HEAT RESILIENCY IN LOW-INCOME COMMUNITIES: A NEEDS ASSESSMENT OF SPACE CONDITIONING POLICIES AND PROGRAMS IN SOUTHERN CALIFORNIA

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ABSTRACT

Heat kills more people per year than the combined total of floods, storms, and lightning. California is expected to face increasingly warmer temperatures, as well as more frequent and longer heat waves that can endanger the health of the public, and in some cases, cause death. Low-income and disadvantaged communities are likely to suffer a disproportionate amount of those deaths during extreme heat events because this vulnerable population is challenged with adapting to extreme heat. One of the most readily available heat adaptation technologies is air conditioning (A/C). However, this technology that is so ubiquitous to most people, especially those with more affluence, is not readily available to some low-income populations in Southern California primarily due to its high purchase and installation costs. Using several public information sources, this Needs Assessment identified 231 vulnerable census tracts making up 290,489 households, in a four-county Southern California region for which a percentage likely doesn't have A/C. Further, available federal, state, and local programs that offer A/C to income-qualified households were inventoried to determine if there was enough funding and enabling policies to directly install A/C in the targeted households. The Needs Assessment concludes that there is a funding gap of $326 million up to $2.2 billion in current programs that could address this need and ensure the identified vulnerable population has the adaptive capacity for extreme heat.

EXECUTIVE SUMMARY

Heat Resiliency in Low-Income Communities: A Needs Assessment on Space Conditioning Policies and Programs in Southern California discusses the increasing temperatures and frequency of heat waves in California, which can have severe public health consequences, especially for low-income and disadvantaged communities. The paper focuses on the heat resiliency gap specific to air conditioning (A/C) for low-income residents in a four-county region of Southern California. While there is more and more research to support the potential negative health impacts of extreme heat and the disproportionate impact it will have on vulnerable communities, there is no comprehensive data that targets specific low-income communities to quantify the heat resiliency gap. The research goals for this Needs Assessment are to quantify the need for A/C in Southern Californian vulnerable households, and then determine if there are sufficient and accessible funding sources, including federal, state, and local, to protect the state's most vulnerable populations through direct-install programs and/or financial subsidies. Drawing from existing data and policy sources, this research paper will compile population data about low-income communities facing the greatest risk from extreme heat due to a lack of A/C. It then quantifies A/C penetration rates for low-income Southern California households, and finally assesses whether or not there are sufficient funds available from local, state, and federal funds to close the A/C gap in the identified at-risk low-income neighborhoods to close the A/C penetration gap and instantly improve their adaptive capacity.

The literature review included numerous sources discusses the Intergovernmental Panel on Climate Change Synthesis Report, California's Climate Change Assessment, and low-income vulnerabilities. The paper emphasizes the need for policy interventions to address the heat resiliency gap and protect low-income communities from the adverse effects of extreme heat events.

The results of this analysis concluded that the for most vulnerable households in the 231 census tracts in the Southern California region targeted in this Needs Assessment, more funding and enabling policies will be needed to ensure these households have the adaptive capacity to endure increased heat waves. Specifically, the results of the inventory of the existing federal, state, and local programs indicate a shortfall of funding ranging from $326 million to $2.24 billion depending on the percentage of actual homes currently without air conditioning.

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ABBREVIATIONS

A/C	Air conditioning
AMI	Area Median Income
CEC	California Energy Commission
CPUC	California Public Utilities Commission
CSD	Department of Community Services Development
ESA	Energy Savings Assistance
ESAP	Energy Savings Assistance Program
ESJ	Environmental & Social Justice
FPL	Federal Poverty Level
GHG	Greenhouse gas
IOU	Investor-owned utilities
IPCC	Intergovernmental Panel on Climate Change
IRA	Inflation Reduction Act
JPL	Jet Propulsion Laboratory
LIWP	Low Income Weatherization Program
LIHEAP	Low Income Home Energy Assistance Program
LINA	Low-Income Needs Assessment
PG&E	Pacific Gas & Electric
SCE	Southern California Edison
SDG&E	San Diego Gas & Electric
TECH	Technology and Equipment for Clean Heating

1 INTRODUCTION

California is expected to face increasingly warmer temperatures, as well as more frequent and longer heat waves. For example, as recently as September 2022, the Western U.S. experienced a seven-day extreme heat wave, known as a heat dome. The record-breaking temperatures exceeded 113 degrees F in some areas and placed over 61 million people on extreme heat advisories. Climate scientists at the Jet Propulsion Laboratory (JPL) developed a metric that measures the average heat index (effects of temperature and humidity) in combination with a heat wave's duration to come up with a heat wave index. Based on that index, the 2022 heat dome is now considered to be one of the worst heat waves over the past four decades, and yet there are likely more to come (Pratt, S.E. 2022).

Heat kills more people per year than the combined total of floods, storms, and lightning. Low-income and disadvantaged communities are likely to suffer a disproportionate amount of those deaths during extreme heat events because this vulnerable population is challenged with adapting to the extreme heat "new normal" (Chen, et al. 2020). One of the most readily available heat adaptation technologies is A/C; however, A/C uses the most energy of all household appliances, typically drawing 15% of total household energy. Therefore, if a resident is fortunate enough to have air conditioning, the cost to operate it may lead residents to not use it if they have to choose between cooling their home in heat waves and paying their rent, buying food, medicine, childcare, etc. (Energy Burden, 2020).

According to 2022 U. S. Census Data, nearly 40,000,000 people are living in California, of which 12.2% (or 4,800,000) have a per capita annual income of $36,000 and are considered to meet the poverty threshold. Specific to the region for this research, Southern California is home to approximately 18,000,000 people and has close to 2,100,000 people meeting the poverty threshold (U.S. Census Bureau. 2022). On average, 69% of all Southern California residents have A/C, with the prevalence of mechanical cooling increasing with hotter climate zones (inland regions) and greater affluence (Chen, et al. 2020). However, poor Southern Californians living in communities that are highly vulnerable to current and future sustained increasing temperatures face far greater and disproportionate consequences than those living in areas with more affluence.

The purpose of this capstone project is to understand and identify the heat resiliency gap specific to A/C for low-income residents in a four-county region of Southern California, including Los Angeles, Orange, Riverside, and San Bernardino. The heat resiliency gap in this research refers to the population of Southern Californians who don't have and likely cannot afford A/C systems, posing a public health risk. In addition, this project will determine if there are sufficient and accessible funding sources, including federal, state, local (including utility), and private investments to protect the state's most vulnerable populations through direct-install (low or no-cost equipment retrofits or new installations) programs and/or financial subsidies.

The inspiration for this purpose derived from known policy gaps in existing federal, state, and local programs that not only did not have program funding dedicated to heat resiliency but for those that did, there are eligibility requirements for participation, including a requirement that households potentially receiving the direct install treatment of benefits have to have an existing working A/C unit. Requirements such as this are policy holdovers from long-standing energy efficiency programs that are measured on energy savings not by widget, or in this case, installation of an A/C unit in a household where no previous working A/C unit exists. Originally, this Needs Assessment was going to focus on the service territory for Southern California Edison, an electric-only investor-owned utility (IOU) that serves most of Southern California except San Diego. The reason for this area of focus is so the findings could be used to potentially inform a future heat resiliency, electrification program, or policy on behalf of the IOU. However, while doing the literature research, the foremost study for this Needs Assessment, focused specifically on the Los

Angeles, Orange, Riverside, and San Bernardino counties (Chen, et. al, 2020). Narrowing the scope down from the 10 main counties SCE serves to the four targeted counties (starred in Figure 1 below) was reasonable given that 85% of the 15 million customers they serve are located in these four counties (see Figure 2), according to 2022 U.S. Census data.

