preparing this report and next steps.

Data Gaps:

- More granular, accurate, and up-to-date income information at the individual customer level, if it can be made available.
- Detailed multifamily building characteristic data, including:
    - Number of multifamily buildings across the state and per utility
    - Location of each building
    - Building vintage
    - Energy use intensity (Some of this information will be available via Assembly Bill 802 building energy use benchmarking data)
    - Renter turnover rate
    - Latest energy efficiency retrofit data
    - Fuel use details – electricity versus natural gas
- Local economic development information, such as local tax benefits resulting from clean energy projects.
- Clean energy small business contracting information through other procurement mechanisms, beyond those described in this draft.
- Clean energy small business details and history:
    - Growth in profit per year
    - Growth in number of employees per year
    - Percentage of employees that live in low-income or disadvantaged communities
    - Percentage of small businesses that go out of business each year
    - Percentage of business that are purchased by other business each year
- Need more detailed workforce development data, including:
    - Are students actually getting into clean energy jobs after training?
    - Number of community workforce agreements in different regions across the state
- Community solar systems locations, number of low-income and disadvantaged households served.
- Microgrid systems location, any “critical infrastructure” (schools, hospitals, designated shelter facilities) served by a microgrid.
- Include “Cool Center”(SCE)/”Cool Zone”(SDG&E) locations with cooling degree day data, possibly add cool center attendance data, which provide alternatives to customers unable to operate air conditioning at home.
- More specific information on utility disconnections and reconnections as it relates to income levels, CARE subsidies, and disadvantaged communities.
- Additional locational information for small-scale energy storage and other distributed

energy resources located across the state.
- Natural gas interval meter data to inform development of a high heating bill energy burden indicator.
- More granular local grid reliability and outage information to better understand relationship with low-income and disadvantaged communities.
- An updated and comprehensive list of critical facilities across the state, with supporting location information, especially as it relates to high fire risk areas.

As potential data sources are identified to fulfill the needs identified above, and data acquired, there are additional next steps that the Energy Commission envisions taking beyond publication of this initial energy equity indicators Tracking Progress report. A summary of next steps is included below.

Next Steps:
- Develop and use an advanced data and analytics platform to support future analyses related to energy equity and performance of clean energy and transportation programs across the state.
- Develop a refined energy burden indicator that factors in costs from both electricity and natural gas consumption.
- Determine a method to more accurately and precisely track income data per specific household and census tract per year.
- Beyond the investor-owned utility data included in this report, work with publicly owned utilities and community choice aggregators to incorporate data for additional areas and incorporate into future updates.
- Determine a method for defining “clean energy” companies based on NAICS codes.
- Leverage best practices and lessons learned from CPUC’s supplier diversity program and small business outreach to coordinate further development of contracting opportunities for small businesses in low income areas and disadvantaged communities.
- Include results of the Health, Comfort, and Safety (HCS) Evaluation of the ESA program, if available (https://pda.energydataweb.com/#/documents/1965/view). In the report are the collective IOU scores for each ESA energy efficiency measure as it addresses the recommended criteria:
    - The extent to which the measure eliminates combustion-related safety threat
    - The extent to which the measure eliminates fire safety threat or improves home security (crime prevention) and building integrity or both
    - The extent to which the measure reduces or eliminates extreme temperature and temperature variations inside the home/improves customer ability to manage in-home temperatures
    - The extent to which the measure improves air quality, ventilation, and/or air flow (for example, reduces drafts and leakage)
- Pursue additional updates to the Energy Commission’s Title 20 Data Collection

Regulations, other regulations, and supporting data requests to fill the data gaps identified above and improve future updates to this and other Tracking Progress reports.

- Following the publication of this energy equity Tracking Progress report, the Energy Commission envisions developing and making available an interactive mapping tool that stakeholders can use to visualize different mapping layers and focus on different regions of the state. Additional data layers would be added to this mapping tool once they become available. It is anticipated this tool will be made available by summer 2018.

Additional References

The following web links provide additional information on various energy equity topics.

- Energy Commission SB 350 Low-Income Barriers Study, Part A. December 2016
  - http://www.energy.ca.gov/sb350/barriers_report/
- California Clean Energy Equity Framework and Indicators, staff draft. May 2017
  - http://docketpublic.energy.ca.gov/PublicDocuments/17-IEPR-08/
- California Air Resources Board SB 350 Low-Income Barriers Study, Part B: Overcoming Barriers to Clean Transportation Access for Low-Income Residents Final Guidance Document. February 2018
  - https://www.arb.ca.gov/msprog/transoptions/transoptions.htm

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Next Update:

December 2018 and annually