Figure 1: Map of California with Targeted Four Counties (starred)

Figure 1 adapted from Burning Compass. (n.d.). *California County Map*. https://www.burningcompass.com/countries/united-states/states/california/california-county-map.html

Figure 2: Southern California Edison Service Territory by County

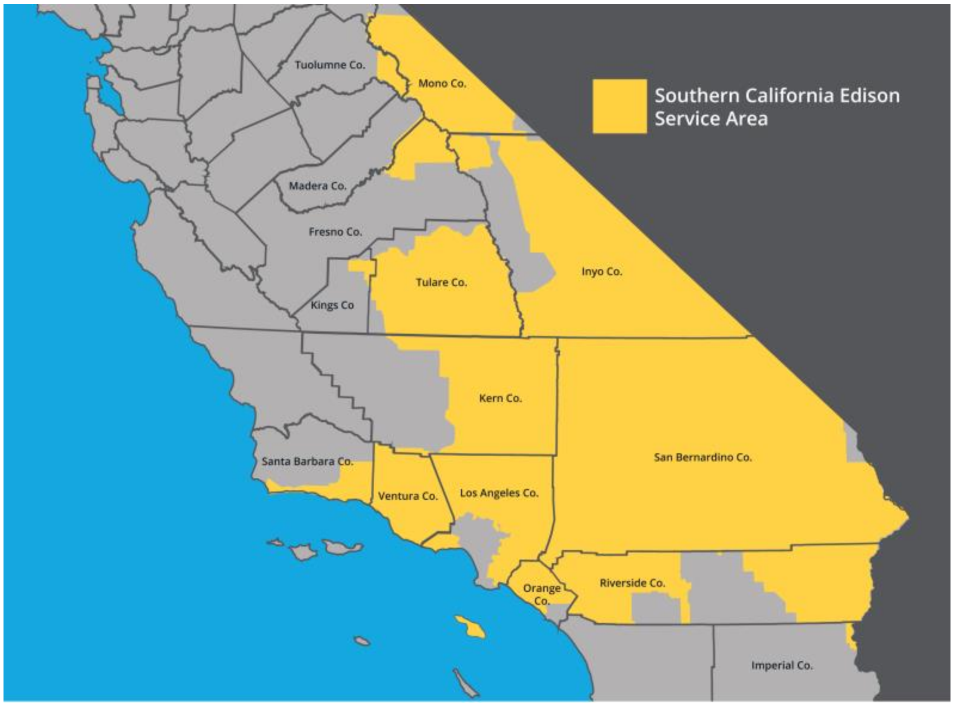

Figure 2 adapted from SCE. (2019, April). Southern California Edison's Service Area. https://newsroom.edison.com/internal_redirect/cms.ipressroom.com.s3.amazonaws.com/166/files/20193/SCE%20Service%20Area%20Fact%20Sheet_Ver2_04252019.pdf

2 LITERATURE REVIEW

2.1 <u>Intergovernmental Panel on Climate Change Synthesis Report</u>

The Intergovernmental Panel on Climate Change (IPCC) Synthesis Report states there is strong supporting evidence showing a likely increase in the frequency of compound heatwaves and droughts, particularly in the mid-latitudes. Meaning, that as global warming increases, impacted regions, such as large swaths of the United States, will, on average, experience temperature extremes that are more widespread and pronounced (IPCC, 2023).

2.2 California's Climate Change Assessment

Focusing at the state level, according to California's Fourth Climate Change Assessment (Assessment), Inland and Southern California have already seen annual temperature increases from roughly 1.7 – 3+ degrees F above the average temperatures across the first six decades of the 20th century. Using the IPCC's moderate Representative Concentration Pathway (RCP 4.5), the Assessment further projects a mid-century annual increase of 4.4 degrees F and 5.6 degrees F by the late century. The worst-case scenario projection of RCP 8.5 portends an annual mid-century average temperature increase of 5.8 degrees F, and the late century could see an increase of 8.8 degrees F (California's Fourth Climate Assessment, 2018), however, depending on the geography and climate, certain parts of California could see much higher late century temperature increases.

2.3 Hazardous Heat Nationwide

According to the 6th National Risk Assessment: Hazardous Heat, the Western U.S. is likely to experience the longest duration of days at or above the 98th percentile heat index value, increasing the risk of heat fatigue, stroke, and death. This research used a model developed from U.S. Government datasets and overlaid other publicly available and third-party data to model heat risks at a local level today and 30 years into the future. This study concluded that heat risk is growing across the country, both in relative and absolute terms (First Street Foundation, 2022). For example, in 2022, 8 million people were impacted by extreme heat danger (heat that exceeds the National Weather Service's highest category of heat and meets a heat index of 125 degrees Fahrenheit). This number is expected to rise to 107 million people by 2053. While the West will experience longer-duration heat events, the Upper Midwest is likely to experience the highest levels of extreme heat exposure, creating an "Extreme Heat Belt" in the central U.S. (First Street Foundation, 2022).

Understanding health impacts as a result of extreme heat events and how to mitigate its effects is critical as the planet continues to warm, especially as it impacts vulnerable populations, such as the elderly, people with comorbidities, and racially and ethnically underrepresented groups. A 2022 study on the Association of Extreme Heat with All-Cause Mortality in the Contiguous U.S., 2008 – 2017 shows that there is an average of 700 heat-related deaths per year ascribed to high levels of heat exposure. Additionally, the study shows that there is an average of 1,373 additional deaths from all-cause mortality (death due to any cause) associated with extreme heat (Khatana, et al., 2022). When presenting results, this study underscores the importance of increasing the adaptive capacity for vulnerable populations as extreme heat days are projected to increase by 20 to 30 days per year across the U.S. by the mid-century.

2.4 Heat Resilience

The dangers of extreme heat on public health are becoming more widely known; however, the concept of heat resiliency, particularly in an urban setting, is new but growing, and as a result, it has been difficult to engage the neighborhoods most impacted. The authors of the Community-engaged Heat Resilience Planning: Lessons from a Youth Smart City STEM Program implemented a summer STEM program for students between the ages of 12 to 14 in Roanoke, Virginia. The summer study participants collected thermal comfort and temperature data using infrared cameras and heat and weather sensors, drones and satellite data, vehicle journeys, and peer-to-peer interviews. The objective of the study was to gather information that urban planners could use to engage neighborhoods in large-scale heat resiliency planning. Relative to this Needs Assessment, what this study presented were important concepts on how to address heat resiliency, such as the vulnerabilities to extreme heat being tied to poor households and people of color, understanding that heat exposure is a social health issue, not a personal responsibility issue; and that the solution for improving comfort and safety is having air conditioning (Lim, et al., 2022).

2.5 Low-Income Vulnerabilities

The household building type is an important consideration when evaluating the heat resiliency needs and energy costs of low-income customers in Southern California. For example, two-thirds of the population designated as low-income in this region reside in multi-family dwelling units, with the remainder residing in single-family buildings. Also, multi-family households tend to spend less on energy than single-family residents because multi-family dwelling units are typically smaller than single-family, and thus use less energy for space conditioning (Evergreen Economics, 2022). For the sake of this research, low income is defined as those households earning 80 percent or less of the area median income or fall at or below 200% of the Federal Poverty Level (FPL) guidelines (CPUC ESAP; see also CEC, 2023).

Research has been done to expand knowledge of extreme heat driving the need for increased heat resiliency in the Southern California region, particularly for low-income and disadvantaged communities. A primary source for this paper was a 2020 study that utilized smart meter data to forecast the impacts of extreme heat on vulnerable populations in Southern California. Using the smart meter data from over 180,000 households over two years, this study was able to develop a methodology driven by heat sensitivity and related cooling energy use, that enabled characterizing A/C penetration at the census tract and climate zone level in the targeted Southern California region (Chen, et al. 2020).

Another 2020 study examined California residents' vulnerability to extreme heat in subsidized housing compared to residents not living in subsidized housing. The study looked at 10 counties in California with the highest percentage of subsidized housing, of which four of those ten, Los Angeles, Orange, Riverside, and San Bernardino Counties, are in Southern California, and found that these areas which are predominantly low-income and disadvantaged communities, are more vulnerable to extreme heat due to greater exposure and higher sensitivity, as well as reduced adaptive capacity (i.e., A/C) (Gabbe & Pierce. 2020).

In addition to the physical vulnerabilities, low-income customers are also sensitive to the cost of electricity needed to power increasing A/C loads as temperatures continue to increase. For reference, residential bundled electricity rates (generation, distribution, and transmission services) in the Southern California region have gone from $.16/kilowatt-hour (kWh) to $.21/kWh in just three years, with average monthly bills growing from $93 to $121 for the same period. Relative to the 200 investor-owned utilities (IOU) nationwide, average electricity rates in Southern California are ranked 17th highest (CPUC, 2023). This is important when considering the energy burden (household income relative to energy costs) for low-income households in California is almost 6.8% for renters and 9.4% for owners, with average bills of $1,308/year and $2,016 for renters and owners, respectively (Evergreen Economics, 2022).

2.6 Extreme Heat and Southern California Climate Zones

The 2020 smart meter (a smart meter is a wireless electric meter that automatically sends usage to the utility) research study used data to project extreme heat impacts on vulnerable, low-income communities in Southern California. Using census tract data, the study sought to project electricity increases that coincide with extreme heat and identify vulnerable populations that are most at risk from rising temperatures due to lack of air conditioning. Included in the study is the California Energy Commission's (CEC) Cal-Adapt web-based extreme heat projection tool, which indicates 95 degrees F is the base threshold for extreme heat. Several of the study's census tracts that were identified as having high levels of poverty, combined with households without air conditioning are already experiencing a baseline of 14 – 29 days of extreme heat, with end-of-century projections reaching 72 – 112 days for the same census tracts (Chen, et al. 2020). This research also looked at electricity use relative to temperature increases at the census tract level per the CEC's climate zones to assess air conditioning penetration levels overlaid on the poverty index, see Table 1 and Figure 1 below.

Table 1 below lists the eight geographic climate zones (out of 16 statewide) that are most predominantly populated in Southern California and have been designated by the CEC according to their weather and climatic characterizations (CEC, 2019).

Table 1: CEC Geographic Climate Zones

Climate Zone #	Geographic/Climatic Description	Avg Temperature Range (degrees F)
6	Coastal, mild summers, cool, cloudy winters	41 - 87
8	Temperate/oceanic, warm summers, and cool, cloudy winters	38 - 93
9	Slightly inland, arid/hot summers; cool, cloudy winters	39 - 97
10	Inland, arid/hot summers; cool, cloudy winters	43 - 103
13	Central Valley, arid/hot summers; cold, cloudy winters	29 - 103
14	High desert, arid/hot summers; cold, cloudy winters	25 - 103
15	Low desert, arid/sweltering summers; cool, cloudy winters	38 - 113
16	Mountains, mild summers; cold, snowy winters	14 - 88

Figure 3: CEC's California Climate Zones within Southern California, with Los Angeles, Orange, Riverside, and San Bernardino Counties highlighted in red.

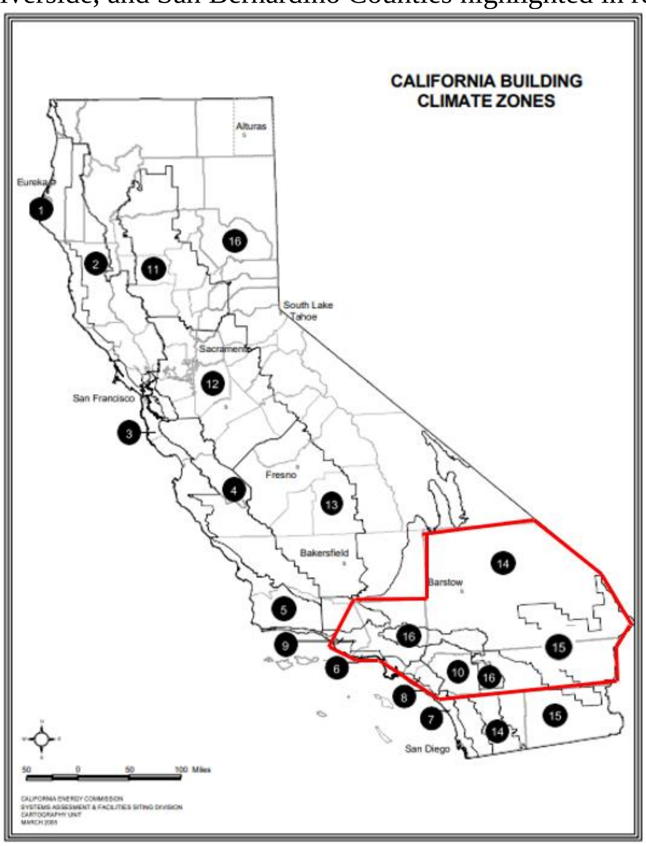

Figure 3 adapted from *Appendix C – California Climate Zones.* California Energy Commission. (2019, January). https://www.energy.ca.gov/sites/default/files/2020-05/Appendix_C_EnergyStandardsClimateZones.pdf

2.7 State Action Plan for Extreme Heat and Environmental & Social Justice Action Plan

In April 2022, California published the State Action Plan to Build Community Resilience (CNRA, 2022), specifically focused on protecting Californians from extreme heat. In the plan, the State identified a specific track (Track C) focused on "improving access to and use of air conditioning and addressing obstacles to the use of air conditioning and other cooling strategies for vulnerable populations" (CNRA, 2022). This Action Plan acknowledges, among many things, a greater need for the Department of Community Services and Development (CSD) and the Department of Public Health to collaborate across various programs through the development of an action plan that assesses the state's Low-Income Weatherization Program (LIWP) and promotion of projects that focus on extreme heat and improving public health and affordability issues. The CPUC published its Environmental & Social Justice (ESJ) Action Plan in 2022 and in it, they identified a goal to increase climate resiliency in ESJ communities that heavily relies on existing programming across the state and at the local level (i.e., utility low-income programs) (CPUC, 2022 April).

2.8 Energy Burden

The research for this paper also included a review of the 2022 Low Income Needs Assessment (LINA). LINA is a legislated (California Assembly Bill 327) triennial report developed by the California investor-owned utilities (IOU) under the auspices of the California Public Utilities (CPUC) and for which its intent is to ensure low-income customers are not overburdened by their energy expenditures (Evergreen Economics, 2022). Specifically, for this paper, the LINA report provided data on the energy burdens for statewide low-income renters and owners and provided particularly strong information that supported a targeted effort needed for single-family households due to higher energy burdens than multifamily. However, for this research, both multi-family and single-family households are being considered as being vulnerable to extreme heat and needing adaptive capacity through mechanical cooling.

3 METHODS

The main deliverable for this Needs Assessment is to broadly quantify the low-income population in Southern California and determine if these vulnerable households have the adaptive capacity (mechanical air conditioning) to endure increasing temperatures and longer duration extreme heat events. As the data suggests, there is a gap between the need for A/C and reasonable access to it, and thus additional information included in this paper will show there are not enough programs and accessible resources available for this vulnerable population to acquire the necessary A/C equipment to rightfully preserve their health and comfort as heat waves increase in intensity and frequency in the coming decades.

Information for this paper originated from a variety of data sources to accomplish the research objectives. Utilizing studies and relevant data from multiple sources, the steps taken to develop and complete this Needs Assessment included: 1) compiling current population, low-income/poverty, and extreme heat data pertinent to the Southern California region; 2) quantifying A/C penetration rates for low-income Southern California households; 3) determining if an A/C penetration gap exists for the defined low-income population; and 4) assessing funding and program availability accessible to this identified population to address the needed heat resiliency.

3.1 Data Gathering and Review

Research using existing public information on the low-income population in the Southern California targeted region, including household types such as renters and owners, provided a basis for identifying their respective energy burdens. The intended use of this data was to understand the low-income population, housing and climate characteristics, and energy burden for the targeted segment in Southern California to provide a basis for assessing the heat resiliency needs of this vulnerable population.

Sources for Southern California low-income population, energy burden, energy bill, residential bundled energy rates, housing type, relevant policy, and air conditioning penetration data included, among many sources:

- U.S. Census Bureau 2020 & 2022 data
- Evergreen Economics 2022 Low Income Needs Assessment
- California Public Utilities Commission
- California Energy Commission

A foundational research source provided information on electricity demand consumption relative to temperature change (i.e., one degree Celsius), referred to as electricity-temperature sensitivity (E-T sensitivity), to predict a household's electricity consumption based on a one-degree Celsius increase and then overlaid the predictions on low-income census tracts. (Chen, et al. 2020). The purpose of this data was to assess A/C penetration rates across varying socio-economic segments by gaining an understanding of the relationship between electricity usage and ambient temperature (see Figure 2). This research revealed varying sensitivities to temperature increases, and depending on income levels, a trend of increased electricity use from surging A/C usage. This source provided further granularity by identifying 231 census tracts in Southern California that are considered to have a high probability of heat vulnerability due to poverty level and low A/C penetration. The 231 census tracts are the target for quantifying households in need of A/C.

Figure 4: Air conditioning penetration rates across CEC's Southern California designated climate zones relative to poverty percentile index.

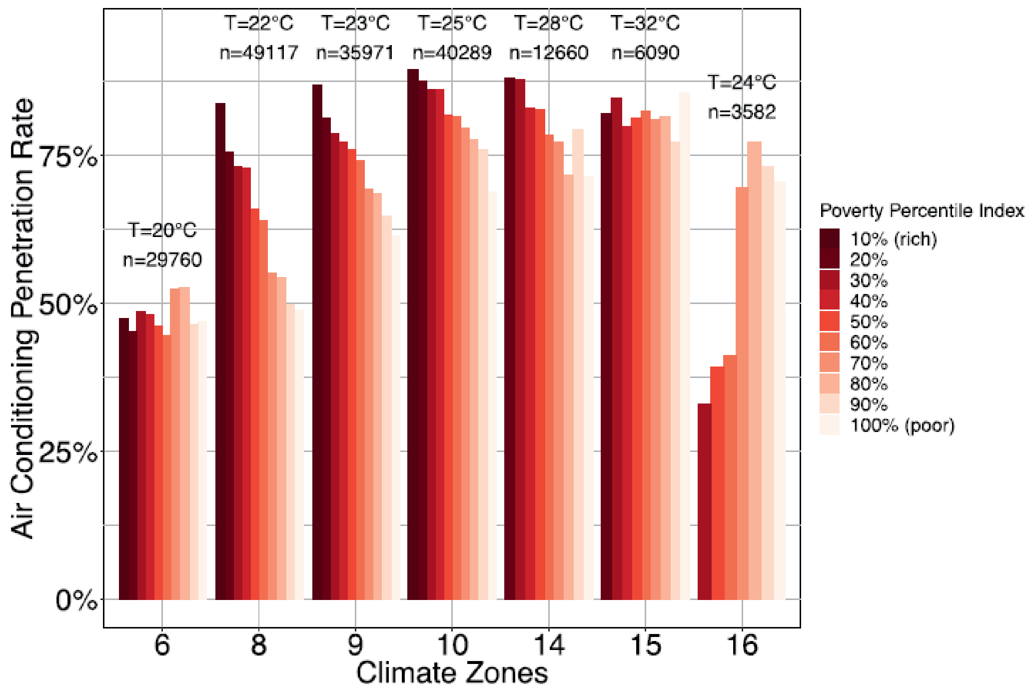

Figure 4 adapted from *Utilizing Smart-meter data to project impacts of urban warming on residential electricity use for vulnerable population in Southern California* by M. Chen, 2020, Environmental Research Letters, doi.org/10.1088/1748-9326/ab6fbe.

3.2 Identifying A/C Penetration Gaps

Identifying A/C penetration gaps required a closer look at the details behind Figure 2, which identifies the poverty percentile across the core California climate zones using electricity smart meter data from 180,476 census tract households to quantify the increase in electricity usage per degree of warming. More specifically, the identified vulnerable census tracts were those neighborhoods where the percentage of the population living in poverty and the percentage of households not having A/C were combined for each Southern California census tract and then ranked across the entire region (Chen, et al., 2022). Using the top 10% (231) vulnerable census tracts identified in the study mentioned above, and described as 1) the percentage of the census tracts living in poverty, and 2) the percentage of households that do not have A/C was then quantified by using the 11-digit census tract number provided in the Chen study, then overlaid with the 2020 Hard-to-Count California census tract data to get population and household quantities to support the research objective for this Needs Assessment (State of California, 2020). The California census tract data provides poverty rates for these vulnerable neighborhoods, ranging from as low as 6% and reaching as high as 78% in some tracts. However, because there is such a dramatic gap between poverty rates in these neighborhoods identified as *vulnerable* in the Chen study, this analysis provides two cost scenarios; 1) 100% of those households within the top 10% vulnerable census tracts need A/C, and 2) 28% of those households within the top 10% vulnerable census tracts need A/C. This assessment uses a high and a low projection to account for the significant divide in the poverty percentages. The 28% is a proxy value that aligns with an April 2023 report filed by the CA Investor Owned Utilities (IOU) with the CPUC, providing annual estimates of the number of households eligible for low-income programs (CPUC, 2023b). The eligibility baseline is 200% of FPL, and 28% is the number of eligible households in the entire service area of Southern California Edison (SCE), the electric utility serving most of the Southern California region targeted in this research paper.

3.3 Cost of Providing A/C to Low-Income Population

An assumption for the type of A/C unit is needed to narrow down the costing options. While some of the state and local programs inventoried for this analysis (ESA and LIHEAP) offer room A/Cs (as well as gas furnaces) in their programs, heat pumps (one device that both heats and cools with electricity) were the appliance of choice used for cost assumptions for this research due to California's governor establishing a goal of installing 6 million heat pumps statewide by 2030, with 50% of the state funding (source and amount not specified) for achieving this goal being directed toward disadvantaged communities (Office of the Governor, 2022). To create a cost projection for addressing the low-income A/C penetration gap, this research relied on a public database that includes heat pump project costing information from the Technology and Equipment for Clean

Heating (TECH) program. TECH, which evolved from California Senate Bill 1477, is a statewide program that offers incentives for building decarbonization measures, such as heat pumps (A/C and heating), for both multifamily and single-family dwellings (California Leginfo, 2018).

TECH's database provides the mean project cost inclusive of a variety of heat pump model types, such as mini-splits (ducted and ductless) and central units, as well as different-size units accounting for multifamily and single-family dwelling types and sizes (TECH). To collapse the varying costs into a representative cost inclusive of multifamily and single-family across the four targeted Southern California counties, this analysis looked at TECH's listed multifamily and single-family average cost per A/C or heat pump across the four main counties in Southern California. To assign a somewhat weighted cost approach, this research used the average installed cost for multifamily buildings (where available) and the average cost for single-family and then projected those distinct average costs in a representative manner to reflect the percentage of housing types in the Southern California targeted region. Using the sampling from the Low-Income Needs Assessment that tracked the percentage dwelling types (single-family vs. multifamily), single-family represents 23% of the housing types, while 77% reflects multifamily dwellings (Evergreen Economics, 2022). It is important to note that while the TECH data is being used for costing information, it is not included in Section 4.3, in Table 4's program and funding inventory section, because TECH is an incentive (rebate) program mostly targeting "market rate" customers, and the scope of this research only includes direct install programs (low or no-cost installations). Figure 3 below is a screenshot of the TECH Clean California interactive public database that shows average project cost based on county location and incentives paid for specific measures, including A/C (heat pumps).

Figure 5: TECH Clean California statewide project costs and incentives.

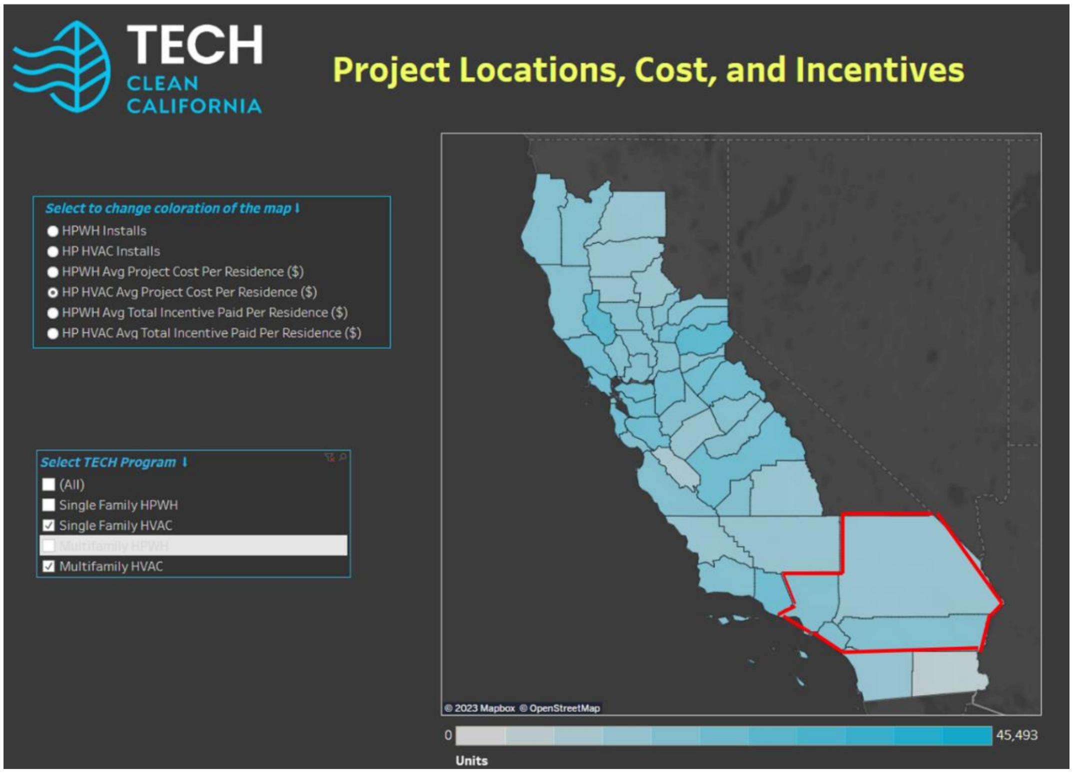

Figure 5 adapted from TECH Clean California Public Database. https://techcleanca.com/public-data/data-visualizations/

3.4 Existing Programs and Available Funding

To determine if there are enough programs and sufficient funding available to serve the population identified as having low or no A/C penetration, an inventory was taken of local, state and federal programs providing direct install programs. For some of the programs, funding for direct install A/C units was straightforward because the data came from the electric utility (SCE) that serves the targeted areas for this research. However, in cases where the data was provided at a statewide level, a percentage was assumed for the funding allocation, targeted at this Southern California region, based on current IOU funding for low-income programs across the state. The method for determining the percentage allocation was an average that used two factors. The first is based on the 2022 CPUC-authorized IOU ratepayer dollars allocated for the Energy Savings Assistance (ESA) program. Total authorized funding in 2022 totaled $190 million, 8% ($16 million) was allocated to San Diego Gas and Electric (SDGE), 53% ($101 million) was allocated to Pacific Gas and Electric (PG&E), and 38% ($73 million) was allocated to SCE (CPUC, 2023b). The second uses the CPUC's historical approach for allocating achievable energy savings and subsequent program funding across the state to the IOUs as laid out in their 2023 Energy Efficiency Potential and Goals Study. In the Potential and Goals Study, the CPUC assigns a 36.4% electric savings allocation to PG&E, 7.4% to SDGE, and 35.9% to SCE (Guidehouse, 2023). The Potential and Goals study assigns reasonable energy savings projections that also inform funding for IOU programs. While both percentages (38% and 35.9%) that are allocated to SCE are nearly the same, for the sake of this research, this paper will assume an average of the two, which is 37%, to estimate the allocation for state and federal funding targeting the Southern California region.

Next, to determine if the available funding is sufficient to fund the A/C penetration gaps, only those programs that offered direct install (low or no-cost installations), not equipment incentives (a portion of the A/C project cost is offset with an incentive or rebate) were considered options for this research. This is because most of the vulnerable households considered in this research are most likely unable to afford the purchase of a new A/C unit even with a significant incentive.

3.5 Data Gaps and Assumptions

This Needs Assessment provides a high-level understanding of the gap between vulnerable populations' exposure to extreme heat and access to A/C to improve their adaptive capacity to heat exposure. However, to quantify the market, some data-based assumptions had to be made when there was a lack of public data with the level of specificity needed for inputs. For example, as mentioned above, the 231 census tracts that were broken down into households had a poverty range (200% FPL) from 6% up to 78%. While the households within the 231 census tracts may be considered highly vulnerable due to poverty levels and A/C penetration, it's unlikely that 100% of those households are without A/C; however, one of the scenarios does calculate the need at 100% primarily to demonstrate the high cost of cooling equity. To get the lower end of the cost range, the second assumption uses a percentage of the population (28%) that are eligible for the electric utility's income-eligible programs. This percentage is not directly tied to A/C penetration, but it does provide a reasonable value for assuming poverty rates and, secondarily, assuming A/C needs. This data gap will need to be addressed with more granularity and validated through in-home assessments and/or leveraging smart meter data at the household level to better identify A/C gaps.

Other assumptions that were made pertain to the available program funding for direct install A/C. As described above, the only funding detail relative to direct install A/C units was available in the IOUs' compliance filings to the CPUC. The programs inventoried in Table 4 below provide many services to income-eligible customers in addition to A/C installation. It was there that a funding percentage was differentiated from the other services for which the program paid, and then applied across the programs to calculate available funding estimates specific to air conditioning. In some cases, with the federal funding from the Inflation Reduction Act (IRA) the programs have yet to be launched, and therefore assumptions from existing operational programs were used. A more detailed funding inventory is needed to better understand how all of the state and local agencies' funding for A/C installations are allocated.

4 RESULTS

4.1 Quantifying Vulnerable Population Needing A/C

Table 5 in the Appendix includes the details for the 231 vulnerable census tracts identified in the Chen study as the top 10% most vulnerable and provides total sums for the population as well as occupied households. Across these vulnerable census tracts, there is a population of 1,068,949 people, occupying 290,489 households. Table 2 below calculates the 290,489 households living at or below 200% of FPL, using California Hard-to-Count census tract data (Chen, et al., 2022, State of California, 2020) and then assumes a high (100%) and low (28%) value for households in need of A/C (CPUC, 2023b).

Table 2: Calculation for the total number of Southern California households in need of A/C.

Count for So Cal Households per Top 10% Vulnerable Census Tracts (n=231)	% CA Vulnerable Households (up to 200% FPL) in Need of A/C	Number of Low-Income So Cal Households Needing A/C
290,489	100%	290,489
	28%	81,337

4.2 Cost of Providing A/C to Low-Income Population

As mentioned previously, using the public database for California's statewide TECH program which provides average heat pump (A/C) costs across the counties represented in this Needs Assessment, the average single-family per household project cost used in this research is $18,124, and multifamily is $6,489 (TECH Clean CA). Table 3 below shows a high-cost projection of $2.66 billion for the total installed cost for A/C (heat pumps) for 100% of the 290,000 vulnerable low-income census tract households in the targeted Southern California region, and $.745 billion for the 28% scenario.

Table 3: High and low scenarios of projected cost of A/C installation for So Cal low-income households in nominal dollars.

Dwelling Type	Number of Low-Income So Cal Households Likely Without A/C	Average installed cost of A/C (heat pumps) in So Cal	Total direct install cost for A/C in vulnerable low-income households in So Cal in nominal $
100%			
SF	66,812	$18,124	$1,210,900,688
MF	223,677	$6,489	$1,451,440,053
Total	290,489		**$2,662,340,741**
28%			
SF	18,708	$18,124	$339,063,792
MF	62,629	$6,489	$406,399,581
Total	81,337		**$745,463,373**

4.3 Available Programs and Funding to Cover Costs for A/C Installations

The funding estimates in Table 4 below show a total of $419 million available for A/C direct install in the targeted vulnerable census tracts attributable to existing funding sources available from 2022 – 2027. The results of the inventory of the existing federal, state, and local programs indicate a shortfall of funding from $326 million to $2.24 billion for both the high and low scenarios in Table 3 above. With some programs where there was no available data specific to budget allocations for A/C installations, the SCE ESA averages were used as a proxy, and in some cases, the entire amount allocated to Southern California was assumed to be used for A/C direct install.

Table 4: Existing programs and available funding for A/C

Program Name	Program Description	Income Qualifications[4]	Provides Free A/C	A/C Eligibility Requirements	Program Administrator	Funding Source	2022 - 2027 Funding for CA ($millions)	Approx. Funding for Southern CA ($millions)	Approximate Allocation to A/C[5] in Southern CA ($millions)
Energy Savings Assistance Programs (ESA)	Provides no-cost weatherization and appliance replacements, including A/C[b]	$75,000/yr - 4 person household[e]	Yes	Replacement of existing working A/C only in climate zones 10, 13-15	California IOUs	Non-bypassable public goods charge paid by IOU customers[f, h]	$2,199	$431	$90.51
Low Income Home Energy assistance Program (LIHEAP)[6]	Provides free energy efficiency upgrades to low-income households to lower their monthly utility bills[a]	$75,600/yr - 4 person household[c]	Yes	60% Area Median Income (AMI), point system based on elderly, disabled, young children, high energy burden[g]	CA Department of Community Services (CS)	U.S. Dept of Health and Human Services	$1,108	$277	$58.17
Low Income Weatherization Program (LIWP)[j]	Provides free low-income households with solar photo-voltaic and energy efficiency upgrades, including A/C	$75,600/yr - 4 person household[e]	Yes	Must demonstrate energy and GHG reduction of at least 15%	CA Department of Community Services (CS)	California Cap & Trade Auction Proceeds[2,3]	$156	$50	$50
Equitable Building Decarbonization Program	Direct Install program that will provide low or no-cost and incentives for building decarbonization & heat resiliency upgrades[d]	$75,600/yr - 4 person household[e]	Yes	Replacement of existing gas-fired or electric resistance heating with electric heat pumps	California Energy Commission (CEC)	State General Funds and CA's Greenhouse Gas Reduction Fund (GGRF)[1]	$689	$220	$220
Inflation Reduction Act (IRA)[i]	High-Efficiency Electric Home Rebate Program (HEERA) provides point-of-sale rebates for appliances, including heat pumps. Covers 100% of costs for households at or below 80% AMI	$141,750/yr - 4 person household (low to moderate income households)	Yes	Replacement of existing gas-fired or electric resistance heating with electric heat pumps	California Energy Commission (CEC)	U.S. Department of Energy	$290	$93	$93M
Totals							**$4,442**	**$1,071**	**$419**

1 Program budgets are consistent with the 2023-24 California State Budget passed by the Legislature and signed by Governor Newsom in 2023. Budgets may change if modified by the Governor or Legislature in future years.
2 LIWP funds only represent approved budgets for 2022-23 and 2023-24 fiscal years.
3 Roughly 43% of those considered meeting the poverty threshold reside in Southern California
4 80% Area Median Income (AMI) and uses 4-person household for illustrative purposes, but median income values are listed for 1 to 8-person households
5 ESA & LIHEAP allocation based on 2022 ESA program contribution to A/C projected over four-year program funding cycle in Southern California Edison Service Area
6 LIHEAP funding is not the same year after year and therefore assumed same allocation over four years as 2023 allocation.

Table 4 data from State of California (n.da)[a], CPUC (n.d.)[b], State of California (n.db)[c], CEC (2023a)[d], HCD, (2023)[e], CPUC (2023b)[f], CSD (2022b)[g], CPUC (2021 June)[h], DOE SCEP (2023)[i], CARB (2023)[j]

5 DISCUSSION OF RESULTS

Based on the analysis of the top 10% of most vulnerable households identified in the census tract data in the Southern California region, the average cost of A/C or heat pump installations for both multifamily and single-family dwellings, and the currently available local, state, and federal funding for A/C installation, indicates more funding and enabling policies will be needed to ensure these vulnerable households have the adaptive capacity to endure increased heat waves. Specifically, the results of the inventory of the existing federal, state, and local programs indicate a shortfall of funding ranging from $326 million to $2.24 billion for both the high and low scenarios in Table 3 above. With some programs where there was no available data specific to budget allocations for A/C installations, the ESA program averages were used as a proxy, and in some cases, the entire funding amount allocated to Southern California was assumed to be used for A/C direct install (CPUC, 2023b), however, a portion of those program dollars are not solely allocated to A/C. This result is not surprising given more affluent census tracts tend to have higher rates of air conditioning particularly in warmer climate zones because more affluent communities tend to have a higher sensitivity to incremental temperature increases and thus increase their electricity load because of A/C load. For example, climate zone 10, located in Southern California's Inland Empire, has a mean summer temperature of 92 degrees Fahrenheit, with over 90% of the most affluent census tracts having A/C. Conversely, only 75% of the poorest census tracts have A/C in the same climate zone (Chen, et al., 2020).

Determining the A/C penetration rates based on census tract poverty levels required data-backed proxy assumptions. The vulnerable census tracts were identified using smart meter data that identified energy usage variabilities through spatial patterns and climate characteristics (Chen, et al., 2020). This narrowing of energy use combined with temperature sensitivities and socioeconomic factors is a critical step in identifying those vulnerable communities/census tracts facing the greatest risk of extreme heat impacts. While this research paper did assume a scenario where every household in the 10% most vulnerable census tracts would receive a free A/C heat pump installation, it is highly unlikely that 100% of those households are without A/C. Therefore, a more conservative value of 28% was used for a lower-end scenario. 28% was used as a proxy value that was consistent with the percentage of the household population in Southern California who are eligible to participate in certain income-qualified (200% FPL) programs (CPUC, 2023). This is not a direct link to A/C penetration, but it's a poverty value that gets close to narrowing the number of homes that do not have A/C.

The results clearly show a gap in available funding for direct install A/C programs for poor Southern California households, so it's important to note some key points. Table 4 identifies over 4 billion dollars in local, state, and federal funding for low-income customers across California; however, not all of that funding is specifically targeting heat resiliency. Some of the funding is for energy efficiency, home weatherization, solar, and storage. Further, there was a lack of detailed reporting on the specific measures or interventions funded by the different state and federal programs (utility regulatory reporting had the most detail and thus the reason for developing proxies based on their reporting data) (CPUC, 2023b). Because A/C installation is a very costly proposition, there will need to be extensive analysis done by administering state agencies at a much more granular level to further narrow and quantify the need.

6. CONSIDERATIONS and RECOMMENDATIONS

6.1 Enabling and Coordinated Policies are Needed at the State Level

This Needs Assessment has a specific, narrow scope – assessing, quantifying, and addressing opportunities to improve heat resiliency for low-income Southern Californians. However, to take action and mitigate what this paper demonstrates to be an A/C and funding gap, the State will need to bring together all agencies and stakeholders to devise a path that sets in motion the aspirations and existing action plans for addressing extreme heat and critical resiliency for low-income households and affordability. California has an ambitious building decarbonization goal of installing 6 million heat pumps by 2030, with 50 percent of the supportive funding going to low-income communities

(Office of the Governor, 2022). Despite this ambitious goal, and the State's documented priority of protecting vulnerable customers and communities from extreme heat, a clear plan for how to achieve these goals and priorities seems lacking. For example, using California's own Environmental & Social Justice (ESJ) Action Plan, the CPUC established a specific goal focused on adaptive capacity and ensuring the programs they oversee emphasize considerations around heat resiliency (CPUC, 2022, April). The ESJ Action Plan, a document that puts forth an operating framework that integrates ESJ considerations with the CPUC's work, demonstrates that the State already seems to be aligned on its objectives for heat resiliency in vulnerable communities across several state agencies. However, a roadmap that lays out policies for quantifying the heat resiliency need in vulnerable communities and the funding sources for the deployment of, in this case, well over a million people in Southern California, is missing. Additionally, the State Action Plan to Build Community Resiliency lays out numerous goals to address extreme heat in vulnerable communities, including public awareness campaigns, using data and statistical approaches to pinpoint high-risk vulnerable communities, and improving access to A/C or other indoor cooling technologies. The State Action Plan notes several channels in which these goals are already being addressed through existing programs, including greater collaboration between the State's LIWP program and public health agencies, stating this collaboration has been ongoing since 2013 (CNRA, 2022). This statewide collaboration has been ongoing for 10 years, yet there is still a heat resiliency gap that is likely to have a public health impact if it's not addressed. The Action Plan goes on to list several activities and regulatory proceedings that are in place to support heat resiliency but stop short of putting forth potential funding commitments or sources to backstop what is likely a significant gap. It is also important to note Table 4 above which shows most of the currently available programs offering direct install A/C or heat pumps to income-qualified households have a requirement to be in certain climates and/or prescribe a home must have an existing working system to be eligible for a new A/C unit. This requirement is a holdover from energy efficiency replacement programs, and unfortunately completely runs counter to the purpose of this paper. As mentioned in Methods, section 3.5, more effort is needed to unobscured the data gaps around actual A/C penetration in the targeted households, as well as better clarity about the available funding in existing federal, state, and local programs. Sweeping state action is needed to quantify the heat resiliency needs and the public health risks so State and key agencies can converge to overcome this dangerous and inequitable heat resiliency shortfall.

The need for coordinated policies and programs is not a problem unique to Southern California. Research for this Needs Assessment took me to the City of Boston's Heat Resilience Solutions plan – a 250-plus page document that tackles heat resiliency from all angles, including a home cooling (A/C) resources distribution plan for income-qualified Bostonians. Similar to California's Extreme Heat Action Plan, Boston's plan provides a framework for dealing with extreme heat, particularly in vulnerable communities. It calls for statewide, local, and community-based coordination to better provide resources for the most vulnerable communities – those with the greatest heat exposure and sensitivity and the least financial resources (City of Boston, 2022). The Boston plan even calls for an "Extreme Temperatures Response Task Force to develop a process for pre-heat wave mobilization into the broader heat relief strategy. At the state level, Massachusetts released its 2023 ResilientMass Plan which is the State's plan for addressing climate hazards and adaptation. The plan does address heat resiliency needs for vulnerable populations and considers it an urgent priority; however, the timeframe for identifying high-risk building occupants and capital planning to mobilize a plan is identified as having a 5-plus year timeframe (State of Massachusetts, 2023).

New York State may provide a template for near and long-term action to address extreme heat and capacity building. In 2022, the state's Department of Environmental Conservation released a report titled Interim Recommendations – Preparing for Extreme Heat (State of New York, 2022). Much like California and Massachusetts, New York is leveraging existing programs and funding sources to address heat resiliency, particularly for low-income and marginalized communities, however, New York's plan also looks to the future and addresses the uncomfortable challenges. While their action plan is aspirational, the State does not dance around the importance of air conditioning in vulnerable communities. It calls out the environmental justice and public health issues related to cooling equity while also being transparent about the significant capital cost and needed investment to provide cooling equity for those most at risk and most likely to not be able to afford it. New York's action plan concludes with concrete next steps for implementation, including "*identifying resource needs and secure necessary funding for effective and substantive implementation of the extreme heat adaptation plan*" and "*analyze access to program benefits and opportunities for improving select key programs and making specific, implementable and actionable recommendations for enhancing support through programs for disadvantage communities and heat-vulnerable populations*" (State of New York, 2022).

6.2 Affordability

Extreme doesn't only affect the health and safety of vulnerable populations, it also leads to higher electricity bills if a household has A/C, and problem that is particularly burdensome for low-income communities. Unfortunately, extreme heat outcomes beyond trips to the hospital or fatalities are rarely tracked and used as evidence for heat resiliency planning (Lim, et al., 2022). Increasing adaptive capacity with A/C is a critical first step, but in parallel electric rate affordability must be addressed. The CPUC opened a proceeding in 2018 to address and gain a common understanding around affordability and the impacts CPUC proceedings and utility rate requests have on customers, as it is within the CPUC's statutory obligation to ensure Californians can afford "essential electricity" supplies (CPUC, 2020 July). This is important given the average electricity rates in

Southern California are ranked 17th highest in the nation among IOUs (CPUC, 2023). Also important to remember is A/C is responsible for roughly 15% of a home's energy use, and no matter how efficient, it will increase electric bills and a household's energy burden (household income relative to energy costs) when adding the technology where none previously existed (Evergreen Economics, 2022). An estimate from the First Street Foundation's Hazardous Heat Assessment estimates electricity costs for A/C in the entire state of California, during an extreme heat event will jump from $3.8 billion in 2023 to $4.3 billion by 2053 (First Street Foundation, 2022). However, there are rate schemes under the oversight of the CPUC that assist low-income customers with electric bills. For example, California for Alternative Rates for Energy (CARE) provides a 30 – 35% discount on income-eligible (200% FPL) customers' electric bills, and the Family Electric Rate Assistance (FERA) provides an 18% discount (CPUC, 2023c). Although helpful, these rate schemes are still primarily based on volumetric pricing and are sensitive to increased energy use when cooling and electrically heating a home, as would be the case with heat pumps. In response to increasing electricity rates, the California legislature passed Assembly Bill 205 in 2022, which directs the CPUC to adopt new a rate structure that establishes a new fixed cost based on income level and reduces the volumetric rate (CA Leginfo, 2022).

6.3 The State Needs to Address Health Impacts Through Legislation

Important to note is California Civil Code Section 1941.1 which requires landlords to keep residential premises in a habitable condition that includes myriad standards, such as water and weatherproofing, plumbing and gas facilities, water supply, electrical lighting, and to an extent, space conditioning. Specifically, the law only requires functioning heating, not cooling, as prescribed in the State's civil code:

> A dwelling shall be deemed untenantable for purposes of Section 1941 if it substantially lacks any of the following affirmative standard characteristics or is a residential unit described in Section 17920.3 or 17920.10 of the Health and Safety Code…***Heating facilities that conform with applicable law at the time of installation, are maintained in good working order.*** (State of California. 2013).

This civil code should be redressed to include cooling requirements to have parity with heating, as extreme heat is a science-backed threat to public health and is discussed throughout the State Action Plan (CNRA, 2022). Sponsors of such legislation need to consider this a social justice issue, not a personal responsibility issue, consistent with the solutions in the heat resiliency summer STEM research (Lim, et al., 2022).

Extreme heat is a public health challenge that disproportionately affects ethnically and racially underrepresented groups across the country. As the heat intensity projections show an increase in the coming decades, the health disparities in the U.S. between those with affluence and those at the poverty threshold will widen (Khatana, et al., 2022). These points further underscore the urgency of legislatively driven interventions, such as direct install A/C programs for qualifying households and communities not only in Southern California but across the country.

7. CONCLUSION

As discussed throughout this Needs Assessment, the research objectives were to identify Southern California vulnerable populations across four counties (Los Angeles, Orange, Riverside, and San Bernardino) at risk of the impacts of extreme heat from lack of adaptive capacity through A/C, quantify that population, and then determine if there is enough funding available through existing sources (local, state, federal) to install A/C in the identified vulnerable households. The results of this Needs Assessment show a gap in the A/C penetration of low-income households identified at the census tract level. Two scenarios were calculated to quantify the gap; 1) 100% of the households in the identified census tracts were without A/C, and 2) 28% of the households had no A/C. This resulted in a range from roughly 81,000 to 290,000 households needing A/C in this targeted region. Further, the program and funding assessment that included federal, state, and local IOU programs concluded that there is a funding shortfall across programs of $326 million to $2.24 billion. While the State has alignment on the importance of extreme heat resiliency for the state's low-income population, there is a lack of coordinated policies, detailed assessments quantifying the need, or a clear strategy on how to ensure all (Southern) Californians are prepared and protected from current and future temperature extremes as global warming increases. As noted earlier, this is not a policy barrier from which California alone is suffering. Massachusetts, for example, is a state that has similar aspirational plans for addressing heat resiliency for its vulnerable communities but has very little clarity about how the strategies will be deployed and funded (State of Massachusetts, 2023). As discussed above, cooling equity is a national social and environmental justice issue. In California, a disproportionate amount of low-income communities experience higher sensitivity to extreme heat and higher barriers to adaptation (Gabbe, et al., 2020).

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9 APPENDIX

Table 5: Top 10% at-risk census tracts in Southern California. Data from (State of CA, 2020; Chen, et al, 2020) *supplementary material*

Census Tract	City	Population	Occupied Housing Units
6037402303	Pomona	4080	1096
6037402801	Pomona	4976	1126
6037402803	Pomona	3270	725
6037408800	Pomona	4387	1461
6037433302	South El Monte	1530	418
6037433402	South El Monte	4713	1197
6037433801	South El Monte	5944	1415
6037434004	South El Monte	3310	713
6037482502	Rosemead	3310	854
6037501400	Whittier	3669	1236
6037503000	Whittier	5606	1232
6037530301	Los Angeles	2211	639
6037530500	Los Angeles	3719	1118
6037530601	Los Angeles	2930	851
6037530700	Los Angeles	2157	547
6037530902	Los Angeles	3840	1060
6037531201	Los Angeles	5530	1272
6037531202	Los Angeles	4431	1145
6037531301	Los Angeles	4824	1232
6037531302	Los Angeles	6215	1490
6037531502	Los Angeles	3397	807
6037531504	Los Angeles	4250	1052
6037531604	Los Angeles	3775	926
6037532302	Los Angeles	4881	1130
6037532603	Huntington Park	3289	759
6037532606	Huntington Park	4405	1278
6037532700	Los Angeles	3417	691
6037532800	Los Angeles	4590	1008
6037532900	Los Angeles	7058	1653
6037533001	Los Angeles	4709	1044
6037533002	Los Angeles	2705	597
6037533103	Huntington Park	3283	815
6037533104	Huntington Park	4415	1266
6037533105	Huntington Park	2510	647
6037533106	Huntington Park	1655	399
6037533107	Huntington Park	3503	935
6037533201	Huntington Park	2788	676
6037533300	Maywood	3346	868
6037533401	Maywood	5098	1218

Census Tract	City	Population	Occupied Housing Units
6037533502	Huntington Park	2143	483
6037533503	Huntington Park	2141	468
6037533601	Bell	4762	1119
6037533602	Bell	5546	1406
6037533603	Bell	6986	1783
6037533701	Maywood	2998	900
6037533702	Maywood	3543	868
6037533703	Maywood	5259	1037
6037533803	Bell	6324	1600
6037533901	Bell	6320	1453
6037534102	Bell	6219	1463
6037534201	Bell	4768	1027
6037534202	Bell	5748	1279
6037534203	Bell	3206	863
6037534301	Bell	4320	1136
6037534404	Bell	3677	976
6037534405	Bell	4351	962
6037534406	Bell	5027	1068
6037534501	Huntington Park	5226	1239
6037534802	Huntington Park	3136	705
6037534803	Huntington Park	4589	1177
6037534804	Huntington Park	3736	885
6037534900	Los Angeles	6319	1476
6037535001	Los Angeles	4512	1019
6037535002	Los Angeles	3648	842
6037535101	Los Angeles	7949	1795
6037535102	Los Angeles	4621	1043
6037535200	Los Angeles	6111	1263
6037535300	Los Angeles	6524	1428
6037535400	Los Angeles	3553	771
6037535501	South Gate	3898	1017
6037535503	South Gate	2240	643
6037535604	South Gate	4476	1020
6037535606	South Gate	2007	451
6037535702	South Gate	5638	1439
6037535803	South Gate	4246	1121
6037535804	South Gate	5328	1346
6037536104	South Gate	3900	1032
6037540202	Lynwood	7116	1601
6037540203	Lynwood	5807	1282
6037540300	Lynwood	4728	1172
6037540400	Los Angeles	2109	442
6037540501	Lynwood	6713	1053

Census Tract	City	Population	Occupied Housing Units
6037540502	Lynwood	6163	1454
6037540600	Los Angeles	4981	1130
6037540700	Los Angeles	3230	810
6037541001	Gardena	1144	365
6037541100	Compton	3251	918
6037541300	Compton	5512	1473
6037541400	Compton	7989	1696
6037541500	Compton	6273	1349
6037541603	Compton	3059	676
6037541604	Compton	5917	1453
6037541605	Compton	4805	1289
6037541606	Compton	2348	611
6037541700	Lynwood	6638	1396
6037541801	Lynwood	6180	1322
6037542000	Compton	4708	1141
6037542103	Compton	3685	847
6037542105	Compton	4781	1095
6037542106	Compton	3523	777
6037542401	Compton	4735	1223
6037542502	Compton	5006	1303
6037542601	Compton	3295	677
6037542602	Compton	5934	1421
6037542700	Compton	6129	1345
6037542900	Compton	3254	737
6037543201	Compton	3605	908
6037543202	Compton	5124	1160
6037553701	Paramount	3981	899
6037553702	Paramount	4723	1090
6037554204	Bellflower	4313	1671
6037570301	Long Beach	7273	2255
6037570303	Long Beach	4471	1248
6037570304	Long Beach	5094	1439
6037570603	Long Beach	5172	1804
6037571600	Long Beach	2309	823
6037572301	Long Beach	3841	963
6037572500	Long Beach	3643	1232
6037572800	Long Beach	986	226
6037572900	Long Beach	5360	1318
6037573002	Long Beach	4086	1131
6037573004	Long Beach	4577	1655
6037573201	Long Beach	4597	1318
6037573202	Long Beach	6379	1697
6037573300	Long Beach	4158	1094

Census Tract	City	Population	Occupied Housing Units
6037575102	Long Beach	4151	1263
6037575201	Long Beach	4772	1243
6037575202	Long Beach	4175	1236
6037575300	Long Beach	4360	1306
6037575401	Long Beach	4788	1217
6037575402	Long Beach	4129	989
6037575801	Long Beach	2254	696
6037575802	Long Beach	5664	1633
6037575803	Long Beach	3229	1289
6037576200	Long Beach	5324	2976
6037576301	Long Beach	4165	1819
6037576302	Long Beach	4077	1224
6037576401	Long Beach	5021	1233
6037576402	Long Beach	5015	1348
6037576403	Long Beach	5140	1440
6037576901	Long Beach	5357	1775
6037576903	Long Beach	3644	1336
6037600100	Los Angeles	7410	2180
6037600201	Los Angeles	5063	1452
6037600202	Los Angeles	7767	2201
6037600303	Los Angeles	3883	1212
6037600304	Los Angeles	3910	1115
6037600602	Inglewood	2542	696
6037600902	Inglewood	6491	2375
6037600911	Inglewood	3146	1124
6037600912	Inglewood	5659	1447
6037601001	Inglewood	2381	1072
6037601100	Inglewood	6869	2104
6037601202	Inglewood	4000	978
6037601211	Inglewood	2880	1055
6037601302	Inglewood	7333	2795
6037601303	Inglewood	5084	2075
6037601401	Inglewood	5949	1728
6037601501	Inglewood	3918	1084
6037601502	Inglewood	4059	872
6037601801	Inglewood	2834	802
6037601900	Inglewood	4847	1238
6037602002	Hawthorne	3057	809
6037602003	Inglewood	4760	1258
6037602004	Inglewood	3709	1052
6037602103	Hawthorne	6650	2090
6037602105	Hawthorne	4116	1248
6037602504	Hawthorne	4961	1748

Census Tract	City	Population	Occupied Housing Units
6037602509	Hawthorne	4457	1141
6037602801	Los Angeles	3718	1247
6037603001	Gardena	7498	2421
6037603004	Gardena	1549	634
6037603006	Gardena	1898	810
6037603704	Hawthorne	6609	2112
6037603802	Lawndale	4040	1154
6037603900	Lawndale	7666	2423
6037604001	Lawndale	4207	1296
6037604002	Lawndale	4856	1511
6037604100	Lawndale	7302	2018
6037650604	Torrance	5567	2419
6037701100	Los Angeles	1101	48
6037900102	Lancaster	710	274
6037910501	Palmdale	5218	2004
6037920011	Santa Clarita	172	47
6059062622	Laguna Woods	3868	2535
6059062625	Laguna Hills	3975	1960
6059062646	Laguna Woods	3433	2425
6059063604	Costa Mesa	4070	1591
6059063605	Costa Mesa	5387	1425
6059063701	Costa Mesa	5930	1621
6059063808	Costa Mesa	6052	1547
6059074300	Santa Ana	4051	804
6059074406	Santa Ana	3693	785
6059074501	Santa Ana	7241	1387
6059074701	Santa Ana	8184	1440
6059074702	Santa Ana	6078	1108
6059074805	Santa Ana	5288	985
6059074806	Santa Ana	5205	905
6059074901	Santa Ana	9933	1910
6059074902	Santa Ana	6221	1220
6059075003	Santa Ana	7500	1659
6059075004	Santa Ana	5267	1344
6059075201	Santa Ana	6089	1133
6059099402	Huntington Beach	8190	2118
6059099510	Seal Beach	4449	3259
6065042405	Moreno Valley	5324	1593
6065043401	Hemet	6883	1868
6065044404	Idyllwild	1122	493
6071003700	Rialto	3782	1251
6071004103	San Bernardino	6290	1342
6071004104	San Bernardino	6360	1221

Census Tract	City	Population	Occupied Housing Units
6071004302	San Bernardino	3655	982
6071004700	San Bernardino	5424	1388
6071004800	San Bernardino	3263	791
6071004900	San Bernardino	7113	1771
6071005400	San Bernardino	6750	1954
6071005500	San Bernardino	9180	2422
6071005600	San Bernardino	6727	1824
6071005701	San Bernardino	1580	802
6071005800	San Bernardino	4013	1327
6071006401	San Bernardino	2778	738
6071006402	San Bernardino	4813	1314
6071006500	San Bernardino	8416	1973
6071007407	San Bernardino	2939	835
6071007601	San Bernardino	7655	2021
6071009116	Adelanto	6700	1963
6071009201	Wrightwood	3984	1538
6071009400	Barstow	3262	1347
6071009800	Victorville	4820	1453
6071010423	Landers	3461	1591
6037300100	La Crescenta	6014	1946
Total		1,068,949	290,489

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